55

STANDING COMMITTEE ON AGRICULTURE
(2017-2018)

SIXTEENTH LOK SABHA

MINISTRY OF AGRICULTURE AND FARMERS WELFARE
(DEPARTMENT OF AGRICULTURAL RESEARCH AND EDUCATION)

"Comprehensive Agriculture Research based on Geographical Conditions and Impact of Climatic Changes to ensure Food Security in the Country"

{Action Taken by the Government on the Observations/ Recommendations contained in the Thirty Ninth Report (Sixteenth Lok Sabha) of the Standing Committee on Agriculture (2016-2017)}

FIFTY FIFTH REPORT

LOK SABHA SECRETARIAT
NEW DELHI

August 2018/Shravana,1940 (Saka)

FIFTY FIFTH REPORT

STANDING COMMITTEE ON AGRICULTURE
(2017-2018)

(SIXTEENTH LOK SABHA)

MINISTRY OF AGRICULTURE AND FARMERS WELFARE
(DEPARTMENT OF AGRICULTURAL RESEARCH AND EDUCATION)

"Comprehensive Agriculture Research based on Geographical Conditions and Impact of Climatic Changes to ensure Food Security in the Country"

{Action Taken by the Government on the Observations/ Recommendations contained in the Thirty Ninth Report (Sixteenth Lok Sabha) of the Standing Committee on Agriculture (2016-2017)}

Presented to Lok Sabha on	03.08.2018
Laid on the Table of Rajya Sabha on	03.08.2018

LOK SABHA SECRETARIAT

NEW DELHI

August 2018/Shravana,1940 (Saka)

COA No. 377

Price: Rs.

Published under Rule 382 of the Rules of Procedure and Conduct of Business in Lok Sabha (Fourteenth Edition) and Printed by

<CONTENTS>

ANNEXURES

APPENDIX

Analysis of Action Taken by the Government on the Recommendations contained in the Thirty Ninth Report (Sixteenth Lok Sabha) of the Standing Committee on Agriculture (2016-2017).

COMPOSITION OF THE STANDING COMMITTEE ON AGRICULTURE (2017-18)

Shri Hukmdev Narayan Yadav - Chairperson

MEMBERS

LOK SABHA

2. Shri Sanjay Dhotre
3. Prof. Ravindra Vishwanath Gaikwad
4. Shri Sanganna Amarappa Karadi
5. Shri Nalin Kumar Kateel
6. Smt. Raksha Tai Khadase
7. Md. Badaruddoza Khan
8. Shri C. Mahendran
9. Dr. Tapas Mandal
10. Shri Janardan Mishra
@11. Shri Praveen Kumar Nishad
12. Shri Devji M. Patel
13. Shri Nityanand Rai
14. Shri Mukesh Rajput
15. Shri Konakalla Narayana Rao
16. Shri C.L. Ruala
17. Shri Arjun Charan Sethi
18. Shri Virendra Singh
19. Shri Dharmendra Yadav
20. Shri Jai Prakash Narayan Yadav
#21. VACANT

RAJYA SABHA

22. Sardar Sukhdev Singh Dhindsa
*23. Shri Rajmani Patel
*24. Shri Narayan Rane
*25. Shri Kailash Soni
26. Shri Mohd. Ali Khan
27. Shri K.K. Ragesh
28. Shri Ram Nath Thakur
29 Shri R. Vaithilingam
*30. Shri Harnath Singh Yadav
31. Dr. Chandrapal Singh Yadav

@ Shri Praveen Kumar Nishad, MP Lok Sabha nominated *vice* Shri Nephiu Rio, MP Lok Sabha w.e.f. 27.04.2018 vide Bulletin Part II No. 6866 dated 27.04.2018

 # Vacant due to resignation of Shri B.S. Yeddyurappa from the Membership of Lok Sabha w.e.f. 18.05.2018 vide Bulletin Part-II Table Office (B) No. 6885 dated 19.05.2018

******vice* **Shri Janardan Dwivedi, Shri Meghraj Jain, Shri Vinay Katiyar and Shri Shankarbhai N. Vegad, who ceased to be the Member of the Committee on their retirement from Rajya Sabha on 27.01.2018, 02.04.2018, 02.04.2018 and 02.04.2018 respectively.**

SECRETARIAT

1.	Shri D.S. Malha	-	Joint Secretary
2.	Shri Arun K. Kaushik	-	Director
3.	Shri Sumesh Kumar	-	Under Secretary

INTRODUCTION

I, the Chairperson, Standing Committee on Agriculture (2017-18), having been authorized by the Committee to submit the Report on their behalf, present this Fifty Fifth Report on action taken by the Government on the Observations/Recommendations contained in the Thirty Ninth Report (Sixteenth Lok Sabha) of the Standing Committee on Agriculture (2016-17) on the Subject "Comprehensive Agriculture Research based on Geographical Conditions and Impact of Climatic Changes to ensure Food Security in the Country" pertaining to the Ministry of Agriculture and Farmers Welfare (Department of Agricultural Research and Education).

2. The Thirty Ninth Report (Sixteenth Lok Sabha) of the Standing Committee on Agriculture (2016-17) on the Subject "Comprehensive Agriculture Research based on Geographical Conditions and Impact of Climatic Changes to ensure Food Security in the Country" pertaining to Ministry of Agriculture and Farmers Welfare (Department of Agricultural Research and Education) was presented to Lok Sabha on 10.08.2017 and laid on the Table of Rajya Sabha on 09.08.2017. The Action Taken Notes on the Report were received on 03.11.2017.

3. The Report was considered and adopted by the Committee at their Sitting held on 31.07.2018.

4. An analysis of the action taken by the Government on the Observations/Recommendations contained in the Thirty Ninth Report (Sixteenth Lok Sabha) of the Committee is given in **Appendix.**

NEW DELHI;
02 August, 2018
11 Shravana, 1940(Saka)

HUKMDEV NARAYAN YADAV
Chairperson,
Standing Committee on Agriculture

CHAPTER - I

REPORT

This Report of the Standing Committee on Agriculture deals with the action taken by the Government on the recommendations contained in the Thirty Ninth Report of the Standing Committee on Agriculture (2016-17) on the Subject "Comprehensive Agriculture Research based on Geographical Conditions and Impact of Climatic Changes to Ensure Food Security in the Country" of the Ministry of Agriculture and Farmers Welfare (Department of Agricultural Research and Education) which was presented to Lok Sabha on 10 August, 2017 and laid on the Table of Rajya Sabha on 09 August, 2017.

1.2 The Ministry of Agriculture and Farmers Welfare (Department of Agricultural Research and Education) have furnished Action Taken Replies in respect of all the 33 Observations / Recommendations contained in the Report. These replies have been categorized as under:-

(i) Observations / Recommendations that have been accepted by the Government:

Recommendation Para Nos. 1, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 25, 26, 28, 29, 31, 32 and 33

(Chapter II - Total 28)

(ii) Observations / Recommendations which the Committee do not desire to pursue in view of the Government's reply:

Recommendation Para No. NIL (Chapter III - NIL)

(iii) Observations / Recommendations in respect of which action taken replies of the Government have not been accepted by the Committee:

Recommendation Para Nos. 2, 4, 24, 27 and 30

(Chapter IV - Total 05)

(iv) Observations / Recommendations in respect of which final replies of the Government are still awaited:

Recommendation Para No. NIL (Chapter V - Total NIL)

1.3 The Committee trust that utmost importance would be given to implementation of the Observations/Recommendations accepted by the Government. In cases, where it is not possible for the Department to implement the Recommendations in letter and spirit for any reason, the matter should be reported to the Committee with reasons for non-implementation. The Committee desire that further Action Taken Note on the Observations/Recommendations contained in Chapter-I of this Report be furnished to them at an early date.

1.4 The Committee will now deal with the action taken by the Government on some of the Recommendations in the succeeding paragraphs.

A. RESEARCH ON IMPACT OF CLIMATE CHANGE ON INDIAN AGRICULTURE (RECOMMENDATION PARA NO. 2)

1.5 The Committee had observed/recommended as under:-

"The Committee note that Fifth Assessment Report (AR5) of Intergovernmental Panel on Climate Change (IPCC) has warned about warming of the climate system across the world. This Report clearly brought out impact of global warming such as warming of atmosphere and oceans, shrinking of glaciers, melting of Arctic and Antarctic ice sheets, rise of sea level etc. The Committee have been informed that as per AR5 report each of the last three decades has been getting successively warmer at the Earth's surface than any preceding decade since 1850. The period from 1983 to 2012 was very likely the warmest 30-year period during the last 800 years in the Northern Hemisphere and likely the warmest 30-year period of the last 1400 years. Over the last two decades, the Greenland and Antarctic ice sheets have been losing mass. Glaciers have continued to shrink almost worldwide. Northern Hemisphere spring snow cover has continued to decrease in extent. Over the period 1901-2010, global mean sea level rose by 0.19 (0.17 to 0.21)m. The rate of sea level rise since the mid-19th century has been larger than the mean rate during the previous two millennia. The Committee further note that Centre for

Climate Change Research (CCCR) under the Indian Institute of Tropical Meteorology (IITM), Pune under Ministry of Earth Sciences carry out scientific studies on climate change and variability under Global and Regional Climate Change (GRCC) programme. The Committee have been informed by the Ministry of Earth Sciences that past observations from instruments and proxy data suggest that there are changes in our climate system on different time scales. There are some natural variations and there are some long term trends which can be attributed to human activities. The Committee note that Annual mean, maximum and minimum temperatures averaged over the country as a whole showed significant warming trend of 0.6^{o}C, 1^{o}C and 0.18^{o}C per hundred years, respectively. The rate of warming trend in the annual mean temperatures since 1980s is much sharper, 0.2^{o}C per decade. The warming is mostly confined to the northern, central and eastern/north-eastern parts of the country. Peninsular India experienced the least warming. The Committee have been further informed that all-India southwest monsoon rainfall does not show any long-term trend, but it exhibits significant multi-decadal variability. There are significant regional trends in southwest monsoon rainfall. Monsoon rainfall in the meteorological sub divisions of Jharkhand, Chhattisgarh and Kerala has shown significant decreasing trends. However, monsoon rainfall over Gangetic West Bengal, West Uttar Pradesh, Jammu and Kashmir, Konkan and Goa, Central Maharashtra, Rayalaseema, Coastal Andhra Pradesh and North Interior Karnataka showed increasing trends. Further, Monsoon rainfall in the month of July has shown decreasing trends over most parts of central India. However, June and August rainfall has shown increasing trend over the central and southwestern parts of the country. There is a clear pattern of decreasing frequency of very light rain and light to moderate rain events over most of the country and increasing frequency of very heavy and extreme rainfall events over northern parts of the country during the monsoon season. The Committee also note above increasing trends in heat waves during the hot weather season and decreasing trend in cold waves during the cold weather season over most parts of the country. The Committee have also been informed that more intense droughts are mainly observed over north and northwest India.

The Committee are of view that there is a need of constantly observing changing weather conditions associated with climate change in order to take corrective steps to offset its negative effect on agriculture and allied sector in the country. The Committee also feel that there should be enhanced level of co-ordination between Ministry of Earth Sciences and Department of Agricultural Research and Education. The Committee, therefore recommend the Government to devise a mechanism to increase the quantum of collaborative research and coordination between these two important Scientific Departments associated with study of climate change. The Committee also desire the Government to provide for adequate funding and manpower for encouraging cutting edge research in this important sector so that the agriculture and allied sector in the Country may be salvaged from negative changes associated with climate change."

1.6 In its Action Taken reply, the Department has stated as under: -

"Analysis of past more than 100 years of data by the scientists of India Meteorological Department and other institutions has found significant changes in the rainfall pattern, extreme events etc. Both flood and drought are part of natural climate variability and occurrences of flood or drought in individual years do not depend on climate change. However, as an impact of climate change, it is being reported that the spatial variability, intensity and frequency of extreme events like heavy rainfall have increased.

Though there was no significant change in the all India rainfall but significant changes in rainfall pattern has been observed in smaller spatial scales viz. meteorological subdivisions or states. Decreasing trend in rainfall during the month of July is observed over most parts of central India. However, increasing trends are seen in rainfall during June and August over the central and south western parts of the country. Significant decreasing trend in rainfall during the southwest monsoon season is seen over ten subdivisions viz. Chhattisgarh, Jharkhand, Uttarakhand, Himachal Pradesh, Arunachal Pradesh, Nagaland, Mizoram and Tripura, sub Himalayan West Bengal, Kerala, east Uttar Pradesh and east Madhya Pradesh whereas eight subdivisions viz. Madhya Maharashtra, Saurashtra and Kutch, south interior Karnataka, coastal Karnataka, Konkan and Goa, coastal Andhra Pradesh,

Lakshadweep and Gangetic West Bengal showed significant increasing trends in monsoon rainfall. Annual frequencies of very light, light to moderate and wet days have decreased in most of the states. Frequencies of dry days have also increased significantly during the period, 1910-2010. Significant increase of heavy rainfall event is observed over the eight states (West Bengal, Tripura, Manipur, Andhra Pradesh, Telangana, Karnataka, Goa and Orissa). Significant increase in the frequency of very heavy events over West Bengal, Tripura, Sikkim, Andhra Pradesh, Telangana, Karnataka, Goa, Jammu & Kashmir and Odisha; and extreme rainfall events over West Bengal, Assam, Punjab, Jammu & Kashmir, Chhattisgarh, Goa and Telangana are being reported.

The latest Inter-Governmental Panel on Climate Change (IPCC) report (2014) highlights that mean surface temperature of the globe has risen by 0.85^0C + 0.18^0C. whereas, all India mean temperature has risen around 0.64^0C over the last 110 years. Mean annual surface air temperatures show a significant warming of about 0.7^o C/100 years during the last century.

The Centre of Climate Change Research (CCCR) was launched in 2009 with the support of the Ministry of the Earth Sciences, Government of India. The CCCR is part of the Indian Institute of Tropical Meteorology (IITM) located at Pune. The CCCR focuses on development of new climate modeling capabilities in India and South Asia to address issues concerning the Science of Climate Change. Two major developments in climate modeling have taken place at CCCR in the recent 2 years.

Development of the IITM Earth System Model (ESM): With the goal of building an ESM appropriate for detection, attribution and projection of changes in the South Asian monsoon, a state-of-the-art seasonal prediction model, namely the Climate Forecast System (CFS) has been transformed to a climate model suitable for extended climate simulations at the CCCR, IITM, Pune, India. IITM ESM will be participating in the next Intergovernmental Panel for Climate Change (IPCC) Coupled Model Inter comparison Project phase 6 experiments – this is a first for an Indian model.

CCCR is also leading the **Coordinated Regional Downscaling Experiment (CORDEX) activity for the South Asian region**. CORDEX is an International Programme under the World Climate Research Program (WCRP) which aims at advancing and coordinating the science and application of Regional Climate Downscaling through global partnerships, in order to inform local and national climate adaptation strategies. The regional modeling activities of CORDEX South Asia are focused on providing reliable projections with much greater detail (than global climate models) and more accurate representation of localized extreme events over the South Asian region, through

- *Development of multi-model ensemble projections of high resolution (50 km) regional climate change scenarios for South Asia. The regional climate projections over South Asia are generated by CCCR-IITM and also by various International partner institutions*
- *Development of an Earth System Grid (ESG) node at CCCR-IITM for archival, management and dissemination of CORDEX South Asia datasets*
- *Evaluation of regional climate projections over South Asia for reliable climate change information for effective harnessing of science-based information by Vulnerability, Impact, Adaptation (VIA) community*
- *Development of regional capacity for assessment of regional climate change*

As part of this activity, high-resolution simulations of 20th century climatic variations and future climate projections (21st century) have been developed at CCCR-IITM. These high-resolution simulations offer new opportunities to better understand several key regional scientific issues concerning climate change over South Asia - e.g., Monsoons, precipitation extremes, heat waves, droughts and floods, changes in cyclonic weather systems, hydrological cycle etc. A variable resolution global modeling framework, based on the Laboratorie Dynamique Meteorologie (LMD, France) atmospheric general circulation model (GCM), has been employed for this purpose under a scientific collaboration between CCCR-IITM and LMD, aimed towards contributing to the IPCC AR6 assessment. The high-resolution climate

projections for India (2006-2095) were released in the Sixth National Workshop on Climate Change organized at INCOIS, Hyderabad during 1-2 September 2014.

IITM-ESMv1: Successful development of the first version of IITM ESM at CCCR, IITM, Pune by transforming a seasonal prediction model (CFSv2) into a long term climate model (Ref: Swapna et al. 2015). This development was achieved by incorporating a new ocean model component (MOM4p1, including ocean biogeochemistry) in CFSv2. Major improvements in the IITM-ESM relative to CFSv2 include:

The IITM-ESMv2 would be first climate model from India to contribute to the Coupled Model Intercomparison Project Sixth Phase (CMIP6) for the IPCC sixth assessment report (Ar6). IITM has requested for funding support from MoES for collaborative work with other Indian agencies involved in the field. Additional manpower requirement has also been projected.

Following the recommendations of the Expert Committee, it is proposed that CCCR-IITM will collaborate with Agricultural Researchers to investigate and address the Impacts of Climate Change on Indian Agriculture. For this purpose, CCCR-IITM has requested for funding support from MoES for collaborative work with other Indian agencies involved in Agriculture and Climate research. Additional manpower requirement will be projected for this collaborative research".

There is a co-ordination between Ministry of Earth Science and Department of Agricultural Research and Education for weather services. The Gramin Krishi Mausam Seva (GKMS) of IMD is rendered twice a week in collaboration with Indian Council of Agricultural Research (ICAR). Accordingly, district level weather forecast for next 5-days are provided to farmers in respect of Rainfall, maximum temperature, minimum temperature, wind speed, wind direction, relative humidity and cloudsweekly cumulative rainfall forecast and Crop specific advisories.

The GKMS of IMD has been successful in providing the crop specific advisories to the farmers through different print/visual/Radio/ IT based media including short message service (SMS) and Interactive Voice Response Service (IVRS) facilitating for appropriate field level actions. Weather forecast based agrometeorological

advisories are also disseminated through Kisan portal launched by the Ministry of Agriculture and Farmers Welfare and also under public private partnership. At present, about 23.0 million farmers in the country are receiving the SMS based advisories."

1.7 The Committee observe that no significant steps have been taken by the Government for devising a mechanism to increase the quantum of collaborative research and coordination between two important Scientific Departments associated with study of climate change *viz.* Ministry of Earth Sciences and Department of Agricultural Research and Education. The Committee were informed that Centre of Climate Change Research-Indian Institute of Tropical Meteorology (CCCR-IITM) will collaborate with Agricultural Researchers to investigate and address the Impacts of Climate Change on Indian Agriculture and for this purpose funding support from requested from Ministry of Earth Sciences (MoES) for collaborative work with other Indian agencies involved in Agriculture and Climate research. The Committee are of view that there is urgent need for multi-sectoral coordination and collaborative research to effectively analyze impact of climatic changes associated with global warming on agriculture and allied sector in the country. Collaborative research will not only help to optimize investment on research but also help to prepare a pool of scientist which can give a quantum leap to our country in cutting edge research in the field of agriculture sciences and ensure food security of country in future. The Committee, therefore, desire the Department of Agriculture Research and Education to take steps to plan more collaborative research with Ministry of Earth sciences.

B. <u>BURNING OF CROP RESIDUE</u>
(RECOMMENDATION PARA NO. 4)

1.8 The Committee had observed/recommended as under:-

"The Committee note that despite being banned, burning of crop residue in agricultural fields has emerged as one of the important challenges in recent times which is adding to already high level of pollutants in the environment. The

Committee further note that as per assessment made by the ICAR approximately 130-140 Mt Crop residues is being burnt annually in agriculture fields out of 679 million tonne (Mt) crop residue generated in the country which is causing emission of 8.57 Mt of CO, 141.15 Mt of CO2, 0.037 Mt of SOx, 0.23 Mt of NOx, 0.12 Mt of NH3 in the atmosphere. The Committee have been informed that ICAR-Indian Institute of Soil Science has developed a technique called "Rapo-compost Technology" for faster decomposition of biodegradable waste that is able to convert biodegradable waste to quality compost in 30-45 days with the help of bio-inoculum consortia (bacteria, fungi and actinomycetes) having ligno-cellulolytic potential. The Committee observe that shortage of agricultural labour, short interval due to intensive agriculture being practised in some parts of the country and mechanized farming are forcing the farmers to take extreme step of burning the crop residue in farm field. The Committee are of considered view that there is a need to provide adequate extension and financial support to help them in adopting technology for decomposition of crop residue, conservation agriculture or utilize for making cupboard in small scale industries. The Committee, therefore, desire the Government to take this issue on priority basis and make policy/plan/ programmes for eco-friendly utilization of crop residue. The Committee also desire the ICAR for development of new technology/bio-logical methods which can reduce the period of in-situ decomposition of plant residue."

1.9 In its Action Taken reply, the Department has stated as under: -

"The ICAR-Indian Institute of Soil Science has developed an *in-situ* rapid crop residue decomposition technique using consortia of ligno-cellulolytic microorganisms. The technology has potential to decompose rice, wheat and sugarcane residues in 45 days."

1.10 The Committee note that Indian Council of Agricultural Research (ICAR) has not taken any step for research to develop new technology/bio-logical methods which can reduce the period of in-situ decomposition of plant residue. However, the Committee recall that the Government has announced a new policy in budget (2018-19) for financial assistance to the farmers and State Government concerned

for eco-friendly use of crop residue and to stop the practice of its burning in the field. The Committee are of view that being apex body for agriculture research in the country, the ICAR has responsibility for providing solution to problems being faced by the farmers in the country. There is urgent need to develop eco-friendly methods/technologies for in-situ decomposition or other utilization of crop residue so that farmers are not forced to burn it in their field. The Committee, therefore once again reiterate their earlier recommendation and desire the ICAR to take this as a challenge so that practice of burning of crop residue in the field may be minimized/abolished.

C. R&D ON ALTERNATIVE FOOD SOURCES FOR FUTURE

(RECOMMENDATION PARA NO. 16)

1.11 The Committee had observed/recommended as under:-

"Earth is the adobe of multitude of biological variability. The Human society across the world including India has however selected few crops such as wheat, rice, maize which constitutes their staple diet. Dominance of mono cropping and excessive reliance of selected crops can become a burden in case of any major fluctuation in climate due to global warming. Keeping in view these factors, it is important to take steps to identify and develop some alternative food sources which can withstand climatic variability and hence can be utilized as staple diet for vast population of our country. The Committee note that ICAR through its network programmes on small millets (AICRP on Small Millets), future crops (AICRN on Potential Crops), legumes (AINP on Arid Legumes) is continuously engaged in conservation of germplasms; breeding short duration, tolerant and climate resilient varieties; developing suitable location specific package of practices for potential future crops; and disseminating production and value addition technologies to the stakeholders. The Committee have been informed that ICAR is giving priority to small millet crops, viz. foxtail millet, kodo millet, proso millet, little millets, and barnyard millets through All India Coordinated Research Project on Small Millets. These crops have potential to withstand the vagaries of climate and ensure the food and nutritional security in future. The Committee have also been informed that ICAR

Institutes have developed and popularized several ready-to-cook and ready-to-eat health foods based on coarse grains which have been developed under the NAIP project. The ICAR is also making efforts fordeveloping potential crops such as pseudocereals, food legumes/pulses, oilseeds, vegetables and fodder crops through All India Coordinated Research Network on Potential Crops with objectives to find out new plant resources for food, fodder, fuel, energy and industrial uses; identify superior genotypes for cultivation in different regions; and standardize package of practice. ICAR through its ongoing programmes/projects/schemes at NBPGR New Delhi, NBAGR Hisar, NBFGR Lucknow, NBAIM Mau and other ICAR institutes is continuously participating in international project or alliances of CGAIR, FAO, SAC to share genotypes, breed or species for use in national crop/breed improvement programmes. The shared materials are maintained and preserved at respective national repositories in the country. The Committee have also been informed that Government is promoting cultivation and value addition in more efficient, climate resilient, short duration C_4 crops viz. maize, pearl millet, sorghum and finger millets in suitable regions.

The Committee observe that despite claim of the Government in taking step for promoting cultivation of coarse grain, there was a decline in cultivated area between 2004-05 and 2014-15 in sorghum (3.5 mha), pearlmillet (1.3 mha). The Committee are of considered view that there is need to shift from mono cropping pattern of agriculture to diversified agriculture in order to enhance biodiversity. Enhanced crop biodiversity will help the country to ensure food security in case of any unforeseen consequences of climate change. The Committee desire the Government to actively encourage the cultivation of coarse grain, apart from providing support to research on coarse grains and other potential food crops for future. The Committee, therefore, call upon the Government to make a comprehensive plan for providing funds, seeds, and other agriculture extension support to the farmers for encouraging farming of coarse cereals in the country. The Committee also desire the Government to take an awareness campaign about health benefits of coarse grain in order to enhance its consumption in the country. The Committee are also of view that there is need to involve farmers especially in rainfed agriculture, hill and tribal areas so that traditional foods being used in these

areas can be properly analyzed and beneficial germplasm can be stored for further research. There is also need to focus on research on tuber crops which are traditionally being cultivated and used as food source in different parts of country. The Committee, therefore, desire the ICAR to take necessary steps in this direction."

1.12 In its Action Taken reply, the Department has stated as under: -

"AICRPs on Small Millets, Sorghum and Pearl millet have been involved in developing improved technologies for sustainable production of these crops which were important food crops before green revolution. These crops are highly adapted to rainfed agriculture in their niche areas from arid high temperature regions, semi-arid plains to hilly regions. Since centuries, the millets have provided food and nutritional security to the populations in the disadvantaged geographical regions. These food crops are unique as they require less water to grow, mature early and are cultivated in low input conditions. Agronomic advantages e.g. highly adapted to low rainfall conditions, able to withstand fairly long dry spells, recover fast after delayed rain, make them good contingent crops. Millets are highly resilient in adapting to different ecological conditions; ideal crops for climate change and contingency plantings. Being C4 plants, these are more environment friendly with high water use efficiency and low input requirement, but equally responsive to high input management. Besides, being farmer-friendly, millets possess unique nutritional properties, i.e. high fiber, quality protein and mineral composition, hence called as “nutri-cereals” also.

The ability of millets to offer a modest yield under marginal farming conditions, poor soil and low or no input, has made them attractive crop option in, hill and tribal agriculture. Besides, they provide fodder contributing to food security of livestock. Owing to their nutritional superiority, millets are being popularized as super foods and value addition technologies are being developed at the ICAR-Indian Institute of Millets Research (IIMR), Hyderabad.

Measures being taken by ICAR-IIMR and respective AICRPs to encourage the farmers for taking up cultivation of millets:

- Enhancing the productivity of millets through evolving new varieties. Production technologies have been developed for all other small millets. The productivity of finger millet, pearl millet, sorghum and foxtail millet doubled during the past 40 years due to efforts in the crop improvement. Varieties with high yield potential have also been developed in different small millets like barnyard millet, kodo millet, little millet and proso millet at national and state levels. List of varieties released during 2016 are given in Annexure XII.

- Varieties/hybrids of sorghum and pearlmillet released during 2014-2016 are given in Annexures XIII and XIV.

- Varieties suitable for different climatic conditions and superior in different nutrients have also been developed (Annexure XV).

- Popularizing the millets as nutri-cereals so that the demand for millet based foods increases and farmers realize beneficial value for their produce. In this regard, ICAR-IIMR has taken up value addition technology development, dissemination of the technologies by training entrepreneurs, media campaign about health benefits of millets, making ready-to-cook (RTC) and ready-to-eat (RTE) millet based foods available through licensing of manufacturing technologies (Annexure XVI). These tasks were taken up with government support in the form of funding in project mode.

- ICAR (AICRPs and IIMR) are regularly taking up Front line Demonstrations in farmers' fields to demonstrate the benefits of latest varieties and production technologies. Farmer groups are regularly trained in production technologies, post-harvest processing and value addition technologies.

- Machinery development for post-harvest processing of millets is underway to enable farm-gate processing that would result in higher returns for the farmer for the produce.

Maize

Maize is another versatile crop with wide adaptability and ICAR-Indian Institute of Maize Research, Ludhiana along with AICRP (Maize) undertakes research programmes on various aspects related to maize improvement. Maize is relatively drought tolerant as compared to major fine cereals. In India maize is cultivated in 8.9 mha. While spring and rabi maize together accounting for around 18% area under maize is predominantly cultivated under assured irrigation, kharif maize accounting for 82% of maize area is largely cultivated under rainfed situation.

It contains 72% carbohydrates (starch), 10 % protein and 4% fat. The mineral content of maize (Calcium; 10 mg, Phosphorus; 348 mg, Iron; 2.5 mg, Zinc; 2.8 mg, magnesium; 139 mg) is quite comparable to any other cereal grain. The yellow maize contains 90 micro grams of carotene, which plays an important role as anti-oxidant and immunity provider. Above 62% of maize in India is consumed in feed industry, while around 12% is used in starch industry. The integration of maize in human diet directly or indirectly can play a major role in solving the problem of malnutrition, particularly Quality Protein Maize (QPM) which is having higher lysine (>2.4 %) as well as tryptophan values (> 0.6%) as compared to the normal maize. Balanced combination of amino acids in the endosperm of QPM results in higher biological value thereby ensuring more availability of protein to human diet and animal feeds than normal maize.

Maize can be used in greater variety of forms than any other cereals such as Baby corn, Sweet corn, Pop corn and normal grain. Huge scope exists for value added products of speciality corns as well. For example pop corn can be used as High fiber pop corn bar, Nutritious burfi, Iron rich laddu, Protein and fiber rich chikkies, Baby corn can be used as Candy, Murabba, Pickles, Brined baby corns, Vinegar preserved baby corn, dehydrated baby corn and QPM as Health mix, Poustic mixture, weaning mixture, energy mixture, malt mix. Some of the convenience foods such as Ready- to- cook mixes and Ready- to- eat mixes which has good market potential and can be prepared with minimum requirement of machinery are listed below.

- Ready –to cook Idli mix
- Ready –to cook Vada mix
- Ready –to cook Nutri mix
- Papad/ fryumes
- Noodles/ Vermicelli/ Pasta
- Sweet and Spicy Pop corn
- Pop corn health Bar
- Baby corn Candies

Since the beginning of this millennium besides release of 7 field corn cultivars through AICRP on Maize, 12 QPM hybrids in addition to one QPM hybrid with enriched vitamin A have also been released for cultivation. Currently number of hybrids and varieties under various categories (popcorn: one hybrid and two varieties, baby corn: one variety and hybrid each, sweet corn: 3 hybrids and one variety) are available for cultivation. Towards diversification of maize for food purpose under AICRP on Maize extensive work is being carried out on value addition.

Technology development for value addition in sorghum/millets and commercialization

A total of 30 value technologies have been developed by ICAR-IIMR, Hyderabad for sorghum foods on a pilot scale. Commercialization of these technologies has been done by transferring them to entrepreneurs and food industries through MoUs. About 30 such firms have commercialized ICAR-IIMR technologies and more than 10 businesses have crossed the break-even point. The “eatrite” branding of millets foods have been successfully built through campaigning, popularization and awareness programmes. Owing to these progresses, Agri-Business Incubator and Technology Business Incubator projects of the institute have been approved under programmes of ministerial departments.

Description: The millet value added product technologies are healthy, convenient Ready To Cook/ Eat (RTC/E) foods. The technologies have been developed from

millets through diversification of processing technologies (flaking, extrusion, baking, popping, parboiling, semolina, blending of flours etc.), standardization and routine R&D activities on product development and studies on the enhancement of shelf life of millet foods.

D**omain:** of the following segments:

- Value added Millets Food Products
- Convenience food
- Healthy food
- Life style disorder management, etc.,

Impact:

- These technologies have aided in spreading of nutritional awareness of millets among the consumers and have gained a wide momentum from consumers especially the health conscious segment.
- These have created lots of interest among the entrepreneurs as they see more business opportunities in these nutritious, convenient and healthy millet foods.
- Thus, resulting in the creation of demand for the millets consumption, increasing of farmers' income, generating employment and helping the beneficiary entrepreneurs/stakeholders.

Various processing technologies developed at ICAR-IIMR are:

- Convenient/ Ready-to-Eat and Ready-to-Cook millet based products
- Removes drudgeries and inconvenience involved in preparation
- Increased nutrient digestibility through pre-processing and diversification of processing technologies (baking, extrusion, parboiling, milling, flaking, etc).

- Development of healthy and convenient RTC/E foods (30 convenient products)
- Nutritional Labelling of *Eatrite* products for highlighting the nutritional benefits vis-à-vis over existing products.
- Consumers are provided convenient options even in sorghum and millet foods.
- Currently Nine products are commercialized in M/s Big Bazaar retail outlets in Hyderabad and Mumbai under *Eatrite* brand developed by ICAR-IIMR, Hyderabad. (*Jowar atta*, Multigrain *atta, Jowar idli rawa, Jowar upma rawa, Jowar khichidi rawa, Jowar* flakes, *Jowar* vermicelli, *Jowar* pasta and *Jowar* biscuits)

Coarse cereals including Millets is one of the components in National Food Security Mission (NFSM) from 2014-15 to enhance the production of coarse cereals. Coarse Cereals is also included under National Food Security Act. Millets contain substantially high amount of fat, fiber, minerals and higher protein compared to fine cereals like rice and wheat and will also help to control malnutrition and many kinds of diseases like obesity, diabetes etc. Under this Programme, Department has been providing support to the farmers for demonstrations, seed distribution and enhancing the production of millets by providing easily accessibility to consumers & industry for value addition of millets. In order to enhance its consumption, awareness campaign is being initiated through social sector schemes and through print and electronic media.

The group called tropical "roots and tuber (R&T)" crops consists of both dicots like sweet potato (*Ipomoea batat***a***s*), cassava/tapioca (*Manihot esculenta*Crantz) and monocots like yams (*Dioscor***e***a* spp.) and edible aroids like taro (*Colocasia esculenta*), tannia (*Xanthosoma sagittifolium*) and elephant foot yam (*Amorphophalluspaeoniifolius* Dennst. Nicolson). R&T crops are the third important food crops of mankind, after cereals and legumes and are either a staple or subsidiary food for about one-fifth of the world population. Individually, cassava, sweet potato and yam rank among the most important food crops worldwide and in

terms of annual volume of production, cassava and sweet potato rank among the top 10 food crops produced in developing countries.They contribute about 6% of the world's dietary calories, and are also an important source of animal feed and raw materials for industrial products. Tropical tuber crops are the source of sustenance and livelihood security of 200 million people across different states of India, mainly Kerala, Tamil Nadu, Andhra Pradesh, Karnataka, Odisha, West Bengal, Bihar, UP, Chhattisgarh, Gujarat, Goa, Maharashtra and north-eastern states. The total tropical tuber crops production in our country is about 12 million tons whose present market value is Rs. 165 billion.

The institute is recognized as the national germplasm repository of tropical tuber crops by ICAR-Central Tuber Crop Research Institute (CTCRI). The institute maintains 5,558 accessions as *ex situ* field gene bank and *in vitro* active germplasm collection. It includes 1,211 accessions of cassava, 1,124 of sweet potato, 1,110 of yams, 672edible aroids, and 200 minor tuber crops besides 1241 collections from Regional Centre. The institute developed and released 61 high yielding varieties of different R&T crops. It includes 16 of cassava, 21 of sweet potato, 13 of yams, 8 taro, 2 elephant foot yam and 1 Chinese potato. The high yielding and high starch containing cassava varieties like H165 and H226 developed by the institute contributed in a major way for establishment of starch and sago industries in and around Salem district of Tamil Nadu. The Institute has recently released two sweet potato varieties, Bhu Sona rich in β carotene (12.5-14 mg/100g) and Bhu Krishna, rich in anthocyanin (85-80 mg/100g). Similarly, an anthocyanin rich Greater yam variety, Sree Neelima has been developed having good culinary and nutritive quality. Sree Athira is the first elephant foot yam hybrid in the world, while Sree Kiran is the first hybrid taro variety released in India.

The institute is constantly collecting germplasm of various tropical tuber crops from different parts of the country and are being conserved, catalogued and evaluated for their characteristics and are used in different breeding programmes to evolve improved tuber crops varieties with different traits. In order to carry out research work in this line a new research project titled '**Conservation and utilization of germplasm of tuber crops for sustaining production**'.

Under the tribal sub plan, the Institute is planning to distribute improved varieties of tropical tuber crops in Odisha (Kandhamal and Koraput districts), Jharkand (Ranchi district) and Chattisgarh (Narayanpur district). Improved varieties of Sweet potato (Kishan and ST-14, Colocasia (Muktakeshi), Greater yam (Orissa Elite and Da 293), Elephant foot yam (Gajendra), Yam bean (RM-1) and Cassava (Sree Jaya, Sree Vijaya and Vellayani Hraswa) are being distributed to farmers in those areas. Cropping system including Greater yam + maize intercropping system (Greater yam planted at 90 x 90 cm spacing. In intra rows between two plants of greater yam three plants of maize sown (1:3 ratio)and Sweet potato + red gram intercropping system (3 rows of sweet potato at 60 x 20 cm spacing and 3 rows of red gram at 60 x 20 cm spacing (3:3)) are also being demonstrated in the tribal districts. In future, the Institute plans programmes to popularize the improved varieties as well as other tuber crops technologies in major tuber crops growing regions of the country."

1.13 The Committee while noting the steps taken by the various institutes of Indian Council of Agricultural Research (ICAR) for research on millet and Root & Tuber crops observe that Department reply is silent on the issue of to make a comprehensive plan for providing funds, seeds, and other agriculture extension support to the farmers for encouraging farming of coarse cereals in the country and need to take an awareness campaign about health benefits of coarse grain in order to enhance its consumption in the country. The Committee are of view that in order to popularize millet/coarse cereals farming in the country, there is need to provide proper support to the farmers in terms of funds, seed and agriculture extension support so that they do not face problem in switching to present mono-cropping pattern to multi-cropping. Further, there is need to popularize health and nutritional benefits of coarse grains/millets among large population so that ready market could be made available for produce of farmers which in turn will help to provide adequate return to the farmers and enhance their income. The Committee, therefore once again reiterate their earlier recommendation and desire the DARE to make plan in this regard and approach Central Government for funding. Further, they may also

approach State Government concerned for formulation of plan to support farmers in switching over to coarse Grain/millet farming.

D. APPROACH FOR MAKING INDIAN AGRICULTURE CLIMATE RESILIENT (RECOMMENDATION PARA NO. 24)

1.14 The Committee had observed/recommended as under:-

"The Committee note that National Mission on Sustainable Agriculture (NMSA) aims to make Indian agriculture more productive, sustainable, and remunerative and climate resilient. NMSA has many objectives such as conservation of natural resources through appropriate soil and moisture conservation measures, Soil health management, optimization of water use efficiency in agriculture, capacity building of farmers and other stakeholders in the domain of climate change adaptation and mitigation measures, improving productivity of rainfed farming by mainstreaming rainfed technologies, and establishing an effective, inter and intra Departmental/Ministerial co-ordination for accomplishing key deliverables of National Mission for Sustainable Agriculture under the aegis of NAPCC.

The Committee have been informed that promoting integrated farming system covering crops, livestock & fishery, plantation and pasture based composite farming, popularizing on-farm and off-farm resource conservation technologies and introducing practices that will support mitigation efforts in times of extreme climatic events, promoting location and crop specific integrated nutrient management practices, promoting effective management of available water resources, enhancing water use efficiency, encouraging improved agronomic practices for higher farm productivity, involving knowledge institutions and professionals in developing climate change adaptation and mitigation strategies for specific agro climatic situations and promoting them through appropriate farming systems are some of strategies being used to achieve objectives of NMSA.

The Committee are of opinion that our farmers who had helped in securing food security of the country, need support in order to face the challenges of climatic

changes due to global warming. Indian agriculture need interventions in the area of irrigation facilities, water efficient irrigation methods, improved abiotic stress tolerant seed varieties, cost effective and environment friendly fertilizers and pesticides, capacity building of farmers and other stakeholders, efficient and advanced agriculture extension services in order to make it climatic resilient and enable it to secure food security of the country. The Committee are of considered view that huge investment will be need in the agriculture sector if the Government wants to achieve objectives set under National Mission on Sustainable Agriculture (NMSA). Since, agriculture is a State subject, the Committee call for the need of better co-ordination between the Central and the State Governments for planning and resource mobilization for implementing schemes to achieve objectives of NMSA. The Committee, therefore, recommend the Government to constitute high powered committee involving representatives of Central and State Governments, subject specialists and other stakeholders for planning and implementation of schemes to achieve objectives set under NMSA. The Committee also desire the Government to start a dedicated fund for implementation of schemes under NMSA so that these schemes do not suffer due to want of funds."

1.15 In its Action Taken reply, the Department has stated as under: -

"NMSA is envisaged as one of the eight Missions outlined under National Action Plan on Climate Change (NAPCC), NMSA aim at promoting sustainable agriculture through climate change adaptation measures. The major thrust is enhancing agriculture productivity especially in rainfed areas focusing on integrated farming, soil health management, and synergizing resource conversation. Besides, NMSA also has a target to fulfil National and International commitments on Sustainable Development Goals (SDG) & Intended Nationally Determined Contribution (INDC). All the components of NMSA such as Rainfed Agriculture, Soil Health Management, Organic Farming, etc. have significant role in achieving SDGs & INDC. Further, NMSA is the only scheme focusing and emphasising country’s thrust on climate change adaptation & mitigation in agriculture sector.

Rainfed Area Development (RAD) is one of the major component of NMSA. RAD is to benefit the small and marginal farmers in the country promoting Integrated Farming System (IFS).Under this system, crops/cropping system is integrated with activities like horticulture, livestock, fishery, agro-forestry, apiculture etc. to enable farmers not only in maximizing farm returns for sustaining livelihood, but also to mitigate the impacts of drought, flood or other extreme weather events with the income opportunity from allied activities during crop damage.

The National Advisory Committee (NAC) under the Chairmanship of Secretary (AoC&FW) constituted with the members of line Departments and organizations to provide overall direction and guidance to the Mission, monitor and review its progress and performance at National level.The NMSA is proposed for continuation for three years i.e. from 2017-18 to 2019-20 which is co-terminus with the remaining period of 14th Finance Commission (FFC) ending 31st March, 2020. Based on the new initiatives and requirement in the area of sustainable agriculture development, certain modifications have been proposed in the present proposal and some of the ongoing schemes of similar nature are proposed for implementation under the frame work of NMSA.

The proposed cost of the project is Rs.12123.62 Crore (Central Share) for implementation of all the components of NMSA."

1.16 On the recommendation of Committee regarding constitution of high powered committee involving representatives of Central and State Governments, subject specialists and other stakeholders for planning and implementation of schemes to achieve objectives set under National Mission on Sustainable Agriculture (NMSA), the Department in their action taken reply has informed that National Advisory Committee (NAC) under the Chairmanship of Secretary (AoC&FW) constituted with the members of line Departments and organizations to provide overall direction and guidance to the Mission, monitor and review its progress and performance at National level. The National Mission on Sustainable Agriculture (NMSA) is proposed for continuation for three years i.e. from 2017-18 to 2019-20. The Committee are of view that since agriculture is a State subject, there must be representative of State

Governments for better co-ordination and speedy implementation of the scheme under National Mission on Sustainable Agriculture (NMSA). The Committee, therefore once again reiterate their earlier stance and desire the Department to include representatives of State Governments in National Advisory Committee (NAC) constituted for the purpose of implementation of National Mission on Sustainable Agriculture (NMSA).

On the issue of dedicated fund for implementation of schemes under NMSA, the Department in their action taken reply has informed that proposed cost of the project is Rs.12123.62 Crore (Central Share) for implementation of all the components of NMSA. However, the Department failed to furnish allocation and utilization of funds under the NMSA schemes since its beginning. The Committee desire the Department to furnish allocation of funds and its utilization along with achievements of scheme to the Committee within one month of presentation of this Report.

E. AGRICULTURAL EXTENSION SERVICES (RECOMMENDATION PARA NO. 27)

1.17 The Committee had observed/recommended as under:-

"The Committee note that existence of a robust system of agriculture extension services is critical for making Indian agriculture climate resilient. The Committee have been informed that responsibility for providing of extension services to farmers lies with the State Governments. However, Central Government is facilitating the efforts of State Governments through a network of 665 Krishi Vigyan Kendra (KVKs) , Agricultural Technology Management Agency (ATMA) and Agri clinic and Agri-business scheme. The Committee note that KVKs are engaged in on-farm testing to identify the location specificity of technology under various farming systems, frontline demonstration to establish the production potential of improved agricultural technologies on the farmers' fields, Capacity development of farmers and extension personnel to update their knowledge and skills and Providing farm advisories on varied subjects of interest to farmers. The KVKs also provide farm inputs such as seeds, planting materials and other technology to the farmers. The

Committee note that ATMA Scheme is under implementation in 652 districts in 29 States and 3 UTs in the country with provision for active participation of farmers/farmer-groups, NGOs, KVK, Panchayati Raj Institutions and other stakeholders operating at district level and below. The Committee have also been informed that Mass Media Support to Agriculture Extension' scheme is being implemented to strengthen the reach of farm information to farming community through the wide network of Doordarshan, DD Kisan channel and All India Radio.

However, the Committee are distressed to note that funding provided to these agriculture extension schemes are not sufficient to make them an effective platform for the benefit of farmers. The Committee in their previous reports on Demands for Grants have repeatedly brought out these facts and recommended the Government to enhance the allocations to these schemes suitably in order to equip KVKs with all necessary infrastructure and manpower. The Committee are of the considered view that condition of farmers of country cannot be improved unless they are provided information and other necessary inputs for making agriculture remunerative. The Committee, therefore recommend the Government to suitably enhance funding to these schemes. The Committee are also of view that construction of a 'Krishi Bhavan' at Panchayat level will help to strengthen the agriculture extension services in the country. Construction of such bhavan with adequate infrastructure, equipments and mass media facilities with regular visits of scientists of ICAR, subject matter specialists of KVKs, progressive farmers etc. will help it to emerge a hub for farmers and solve their problems related to agriculture. The Committee, therefore, recommend the Government to take steps for construction of 'Kisan Bhavan' at Panchayat level."

1.18 In its Action Taken reply, the Department has stated as under: -

"Regarding enhancing allocation of fund to KVK scheme it is to state that enhanced provision has been made for 2017-18 to 2019-20, for increasing the manpower and improving infrastructure in KVKs.

The Centrally Sponsored Scheme "Support to State Extension Programs for Extension Reforms", popularly known as ATMA Scheme was launched in May,

2005 and aims at making extension system farmer driven and farmer accountable by way of institutional arrangements for technology dissemination in the form of an Agricultural Technology Management Agency (ATMA) at district level to operationalize Extension Reforms. The detail of year-wise budgetary position under the Scheme is given below:

(Rs.in Crore)

Year	B.E.	R.E.	Release
2005-06	45.00	45.00	43.44
2006-07	75.00	50.00	48.27
2007-08	230.00	150.00	155.81
2008-09	298.00	198.00	193.01
2009-10	298.00	188.98	178.59
2010-11	250.00	220.00	240.28
2011-12	500.00	458.60	434.02
2012-13	600.00	504.13	508.07
2013-14	550.00	505.10	480.93
2014-15	475.00	470.58	522.98
2015-16	450.00	395.35	406.69
2016-17	450.00	410.50	413.41
2017-18	650.00	-	307.17 (upto 16.10.17)

Above table reveals that public investment in Agricultural Extension by Central Government has increased from Rs.43.44 crore during the year 2005-06 to Rs.508.07 Crore in 2012-13 under the Scheme. Since modification of the Scheme in the year 2010, the increase has been more substantial. Amount released to the States during last 3 years is nearly 100% of the Revised Estimates. Expenditure incurred by the States during these three years has also been keeping pace with releases by the Center.

ATMA Scheme provides for active involvement of research system/research agencies at different level of implementation. State Agricultural Universities (SAUs) and Krishi Vigyan Kendra (KVKs) are fully involved not only in preparation of Strategic Research Extension Plan (SREP) and State Extension Work Plans (SEWPs) but also in implementation of various programs in the field. They are also representing in all the bodies namely ATMA Governing Board and ATMA Management Committee at District level, SLSC and IDWG at State level BTT-BFAC meetings at Block level. In addition, each KVK scientist may be made in-charge of one or more block with the District. The KVK scientist technically advises the BTT

and involve actively in preparation of Block Action Plans, especially with regard to research related issue/gaps and strategies.

Agricultural Technology refinement, validation and adoption segment of cafeteria of activities including Farmers-Scientists Interactions (FSIs), to designate expert from KVKs at District level and joint visits by Scientists and extension workers, organization of Kisan Goshities and R-E-F linkages are dealt by KVKs. Apart from this, a joint circular on convergence between ATMA and KVK was issued under the signature of DG, ICAR and the Secretary, DAC&FW. As per the Circular, one of the activities is joint visits of Program Coordinator, KVK and Project Director to at least 5 villages in a district every month.

As per extant ATMA Scheme, there is no provision to fund construction of 'Kisan Bhawan' at panchayat level."

1.19 On the issue of need of enhancing funding under the (Krishi Vigyan Kendra) KVK scheme, the Department in their action taken reply has informed that public investment in Agricultural Extension by Central Government has increased from Rs.43.44 crore during the year 2005-06 to Rs.650 Crore in 2018-19 (BE) under the Scheme. However, the Committee note that allocation under the scheme reached to Rs. 522.98 crore in 2014-15 and decreased thereafter in each financial year. The Committee in their previous reports has time and again emphasized the importance of agriculture extension for enhancing agriculture productivity and increase income of farmers and recommended the Government to enhance allocation under KVKs scheme. The Committee are of view that present allocation of Rs. 650 crore for KVK scheme will not be sufficient for enhancing the scope of extension work in KVK. The Committee, therefore, recommend the Government to enhance allocation for KVK scheme at RE stage so that implementing agencies do not face fund crunch to provide extension support to the farmers.

On the issue of recommendation of Committee regarding construction of 'Kisan Bhavan' at Panchayat level, the Department in their action taken reply has informed that as per extant Agricultural Technology Management Agency (ATMA) Scheme, there is no provision to fund construction of 'Kisan Bhawan' at panchayat level. The

Committee are of view that availability of a Kisan bhavan will help to decentralize the efforts of Central and State Government for agriculture extension. It will also help to spread information about agriculture schemes, new varities of crops and agriculture technologies among farmers. The Committee, therefore desire the Govenment to make provision of Kisan Bhavan under ATMA scheme.

F. INTERNATIONAL ACCORD ON CLIMATE CHANGE AND INDIA' COMMITMENT (RECOMMENDATION PARA NO. 30)

1.20 The Committee had observed/recommended as under:-

"The Committee note that our country has ratified Paris Agreement on climate change within the United Nations Framework Convention on Climate Change (UNFCCC) dealing with greenhouse gases emissions mitigation, adaptation and finance starting in the year 2020. The Committee also note that Paris Agreement's central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. The Committee have been informed that it is a legally binding agreement that covers all countries, developed and developing, with the aim to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty. The Committee also note that Paris Agreement also mandate to contribute funds amounting to US $ 100 Billion by 2020 by the Developed countries along with provisions for providing appropriate technology and capacity building support for mitigation and adaptation efforts to be undertaken by the developing countries.

The Committee note that Paris Agreement reflects the principle of equity and common but differentiated responsibilities and respective capabilities. The Agreement acknowledges the development imperatives of developing countries and recognize the developing countries' right to development and their efforts to harmonize development with environment, while protecting the interests of the most vulnerable. The Committee have been informed that India has submitted its Intended Nationally Determined Contribution (INDC) which is country driven

initiatives for undertaking mitigation strategies for reduction of greenhouse gases emission which aims to reduce the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level. The Committee have been assured that no INDC does not include any commitment for reduction of GHGs emission from agriculture sector.

The Committee note that despite having no binding mitigation obligations as per the Convention, India declared a voluntary goal of reducing its emissions intensity of its GDP by 20-25% over 2005 levels by 2020. The Committee also note that Government of India is implementing the National Action Plan on Climate Change (NAPCC) which enshrines eight national missions in specific areas of Solar Energy, Enhanced Energy Efficiency, and Sustainable Habitat, Water Sustaining the Himalayan Ecosystem, Green India, Sustainable Agriculture and Strategic knowledge for Climate Change. The Committee have also been informed that voluntary measures undertaken by the Government to promote low carbon strategies and Renewable Energy has resulted in the decline of emission intensity of our GDP by 12% between 2005 and 2010 which have been recognized by the United Nations Environment Programme (UNEP) in its Emission Gap Report 2014.

The Committee are of view that voluntary steps undertaken by the Government for reduction of GHGs emission and to make it a low energy economy under Paris agreement are in interest of Indian Economy. However, the Committee are of view there is need to provide adequate support to the Indian industry and allied sectors in the form of technologies, professional support and tax rebate in order to emerge as low carbon intensive sector as well as competitive in worlds market. The Committee, therefore, recommend the Government to constitute a dedicated cell for transfer of technologies and other support to Indian Industry and allied sector. The Committee also desire the Government to provide tax rebate to industries which invest for Research & Development of green technologies in the country. The Committee also recommend the Government to engage diplomatically with other countries so that developed countries fulfill their commitment for transfer of clean technologies and dedicated funds as mandated under Paris Agreement."

1.21 In its Action Taken reply, the Department has stated as under: -

"The Technology Mechanism™ of the United Nations Framework Convention on Climate Change (UNFCCC) is for promoting innovation; catalysing the use of technology road maps or action plans; responding to developing country Party requests on matters related to technology transfer; and facilitating joint R&D activities.The article 10 of Paris Agreement (PA), a post 2020 instrument for climate change action, provides for setting up of technology framework to guide work of TM in promoting and facilitating enhanced action in technology development and transfer.

The present negotiations are on principle and structure of Technology Framework (TF). India has taken a stand that TF through its principles and provisions should be an instrument to integrate and articulate all important elements on technology development and transfer to developing countries. It must incorporate all cardinal principles of the Convention (Art 4) and the Paris agreement. These negotiations are continuing under UNFCCC."

1.22 The Committee had emphasised the need to engage diplomatically with other countries so that developed countries fulfill their commitment for transfer of clean technologies and dedicated funds as mandated under Paris Agreement. The Department in their action taken reply has informed the Committee that negotiations on principle and structure of Technology Framework (TF) are continuing under UNFCCC. India has taken a stand that TF through its principles and provisions should be an instrument to integrate and articulate all important elements on technology development and transfer to developing countries. It must incorporate all cardinal principles of the Convention (Art 4) and the Paris agreement.

However, the Committee note that the Department has not furnished reply on recommendation of the Committee regarding constitution of dedicated cell for transfer of technologies and other support to Indian Industry and allied sector and . need to provide tax rebate to industries which invest for Research & Development of green technologies in the country. The Committee are of view that presence of a

dedicated cell for transfer of transfer of green technologies and other support to Indian Industry and allied sector will be pivotal for transforming Indian economy to less carbon intensive. Further, tax rebate to private sector for investment on research for green technologies will be useful to involve private sector in this endeavour which is crucial for safeguarding our earth. It will also help to create industrial base in our country which can be utilized for manufacturing and export of eco-friendly products and technologies especially in agriculture sector to the rest of world. The Committee, therefore, recommend the Government to formulate policy in this regard so that our country could emerge as leader in green technologies in future.

CHAPTER-II

OBSERVATIONS/RECOMMENDATIONS WHICH HAVE BEEN ACCEPTED BY THE GOVERNMENT

(RECOMMENDATION PARA NO. 1)

Climate plays a limiting role on development of bio-geographical variability of flora and fauna including human culture and civilization. Eachsociety has structured its culture around historical and current climatic conditions. Human culture is basically a by-product of locally available resources and local climatic conditions. Human societies are accustomed to a normal range of conditions and may be sensitive to extremes that fall out of this range. The Committee note that various studies across the world have provided ample evidence about climate changes due to enhanced emission of Green House Gases such as Carbon Dioxide, Nitrous Oxide, Methane, Hydro-Fluoro-Carbons, etc. in the atmosphere. Anthropogenic sources such as increased fossil fuels consumption, Industrialization, increasing Pace of Urbanization, excessive use of Nitrogenous Fertilizers in agriculture sector, etc. has led to a situation which is destabilizing critical environmental balance of Earth atmospheric system and causing changes in climate/weather patterns, such as increase in intensity of heat waves, rainfall periodicity, floods, cyclones, melting of ice at Arctic and Antarctic regions, rise in sea levels etc. The Committee also observe that these climatic changes have potential to harm agriculture and allied sectors which critically dependupon climatic conditions and thereby, posing a danger to food security. The Committee in succeeding paragraphs have discussed the impact of climate-changes on agriculture and allied sectors in the country, policy of the Government towards climate change, R&D in agriculture and allied sectors for transforming Indian agriculture into climate smart agriculture, preparation of the Government to provide support to the farmers of the country in adapting them to climatic changes and in accordance with the Paris agreement on climate change.

REPLY OF THE GOVERNMENT

Suitable replies are furnished for the subsequent observations and recommendations made by the committee separately for each recommendation/observation as sought by the committee.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

GREENHOUSE GAS EMMISSION FROM AGRICULTURE AND ALLIED SECTOR (RECOMMENDATION PARA NO. 3)

The Committee note that Paddy fields is major sources of Green House Gases (GHGs) in the farm sector. The Committee have been informed that ICAR-IARI, New Delhi and ICAR-NRRI under National Innovations in Climate Resilient Agriculture (NICRA) projects have quantified the GHGs emissions from paddy fields and they have analyzed that overall methane emission from rice fields in India is about 3.5-4.7 Tegagram (Tg) per year and N2O emission is about 0.05 Tg per year. The Committee note that findings of research being done at these Institutes has shown that methane emission from rice field is negligible compared to other rice growing countries like America, China, eastern and far-eastern Asian countries where it ranged from 20-100 Tg per year. The Committee also note that ICAR Institutes are engaged in R&D for regulating the release of these gases from agro-ecosystems through judicious land-use and appropriate management practices that could mitigate the process of climate change. The Committee have been informed that based on study conducted at IIFSR, Modipuram for measuring methane and nitrous oxide flux from the rice field, it was found that Methane emission reduced by 19.2 % and 9.9 %, respectively with the application of neem-coated urea and sulphur-treated urea compared to prilled urea under conventional method of transplanting. N_2O emission reduced by 23.7% and 11.8%, respectively in the application of neem coated urea and sulphur-treated urea compared to prilled urea under the conventional method of transplanting. Among the establishment methods, direct seeded rice (dry) and direct seeded rice (wet) methods resulted in less emission of CH_4 by the order of 27.9 % and 26.6 %, respectively compared to conventional puddled transplanting. However, the N_2O emission reduced by 1.3 % and 4.6 %, respectively in direct seeded rice (dry) and direct seeded rice (wet) method of establishments compared to conventional puddled transplanting. The Committee have also been informed that emissions of GHGs from paddy fields can be reduced by modifying water, nutrient and tillage management. Conversion of rice straw into biochar and its application in rice fields greatly decreased the GHG emission.

The Committee are of the view that reduction in emission of GHGs from paddy field will help the country to meet its obligation under International Accord on Climate Change. The Committee, therefore, desire the ICAR to give adequate support to the ICAR institutes engaged in development of appropriate methods, variety, technology and paddy varieties which can help to reduce GHGs emission from paddy fields. The Committee also desire the Government to make an inventory of the outcome of all these research studies and transfer them to the farmers in entire country through the network of KVKs and extension network of respective State Governments so that they can also become a partner in the voluntary commitment of the country to reduce share of GHGs emission from India.

REPLY OF THE GOVERNMENT

Green House Gas (GHG) Emissions from Agriculture and Allied Sectors

Under NICRA, emphasis has been placed on the development of technologies which can reduce the greenhouse gas emissions without compromising on yield. As part of this initiative, various ICAR institutes such as Indian Agricultural Research Institute (IARI), New Delhi, Indian Institute of Farming Systems Research (IIFSR), Modipuram, Indian Institute Soil Science (IISS), Bhopal, Central Arid Zone Research Institute (CAZRI), Jodhpur, ICAR Research Complex for NEH Region (ICAR-NEH), Umiam are working on various themes related to the GHG emissions. Facilities like, Eddy Covariance towers are established at IARI, New Delhi and National Rice Research Institute (NRRI), Cuttack for continuously monitoring the GHG emissions from the crop fields during growing season so as to quantify precisely the extent of GHG emissions from the paddy systems. Research facilities like Rainout shelter, Carbon dioxide Temperature Gradient Chamber (CTGC), Free Air Carbon dioxide Enrichment (FACE), Free Air Temperature Enrichment (FATE) etc. have been established to understand the impact of elevated carbon dioxide (eCO_2) and temperature and develop crop varieties that can withstand these stresses. Practices which can further reduce the GHG emissions such as improved systems of paddy cultivation, fertiliser management, improved fertiliser materials, crop diversification, etc. are explored for further reducing the GHG emissions from the paddy based systems.

Location specific, crop specific mitigation practices such as system of rice intensification, direct seeded rice cultivation (dry and wet methods of cultivation), soil test based fertiliser application, rational application of nitrogen, integration of trees especially fruit trees in the arable systems, efficient irrigation systems such as drip method and sprinkler method of application which can reduce the energy use while irrigating field crops, demonstration of zero tillage cultivation as an alternate to burning crop residues in rice-wheat systems of Punjab and Haryana where large quantities of rice residues are being burnt, integration of green manure crops in the existing cropping systems, promotion of green fodder crops and greater use of green fodder for livestock, etc. are being demonstrated as part of the Technology Demonstration Component of NICRA in the 121 climatically vulnerable districts of the country through KVKs.

The proven resilient practices are being integrated in the development programs such as the Crop diversification in traditionally paddy growing regions as part of the National Food Security Mission (NFSM) wherein 1.02 lakh ha is being diversified from paddy to other less water consuming crops in the country during the year 2015-2016. Similarly, the paddy systems of cultivation such as System of rice cultivation, direct seeded rice are being promoted by the development programs as part of the NFSM where in 1.63 lakh ha area was brought under these improved methods of paddy cultivation in the country during the year 2015-2016.Such kind of efforts would contribute to reduction of GHG emissions in the country.

Extension services in the country have been revitalized making these farmers friendly, farmer driven farmer accountable and bottom up planning on Agricultural Technology Management Agency (ATMA) Model. ATMA Scheme is in implementation in 652 Districts. Farmers capacity building and dissemination of modern agricultural technologies etc. extension work is carried out through Training of Farmers & Extension Functionaries, Exposure Visit of Farmers, Demonstrations, Kisan Melas, Kisan Goshities, Farmers-Scientist Interaction (FSI), Farmers Interest Groups (FIGs) and Farm School in different thematic areas including climate change.

The highlights of research studies related to Greenhouse Gas Emission from Agricultural and Allied Sector are compiled under the project entitled, “National Innovations in Climate Resilient Agriculture (NICRA)” which is implemented by the ICAR- Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad. These highlights are shared with 100 KVKs engaged in implementation of NICRA project

The proven mitigation practices which can reduce the GHG emissions are being demonstrated to farmers as part of the Technology Demonstration Component (TDC) of NICRA. The TDC of NICRA is being implemented in 121 climatically vulnerable districts of the country by taking one or cluster of villages in each of the vulnerable district through KVKS.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

INFLUENCE ON AGRICULTURE DUE TO INGRESS OF SEAWATER (RECOMMENDATIONS PARA NO. 5)

The Committee note that global mean sea level rose by 0.19 (0.17 to 0.21)m over the period 1901-2010 due to warming effect of rising GHGs in the atmosphere. Rise in sea surface due to effect of global warming is expected to cause submergence of significant portion of land in areas near sea in many parts of the country. The Committee further note that comprehensive study on assessment of submergence of agricultural land due to sea level rise in the Coastal region has not been carried out. However, ICAR funded NICRA project indicated that the sea levels at three stations Diamond Harbour, Garden Reach and Haldia in Sundarbans are increasing at the rate of 4.85, 8.22 and 3.0 mm/yr. A 2007 report by UNESCO "Case Studies on Climate Change and World Heritage" has predicted 45 cm rise in sea level likely by the end of the 21st century due to anthropogenic activities in the Sundarbans. A study carried out by IIT, Kharagpur revealed that during the 20th century, 34.906 sq. km of area along the Indian coast went under the sea due to the rise in sea level. The Committee also note that a significant fertile agricultural land and adjoining mangrove forests were turned in to a vast waste land due to ingress of saline sea water due to cyclone Aila in West Bengal during 2009, super cyclone in Orissa during 1999 as well as Tsunami in eastern coast in 2014 leading to reduction in agriculture productivity.

The Committee have been informed that ICAR-Central Soil Salinity Research Institute, Regional Research Station, Canning Town, West Bengal engaged in the research and management needs of coastal salt affected soils has developed several technologies for enhancement of agricultural productivity under degraded saline coastal soils and poor water qualities. The Committee are of view that ingress of sea water into agricultural fields would lead to devastating consequences for farmers near coastal regions as high salinity in the soil as well as acute shortage of fresh water for agricultural uses pose a serious problem leading to low productivity. The Committee, therefore, recommend the ICAR to actively engage in Research on identification of soil tolerant varieties of crops and incorporation of these genes in higher yielding crop varieties so that agriculture productivity in coastal areas may maintained in coming years. The Committee desire the Government to formulate an action plan for enhancing locally suitable mangrove plantation near coastal areas so that these can act as natural barriers in case of rising sea level. The Committee also desire the Government to provide adequate agricultural extension support to the farmers in coastal regions so that they are provided suitable technologies, seeds and training for shift to paddy- fishery farming.

REPLY OF THE GOVERNMENT

In order to maintain higher agricultural productivity in coastal areas, ICAR-CSSRI Regional Station at Canning Town (WB) has developed/identified rice varieties suitable for coastal regions both for rabi/summer and kharif seasons(Table 1&2).

Table 1. Improved varieties of rice for rabi/summer

Salinity Level (dS/m)	Varieties
Low (< 6.0)	CSR 4, Canning 7, Ratna, Khitis, Rasi, Boby, IR 7634, IR 75395.
Medium (6-8)	CSR 4, Canning 7, CST 7-1, CSRC (S) 7-10-4-0-1, IET 4786
High (> 8)	Bidhan 2, WGL 20471, Annada, Lalat, CSRC(S)39-B-1-B-2, CSRC(S) 47-7-B-B-1

Table 2. Improved rice varieties of rice for kharif

Water regimes	Soil salinity	Varieties*
Up to 15 cm (up land)	Medium to high	Early: CSR4, Canning 7, IET 1444, CSRC(S)7-10-2-0 Medium: CST7-1, Jaya, CSR 1, CSR 2, CSR 3
15-30 cm (Shallow water)	Low to medium	Medium: CSR 6, SR26B, Bhutnath, Sumati, Utpala, IR 16294, CS9-1-30, Dudheswar, CSRC(S)21-2-5-B-1-1 Late: NC1281, NC678, Matla, Hamilton, Najani, , Jhingasail, C300, BD50-11, C340-22-17, Gavir Saru, Gopal Bhog, C340-22-5

30 –50 cm (Semi-deep water)	Low to medium	Medium: CSRC (S) 2-1-7, SR 26B, CSR 6, IR 16294, CS 9-1-30, Amal-Mana (CSRC(S) 7-1-4), Geetanjali, SR 26B, Pankaj, Sabita, Patnai23 Late: C300, BD50-11, C340-22-17, C340-22-5, NC 1281, Matla, Hamilton, Asfal, Gavir, Saru, NC 678
Acid saline soils (pH 4.0-5.5)		Medium: Mahsuri, Canning 7, SR 26B
Flash floods		CAC615, CSR6, SR26B, Swarna Sub-1, CR 1009 Sub-1

Besides, ICAR – Central Coastal Agricultural Research Institute, Old Goa has developed, two high yielding salinity tolerant rice varieties viz., Goa dhan-1 (KS-12) and Goa dhan-2 (KS-17) for cultivation in the coastal saline soils of Goa state. Average yield of these new varieties are between 2.5 and 3.0 t/ha, with an increased productivity of 50 – 70% more compared to prevailing local varieties which are yielding 1.5 – 2.0 t/ha.Mangrove ecosystems play a major role in protecting the coastline against erosion and function as bio-shield against cyclones, tsunami, high tide etc.

The Ministry of Environment, Forest and Climate Change is implementing a Centrally Sponsored Scheme (CSS) on conservation and management of Mangroves and Coral Reefs in the coastal States/UTs of India. The main objectives of scheme are to protect, sustain conserve and augment mangroves in the country through regulatory and promotional measures. The scheme mainly aims at restoration and regeneration of mangroves covering nearly 3000 hectares and providing alternate and supplementary livelihoods to the local communities. Under the scheme, annual action plans of coastal states are supported at 60:40 central state ratio. The Government has identified 38 mangrove sites through a National Committee for undertaking replantation and rehabilitation of mangroves through Management Action Plan (MAPs) under this scheme. The State-wise list of 38 mangrove sites is attached as Annexure-I. According to Forest Survey of India (FSI) Report titled ‘India State of Forest Report (2015), the mangrove cover in the country is 4,740 km2. The table-3 below shows State/Union Territory (UT)-wise status of the mangrove cover as estimated in the 2015 assessment and also the change with respect to the previous assessments.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

PEST SEVERITY AND DISEASE PROLIFERATION
(RECOMMENDATION PARA NO. 6)

The Committee note that incidence of insect pests and proliferation of diseases on field crops may likely to increase during future climate change periods due to elevated CO_2 and temperature. The Committee have been informed that insect pests will go for more amount of consumption (compensatory feeding) due to the dilution / decline of nutritional quality of the crop plants to meet the nutritional requirement of the insect pests under elevated CO_2 and temp conditions. This may lead to higher yield losses in different crops which in turn may affect the food security. More number of generations of insect pests are expected to occur during future climate change periods because of increased temperatures. The Committee observe that studies have been initiated to document Real Time Pest Dynamics (RTPD) in 5 crops (Rice, Pigeonpea, Groundnut, Tomato and Mango) under Strategic Research component of NICRA programme. The Committee also note that Department of Agriculture, Cooperation and Farmers Welfare and State Governments is implementing various schemes under plant protection under "Strengthening and Modernization of Pest Management Approach in India" (SMPMA). Indian Council of Agricultural Research is also evolving and implementing climate resilient plant protection technologies through its National Crop institutes.

The Committee are of opinion that there is a need to give boost to deployment of cutting edge research methodologies to analyze and predict future scenario of pest development and proliferation as well as development of plant protection technologies and practices so that farmers in the country could be trained in these methods to offset decline in agricultural productivity due to change in severity of pest attack associated with climate change. The Committee, therefore, recommend the Government to provide adequate financial support to the Institutes engaged in development of pest protection technologies. The Committee also desire the Government to enhance allocations for implementation of programmes for Pest management.

REPLY OF THE GOVERNMENT

As the standing committee on agriculture observed greater incidence of insect pests and proliferation of diseases on field crops and also anticipates greater loss of crop productivity due to more consumption of plant tissues by the insects owing to dilution/decline of nutritional quality of host crops to meet the nutritional requirement of the insect pests under elevated CO_2, and occurrence of more number of insect generations due to their shorter life cycle under increased temperature is quite inevitable in near future of changing climatic scenario. With regards to the recommendation of committee for imparting financial and structural support to carryout research on climate change to cope with greater loss of crop yield due to more incidences of insect pests and diseases under future climatic scenarios, the Indian Council of Agricultural Research (ICAR) has already launched National Initiative on Climate Resilient Agriculture (NICRA) under which several

state of art facilities of global standard such as Eddy covariance flux tower, Satellite real data receiving system, Field and lab phonemics, Free Air CO_2 and Temperature enhancement (FACE), Open top chamber (OTC) and Temperature gradient tunnel have been developed and established at IARI, CRIDA, IIHR, and other research institutions of ICAR to undertake advanced research on assessing the impacts of elevated CO_2 and temperature on crop productivity, quality, insect pests and disease incidence; and adaptation and mitigation strategies to climate change. Further, simulation studies projected greater incidence of leaf blast disease in winter rice for which research strategies needs to be strengthen in future climatic scenarios.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

AGRO-CLIMATIC CLASSIFICATION
(RECOMMENDATION PARA NO. 7)

The Committee note that the concept of Agro-Climatic Regions (AER) and Agro-Climatic Sub Regions (AESR) categorised on the basis of climatic conditions, local geographic parameters, landform, soils type, soil texture, depth and mineralogy help to maximise agricultural productivity if crop suitable to local conditions are sown by the farmers.The Committee note that 20 AERs and 60 AESRs were identified in the Country. However, the Committee are distressed to note that Agro-climatic classifications are not being strictly followed by the farmers in cultivation of crops. Factors such as socio economic conditions, market prices, government supports in the form of Minimum Support Price (MSP) and subsidies apart from factors such as favorable climate and soil factors, farmers' preferences, consumption patterns and resources available with the farmers decide the kind of crop grown in different locations, thereby, reducing possibility of achievements of optimal production with minimum investment. The Committee have been informed that the government is giving advisory to States to educate farmers for growing crops that are suitable to a given agro-climatic situation so that risk is minimized and incomes are maximized. The Committee further observe that climatic changes associated with Global warming may necessitate refinement in concept of agro-climatic regions. The Committee therefore, recommend the Government to start a study of impact of climatic changes on different of agro-climatic regions so that new strategy may be worked out to offset negative effect associated with climatic changes. The Committee are also of considered view that policy of Minimum Support Price is promoting farming practices which are not suitable to local bio-graphical and climatic conditions, thereby, causing problems such as depletion of ground water resources, degradation of soil, loss of local bio-diversity, etc. Further, absence of an alternative and economically remunerative cropping strategy is forcing farmers to opt for prevailing water intensive cropping pattern. The Committee, therefore, desire the Government (Department of Agriculture, Cooperation

and Farmers welfare) to initiate a study to analyse the effect of policy of MSP on farming practices in the country and bring suitable changes in MSP policy so that environment friendly farming practices based on the concept of agro-ecological regions may be promoted in the country. The Committee also desire the ICAR to work out an alternative cropping strategy for these regions which is economically remunerative for farmers in these regions. The Committee would like the Department to prepare such cropping strategy within three months of presentation of Report.

REPLY OF THE GOVERNMENT

The agro-ecological regions (AERs) map of the country published earlier by ICAR-NBSS&LUP in 1992 has recently been revised (NBSS Publ. 170) based on high resolution soil data and updated climatic data as well as Length of Growing Period(LGP) information for over 450 locations. The revised Agro-ecological Regions Atlas is an up-to-date reliable primer for drawing upintegrated land use plans for sustained and increased ecologically sensitive, environmentally safe, climate smart agricultural production systems. The ICAR-NBSS&LUP has initiated a mega project on Land Resource Inventory of the country on 1:10000 scale to work out alternative and remunerative (to farmers) cropping strategy in each of the 20 revised agro ecological regions based on the potentials identified for different crops.

The commission recommends Minimum Support Price (MSP) for 22 agricultural commodities besides fair and remunerative price (FRP) for Sugarcane. While recommending MSPs for these commodities besides all India weighted costs of production, the commission considers various other important factors such as demand and supply, price trends in the domestic and international markets, inter-crop price parity, terms of trade between and non-agriculture sectors, the likely impact of MSPs on consumers and ensuring rational utilization of natural resources like land and water.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

IMPACT OF CLIMATE CHANGE ON AGRICULTURE
(RECOMMENDATIONS PARA NO. 8)

The Committee note that fifth IPCC report clearly brought out the global and regional impacts of climate change on agriculture, water resources, natural eco-systems and food security. The Committee have been informed that climate change and its variability are emerging as major challenges facing Indian agriculture. The high inter and intra-seasonal variability in rainfall distribution, extreme temperature and rainfall events are

causing crop damages and huge losses to farmers. The Committee note that modeling studies indicate that changing climate will decrease yields in major crops like wheat, rice and maize. On the other hand the impact could be neutral to positive in others like groundnut, soyabean and chickpea. The Committee also note that although there will be increased yields by 10-20% with increase in Co2 level to 550 ppm, however, productivity of most crops is likely to decrease marginally by 2020 but by 10-40% by 2100. The Committee note with satisfaction that the Government of India has initiated and supported research in agriculture sector under National Innovations in Climate Resilient Agriculture (NICRA). However, the Committee are of considered view that since huge population of our country is dependent on agriculture, there is need to enhance allocations for the R&D under NICRA so that scientist of the country can be successful in arriving solutions to challenges posed to the agriculture and allied sectors due to climate changes associated with global warming. The Committee, therefore, recommend the Government to enhance allocations to the NICRA projects.

REPLY OF THE GOVERNMENT

Climate change has become an important area of concern for India to ensure food and nutritional security for growing population. To meet the challenges of sustaining domestic food production in the face of changing climate and generate information on adaptation and mitigation in agriculture to contribute to global fora like UNFCC, it is important to have concerted research on this important subject. With this background, ICAR launched a major project '*National Initiative on Climate Resilient Agriculture*' (NICRA) during XI Plan in February 2011 and now during XII Plan it is referred as '*National Innovations in Climate Resilient Agriculture*' (NICRA). The project had an overall outlay of Rs. 35,000 Lakhs for the XI Plan, Rs.60,000 Lakhs in XII Plan period. However, as directed by the ICAR proposal for Rs.17362.50 Lakhs for the period of 2017-2020 under NICRA has been submitted which is about 48% of the previous plan periods budget allocation due to budgetary constraints. Enhanced budget allocation for the R&D under NICRA will enable the scientist of the country to sustain the efforts initiated during the past 5 years for arriving the solutions to deal with changing climate.Recommendations of the Committee has been noted for necessary compliance. Accordingly, the Council/Department has requested Ministry of Finance for allocation of enhanced funds and expedite the modalities to increase the investment to the extent of 1% agricultural GDP in coming financial years.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

DEVELOPMENT OF VARIETIES OF CROPS WITH ENHANCED ABIOTIC STRESS TOLERANCE
(RECOMMENDATION PARA NO. 9)

Identification and development of crop varieties with enhanced abiotic stress tolerance will be the key for making Indian agriculture climate resilient . The Committee note that the ICAR through its network of institutes and State Agriculture Universities is engaged in identification and development of abiotic stress tolerant crop varieties under NARS and NICRA projects. The Committee have been informed about identification of heat tolerant gene in a Nagina-22 variety of paddy which can be used for development of advanced heat tolerant varieties through breeding process avoiding the need of use of expensive Genetic Modified technology. The Committee have also been informed about identification and development of crop varieties with advance abiotic stress tolerance by the IARI-Pusa.

The Committee have been informed that Government is encouraging use of location specific climate resilient crops varieties including heat/ water logging tolerating seed varieties among farmers by ensuring availability of quality seeds of desirable varieties; developing, demonstrating and disseminating complete package of practices to stakeholders; seed subsidies, capacity building besides bringing convergence among public and private agencies in seed chain. The Committee are of view that development of new crop varieties with higher yield potential and resistance to multiple stress (heat, drought, flood, salinity) will be the key to maintain yield stability under the challenges associated with climate changes in coming decades. The Committee, therefore, desire the ICAR to give further push to their efforts for development of crop varieties with enhanced abiotic stress tolerance.

REPLY OF THE GOVERNMENT

DEVELOPMENT OF VARIETIES OF CROPS WITH ENHANCED ABIOTIC STRESS TOLERANCE

ICAR through crop based institutes and AICRPs has undertaken focused programmes to develop improved varieties/hybrids with enhanced abiotic stresses (drought, heat, salinity) tolerance in crops. In field crops, particularly in rice, wheat, maize, sorghum, pulses, oilseeds, etc. intensive screening of landraces, germplasm and advanced breeding lines is a regular activity. The continued efforts resulted in the identification of genetic stocks tolerant to abiotic stresses which are being utilized in crop improvement programmes aimed at development of abiotic stresses tolerant varieties. The tolerant genotypes, thus developed, in different field crops are at different stages of evaluation/testing. A list of varieties of different field crops tolerant to abiotic stresses is given in Annexure-II.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

AVAILABILITY OF SEED
(RECOMMENDATIONS PARA NO. 10)

The Committee note that Indian seed programme largely adheres to the limited generations' system for seed multiplication in a phased manner. The system recognizes three generations namely breeder, foundation and certified seeds and provides adequate safeguards for quality assurance in the seed multiplication chain to maintain the purity of the variety as it flows from the breeder to the farmer. The Committee have been informed that ICAR apart from research & development on development of varieties/hybrids for different abiotic stresses, have also been entrusted with responsibility for production of Breeder seed which is being undertaken with the help of ICAR Research Institutions, State Agricultural Universities (SAUs), National Seeds Corporation (NSC) / State Farms Corporation of India (SFCI), State Seeds Corporation (SSCs), Krishi Vigyan Kendras (KVKs), Sponsored breeders recognized by selected State Seed Corporations, and Non-Governmental Organizations. The responsibility for production of foundation seed has been entrusted to the NSC, SFCI, State Seeds Corporation, State Departments of Agriculture and private seed producers, who have the necessary infrastructure facilities, whereas the production and distribution of quality/certified seeds are primarily the responsibility of the State Governments. Certified seed production is organized through State Seed Corporation, Departmental Agricultural Farms, Cooperatives etc.

The Committee note that breeder seed production increase from 3914 quintals during 1981–82 to a level of 89266.23 quintals during 2013-14 after Launch of AICRP-NSP (Crops). During 2013-14, total production of quality seed including all classes was 6,48,325 quintals against the target of 4,75,179 quintals. Production comprises 94,953 quintals of breeder seed, 1,44,369 quintals of foundation seed, 1,63,465 quintals of certified seeds, 1,72,351 quintals of truthfully labelled seed and 73,185 quintals of planting material of field crops. In addition, 155.59 lakhs planting material and 5.60 lakh tissue culture plantlets of field crops were produced against the targets of 94.80 and 2.07 lakhs.

The Committee note that country has skewed Seed Replacement Ratio, i.e. the percentage of area sown out of total cropped area by using certified/quality seeds other than farm saved seed, as seed requirement of 65 % of the farmers are met using their own saved seed or seed distributed among themselves. Amelioration of skewed SRR is a major challenge.

The Committee also note that Central Sector Scheme 'Development and Strengthening of Infrastructure Facilities for Production and Distribution of Quality Seeds' is being implemented by the Department of Agriculture, Cooperation and Farmers Welfare

since 2005-06 to ensure production and multiplication of high yielding certified/quality seeds of all crops in sufficient quantities and make the seeds available to farmers at affordable price. However, the Committee is distressed to note that despite efforts being made by the Government, private sector dominates in seed production contributing to 50-57 % of total seed production of the country. The main focus of private seed companies has been on the high-value and low-volume seeds.

The Committee are of considered view that availability of good quality seed at reasonable price is one of important factor for ensuring high productivity in agriculture and to ensure remunerative prices to the farmers. The need of timely availability of seed varieties with enhanced abiotic stress tolerance will increase in coming decades with more increasing uncertainty associated with climate change. The Committee observe that Government have not been able to fulfil its aim to ensure availability of high yielding varieties of improved seeds to the farmers in the country which is evident by low Seed Replacement Ratio and large share of Private companies in the market for high value and low volume seeds in the country. The Committee desire the Government to decentralize the process of production, procurement and distribution of improved varieties of hybrid seeds as it will help in lowering the prices and ensure easy access of farmers to procure these seeds. The Committee, therefore, recommend the Government to examine present system of seed production, procurement and distribution in the country to analyze its shortcomings and take steps for decentralizing the system, in order to enhance Seed Replacement Ratio and to achieve optimum agriculture productivity in the country. The Committee also recommend the Government to involve progressive farmers in the process of production of hybrid seeds. The Committee also desire the ICAR to initiate a study to identify high value and low volume seed varieties in which private sectors are excelling and to sponsor research & development of these seed varieties so that these could be made available to the farmers in the country at affordable price.

REPLY OF THE GOVERNMENT

Agricultural productivity depends on various critical inputs like seed, irrigation, soil fertility, fertilizer, nutrients management, pest and disease management etc. Seeds play a pivotal role in increasing production and productivity of various crops. Efficacy of other agricultural inputs is significantly determined by the quality of seeds. Seeds may account for twenty to twenty-five percent of agricultural productivity.

Seed availability:

Agriculture being a State subject, the role of the State Government is critical in the production, availability and distribution of seeds. The Government of India supplements the efforts of the State Governments by coordinating seed requirement and availability among the states through Zonal Seed Review Meetings (ZSRM) held before every crop

season by a weekly video conference on inputs availability as well as the bi-yearly national Kharif and Rabi campaign meetings. NSC, a Central Public Sector Enterprises (CPSEs) and State Seeds Corporations (SSCs) play an important role in production and availability of certified seeds to the farmers. NSC also take up Test Stock Multiplication, which is an important function in release and popularization of new varieties.

The steps taken for quality seed production includes the systematic production of Breeder Seed, Foundation Seed and then Certified Seed production through seed multiplication under a generation system followed in India i.e. Breeder Seed – Foundation Seed – Certified Seeds. Production of breeder seed as per the indent of Department of Agriculture Cooperation and Farmers Welfare (DoAC&FW), Govt. of India, is the mandate of ICAR. Breeder seeds of new improved varieties is produced and provided to both public and private sector organizations as per indents of DAC&FW for maintaining effective seed chain through its conversion to foundation and certified seeds. Besides, under ICAR-Seed Project, different category of seeds are also produced to enhance the availability of quality seeds to the farmers.

BSP and Quality seed production during 2016-17

ICAR through AICRP-NSP (Crops) is guiding and coordinating breeder seed production in field crops. During 2016-17, a total of 121988.4 q of breeder seed was produced against the indent of 104045.7 q (production comprises 83105.0 q against GoI indent of 67463.3 q; 25476.9 q against state indent of 24378.1 q and additional production of 13406.5 q against ICAR Seed Project targets of 12204.3 q). ICAR also organize quality seed production through ICAR Seed Project and a total of 124576.4 q of foundation seed, 273681.0 q of certified seed, 98198.6 q of truthfully labeled seed and 30421.8 q of planting material has been produced by cooperating centers during 2016-17. In addition, 239.32 lakhs planting material and 1.94 lakhs tissue culture plantlets of field crops were also produced.

High value and low volume seed varieties

Generally, vegetable seeds (varieties / hybrids) are categorized as high value and low volume seeds. ICAR institutes, IARI, New Delhi; IIHR, Bangalore; IIVR, Varanasi; Directorate of Onion & Garlic Research, Pune undertake research programmes to develop varieties / hybrids in their mandated vegetable crops. These institutes along with their regional stations also produce seeds of improved varieties.

Further, hybrid seeds is also considered as high value seed and ICAR undertakes promotion of public sector hybrids in field crops through production of parental lines (breeder and foundation seed) and F_1 hybrid seeds (certified and labeled seed). During 2016-17, 210.9 q of breeder, 87.9 q foundation, 1008.4 q certified and 657.2 q labeled seeds of hybrids were produced in paddy, maize, pearlmillet, sorghum, sunflower and castor.Progressive farmers are involved in seed production programmes of institute like

IARI and producing quality seeds in different crops.The crop wise details of Breeder Seed indent, production and allocation for last five years are at Annexure-III. The crop wise details of foundation seed requirement and production/availability for last five years are at Annexure-IV.

Seed Industry in India:

Indian Seed Industry comprising of Public Sector and Private Sector. Production of Seeds by Public Sector and Private Sector and their share during the last five year 2013-14to 2017-18 is as follows.

(Quantity in lakh quintals)

Year	Requirement/ Demand	Production		Percent
2013-14	335.26	Government	167.76	48.30
		Private	179.55	51.70
		Total	**347.31**	
2014-15	343.56	Government	151.09	42.95
		Private	200.68	57.05
		Total	**351.77**	
2015-16	337.09	Government	147.28	42.87
		Private	196.24	57.13
		Total	**343.52**	
2016-17	353.48	Government	184.21	48.44
		Private	196.07	51.56
		Total	**380.29**	
2017-18	371.37	Government	179.33	42.76
		Private	240.08	57.24
		Total	**419.4**	

Availability of Certified/Quality Seeds for Kharif-2017:

A requirement of 154.69 lakh quintals of certified/quality seed was indicated by the States for Kharif-2017 in the ZSRM held in February, 2017. Against this, an all India availability of 176.26 lakh quintals of certified/quality seed was assessed. An overall surplus of 21.57 lakh quintals was thus available for Kharif, 2017. Overall, no shortfall of certified/quality seeds has been reported in any major crops for Kharif, 2017. Crop-wise availability of seeds is at Annexure-*V*. Regional shortages were reported by some States, which were tied up with other states/ agencies in the ZSRM held in February, 2017 through available national surplus in respective crops and summer production in 2017. The State-wise overall requirement and availability of seed is placed at Annexure-VI. There was sufficient availability of certified/quality seeds of all major Kharif crops as per requirements of the States.

Availability of Certified/Quality Seeds for Rabi-2017-18:

A requirement of 216.68 lakh quintals of certified/quality seed was indicated by the State for Rabi 2017-18. Against this, an all India availability of 243.14 lakh quintals certified/quality seed was assessed. An overall surplus of 26.45 lakh quintals is available

for Rabi, 2017-18. Overall no shortfall of seeds has been reported in any major crops for Rabi, 2017-18 except on Peas, Lentil, Linseed and Potato. The shortage in Peas and Lentil will be meet from the private sector and farm saved seeds. The shortage in Linseed will be meet from farm saved seed. The deficit in potato will also be meet from the States of Himachal Pradesh and Punjab, private sector and farm saved seed. Crop wise availability of seeds is at Annexure-VII. Regional shortages were reported by some States, which were tied up with other states/ agencies in the ZSRM held in August, 2017 through available national surplus in the respective crops. The State wise overall requirement and availability of seed is at Annexure-VIII.

There has been significant increase the production and availability of certified/quality seeds for Kharif and Rabi season during the last ten years is as under:

Quantity in lakh Quintals

Year	Kharif			Rabi		
	Requirement as indicated by States	Availability	Surplus	Requirement as indicated by States	Availability	Surplus
2008-09	96.04	105.53	9.49	111.24	144.81	33.57
2009-10	110.96	126.50	15.54	138.15	153.21	15.06
2010-11	123.11	141.93	18.82	167.64	179.43	11.79
2011-12	139.33	151.29	11.96	190.91	202.17	11.25
2012-13	129.64	141.80	12.16	185.54	186.77	1.24
2013-14	139.87	153.94	14.06	194.10	192.09	-2.01
2014-15	145.51	149.31	3.80	197.89	202.30	4.41
2015-16	136.54	140.76	4.22	200.56	202.77	2.21
2016-17	140.43	153.69	13.26	213.05	226.59	13.54
2017-18	154.69	176.26	21.57	216.68	243.14	26.45

Availability of hybrid seed:

The hybrid seeds are mainly used in paddy, maize, sorghum, bajra, sunflower, castor and cotton crops as well as many horticultural crops. As reported by States the requirement of the certified/ quality seeds of hybrid for 2017-18 is 23.45 lakh qtls. against this the availability is 26.42 lakh qtls. The crops wise details for last five years are as under:

Requirement And Availabilty Of Certified / Quality Seeds (in quintal) of Hybrids

Crop	2013-14		2014-15		2015-16		2016-17		2017-18	
	R	A	R	A	R	A	R	A	R	A
Paddy	427885	342091	151501	195041	385400	614240	192142	220936	523745	585223
Maize	937947	968202	935524	1069035	1015670	1205390	1001970	1252908	1134359	1296257
Jowar	79132	102823	156507	190614	177250	199810	132465	195706	165321	182247
Bajra	236193	332651	210167	248028	240940	266130	196408	249772	259317	288101
Arhar	26	26	870	923	1260	0			3630	4560
Sun-flower	49195.2	54245	28716	29656	44330	46150	61038	62593	7682	8513
Saf-flower	0	0							339	339

Castor	33917	43259	70690	84405	60450	61460	49149	57759	52304	54852
Cotton	159302	179767	179626	217636	186900	198040	183618	197268	198738	222743
Total	**1923597**	**2023064**	**1733601**	**2035338**	**2112200**	**2591220**	**1816790**	**2236942**	**2345434**	**2642835**

R : Requirement A : Availability

Availability of Certified/Quality Seeds for 2017-18:

The overall requirement of certified/quality seeds for 2017-18 is estimated at 371.37 lakh quintals by the States. Against this, 419.4 lakh quintals of certified/quality seed are available. An overall surplus of 48.03 lakh quintals seed is thus available for 2017-18. Crop wise availability of seed is at Annexure-IX.

There has been significant increase in the production and availability of certified/quality seed during last ten years is as under :

The progress of seed production (Qty. in Lakh Qtls.)

Year	KHARIF		RABI		TOTAL		
	Demand	Production/Availability	Demand	Production/Availability	Demand	Production/Availability	Surplus Status
2008-09	96.04	105.53	111.23	144.8	207.28	250.34	43.06
2009-10	110.96	126.51	138.15	153.21	249.12	279.72	30.6
2010-11	123.11	141.93	167.64	179.42	290.75	321.35	30.6
2011-12	139.33	151.29	191.07	202.33	330.4	353.62	23.21
2012-13	129.64	141.81	185.53	186.77	315.18	328.58	13.4
2013-14	139.87	153.94	195.38	193.37	335.26	347.31	12.05
2014-15	145.51	149.31	197.89	202.3	343.56	351.77	8.21
2015-16	136.54	140.76	200.56	226.59	337.09	343.52	5.43
2016-17	140.43	153.69	213.05	226.59	353.49	380.29	26.8
2017-18	154.69	176.26	216.68	243.14	371.37	419.4	48.03

The production and availability of certified/quality seed had significantly contributed in achieving this record agricultural production

Crop-wise Production

Quantity in millions tons

Crop	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Rice	99.18	89.09	95.98	105.3	104.4	106.65	105.48	104.41	**110.15**
Wheat	80.68	80.8	86.87	94.88	92.46	95.85	86.53	92.29	**98.38**
Coarse Cereals	40.04	33.55	43.4	42.01	40.06	43.29	42.86	38.52	**44.19**
Pulses	14.57	14.66	18.24	17.09	18.45	19.25	17.15	16.35	**22.95**
Total Food-grains	234.47	218.1	244.49	259.29	255.36	265.04	252.02	251.57	**275.77**
Oilseeds	27.72	24.88	32.48	30.01	31	32.75	27.51	25.25	**32.1**
Cotton*	222.78	240.2	330	352	340	359.02	348.05	300.05	330.92

*lakh bales

The Government of India is providing assistance for seeds/planting materials to States under the following Schemes:

1. National Food Security Mission (NFSM).
2. Bringing Green Revolution in Eastern India (BGREI).
3 National Mission on Oilseeds and Oilpalm (NMOOP)
4. *Rashtriya Krishi Vikas Yojana* **(***RKVY***).**
5. Sub Mission on Seeds & Planting Material (SMSP) under National Mission on Agriculture Extension and Technology (NMAET).
6. *Mission for Integration Development of Horticulture (MIDH).*
7. *Mega Seed Project for Producing Quality Seed and Planting Materials (Indian Council of Agricultural Research).*

*The pattern of assistance to the farmers under these schemes is at Annexure –*X.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

CONSERVATION OF INDIGENOUS VARIETIES OF SEEDS
(RECOMMENDATIONS PARA NO. 11)

The Committee note that National Bureau of Plant Genetic Resources (NBPGR) is the national institute for conservation of seeds, all germplasm collection, genetic stocks and varieties of different crops in the country. The Committee have been informed that 4.14 lakh accessions are presently conserved for long term in the National Genebank.2.62 lakh indigenous accessions have been collected, more than 60 thousand accessions repatriated, 6.26 lakh accessions imported and tested for quarantine clearance, and more than four lakh accessions have been supplied to breeders and researchers within the country. Nearly 1.9 lakh germplasm accessions have been characterized and more than two thousand cultivars have been DNA fingerprinted. The Committee have also been informed that Intellectual property rights (IPRs) on genetic resources were facilitated by registering about 1100 unique accessions and by filing over a thousand applications with Protection of Plant Varieties and Farmers' Rights (PPV&FR) Authority for varietal registration. The Committee also note that specific set germplasm, breeding lines, varieties are being evaluated for tolerance to abiotic stresses such as heat, drought, water logging etc, which is being used in hybridization for developing new cultivars under NICRA project.

The Committee are of the view that endemic crop varieties available in our country provide the scientist an excellent opportunity to identify traits which can be used for development of crop varieties with enhanced abiotic stress tolerance thereby enabling farmers to adapt to the climate changes associated with global warming. The Committee note with satisfaction about work of cataloguing of indigenous crop varieties being done by the NBGPR and other agricultural institution. However, the Committee desire the ICAR to

enhance awareness about gene banks so that this knowledge can be utilized by the agriculture scientist community across the country in order to develop region specific crop varieties which can withstand specific climatic fluctuation associated with climate change. The Committee, therefore, desire the ICAR to make efforts to enhance access to these depository of crop seed/germplasm for wider scientific community along with innovative farmers.

The Committee also observe that farmers use different nomenclature for similar crops, vegetables, fruits and medicinal plants in regional languages and dialect in regions across the Country. The Committee are of view that inventory of such nomenclature will help in the efforts for conservation and exploitation of bio-diversity. The Committee, therefore, recommend the ICAR to take steps for making an inventory such nomenclature of crops, vegetables, fruits and medicinal plants which are being used in various languages across the regions of the country.

REPLY OF THE GOVERNMENT

One of the objectives of ICAR-National Bureau of Plant Genetic Resources, New Delhi is to conduct, research, undertake teaching and training, develop guidelines and create public awareness on plant genetic resources. Accordingly, the Bureau undertakes several activities to promote the utilization of plant genetic resources and to generate awareness about these resources as detailed below. Regular trainings/awareness programmes are being conducted by NBPGR and its Regional Stations (10) on *Conservation and Utilization of Genetic Resources* for Scientific and farming community. Also short term training programmes on *Genebank Management Techniques* are conducted by NBPGR HQ for scientific and technical personnel to increase the awareness about genebanks and genetic resources conserved. During 2013-14 to 2015-16, six training programmes were organized on conservation and management of plant genetic resources.

Organizing germplasm field days for researchers, breeders etc. for popularization and utilization of germplasm conserved in national genebank (NGB) at NBPGR headquarter and the Regional Stations located in different agro-ecological zones of the country is the priority of the institute. NBPGR, New Delhi and its regional stations organized 28 programmes (field days, biodiversity fairs, awareness generation) for enhancing utilization of germplasm and awareness generations during 2013-14 to 2015-16. Information dissemination on trait specific germplasm and released varieties conserved in the NGB is also being done by NBPGR Scientists by participation in workshops of crop based AICRPs.

Trait-specific germplasm including those registered for specific traits and released cultivars conserved in the NGB are being regularly supplied to indenters to enhance their utilization for development of new climate resilient crop varieties. During 2015-16, a total

of 12,192 samples of different crops were supplied to national users for utilization in various crop improvement programmes in the country based on requests received from research workers under Material Transfer Agreement (MTA),

The ICAR has already done some work on inventory of nomenclature as it published a book entitled “Dictionary of economic plants in India” wherein names of palnts were given in English and Hindi both. The CSIR brought out another publication entitled “The useful plants of India” wherein name are given in English, Punjabi, Odissa, Bengali, Tamil, Telugu, Kannada, Malayali, Gujarati and Marathi. However, book published by ICAR will be uploaded with local languages.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

IMPACT OF CLIMATE CHANGE ON HORTICULTURE SECTOR
(RECOMMENDATIONS PARA NO. 12)

The Committee observe that horticulture sector is an important source of income for farmers in the ccountry. Horticulture is going to be one of thesectors which will be severely affected due to unseasonal rains and temperature variations. India, which is one of the pioneers in horticulture sector, will bear the losses caused due to climate change leading to loss of livelihood for millions of farmers.

The Committee also observe the ICAR while recognizing the need have taken steps under NICRA such as development of location specific technologies for addressing climate change issues especially the impact of elevated temperature, CO_2 on the flowering behavior, pollinators and yield losses due to variable climate including flooding and heavy rains. The Committee also note that ICAR is continuously engaged in identifying and improving varieties of horticulture crops which have inherent potential to withstand abiotic stress associated with the climate change. ICAR have since achieved success in development of water logging resistant germplasm of tomato by grafting on brinjal root stock, development of agro-techniques to overcome alternate bearing in mango, testing of environmentally safe protocols for induction of synchronized flowering in rejuvenated Alphonso mango trees in the age group of 25-40 yrs, etc. The Committee further note that proven technologies including varieties are disseminated among farmers/villages through Technology Demonstration Component (TDC) of NICRA and these technology is further being up-scaled through the support from developmental agencies of Central and State Governments.

The Committee are of view that the importance of horticulture sector in the country will further increase with increasing income and associated Dietary changes over the time. Climatic fluctuations such as draught, flodding, hailstrom etc. associated with global warming can proove disastrous to farmers engaged horticulture cropping. The Committee, therefore, recommend the ICAR to devise a long term strategy for research in horticulture sector identifying potential regions for horticulture crop expansion, identification of draught and abiotic stress tolerant varities, development of new heat stress tolerant varieties,

devising improved agronomic methods, water saving irrigation methods/technologies, training of farmers etc. so that horticulture sector in the country can equip itself to successfully adapt to the changes associated with global warming and keep pace with increasing demands.

REPLY OF THE GOVERNMENT

Climate change impacts several horticultural crops in the country. Flooding for 24 hours severely affects tomato during flowering stage. Onion during bulb stage is highly sensitive to flooding, whereas warmer temperatures shorten the duration of onion bulb development leading to lower yields. Similarly, soil warming adversely affects several cucurbits. Reduction in chilling temperature in the recent years in Himachal Pradesh drastically affected apple production, and the farmers are shifting from apple to kiwi, pomegranate and other vegetables. More importantly, temperature and carbon dioxide are likely to alter the biology and foraging behavior of pollinators that play key role in several horticulture crops. Under NICRA project, research has been initiated at 5 ICAR Institutes viz., Indian Institute of Horticultural Research (IIHR), Bengaluru, Indian Institute of Vegetable Research (IIVR), Varanasi, Central Potato Research Institute (CPRI), Shimla, Central Institute of Temperate Horticulture (CITH), Srinagar and Directorate of Onion and Garlic Research (DOGR), Pune. High throughput screening of germplasm using plant Phenomics, Temperature Gradient Chambers and Rainout shelter enabled to characterizes large number of germplasm lines and identify suitable donors for breeding against drought, heat stress and flooding in tomato, brinjal and onion. The technique for inter-specific grafting of tomato over brinjal has been standardized and large scale demonstrations have been takenup to withstand drought and flooding in tomato. Environmentally safe protocol was developed for synchronizing flowering in mango, which is induced due to changing climate. A microbial inoculation with osmo tolerant bacterial strains have been developed to improve yield under limited moisture stress in tomato. Several resource conservation technologies viz., mulching, zero tillage, reduced tillage, biochar etc. have been demonstrated in climatically vulnerable districts across the country through Krishi Vigyan Kendras (KVKs). Large-scale adoption of these climate resilient technologies enable to adopt the changes associated with global warming and also keep pace with increasing demand for horticulture products in the country in the years to come.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

IMPACT OF CLIMATE CHANGE ON LIVESTOCK

(RECOMMENDATIONS PARA NO. 13)

The Committee note that milk production and reproductive function of cattle and buffaloes will be adversely affected by projected temperature rise of 2-6^{o}C over existing temperature during the period 2070-2099. The Committee also note that studies indicated that warming will negatively impact the productivity of indigenous cows and productivity loss will be about 0.33 million tons. The Northern India is likely to experience more negative impact of climate change on milk production. The decline in milk production will be higher in crossbreds (0.63%) followed by buffaloes (0.5%) and indigenous cattle (0.4%). The Committee have been informed that many varieties of indigenous cattle have capabilities to endure climatic changes associated with global warming. At the same time, some indigenous varieties of cattle such Rathi, Gir, Dhaliwal, Tharparkar and Red Sindhi which are high yielding and could be utilized in improvement of other indigenous varieties of cattle. The Committee observe that ICAR through its network of livestock based ICAR institutes such as ICAR-NDRI, Karnal, ICAR-IVRI, Izathnagar, ICAR, NIANP, Bengaluru and others have taken research projects to develop technologies to offset negative impact of climate change on milk production of both cattle and buffaloes due to rise in temperature by way of (i) development of tolerant/resistant breeds, (ii) improved feeds and supplements and (iii) improved shelter management. The Committee also note that Central Government programmes like National Programme for Bovine Breeding (NPBB), National Dairy Plan (NDP), National Livestock Mission (NLM) and Sub-Missions on Livestock Development, Pig Development in North-Eastern Region, etc. are being under implementation by State Department of Animal Husbandry to improve indigenous varieties of livestock.

The Committee are of considered view that animal husbandry and especially cattle rearing are important source of income for majority of farmers in India. However, the Committee observe that National Plan on Dairying has ignored indigenous varieties of cattle leading to over dependence on crossbreds varieties for milk production. They note that indigenous varieties of cattle possess many traits such as heat tolerance that can be very effective in future scenario projected for climate change. They feel that these traits can be utilized for development of improved varieties of cattle if these are crossbred with high milk yielding indigenous varieties such as Rathi, Gir, Dhaliwal, Tharparkar and Red Sindhi.

The Committee, therefore, recommend the Government to start a comprehensive plan for making inventory of all indigenous varieties of cattle in country, identification and separation of their specific traits, proper breeding plan for cross breeding of indigenous varieties of cattle, vaccination, deworming etc. so that farmers of our country are equipped with wherewithal for coping with vagaries associated with climate changes in the country. The Committee also desire the Government to associate organizations, dairy industries, farmers associations etc. working in the area of cattle breed improvement in the endeavor to improve indigenous varieties of cattle.

REPLY OF THE GOVERNMENT

Under NICRA project climate change research facilities for livestock viz., CO_2 Environmental Chambers, Thermal Imaging System, Animal Calorimeter, Custom Designed Animal Shed etc. have been established at ICAR-National Dairy Research Institute (NDRI), Karnal and ICAR-Indian Veterinary Research Institute (IVRI), Izatnagar. Biochemical, morphological and physiological characterization of indigenous cattle breeds were carried out and compared with exotic breeds. The traits identified in indigenous breed viz., heat shock proteins, air coat colour, wooly hair etc. that impart tolerance to heat stress could be used in future animal breeding programs to develop breeds that can withstand high temperature. Different feed supplements have been identified and tested successfully to withstand heat stress in cattle. Studies on pilled feeding in cattle showed that they help lowering stress levels and methane emission. Custom designed shelters system and feed supplementation with chromium propionate, mineral supplements (Cu, Mg, Ca and Zn) both in feed and fodder significantly improved the ability to withstand heat stress. Many of these climate resilient technologies viz., feed supplement, shelter management, improved breeds, silage making, de-warming etc. have been demonstrated in the farmer's field through KVKs in the 121 climatically vulnerable districts across the country. Up-scaling of these technologies through respective State Governments would enable the livestock farmers in the country cope with vagaries associated with climate change.

National Bureau of Animal Genetic Resources (NBAGR) has characterized many recognized as well as new indigenous livestock breeds in a systematic manner through survey in the native tracts so as to develop their breed descriptors. The breeds/populations of cattle characterized include Sahiwal, Hariana, Rathi, Tharparkar, Nagori, Ponwar, Kherigarh, Kankrej, Gangatiri, Mewati, Kenkatha, Red Sindhi, Krishna Valley, Red Kandhari, Hallikar, Malnad Gidda, Bargur, Pullikulam, Hill cattle of Uttarakhand, Shahabandi, Purnea, Indigenous cattle of Tripura, Mizoram and Manipur, Sanchori, Siri, Nari, Belahi, Kankan, Ladhakhi.

Further, under Network project on Animal Genetic Resources some of the cattle breeds were studied in collaboration with local agencies. These breeds are Deoni, Ongole, Gir, Umblacherry, Bachaur, Dangi, Amritmahal, Khillar, Gaolao, Surti, Gangatiri, Tho Tho, Kosali, Binjharpuri and Purnea. The study undertaken by NBAGR, Karnal revealed that indigenous cattle breeds/population found in different parts of the country possess better heat tolerance and disease resistance as compared to exotic cattle breeds and their crosses. Since productivity of indigenous cattle is lower than exotic/crossbred cattle, the indigenous cattle are facing stiffer competition with exotic/crossbred cattle. Therefore, it is essentially needed to take up genetic improvement program for our indigenous cattle population which is nearly 80% of the total cattle of India.

Work has also been initiated to study climate resilience strength of indigenous cattle breeds. Laboratory experiments have revealed that Sahiwal cows have superior tolerance to summer stress as been shown by hematological, cell proliferation, heat shock proteins and stress marker data. In this process of inventorization of cattle genetic resources ICAR collaborated with many Govt. and non-govt. agencies, research institutions and progressive farmers.

Department of Animal Husbandry, Dairying and Fisheries is implementing a central spotted scheme, name, National Livestock Mission with sub mission on Feed and Fodder development since, 2014-2015. Under the Sub-mission, financial assistance is being provided to all states and UTs on the components as follows.

- Fodder production from forest land and non-forest waste land/range land/grass land/non arable land
- Fodder seed production and/ procurement and distribution to livestock rearers
- distribution of hand driven chaff-cutters and power driven chaff-cutter low capacity tractor mountable fodder block making unit, hay baling machines/ reapers/ forage harvesters
- Establishment of silage making units, by-pass protein production units, area specific mineral mixture/ feed pelleting/ feed manufacturing units

Amount of Rs. 100 crores has been provided to the states/UTs since 2014-15.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

(RECOMMENDATIONS PARA NO. 14)

The Committee note that rumen fermentation is the major source of greenhouse gas emission in farm sector. The Committee have been informed that ICAR institutes are working on various projects under National Plan on Climate Change and NICRA project to reduce GHG emissions from large and small ruminants and developed different forms of complete feed, silage, fortified feed with varied levels of antioxidants, electrolytes and osmolytes, astaxanthin, melatonin along with different types of shelters with low cost and locally available material and herbal supplements to reduce GHGs emission from rumen fermentation. These Institutes have also been successful in identification of bacteriocin producing strains of lactic acid producing bacteria, microencapsulation of Bacteriocins, release kinetics of encapsulated Bacteriocins, lignocellulosic biomass for improving feed utilization, biogeography of gut microbes, novel approaches for assessing and improving nutrient bio-availability. The Committee have been informed that Ration balancing, use of ionophores, probiotics, plant secondary metabolites (Saponins, tannins, terpenoids etc.), organic acids (fumarate, malate), essential oils, defaunation etc. have been found to reduce GHG (methane) emission to the extent of 10-15% in dairy animals. The Committee also note that increase of GHG emissions by Indian livestock was less (74% vs 82% over the period of 1961 to 2010) than the developing countries and this was due to creation of awareness, demonstration of field experiments (FLDs), encouragement provided for growing green fodder, silage making, complete feed preparation, regulations in manure management and waste disposal.

The Committee observe that significant achievement have been made by the ICAR institutions for reduction of GHGs emission from rumen fermentation. however, there is need to work for dissemination of these outcomes to the farmers and dairy entrepreneurs in the country. At the same time, there is need to give additional impetus for identification of cattle varieties which is capacity for lower emission of GHGs.

REPLY OF THE GOVERNMENT

It has now been established that 'ration balancing" helps in reducing enteric methane emissions by 10-15% per kg of milk produced. NDDB has initiated implementation of ration balancing programme (RBP) under the National Dairy Plan Phase-I, Under RBP, balanced feeding advisory services would be provided at farmers" doorstep to about 2.7 million milch animals in the country. So far about 2.5 million animals belonging to 1.9 million farmers are covered under the programme.

In our country, the average methane emission per animal is found to be 60 kg/year, and due to RBP even if a 10% reduction in methane emission is considered, then total methane emission reduction from 2.5 million milch animals amounts to 15,000 tonne/year (i.e. 5,10,000 tonne CO2-equivalent/year). In addition, due to RBP, improvement in the daily milk yield by 0.3 kg/animal and milk fat by 0.1 units has been observed and the average net daily income of farmers has increased by Rs 25/animal.

Thus, ration balancing has proven to be a promising approach for reducing environmental impacts of dairying.

ICAR- National Dairy Research Institute, Karnal assessed the following technologies under the Technology Demonstration Component of National Innovations in Climate Resilient Agriculture (NICRA) after their dissemination to farmers in Manglora, Dilawra and Suhana villages in Karnal district of Haryana during 2013-2017 wherein climate sensitive areas in livestock farming were addressed on priority basis so that farmers will cope with climate change and maintain /enhance the farm productivity. The details on the basis of farmers perception are given as under:

S.No	Name of the technology	No. of farmers	Significant outputs
1.	Effect of area specific mineral mixture on milk productivity for heat stress amelioration	50	0.5 litres of milk increase was **sustained**. Overall **growth** and **health** performance was **improved** and made animals to remain resilient under climate stress.
2.	Effect of vitamin E supplementation on milk productivity under heat stress condition	20	Supplementation of vitamin E played crucial role for reducing the mastitis. Increase of 0.5 litre to 1 litre milk production as it works as antioxidant and improves the immunity.
3.	Effect of mustard oil on milk productivity for heat stress management	40	**Energy status** of animals remains maintained during heat stress. Maintains the **normal** milk production. Animal body become **shiny.**
4.	Safe dung disposal through composting	30	Growth of flies and insects is controlled paving the way for animal comfort. Nutrient loss is minimised and availability of micronutrient is ensured. The chances of spread of diseases and insects highly reduced. It is beneficial for both human as well as livestock. Played crucial role in sanitation at individual household as well as at village level. Created mass awareness among the fellow villagers.
5.	Improved fodder crop 50 varieties to address fodder scarcity		Berseem (BL-42) variety gavemore number of harvests and available in the fields for 5-6 months. Less water requirement over other traditional varieties.

			The traditional variety was giving up to 3-4 cuts, berseem (BL-42) ensures 6-8 cuts in its life duration.
6.	Silage making using bag	20	Purchase of fodder during fodder shortage from other farmers and market was reduced. They used maize and sorghum fodder for silage preparation. Farmers evinced interest to adopt this method. They mix 75-85% straw with silage. Silage reduced fodder shortage and helped to maintain the milk productivity in the shortage period.

Benefits of supplementing the anti-oxidants to address heat stress in dairy animals

1. Benefit of supplementing Astaxanthin heat stress amelioration in dairy animals:

Supplementation of astaxanthin @ 0.25 mg/kg body weight to the Karan Fries (Tharparkar x Holstein Frisian) bulls improved their semen quality in terms of individual motility by 6%, sperm concentration by 76 millions/ml, acrosomal integrity by 3%, live spermatozoa by 4% and total sperm output by 850 millions/ ejaculate compared to control group during heat stress.

2. Melatonin

Subcutaneous implantation of melatonin @ 18 mg/ 50 kg body weight to growing and lactating buffaloes at the interval of 45 days indicated an increase in average daily gain (Body weight) by 70 gm per day and dry matter intake by 0.27 kg in growing buffaloes compared to control group: The service period was reduced by 14 days and increase the conception rate by 18 per cent.

3. Use of Astaxanthine and herbal supplements for heat stress alleviation in female cows and buffaloes:

Experiments are under progress to study the effect of supplementation of staxanthine and herbal supplements on milk production and reproduction in cows and buffaloes.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

ASSESSMENT OF FOOD REQUIREMENT VIS-À-VIS FOOD AVAILABILITY (RECOMMENDATIONS PARA NO. 15)

South Asia has been categorized as one of the most vulnerable ones to challenges associated with climate changes due to global warming. Vulnerability of Indian agriculture due to vagaries associated with climate change and low adaptation capacity of majority of Indian farmers poses risk to food security of the country. The Committee note that population of India is projected to be 1.65 billion by 2050 with 50% of people residing in the urban areas. The Committee also note that total foodgrain demand is estimated to be 291 Mt by 2025 and 377 Mt by 2050, whereas the total production is estimated to be 292 Mt by 2025 and 385 Mt by 2050, which is 2.0% more than the demand. However, production deficits are projected for other cereals, oilseeds, and pulses. The projected deficit is 33% by 2025 and 43% by 2050 for other cereals, while 3% by 2025 and 7% by 2050 for pulses.

The Committee have been informed that it has been analyzed using Infocrop Decision Support System that the impact of climate change on production of wheat, paddy, kharif, maize and rain fed Sorghum can be minimized through adaptation to climate change by sowing improved varieties and employing improved input efficiency technologies coupled with application of additional nitrogen.

The Committee note that Government have launched Food Security Mission during 2007 for additional production of food grains of 25 million tons comprising 10 million ton rice, 8 million ton wheat, 4 million ton pulses and 3 million ton of coarse cereals by the end of 12th Five Year Plan through area expansion and productivity enhancement in sustainable manner in identified districts of the country; restoring soil fertility and productivity at individual farm level; creation of employment opportunities; and enhancing farm level economy (i.e. farm profits) to restore confidence among farmers. The Committee further note that the Government aims to ensure food security in the nation through implementing National Food Security Act, 2013 by undertaking price support operations through efficient procurement of food crops, strengthening public distribution systems, increasing crop production and productivity, and enhancing resilience of Indian agriculture to climate change and climate vulnerability through strategic research and technology demonstration. To meet the requirement of food commodities, particularly pulses and oilseeds, trade related measures are also undertaken by the government besides the ongoing efforts to improve the production within the country. The Committee have also been informed that National Mission for Sustainable Agriculture (NMSA) was initiated with the aims to devise strategies to make Indian agriculture more resilient to climate change. It would identify and develop new varieties of crops and alternative cropping patterns, capable of withstanding extremes of weather, long dry spells, flooding and variable moisture availability. The Government is also supporting the ICAR by funding the NICRA project with the aim of developing technologies that help minimize the adverse impacts of climate change. The government is also adjusting the trade policies and domestic marketing policies keeping in view the food security.

The Committee are of view that the there will changes in consumption patterns in coming decades due to increasing rate of urbanization and increased income of households. Therefore, demand for fruits, vegetables, dairy products, meat, poultry and fisheries will increase at faster rate than that of food grains. Thus, there the country will

need to increase crop diversification and improve allied activities such as dairying, fisheries and poultry farming alongwith maintaining the current rate of growth of food grain production. The country will be required to invest heavily in development of improved crop varieties with enhanced abiotic stress tolerance, development of improved varieties of fertilizers with less GHGs emission effect, better irrigation methods, weather forecasting, training of farmers etc. The Committee, therefore, recommend the Government to provide adequate support to the scientist of the country engaged in climate research in agriculture and weather forecasting sectors under progrmmes such NICRA and NMSA. Further, the

Committee desire the Government to provide fillip to enhance the production of oil seeds and pulses in the country by taking steps for area expansion, development of high yielding varieties of pulses and oil seeds/oil palm, support to farmers etc. so that the country do not face shortage of oil and pulses in coming decades. They also desire the Government to provide adequate funds to Ministry of Agriculture and Farmers Welfare and State Governments to achieve these objectives.

REPLY OF THE GOVERNMENT

In order to increase the production of oilseeds and pulses, the Indian Council of Agricultural Research (ICAR) is engaged in basic, strategic and applied research programmes on different oilseeds (Groundnut, Rapeseed-mustard, Soybean, Sunflower, Sesame, Niger, Safflower, Castor and Linseed) and pulses (Chickpea, Pigeonpea, Mungbean, Urdbean, Lentil, Lathyrus, Rajmash, Fieldpea, Mothbean, Horsegram and Cowpea) at five commodity based institutes and through 10 All India Coordinated Research Projects on specific oilseeds and pulses also develops location specific high yielding varieties/hybrids and suitable production and protection technologies for increasing productivity and production of these two groups of crops.

The efforts of ICAR have resulted in the release of 74 varieties/hybrids of different oilseeds and 63 varieties of different pulses during 2014-2016, given as Annexure-XI, that have fair degree of tolerance to biotic and abiotic stresses. Early maturing varieties/hybrids of oilseeds and pulses have also been found suitable for cultivation in newer niches and cropping systems. Besides, the improved varieties and production technologies are demonstrated at the farmers' fields by the ICAR institutes, State Agricultural Universities (SAUs) and Krishi Vigyan Kendras (KVKs) through frontline demonstrations (FLD) programme to create awareness among the farmers about them. Further, it is submitted that National Food Security Mission (NFSM) is being implemented across the country through various components like NFSM-Rice (194 districts of 25 States), NFSM-Wheat (126 districts of 11 States), NFSM-Pulses (638 districts of all the 29 States) and NFSM-Coarse Cereals in 265 districts of 28 States.

Under NFSM various interventions are being promoted to increase the production of rice, wheat, pulses and coarse cereals through area expansion and productivity enhancement in sustainable manner. Apart from this restoration of soil fertility and

productivity enhancement at individual farm level and enhancing farm economy to restore confidence amongst the farmers.

Assistance is being provided for latest crop production technologies through cluster demonstrations, promotion of newly released varieties, which are resistant to biotic and abiotic stresses, INM & IPM techniques, resource conservation techniques/tools/implements, efficient water application tools and capacity building of farmers through cropping system based trainings. to address various research issues and gaps of potential yield and yield realized at farmers' field, Research projects are supported to SAUs, National and International research organizations.

For increasing pulse production, NFSM-Pulses Programme is being implemented in 29 States in 638 districts of the country. Under this Programme, the following initiatives have been taken

- More than 60% of NFSM allocation dedicated to Pulses to increase the production of pulses in the country through area expansion and productivity enhancement
- Financial Assistance for various interventions like demonstration of improved technologies, distribution of quality seeds of new varieties, integrated pest management and soil amendments, farm machinery & implements, water saving devices and capacity building of farmers are being provided under NFSM and RKVY to enhance the production and productivity of pulses
- Under revamped NFSM since 2014-15, the pulses component of NFSM is extended from 468 to 638 districts of 29 states including all districts of North-Eastern states and hill states like Himachal Pradesh, Jammu & Kashmir and Uttarakhand
- The cultivation of pulses as inter-crop with cereals, oilseeds, commercial crops and on farm bunds of paddy fields is being promoted to increase the area under pulses.
- At least 30% of the cluster demonstrations under NFSM and BGREI are being conducted by adopting cropping system approach to utilize the paddy fallow area for pulses cultivation.
- Under NFSM, a programme of Additional area coverage for increasing pulses production during Rabi/Summer was also being implemented since 2012-13 to expand area and enhancement of productivity of pulses during rabi/summer season in major pulse growing states
- SAUs/ICAR/CGIAR institutes are also involved to address various researchable issues of pulses and demonstrations of latest technologies for better yield realization at farmers' field.

- From 2016-17, new initiatives like distribution of seed minikits, subsidy on production of quality seed, creation of seed hubs, strengthening breeder seed production programme and cluster frontline demonstrations through KVKs have been undertaken under NFSM.
- Procurement of pulses at Minimum Support Prices and increase limit of buffer stock up to 20 lakh tonnes
- Promotion of mini dal mill for primary processing for reducing losses and value chain addition
- Regular monitoring by Senior Officers, National Consultants and Director of Crop Development Directorates of DAC & FW

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

R&D ON ALTERNATIVE FOOD SOURCES FOR FUTURE
(RECOMMENDATIONS PARA NO. 16)

Earth is the adobe of multitude of biological variability. The Human society across the world including India has however selected few crops such as wheat, rice, maize which constitutes their staple diet. Dominance of mono cropping and excessive reliance of selected crops can become a burden in case of any major fluctuation in climate due to global warming. Keeping in view these factors, it is important to take steps to identify and develop some alternative food sources which can withstand climatic variability and hence can be utilized as staple diet for vast population of our country. The Committee note that ICAR through its network programmes on small millets (AICRP on Small Millets), future crops (AICRN on Potential Crops), legumes (AINP on Arid Legumes) is continuously engaged in conservation of germplasms; breeding short duration, tolerant and climate resilient varieties; developing suitable location specific package of practices for potential future crops; and disseminating production and value addition technologies to the stakeholders. The Committee have been informed that ICAR is giving priority to small millet crops, viz. foxtail millet, kodo millet, proso millet, little millets, and barnyard millets through All India Coordinated Research Project on Small Millets. These crops have potential to withstand the vagaries of climate and ensure the food and nutritional security in future. The Committee have also been informed that ICAR Institutes have developed and popularized several ready-to-cook and ready-to-eat health foods based on coarse grains which have been developed under the NAIP project. The ICAR is also making efforts fordeveloping potential crops such as pseudocereals, food legumes/pulses, oilseeds, vegetables and fodder crops through All India Coordinated Research Network on Potential Crops with objectives to find out new plant resources for food, fodder, fuel, energy and industrial uses; identify superior genotypes for cultivation in different regions; and standardize package of practice. ICAR through its ongoing programmes/projects/schemes at NBPGR New Delhi, NBAGR Hisar, NBFGR Lucknow, NBAIM Mau and other ICAR institutes is continuously participating in international project

or alliances of CGAIR, FAO, SAC to share genotypes, breed or species for use in national crop/breed improvement programmes. The shared materials are maintained and preserved at respective national repositories in the country. The Committee have also been informed that Government is promoting cultivation and value addition in more efficient, climate resilient, short duration C_4 crops viz. maize, pearl millet, sorghum and finger millets in suitable regions.

The Committee observe that despite claim of the Government in taking step for promoting cultivation of coarse grain, there was a decline in cultivated area between 2004-05 and 2014-15 in sorghum (3.5 mha), pearlmillet (1.3 mha). The Committee are of considered view that there is need to shift from mono cropping pattern of agriculture to diversified agriculture in order to enhance biodiversity. Enhanced crop biodiversity will help the country to ensure food security in case of any unforeseen consequences of climate change. The Committee desire the Government to actively encourage the cultivation of coarse grain, apart from providing support to research on coarse grains and other potential food crops for future. The Committee, therefore, call upon the Government to make a comprehensive plan for providing funds, seeds, and other agriculture extension support to the farmers for encouraging farming of coarse cereals in the country. The Committee also desire the Government to take an awareness campaign about health benefits of coarse grain in order to enhance its consumption in the country. The Committee are also of view that there is need to involve farmers especially in rainfed agriculture, hill and tribal areas so that traditional foods being used in these areas can be properly analyzed and beneficial germplasm can be stored for further research. There is also need to focus on research on tuber crops which are traditionally being cultivated and used as food source in different parts of country. The Committee, therefore, desire the ICAR to take necessary steps in this direction.

REPLY OF THE GOVERNMENT

AICRPs on Small Millets, Sorghum and Pearlmillet have been involved in developing improved technologies for sustainable production of these crops which were important food crops before green revolution. These crops are highly adapted to rainfed agriculture in their niche areas from arid high temperature regions, semi-arid plains to hilly regions. Since centuries, the millets have provided food and nutritional security to the populations in the disadvantaged geographical regions. These food crops are unique as they require less water to grow, mature early and are cultivated in low input conditions. Agronomic advantages e.g. highly adapted to low rainfall conditions, able to withstand fairly long dry spells, recover fast after delayed rain, make them good contingent crops. Millets are highly resilient in adapting to different ecological conditions; ideal crops for climate change and contingency plantings. Being C4 plants, these are more environment friendly with high water use efficiency and low input requirement, but equally responsive to high input management. Besides, being farmer-friendly, millets possess unique nutritional properties, i.e. high fiber, quality protein and mineral composition, hence called as “nutri-cereals” also.

The ability of millets to offer a modest yield under marginal farming conditions, poor soil and low or no input, has made them attractive crop option in, hill and tribal agriculture. Besides, they provide fodder contributing to food security of livestock. Owing to their nutritional superiority, millets are being popularized as super foods and value addition technologies are being developed at the ICAR-Indian Institute of Millets Research (IIMR), Hyderabad.

Measures being taken by ICAR-IIMR and respective AICRPs toencourage the farmers for taking up cultivation of millets:

- Enhancing the productivity of millets through evolving new varieties. Production technologies have been developed for all other small millets. The productivity of finger millet, pearl millet, sorghum and foxtail millet doubled during the past 40 years due to efforts in the crop improvement. Varieties with high yield potential have also been developed in different small millets like barnyard millet, kodo millet, little millet and proso millet at national and state levels. List of varieties released during 2016 are given in Annexure-XII.
- Varieties/hybrids of sorghum and pearlmillet released during 2014-2016 are given in Annexures XIII and Annexure-XIV.
- Varieties suitable for different climatic conditions and superior in different nutrients have also been developed (Annexure XV).
- Popularizing the millets as nutri-cereals so that the demand for millet based foods increases and farmers realize beneficial value for their produce. In this regard, ICAR-IIMR has taken up value addition technology development, dissemination of the technologies by training entrepreneurs, media campaign about health benefits of millets, making ready-to-cook (RTC) and ready-to-eat (RTE) millet based foods available through licensing of manufacturing technologies. These tasks were taken up with government support in the form of funding in project mode.
- ICAR (AICRPs and IIMR) are regularly taking up Front line Demonstrations in farmers' fields to demonstrate the benefits of latest varieties and production technologies. Farmer groups are regularly trained in production technologies, post-harvest processing and value addition technologies.
- Machinery development for post-harvest processing of millets is underway to enable farm-gate processing that would result in higher returns for the farmer for the produce.

Maize

Maize is another versatile crop with wide adaptability and ICAR-Indian Institute of Maize Research, Ludhiana along with AICRP (Maize) undertakes research programmes on various aspects related to maize improvement. Maize is relatively drought tolerant as compared to major fine cereals. In India maize is cultivated in 8.9 mha. While spring and rabi maize together accounting for around 18% area under maize is predominantly

cultivated under assured irrigation, kharif maize accounting for 82% of maize area is largely cultivated under rainfed situation.

It contains 72% carbohydrates (starch), 10 % protein and 4% fat. The mineral content of maize (Calcium; 10 mg, Phosphorus; 348 mg, Iron; 2.5 mg, Zinc; 2.8 mg, magnesium; 139 mg) is quite comparable to any other cereal grain. The yellow maize contains 90 micro grams of carotene, which plays an important role as anti-oxidant and immunity provider. Above 62% of maize in India is consumed in feed industry, while around 12% is used in starch industry. The integration of maize in human diet directly or indirectly can play a major role in solving the problem of malnutrition, particularly Quality Protein Maize (QPM) which is having higher lysine (>2.4 %) as well as tryptophan values (> 0.6%) as compared to the normal maize. Balanced combination of amino acids in the endosperm of QPM results in higher biological value thereby ensuring more availability of protein to human diet and animal feeds than normal maize.

Maize can be used in greater variety of forms than any other cereals such as Baby corn, Sweet corn, Pop corn and normal grain. Huge scope exists for value added products of speciality corns as well. For example pop corn can be used as High fiber pop corn bar, Nutritious burfi, Iron rich laddu, Protein and fiber rich chikkies, Baby corn can be used as Candy, Murabba, Pickles, Brined baby corns, Vinegar preserved baby corn, dehydrated baby corn and QPM as Health mix, Poustic mixture, weaning mixture, energy mixture, malt mix. Some of the convenience foods such as Ready- to- cook mixes and Ready- to- eat mixes which has good market potential and can be prepared with minimum requirement of machinery are listed below.

- Ready –to cook Idli mix
- Ready –to cook Vada mix
- Ready –to cook Nutri mix
- Papad/ fryumes
- Noodles/ Vermicelli/ Pasta
- Sweet and Spicy Pop corn
- Pop corn health Bar
- Baby corn Candies

Since the beginning of this millennium besides release of 7 field corn cultivars through AICRP on Maize, 12 QPM hybrids in addition to one QPM hybrid with enriched vitamin A have also been released for cultivation. Currently number of hybrids and varieties under various categories (popcorn: one hybrid and two varieties, baby corn: one variety and hybrid each, sweet corn: 3 hybrids and one variety) are available for cultivation. Towards diversification of maize for food purpose under AICRP on Maize extensive work is being carried out on value addition.

Technology development for value addition in sorghum/millets and commercialization

A total of 30 value technologies have been developed by ICAR-IIMR, Hyderabad for sorghum foods on a pilot scale. Commercialization of these technologies has been done by transferring them to entrepreneurs and food industries through MoUs. About 30 such firms have commercialized ICAR-IIMR technologies and more than 10 businesses have crossed the break-even point. The “eatrite” branding of millets foods have been successfully built through campaigning, popularization and awareness programmes. Owing to these progresses, Agri-Business Incubator and Technology Business Incubator projects of the institute have been approved under programmes of ministerial departments.

Description: The millet value added product technologies are healthy, convenient Ready To Cook/ Eat (RTC/E) foods. The technologies have been developed from millets through diversification of processing technologies (flaking, extrusion, baking, popping, parboiling, semolina, blending of flours etc.), standardization and routine R&D activities on product development and studies on the enhancement of shelf life of millet foods.

Domain: of the following segments:

- Value added Millets Food Products
- Convenience food
- Healthy food
- Life style disorder management, etc.,

Impact:

- These technologies have aided in spreading of nutritional awareness of millets among the consumers and have gained a wide momentum from consumers especially the health conscious segment.
- These have created lots of interest among the entrepreneurs as they see more business opportunities in these nutritious, convenient and healthy millet foods.
- Thus, resulting in the creation of demand for the millets consumption, increasing of farmers’ income, generating employment and helping the beneficiary entrepreneurs/stakeholders.

Various processing technologies developed at ICAR-IIMR are:

- Convenient/ Ready-to-Eat and Ready-to-Cook millet based products
- Removes drudgeries and inconvenience involved in preparation
- Increased nutrient digestibility through pre-processing and diversification of processing technologies (baking, extrusion, parboiling, milling, flaking, etc).
- Development of healthy and convenient RTC/E foods (30 convenient products)
- Nutritional Labelling of *Eatrite* products for highlighting the nutritional benefits vis-à-vis over existing products.
- Consumers are provided convenient options even in sorghum and millet foods.
- Currently Nine products are commercialized in M/s Big Bazaar retail outlets in Hyderabad and Mumbai under *Eatrite* brand developed by ICAR-IIMR, Hyderabad.

(*Jowar atta*, Multigrain *atta, Jowar idli rawa, Jowar upma rawa, Jowar khichidi rawa, Jowar* flakes, *Jowar* vermicelli, *Jowar* pasta and *Jowar* biscuits)

Coarse cereals including Millets is one of the components in National Food Security Mission (NFSM) from 2014-15 to enhance the production of coarse cereals. Coarse Cereals is also included under National Food Security Act. Millets contain substantially high amount of fat, fiber, minerals and higher protein compared to fine cereals like rice and wheat and will also help to control malnutrition and many kinds of diseases like obesity, diabetes etc. Under this Programme, Department has been providing support to the farmers for demonstrations, seed distribution and enhancing the production of millets by providing easily accessibility to consumers & industry for value addition of millets. In order to enhance its consumption, awareness campaign is being initiated through social sector schemes and through print and electronic media.

The group called tropical "roots and tuber (R&T)" crops consists of both dicots like sweet potato (*Ipomoea batata*s), cassava/tapioca (*Manihot esculenta*Crantz) and monocots like yams (*Dioscorea* spp.) and edible aroids like taro (*Colocasia esculenta*), tannia (*Xanthosoma sagittifolium*) and elephant foot yam (*Amorphophalluspaeoniifolius* Dennst. Nicolson). R&T crops are the third important food crops of mankind, after cereals and legumes and are either a staple or subsidiary food for about one-fifth of the world population. Individually, cassava, sweet potato and yam rank among the most important food crops worldwide and in terms of annual volume of production, cassava and sweet potato rank among the top 10 food crops produced in developing countries.They contribute about 6% of the world's dietary calories, and are also an important source of animal feed and raw materials for industrial products. Tropical tuber crops are the source of sustenance and livelihood security of 200 million people across different states of India, mainly Kerala, Tamil Nadu, Andhra Pradesh, Karnataka, Odisha, West Bengal, Bihar, UP, Chhattisgarh, Gujarat, Goa, Maharashtra and north-eastern states. The total tropical tuber crops production in our country is about 12 million tons whose present market value is Rs. 165 billion.

The institute is recognized as the national germplasm repository of tropical tuber crops by ICAR-Central Tuber Crop Research Institute (CTCRI). The institute maintains 5,558 accessions as *ex situ* field gene bank and *in vitro* active germplasm collection. It includes 1,211 accessions of cassava, 1,124 of sweet potato, 1,110 of yams, 672edible aroids, and 200 minor tuber crops besides 1241 collections from Regional Centre. The institute developed and released 61 high yielding varieties of different R&T crops. It includes 16 of cassava, 21 of sweet potato, 13 of yams, 8 taro, 2 elephant foot yam and 1 Chinese potato. The high yielding and high starch containing cassava varieties like H165 and H226 developed by the institute contributed in a major way for establishment of starch and sago industries in and around Salem district of Tamil Nadu. The Institute has recently released two sweet potato varieties, Bhu Sona rich in β carotene (12.5-14 mg/100g) and Bhu Krishna, rich in anthocyanin (85-80 mg/100g). Similarly, an anthocyanin rich Greater

yam variety, Sree Neelima has been developed having good culinary and nutritive quality. Sree Athira is the first elephant foot yam hybrid in the world, while Sree Kiran is the first hybrid taro variety released in India.

The institute is constantly collecting germplasm of various tropical tuber crops from different parts of the country and are being conserved, catalogued and evaluated for their characteristics and are used in different breeding programmes to evolve improved tuber crops varieties with different traits. In order to carry out research work in this line a new research project titled '**Conservation and utilization of germplasm of tuber crops for sustaining production**'.

Under the tribal sub plan, the Institute is planning to distribute improved varieties of tropical tuber crops in Odisha (Kandhamal and Koraput districts), Jharkand (Ranchi district) and Chattisgarh (Narayanpur district). Improved varieties of Sweet potato (Kishan and ST-14, Colocasia (Muktakeshi), Greater yam (Orissa Elite and Da 293), Elephant foot yam (Gajendra), Yam bean (RM-1) and Cassava (Sree Jaya, Sree Vijaya and Vellayani Hraswa) are being distributed to farmers in those areas. Cropping system including Greater yam + maize intercropping system (Greater yam planted at 90 x 90 cm spacing. In intra rows between two plants of greater yam three plants of maize sown (1:3 ratio)and Sweet potato + red gram intercropping system (3 rows of sweet potato at 60 x 20 cm spacing and 3 rows of red gram at 60 x 20 cm spacing (3:3)) are also being demonstrated in the tribal districts. In future, the Institute plans programmes to popularize the improved varieties as well as other tuber crops technologies in major tuber crops growing regions of the country.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

COMMENTS OF THE COMMITTEE

For comments of the Committee please refer to Para No. 1.13 of Chapter I of this Report.

AGROFORESTRY
(RECOMMENDATIONS PARA NO. 17)

The Committee note that National Agroforestry Policy (NAFP) announced in 2014 aims at conservation of natural resources, diversification of land use and farming systems to meet the demands of fuel, fodder, timber, and thus promoting economic transformation of farmers. The Committee have been informed that NAFP with objective to protect and stabilize ecosystems and promote resilient cropping and farming systems to minimize the

risk during extreme climatic events will complementachieving the target of increasing forest/tree cover to promote ecological stability especially in the vulnerable regions. The Committee also note that apart from agroforestry development and promotion programmes of State Forest Departments, Central Government has initiated various programmes on research & development through ICAR- Central Agroforestry Research Institute (CAFRI) Jhansi, ICAR- All India Coordinated Research Project on Agroforestry (AICRPAF) and Indian Council of Forestry Research and Education (ICFRI), Dehradun. The Committee have also been informed that programmes for capacity building of farmers and other stakeholders are also being implemented.

The Committee are of the view that agroforestry programmes, if implemented in scientific manner and proper support to the farmers, can emerge as significant income multiplier for small and marginal farmers of the country. However, agroforestry programmes have been implemented in the country without taking care of requirement of farmers, local economy and environment. These agroforestry programmes have so far been at meeting the target of plantation without proper support for post plantation care and resulted in the loss of majority of saplings and huge losses to the farmers. The Committee are of considered opinion that a meticulously-planned nationwide programme for agroforestry based on region-wise environmental and economic factors will go a long way to protect environment along with enhancing income of farmers. The Committee, therefore, recommend the Government to plan a nation-wide programme for agroforestry after consultation with all the stakeholders including State Governments and farmers. The Committee would like to be apprized about the steps taken in this direction within three months of presentation of this report.

REPLY OF THE GOVERNMENT

The National Agroforestry Policy, 2014 (NAF-2014) was formulated to have trees along with the crops in the farmers' fields with focused objectives viz., to encourage and expand tree plantation in complementarities and integrated approach of farming with crops and livestock the policy recommends for setting up of a Mission or Board to address development of the sector in an organized manner.

As a follow up to NAF-2014, Sub-Mission of Agroforestry (SMAF) has been launched from the year 2016-17. The scheme is being implemented in the states those have notified liberalized transit regulations for transport of timber. Implementation of the scheme has been started in 8 States and during 2016-17 and in 8 more States during 2017-18 after notifying liberalized transit regulations.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

(RECOMMENDATIONS PARA NO. 18)

The Committee note that stress on exotic plants in agroforestry programmes was one of the reasons for their failure across the country. These plants despite their property for fast growth, affect local biodiversity and hydrology. However, the Committee in this regard have been informed that various studies have shown that exotic species such as Eucalyptus is more water efficient than other tree species for the per gram biomass production. The Committee have been informed that ICAR-CAFRI, Jhansi has identified suitable tree species for different agro-climatic regions of the country. Further, research institutes are also engaged in identification of tree species which is suitable for local environment and farming system. The Committee are of view that agroforestry programmes should be planned after proper study of local bio-diversity, farming system and availability of market for agroforestry products. It is also important to involve farmers and other stakeholders in planning of agroforestry programmes. The Committee are also of view that there should be stress on use of indigenous plant species in agroforestry as our country has tremendous biodiversity which, if properly studied, can bring forth many local plant species suitable for agroforestry. The Committee, therefore, recommend the Government to issue advisory/notification to the State/UTs Governments for use of indigenous plant species in agroforestry programme. The Committee also desire the Government to focus on Research &Development for identification of locally suitable plant species for agroforestry programmes.

REPLY OF THE GOVERNMENT

The Indian Council of Forestry Research and Education (ICFRE) as it stands today, embodies a very strong, more than century old Forest Research. Education and Extension Foundation in the country. It is actively engaged in developing and promoting improved varieties of multipurpose trees that are also used extensively in agroforestry and in combination with agricultural, horticultural and medicinal plants. ICFRE through its institutes has also developed models for enhancing green cover in the country with a view to achieve the twin objectives of increasing carbon sink and increasing availability of wood. ICFRE's efforts have helped popularized Eucalypts and popular based agroforestry in Panjab, Haryana, western Uttar Pradesh and lower areas of Uttarkhand, Himachal Pradesh and J&K. the organisation has also developed high yielding clones through a systematic tree improvement program for various species in implemented in institutes of ICFRE which include Casuarina, Eucalypts, Poplars, Shisham, Melia, Teak, Acacia, Leucaena, Gmelina, Mahogany, Thespesia, Ailanthus, Kadamba, Tamarind, Calophyllum, Pongamia, Terminalia, Sandalwood, Agarwood and Bamboos.The ICAR-CAFRI research

on Multipurpose Tree Species (MPTS) suitable for agroforestry has also focused on indigenous species distributed in different parts of the country. Some of the important indigenous MPTS suitable for agroforestry for different species are given in Annexure-XVI.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

WATER RESOURCES MANAGEMENT
(RECOMMENDATIONS PARA NO. 19)

Water is one of the fundamental natural resources which is critical for development of human society. There are increasing evidences that climatic changes associated with global warming will affect rainfall pattern across the globe thereby affecting availability of water in different continents. Therefore, it becomes imperative to analyze availability of water resources in our country and prepare an efficient water resource management plan to effectively preparedness to augment water resources for agriculture sector to face the climatic changes associated with global warming.

The Committee note that our country with around 18% of world population has only 4% of the global renewable water resources. The Committee have been informed that despite receiving 4,000 billion average rainfall and snowfall average, availability of water from surface water and replenishable ground water sources in the country is only 1,869 billion cubic metre. However, only about 60% of this i.e. 690 billion cubic metre from surface water and 432 billion cubic metre from ground water can be put to beneficial use because of topographical and other constraints.

The Committee note that irrigation facilities for agriculture in the country are far below the requirement. In this regard, the Committee have been informed that only 65 million hectare out of the 140 million hectare of net sown area in the country is covered under irrigation facility leaving 75 million hectares under rainfed farming. The Committee were also informed that Even after completing all irrigation projects and covering the potentially irrigable area, nearly 50% of the cultivated area will continue to remain rain dependent. Ensuring availability of adequate water in monsoon dependant Rainfed agriculture area is a daunting task which can become a serious problem if climate changes affect intensity and timing of Monsoon rains in India.

The Committee in this regard have been informed that various studies on Indian subcontinent monsoon have indicated strong sensitivity to global warming under the projected climate change scenarios. It is projected that the rainfall magnitude will increase over core monsoon zone in future climate along with lengthening of the season due to late withdrawal. On inter-annual timescales, the severity and frequency of both strong

monsoon (SM) and weak monsoon (WM) might increase in future climate. Substantial changes in the daily variability of ISM are also projected which are largely associated with the increase in heavy rainfall events and decrease in number of wet days during future monsoon. Both extreme wet and dry episodes are likely to intensify and regionally extend in future climate with enhanced tendency of long dry spells. The Commiitee note that projected change in rainfall pattern will create stress to majority of small and marginal farmers dependent on Rainfed farming. The Committee are of view that there is need of comprehensive policy for sustaining rainfed farming in the country which can take into account of future projection for Monsoon rainfall changes. The Committee, therefore, recommend the Government to make a comprehensive perspective plan for sustainable development of Rainfed farming in the country.

REPLY OF THE GOVERNMENT

As per the projected climate change the crop water requirement will be increased by 7-8% by 2060 and 13-15% by 2090. The climate change may change the rainfall pattern not as total but its distribution. It is also projected due to climate change heavy rainfall events will be increased but number of wet days will be decreased in future. Therefore, water conservation through different water conservation structures and groundwater recharge plan needs to be developed for augmenting water resources of the country to face the climate change associated with global warming. More water conservation and groundwater recharge structures need to be developed to increase the utilizable water resources of the country from its present value i.e. 1122 BCM.

Presently only 65 million hectares out of 140 million hectare of net sown area in the country is under irrigation and 75% area of cultivable land is still under rainfed. Rainfed agriculture needs to be developed to improve the productivity of ecology. The ICAR-CRIDA has developed different technologies to improve productivity of rainfed area like crop diversification with low water requiring crops, rainwater conservation through dyke, tank-cum-well system, low cost amelioration technology for rainfed acid soil, rainwater conservation through farm pond, improved irrigation systems to improve the rainfed area of eastern India. In view of the climate change and its impact on rainfall pattern, the technology developed by the research may be incorporated in the comprehensive policy for sustaining rainfed farming in the country to reduce stress to small and marginal farmers of rainfed areas.

Government of India launched a programmer titled ‘Prime Minister Krishi Sinchayee Yojana (PMKSY)’ in 2015 and is committed to accord high priority to water conservation and its management. PMKSY has been formulated with the vision of extending the coverage of irrigation to every farm land ‘Har Khet Ko Pani’ and improving water use efficiency ‘more crop per drop’ in the focused manner with the end to end solution on

source creation, distribution, management, field application and extension activities. PMKSY has been formulated amalgamating on going schemes, viz., Accelerated irrigation Benefit Programme (AIBP) of the Ministry of Water Resources, River Development Ganga Rejuvenation (MoWR, RD &GR), Integrated Watershed Management Programme (IWMP) of Department of Land Resources (DoLR) and the On Farm Water Management (OFWM) of Department of Agriculture and Co-operation, Ministry of Agriculture and Farmers Welfare. In Rainfed areas under this scheme the following activities are being promoted.

1. Water harvesting structures are being constructed such as check dams, nala bund, farm pounds, percolation tanks, etc. This stress is laid more on rainwater harvesting in-situ and Ex-situ at field levels to reduce the runoff and soil loss. In-situ measures include field bunding, contour bunding-trenching, staggered trenching in areas having undulating topography laser land levelling in Indo-Gangetic plain areas. Ex-situ measures include Farm ponds and many state governments have launched special programs like a million farm ponds scheme in AP state alone besides others. The rainwater harvested in ponds beings utilized for life saving irrigation of crops through micro-irrigation system (Sprinkler4 and Rain gun).
2. Several states have adopted micro-irrigation system to improve the water use efficiency. Dripand sprinkler systems are provided on subsidy ranging from 50-90 percent.
3. Repair, restoration and renovation of water bodies particularly of recycling of tanks silt has beenadopted by various state governments particularly Telangana (Mission Kakatiya), Karnatakaand Maharashtra.
4. Crop diversification is being promoted in areas growing water loving crops mainly Paddy andSugarcane so as to divert the saved water to other rainfed crops for life saving irrigation.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

AUGMENTATION OF WATER RESOURCES IN THE COUNTRY

(RECOMMENDATIONS PARA NO. 20)

The Committee note that Prime Minister Krishi Sinchayi Yojana (PMKSY) has been launched by amalgamating ongoing schemes, viz. Accelerated Irrigation Benefit Programme (AIBP) of the Ministry of Water Resources, River Development & Ganga Rejuvenation (MoWR,RD&GR), Integrated Watershed Management Programme (IWMP) of Department of Land Resources (DoLR) and

the On Farm Water Management (OFWM) of Department of Agriculture and Cooperation (DAC). The aim of PMKSY is to achieve convergence of investments in irrigation at the field level, expand cultivable area under assured irrigation, improve on-farm water use efficiency to reduce wastage of water, enhance the adoption of precision irrigation and other water saving technologies (More crop per drop), enhance recharge of aquifers and introduce sustainable water conservation practices by exploring the feasibility of reusing treated municipal waste water for peri-urban agriculture and attract greater private investment in precision irrigation system. The scheme will be implemented by Ministries of Agriculture, Water Resources and Rural Development. The Ministry of Rural Development will undertake rain water conservation, construction of farm pond, water harvesting structures, small check dams, contour bunding, etc. The MoWR, RD &GR will undertake various measures for creation of assured irrigation source, construction of diversion canals, field channels, water diversion/lift irrigation, including development of water distribution systems. The Ministry of Agriculture will promote efficient water conveyance and precision water application devices like drips, sprinklers, pivots, rain-guns in the farm "(Jal Sinchan)", construction of micro-irrigation structures to supplement source creation activities, extension activities for promotion of scientific moisture conservation and agronomic measures.

The Committee have also been informed that PMKSY envisage decentralized 'State level planning and projectised execution' structure that allow States to draw up their own irrigation development plans based on District Irrigation Plan (DIP) and State Irrigation Plan (SIP). It aims to act as convergence platform for all water sector activities including drinking water & sanitation, MGNREGA, application of science & technology, etc. through comprehensive plan. State Level Sanctioning Committee (SLSC) chaired by the Chief Secretary of the State will be vested with the authority to oversee its implementation and sanction projects.The programme is being supervised and monitored at Central level by an Inter-Ministerial National Steering Committee (NSC) constituted under the Chairmanship of Prime Minister with Union Ministers from concerned Ministries. A National Executive Committee (NEC) constituted under the Chairmanship of Vice Chairman, NITI Aayog is overseeing programme implementation, allocation of resources, inter-ministerial coordination, monitoring & performance assessment, addressing administrative issues, etc.

The Committee have also been informed by the Ministry of Water Resources, River Development and Ganga Rejuvenation that they have included various components such as Minor Irrigation scheme below 2000 Hectare, repair, renovation and restoration of water bodies, command area development and water management, use of recycle water and ground water schemes proposed by the State Governments under PMKSY for development of

irrigation facilities in the Country. The Committee have been assured that State Governments have been given full autonomy to plan schemes for irrigation facilities in their States under PMKSY and the Government is Committed to fund the projects as per funding pattern.

The Committee are of view that convergence of scheme as envisaged in PMKSY will go a long way to optimize utilization of funds for irrigation development schemes. However, the Government is required to allocate sufficient funds to Ministries involved for execution of schemes within stipulated time.The Committee, therefore, recommends the Government to make adequate allocation of funds for implementation of projects under the scheme. The State Governments should also be provided support for adequate technical support for planning of District irrigation plan and State irrigation plan and execution of projects under the scheme. The Committee, therefore, recommend the Government to constitute a technical support team to assist at the Central Level to assist the State Government in planning and implementation of projects under the PMKSY. The Committee also desire the Government to take steps for demarcation of beneficiary at District and Block level. The Committee would also like to be apprised about the steps taken in this regard within three months of presentation of scheme.

REPLY OF THE GOVERNMENT

DAC&FW is implementing 'Per Drop More Crop' component of Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) which is operational from 2015-16. Per Drop More Crop mainly focuses on water use efficiency at farm level through precision/Micro Irrigation. Under this component assistance is provided to farmers for installation of Drip & Sprinkler Irrigation systems.

During 2015-16 & 2016-17 an area of 14.11 lakh ha has been covered under Micro Irrigation against the target of 13 lakh ha. During, current year, target of 12 lakh ha under Micro Irrigation has been set against which so far coverage of 2.46 lakh ha has been reported by States.

To reduce the water requirement in paddy cultivation, government is promoting water conservation techniques like Direct Seeded Rice (DSR) through seed drills and drum seeders, System of Rice Intensification (SRI), alternate wetting & drying method, laser land leveling and adoption of varieties which require less water, etc. Similarly, in case of sugarcane, farmers are given advisories for adoption of modern agronomic practices like raised bed sowing, alternate furrow irrigation, sprinkler irrigation, drip irrigation, mulching, etc. are advocated. Besides, diversifying cropping pattern from water guzzling crops to pulses, oilseeds, maize and agro-forestry are also suggested.

Ninety-Nine (99) ongoing projects under Pradhan Mantri Krishi Sinchai Yojana (PMKSY) Accelerated Irrigation Benefits Programme (AIBP) having irrigation potential of 76.03 lakh ha. have been identified, in consultation with states for completion in phases up to December, 2019. For completion of these projects in a mission mode, funding mechanism through NABARD has been approved by the Government for both Central as well as State share. Further, a Mission has also been established for implementation of these 99 projects. Funds are regularly released to States based upon the proposals received from the States and their eligibility as per the guidelines of the schemes. Central Assistance (CA) released during 2016-17 is as under:

- C A released under AIBP : Rs. 3307.86 cr.
- C A released under CADWM : Rs. 853.95 cr.
- C A released to Polavaram Project Authority : Rs. 2514 cr.
- State Share released through NABARD : Rs. 3334.38 cr.

In view of the above, this Ministry has already arranged requisite funding to implement the 99 identified projects.

Technical support, if any required by the States is provided by Central Water Commission (CWC). This Ministry has also prepared detailed 'Guidelines for planning and design of piped irrigation network' and circulated to States during Jal Manthan-4 held on 28-29th July, 2017 with the suggestion to adopt Piped Distribution Network (PDN). These guidelines shall help states in overcoming Land Acquisition problems and savings in cost. Further, CWC is regularly monitoring these projects and bring our short comings/remedial measures to the notice of project.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

INTERLINKING OF RIVERS
(RECOMMENDATIONS PARA NO. 21)

The Committee note that interlinking of river envisage transfer of water from surplus to water deficit areas in the country. Inter-Linking River Programme will help saving the people living in drought-prone zones from hunger and people living in flood-prone areas from the destruction caused by floods. The Committee were informed thatimplementation of interlinking would give benefits of 25 million ha of irrigation from surface water, 10 million ha by increased use of ground water, raising the ultimate irrigation potential from 140 million ha to 175 million ha and generation of 34 million KW of power apart from other benefits. However, the Committee are distressed to know that despite considerable lapse of time, the Government is yet to made any significant headway towards interlinking of rivers in the country except two projects namely Ken-Betwa Project and Pancheswar Project wherein, understanding has been reached between the Government of Uttar

Pradesh and Madhya Pradesh and with Government of Nepal respectively. In this regard, the Committee were informed that constitutional provisions regarding division of Water resources restrict power of Central Government for planning and implementation of projects on water resources management such as interlinking of rivers. The Committee were also informed that many State Governments have raised objections on these projects.

The Committee are of view that projects for interlinking of river are crucial to solve the problems of water scarcity in various parts of country. It will also be crucial to face challenges related to water resource management due to climatic changes associated with global warming. The Committee are, therefore, of opinion that Government should comprehensively examine environmental, socio-economic and financial aspects related to interlinking of rivers and formulate a detailed project for interlinking of rivers in order to effectively utilize water resources of the country for the benefit of the masses. further, the Committee are not convinced with government's contention about limitation posed on Central Government for interlinking of rivers due to constitutional provisions. The Committee are of view that had sincere efforts been made in consultation with the State Governments concerned, consensus could have reached among all stakeholders for interlinking of rivers as it being a win-win formula for all. The Committee, therefore, recommend the Government (Ministry of Water Resources, River Development & Ganga Rejuvenation) to initiate the process of consultations with all stakeholders for constitution of an Empowered Group of State Ministers on Interlinking of Rivers on the pattern of Empowered Group of State Finance Ministers on Goods and Services Tax. The Committee hope that constitution of such group by the Central Government will help in examining all facets related to interlinking of rivers and achieve the desired goal.

REPLY OF THE GOVERNMENT

Under the National Perspective Plan for water resources development through inter basin transfer of water from water surplus basins to water-deficit basins, prepared by the then Ministry of Irrigation (now Ministry of Water Resources, RD & GR), NWDA has identified 30 links (16 under Peninsular Component & 14 under Himalayan Component) for preparation of Feasibility Reports/Detailed Project Reports. The pre-feasibility report of the all 30 links have been prepared and circulated to the concerned State Governments by the NWDA. After survey and investigations, Feasibility Reports of 14 links under Peninsular Component and Feasibility Reports of 2 links (Indian portion) and draft Feasibility Reports of 7 links (Indian portion) under Himalayan Component have been completed.

Consensus Building process:

The efforts of consensus building for preparation of the Detailed Project Report of the Mahanadi – Godavari link, a mother link of 9 link system viz., Mahanadi – Godavari – Krishna – Pennar – Palar – Cauvery – Vaigai – Gundar linkage with concerned State of Odisha are under process. Also efforts are being made with the concerned States for preparation of DPR of MSTG link project.

The Government is pursuing the Interlinking of Rivers program in a consultative manner. The implementation of Interlinking of Rivers (ILR) projects involves various steps such as preparation of Pre-feasibility Reports(PFRs)/Feasibility Reports(FRs) of links, negotiation and consensus among concerned States, agreement with neighbouring countries if link involves area lying in those countries, preparation of DPRs of the projects, clearance from appraisal agencies which includes clearance by Ministry of Environment & Forests and Climate Change (MoEF & CC) and Ministry of Tribal Affairs (MoTA), techno-economic clearance by Advisory Committee on Irrigation, Flood control & Multipurpose projects of MoWR, RD&GR, investment clearance, finalisation of funding pattern, water sharing, implementation mechanism like constitution of SPV/Board, etc., and the time required for the completion of the project as per DPR.

The stage of implementation of a project would be reached after its DPR is prepared with the consensus of concerned States and the requisite statutory clearances are obtained. Thus, the implementation of the projects will take varying periods of time. The Hon'ble Supreme Court vide its judgment dated 27.02.2012 in the Writ Petition (Civil) No. 512 of 2002 on 'Networking of Rivers' alongwith Writ Petition No. 668 of 2002 has directed the Union of India and particularly the Ministry of Water Resources to constitute a Committee under the chairmanship of Hon'ble Minister of Water Resources for the implementation of Interlinking of Rivers Programme. In compliance, MoWR, RD and GR has constituted a committee called Special Committee on Interlinking of Rivers vide Gazette Notification dated 23rd September, 2014.

The Union Cabinet while approving the constitution of Special Committee for ILR in its meeting held on 24th July, 2014 directed that a committee comprising of experts be constituted to look into the issues relating to inter linking of rivers. In compliance to the direction of Union Cabinet, MoWR, RD & GR vide O.M. dated 13th April, 2015 has constituted a Task Force for Interlinking of Rivers (TF-ILR) under the Chairmanship of Shri B.N. Navalawala, Chief Advisor, MoWR, RD&GR. Minister for Water and/or Irrigation with Principal Secretary from each of the concurring States are the Members of Special Committee in addition to the Chief Secretaries of involved States experts and social activist. Task Force will assist the Special Committee for ILR and MoWR, RD & GR regarding the implementation of ILR Programme.

As decided in the first meeting of Special Committee for ILR held on 17.10.2014 at New Delhi to constitute four specific sub-committees; (i) Sub-committee for comprehensive evaluation of various studies/reports (ii) Sub-Committee for system studies for identifications of most appropriate alternate plan, (iii) Sub-Committee for restructuring of National Water Development Agency and (iv) Sub-Committee for consensus building through negotiations and arriving at agreement between concerned States. The Sub-Committee at serial no (iv) is already functioning as consensus group under Chairman,

CWC and members from the concerned States, other three sub-committees have been constituted vide MoWR, RD&GR letter dated 13.02.2015.

The Special Committee is taking ahead implementation of ILR Programme in the consultative manner.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

REJUVENATION OF TRADITIONAL WATER STORAGE SYSTEM
(RECOMMENDATION PARA NO. 22)

Traditional water bodiessuch as tanks, ponds, baories etc. in various parts of the country has served as important source not only to meet the requirement of drinking water but also as an important source of irrigation. These structures have also served as excellent water harvesting mechanism maintaining ground water level. However, the Committee are distressed to observe that majority of traditional water storage structures have disappeared due to lack of maintenance and illegal encroachment. In this regard, the Committee have been informed that the Government have started a scheme for Repair, Renovation and Restoration (RRR) of water bodies since Tenth Plan for comprehensive improvement and restoration of water bodies thereby increasing tank storage capacity, Ground Water Recharge, increased availability of drinking water, improvement in agriculture/horticulture productivity, etc. However, the Committee are distressed to note that the Government have been able to complete repair renovation and restoration of 11640 water bodies against the target of 15,326 under the scheme.

The Committee are of opinion that traditional water bodies are prime example of our knowledge and engineering skill of our ancestors which enabled them to face the challenges of water shortage. Restoration and rejuvenation of traditional water bodies can emerge as one of bulwark of our preparedness for making Indian agriculture climate resilient. The Committee, therefore, recommend the Government (Ministry of Water Resources, River Development &Ganga Rejuvenation) to enhance the target for repair, renovation and Rejuvenation of traditional water storage structure based upon a comprehensive study for identification of all traditional water storage structure in the country. The Committee also desire the Government to include the rejuvenation of dead stream of rivers and numerous small rivers in the country under the scheme through construction of check dams so that water resources of these rivers can be utilized for the benefit of farmers. The Committee would like to be apprised of the steps taken in this regard within three months of presentation of Report.

REPLY OF THE GOVERNMENT

Works related to water resources development and management are planned, funded, executed and maintained by the concerned state government themselves as per their own priority and resources. In order to supplement the efforts of state government, Government of India provides technical and financial assistance to state government to encourage sustainable development of water resources through various schemes including Repair, Renovation and Restoration (RRR) of water bodies etc. The information pertaining RRR of water bodies being implemented by this Ministry is given in the following paras:

Renovation and Restoration (RRR) of water bodies is now part of PMKSY (Har Khet Ko Pani). This scheme has multiple objectives such as reclamation of the lost irrigation potential, improvement of catchment area of the tanks, increase in storage capacity of water bodies and development of tourism and cultural activities. Therefore, it was visualized that this programme will go in a long way in enhancing water availability in different parts of the country.

During the X Plan, the Pilot Scheme namely “Repair, Renovation and Restoration (BR) of Water Bodies directly linked to agriculture was launched in January 2005. Under this scheme works in 1085 water bodies were completed and an irrigation potential of 0.78 lakh ha was restored. Based on success of the pilot scheme, two schemes of RRR, one with domestic support & other with external assistance were launched. Under the scheme of external assistance, 8747 water bodies were proposed for restoration in the states of Andhra Pradesh including Telengana (3000), Karnataka (1224), Orissa (900) and Tamil Nadu (5763). About 8054 water bodies have been reported to be revived under the scheme of external support. Under the scheme of domestic support, a total of 3341 water bodies were taken up for restoration in 12 states out of which 2198 water bodies have been completed till date and an irrigation potential of 1.093 lakh ha has been reported to be restored.

In XII Plan, 1345 water bodies have been included under this scheme and an irrigation potential of 1.0187 lakh ha is planned to be revived through the revival of these water bodies. So far, central assistance of Rs. 264.67 crore has been released under this scheme upto 03/2017.

Further, convergence of Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) with PMKSY-HKKP has been made. Under MGNREGS being implemented by Ministry of Rural Development, assistance is provided for water conservation related activities including check dams, creation of farm ponds etc. 2264 Mission Water Conservation Blocks have been identified under it and at least 65% of Natural Resources Management (NRM) expenditure is incurred on these blocks. Under MGNREGS, an amount of Rs. 52,200 cr. has been spent on water related activities (upto 31/7/2017) as per information available with this Ministry.

During XII Plan, total 1354 water bodies from 9 States, at the cost of Rs.1025.8723 crore with target restoration area of 112167 ha, were approved for their inclusion under the scheme of RRR of Water Bodies. Out of these 1354 water bodies, RRR work of 691 water bodies have been completed with CCA restoration of more than 70000 ha. The works of rest are under progress.

Government of India is committed to accord high priority to water conservation and its management to this effect Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) has been formulated with the vision of extending the coverage of irrigation 'Har Khet ko pani (HKKP) and improving water use efficiency 'More crop per drop' in a focused manner with end to end solution on source creation, distribution, management, field application and extension activities. The Cabinet Committee on Economic Affairs chaired by Hon'ble Prime Minister accorded approval of Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) in its meeting held on 1st July, 2015.

PMKSY has been formulated amalgamating ongoing schemes viz. Accelerated Irrigation Benefit Programme (AIBP) of the Ministry of Water Resource, River Development & Ganga Rejuvenation (MoWR, RD & GR), Integrated Watershed Management Programme (IWMP) of Department of Land Resources (DoLR) and the On Farm Water Management (OFWM) of Department of Agriculture and Cooperation (DAC). PMKSY has been approved for implementation across the country with an outlay of Rs. 50,000 crore in five years.

Under PMKSY, RRR of Water Bodies scheme is a part of sub-component Har Khet ko pani. Under PMKSY the Cabinet has approved for an outlay of Rs.9050 crores for PMKSY (HKKP) component with a target to create 21.0 lakh ha of irrigation potential including 1.50 lakh ha from RRR of water bodies scheme.

Necessary changes in policy & funding guidelines may be taken at the appropriate level to implement the recommendation of committee to enhance the target for Repair, Renovation and Rejuvenation of traditional water storage structure based upon a comprehensive study for identification of all traditional water storage structure in the country. Further, the decision to include the rejuvenation of dead streams of rivers and numerous small rivers in the country under the scheme through construction of check dams so that water resources of these rivers can be utilized for the benefit of farmers can also be taken at appropriate level.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

GROUNDWATER RESOURCES MANAGEMENT

(RECOMMENDATIONS PARA NO. 23)

The Committee note that about 60% of the groundwater in the country i.e. 432 billion cubic meter from can be put to beneficial use. total groundwater resources over the years, due to enhanced availability of energy sources such as electricity and petroleum, groundwater emerged as a secure source of supply for irrigation and become one of backbone of green revolution in the country. However, due to indiscriminate use has led to environmental consequences such as groundwater depletion, pollution and water quality deterioration. The Committee have been informed that Central Ground Water Board (CGWB) has identified 1071 blocks/talukas under over exploited category for ground water. They have also notified about 150 blocks/talukas as most vulnerable areas which witness serious scarcity of water and are vulnerable even to sustain drinking water requirement unless addressed for ground water recharge and its regulated use. The Committee also note that situation of ground water exploitation in many States is more than ground water replenishment. Level of ground water development in States/UTs like Punjab, Rajsthan, Delhi and Haryana are at the level of 172%, 137%, 137%, and 133% respectively. The Committee also note that situation in Tamilnadu, Uttar Pradesh and Himachal Pradesh is critical since ground water development are at the level of 77%, 74% and 71% respectively. The Committee also note that study on excess ground water exploitation conducted by ICAR has also confirmed decreasing level of ground water. The study have also shown sea water intrusion in South Saurashtra coast of Gujrat due to over exploitation of ground water.

The Committee note that regulation of ground water withdrawal, artificial recharge of ground water, rain water harvesting, proper implementation of Watershed management programmes, Roof top water harvesting in urban areas and conjunctive use of surface water with ground water are some of the ways whereby, ground water level can be maintained. The Committee also note that Government is implementing schemes such as Integrated Watershed Management Programmes (IWMP), artificial recharge project under central sector scheme and Rooftop rainwater harvesting scheme for enhancement of ground water level in the country. The Committee have been informed that 8,214 watershed projects covering an area of 39.07 million hectare have been sanctioned under Integrated Watershed Management Programme which has now been subsumed as watershed development component of 'Pradhan Mantri krishi Sinchayee Yojana'. The Committee also note that Central Ground Water Board (CGWB) has taken steps such as notification of Blocks for regulation of ground water development and management, appointed Authorized Officer(s) under section 4 of the Environment Protection Act, 1986 to oversee ground water management, framed guidelines for ground water abstraction to accord ‘No Objection Certificate’ to Industries/Infrastructure/Mining proposal, criteria for recharge of ground water by Water Intensive Industries’, etc. The CGWB has submitted EFC proposal for artificial recharge in 6 over exploited ground water Blocks in Andhra Pradesh, Madhya Pradesh, Punjab, Tamilnadu, and Uttar Pradesh. Additionally, CGWB has also submitted plan for artificial recharge in 442 over exploited ground water Blocks in Andhra Pradesh, Harayana, Karnataka, Maharashtra, Punjab, Rajasthan,Tamilnadu, Telangana and Uttar Pradesh.

The Committee are of view that Ground water, being one of the important source of fresh water on earth, should be effectively managed. Over exploitation of ground water

above the replenishment rate not only hampers equitable distribution of water but also causes problems such as water pollution, intrusion of sea water,etc., thus affecting the quality of water. Further, indiscriminate use of ground water in over-exploited Blocks of the country by the water extensive industries put life of residents in danger by denying them access to drinking water. The Committee, therefore, recommend the Government (Ministry of Water Resources, River Development and Ganga Rejuvination and Central Gorund Water Board) to strictly implement guidelines for use of ground water in the country and issuance of 'No Objection Certificate (NOC)' to water intensive Industries.The Committee desire the Government to submit a report on NOC to the industries for withdrawal of ground water in notified area by the Authorised Officers appointed by the CGWB and compliance of conditions attached within one month of presentation of this report. The Committee also desire the Government to take steps for timely completion of sanctioned watershed projects within stipulated time period so that ground water level could be restored in over exploited ground water areas.

The Committee are also of view that farming of less water intensive crops should be promoted in over exploited ground water Blocks in the country in order to maintain ground water level. There is also need for financial assistance to the farmers for for farming of less water intensive crops and adoption of advanced irrigation methods such as sprinkler or drip irrigation. The Committee, therefore, recommend the Government (Department of Agriculture, Cooperation & Farmers welfare) to make efforts for awareness of farmers regarding problems associated with indiscriminate use of ground water for farming. The Committee also desire the Government to formulate a plan in consultation with the State Government concerned for providing financial assistance to farmers in over exploited ground water blocks in the country for farming of less water intensive crops and adoption of advanced irrigation methods such as sprinkler or drip irrigation.

REPLY OF THE GOVERNMENT

The CGWA is according NOC for the industries, infrastructure and mining projects as per the guidelines which are being revised from time to time. As per the guidelines in vogue, the water intensive industries seeking NOC has got specific component of mandatory recharge measures to be fulfilled in order to consider the proposal for issuance of NOC. While according NOC to the water intensive industries, necessary compliance conditions as stipulated in the guidelines is indicated for strict compliance by the project proponents.

As regards to the NOC issued for the withdrawal of groundwater in the notified areas to the water intensive industry, it is to mention that in the notified areas authorized officers are according NOC for drinking and domestic purposes only. As such, no NOCs have been accorded by the authorized officer appointed by CGWB in the notified areas. Howver, CGWA has issued NOC to the water intensive industries which were prior to the notification. Further after introduction of NOCAP system, the water intensive industries which are operating prior to the notification were issued NOC as per the directives of

Hon'ble NGT. The details of NOCs accorded by CGWA to the water intensive industries are given in Annexure-XVII.

The Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) was launched on 1st July, 2015. Per Drop More Crop (PDMC) component of the scheme focuses on water use efficiency at farm level through precision/micro-irrigation. Main objectives of PDMC are:

1. Increase area under micro-irrigation technologies to enhance water use efficiency.
2. Increase productivity of crops and income of farmers through precision water management.
3. Promote micro irrigation technologies in water intensive/consuming crops like sugarcane, banana, cotton etc. and give adequate focus to extend coverage of field crops under micro irrigation technologies.
4. Make potential use of micro irrigation systems for promoting fertigation.
5. Promote micro irrigation technologies in water scarce, water stressed and critical ground water blocks/districts.
6. Establish convergence and synergy with activities of on-going programmes and schemes, particularly with created water source for its potential use, integration of solar energy for pressurized irrigation etc.
7. Promote, develop and disseminate micro irrigation technology for agriculture and horticulture development with modern scientific knowledge.

During 2015-16 & 2016-17 an area of 14.11 lakh ha has been covered under Micro Irrigation against the target of 13 lakh ha. During current year, target of 12 lakh ha under Micro Irrigation has been set against which so far coverage of 2.46 lakh ha has been report by States. Besides above, water conservation and drought proofing activities are also supported under PDMC to supplement watershed and MGNREGS work. In the last 2 years 56506 structures with irrigation potential of 114230 ha have been created. These structures not only help in life saving irrigation and moisture conservation, but also in groundwater recharge.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

NATIONAL INNOVATIONS ON CLIMATE RESILIENT AGRICULTURE (NICRA)
(RECOMMENDATIONS PARA NO. 25)

The Committee note that National Innovations on Climate Resilient Agriculture (NICRA) initiated by ICAR as a network project since 2010-11 encompasses multi-pronged strategic research, technology development, capacity building of stakeholders and technology demonstrations at farmer's fields. The Committee have been informed that

NICRA has three components namely strategic research, Technology Demonstration and Institutional Intervention.

The Committee note that strategic research component under NICRA aims to evolve crop varieties tolerant to climatic stresses like floods, droughts, frost, inundation due to cyclones and heat waves. The Committee have been informed that 40 Research Institutes of ICAR are conducting research under Strategic Research Component covering various research theme areas viz., development of multiple stress Tolerant Crop Genotypes, Natural Resource Management, Green House Gas Emissions, Climate Resilient Horticulture, Marine, Brackish and inland Fisheries, Heat tolerant Livestock, Small Ruminants and Poultry. The Committee have also been informed that NICRA projects helped to create infrastructure and necessary modern equipments such as high through-put pheno-typing platforms, free air temperature elevation (FATE), carbon dioxide and temperature gradient tunnels (CTGC), high performance computers, automatic weather stations, growth chambers, large glass houses, animal calorimeter, shipping vessel, flux towers and satellite receiving station in ICAR institutes involved in NICRA projects. The Committee note that these institutes have completed 32 out of 52 research projects sanctioned under NICRA. The Committee also note that ICAR is making efforts to involve State Agricultural Universities/research Institutes in public/private sectors as 11-State Agricultural Universities from different states of the country and 2 Research Institutes in private sectors as a partner in NICRA projects.

The Committee note that Technology Demonstration Component (TDC) under NICRA aims at demonstration of location specific practices and technologies to enable farmers cope with current climatic variability. Demonstration of available location-specific technologies related to natural resource management, crop production, livestock and fisheries is being taken up in the climatically vulnerable districts for enhancing the adaptive capacity and resilience against climatic variability. The Committee have been informed thattechnologies with a potential to cope with climate variability are being demonstrated under Technology Demonstration Component (TDC) in 121 most vulnerable districts selected across the country through Krishi Vigyan Kendras (KVKs).

The Committee note that institutional intervention Component under NICRA aims at creating enabling support system in the village comprising of strengthening of existing institutions or initiating new ones (Village Level Climate Risk Management Committees (VCRMC), establishment and management of Custom Hiring Centers (CHCs) for farm implements, seed bank, fodder bank, creation of commodity groups, water sharing groups, community nursery and initiating collective marketing by tapping value chains. The Committee have been informed that 100 custom hiring centers (CHCs) for farm machinery were setup under NICRA project which are being managed by Village Climate Risk Management Committee (VCRMC) comprising of villagers. The Committee have also been informed that a module on use of ICT for knowledge empowerment of the communities in terms of climate risk management is also being planned in select KVKs for generation of locally relevant content and its dissemination in text and voice enabled formats. The Committee also note that 121 KVKs associated under NICRA projects have also taken initiatives such as participatory village level seed production of short duration, drought and flood tolerant varieties, establishment of seed banks involving these varieties were established in the KVKs, demonstration and of improved varieties of fodder seeds and establishment of fodder bank in NICRA villages.

The Committee are of considered view that investment in research and development in agriculture is pre-requisite for making Indian agriculture climate resilient. There is urgent need for enhancing public investment in agriculture research to make it at forefront of country's effort to ensure food security of country threatened by risk associate with climatic changes. Against this background, National Innovations on Climate Resilient Agriculture (NICRA) projects which tries to link strategic research with technology demonstration and capacity building of farmers and other stakeholders could help the country to emerge as pioneer country in agriculture filed in coming decades. However, the Committee are of opinion that there is need to enhance allocations under the NICRA so that scientists do not face resource crunch in their pursuit to solve problems of Indian agriculture and to make it climate resilient. The Committee, therefore, recommend the Government to enhance allocations for NICRA scheme in upcoming fiscals. The Committee also desire the ICAR to analyze performance of NICRA projects to make it more outcome oriented. Impact of institutional intervention such as technology demonstrations custom hiring, seed banks, fodder banks etc. on capacity building of farmers and enhancing agriculture productivity should be analyzed so that these can be replicated at all India level. The Committee like to be apprized about the outcomes of evaluation of NICRA projects within three months of presentation of this report.

REPLY OF THE GOVERNMENT

Climate change has become an important area of concern for India to ensure food and nutritional security for growing population. To meet the challenges of sustaining domestic food production in the face of changing climate and generate information on adaptation and mitigation in agriculture to contribute to global fora like UNFCC, it is important to have concerted research on this important subject. With this background, ICAR launched a major project '*National Initiative on Climate Resilient Agriculture*' (NICRA) during XI Plan in February 2011 and now during XII Plan it is referred as '*National Innovations in Climate Resilient Agriculture*' (NICRA). The project had an overall outlay of Rs. 35,000 Lakhs for the XI Plan, Rs.60,000 Lakhs in XII Plan period. However, as directed by the ICAR proposal for Rs.17362.50 Lakhs for the period of 2017-2020 under NICRA has been submitted which is about 48% of the previous plan periods budget allocation. Enhanced budget allocation for the R&D under NICRA will enable the scientist of the country to sustain the efforts initiated during the past 6 years for arriving the solutions to deal with changing climate.

At the end of the XII five year plan the NICRA project has been evaluated by third party i.e. Interco-operation Social Development India (ICSD), Secunderabad. The firm visited several partner institutes of NICRA, interacted with scientists, farmers and other stakeholders and submitted a report. The executive summary of the third party evaluation firm is as under.

To sustain agricultural production, food security of the nation, and agriculture-dependent rural livelihoods through adaptation to climate change on one hand, and to mitigate the greenhouse gas (GHG) emissions from agriculture and allied sectors on the other, the ICAR has launched a major Project entitled, National Initiative on Climate Resilient Agriculture during 2010-11under the XI Plan, which later metamorphosed into the National Innovations in Climate Resilient Agriculture (NICRA) under the XII Plan. The project consists of four components viz. Strategic Research, Technology Demonstration, Capacity Building and Sponsored/Competitive Grants.

The Central Research Institute for Dryland Agriculture (CRIDA) is the lead Institute and the National Nodal point for NICRA which is being implemented at large number of Research Institutes of ICAR, State Agricultural Universities and KVKs and expanded in 151 districts. CRIDA has designated the Intercooperation Social Development India (ICSD) for conducting the Third-Party Evaluation of NICRA project being implemented at different locations across the country, to assess the progress made during the past six years (2011-17) in relation to the objectives set in terms of technical, institutional and environmental progress, both in Strategic Research and Technology Demonstration components.

Evaluation of the Strategic Research Component (SRC) of NICRA has been carried out in 10 ICAR core Institutes representing all sector-wise Crops, Horticulture, Natural Resource Management, Fisheries and Livestock & Poultry. Similarly, 18 KVKs representing all the 8 ATARIs also have been evaluated.

Evaluation of Strategic Research Component addressed various aspects of the project viz., Progress of relevant research, salient achievements; Status of Infrastructure facilities, assessment of their quality; Quantum of fund sanctioned and expenditure; Documentation of research and technical findings in the form of publications; and Identifying constrains and bottlenecks in the implementation of NICRA project. Whereas evaluation of Technology Demonstration Component (TDC) involved Assessing the impact and usefulness of the technology interventions; Usefulness of capacity building and training programmes organized and Identifying best practices for up scaling them through other development programmes.

NICRA, over the past six years, has made considerable progress. The most important contributions like Contingency Planning and Vulnerability Atlas have gained visibility across Ministries in the Govt of India. Interface meetings have been conducted regularly covering 5 States during 2014, 11 States in 2015 and 12 States during 2016. The purpose of these interface meetings was to appraise the seasonal forecast of monsoon, their implications for the respective States and to develop strategies to overcome the weather aberrations and to harness the better monsoon to enhance and sustain the food production. So far, contingency plans have been completed for 623 districts and are being updated regularly. However, it is very pertinent to regularly update Contingency Plans and enable to implement these Plans by providing technical backstop to DAC and respective State Governments.

One of the major achievements so far in the NICRA project, is development and standardization of state of the art infrastructure for climate change research such as High Throughput Plant Phenomics facilities, Free Air Temperature Environment (FATE), Carbon dioxide Temperature Gradient (CTGC), Eddy Covariance Towers, Automatic Weather Stations, Satellite Data Reception System, Rainout shelter facility, Animal Calorimeter, CO_2 Environmental Chambers, Custom designed animal shed, Research Shipping Vessel, etc. These facilities have been established to support strategic research aimed at understanding how plants, livestock and fish respond to higher CO_2 and temperature conditions.Standardized the techniques for measurement of GHG emissions in different crop, livestock and marine ecosystems, and estimates of carbon sequestration potential through major agroforestry systems in the country. Extensive field phenotyping of

germplasm of crops (rice, wheat, maize, pigeonpea, black gram, tomato) to multiple abiotic stresses is under progress, which will lead to development of varieties and hybrids to cope up with climate change and variability. Natural Resource Management Technologies such as Biochar, Conservation Agriculture, Water footprint and emission reduction through efficient energy management are being developed. Unique traits for thermal tolerance in livestock, has been mapped, invented heat & cold mixture for poultry, sheep and goat. Developed several technologies in feed management, breed improvement and shelter management to cope with climate change in livestock. Relationship was established between increase in Sea Surface Temperature (SST) and catch and spawning in major marine fish species. Simulationmodeling was used to understand the climate change and impacts at regional and national level.

Technology Demonstration Component (TDC) of NICRA is being taken up in 121 climatically vulnerable districts of the country to enhance the adaptive capacity and to enable farmers cope with current climatic variability. The location specific technologies which are developed by the National Agricultural Research System (NARS), which can impart resilience against climatic vulnerability, are being demonstrated by involving Krishi Vigyan Kendras (KVKs) and Agricultural Technology Application Research Institutes (ATARIs). The project addresses predominant climatic vulnerabilities being witnessed in the country, viz., drought, heat wave, cold wave, flood, cyclones, etc. The resilient technologies were demonstrated in a participatory mode involving farmers and the innovation of the project is keeping the communities in the forefront by establishing innovative institutions at the village level such as Village Level Climate Risk Management Committee (VCRMC), seed bank, fodder bank, etc.

As a part of the technology demonstrations, more than 1000 rain water harvesting structures (farm ponds, check dams, percolation pond, jalkund etc.) were constructed/renovated, and 100000 m^3 additional rainwater storage capacity was created resulting in providing opportunities for critical irrigation for addressing midseason drought and enhanced improvement in the cropping intensity up to 120% in several villages. Location specific In-situ moisture conservation and planting methods were demonstrated to improve the soil moisture availability at the root zone and reduce the impact of dry spells. These technologies contributed to improvement in the productivity of crops by 15-20% at several locations. A number of short duration and drought escaping varieties were demonstrated in the NICRA villages resulting in yield advantages in Soybean (22-37 %), Pigeonpea (23-33%), Pearl millet (10-21%), Paddy (5-14%), Sesame (20-28%) and Chickpea (14-39%). In frequently flood affected regions, flood tolerant varieties of paddy viz., Swarna sub1, MTU-1061, MTU-1140, etc. have reached large number of farmers and replaced traditional long duration varieties. Intercropping systems performed better than sole crops during dry spells resulted in improving yields ranging from 10 to 35.2% in several frequently drought affected states. Improved cultivars of fodder crops suitable for both the kharif and rabi were demonstrated resulting in improvement in the green fodder availability and consequently milk production in several NICRA villages. Custom hiring centres were established for farm implements in all the NICRA villages for ensuring timeliness of farm operations during the limited period of moisture availability in rainfed areas. In order to make communities understand the intricacies and the manifestations of climate change and variability, extensive capacity building of communities on various facets of climate change is being taken up. Capacity building on various resilient practices/ technologies, location specific mitigation and adaptation strategies, use of farm machinery,

seed bank, fodder bank etc. are being taken up to enhance capacities of communities for better adoption of resilient practices. During the past six years, 10,130 Capacity Building programs have been organized benefitting 4.1 Lakh stakeholders across the country. These sensitization and capacity building programmes organized will augur well for better acceptance of the outputs that emanate from NICRA.

NICRA project is contributing to several national projects i.e., INDC, BUR, NAMAs, NMSA and also to Missions under National Action Plan on Climate Change. Representatives from other Ministries viz., Earth Sciences, Environment, Forest & Climate Change, Rural Development, Water Resources, Science& Technology etc. are members of High Level Monitoring Committee of NICRA, which is a highest decision taking body of this project. Development of contingency plans, sensitization of development departments about the implementation of these plans and sharing of experiences in establishing climate resilient villages with other developing and developed countries at the COP/MOP meeting of UNFCCC is noteworthy and further help in scaling up of resilient practices in India and in other developing countries as well.

Apart from the third party evaluation, evaluation of the interventions is being taken up in the TDC of NICRA and the details are reported in the annual reports of the project. Some of the salient aspects are given below:

Custom hiring centers (CHCs) were established in all the NICRA villages to meet various farm machinery needs of the communities, such as timely sowing, intercultural operations especially in small farms and also to support various natural resources management interventions such as in-situ moisture conservation, mulching, residue incorporation instead of burning, zero tillage and water saving irrigation technology (drip, sprinkler, raingun, etc.). Farmers in the NICRA village hire this equipment from the CHCs by paying nominal rent during the cropping season for taking up various farm operations. Most popular implements used in these CHCs are rotavator, power tiller, furrow irrigated raised bed planter, happy seeder, multi crop planter, zero till drill, seed cum fertilizer drill, drum seeder, etc.

The effect of the custom hiring centers in timeliness of farm operations and other interventions is being assessed every year in terms of the crop yields, resource use efficiency, cost minimisation, etc. The impact of the equipment of CHC at some of the KVKs assessed during the year 2015-16 is furnished below:

- Demonstrations of zero till drill for wheat and gram in Manjhi village of Nawadah district were taken up in an area of 16 ha in 32 farmers' fields. The practice resulted in increase in yield by11%, 13% in wheat and gram, respectively, as compared to farmers' traditional practice (42.5q/ha, 18.3q/ha).
- In Bharu village of Jhunjhunu district, earlier (before the initiation of NICRA) farmers used to harvest their crops manually and incur Rs. 9000-11000/ha on labour cost for harvesting of wheat and barley. With the introduction of reaper binder under CHC in the village, there is significant reduction in cost and grain losses.

Impact of Reaper Binder for reducing cost and grain losses at Bharu village, Jhunjhunu, Rajasthan

Parameter	Impact

Area and crop	181ha; wheat&barley
Costsavinginharvesting compared to the farmers practice	60%
Reductioningrainlosses	10-15%

In Rasidpur village of Faridkot, generally the fields are not levelled, which directly affect the sowing, nutrient supply, irrigation, plant growth and yield. Demonstration of laser land levelling resulted in uniform application of irrigation water and increased the yield of paddy and net returns.

Impact of Laser Land Leveller for water saving in Farid kot, Punjab

Equipment used	Laser land leveller
Areaandfarmers	296haand98farmers
Watersaving	10-15%
Paddyyield	73q/ha
Netreturns(Rs.ha)	68252

In Hengbung village Senapati, during 2015-16, 96 farmers have hired different farm equipment and implements from CHC and covered 30 ha area. A net income of Rs.15,000 was generated by renting seven equipments. In Aliba village of Mokokchung, demonstration of powertiller in 37 ha area in 42 farmer's field was taken up. The farmers found this machine very useful, as it was very convenient for carrying out agricultural operations in small plots. Apart from this, farmers reported transplanting of paddy in time and saved 65% of coston labour.

Village level seed bank

Availability of quality seed of resilient/ improved cultivars is an important constraint in several villages of the country and seed banks were established to provide quality seed of resilient crop varieties to famers in NICRA villages. Seed production of short duration, drought and flood tolerant varieties was demonstrated in several NICRA villages in rice, wheat, soybean, mustard, chickpea, sorghum, gram, foxtail millet and contributed to their spread in the NICRA villages. VCRMCs facilitated seed bank activities in the NICRA village.

Short duration drought tolerant varieties produced at farmers' level for seed bank in NICRA villages

State	District	Crop	Variety	Quantity (qt) / produced	No.of farmers involved	Area (ha)
Haryana	Sirsa	Wheat	KRL- 219, KRL-210	140	5	50
Jharkhand	Chatra	Rice,Mustard, Wheat	Anjali, Siwani,Helna	96	6	7.4
	Godda	Paddy,Mustard, Gram	Sahbhagi, Pusa-27, JAKI-9218	6	47	4.8
	Buxar	Rice,Chickpea, Wheat,Pigeonpea	Naveen, Sahbhagi, Pusa256, HD2967, WR 544, Narendra Arhar2	16	294	138.5
Bihar	Supaul	Paddy,Wheat	Prabhat, Sahbhagi,	2		

			DBW-14	
WestBengal	South24Paraganas Assam	Paddy	Sabita	3
Assam	Dibrugarh	Rapeseed	TS-38	50
Nagaland	Mon	Maize	HQPM-1	1
UttarPradesh	Gonda	Paddy,Wheat	NDR359, K-9533	104
	Jhansi	Wheat,& Groundnut,Sesamum, Urd, Moong, Lentil Raj-4120,Raj-3700, HUW-234,PBW-502, W.H.-147,TAG-24, T.G.37Azad-3, Shekhar,Pragati, Shekhar,KLB-320 &K-75	114.5	22
	Sonbhadra	Pigeonpea	NDA-1 and 2	40
Maharashtra	Amravati	Soybean,chickpea	JS-9305, Jacki-9218	124
Rajasthan	Barmer	Mothbean, Greengram, Clusterbean	RMO-435, GM-4, RGC-1017	8.2
M.P	Guna	Soybean,Wheat, Gram	JS 95-60, HI 1544, JG14	2587
M.P	Satna	Greengram,Rice, Mustard,Chickpea Barley,Wheat	Samrat, JR-201, PusaTarak, JG-14JB-1, JW-17	19

12	40
30	4
20	15
10	4
312	118

30	78

78	21
123	25
30	42
220	293
103	65

Fodder bank in NICRA Villages

To full fill the requirement of the green fodder in NICRA villages during off season, drought season etc, fodder bank was established under NICRA project with high yielding improved varieties of fodder such as multi cut fodder (pearl millet,sorghum), maize (Yashwant grass,MPChari,Africantall),hybridnapier(BNH-10,CO-3,NB),lucerne(RL-88), multi cut bajra,oat (Kent,JHO – 822), sorghum (CSV-15,CSH-24),berseem (J.H.B-146,Vardan), maize (MPC hari). These varieties have higher nutritive value and enabled farmers to have round the year the production of green fodder.

In Bhalot village of Kutch district, during summer 2015-16, green fodder of 108 tons of maize and sorghum and 184 tons of dry fodder (sorghum and wheat straw) was collected from different sources. A total of 364 tons of fodder was supplied to the cattle during summer 2016 from fodder bank. Milk production in the village increased due to fodder bank and f a rm e r s purchased the fodder from fodder bank. Earlier, before 2011, there was no dairy unit for milk marketing and one private dairy was collecting on an average 110 liter of milk daily. While, today one milk collection center has been established by “Sarhad (Co-operative) Dairy” and collecting average 340-liter milk even during summer months. Today, four persons have started large size dairy farm of cows and buffalo. About 140 farm families rearing 365 cattle have benefited from this activity.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

DISTRICT AGRICULTURAL CONTINGENCY PLAN
(RECOMMENDATIONS PARA NO. 26)

The Committee note that ICAR-CRIDA has prepared Agricultural Contingency Plans for 614 districts recommending location specific climate resilient crops and varieties for use by the farmers. These agricultural contingency plans cover situation like delay in monsoon onset, breaks in monsoon leading to early, mid and late-season droughts, delayed or limited release of water for irrigation, floods, unseasonal rains and extreme weather events such as heat wave, cold wave, frost, hailstorm, cyclone etc. The contingency plans provide information on technological interventions to be made during weather aberrations such as alternate crops/ varieties, management practices etc. which could be followed by farmers. The Committee have been informed that ICAR-CRIDA along with other ICAR institutes regularly interact with officials of the State Government for Crop planning based on agricultural contingency plan. The Committee have also been informed that States of Andhra Pradesh, Telangana, Karnataka, Maharashtra, Madhya Pradesh, Gujarat, Rajasthan, Jharkhand, Assam, Meghalaya and West Bengal are making use of District Agricultural Contingency Plan.

The Committee are of view that Agricultural Contingency Plans prepared the ICAR-CRIDA are one of the important contribution which address unmet needs of intervention required in rainfed based agriculture prevalent in our country. There is need to mainstreaming these agricultural contingency plans for planning and management of agricultural operation in our country. The Committee, therefore, desire the Government to impress upon states to utilize these Contingency plans and disseminate information among farmers to safeguard their crops in case of any unforeseen weather conditions. The Committee also desire the Government to take steps for enhancing awareness among farmers regarding District Agricultural Contingency plans.

The Committee are also of view that these contingency plan will be also useful to face the challenges associated with climatic changes. However, there is need for regular revision/updation of agricultural contingency plan based on feedback obtained from their implementation in different States. The Committee, therefore, desire the ICAR to periodically review these contingency plans based on inputs obtained from field and latest technological inventions. The Committee also recommend the Government to allocate additional fund for this purpose to the ICAR-CRIDA.

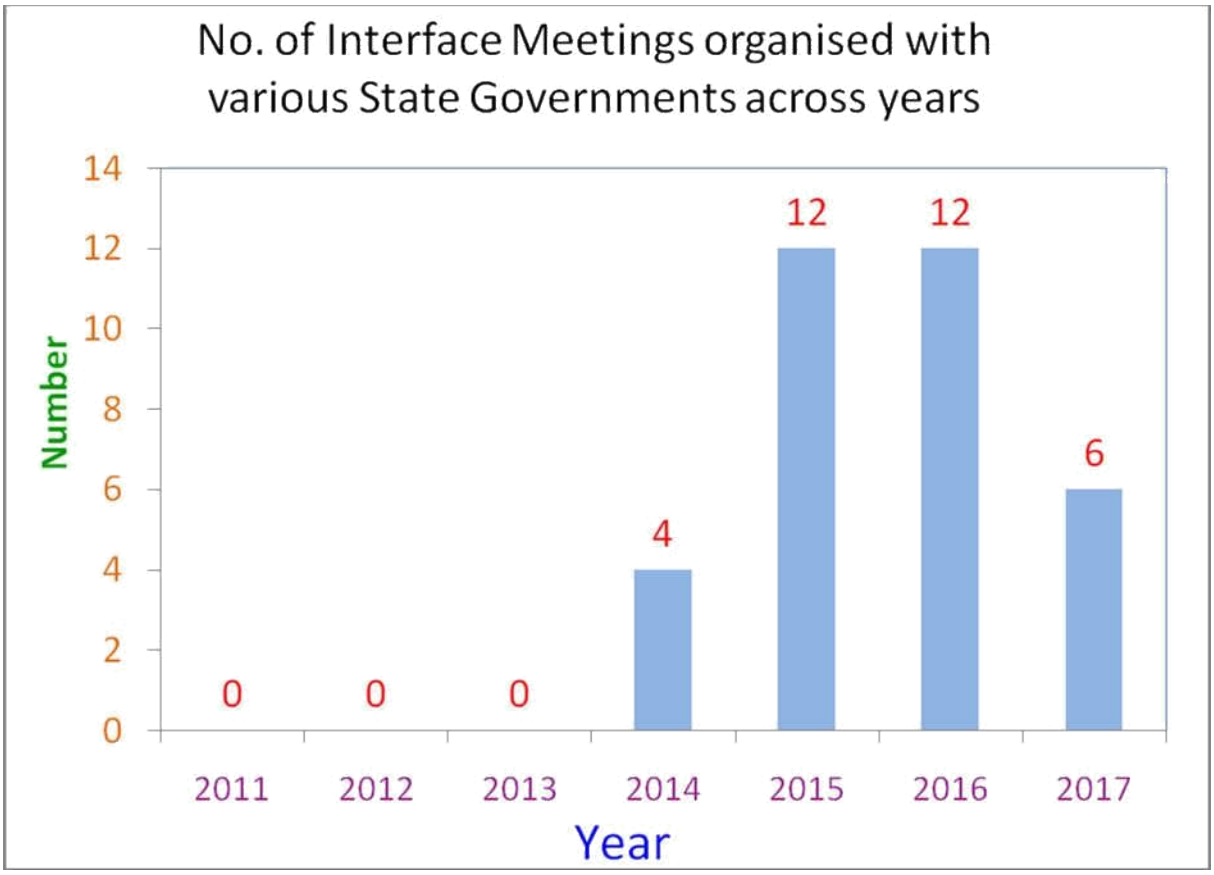
REPLY OF THE GOVERNMENT

ICAR-CRIDA along with other institutes, State Agriculture Universities and KVKs are involved in the development of District Based Agriculture Contingency Plans. A total of 623 districts plans have been prepared so far. In order to operationalize these contingency

plans, ICAR-CRIDA along with Department of Agriculture, Co-operation & Farmers Welfare and State Departments of Agriculture has been conducting Interface meetings with different state governments separately prior to the commencement of *Kharif* season to enhance the preparedness of line departments to meet the weather aberrations. The meetings are being attended by senior officials from department of agriculture district level officials, state agriculture universities and ICAR institutes located in that particular state. During these meetings the seasonal forecast (state specified) for the *Kharif* season made by IMD, SASCOF (South Asia Seasonal Climate Outlook Forum) etc. were shared along with expected deficient /excess rainfall scenario, possible contingency scenarios during the ensuring *kharif* season and measures to be taken are discussed and action plans are finalised.In addition, advisories for Rabi season covering crops to be grown in groundwater irrigated and residual moisture based systems are issued based on *kharif* season rainfall.During the last 3 years, about 34 meetings are organised in various states. The states are chosen based on the forecast of the *kharif* season and the possibility for deficit or excess rainfall. List of states where meetings were organised during 2014-2017 are given below.The district based agriculture contingency plans are also being updated with support from DAC. The plans are being updated in consortium mode with participation of State agriculture/horticulture and veterinary universities, Krishi Vigyan Kendras and ICAR institutes. As part of this effort, a permanent agriculture contingency cell with Director (Research) or Director (extension) as Chairman supported by multi-disciplinary team is being established at SAUs.

No. of Interface Meetings organized with various State Governments

Year	**2014**	**2015**	**2016**	**2017**
Telangana	-	Yes	Yes	-
Maharashtra	-	Yes	Yes	Yes
Madhya Pradesh	-	Yes	Yes	-
Andhra Pradesh	-	Yes	Yes	Yes
Karnataka	Yes	Yes	Yes	Yes
Haryana	-	Yes	-	-
Gujarat	Yes	Yes	Yes	-
Uttar Pradesh	-	Yes	-	-
Rajasthan	Yes	Yes	Yes	Yes
Chattisgarh	-	Yes	-	-
Jharkhand	-	Yes	Yes	-
Bihar	Yes	-	Yes	-
Assam	-	-	Yes	-
Meghalaya	-	-	Yes	-
West Bengal	-	-	Yes	Yes
Odisha	-	-	-	Yes
National Consultation	-	Yes	-	-
Total	**4**	**12**	**12**	**6**



The primary responsibility of managing drought (or any other natural disaster) is that of the State Governments. The State Government is primarily responsible for undertaking necessary relief in the wake of natural calamities including drought. Government of India supplements efforts of state Government with financial assistance.

State Governments have been advised *inter alia*, vide D.O. dated 02.05.2017, to review the state of preparedness in districts in line with the District Agricultural Contingency Plans to manage any weather related contingency to meet any eventualities arising out of an aberrant monsoon to minimize the adverse impact thereof on the agriculture sector.

Video Conferences with the state governments were held by Crop Weather Watch Group for Drought Management (CWWGDM) under the Chairmanship of Additional Secretary & Central Drought Relief Commissioner on weekly basis to keep a close watch on the developments in the agricultural sector during June - September period (Monsoon season) so that proactive measures can be taken to tackle any drought like situation in the country. During these video conferences States were also asked to keep their contingency plans ready and sensitize the entire line department about implementing of the contingency plans in case of an eventuality of drought.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

(RECOMMENDATIONS PARA NO. 28)

The Committee are of view that there is need for a dynamic and vibrant system of Agriculture extension services in order to face the climatic challenges associated with global warming. Farmers of the country need to be supported through an extensive agriculture extension services whereby they can be provided with all necessary inputs such as weather advisory, crop selection, technologies, expert advice etc. However, the Committee are of opinion that present system of Agriculture Extension Services being implemented through State Governments and supplemented through Central Government are not in position to provide required support to the farmers in every nook and corner of the country. The present system of agriculture extension is deficient in their accessibility, infrastructure facilities, subject matter specialists and flexibility required to solve challenges of modern day agriculture facing climatic uncertainties associated with global warming. There is also need to make agriculture extension services in every village of the country. The Committee are of considered opinion that there is need for reorientation of agriculture extension system, if country intends to make Indian agriculture climate resilient. The Committee, therefore, recommend the Government to take steps for modernization of agriculture extension system in the country. The Committee desire the Government to hold consultation with all State Governments in order to revitalize the Agriculture Extension Services in the Country. The Committee would like to be apprised about the steps taken by the Government within three months of presentation of this Report.

REPLY OF THE GOVERNMENT

To face the climatic challenges associated with global warming, Krishi Vigyan Kendras (KVKs) are working in 121 climatically vulnerable districts of the country. These KVKs are working on climate resilient technologies with focus on suitable crops, varieties, natural resource management, farm mechanization and custom hiring services, and also sensitizing stakeholders on drought, flood, frost, soil related issues and ground water depletion. Under climate resilient programs, KVKs have developed climate smart villages which are weather smart (weather forecast, seeds for needs, crop diversification and agro-forestry), water smart (direct seeded rice, precision land levelling), carbon smart (zero tillage, residue management), nutrient smart (site specific nutrient management and legume integration), energy smart (zero tillage, residue management, precision water management, direct seeded rice) and knowledge smart (ICT, capacity development for women and youth). Besides, the KVKs are also providing advisories to farmers on various aspects of farming including weather based crop advisories on their mobile phones through m Kisan Portal.

Extension Reforms in India were plot tested in 28 districts of 7 State from 1998 to 2005. This successful experiment served as a basis to launch the Scheme **"Support to State Extension Program for Extension Reforms"** in the year 2005-06. It was

revamped, expanded and strengthened comprehensively in the year 2010 and 2014. Coverage of the scheme was increased in a phased manner. It is currently operational in 652 rural districts of 29 States and 3 UTs.

Extension services in the country have been revitalized making these farmers friendly, farmer driven, farmer accountable and bottom up planning on ATMA Model. Farmers capacity building and dissemination of modern agricultural technologies etc. extension work is carried out through Training of Farmers & Extension Functionaries, Exposure Visitsof Farmers, Demonstrations, Kisan Melas, Kisan Goshities, Farmers-Scientist Interaction (FSI), Farmers Interest Groups (FIGs) and Farm School in different thematic areas including climate resilient technologies.

In order to make agriculture extension services in every village of the country, following key extension reforms are being promoted under ATMA Scheme:

- Encouraging multi-agency extension strategies involving Public/ Private Extension Service Providers**.**
- Ensuring an integrated, broad-based extension delivery mechanism consistent with farming system approach with a focus on bottom up planning process.
- Adopting group approach to extension in line with the identified needs and requirements of the farmers in the form of Commodity Interest Groups (CIGs) & Farmers Interest Groups (FIGs) and consolidate them as Farmers Producer Organizations;
- Facilitating convergence of farmer centric programs in planning, execution and implementation.
- Addressing gender concerns by mobilizing farm women into groups and providing training to them.

For meeting above key reforms/objectives through strengthened institutional arrangements, dedicated manpower following strategy has been provided in the Scheme at various level:

(i) **At Village Level:** A provision to identify a progressive farmer as Farmer Friend (FF) has been made in the Scheme @ one FF per two villages. The Farmer Friend helps in activating the much needed village-based bottom-up planning process and serve as vital link between extension system and farmers at village level.

(ii) **At Block Level:** The Block ATMA Cell consisting of Block Technology Team (BTT) (A team comprising officers of agriculture and other allied departments within the block) and Block Farmers Advisory Committee (BFAC) (A group exclusively consisting of selected farmers of the block) prepares Block Action Plan (BAP) and provide necessary extension support within the Block in its execution.

(iii) **At District Level:** Agricultural Technology Management Agency (ATMA) is an autonomous institution set up at district level to ensure delivery of extension services to farmers. ATMA Governing Board is the apex body of ATMA which

provides overall policy direction. ATMA Management Committee is the executive body looking after implementation of the Scheme. District Farmers Advisory Committee (DFAC) is a body to provide farmers' feedback for district level planning and implementation. With dedicated staff provided for the ATMA, it will continue to be the district level nodal agency responsible for overall management of agriculture extension system within the district, including preparation of Strategic Research Extension Plan (SREP).

(iv) **At State Level:** The State Level Sanctioning Committee (SLSC) set up under Rashtriya Krishi Vikas Yojana (RKVY) is the apex body to approve State Extension Work Plan (SEWP). The SLSC is supported by the Inter Departmental Working Group (IDWG), which is responsible for day-to-day coordination and management of the Scheme activities within the State. The State Nodal Cell (SNC) ensures timely receipt of District Agriculture Action Plans (DAAPs), formulation of SEWP duly incorporating feedback obtained through State Farmers Advisory Committee (SFAC) and its approval by SLSC. The SNC then convey the approval and monitor implementation of these work plans by States Agricultural Management & Extension Training Institutes (SAMETIs) and ATMAs. The SAMETIs will draw-up and execute an Annual Training Calendar for capacity building of Extension Functionaries in the State.

Bottom-up Planning: - ATMA is process oriented Scheme as per details given below:-

(1) Strategic Research Extension Plans (SREPs): SREP is a comprehensive document identifying research/extension priorities for district. Keeping in mind Agro-Ecological Situations (AES) and existing gaps in technology generation and dissemination in all agriculture and allied sector areas/activities, SREP is prepared for each district in coordination with the line departments, Krishi Vigyan Kendras (KVKs), Panchayati Raj Institutions (PRIs), Private Sector, Farmers and other Stake-holders at the District level. SREP is a vision document which serves the basis for formulation of Block Action Plan (BAP) on annual basis. BAPs are then consolidated at district level to prepare the District Agriculture Action Plan (DAAP). DAAPs are consolidated in the form of State Extension Work Plan (SEWP)

(2) Block Action Plan (BAP): At the Block level, Block Technology Team (BTT) (A team comprising officers of Agriculture and all live departments within the block) and Block Farmer Advisory Committee (BFAC) (A group exclusively consisting of farmers of the block) provides extension support for preparation and execution of BAP. The BAP is prepared annually based on the extension gaps identified in Strategic Research Extension Plan (SREP) of the District.

(3) District Agriculture Action Plan (DAAP): District Agriculture Action Plan (DAAP) is prepared compiling BAPs of all the Blocks in the District in consultation with District Farmers Advisory Committee (DFAC) and KVK experts.

(4) State Extension Work Plan (SEWP): State Extension Work Plan is prepared by the State Nodal Cell duly consolidating DAAPs of all the rural Districts in the State

and feedback of State Farmers Advisory committee (SFAC). The Inter-Departmental Working Group (IDWG) at State level is responsible for day to day coordination and management of scheme activities within the State. The SLSC setup under RKVY is the apex body to approve SEWP.

In order to ensure greater involvement of farmers in planning and execution of extension activities, a provision of Farmer Advisory Committees (FACs) at State, District and Block levels comprising a group of farmers has been kept in the Scheme Guidelines. The Department of Agriculture, Cooperation and Farmers Welfare is trying its utmost to strengthen ATMA Scheme in a mission mode during the period from 2017-18 to 2019-20 under Green Revolution – Krishonnati Yojana.

Consultation between Government of India and State Governments is held regularly (twice in a year) during the course of Zonal Conference of Rabi and Kharif Seasons. The issues related to implementation of ATMA Scheme and revitalization of agriculture extension services etc. are thoroughly discussed in these pre-seasonal Zonal Conferences. A day long consultative meeting-cum-workshop with State Governments representatives is expected to be organized shortly in New Delhi to discuss bottlenecks in the existing extension system and suggestions for modernization of agricultural extension system in the country.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

MECHANIZATION OF AGRICULTURE
(RECOMMENDATIONS PARA NO. 29)

The Committee observe that agriculture sector is facing problem of shortage of labour due to diversification of economy and higher prospect of earning in other sectors. Further, climatic fluctuation due to global warming will require shorter duration crops and hence, there will be need of enhanced mechanization in agriculture sector to offset problem of shortage of labour. The Committee have been informed that overall level of mechanization in country's agriculture sector is about 40-45%. However, the Committee are distressed to note that Department did not maintain information regarding State-wise level of mechanization. The Committee were further informed that important agriculture operations mechanized include seed-bed preparation (40%), seeding/ planting (29%), plant protection (34%), irrigation (37%), harvesting and threshing (60-70% for wheat & rice and less than 5% for other crops).

The Committee note that Government has launched a Sub-Mission on Agricultural Mechanization to extend the benefit of mechanization to small and marginal farmers through establishment of custom hiring centres. This mission also intend to create high tech hubs for high value farm equipment and creating awareness amongst the stakeholders through demonstration and capacity building activities. The Committee were

informed that the Government is providing subsidy ranging from 25 to 50% for establishment of these centres. The Committee also note that 10% additional subsidy is provided to ST, ST and women/small-marginal farmers of NEH state beneficiaries under this scheme.
The Committee were also informed that ICAR-Central Institute of Agricultural Engineering, Bhopal is engaged in conducting basic and applied research for development of new machines and technologies including harvesting machines in the country. The Committee also note that All India Coordinated Research Project (AICRP) on Farm Implements & Machinery while working on development of cost effective harvesters and other farm equipments in association with private manufacturers has developed various agricultural equipments such as Multi-purpose Self Propelled Hydraulic Platform, Tractor Mounted Fodder Harvester, Root Crop Harvester, Tractor Operated Groundnut Digger Shaker, Tractor Operated Coconut Harvester etc.

The Committee observe that across the world, mechanization is considered as one of the important method to enhance farm productivity and reduce post harvest crop losses. The Committee are also of opinion that due to small size of farm holding and weak economic condition of majority of small and marginal farmers in the country, there is need to focus on research to develop efficient farm equipments which are suitable to unique agricultural conditions of the country. Further, the Committee are of view that increasing the level of mechanization of Indian agriculture can be adopted as one of the way to reduce cost of cultivation in country, and thereby enhancing the income of farmers. The Committee are however, distressed to note that level of mechanization in agricultural operations in the country is only 40-45%, which is quite low as compared to agriculturally advanced country such as USA, Brazil, China etc. The Committee, therefore, recommend the Government (Department of Agriculture, Cooperation& Farmers Welfare) to widen the ambit of Sub-Mission on Agricultural Mechanization to set a definite time frame for enhancing level of agricultural mechanization in the country. The Committee desire the Government to adequately enhance allocations of funds for scheme in order to establish custom hiring centers in each Gram Panchayat.

The Committee also recommend the ICAR to suitably reorient AICRP-Farm Implements & Machinery to develop cost efficient and effective farm equipments suitable for farming practices of all agro-climatic regions of the country. The Committee desire ICAR to develop small farm equipments which can reduce drudgery while utilizing human power. The committee would like to be apprised about the steps taken in this direction within three months of presentation of report.

REPLY OF THE GOVERNMENT

The AICRP onFarm Implements & Machinery is conducting Research & Development, Prototype Production, Feasibility Testing and Frontline Demonstration of Farm Equipment & Machinery through 25 cooperating centres located in different parts of the country to bridge identified mechanization gaps for different agro-climatic regions, crops and operations. The project is addressing issues of farm mechanization gaps in most of the agro-climatic regions of the country where the centres are located.

A number of manually operated, animal drawn and self-propelled small farm equipment have been developed to reduce drudgery of human workers. The targets and projected outcome of the Agricultural Engineering Division including AICRP on Farm Implement and machinery for the year 2017-20 is given in Table 1.

Table 1: Targets and projected outcome for the year 2017-20

S. No.	Targets	Projected outcome (2017-20)
1.	Farm mechanization status in India	Status and future prospects of farm mechanization in country
2.	Farm machinery package for different agro climatic zones of India	Package of farm machines for different crops under different agro-climatic zones
3.	Zero till planter-cum-residue mulcher under maize wheat cropping system	Wheat/ maize planting under residue conditions
4.	Seed metering mechanism for high speed seeding or planting	High speed seeding/planting
5.	Real time uniform rate spraying system for field crops	Efficient utilization of plant protection chemicals
6.	Multipurpose vehicle for various operation in vegetable crops	Facilitation of multiple operations in vegetable crops
7.	Light weight multi crop thresher for Uttarakhand hills	Drudgery reduction of hill farmers
8.	Transplanter for onion seedling	Mechanized transplanting of onion
9.	Smart sprayers for pomegranate young orchards	Efficient utilization of plant protection chemicals
10.	Drip lateral and plastic mulch layer-cum-planter for raised beds	Mechanized planting, plastic mulch and drip lateral laying in single operation
11.	Automatic vegetable transplanter for plug type seedlings	Mechanized transplanting of plug seedlings
12.	Intra and inter row weeder for wide row field crops	Complete mechanized weeding solution
13.	Automated control system for tractor-implement combination	Efficient utilization of tractor-implement combination
14.	Tractor mounted ginger planter	Mechanized ginger planting with reduced drudgery
15.	Tractor front mounted cotton stalk puller	Mechanized cotton stalk pulling with reduced drudgery
16.	Integrated system for harvesting and conveying of bunch crops	Mechanized harvesting of bunch crops
17.	Automatic total mix ration (TMR) system for cattle	Cost effective TMR Wagon delivery
18.	Site specific band fertilizer applicator	Efficient use of fertilizer for cotton crop
19.	Tractor operated grass seed harvester	Mechanised harvesting of grass seed
20.	Potato combine harvester	Timely harvesting of potatoes

S. No.	Targets	Projected outcome (2017-20)
21.	Development of portable briquetting machine for paddy straw	Portable briquetting machine for paddy straw
22.	Energetics of production and post production of major cropping system of Madhya Pradesh	Energy inflow and outflow in production and post production of soybean-wheat, maize-gram cropping systems
23.	Micro-planning and management of a rural energy system	Energy planning and management model at village level
24.	Development of micro algae production and harvesting system for biofuel	Micro algae production and harvesting system
25.	Development of subsurface drip lateral laying machine	Machine for laying subsurface drip laterals
26.	Irrigation and fertigation schedules for cultivating tomato & capsicum in open field, shadenets, polyhouses	Irrigation and fertigation schedules under different growing environments
27.	Solar powered micro irrigation systems	Adoption and creation awareness on harnessing renewable energy for operating micro irrigation system
28.	Use of broad bed and furrow and Mole drainage for enhancing productivity of sensitive to water logging in Vertisols	Identification of appropriate size of BBF in relation to drainage and crop demonstration of cost effective drainage technology for enhanced productivity in temporarily waterlogged Vertisols
29.	Development and evaluation of real time precision irrigation using sprinkler system for field crops	Study of the variability of soil moisture and its effect on wheat plants growth monitoring of soil moisture sensors using sensor network
30.	Development of technology and equipment for processing, value addition and loss prevention in agricultural commodities	Approximately 10 technologies in form of process plant/ equipment, processes, products etc. would be developed.
31.	Micro-controller based sugarcane planting technology	Micro-controller based technology for sugarcane planting
32.	Self-propelled multi-purpose tool carrier with provision of variable height and width	Self-propelled multi-purpose tool carrier for horticultural crops
33.	Harvester cum collector for cluster onion	Harvester cum collector for cluster onion
34.	Vertical cup belt type vegetable transplanter for cell feed nursery	Vertical cup belt type vegetable transplanter for cell feed nursery
35.	Red gram portray seeder	Red gram portray seeder
36.	Seed pelletizing machine	Seed pelletizing machine
37.	Tractor operated sorghum and pearl millet ear head separator	Tractor operated sorghum and pearl millet ear head separator
38.	Tractor operated pneumatic planter for chilli cultivation	Tractor operated pneumatic planter for chilli

S. Targets Projected outcome (2017-20)

No.		
39.	Package of farm machinery for seed spices crop	Farm machinery package for seed spices
40.	Mechanization study and database development for agricultural machinery and manufacturers	Identification of location specific farm mechanisation gaps
41.	Multiplication of selected research Total their supply to other manufactured and centres for multi-location trials	1500 prototypes will be prototypes and supplied
42.	Development of bullock drawn air mist canopy sprayer	30-40% saving in cost of operation, Increase in field capacity and fuel saving
43.	Development of bullock drawn vegetable transplanter	Higher field capacity, reduced human drudgery and 30-40% saving in time and labour
44.	Development of package of improved implements for cotton and red gram crops	Improvement in productivity of crop status and also the livelihood of farmers
45.	Development of low heat grinding machine for rotary transmission system	Increase in annual use of animal, improve quality of flour and farmers will get more profit
46.	Feasibility trials of animal drawn seed drill for inter-crop	Simultaneous sowing of various crops, Labour saving up to 50% and Higher income to farmers
47.	Draught performance of crossbred males under sustained working conditions	Utilization of cross bred males, enhancement in annual hour use, help in hill mechanization.
48.	Development of yoke with harnessing system for pack load transport in hilly areas using Yak and other animals	Adjustable with less weight, utilization of yak for transport and profit to hill farmers.
49.	Development of earthing-up cum inter-culturing implement for sugarcane and turmeric crop	Labour saving up to 40% and utilization of single animal for earthing-up cum inter-culturing
50.	Development of compressed air driven engine operated by animal drawn rotary gear system	Increase annual use of animals, reduction in maintenance cost, more profit and saving in electrical.
51.	Development and modification of Mules for pack load as well as in cart transport, carting for equines	will be used for pack load and saddles more comfort to animals and loading capacity of 40% will increase
52.	Training to the farmers, village artisans and manufacturers for entrepreneurship development	Skill of farmers will be enhanced, employment generation and availability of improved implements in village
53.	Development of Renewable Energy Technologies	About 18 technologies would be developed under the DRET component
54.	Energy Management in Agriculture	Energy audit in the agro industrial sector will be conducted and efficient

S.
No.

S. No.	Targets	Projected outcome (2017-20)
		energy utilization in various agriculture and agro based industries will be recommended
56.	Demonstration of Renewable Energy Systems	18 technologies of renewable energy systems would be demonstrated under field conditions
57.	Prototype of root wash type manual rice transplanter	Equipment with field capacity, physiological cost and overall less discomfort
58.	Research prototype of a unmanned coconut harvesting device (robot)	Reduction in drudgery of coconut harvesting
59.	Package of safety gadgets/practices for women working in cashewnut processing activities	Safety of women workers engaged in cashewnut processing.
60.	Package of safety gadgets/practices for workers involved in turmeric polishing and coconut coir industry	Safety of women workers engaged in turmeric polishing and coconut coir industry
61.	Dust mask for agricultural workers	Mask with better dust filtration efficiency
62.	Minimizing dust problem in rice mills	Reduction in dust concentration, overall health of workers
63.	Studies for wider adoption of chaff cutter safety devices	Reduction in chaff cutter accidents
64.	Research prototype of Improved muffler for tractor	More comfort to operator and reduced noise level.
65.	Pruning equipment for apple/ grapevine orchards	Equipment to reduce drudgery
66.	Farm tools and equipment for people with disabilities	Gadget to enable the people with disabilities
67.	Light weight manually guided engine operated tools for hill areas	Equipment for hilly region
68.	Gender friendly tractor operators workplace	Physiological cost, overall discomfort and performance data on women tractor operators
69.	Improved equipment package for rice cultivation in hill agriculture of Arunachal Pradesh and Himachal Pradesh	Equipment **package** for hilly areas
70.	Multi-location evaluation of low cost gravity based ropeways in hill areas for agricultural material handling	Acceptability of gravity ropeway in hilly areas and amount of material handled
71.	Package of improved agricultural equipment for tribal farmers of Odisha	Package of equipment for tribal agriculture of Odisha
	Prototype Feasibility Testing of improved farm equipment for their adoption to bridge the identified	25 equipment will be taken under prototype feasibility testing covering 500 ha and for threshing 200 h

S. No. Targets

	mechanization gaps	**Projected outcome (2017-20)**
72.	Transfer of Technology activities including HRD & Capacity Building Programmes	200 custom hiring centres to be established by entrepreneurs trained; 1000 participants will be trained; 1500 farmers/ extension officer will be trained at KVK, CIAE; Participation in 15 agricultural exhibitions/ fair of International/ National/ Regional level; Patents and copyrights applications will be filed for about 12 technologies; 6000 prototypes will be supplied to different stakeholders; Commercial machines will be tested.
73.	Frontline demonstrations of selected farm implements and machinery at farmer's fields to obtain feedback for design refinement.	Approx. 1000 ha area under different machines for various operations, 200 h threshing, and 200 demonstrations of horticultural tools under FLD.
74.	Training programmes/ FLD programmes for creating greater awareness about farm safety measures, ergonomically improved equipment and women friendly equipment	Popularization of farm safety measures and ergonomically improved tools/ equipment.

The detail updated Action report of the funds released and achievements under SMAM since 2014-15 to 2017 -18 (Till 30.08.2017) may be referred in Annexure-XVIII. The action plan to achieve the goals up to 2022 is enclosed in Annexure-XIX.

As regard the establishment of Custom Hiring Centers and allocation of funds under SMAM, the year wise Progress is as under:

Year	Different Type of Custom Hiring Centers (Nos)			Total	Total Funds Released Under SMAM (Rs. In Crores)
	CHCs	FMBs	Hi-tech Hubs		
2014-15	663	388	16	1067	165.85
2015-16	268	218	13	499	132.57
355.272016-17	2716	1087	12	3815	355.27

2017-18	1251	609	06	06	419.04
Total	**4898**	**2302**	**47**	**7247**	**1072.73**

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

STEPS FOR AUGMENTATION OF FUNDS FOR MAKING INDIA A LOW ENERGY ECONOMY
(RECOMMENDATIONS PARA NO. 31)

The Committee have further been informed that National Clean Energy Fund (NCEF) was created in 2010 by the Government for the purpose of financing and promoting clean energy initiatives and funding research in the area of clean energy in the country. The corpus of the fund is built by levying a cess of INR 400 per tonne of coal produced domestically or imported. This fund is being used for financing schemes like installation of solar photovoltaic (SPV) Lights and small capacity lights, installation of SPV water pumping under Jawaharlal Nehru National Solar Mission (JNNSM), projects relating to R&D to replace existing technologies with more environment friendly ones under National Mission on Strategic Knowledge for Climate Change (NMSKCC), Grid Interactive and Distributive renewable power and Research Design and Development in Renewable Energy of Ministry of New and Renewable Energy. Similarly, National Adaptation Fund for Climate Change (NAFCC) with allocations of Rs. 531 croreshave been launched in 2015 to provide financial and technical support for concrete adaptation activities to be implemented under State Action Plan on Climate Change (SAPCC), funds for adaptation activities in agriculture, water, health, infrastructure, forests, bio-diversity and coastal systems etc. and to reduce the vulnerability and associated risks. The Committee also note that Government has allocated Rs.100 crores to set up a National Mission on Himalayan Studies with the objective of enhancing natural and human capital in the Himalayan region under National Mission on Sustaining Himalayan Ecosystem (NMSHE).

The Committee have been informed that National Mission for Sustainable Agriculture (NMSA) has been initiated with aims to devise strategies to make Indian agriculture more resilient to climate change. The NMSA would identify and develop new varieties of crops and alternative cropping patterns, capable of withstanding extremes of weather, long dry spells, flooding and variable moisture availability. The Committee have also been informed that climate resilient interventions strategies have been embedded and mainstreamed into Missions/Programmes/Schemes of Department of Agriculture & Farmers Welfare (DAC & FW). The Government has emphasized that new credit and insurance mechanisms are being devised to facilitate adoption of desired practices by the Indian farmers.

The Committee are of view that there will be need for huge investment in form of infrastructure, research, and finance support if they aim to make Indian Agriculture climate resilient. However, the Committee are distressed to note that allocations for climate change programmes are too meager to make any significant impact. The Committee in their previous reports on demands for Grants have stressed the need to provide adequate funds for research & Development sector in agriculture, to provide farm inputs and for establishment of an efficient and modern agriculture extension services to the farmers. The Committee are of considered opinion that investment in agriculture sector is utmost

necessary to make it climate resilient. The Committee, therefore, recommend the government to formulate a dedicated scheme for providing support to the farmers so that they can invest in adaptation mechanism at farm level to face challenges associated with the climatic change. The Committee also desire the government to enhance allocations for research and development activities in agriculture sector in order to develop improved varieties of seeds, environment friendly fertilizers and pesticides.

REPLY OF THE GOVERNMEN

Recommendations of the Committee has been noted for necessary compliance. Accordingly, the Council/Department has requested Ministry of Finance for allocation of enhanced funds and expedite the modalities to increase the investment to the extent of 1% agricultural GDP in coming financial years.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

CONSTITUTION OF DISTRICT LEVEL AGRICULTURE VIGILANCE COMMITTEE
(RECOMMENDATIONS PARA NO. 32)

The Committee are of the view that constitution of a specific District level Agriculture Vigilance Committee will go a long way to improve implementation of various schemes being implemented by the Central Government. The Committee feel that it will be helpful to assess ground realities and problems being faced by the small and marginal farmers so that various schemes implemented by the Government are reviewed, evaluated and improved/modified in order to address the difficulties of the farmers comprehensively. The Committee, therefore, recommend the Government to take steps for constitution of District level Agriculture Vigilance Committee under the Chairmanship of a senior Member of Parliament at the District Level for review, monitoring and evaluation of all schemes related to agriculture. The Committee should consist of Agriculture Officers from District to Block level, KVK Functionaries and Chairman of the Advisory Committee of ATMA. The Committee desire the Government to initiate discussion with State Governments for constitution of District level Agriculture Vigilance Committee.

REPLY OF THE GOVERNMENT

All the approved activities of the Scheme are monitored and evaluated at periodic intervals through a specific mechanism generated at different levels - Block, District, State

& National Level Monitoring & Evaluation (M&E) is conducted through BFAC and BTT (Block level) & ATMA Governing Board (District level) for achieving necessary convergence, SLSC set up in the State under RKVY approved SEWP and carry out period monitoring the IDWG under the Chairmanship of APC/Principal Secretary (Agriculture)

may continue with the day to day monitoring to ensure that the Extension Reforms are executed in line with the broad policy framework. Effective M&E is ensured through regular field visits of Inter Disciplinary Teams in project areas, reports, interfaces, conferences etc. The Scheme also provides for concurrent Monitoring & Evaluation (M&E). DAC&FW also organizes concurrent M&E including impact evaluation as needed as part of its scheme "Extension Support to Central Institutes/DoE". Besides, all activities of the scheme would continue to be reviewed on quarterly basis in meetings held at National Level.

Further, in the Zonal Conferences for inputs for Rabi/Kharif Seasons/Crops, the monitoring of the scheme implementation by the States/UTs is carried out. State Nodal Officers for the scheme are appointed in this Department for regular inspection/verification and monitoring implementation of the scheme. As three Committees at district level namely ATMA, governing Board, ATMA, Management Committee and District Farmers Advisory Committee (DFAC) are already involved in monitoring the progress, one more Committee at district level i.e. District level Agriculture Vigilance Committee for monitoring implementation of the ATMA Scheme seems to be not feasible.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

REORIENTATION OF AGRICULTURAL EDUCATION SYSTEM
(RECOMMENDATIONS PARA NO. 33)

The Committee observe that Agriculture Education System as of now, do not focus on short term courses which can be helpful to provide agriculture foot soldiers in the country. The Committee are of view that Short term courses of six - twelfth months can be very useful offering solution to problems faced by the farmers in every nook and corner of the country. The Committee, therefore, recommend the Government to start discussion with State Governments to start such courses in the field of agriculture. The Government may explore option of linking such short term courses with National Skill Development Mission. Further, the Committee desire reorientation of Agricultural education system as per prevailing social, economic, psychological and practical conditions of farmers of the country. The Committee also desire that priority should be given to person of rural aptitude in operation and management of Agricultural Universities in the country.

The Committee are also of view that there is need to bring more practicality in agricultural education system in the country. The Committee, desire the ICAR to incorporate provisions for mandatory assignment to students which should be completed while staying among farmers in villages. Students along with Professors should be assigned time bound task for improving agricultural productivity and income of farmers. Those groups achieving the task should be given financial remuneration and awards.

REPLY OF THE GOVERNMENT

Agricultural Universities including Deemed Universities under Indian Council of Agricultural Research are already running different short courses in agriculture and allied sciences. These short courses are offered in certificate as well as Diploma form. Universities also conduct ICAR-sponsored short courses. These courses are conducted for students, farmers, entrepreneurs, officials, academicians etc.

Further, as suggested by the Committee, the Government will take appropriate action, and will ask State Governments to start short courses in all agricultural universities to cater the needs of the farming community in the respective region. Necessary communication will be made to the State Governments that the priority should be given to persons of rural aptitude in operation and management of Agricultural Universities.

With respect to bringing practicality in agricultural education, Students 'READY' programme is designed for one-year duration and introduced in UG courses. Under this programme, the students are also earning through experiential learning component. Further, 'RAWE' is made as an essential part of student READY to interact with farmers and understand the issues for improving agricultural productivity.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

CHAPTER - III

OBSERVATIONS/RECOMMENDATIONS WHICH THE COMMITTEE DO NOT DESIRE TO PURSUE IN VIEW OF THE GOVERNMENT'S REPLIES

- NIL -

CHAPTER - IV

OBSERVATIONS/ RECOMMENDATIONS IN RESPECT OF WHICH REPLIES OF THE GOVERNMENT HAVE NOT BEEN ACCEPTED BY THE COMMITTEE

(RECOMMENDATION PARA NO. 2)

The Committee note that Fifth Assessment Report (AR5) of Intergovernmental Panel on Climate Change (IPCC) has warned about warming of the climate system across the world. This Report clearly brought out impact of global warming such as warming of atmosphere and oceans, shrinking of glaciers, melting of Arctic and Antarctic ice sheets, rise of sea level etc. The Committee have been informed that as per AR5 report each of the last three decades has been getting successively warmer at the Earth's surface than any preceding decade since 1850. The period from 1983 to 2012 was very likely the warmest 30-year period during the last 800 years in the Northern Hemisphere and likely the warmest 30-year period of the last 1400 years. Over the last two decades, the Greenland and Antarctic ice sheets have been losing mass. Glaciers have continued to shrink almost worldwide. Northern Hemisphere spring snow cover has continued to decrease in extent. Over the period 1901-2010, global mean sea level rose by 0.19 (0.17 to 0.21)m. The rate of sea level rise since the mid-19th century has been larger than the mean rate during the previous two millennia. The Committee further note that Centre for Climate Change Research (CCCR) under the Indian Institute of Tropical Meteorology (IITM), Pune under Ministry of Earth Sciences carry out scientific studies on climate change and variability under Global and Regional Climate Change (GRCC) programme. The Committee have been informed by the Ministry of Earth Sciences that past observations from instruments and proxy data suggest that there are changes in our climate system on different time scales. There are some natural variations and there are some long term trends which can be attributed to human activities. The Committee note that Annual mean, maximum and minimum temperatures averaged over the country as a whole showed significant warming trend of 0.6^{o}C, 1^{o}C and 0.18^{o}C per hundred years, respectively. The rate of warming trend in the annual mean temperatures since 1980s is much sharper, 0.2^{o}C per decade. The warming is mostly confined to the northern, central and eastern/north-eastern parts of the country. Peninsular India experienced the least warming. The Committee have been further informed that all-India southwest monsoon rainfall does not show any long-term trend, but it exhibits significant multi-decadal variability. There are significant regional trends in southwest monsoon rainfall. Monsoon rainfall in the meteorological sub divisions of Jharkhand, Chhattisgarh and Kerala has shown significant decreasing trends. However, monsoon rainfall over Gangetic West Bengal, West Uttar Pradesh, Jammu and Kashmir, Konkan and Goa, Central Maharashtra,

Rayalaseema, Coastal Andhra Pradesh and North Interior Karnataka showed increasing trends. Further, Monsoon rainfall in the month of July has shown decreasing trends over most parts of central India. However, June and August rainfall has shown increasing trend over the central and southwestern parts of the country. There is a clear pattern of decreasing frequency of very light rain and light to moderate rain events over most of the country and increasing frequency of very heavy and extreme rainfall events over northern parts of the country during the monsoon season. The Committee also note above increasing trends in heat waves during the hot weather season and decreasing trend in cold waves during the cold weather season over most parts of the country. The Committee have also been informed that more intense droughts are mainly observed over north and northwest India.

The Committee are of view that there is a need of constantly observing changing weather conditions associated with climate change in order to take corrective steps to offset its negative effect on agriculture and allied sector in the country. The Committee also feel that there should be enhanced level of co-ordination between Ministry of Earth Sciences and Department of Agricultural Research and Education. The Committee, therefore recommend the Government to devise a mechanism to increase the quantum of collaborative research and coordination between these two important Scientific Departments associated with study of climate change. The Committee also desire the Government to provide for adequate funding and manpower for encouraging cutting edge research in this important sector so that the agriculture and allied sector in the Country may be salvaged from negative changes associated with climate change.

REPLY OF THE GOVERNMENT

Analysis of past more than 100 years of data by the scientists of India Meteorological Department and other institutions has found significant changes in the rainfall pattern, extreme events etc. Both flood and drought are part of natural climate variability and occurrences of flood or drought in individual years do not depend on climate change. However, as an impact of climate change, it is being reported that the spatial variability, intensity and frequency of extreme events like heavy rainfall have increased.

Though there was no significant change in the all India rainfall but significant changes in rainfall pattern has been observed in smaller spatial scales viz. meteorological subdivisions or states. Decreasing trend in rainfall during the month of July is observed over most parts of central India. However, increasing trends are seen in rainfall during June and August over the central and south western parts of the country. Significant decreasing trend in rainfall during the southwest monsoon season is seen over ten subdivisions viz. Chhattisgarh, Jharkhand, Uttarakhand, Himachal Pradesh, Arunachal Pradesh, Nagaland, Mizoram and Tripura, sub Himalayan West Bengal, Kerala, east Uttar Pradesh and east Madhya Pradesh whereas eight subdivisions viz. Madhya Maharashtra, Saurashtra and Kutch, south interior Karnataka,

coastal Karnataka, Konkan and Goa, coastal Andhra Pradesh, Lakshadweep and Gangetic West Bengal showed significant increasing trends in monsoon rainfall. Annual frequencies of very light, light to moderate and wet days have decreased in most of the states. Frequencies of dry days have also increased significantly during the period, 1910-2010. Significant increase of heavy rainfall event is observed over the eight states (West Bengal, Tripura, Manipur, Andhra Pradesh, Telangana, Karnataka, Goa and Orissa). Significant increase in the frequency of very heavy events over West Bengal, Tripura, Sikkim, Andhra Pradesh, Telangana, Karnataka, Goa, Jammu & Kashmir and Odisha; and extreme rainfall events over West Bengal, Assam, Punjab, Jammu & Kashmir, Chhattisgarh, Goa and Telangana are being reported.

The latest Inter-Governmental Panel on Climate Change (IPCC) report (2014) highlights that mean surface temperature of the globe has risen by 0.85^0C + 0.18^0C. whereas, all India mean temperature has risen around 0.64^0C over the last 110 years. Mean annual surface air temperatures show a significant warming of about 0.7^o C/100 years during the last century.

The Centre of Climate Change Research (CCCR) was launched in 2009 with the support of the Ministry of the Earth Sciences, Government of India. The CCCR is part of the Indian Institute of Tropical Meteorology (IITM) located at Pune. The CCCR focuses on development of new climate modeling capabilities in India and South Asia to address issues concerning the Science of Climate Change. Two major developments in climate modeling have taken place at CCCR in the recent 2 years.

Development of the IITM Earth System Model (ESM): With the goal of building an ESM appropriate for detection, attribution and projection of changes in the South Asian monsoon, a state-of-the-art seasonal prediction model, namely the Climate Forecast System (CFS) has been transformed to a climate model suitable for extended climate simulations at the CCCR, IITM, Pune, India. IITM ESM will be participating in the next Intergovernmental Panel for Climate Change (IPCC) Coupled Model Inter comparison Project phase 6 experiments – this is a first for an Indian model.

CCCR is also leading the **Coordinated Regional Downscaling Experiment (CORDEX) activity for the South Asian region**. CORDEX is an International Programme under the World Climate Research Program (WCRP) which aims at advancing and coordinating the science and application of Regional Climate Downscaling through global partnerships, in order to inform local and national climate adaptation strategies. The regional modeling activities of CORDEX South Asia are focused on providing reliable projections with much greater detail (than global climate models) and more accurate representation of localized extreme events over the South Asian region, through

- *Development of multi-model ensemble projections of high resolution (50 km) regional climate change scenarios for South*

Asia. The regional climate projections over South Asia are generated by CCCR-IITM and also by various International partner institutions

- *Development of an Earth System Grid (ESG) node at CCCR-IITM for archival, management and dissemination of CORDEX South Asia datasets*

- *Evaluation of regional climate projections over South Asia for reliable climate change information for effective harnessing of science-based information by Vulnerability, Impact, Adaptation (VIA) community*

- *Development of regional capacity for assessment of regional climate change*

As part of this activity, high-resolution simulations of 20th century climatic variations and future climate projections (21st century) have been developed at CCCR-IITM. These high-resolution simulations offer new opportunities to better understand several key regional scientific issues concerning climate change over South Asia - e.g., Monsoons, precipitation extremes, heat waves, droughts and floods, changes in cyclonic weather systems, hydrological cycle etc. A variable resolution global modeling framework, based on the Laboratorie Dynamique Meteorologie (LMD, France) atmospheric general circulation model (GCM), has been employed for this purpose under a scientific collaboration between CCCR-IITM and LMD, aimed towards contributing to the IPCC AR6 assessment. The high-resolution climate projections for India (2006-2095) were released in the Sixth National Workshop on Climate Change organized at INCOIS, Hyderabad during 1-2 September 2014.

IITM-ESMv1: Successful development of the first version of IITM ESM at CCCR, IITM, Pune by transforming a seasonal prediction model (CFSv2) into a long term climate model (Ref: Swapna et al. 2015). This development was achieved by incorporating a new ocean model component (MOM4p1, including ocean biogeochemistry) in CFSv2. Major improvements in the IITM-ESM relative to CFSv2 include:

The IITM-ESMv2 would be first climate model from India to contribute to the Coupled Model Intercomparison Project Sixth Phase (CMIP6) for the IPCC sixth assessment report (Ar6). IITM has requested for funding support from MoES for collaborative work with other Indian agencies involved in the field. Additional manpower requirement has also been projected.

Following the recommendations of the Expert Committee, it is proposed that CCCR-IITM will collaborate with Agricultural Researchers to investigate and address the Impacts of Climate Change on Indian Agriculture. For this purpose, CCCR-IITM has requested for funding support from MoES for collaborative work with other Indian agencies involved in

Agriculture and Climate research. Additional manpower requirement will be projected for this collaborative research".

There is a co-ordination between Ministry of Earth Science and Department of Agricultural Research and Education for weather services. The Gramin Krishi Mausam Seva (GKMS) of IMD is rendered twice a week in collaboration with Indian Council of Agricultural Research (ICAR). Accordingly, district level weather forecast for next 5-days are provided to farmers in respect of Rainfall, maximum temperature, minimum temperature, wind speed, wind direction, relative humidity and cloudsweekly cumulative rainfall forecast and Crop specific advisories.

The GKMS of IMD has been successful in providing the crop specific advisories to the farmers through different print/visual/Radio/ IT based media including short message service (SMS) and Interactive Voice Response Service (IVRS) facilitating for appropriate field level actions. Weather forecast based agrometeorological advisories are also disseminated through Kisan portal launched by the Ministry of Agriculture and Farmers Welfare and also under public private partnership. At present, about 23.0 million farmers in the country are receiving the SMS based advisories.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

COMMENTS OF THE COMMITTEE

For comments of the Committee please refer to Para No. 1.7 of Chapter I of this Report.

BURNING OF CROP RESIDUE
(RECOMMENDATION PARA NO. 4)

The Committee note that despite being banned, burning of crop residue in agricultural fields has emerged as one of the important challenges in recent times which is adding to already high level of pollutants in the environment. The Committee further note that as per assessment made by the ICAR approximately 130-140 Mt Crop residues is being burnt annually in agriculture fields out of 679 million tonne (Mt) crop residue generated in the country which is causing emission of 8.57 Mt of CO, 141.15 Mt of CO2, 0.037 Mt of SOx, 0.23 Mt of NOx, 0.12 Mt of NH3 in the atmosphere. The Committee have been informed that ICAR-Indian Institute of Soil Science has developed a technique called "Rapo-compost Technology" for faster decomposition of biodegradable waste that is able

to convert biodegradable waste to quality compost in 30-45 days with the help of bio-inoculum consortia (bacteria, fungi and actinomycetes) having ligno-cellulolytic potential. The Committee observe that shortage of agricultural labour, short interval due to intensive agriculture being practised in some parts of the country and mechanized farming are forcing the farmers to take extreme step of burning the crop residue in farm field. The Committee are of considered view that there is a need to provide adequate extension and financial support to help them in adopting technology for decomposition of crop residue, conservation agriculture or utilize for making cupboard in small scale industries. The Committee, therefore, desire the Government to take this issue on priority basis and make policy/plan/ programmes for eco-friendly utilization of crop residue. The Committee also desire the ICAR for development of new technology/bio-logical methods which can reduce the period of in-situ decomposition of plant residue.

REPLY OF THE GOVERNMENT

The ICAR-Indian Institute of Soil Science has developed an *in-situ* rapid crop residue decomposition technique using consortia of ligno-cellulolytic microorganisms. The technology has potential to decompose rice, wheat and sugarcane residues in 45 days.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

COMMENTS OF THE COMMITTEE

For comments of the Committee please refer to Para No. 1.10 of Chapter I of this Report.

APPROACH FOR MAKING INDIAN AGRICULTURE CLIMATE RESILIENT (RECOMMENDATIONS PARA NO. 24)

The Committee note that National Mission on Sustainable Agriculture (NMSA) aims to make Indian agriculture more productive, sustainable, and remunerative and climate resilient. NMSA has many objectives such as conservation of natural resources through appropriate soil and moisture conservation measures, Soil health management, optimization of water use efficiency in agriculture, capacity building of farmers and other stakeholders in the domain of climate change adaptation and mitigation measures, improving productivity of rainfed farming by mainstreaming rainfed technologies, and establishing an effective, inter and intra Departmental/Ministerial co-ordination for accomplishing key deliverables of National Mission for Sustainable Agriculture under the aegis of NAPCC.

The Committee have been informed that promoting integrated farming system covering crops, livestock & fishery, plantation and pasture based composite farming, popularizing on-farm and off-farm resource conservation technologies and introducing practices that will support mitigation efforts in times of extreme climatic events, promoting location and crop specific integrated nutrient management practices, promoting effective management of available water resources, enhancing water use efficiency, encouraging improved agronomic practices for higher farm productivity, involving knowledge institutions and professionals in developing climate change adaptation and mitigation strategies for specific agro climatic situations and promoting them through appropriate farming systems are some of strategies being used to achieve objectives of NMSA.

The Committee are of opinion that our farmers who had helped in securing food security of the country, need support in order to face the challenges of climatic changes due to global warming. Indian agriculture need interventions in the area of irrigation facilities, water efficient irrigation methods, improved abiotic stress tolerant seed varieties, cost effective and environment friendly fertilizers and pesticides, capacity building of farmers and other stakeholders, efficient and advanced agriculture extension services in order to make it climatic resilient and enable it to secure food security of the country. The Committee are of considered view that huge investment will be need in the agriculture sector if the Government wants to achieve objectives set under National Mission on Sustainable Agriculture (NMSA). Since, agriculture is a State subject, the Committee call for the need of better co-ordination between the Central and the State Governments for planning and resource mobilization for implementing schemes to achieve objectives of NMSA. The Committee, therefore, recommend the Government to constitute high powered committee involving representatives of Central and State Governments, subject specialists and other stakeholders for planning and implementation of schemes to achieve objectives set under NMSA. The Committee also desire the Government to start a dedicated fund for implementation of schemes under NMSA so that these schemes do not suffer due to want of funds.

REPLY OF THE GOVERNMENT

NMSA is envisaged as one of the eight Missions outlined under National Action Plan on Climate Change (NAPCC), NMSA aim at promoting sustainable agriculture through climate change adaptation measures. The major thrust is enhancing agriculture productivity especially in rainfed areas focusing on integrated farming, soil health management, and synergizing resource conversation. Besides, NMSA also has a target to fulfil National and International commitments on Sustainable Development Goals (SDG) & Intended Nationally Determined Contribution (INDC). All the components of NMSA such as Rainfed Agriculture, Soil Health Management, Organic Farming, etc. have significant role in achieving SDGs & INDC. Further, NMSA is the only scheme focusing and emphasising country's thrust on climate change adaptation & mitigation in agriculture sector.

Rainfed Area Development (RAD) is one of the major component of NMSA. RAD is to benefit the small and marginal farmers in the country promoting Integrated Farming System (IFS).Under this system, crops/cropping system is integrated with activities like horticulture, livestock, fishery, agro-forestry, apiculture etc. to enable farmers not only in maximizing farm returns for sustaining livelihood, but also to mitigate the impacts of drought, flood or other extreme weather events with the income opportunity from allied activities during crop damage.

The National Advisory Committee (NAC) under the Chairmanship of Secretary (AoC&FW) constituted with the members of line Departments and organizations to provide overall direction and guidance to the Mission, monitor and review its progress and performance at National level.The NMSA is proposed for continuation for three years i.e. from 2017-18 to 2019-20 which is co-terminus with the remaining period of 14th Finance Commission (FFC) ending 31st March, 2020. Based on the new initiatives and requirement in the area of sustainable agriculture development, certain modifications have been proposed in the present proposal and some of the ongoing schemes of similar nature are proposed for implementation under the frame work of NMSA.

The proposed cost of the project is Rs.12123.62 Crore (Central Share) for implementation of all the components of NMSA.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

COMMENTS OF THE COMMITTEE

For comments of the Committee please refer to Para No. 1.16 of Chapter I of this Report.

AGRICULTURAL EXTENSION SERVICES
(RECOMMENDATIONS PARA NO. 27)

The Committee note that existence of a robust system of agriculture extension services is critical for making Indian agriculture climate resilient. The Committee have been informed that responsibility for providing of extension services to farmers lies with the State Governments. However, Central Government is facilitating the efforts of State Governments through a network of 665 Krishi Vigyan Kendra (KVKs) , Agricultural Technology Management Agency (ATMA) and Agri clinic and Agri-business scheme. The Committee note that KVKs are engaged in on-farm testing to identify the location specificity of technology under various farming systems, frontline demonstration to establish the production potential of improved agricultural technologies on the farmers' fields, Capacity development of farmers and extension personnel to update their knowledge and skills and Providing farm advisories on varied subjects of interest to farmers. The KVKs also provide farm inputs such as seeds, planting materials and other technology to the farmers. The Committee note that ATMA Scheme is under implementation in 652 districts in 29 States and 3 UTs in the country with provision for active participation of farmers/farmer-groups, NGOs, KVK, Panchayati Raj Institutions and other stakeholders operating at district level and below. The Committee have also been informed that Mass Media Support to Agriculture Extension' scheme is being implemented to strengthen the reach of farm information to farming community through the wide network of Doordarshan, DD Kisan channel and All India Radio.

However, the Committee are distressed to note that funding provided to these agriculture extension schemes are not sufficient to make them an effective platform for the benefit of farmers. The Committee in their previous reports on Demands for Grants have repeatedly brought out these facts and recommended the Government to enhance the allocations to these schemes suitably in order to equip KVKs with all necessary infrastructure and manpower. The Committee are of the considered view that condition of farmers of country cannot be improved unless they are provided information and other necessary inputs for making agriculture remunerative. The Committee, therefore recommend the Government to suitably enhance funding to these schemes. The Committee are also of view that construction of a 'Krishi Bhavan' at Panchayat level will help to strengthen the agriculture extension services in the country. Construction of such bhavan with adequate infrastructure, equipments and mass media facilities with regular visits of scientists of ICAR, subject matter specialists of KVKs, progressive farmers etc. will help it to emerge a hub for farmers and solve their problems related to agriculture. The Committee, therefore, recommend the Government to take steps for construction of 'Kisan Bhavan' at Panchayat level.

REPLY OF THE GOVERNMENT

Regarding enhancing allocation of fund to KVK scheme it is to state that enhanced provision has been made for 2017-18 to 2019-20, for increasing the manpower and improving infrastructure in KVKs.

The Centrally Sponsored Scheme "Support to State Extension Programs for Extension Reforms", popularly known as ATMA Scheme was launched in May, 2005 and aims at making extension system farmer driven and farmer accountable by way of institutional arrangements for technology dissemination in the form of an Agricultural Technology Management Agency (ATMA) at district level to operationalize Extension Reforms. The detail of year-wise budgetary position under the Scheme is given below:

(**Rs.in Crore)**

Year	B.E.	R.E.	Release
2005-06	45.00	45.00	43.44
2006-07	75.00	50.00	48.27
2007-08	230.00	150.00	155.81
2008-09	298.00	198.00	193.01
2009-10	298.00	188.98	178.59
2010-11	250.00	220.00	240.28
2011-12	500.00	458.60	434.02
2012-13	600.00	504.13	508.07
2013-14	550.00	505.10	480.93
2014-15	475.00	470.58	522.98
2015-16	450.00	395.35	406.69
2016-17	450.00	410.50	413.41
2017-18	650.00	-	307.17 (upto 16.10.17)

Above table reveals that public investment in Agricultural Extension by Central Government has increased from Rs.43.44 crore during the year 2005-06 to Rs.508.07 Crore in 2012-13 under the Scheme. Since modification of the Scheme in the year 2010, the increase has been more substantial. Amount released to the States during last 3 years is nearly 100% of the Revised Estimates. Expenditure incurred by the States during these three years has also been keeping pace with releases by the Center.

ATMA Scheme provides for active involvement of research system/research agencies at different level of implementation. State Agricultural Universities (SAUs) and Krishi Vigyan Kendra (KVKs) are fully involved not only in preparation of Strategic Research Extension Plan (SREP) and State Extension Work Plans (SEWPs) but also in implementation of various programs in the field. They are also representing in all the bodies namely ATMA Governing Board and ATMA Management Committee at District level, SLSC and IDWG at State level BTT-BFAC meetings at Block level. In addition, each KVK scientist may be made in-charge of one or more block with the District. The KVK scientist technically advises the BTT and involve actively in preparation of Block Action Plans, especially with regard to research related issue/gaps and strategies.

Agricultural Technology refinement, validation and adoption segment of cafeteria of activities including Farmers-Scientists Interactions (FSIs), to designate expert from KVKs at District level and joint visits by Scientists and extension workers, organization of Kisan

Goshities and R-E-F linkages are dealt by KVKs. Apart from this, a joint circular on convergence between ATMA and KVK was issued under the signature of DG, ICAR and the Secretary, DAC&FW. As per the Circular, one of the activities is joint visits of Program Coordinator, KVK and Project Director to at least 5 villages in a district every month.

As per extant ATMA Scheme, there is no provision to fund construction of 'Kisan Bhawan' at panchayat level.

Ministry of Agriculture & Farmers Welfare
(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

COMMENTS OF THE COMMITTEE

For comments of the Committee please refer to Para No. 1.19 of Chapter I of this Report.

INTERNATIONAL ACCORD ON CLIMATE CHANGE AND INDIA' COMMITMENT (RECOMMENDATIO PARA NO. 30)

The Committee note that our country has ratified Paris Agreement on climate change within the United Nations Framework Convention on Climate Change (UNFCCC) dealing with greenhouse gases emissions mitigation, adaptation and finance starting in the year 2020. The Committee also note that Paris Agreement's central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. The Committee have been informed that it is a legally binding agreement that covers all countries, developed and developing, with the aim to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty. The Committee also note that Paris Agreement also mandate to contribute funds amounting to US $ 100 Billion by 2020 by the Developed countries along with provisions for providing appropriate technology and capacity building support for mitigation and adaptation efforts to be undertaken by the developing countries.

The Committee note that Paris Agreement reflects the principle of equity and common but differentiated responsibilities and respective capabilities. The Agreement acknowledges the development imperatives of developing countries and recognize the developing countries' right to development and their efforts to harmonize development with environment, while protecting the interests of the most vulnerable. The Committee have been informed that India has submitted its Intended Nationally Determined Contribution (INDC) which is country driven initiatives for undertaking mitigation strategies for reduction of greenhouse gases emission which aims to reduce the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level. The Committee have been assured that no

INDC does not include any commitment for reduction of GHGs emission from agriculture sector.

The Committee note that despite having no binding mitigation obligations as per the Convention, India declared a voluntary goal of reducing its emissions intensity of its GDP by 20-25% over 2005 levels by 2020. The Committee also note that Government of India is implementing the National Action Plan on Climate Change (NAPCC) which enshrines eight national missions in specific areas of Solar Energy, Enhanced Energy Efficiency, and Sustainable Habitat, Water Sustaining the Himalayan Ecosystem, Green India, Sustainable Agriculture and Strategic knowledge for Climate Change. The Committee have also been informed that voluntary measures undertaken by the Government to promote low carbon strategies and Renewable Energy has resulted in the decline of emission intensity of our GDP by 12% between 2005 and 2010 which have been recognized by the United Nations Environment Programme (UNEP) in its Emission Gap Report 2014.

The Committee are of view that voluntary steps undertaken by the Government for reduction of GHGs emission and to make it a low energy economy under Paris agreement are in interest of Indian Economy. However, the Committee are of view there is need to provide adequate support to the Indian industry and allied sectors in the form of technologies, professional support and tax rebate in order to emerge as low carbon intensive sector as well as competitive in worlds market. The Committee, therefore, recommend the Government to constitute a dedicated cell for transfer of technologies and other support to Indian Industry and allied sector. The Committee also desire the Government to provide tax rebate to industries which invest for Research & Development of green technologies in the country. The Committee also recommend the Government to engage diplomatically with other countries so that developed countries fulfill their commitment for transfer of clean technologies and dedicated funds as mandated under Paris Agreement.

REPLY OF THE GOVERNMENT

The Technology Mechanism™ of the United Nations Framework Convention on Climate Change (UNFCCC) is for promoting innovation; catalysing the use of technology road maps or action plans; responding to developing country Party requests on matters related to technology transfer; and facilitating joint R&D activities.The article 10 of Paris Agreement (PA), a post 2020 instrument for climate change action, provides for setting up of technology framework to guide work of TM in promoting and facilitating enhanced action in technology development and transfer.

The present negotiations are on principle and structure of Technology Framework (TF). India has taken a stand that TF through its principles and provisions should be an instrument to integrate and articulate all important elements on technology development and transfer to developing countries. It must incorporate all cardinal principles of the Convention (Art 4) and the Paris agreement.

These negotiations are continuing under UNFCCC.

(Department of Agricultural Research and Education)
F.No. NRM/11(26)/2017-AFC (Pt.) dated 03/11/2017

COMMENTS OF THE COMMITTEE

For comments of the Committee please refer to Para No. 1.22 of Chapter I of this Report.

CHAPTER - V

OBSERVATIONS/ RECOMMENDATIONS IN RESPECT OF WHICH FINAL REPLIES OF GOVERNMENT ARE STILL AWAITED

- N I L -

NEW DELHI;
August, 2018
Shravana, 1940 (Saka)

HUKMDEV NARAYAN YADAV
Chairperson,
Standing Committee on Agriculture

Annexure-I

List of 38 mangrove sites selected

State /Union Territories	Mangrove sites
West Bengal	1. Sundarbans
Orissa	2. Bhaitarkanika
	3. Mahanadi
	4. Subernarekha
	5. Devi
	6. Dharma
	7. Mangrove Genetic Resources Centre
	8. Chilka
Andhra Pradesh	9. Coring
	10. East Godavari
	11. Krishna
Tamil Nadu	12. Pichavaram
	13. Muthupet
	14. Rammad
	15. Pulicat
	16. Kazhuveli
Andaman & Nicobar	17. North Andamans
	18. Nicobar
Kerala	19. Vembanad
	20. Kannur (Northern Kerala)
Karnataka	21. Coondapur
	22. Dakshin Kannada/Honnavar
	23. Karwar
	24. Manglore Forest Division
Goa25. Goa	
	27. Devgarh
	28. Veldur
	29. Kundalika-Revdanda
	30. Mumbra-Diva
	31. Vikroli
	32. Shreevardhan
	33. Vaitarna
	34. Vasai-Manori
	35. Malvan
Gujarat	36. Gulf of Kutchh

37. Gulf of Khambhat
38. Dumas-Ubhrat

Table 3. Status of mangrove cover (in km) in India in 2015 and the change with report to previous assessments

State /UT	Assessment Year														
	1987	1989	1991	1993	1995	1997	1999	2001	2003	2005	2009	2011	2013	2015	Change w.r.t. 2013
Andhra Pradesh	195	405	399	378	383	383	397	333	329	354	353	352	352	367	45
Goa	0	3	3	3	3	5	5	5	16	16	17	22	22	26	4
Gujarat	127	412	397	419	689	901	103	911	916	991	1046	1058	1103	1107	4
Karnataka	0	0	0	0	2	3	3	2	3	3	3	3	3	3	0
Kerala	0	0	0	0	0	0	0	0	8	5	5	6	6	9	3
Maharashtra	440	444	113	155	155	124	108	118	158	186	186	186	186	222	36
Orissa	199	192	193	195	195	211	215	219	203	217	221	222	213	231	18
Tamil Nadu	23	47	47	21	21	21	21	23	35	36	39	39	39	47	8
West Bengal	2076	2109	2119	2119	2119	2123	2125	2081	2120	2136	2152	2155	2097	2106	9
A&N Island	686	973	971	966	966	966	966	789	658	635	615	617	604	617	43
Daman & Diu	0	0	0	0	0	0	0	0	1	1	1	2	163	3	1
Puducherry	0	0	0	0	0	0	0	1	1	1	1	1	1	2	1
Total	4016	4255	4244	4236	4533	4737	4871	4482	4448	4581	4639	4663	4628	4740	+112

Annexure - II

Varieties of Field Crops Tolerant to Abiotic stresses

p/Varieties	Stress/Trait Area	of adoption (Zone / State)
Cereals		
Rice		
SahabhagiDhan, Vandana, Anjali, Satyabhama, DRR Dhan 42, BirsaVikasDhan 203, BirsaVikasDhan 111, RajendraBhagwati, JaldiDhan 6, IR64 Drt I	Drought tolerance	Upland rice areas of Uttar Pradesh, Bihar, Odisha, Jharkhand and Madhya Pradesh, Tamil Nadu, Andhra Pradesh, Telangana, Chhattisgarh
ANNA(R)4, Indira Barani Dhan-1, Sabour Shree, Kalachampa, DRR Dhan 43, ADV 8301, DRR Dhan 46, JRH-19	Drought tolerance	Tamil Nadu, Chhattisgarh, Bihar, Odisha, Tamil Nadu, Puducherry, Kerala, Karnataka,Gujarat, Maharashtra, Andhra Pradesh, Madhya Pradesh
Jagjeevan, IGKVR-1, IGKVR-2, CR Dhan 401, PoornaBhog, CR Dhan 404, PAC 801, CR Dhan407, VL Dhan 157, Hiranmayee, Tanmayee, DRR Dhan 44, Chhattisgarh Zinc rice-1, BNKR 3, Somnath, VL 7620, Purna	Rainfed	Odisha, Gujarat, Kerala, Chhattisgarh, Madhya Pradesh, Bihar, West Bengal,Tamil Nadu, Andhra Pradesh, Uttar Pradesh, Meghalaya, Uttarakhand, Haryana, Bihar, Assam, Karnataka
Karjat 184, BirsaVikas Dhan-111, CR Dhan 101, Dehangi, Inglongkiri, Rongkhang	Rainfed uplands	Maharashtra, Jharkhand, Odisha,
Wheat		
PBW 527	Drought tolerance	Punjab, Haryana, Western Uttar Pradesh, Rajasthan
HI 1531, HI 1500, HI 8627	Drought tolerance	Madhya Pradesh, Gujarat,
HD 2888, SabourNirjal	Drought tolerance	Eastern Uttar Pradesh, Bihar, West, Bengal, Jharkhand, Assam, Odisha
HPW 349, PBW 644, WH 1080, HD 3043, PBW 396, K 9465, K 8962, MP 3288, HD 4672, NIAW 1415, HD 2987	Drought tolerance	Madhya Pradesh, Gujarat, Punjab, Haryana, Western Uttar Pradesh, Rajasthan
NIAW 34	High temperature stress tolerance	Karnataka, Parts of Maharashtra
Raj 3765	High	Punjab, Haryana, Western Uttar

	temperature stress tolerance	Pradesh, Rajasthan
Raj 4037	High temperature stress tolerance	Karnataka, Parts of Maharashtra
VL Gehun 907, Pusa Suketi HS 507, Netravati, WH 1080, MP 3288, PBW 644, PDKV Washim, HPW 349, Narendra Wheat 4018, Pusa Kiran, Shalimar Wheat 2, UAS 446, UAS 347, Central Wheat HS 562, MPO (JW) 1255, PBW 660, HD 3171,	Rainfed	Himachal Pradesh, J & K, Uttarakhand, Sikkim, North Eastern states, Maharashtra, Karnataka, Haryana, Punjab, Uttar Pradesh, Rajasthan, Madhya Pradesh, Chhattisgarh, Gujarat, Punjab, Delhi, West Bengal, Punjab,
Maize		
Buland	High temperature stress tolerance	Northern parts of India
PMH 1	High temperature stress tolerance	Irrigated areas of Punjab
PMH 3	High temperature stress tolerance	Northern parts of India
HM 9	High temperature stress tolerance	Bihar, Jharkhand, Orissa
Pusa hybrid Makka 1	Drought tolerance	Rajasthan, Gujarat, Madhya Pradesh
HM 4, KMH 7148	Drought tolerance	Punjab, Haryana, Uttar Pradesh, Andhra Pradesh, Maharashtra, Tamil Nadu and Goa, Delhi
Pusa hybrid Makka 5	Drought tolerance	Whole of India
DHM 121	Moisture stress tolerance	Odisha, Jharkhand, Bihar, West Bengal, Gujarat, Rajasthan, Chhattisgarh and Madhya Pradesh
Candy, D2244, GK 3150, DRONA	Drought tolerance	J&K, Himachal Pradesh, Assam, Meghalaya, Tripuram, Arunachal Pradesh, Nagaland, Manipur, Sikkim, Punjab, Haryana, Delhi, Uttar Pradesh, Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra, Tamil Nadu, Madhya Pradesh, Rajasthan, Gujarat and Chhatisgarh

Gujarat Anand Yellow Maize Hy-1, Karimnagar Makka	Rainfed	Gujarat, Telangana, Andhra Pradesh, Maharashtra, Karnataka, Tamil Nadu
Sorghum		
CSH 19 R, CSV 18, CSV 26	Drought tolerance	All rabi sorghum area
CSH 15 R, Kinnerea, Pratap Chari 1080, CSV 32F, PhuleRohini, PhuleMadhur, RVICSH 28	Drought tolerance	Maharashtra, Karnataka, Andhra Pradesh and Tamil Nadu, Rajasthan, Madhya Pradesh
PhuleAnuradha	Terminal moisture	Maharashtra
CSH 32	Rainfed	Maharashtra, Karnataka, Madhya Pradesh, Andhra Pradesh, Gujarat
Millets		
(i) Pearl Millet HHB 67 improved, GHB 757, GHB 538, GHB 719, Dhanshakti, HHB 234, MandorBajra Composite 2, HHB-226, RHB-177, Pusa Composite 443, HHB 223, Nandi 64	Drought tolerance	All dry areas of Western Rajasthan and Gujarat
RHB 173, Mahabeej 1005	Rainfed	Rajasthan, Haryana, Gujarat, Maharashtra
(ii) Finger Millet GPU 67, DHRS 1, PRM-2, KMr-301, VL Mandua 347, Indira Ragi-1, Dapoli safed-1, HIMA, KMR 204, VL Mandua-352 (VL352), Phule Nachani-1 (KOPN-235), CO 15, KMR 340	Drought tolerance	Millets growing dry regions TamilNadu, Karnataka
(iii) Foxtail Millet Sia 3085, SiA 3156	Drought tolerance	Millets growing dry regions
(iv) Barnyard Millet CO(KV)2	Drought tolerance	Millets growing dry regions
(v) Kodo Millet Indira Kodo-1, JawaharKodo 137	Drought tolerance	Millets growing dry regions, Chhattisgarh
(vi) Little Millet JawaharKutki 4 Saura, Phule Ekadashi	Drought and lodging tolerance Rainfed	Madhya Pradesh Odisha, Chhattisgarh, Gujarat
(vii) Proso Millet TNAU 164	Rainfed	Andhra Pradesh, Delhi, Karnataka, Maharashtra, Tamil

		Nadu, Uttrakhand
Barley		
RD 2660, K603	Drought tolerance	North west plains region
PRB 502, Pusa Losar, HBL 391, UPB 1008, VL Jau 118, Pusa Sheetal VLB 94	Rainfed	Himachal Pradesh, J & K, Uttarakhand, Sikkim, North Eastern states

Pulses

Variety	Trait	Zone
Mungbean		
MadhiraPesara 347	Drought tolerance	Andhra Pradesh
MH 318	Rainfed during spring, summer, kharif season	Haryana
IPM 410-3, IPM 205-7, SML 1115	Suitable for summer season	Rajasthan, Punjab, Haryana, Dlhi, Himachal Pradesh, Uttrakhand, J&K, Madhya Pradesh, Maharashtra, Gujarat, Uttar Pradesh, Karnataka, Tamil Nadu, Tripura, Manipuram and Mirozam
Urdbean		
Indira UrdPratham	Rainfed and irrigated summer	Chhattisgarh, Karnataka, Andhra Pradesh, Odisha, Tamil Nadu
MNK 1, HK 4	Rainfed as well as irrigated conditions	Uttar Pradesh, Bihar, Jharkhand, West Bengal
LBG 787 (Tulasi)	Suitable for rice-fallows after kharif and rabi paddy (summer)	Tamil Nadu, Andhra Pradesh, Karnataka, Telangana, Andaman & Nicobar
Chickpea		
CO1, ICCV 10, NandyalaSanaga 1 (NBeG 3)	Drought tolerance	Southern Zone Andhra Pradesh
Vijay, Vikas	Drought tolerance	Central Zone
RSG 14 , RSG 888	Drought tolerance	North West Plain Zone
PKV Harita	Drought tolerance	Maharashtra
Pant Gram 5	Rainfed/ irrigated	Rajasthan, Haryana, Punjab, Uttar Pradesh, Uttrakhand, J&K (NMPZ)
PhuleVikram	Rainfed	Maharashtra
Lentil Shalimar Masoor 2	Rainfed	J&K
Pigeonpea Rajeshwari Ujwala	Optimum sown rainfedconds.	Gujarat, Maharashtra, Madhya Pradesh

Low rainfall Low rainfall areas and chalka

		soils of Telangana
Cowpea Pant Lobia 1, Hisar Cowpea 46 MFC 08-14	Drought tolerance Rainfed	Uttrakhand, Haryana Karnataka, Kerala, Andhra Pradesh, Tamil Nadu and Pudducherry
Fieldpea IPFD 10-12	Both rainfed& irrigated conds.	Madhya, Chhattisgarh, Uttar Pradesh, Gujarat, Rajasthan
Cluster bean HG 884, HG 2-20	Rainfed	Uttar Pradesh, Madhya Pradesh, Haryana, Gujarat, Rajasthan
Horse gram VL Gahat 19, Cridalatha, Gujarat DantiwadaHorsegram 1	Rainfed	North zone, South Zone, Gujarat, Rajasthan, Uttrakhand, Jharkhand, Uttar Pradesh, and Maharashtra

Oilseeds

Variety	Trait	Zone
Rapeseed Mustard		
NRCDR2, RH 0119, Pusa Mustard 26, Pusa Mustard 27, Pant Rai 19	High temperature tolerance	North West Plain Zone, HR, J&K, Punjab, Haryana, Rajasthan, Delhi, Uttar Pradesh, Madhya Pradesh, Uttrakhand
NRCDR 601, RGN 236, RGN 229	High temperature and salinity tolerance	North West Plain Zone, Punjab, Haryana, Delhi, J&K, Rajasthan
Raj Vijay Mustard 2, Pant Rai 20, RGN 298, PBR 378, GDM 5	Rainfed	Delhi, Haryana, J&K, Rajasthan, Punjab, Uttar Pradesh
Toria Raj Toria 1	Drought as well as rainfed tolerance	Madhya Pradesh
Taramira Jobner Tara, Jwala Tara	Rainfed	Rajasthan, Haryana, Punjab, Uttar Pradesh, Gujarat, Delhi, Uttrakhand, Maharashtra& Madhya Pradesh
Soybean		
NRC-7, JS 71-05, JS 95-60, Pant Soybean 24	Pod shattering and drought tolerance	All soybean growing zones Uttar Pradesh&Uttrakhand
KDS 344, Pant Soybean 21, Pant Soybean 23	Rainfed	Maharashtra, Karnataka Tamil Nadu, Telangana, Uttrakhand
Pant Soybean 23	Lodging & shattering	Uttrakhand
Groundnut		

Ajiya, Girnar1, TAG-24, GG20, Kadiri 6, ICGV 91114, GKVK 5	Drought Tolerance	Central and South zone Karnataka
Vijetha, JL 501, Girnar 3ICGV 00350, HNG 123, Raj Mungfali 1, Gujarat Junagadh Groundnut 31, CO6, Gujarat Junagadh Gnut 22, Gujarat Junagadh Groundnut 17, Dharni, Gujarat Junagadh Gnut 18, Raj Mungfali 2, CO7, KadiriAmaravathi, VRI 8	Rainfed	Odisha, Jharkhand, West Bengal, North Eastern states, Karnataka, Maharashtra, Tamil Nadu& Andhra Pradesh, Gujarat, Rajasthan, Uttar Pradesh, Punjab
ICGV 00350, Gujarat Junagadh Groundnut 9	Rabi summer irrigated	Gujarat
Linseed		
JLS 67, Mau Azad Alsi 2, Kota BaraniAlsi 3, PKV-NL-260, Chhattisgarh Alsi 1, Arpita, Uma, Priyam	Rainfed	Bundelkhand part of Uttar Pradesh, Madhya Pradesh, Rajasthan, Chhatisgarh, Maharashtra, Karnataka, Odisha, Punjab, Haryana, Himachal Pradesh
Niger		
Birsa Niger 3	Drought	Jharkhand, Chhattisgarh, Madhya Pradesh, Odisha, Maharashtra, Karnataka, Andhra Pradesh, West Bengal
JNS 30, IGPN 8004	Rainfed	Madhya Pradesh, Maharashtra

Forages

Variety	Trait	Zone
Pearl Millet		
Nutrifeed (PAC 981)	Rainfed	Punjab, Haryana, Rajasthan, Gujarat, Madhya Pradesh, Maharashtra, Uttar Pradesh under both irrigated and rainfed condition in Kharif and summer season
IGPM 5-2	Low rainfall conditions	Haryana, Punjab, Rajasthan, Uttar Pradesh, Bihar, Jharkhand, Odisha, Gujarat, Maharashtra and Madhya Pradesh
Forage Sorghum		
UPC 628	Irrigated summer and rainfedkharif	Uttrakhand, Himachal Pradesh, J&K,Punjab, Haryana, Rajasthan, Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Bihar, Jharkhand, West Bengal, Odisha, Assam, Gujarat, Maharashtra

Bundel Lobia-4, MFC-09-1	Rainfed	North Eastern region, Karnataka, Kerala, Andhra Pradesh, Tamil Nadu and Pondicherry
Guinea Grass	Rainfed	Humid/arid tropical and sub- tropical

Bundel Guinea - 4 (JHGG 08-1),		areas of the country
Dharwad Guinea Grass1(DGG-1) (RSDGG-1)	Rainfed condition, resistant to lodging, Non shattering type/drought tolerance	All India
Ricebean Shyamalima (JCR-7-20)	Drought tolerant	AS
Napier X Bajra Hybrid PhuleJaywant (RBN 13)	Drought tolerant	Madhya Pradesh, Maharashtra, Gujarat, Uttar Pradesh, Andhra Pradesh, Tamil Nadu, Karnataka and Kerala under irrigated condition
Tall Fescue Grass EC 178182	Drought tolerant	Temperate and sub-temperate grasslands and pastures of hill zone of the country comprising Himachal Pradesh, Uttrakhand and J&K
Setaria grass PalamSetaria 1 (S 18)	Drought tolerant	Himachal Pradesh &Uttrakhand

Commercial Crops

Variety/Hybrid	**Traits**	**Zone**
Cotton		
LRA 5166	Tolerance to drought	Central Zone
KC 3	Tolerance to drought	South Zone
HD 324, CICR-1, Raj DH 7, Jawahar Tapti, PratapKapi, Suraj, Surabhi, Veena, AK 235	Drought Tolerant	Cotton growing areas
VBCH 2231, SVPR 4, Phule Anmol, GN.Cot. 25, SVPR 1 (Hy.)	Drought Tolerant	Maharashtra, Gujarat, Madhya Pradesh, Odisha, Tamil Nadu, Andhra Pradesh, Telangana, Karnataka
Nirmal 18	Rainfed/ irrigated	Maharashtra, Madhya Pradesh, Gujarat, Karnataka. Andhra Pradesh, Tamil Nadu
Central Cotton NHH 250 (Hy.)	Rainfed	Maharashtra, Madhya Pradesh, Gujarat
Jute		
JBO 1 (Sudhangsu)	Drought tolerance	Tossa jute belt of West Bengal, Assam, Bihar & Orissa
Arpita, Kkhyati	Water logging	West Bengal, Assam and Uttar Pradesh
Rithika, Shresthaa, JRO 2407, Ishani, Kkhyati	Rainfed	Tossa Jute growing belt, Odisha, Assam, Uttar Pradesh, West Bengal, Bihar
Mesta		
Sneha, Shrestha, Shakti, Shanti, Satyen	Rainfed	Mesta growing belt Andhra Pradesh, Odisha, Assam, Maharashtra, Bihar&

		West Bengal
AMV 7	Drought	
Kenaf		
Bimal, Central Kenaf JBMP 2	Rainfed	Mid and highland rainfed agro-ecosystem, Mesta growing belt
Sunhemp		
Prankur	Rainfed agro-ecosystem	Sunhemp growing belt
Roselle		
Sampurna, Central Roselle Ratna	Adapted to Mesta growing belt	Rainfed agro-ecosystem
Sugarcane		
Co 94008 (Shyama), Co-0218, Co 09004 (Amitha)	Tolerant to drought and salinity	Peninsular Zone Gujarat, Maharashtra, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Madhya Pradesh, Chhattisgarh
Co 98014 (Karan-1), CoC(SC)24	Tolerant to drought, water-logging	North West Zone Tamil Nadu, Andhra Pradesh& Odisha
CoLk 94184 (Birendra)	Tolerant to drought and waterlogging with good rationing	North Central Zone
Co 0239, Co 0238, Co 06927, Co 0403, Co 86032	Tolerant to drought	Southern and central zone
Sankeshwar 049 (Co Snk 05103), SNK-632, Revathi	Tolerant to moisture stress	Andhra Pradesh, Gujarat, Maharashtra, Karnataka, Tamil Nadu, Kerala and Madhya Pradesh
D01YANG	Drought	Assam
CO 0212	Drought	Tamil Nadu

Flood/submergence Tolerant Varieties of field crops

Crop	Variety	Traits	Area of adoption
CEREALS			
Rice	Swarna Sub-1, DRRH-3 (Hy), Pusa Basmati 6, SAVA 127, CR 1009 Sub 1, Kanaklata, CR Sugandh Dhan 908, RajendraNilam, PAN 802(Hy.), Karjat 8,	Lodging resistant.	Madhya Pradesh,Odisha,Uttar Pradesh, ,Gujarat, Andhra Pradesh, Punjab, Haryana, Western Uttar Pradesh, Uttrakhand,

	Maize	Karjat 9,
	Sorghum	Narendra Usar Dhan-2008
Wheat		

Amara (MTU 1064), JayantiDhan, CR Dhan 505, Samba Sub-1, CR 1009 Sub 1, Bheema/ Dheera (MTU 1140), CR Dhan	506 SabourNirjal (BRW 3723) BH 40625 (DHM 117), BH 1620 (DHM 113), BH 1576 (DHM 111), PMH 4 (JH 31153 GJ-42 (SR-666-1), RVICSH 28 (Hybrid)	Resistant to lodging and shattering, saline areas Flood/ water logging/deep water/submergence tolerant Lodging tolerant, shattering, Tolerance to lodging Resistant to lodging	Assam, West Bengal, Bihar, Maharashtra Saline areas of Orissa, Andhra Pradesh and West Bengal Andhra Pradesh, Odisha, Assam, Uttar Pradesh, Tamil Nadu, Karnataka Bihar Andhra Pradesh, Punjab, Haryana, Delhi and Western Uttar Pradesh
Pearl Millet	Nandi 64 (MSH 199) (Hybrid) (NMH 69)	Resistant to lodging	Gujarat Gujarat, Rajasthan, Maharashtra, Uttar Pradesh in summer season
Kodo Millet	JawaharKodo 137	Resistant to lodging	Chhattisgarh
Finger Millet	VL Mandua 348, CO 15	Tolerant to lodging	Uttrakhand, Tamil Nadu
Oilseeds			
Indian Mustard	RH 0406	Lodging tolerance	J&K, Punjab, Haryana, Delhi, Rajasthan
Soybean	Pant Soybean 23 (PS 1523)	Resistant to lodging	Uttrakhand
Niger	PhuleKarala (IGPN 2004-1)	High rainfall areas	Maharashtra, Karnataka
Fibres			
Jute	Arpita (JBC 5), JRCM 2 (Partho), JRO 2407 Samapti (Tossa Jute), 9057) White Jute	Tolerant to water logging Ishani (JRC-	Wes Bengal, Assam, Uttar Pradesh and Bihar, Odisha, Entire Tossa Jute growing states of the country
Forages			
Forage Bajra	NDFB 3 (Narendra CharaBajra 3)	Lodging/shattering in normal and salt affected soil quality	Uttar Pradesh, Bihar, Odisha, Jharkhand and West Bengal

Forage Sorghum	Punjab Sudax Chari 4, CSV 33 MF	Multi-cut forage sorghum hybrid resistant to lodging	Punjab, Haryana, Uttarkhand, Uttar Pradesh, Gujarat, Rajasthan, Tamil Nadu, Karnataka and Maharashtra
Rice bean	Bidhan Rice bean-3 (KRB-19)	Moderately tolerant to acid soils and water logging conditions.	Jharkhand, West Bengal, Odisha, Assam, Manipuram and Kerala
Sugarcane	Karan 6 (Co 0239), Karan 5 (Co 0124), CoC(SC)24, Gujarat Sugarcane 5, Gujarat Sugarcane 7, Buddhi 2003 A 255 (CoA 08323)	Tolerant to water logging	Punjab, Haryana, Rajasthan, Central and Western UP and Uttarakhand, Tamil Nadu, Andhra Pradesh, Odisha, Gujarat
	Sankeshwar 814 (Co Snk 05104)	Tolerant to salinity, water-logging & moisture stress	Andhra Pradesh, Gujarat, Maharashtra, Karnataka, Tamil Nadu, Kerala and Madhya Pradesh
	Co9022 (Karan 12)	Non-lodging	Haryana, Punjab, Rajasthan, Uttrakhand and Uttar Pradesh

Annexure-III

Details of breeder seed indent, production and allocation (in quintals) of major crops for last five years

Sl.No	Crop	2013-14			2014-15			2015-16			2016-17			2017-18		
		Indent	Production	Allocation	Indent	Production	Allocation	Indent	Production	Allocation	Indent	Production	Allocation	Indent	Production	Allocation
1	Wheat	*21403*	27502	*18816*	21250	22827	19162	*21680*	25672	18901	20366	26148	21067	23185	35086	21800
2	Barley	*1037*	*698*	*640*	862	1820	854	*1114*	*1479*	808	1138	1133	900	1141	1527	1119
3	Paddy	*5184*	*11483*	*4655*	4734	5504	3920	*4316*	*8040*	4043	4990	12136	4454	5116	8861	4580
	Paddy Hyd.	*16*	*23*	*12*	6	88	6	*7*	*62*	6	16	3	1	3	7	2
4	Maize	*64*	*91*	*56*	26	19	14	*16*	*23*	9	50	43	40	45	11	7
	Maize Hyd.	*36*	*17*	*7*	35	40	14	*28*	*7*	5	54	26	11	49	41	31
5	Millets				9	6	6				6	102	99	4	7	4
6	Jowar	*69*	*334*	*59*	47	251	47	*52*	*281*	55	43	95	43	41	205	55
	Jowar Hyd.	*6*	*57*	*6*	5	9	3				9	23	8	11	13	11
7	Ragi	*18*	*87*	*18*	17	80	15	*12*	*60*	12	22	48	20	17	77	18
8	Bajra	*11*	*34*	*10*	5	17	5	*11*	*44*	6	4	18	4	5	16	6
9	Bajra Hyd.	*4*	*31*	*4*	4	18	4				5	25	4	3	16	3
10	Kodo										7	26	22	4	6	4
Cereals Total :		27847	40356	24283	27000	30678	24050	27235	35667	23846	26710	39825	26672	29625	45874	27638
1	Moong	*1065*	*726*	*719*	930	679	646	*935*	*1387*	1248	705	618	449	744	940	665
2	Urd	*762*	*606*	*566*	581	533	473	*426*	*490*	402	433	217	189	437	360	270
3	Arhar	*565*	*792*	*464*	541	657	486	*292*	*654*	340	243	736	264	313	747	308
4	Gram	*8325*	*10367*	*6391*	8285	8768	5661	*6707*	*7697*	5894	7184	7737	6277	10119	11174	8906
5	Lentil	*568*	*916*	*442*	380	614	525	*265*	*312*	267	476	516	383	477	535	430
6	Peas	*890*	*863*	*565*	719	631	568	*465*	*637*	597	1409	759	688	623	777	530
7	Moth	*99*	*63*	*53*	98	40	40	*83*	*55*	36	59	29	23	62	66	50
8	GUAR	*342*	*193*	*428*	380	205	143	*300*	*281*	145	269	257	125	227	277	207
9	Lethryus													115	166	151

10	Cowpea	*143*	*57*	*31*	152	53	53	*49*	*11*	6	220	9	8	42	147	29
11	Rajmash	*9*	*1*	*1*							25	6	6	15	14	14
12	Horse Gram										10	2	2	17	22	14
Pulse Total		12767	14584	9660	12066	12178	8596	9522	11522	8935	11034	10887	8414	13190	15225	11576
1	Groundnut	*13206*	*11944*	*9640*	13777	12996	12011	*11465*	*10561*	9787	7129	9823	6413	11203	14153	11586
2	Soybean	*27571*	*20718*	*15507*	18417	8019	8019	*15326*	*9009*	8346	16941	8956	8922	18079	15311	12153
3	Sunflower				3	20	3							0	0	0
	Sunflower Hyd	*5*	*15*	*5*				*2*	*2*	9	2	11	2	2	23	2
4	Sesamum	*32*	*41*	*9*	31	59	26	*25*	*33*	10	25	39	15	29	28	20
5	Castor	*6*	*7*	*6*	6	19	6	*5*	*13*	5	3	9	1	0	0	0
	Castor Hyd.	*4*	*9*	*4*										2	3	2
6	Niger	*21*	*15*	*9*	10	10	7	*11*	*5*	5	13	12	12	14	23	12
7	Rape & Must.	*91*	*212*	*74*	98	209	72	*127*	*290*	111	107	306	106	99	248	93
8	Safflower	*29*	*65*	*6*	21	328	324	*28*	*33*	21	14	65	12	11	305	10
	Safflower Hyd										14			0	0	0
9	Linseed	*43*	*139*	*38*	42	49	36	*62*	*116*	35	50	262	69	49	181	37
Oilseeds Total :		41007	33165	25298	32403	21709	20504	27052	20062	18329	24296	19483	15553	29490	30274	23916
1	Cotton	*39*	*93*	*33*	27	36	22	*32*	*57*	26	22	41	17	0	0	0
	Cotton Hyd.	*1*	*14*	*1*										24	103	26
2	Jute	*11*	*12*	*10*	17	19	17	*16*	*17*	16	11	12	11	7	8	7

3	Fodder	*1438*	*1265*	*999*	595	664	540	504	451	413	503	527	485	639	650	588
	Total	*1490*	*1384*	*1044*	640	718	580	552	525	454	535	579	513	670	760	621

		83112	89490	60285	72108	65283	53729	64360	67777	51564	62576	70774	51152	72975	92133	63751
1	POTATO	*20366*	*20574*	*12588*	25890	16829	12934	*35100*	*18376*	16918	36475	19330	16771	39195	18314	17156
2	VEGETABLE	138	141	107	80	179	43	*99*	*61*	36	280	258	79	159	267	138
		103616	110205	72979	98078	82292	66707	99559	86213	68518	99331	90363	68002	112328	110714	81046

Details Of Requirement And Availability Of Foundation Seed **Annexure-IV**

Quanity In Quintals

Crop	2013-14		2014-15		2015-16		2016-17		2017-18	
	Requirement	Production/availability	Requirement	Production/availability	Requirement	Production/availability	Requirement	Production/availability	Requirement	Production/availability
Wheat	335337	543778	431713	560570	466442	561650	466065	1159611	424424	687295
Paddy	280551	418042	267208	416261	195238	389908	284889	416405	243892	428642
Maize	3001	6522	3006	5300	2282	2545	2168	3068	8750	9104
Jowar	1717	2707	1299	1938	1326	2538	1360	1986	4763	5647
Bajra	223	951	224	310	84	269	67	294	721	1014
Ragi	527	687	413	835	376	740	483	2432	480	720
Barley	5036	14768	8214	9151	7124	8014	9795	10044	8839	9988
Others	99	286	521	484	191	307	254	665	121	356
Total cereals	626491	987741	712598	994849	673064	965972	765082	1594505	691990	1142765
Gram	136221	185370	118240	119993	120837	113007	144973	123502	138323	123918
Lentil	2824	3839	6945	5922	9579	4741	7625	5724	7716	7129
Peas	4558	4831	15728	16512	47668	47530	16168	15379	15822	25130
Urd	9612	13902	10764	13956	9336	19010	7271	9503	13363	17725
Moong	6244	9650	13174	18868	6276	8524	7806	11742	5980	11449
Arhar	3627	5765	7989	12304	8047	11959	11962	14010	10068	13998
Cowpea	572	601	772	624	498	606	6121	6171	13938	543
Moth	678	1256	1030	879	670	1075	392	422	1673	2162
Guar			1152	1994	652	1201	527	1256	535	1050

Others	1267	2029	1041	419	1017	1980	1969	1783	126	77
Total pulses	165602	227243	176836	191471	204580	209632	204812	189490	207544	203180
Groundnut	188422	189838	161957	179360	151413	175054	149931	203335	149292	165984

Rape/ mustard	5699	11713	3503	7071	3030	4867	2362	5085	3100	5825
Til	233	1810	313	1903	466	969	639	2611	1351	2662
Sunflower	298	434	166	328	192	236	210	236	141	151
Soybean	175232	250310	188701	168750	198560	105719	208707	106847	232020	335557
Linseed	357	718	659	828	267	354	392	600	500	650
Castor	876	1159	424	492	441	628	322	733	473	558
Safflower	247	352	414	438	213	312	465	537	274	460
Niger	50	104	71	265	60	157	64	154	91	235
Totaloilseeds	371414	456437	356207	359434	354643	288296	363092	320138	387241	512082
Cotton	628	2366	946	2088	301	284	750	1651	5844	5864
Jute/others	151	627	638	650	658	663	4050	4109	146	236
Total fibre	779	2993			959	946	4800	5760	5990	6100
Others	1481	2940	550	1153	378	620	478	1027	1173	1584
Potato	80215	65716	57589	26517	49576	29955	127470	98158	94955	88438
Grand total	1245982	1743070	1305365	1576161	1283199	1495420	1465734	2209078	1388894	1954150

Annexure-V

All India position of requirement and availability of certified/quality seeds (in quintals) for kharif 2017

Crop	Requirement	Availability	Surplus/Deficit	Remarks
Paddy	7028080	8346745	1318665	
Bajra	267817	296767	28950	
Sorghum	229016	244971	15955	
Maize	1222499	1289122	66624	
Ragi	27792	37984	10192	
Little millet	635	650	15	
Italian millet	2000	3089	1089	
Kodo millet	3085	3296	211	
Millet	470	470	0	
Banyard millet	731	584	-147	**Meet from Farm Saved Seeds**
Buckwheat	20		-20	
Grain amaranthus	40	4	-36	
Cereals total	8782184	10223682	1441498	
Arhar	329898	375936	46038	
Urd	190688	274234	83546	
Moong	191790	243821	52031	
Cowpea	24070	24616	546	
Moth bean	18570	23835	5265	
Horse gram	10775	7689	-3086	**Meet from Farm Saved Seeds**
Rajmash	15898	15964	66	
Guar	78134	84638	6504	
Pea	1900	1900	0	
Ricebean	1180	1180	0	
Pulses total	862903	1053814	190910	
Groundnut	1784902	1824967	40066	
Soybean	3565251	4024653	459401	
Sunflower	14789	15983	1194	
Sesame	22123	24633	2510	
Niger	1483	1831	348	
Castor	59852	63339	3487	
Oilseeds total	5448399	5955406	507006	
Cotton	314208	343803	29595	
Dhaincha	16164	10000	-6164	**Meet from Private**
Jute	38880	32944	-5936	
Sunnhemp	5366	5525	159	
Potato	1500	1500	0	
Grand total	**15469604**	**17626674**	**2157069**	

Annexure –VI

All India position of state wise requirement and availability of certified/quality seeds (in quintals) for kharif 2017

State	Requirement	Availability	Surplus/Deficit	Remarks
Andhra pradesh	1531588	1644352	112764	
Arunachal pradesh	12278	12278	0	
Assam	706422	706422	0	
Bihar	587951	479835	-108116	**Meet from NSC and Private**
Chhattisgarh	781405	1007172	225767	
Goa	3535	3535	0	
Gujarat	841088	902092	61004	
Haryana	108365	218369	110004	
Himachal pradesh	25745	25745	0	
Jammu&kashmir	110604	110604	0	
Jharkand	365863	450971	85108	
Karnataka	1135257	1281384	146127	
Kerala	27743	27748	5	
Madhya pradesh	2031705	2468365	436660	
Maharashtra	2613217	2776700	163483	
Manipur	10710	10710	0	
Meghalaya	33455	33455	0	
Mizoram	13150	820	-12330	**Meet from NSC**
Nagaland	44298	44298	0	
Orissa	751219	618267	-132952	**Meet from Rabi summer production, NSC,HIL and Private**
Puducherry	985	1036	51	
Punjab	106975	106975	0	
Rajasthan	800000	884254	84254	
Sikkim	2600	540	-2060	**Meet from NSC and Farm Saved Seed**
Tamilnadu	210989	365300	154311	
Telanagana	842018	1249598	407580	
Tripura	20555	24595	4040	
Uttar pradesh	1150930	1152057	1127	
Uttarakhand	44165	53952	9787	
West bengal	554790	965245	410455	
Grand total	**15469604**	**17626674**	**2157069**	

Annexure-VII

All India Cropwise Requirement and Availability of Certified/Quality Seeds (in quntals) for Rabi 2017-18

State Name	Requirement	Availability	Deficit/Surplus	Remarks
Wheat	12126453	14977119	2850666	
Paddy	1921962	2059960	137998	
Barley	229755	347966	118211	
Maize	223260	278751	55492	
Bajra	18475	23624	5149	
Sorghum	105461	107176	1715	
Ragi	2103	9131	7028	
Buckwheat	1100	730	-370	Meet from Farm Saved Seeds.
Kodo millet	270	140	-130	
Italian millet	755	1145	390	
Little millet	600	968	368	
Banyard millet	50	60	10	
Total cereals	**14630244**	**17806771**	**3176528**	
Gram	1716310	1926750	210440	
Moong	49346	70620	21274	
Urd	83282	99503	16221	
Arhar	773	5440	4667	
Lentil	137004	135865	-1139	Meet from Private and Farm Saved Seeds.
Peas	237261	234102	-3159	
Rajmash	6958	5284	-1674	
Khesari	19687	19600	-87	
Cowpea	2856	3596	740	
Horse gram	8856	9241	385	
Faba bean	500	500	0	
Total pulses	**2262833**	**2510500**	**247667**	
Groundnut	643621	676325	32703	
Soybean	125	125	0	
Toria	13785	13006	-779	Meet from R&M
R&m	217773	242363	24590	
Castor	80	80	0	
Sesame	26738	26665	-73	Meet from GSSC
Linseed	7511	5016	-2495	Meet from Farm Saved Seeds.
Sunflower	5184	5124	-60	
Safflower	10989	12291	1302	
Total oilseeds	**925806**	**980994**	**55187**	

Cotton	2391	2619	228	
Oat	16943	16943	0	
Berseem	4179	4179	0	
Jute	5500	5750	250	
Potato	3820846	2986683	-834163	Meet from Punjab, HP and Private
Total	**21668742**	**24314439**	**2645697**	

Annexure-VIII

Statewise Position of Requirement and Availability of Certified/Quality Seeds for Rabi 2017-18

Quantity in Quintals

State Name	Requirement	Availability	Deficit/Surplus	Remarks
Andhra pradesh	707563	848566	141003	
Aruanchal pradesh	3700	3700	0	
Assam	354864	354864	0	
Bihar	872195	1394931	522736	
Chhattisgarh	143500	159045	15545	
Goa	2072	2072	0	
Gujarat	574068	774444	200376	
Haryana	1632700	1890378	257678	
Himachal pradesh	84875	84875	0	
Jammu & kashmir	145170	145170	0	
Jharkhand	129995	172211	42216	
Karnataka	464786	665895	201109	
Kerala	52885	53970	1085	
Madhya pradesh	2460376	2624086	163710	
Maharashtra	815090	817634	2544	
Manipur	16100	16100	0	
Meghalaya	3680	3680	0	
Mizoram	637	518	-119	Meet from NSC
Nagaland	8990	6235	-2755	Meet from NSC and Farm Saved Seeds.
Odisha	183343	92123	-91220	Meet from NSC, HIL, Seed Village Programme
Puducherry	6392	6722	330	
Punjab	1216167	1650509	434342	
Rajasthan	1503604	2047827	544223	
Sikkim	3660	1946	-1714	Meet from NSC and Farm Saved Seeds.
Tamilnadu	551294	592547	41253	
Telangana	680918	689264	8346	
Tripura	10475	11525	1050	
Uttar pradesh	5285200	5325956	40756	
Uttarakhand	42575	249106	206531	
West bengal	3711868	3628540	-83328	Meet from, NSC, HIL, Punjab, HP, Seed Village and Private
Grand total	**21668742**	**24314439**	**2645697**	

All India Crop wise Requirement and Availability of Certified/Quality Seeds (in quintals) for 2017-18							Annexure-IX		
	KHARIF-2017			RABI 2017			Total		
Crop	**Requirement**	**Availability**	**Status**	**Requirement**	**Availability**	**Status**	**Requirement**	**Availability**	**Status**
Wheat			0	12126453	14977119	2850666	12126453	14977119	2850666
Paddy	7028080	8346745	1318665	1921962	2059960	137998	8950042	10406705	1456663
Bajra	267817	296767	28950	18475	23624	5149	286292	320391	34099
Maize	1222499	1289122	66624	223260	278751	55492	1445758	1567874	122116
Sorghum	229016	244971	15955	105461	107176	1715	334477	352147	17670
Ragi	27792	37984	10192	2103	9131	7028	29895	47115	17220
Barley			0	229755	347966	118211	229755	347966	118211
Little millet	635	650	15	600	968	368	1235	1618	383
Italian millet	2000	3089	1089	755	1145	390	2755	4234	1479
Kodo millet	3085	3296	211	270	140	-130	3355	3436	81
Millet	470	470	0			0	470	470	0
Banyard millet	731	584	-147	50	60	10	781	644	-137
Buckwheat	20		-20	1100	730	-370	1120	730	-390
Amaranthus	40	4	-36			0	40	4	-36
Others			0			0	0	0	0
Cereals total	**8782184**	**10223682**	**1441498**	**14630244**	**17806771**	**3176528**	**23412428**	**28030454**	**4618026**
Gram			0	1716310	1926750	210440	1716310	1926750	210440
Lentil			0	137004	135865	-1139	137004	135865	-1139
Pea	1900	1900	0	237261	234102	-3159	239161	236002	-3159
Urd	190688	274234	83546	83282	99503	16221	273970	373737	99767
Moong	191790	243821	52031	49346	70620	21274	241136	314441	73305
Arhar	329898	375936	46038	773	5440	4667	330671	381376	50705
Cowpea	24070	24616	546	2856	3596	740	26926	28212	1286
Moth bean	18570	23835	5265			0	18570	23835	5265
Horse gram	10775	7689	-3086	8856	9241	385	19631	16930	-2701
Rajmash	15898	15964	66	6958	5284	-1674	22856	21248	-1608

Guar	78134	84638	6504			0	78134	84638	6504
Khesari			0	19687	19600	-87	19687	19600	-87
Faba bean			0	500	500	0	500	500	0

Ricebean	1180	1180	0			0	1180	1180	0
Others			0			0	0	0	0
Pulses total	**862903**	**1053814**	**190910**	**2262833**	**2510500**	**247667**	**3125736**	**3564314**	**438577**
Groundnut	1784902	1824967	40066	643621	676325	32703	2428523	2501292	72769
R&m			0	217773	242363	24590	217773	242363	24590
Toria			0	13785	13006	-779	13785	13006	-779
Sesame	22123	24633	2510	26738	26665	-73	48861	51298	2437
Sunflower	14789	15983	1194	5184	5124	-60	19973	21107	1134
Soybean	3565251	4024653	459401	125	125	0	3565376	4024778	459401
Linseed			0	7511	5016	-2495	7511	5016	-2495
Castor	59852	63339	3487	80	80	0	59932	63419	3487
Safflower			0	10989	12291	1302	10989	12291	1302
Niger /others	1483	1831	348			0	1483	1831	348
Oilseeds total	**5448399**	**5955406**	**507006**	**925806**	**980994**	**55187**	**6374206**	**6936399**	**562194**
Cotton	314208	343803	29595	2391	2619	228	316599	346422	29823
Jute	38880	32944	-5936	5500	5750	250	44380	38694	-5686
Mesta/others			0			0	0	0	0
Fibre total	**353088**	**376747**	**23660**	**7891**	**8369**	**478**	**360979**	**385116**	**24138**
Oat			0	16943	16943	0	16943	16943	0
Berseem			0	4179	4179	0	4179	4179	0
Dhaincha	16164	10000	-6164			0	16164	10000	-6164
Sunnhemp	5366	5525	159			0	5366	5525	159
Potato	1500	1500	0	3820846	2986683	-834163	3822346	2988183	-834163
Grand total	**15469604**	**17626674**	**2157069**	**21668742**	**24314439**	**2645697**	**37138346**	**41941113**	**4802766**

Annexure-X

Details of Assistance/Subsidy for seed production and distribution provided under various existing Schemes/Programmes implemented by States

Sl. No.	Scheme/Component	Crop	Scale of Assistance
1.	National Food Security Mission(NFSM)	Rice	a) Rs.5000/- per quintal or 50% of seeds cost whichever is less for certified hybrid rice seed distribution. b) Rs.10/- per kg. or 50% of the cost, whichever is less for certified high yielding varieties certified seed distribution for less than 10 years old varieties.
		Wheat	Rs.10/- per kg. or 50% of the cost whichever is less for certified high yielding varieties seed distribution for less than 10 years old varieties.
		Pulses	Rs.2500/- per quintal or 50% of cost whichever is less for certified seeds distribution for less than 10 years old varieties.
		Coarse cereals- HYVs seed	HYVs Rs.1500/- per quintal or 50% of cost whichever is less for HYVs certified seeds distribution for less than 10 years old varieties.
		Hybrid seed	Rs. 5000/- per quintal or 50% of cost of seeds whichever is less for Hybrid coarse cereal certified seeds distribution for less than 10 years old varieties.
		Commercial Crops-Jute based cropping system Seed Village Programme and Production of seed in Govt. Farms	**Seed production** a) Production of breeder seed @Rs.20000/qtl. b) Production of certified Seeds 50% of the cost limited to Rs.120/- per kg for foundation seed production. c) Rs.50/- per kg for certified seed production. d) Rs.5500/qtl. for certified seed produced by State Department of Agriculture, State Agricultural Universities, KVKs, SSCs, NSC and SSCA.
		Commercial Crop – Sugarcane	Assistance for breeder seed production @Rs.40000/ha.(Rs.34000 for inputs and Rs.6000 for contingency) to SAUs, ICAR and Sugarcane Research "Institute (SRI) Production of tissue culture raised plantlets/ seedlings @Rs.3.5 per seedling.

2	Bringing Green Revolution	Rice and in Wheat	Distribution of seeds a) Rs.5000/- per quintal or 50% of seeds cost

	Eastern India (BGREI)		whichever is less for certified hybrid rice seed distribution. b) Rs.10/- per kg. or 50% of the cost, whichever is less for certified high yielding varieties certified seed distribution for less than 10 years old varieties.
		Rice and Wheat	Production of seeds The assistance for production of seeds @ Rs. 1,000 per qtl. for HYVs of paddy and wheat and Rs. 5,000 per qtl.for paddy hybrid for less than 10 years old varieties from the year 2015-16. Out of this, 75% amount of subsidy is meant for farmers and 25 % to seed producing agencies for meeting expenditure including certification cost.
3.	National Mission on Oil Seeds and Oil Palm (NMOOP)	All oilseeds, Hybrid seeds Oil Palm Sprouts Cultivation cost as assistance for gestation period for oil palm.	a) Full cost for purchase of Breeder Seed of oilseeds from ICAR/SAUs etc. b) 50% of the cost with a ceiling of Rs. 25 per Kg. of certified seeds except sesame which are not older than 10 years for distribution and Rs. 5000/- per quintal for hybrids and variety of sesame not older than 15 years. c) Full cost of Seed Minikits of high yielding varieties/hybrids which are less than 10 years. (Implementing agency NSC /NAFED/KRIBHCO etc). d) 85% of cost of planting material with a ceiling of Rs. 8000/ha. for entire land holding of farmers for oil palm. e) 50% cost during gestation period for 4 years with ceiling of Rs. 16000/ per ha. for oil palm.
		Assistance for production of Foundation Seeds	Rs. 1000 per quintal for all verities / hybrids released during last 10 years and additional assistance of Rs. 100/quintal on the varieties /Hybrids released in last 5 years. 75% of subsidy amount is meant for farmers and 25% for seed producing agencies for meeting expenditure towards certification and production etc. (SDAs/NSC/ NAFED/ KRIBHCO/ IFFCO/HIL/IFFDC/Central Multi State Cooperatives such as NCCF)
		Assistance for production of Certified Seeds	Rs. 1000 per quintal for all varieties / hybrids released during last 10 years and additional assistance of Rs. 100/- quintal on the varieties. Hybrids released in last 5 years, 75% of subsidy amount is meant for farmers and 25% for seed

4.

5.			producing agencies for meeting expenditure towards certification and production etc. (SDAs/NSC/NAFED /KRIBHCO /IFFCO/HIL/IFFDC/Central Multi State Cooperatives such as NCCF)
	Rashtriya Krishi Vikas Yojna (RKVY)	All Crops	All activities including Seed Infrastructure
	National Mission on Agricultural Extension and Technology (NMAET)-Sub-Mission on Seeds & Planting Material (SMSP)	Seed Village Programme - All Agricultural Crops (60% GOI and 40% State Share)	a. Distribution of Seeds To upgrade the quality of farmer saved seed financial assistance for distribution of foundation / certified seeds @ 50% cost of the seeds for Cereals crops and 60% for oilseeds, pulses, green manure and fodder crops is provided for 1 acre of area per farmer for production of quality seeds. b. Farmers Training- Assistance to train the farmers on seed production and seed technology @ Rs.15000/- for a group of 50-150 farmers. c. Seed treating/dressing drums - Financial assistance for treating seeds @ Rs.3500 per seed treating drum of 20Kg capacity and Rs. 5000 per drum of 40Kg capacity. d. Storage bins To encourage farmers to develop storage capacity of appropriate quality, financial assistance is provided to farmers for purchasing Seed Storage bins. The rate of assistance is as under. @33% for SC/ST farmers for 10 qtls. capacity Rs.1500 @33% for SC/ST farmers for 20 qtls. capacity Rs.3000 @25% for General farmers for 10 qtls. capacity Rs.1000 @25% for General farmers for 20 qtls. capacity Rs.2000

157		Certified Seed Production of oilseeds, pulses, green manure and fodder crops through Seed Village (60% GOI and 40% State Share)	A Distribution of Seeds- financial assistance for distribution of foundation seeds @ 75% cost of the seeds of oilseeds, pulses, green manure and fodder crops is provided to the farmers. Farmers Training - Assistance to train the farmers on seed production and seed technology @ Rs.15000/- for a group of 50-150 farmers. Certification Charges- 50% Seed Certification charges maximum of Rs.600/ha or actual whichever is less for certification of seeds produced under the programme. Seed processing and seed storage godowns- Assistance is provided to establish seed processing and prefabricated or other type of seed storage godowns 150 sqm. @ Rs.10000 per sqm. to process and store 200 MT capacity for each seed village. Financial assistance of Rs.7.56 lakh is available for seed processing machinery and supporting equipments etc.
6.	Mission for Integrated Development of Horticulture (MIDH) Seed production for vegetables and Spices	Open pollinated crops Hybrid seeds Seed infrastructure	@ Rs. 35,000/ha - For public sector 100%, for private sector 35% in general areas and 50% in NE & Himalayan States, Tribal Sub Plans (TSP) areas, Andaman & Nicobar & Lakshadweep Islands, limited to 5 ha. Output target of seed for each crop will be fixed by the individual state. @ Rs. 1.50 lakh/ha- For public sector 100%. For private sector 35% in general areas and 50% in NE & Himalayan States, TSP areas, Andaman & Nicobar & Lakshadweep Islands, limited to 5 ha. Output target of seed for each crop will be fixed by the individual state for each beneficiary, before releasing funds. vii) Import of planting material Rs. 100.00 lakh - 100% of cost for State Govt. / PSUs, as project based activity. Seed infrastructure (for handling, processing, packing, storage etc. of seeds meant for use as seed material for cultivation of horticulture crops) @Rs. 200.00 lakh- 100% of cost to public sector For private sector, credit linked back end subsidy @ 50% of cost of project.

Annexure-XI

Number of varieties/hybrids of oilseeds and pulses released during the last five year (2012-2016)

Crop-groups	2014	2015	2016	Total
Oilseed crops	8	16	50	**74**
Pulse crops	12	8	43	**63**

List of varieties/hybrids of oilseeds and pulses released during the last five years

		2014	2015	2016
Oils eeds (108)		**Oilseeds :08**	**Oilseeds: 16**	**Oilseeds: 50**
1.	Rapeseed-Mustard (33)	**-**	**Total :04** Gujarat Dantiwada Mustard-4, Albeli-1; RSPN 25, GSC 7 (GSC 101)	**Total: 16** Pant Rai 20; PBR-357; RGN-298; GM3 (Gujarat Mustard 3); Pusa Double Zero Mustard31 (PDZ-1); RLC 2 (IC 511615); PBR 378; Gujarat Dantiwada Mustard 5 (GDM 5) (SKM 518); Raj Vijay Mustard 1; JK Samriddhi Gold (JKMS 2); JK Pukhraj (JKYS 2); Bayer Mustard 5450; RLC 3; Sushree, TL 17; BJC 1 (PC 6)
2.	Groundnut (17)	**-**	**Total :03** Gujarat Junagadh Groundnut -18 Raj Mungfali-2 (RG-578), Phule Bharati (JL 776)	**Total: 8** G 2-52; CO 7; GJG 19 (Gujarat Junagarh Groundnut 19) JSP 51; Central GNut Raj Mungfali 3 (RG 559-3); Phule Warna (KDG 128); Phule Morna (KDG 123); KCG 6; GKVK 5;
3.	Sesame (10)	**-**	**Total : 02** Smarak (OSC 560), Subhra (OSC 207),	**Total: 4** DS-5; PKV-NT-11 (NT-11-91); Gujarat Junagadh Til 5 (GJT 5); LT 8 (Punjab Til No. 2);
4.	Soybean (18)	**Total : 06** JS 20-29; JS 20-34; Raj Vijay Soybean 2001-04 (RVS 2001-4); MAUS-2 (Pooja); MAUS-162; DSb-21	**Total : 04** NRC 86 (Ahilya 6), KDS 344 (Phule Agrani), Pusa 12 (DS 12-13), DSB 21	**Total: 5** SL 958; MACS 1281; JS-20-69; VL Soya 77 (VLS 77); VL Bhat 201 (VLB 201);
5.	Sunflower (9)	**-**		**Total: 5** Sunlight (NSFH 1001); PSH 996; Phule Bhaskar (SS 0808); PSH 1962 (Hybrid); RSFH 1887 (Hybrid);
6.	Castor (5)	-		**Total: 3** Kohinoor (NBCH-66); Pragati (PCS-262); HCH 6 (Hybrid);
7.	Linseed (9)	-	**Total :02** Pratap Alsi-2, Tiara (JRF-2)	**Total: 7** Kota Barani Alsi-3; Kota Barani Alsi-4 (RL 10193); PKV-NL-260 (NL-260); JLS 79;

Chhattisgarh Alsi1 (RLC133); Divya (BAU-06-

				03); Arpita;
8.	Niger (3)	**Total : 01** DNS 4		**Total: 2** JNS-30; IGPN-8004
9.	Safflower (4)	**Total : 01** NARI-H-23	**Total : 01** NARI-57	- -
Pul ses (90)		**Pulses :12**	**Pulses 8**	**Pulses: 43**
10.	Chickpea (21)	**Total: 01** JG-12	**Total:03** Bidisha (BG 1084), Vallabh Kabuli Chana-1, Raj Vijay Gram 202	**Total : 10** Pusa 3022 (BG); PBG7 (GL 26054); Aman (CSJ-515); Nandyal Gram 119; Teej (GNG-2144); JGK-5; BDNGK 798; GBM 2, Gujarat Junagadh Gram 6 (GJG6); JG 36 (Jawahar Gram 36);
11.	Mungbean (20)	**Total: 03** MH 421; DGGV-2; BGS-9 (Somnath)	**Total:02** CO 8 Shalimar Moong-2 (SKUAM -300)	**Total : 11** MH 318; Utkarsh (KM-11-584); Yadadri (WGG-42); Sri Rama (MGG351); GBM-1; IPM 410-3 (Shikha); IPM 205-7 (Virat); SML-1115; MSJ 118 (Keshwanand Mung 2); ML 2056; RMG 975 (Keshwanand Mung 1);
12.	Urdbean (11)	**Total: 01** DBGV-5	**Total:01** Vallabh Urd-1,	**Total : 3** Indira Urd Pratham (RU 03-14); LBG 787 (Tulasi); PDKV Blackgold (AKU 10-1);
13.	Pigeon pea (13)	**Total: 02** BRG-4 (BRG 10-2); ICPH 2671 (Hybrid)		**Total : 6** Prakash (IPA 203); Gujarat Junagadh Pigeonpea-1 (GJP-1); Ujwala (PRG 176); Mannem konda Kandi (ICPH 2740); GT-102; BRG 5
14.	Lentil (7)	**Total: 01** Raj Vijay Lentil 31 (JL 31)	**Total:01** Shalimar Masoor-2 (SKUA-L9)	**Total : 4** KLB 2008-4 (Krati); KLS-09-3 (Krish); RLG-5 (Keshwanand Masoor-1); IPL 526
15.	Field pea (9)	**Total: 02** IPFD 10-12; HFP 715	**Total:01** Shalimar Pea-1 (SKUA-P-8)	**Total : 4** Indira Matar 1 (REP 2009-1); Central Field pea IPFD 11-5; IPFD 6-3; RFP 4 (Keshwanand Matar 1)
16.	Cowpea (4)	**Total: 01** DCS 47-1		**Total : 2** Pant Lobia -3 (PGCP -6), Phule Vithai (Phule CP-05040)
17.	Horse gram (5)	**Total: 01** CRIDAHARSHA(CRHG 19)		**Total : 3** Pratap Kulthi-2 (AK 53); CRIDAVARDHAN (CRHG-22); Phule Sakas (SHG 0628-4)

Annexure-XII

Varieties of Small Millets released during 2016

S. No.	Name of variety	Area of adaptation	Special features
	Finger Millet		
7	VL 376	All Ragi growing areas of country	Responsive to fertilizer and moderately resistant to blast.
8	GNN-6	Gujarat	Moderately resistant to leaf blast and finger blast
9	GN-5	Gujarat	Late maturing, White colour seed, Moderately resistant to leaf and finger blast.
10	VL Mandua -348	Uttarakhand	Suitable for organic cultivation; Resistant to neck and finger blast; and tolerant to lodging; light copper grains.
11	KMR 340	Karnataka	White ragi variety, especially for confectionary purpose, resistant to blast and blight diseases, tolerant to stem borer and aphids
	Kodo millet		
4	Jawahar Kodo 137	Rainfed areas of Madhya Pradesh	Suitable for sole as well as inter/mixed cropping, responsive to NPK, resistant to drought, lodging, and key pest shoot fly and moderately resistant to head smut

	Barnyard Millet		
1	DHBM 93-3	National	Responsive to fertilizer application
	Little Millet		
1	BL 6	National	Recommended for upland cultivation, and rich in zinc and calcium
2	DHLM 36-3	National	Late maturing variety
3	Chhattisgarh Kutki-2 (BL-4)	Chhattisgarh	It has high iron content (28.3 mg/100 g grain). Tolerant to major pests.
4	GV-2	Gujarat	Clean White colour and bold seeded, Resistant to pest and diseases.
5	Phule Ekadashi (KOPLM 83)	Sub-montane and Ghat Zone of Maharashtra	
6	Jawahar Kutki 4 (JK 4)	Rainfed areas of Madhya Pradesh	

Non- lodging.

Suitable for sole as well as inter/mixed cropping, responsive to NPK, resistant to drought, lodging, and key pest shoot fly and moderately resistant to head smut

Annexure-XIII

Sorghum hybrids and varieties released National Level during 2014-2016

S. No	Hybrid	Year of release	Centre	Recommended for the states of	Remarks
Hybrids					
1.	CSH 32	2014	Dev Gen seeds	Maharashtra , Karnataka, MP, South Gujarat, and north AP	Kharif hybrid, 221 cm tall, White midrib colour, semi erect leaves, semi compact panicle, Tolerant to Charcoal rot, Ergot, Rust, shoot fly, aphids and stem borer. Non-lodging, & non-shattering, highly responsive for Deep soils.
2.	CSH 33	2014	Nuziveedu seeds	Rajasthan, UP, North Gujarat, South Andhra Pradesh & TN	Kharif hybrid, 185 cm, early maturity, well exerted compact panicle, medium bold grain, Non-lodging, & non shattering tolerant to major pests and diseases.
3.	CSH 34	2014	Hitech seeds	Maharashtra , Karnataka, MP, AP, Chattisgarh Gujarat, and Rajasthan	Kharif hybrid, 210 cm tall, medium maturity, ear head - semi compact,, awn less, long bulging panicle, board in upper part to symmetrical in shape, white medium length stigma, creamy white medium bold grain, resistant to downy mildew, under natural conditions escapes grainmold due to little bit more maturity duration.
4.	CSH 35	2014	Akola	Maharashtra , Karnataka, MP, South Gujarat, and Telangana	Kharif hybrid, 215 cm tall, medium maturity, ear head - semi compact, oblong with tapering apex; internodes covered by leaf sheath, dull green mid rib, non-lodging non shattering, moderately tolerant to major pests and diseases.
Varieties					
1.	CSV 30F	2014	Rahuri	All forage sorghum growing areas of India.	Forage Sorghum, Goose neck tendency of panicle observed sometimes due to environmental fluctuations

S. No	Hybrid	Year of releas	Centre	Recommended for the states of	Remarks

		e			
2.	CSV 31	2014	Palem	Under rainfed conditions in Kharif season in Andhra Pradesh, Tamil Nadu, Rajasthan and Gujarat	Kharif variety, 210-250 cm tall, juicy stem, white colour mid-rib, waxy bloom, seni-compact symmetric panicle, pearly white seed and grey yellow endospem, tolerant to grain mold and resistant to anthracnose and leaf blight.
3.	CSV 32F	2015	ICAR-IIMR	All forage sorghum growing areas of Maharashtra, Tamilnadu and Karnataka (Zone II)	Forage Sorghum
4.	CSV 33MF	2016	TNAU	All forage sorghum growing states (Zone-1&II)	Forage Sorghum, Tall, thin stem, high tillering , first cut after 62 days subsequent cut after 50 days, 1039 q/ha green fodder yield, 280 q/ha dry fodder yield resistant to leaf blight, anthracnose

Annexure-XIV

Hybrids and Varieties of Pearl Millet Released during 2014 to 2016

Hybrids	Area of adaptation	Maturity group/duration and salient features
MPMH 21 (MH 1777)	Drier part of Rajasthan, Gujarat and Haryana	Early maturing, brown anthers, lanceolate compact ear heads, grey brown hexagonal grains, resistant to downy mildew, blast and smut
HHB 272 (MH 1837)	Drier part of Rajasthan, Gujarat and Haryana	Early maturing, brown anthers, lanceolate compact ear heads, grey globular grains, resistant to blast.
86M84 (MH 1890)	Rajasthan, Gujarat, Haryana, Punjab, Delhi, UP and MP	Late maturing, yellow anthers, lanceolate very compact ear heads, grey obovate bold grains resistance to downy mildew and blast other disease
PHB 2884	Punjab	Late maturing, tall plant height, lanceolate ears heads, grey seeds
Proagro Tejas	Rajasthan	Early maturing, medium height, candle ear heads, grey seeds, resistant to downy mildew
86M88 (MH 1816)	Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu	Late maturing, purple anther colours, compact conical earheads, grey obovate coloured grains, resistant to downy mildew, smut, rust and blast
86M01 (MH 1790)	Rajasthan, Gujarat, Haryana, Punjab, Delhi, UP, MP, Maharashtra, Karnataka, Andhra Pradesh and Tamil Nadu	Medium maturing, purple anther colours, compact conical earheads with bristles, grey obovate coloured grains, resistant to downy mildew and smut
NBH 5767 (MH 1785)	Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu	Medium maturing, purple anther colours, medium plant height, compact lanceolate earheads, deep grey coloured grains
NBH 5061 (MH 1812)	Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu	Late maturing, purple anther colors, medium plant height, compact lanceolate earheads, grey coloured grains

Annexure-XV

Short duration drought tolerant cultivars of millets

Crop	Cultivar	Duration (days)
Sorghum-rabi	Mauli	105-110
Sorghum-kharif	CSV 17	97
Pearl millet	HHB-94	70-75
Finger millet	VL 347	95-100
Foxtail millet	SiA 3088	70-75
Kodo millet	TNAU 86	95-110

Superior varieties of millets for iron and zinc content (mg/100 g)

Crop	Iron	Zinc
Pearl millet	Dhanashakti (8.1)	Dhanashakti (4.3)
Finger millet	KMR-216 (13.3); VL 347 (7.9-8.0)	GPU-67 (4.81); VL 347 (3.5-3.7)
Little millet	JK-8 (34.6)	OLM-203 (2.37)
Foxtail millet	SiA-3088 (12.9)	TNAU-59 (3.22)

Annexure-XVI

Important indigenous MPTS suitable for agroforestry for different regions

Scientific, English & Common name	Distribution	Potential area for agroforestry	Uses
Acacia catechu	Throughout greater parts of India except in very humid and temperate region	Kandi area of Punjab, Shivalik foothills of HP.	Cutch and katha, medicinal purposes
Acacia nilotica [Indian Gum Arabic, Babul, Kikar]	Indigenous to northern Deccan including AP, Maharashtra Rajasthan, Gujarat	Canal side Platonism in Punjab, Haryana, UP, dry part of Bihar, Chota Nagpur ,central India, Tamil Nadu, Karnataka, Chhattisgarh, West Bengal	Carts, Agril. Implements. Gum, kutch, Katha, Fodder, 3-5MAI m^3 ha/yr
Ailanthus excelsa [Tree of Heaven, Ardu]	South of Gangetic region, West Bengal, Bihar, Orissa Andhra Pradesh, Orissa, Maharashtra, Gujarat, Rajasthan and Haryana	Tamil Nadu, Karnataka, Madhya Pradesh (industrially important in Gujarat and Rajasthan)	Catamarans for fishing, packing cases, sword sheaths, matchbox, fodder, biomass yield 41.8 t/ha
Albizia lebbeck	Throughout India Uttar Pradesh to 900 m in the Himalaya and in the Andaman	South and Central India	Poles, fuelwood, fodder
Albizia procera	Sub Himalayan tract from Yamuna eastwards to West Bengal , Satpura region Gujarat, South India and Andaman Assam low elevations in Mizoram, Meghalaya, Nagaland, Tripura, AP	Rajasthan, Punjab Haryana and some lower part of Himachal and J&K	
Anthocephalus kadamba [Miracle tree, Kadamb]	It is found in chota nagpur of Bihar, Raipur and Bilaspur districts of Madhya pradesh, Northern Western Ghats in South,	West Bengal, Arunachal Pradesh, Tamil Nadu, in	Ceiling boards, packing cases, Veeners and plywood. Writing and printing paper.

	circars tract of Andhra pradesh and the evergreen forest of Karnataka; Southwards to Trivandrum in Kerala (Anon, 198	Central Maharashtra - Sahyadris, in North Eastern part - Assam, lower hills of Darjeeling, Terai, Bihar, Orissa, in Singh bum valley and also in Andaman Islands	Fruits edible. Bark and leaves used in medicine, pencil making, 19 m^3 ha/yr
Azadirachta indica [Indian Lilac, Neem]	Through India (except J&K, North-East, Coastal region)	UP, MP Gujarat, Maharashtra, AP and Telangana	Oil, Fodder, Timber, Medicine
Bambusa vulgaris [Golden bamboo, Peela bans]	Throughout India	Throughout India except Arid region	Paper and pulp, poles, post, rayon
Casuarina equisitifolia [Casuarina, Beefwood Sura, Chowku]	Tamil Nadu, Gujarat, Uttar Pradesh, Andhra Pradesh, Orissa, Coastal belt of Maharashtra, Karnataka and Kerala	500,000 ha are planted with *Casuarina* in the states of Andhra Pradesh, Orissa, Tamil Nadu and the Union Territory of Puducherry	Poles, pulp for paper making, Charcoal, 10–20 MT/ha/yr
Dalbergia sissoo [Rosewood, Sitsal Beete]	Sub-Himalayan tract from Indus to Assam and Himalayan valleys	Jammu & Kashmir, Himachal Pradesh, Punjab, Haryana, Rajasthan, Uttar Pradesh, Bihar, Orissa, West Bengal, Sikkim, Arunachal Pradesh, Assam, Nagaland, Manipur, Mizoram, Meghalaya, Tripura, Madhya Pradesh, Gujarat, Maharashtra, Andhra Pradesh, Pondicherry, Tamil Nadu, Karnataka, Telangana and Kerala	Premium furniture making and cabinetry, as veneer
Gmelina arborea [Malay Beechwood, Gamhar]	Madhya Pradesh, West Bengal, Andhra Pradesh, Tamil Nadu, Karnataka, Kerala,	West Bengal, Bihar, Assam, Chhatisgarh, Madhya Pradesh, Gujarat, Punjab, Haryana,	Food, Fodder, Fuel, Apiculture, Fibre, pulp, timber, plywood, matches and Medicine,

	Maharashtra, Orissa, Assam	Uttarakhand	silkworm culture.
Grewia optiva [Bhimal]	J & K, Himachal Pradesh, Uttrakhand	Shivalik foothills of Punjab and lower Himalayan foothills	Food, Fodder, Fuel, Fibre
Hardwickia binata [Indian Black wood, Anjan]	Andhra Pradesh, Telangana, Tamil Nadu, Karnataka, Maharashtra, Uttar Pradesh, Bihar, Jharkhand, Madhya Pradesh	Gujarat, Rajasthan	Wood timber, bark – fibre Leaves fodder
Melia dubia [Persian Lilac, White Cedar, Malabar neem, Ghora neem]	Tamil Nadu, Karnataka, Kerala, Eastern Himalayan	Andhra Pradesh, Maharashtra, Madhya pradesh, Gujarat, Punjab	Fruit stones are used in making necklaces and rosaries. Wood is good for agric. implements, furniture, plywood, boxes, poles, tool handles
Prosopis cineraria Mesquite, Khejri]	Arid north-western planes of India comprises of Punjab, West Rajasthan, Gujarat, Uttar Pradesh, in dry parts of central India	Drier parts of Andhra Pradesh, Karnataka, Maharashtra and Tamil Nadu	Fodder, Firewood, Timber, Charcoal, Pods consumed by human beings, 1 - 2 m^3 ha/yr
Salix alba [Indian Willow, Bed]	W. Himalayas, Kashmir, Kullu Vally, Uttarakhand		Basket and rope work, Cricket bats, MAI 8-23m^3 ha/yr
Tectona grandis [Teak, Sagwan]	Gujarat, Rajasthan, UP, MP, Orissa, Andhra, Maharashtra, Karnataka, Tamil Nadu, Kerala, Manipur	Bihar, Assam, West Bengal, Tripura, Arunachal Pradesh , Punjab, Nagaland, Orissa, Goa, Andaman	Construction, Railway sleepers, Plywood, MAI 21-30m^3 ha/yr, Estimated 44% of teak plantation of the world in India
Terminalia arjuna [Arjun]	Peninsular India, Indo Gangetic plain, Bihar, Orissa, MP, Karnataka	Jharkhand, Assam, Chhattisgarh, Uttar Pradesh	Carts, boat building, Tussar silk, fire wood, charcoal making, medicine

			and tannins

S. NO.	Name of Firm	Status	Purpose of application	Type of project	Location	State	Qua with m^3/
1	Abhishek Industries Ltd	E-212, Kitchlu Nagar, Ludhiana-141001	GW Clearance in respect of expansion of cotton spinning unit	Industry	Village Sanghera, Block & District Barnala, Punjab	Punjab	174 m3/ (exi m3/ (pro thro 4 tu 2 tube
2.	Jheel Overseas	G-1/91, Badharna, Road No.14, VKIA Extn., Jaipur-302013	GW Clearance in respect of textile & handicrafts manufacturing unit	Industry	Village Harmada, Block Amer, District Jaipur, Rajasthan	Rajasth an	20 r
3.	M/s Dalip Industries	Village Jatauli Halley Mandi, Block Pataudi, District Gurgaon, Haryana	GW Clearance in respect of proposed packaged drinking water unit	Industry	Village Jatauli Hailey Mandi, Block & Tehsil Pataudi, District Gurgaon, Haryana	Haryana	33 pro (1)
4.	M/s Dhillon Kool Drinks & Beverages (P) Ltd.	G.T. Road Phillaur, District Jalandhar, Punjab	Ground Water clearance for proposed packaged drinking water	Industry	Village Bachowal, Block & Tehsil Phillaur, District Jalandhar, Punjab	Punjab	550 pro (1)

5.	M/s Balaji Group	Ashok Nagar, At. Ponkh,Taluka Udaipurwati, District Jhunjhunu-333053, Rajasthan		Industry	Village Ponkh, Tehsil Udaipurwati, District Jhunjhunu, Rajasthan	Rajasth an	16 gro thro one only
6.	M/s Sudh Ganga Beverages	Maa Engineering Services, A-24, Main Bajghera Road, Rajendra park, Gurgaon, Haryana	Ground Water clearance for proposed packaged drinking water	Industry	Village Tikli, Block Sohna, District Gurgaon, Haryana	Haryana	20 gro thro one only
7.	M/s SMJ Beverages Asia Ltd.	Plot No.56A, KIADB Industrial Area, Hoskote-562114, Bangalore Rural District, Karnataka	Ground Water Clearance for proposed packaged drinking water unit	Industry	Plot No.56A, KIADB Industrial Area, Hoskotes621 14, Bangalore Rural District,	Karnata ka	26 exis bor

						Karnataka		

Annexure-XVIII

Action plan proposed for 7 years in respect of Mechanization and Technology Division to promote the Agriculture Mechanization with a view of Doubling the Income of the Farmers by 2022:

07 Years vision 2016-17 to 2021-22		
Scheme	**Vision and Outcome**	**Targets**
Sub Mission on Agricultural Mechanization	1. To increase Farm power availability from the existing level of 2.02 KW/ha in 2016-17 to 2.8kW/ha by 2022	2.5 kW/ha to be achieved by 2022
	2. To develop Skilled man Power in Farm Mechanization sector	1,48,000 trainees to be trained
	3. To ensure the Quality, durability, safety and comfort of the farm machinery available to the users through testing.	10,270 Agricultural Machneries including, Tractor, Power Tillers and Combine harvester are likely to be tested.
	4. Technology diffusionand commercialization through demonstration, and entrepreneurship development for Custom Hiring Centres. Distribution of Farm machinery for individual ownership.	2,80,000 nos of Custom Hiring Centers to be established at village level. 19000 field demonstration on farmer field to be organized. 19,00,000 nos of farm machinery would be distributed under SMAM with
	5. To lead and coordinate to develop network of research SAUs/ ICAR/Manufacturers and Farmers promote location-specific technologies.	14 nos of Conferences /workshops will be organized coordinate to develop network of research with SAUs/ICAR/Manufacturers and Farmers promote location-technologies
	6. To promote Agriculture Mechanization in NE and Himalayan region through a new central sector specific Scheme.	
	7. Exchange of Expertise and Technologies under relevant national and international agencies in achieving the above objectives.	About 2,00,000 beneficiaries to be benefitted Distribution of farm machinery for individual ownership

	8. Establishment of New upgradation of expertise in the field of Human training and Testing Capacity	As per requirements, the FMTTIs for resource development, testing & manufacturing of farm machineries will be exchanged with developed/ advanced countries. 08 Nos

Annexure-XIX

SMAM (2014-15 to 2017-18)

State	Released (Rs. in crores)	Nos. of Demon-Stration Conducted (in Numbers)	Nos. of Trainees Trained	Nos. Of Agricul Tural Machinery Distributed	Nos. Of Custom Hiring Centres Established	Nos. Of hi-tech hubs Establi shed	Farm Machinery banks Estblshed at village level
Andhra Prad.	101.80	600	1950	58297	275	0	220
Arunachal Pradesh	6.45	1700	2710	3004	3	0	0
Assam	6.70	0	0	305	8	2	40
Bihar	23.01	0	0	0	166	2	229
Chhattisgarh	49.19	0	0	26929	182	0	16
Gujarat	21.50	400	1174	16582	14	3	8
Haryana	47.55	0	185	16100	14	1	15
HP	15.72	200	150	5235	9	0	0
J&K	7.57	100	0	7057	4	0	0
Jharkhand	9.37	0	1250	0	0	0	182
Karnataka	84.03	225	75	32275	2	6	4
Kerala	8.26	504	56	935	29	0	43
MP	103.05	500	310	99635	128	12	0
Maharashtra	68.36	0	0	38129	189	0	0
Manipur	6.86	4752	0	6457	7	0	7
Meghalaya	2.65	200	0	542	0	0	0
Mizoram	8.19	0	0	873	0	0	54
Nagaland	18.20	592	586	2071	21	0	34
Orissa	72.09	200	300	13178	951	0	0
Punjab	102.68	0	0	13700	1576	6	0
Rajasthan	29.05	200	1250	13464	45	10	10
Sikkim	3.66	640	233	1317	0	0	10
Tamil Nadu	83.40	0	0	7151	679	0	90
Telengana	27.66	1800	900	25098	49	0	0
Tripura	12.59	0	0	1507	0	0	16
UP	119.68	400	1251	63219	340	0	1262
Uttarakhand	7.81	240	418	4565	32	0	29
West Bengal	25.63	1700	1475	5565	175	5	33
Fmtt		757	28022	0	0	0	0
Total	1072.70	14953	14273	463190	4898	47	2302

ANNEXURE-XX

STANDING COMMITTEE ON AGRICULTURE

(2017-18)

MINUTES OF THE TWENTY SEVENTH SITTING OF THE COMMITTEE

*****

The Committee sat on Tuesday, the 31st July, 2018 from 1500 hrs. to 1635 hrs. in the Committee Room "B", Ground Floor, Parliament House Annexe, New Delhi.

PRESENT

Shri Hukm Deo Narayan Yadav – Chairperson

MEMBERS

LOK SABHA

2. Shri Sanjay Dhotre
3. Prof. Ravindra Vishwanath Gaikwad
4. Shri Nalin Kumar Kateel
5. Smt. Rakha Nikhil Khadse
6. Md Badaruddoza Khan
7. Shri C. Mahendran
8. Dr. Tapas Mandal
9. Shri Nityanand Rai
10. Shri Mukesh Rajput
11. Shri Virendra Singh
12. Shri Dharmendra Yadav
13. Shri Jai Prakash Narayan Yadav

RAJYA SABHA

14. Shri Rajmani Patel
15. Shri Kailash Soni
16. Shri Harnath Singh Yadav

SECRETARIAT

1.	Shri D.S. Malha	–	Joint Secretary
2.	Shri Arun K. Kaushik	–	Director
3.	Smt. Juby Amar	–	Additional Director
4.	Shri Sumesh Kumar	–	Under Secretary

*2. XXXXX XXXXX XXXXX XXXXX

*3. XXXXX XXXXX XXXXX XXXXX

[THE WITNESSES WITHDREW]

4. Thereafter, the Committee took up for consideration the following draft Reports:

*(i) XXXXX XXXXX XXXXX XXXXX

(ii) Draft Report on the Action Taken by the Government on the Observations/Recommendations contained in the 39th Report (16th Lok Sabha) of the Standing Committee on Agriculture (2016-17) on Comprehensive Agriculture Research based on Geographical Conditions and Impact of Climatic Changes to ensure Food Security in the Country" of the Ministry of Agriculture and Farmers Welfare (Department of Agricultural Research and Education).

*(iii) XXXXX XXXXX XXXXX XXXXX

*(iv) XXXXX XXXXX XXXXX XXXXX

*(v) XXXXX XXXXX XXXXX XXXXX

*(vi) XXXXX XXXXX XXXXX XXXXX

5. After some deliberations, the Committee adopted the draft Reports at para (i), (ii), (iii), (v) and (vi) without any modifications and Draft Report at para (iv) with minor modification and authorized the Chairperson to finalize and present these Reports to Parliament after factual verification of Subject report from the concerned Departments/Ministries.

*6. XXXXX XXXXX XXXXX XXXXX

The Committee then adjourned.

(A copy of the verbatim proceedings of the Sitting has been kept separately).

***Matter not related to this Report.**

APPENDIX

(Vide Para 4 of Introduction of the Report)

ANALYSIS OF ACTION TAKEN BY GOVERNMENT ON THE THIRTY NINTH REPORT OF STANDING COMMITTEE ON AGRICULTURE (2016-17) ON THE SUBJECT "COMPREHENSIVE AGRICULTURE RESEARCH BASED ON GEOGRAPHICAL CONDITIONS AND IMPACT OF CLIMATIC CHANGES TO ENSURE FOOD SECURITY IN THE COUNTRY" OF THE MINISTRY OF AGRICULTURE AND FARMERS WELFARE (DEPARTMENT OF AGRICULTURAL RESEARCH AND EDUCATION)

(i)	Total number of Recommendations	33
(ii)	Recommendations/Observations which have been Accepted by the Government Para Nos. 1, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 25, 26, 28, 29, 31, 32 and 33	
	Total	28
	Percentage	84.84%
(iii)	Recommendations/Observations which the Committee Do not desire to pursue in view of the Government's replies Para No. Nil	
	Total	NIL
	Percentage	0.00 %
(iv)	Recommendations/Observations in respect of which replies of the Government have not been accepted by the Committee Para Nos. 2, 4, 24, 27 and 30	
	Total	05
	Percentage	15.15%
(v)	Recommendations/Observations in respect of which Final replies of the Government are still awaited Para No. Nil	
	Total	NIL
	Percentage	0.00%