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**STANDING COMMITTEE ON
CHEMICALS & FERTILIZERS**

(2022-23)

SEVENTEENTH LOK SABHA

**MINISTRY OF CHEMICALS AND FERTILIZERS
(DEPARTMENT OF FERTILIZERS)**

**NANO-FERTILIZERS FOR SUSTAINABLE CROP PRODUCTION AND
MAINTAINING SOIL HEALTH**

THIRTY- NINTH REPORT



सत्यमेव जयते

LOK SABHA SECRETARIAT

NEW DELHI

March, 2023/ Phalguna, 1944 (Saka)

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SOIL HEALTH**

Presented to Lok Sabha on 21.03.2023

Laid in Rajya Sabha on 21.03.2023



LOK SABHA SECRETARIAT

NEW DELHI

March, 2023/ Phalguna, 1944 (Saka)

CONTENTS

		PAGE No.
COMPOSITION OF THE COMMITTEE (2021-22)		(iv)
COMPOSITION OF THE COMMITTEE (2022-23)		(v)
INTRODUCTION		(vi)
Acronyms/Abbreviations		(vii)
REPORT		
PART - I	NARRATIVES	1
I	Introductory	
II	Research and Field Trials on Nano Fertilizers (i) Research and Field trials (ii) Variance in crop yield on application of Nano Urea (iii) Efficacy Trials for Nano Urea (iv) Development of other nano fertilizers (v) Efficacy of Nano Urea (vi) Nano fertilizers and Conventional Fertilizers - a Comparative Analysis (vii) Research Trials on Nano DAP	3
III	Progressive journey of Nano Fertilizers (i) Progressive journey Nano Urea (ii) Measures to increase the production of Nano Urea (iii) Benefits of Nano Urea in Reduction of Imports and Subsidy Savings of Bulk Urea	13
IV	Application of Nano Urea (i) Best application of Nano Fertilizers (ii) Methodology for spraying Nano Urea (iii) Availability of drones for Nano Fertilizers spray (iv) Need for Drone Pilot Training (v) Corporate Social Responsibility (CSR) fund to facilitate drone spray of Nano Fertilizers	17
V	Promotion of Nano Urea (i) Methods adopted for promotion of Nano Urea (ii) Testing Laboratories for Nano fertilizers. (iii) Equitable Distribution of Nano Fertilizers (iv) Need for Relief in Basic Customs duty on fertilizer raw materials	27
PART - II		
OBSERVATIONS/RECOMMENDATIONS		33-46
ANNEXURES		
I.	Summary of all India Experimental Results of Nano Urea (liquid) in Kharif 2021.	47
II.	Seasons-wise/crop-wise experimental trails undertaken on Nano urea (liquid) (Nano nitrogen).	
III.	Safety assessment of IFFCO Nano urea (liquid) as per DBT Nano guidelines.	
APPENDICES		
I.	Minutes of the sitting of the Standing Committee on Chemicals & Fertilizers (2021-22) held on 18 th April, 2022.	
II.	Minutes of the sitting of the Standing Committee on Chemicals & Fertilizers (2021-22) held on 04 th May, 2022.	
III.	Minutes of the sitting of the Standing Committee on Chemicals & Fertilizers (2021-22) held on 04 th August, 2022.	
IV.	Minutes of the sitting of the Standing Committee on Chemicals & Fertilizers (2022-23) held on 14 th February, 2023.	

**COMPOSITION OF THE STANDING COMMITTEE ON CHEMICALS & FERTILIZERS
(2021-22)**

Smt. Kanimozhi Karunanidhi - Chairperson

MEMBERS

LOK SABHA

2. Shri Dibyendu Adhikari
3. Maulana Badruddin Ajmal
4. Shri Deepak Baij
5. Shri Ramakant Bhargava
6. Shri Prataprao Patil Chikhlikar
7. Shri Rajeshbhai Naranbhai Chudasama
8. Shri Sanjay Shamrao Dhotre
9. Shri Ramesh Chandappa Jigajinagi
10. Shri Kripanath Mallah
11. Shri Vasava Parbhubhai Nagarbhai
12. Shri Satyadev Pachauri
13. Smt Aparupa Poddar
14. Dr. M.K.Vishnu Prasad
15. Shri Arun Kumar Sagar
16. Shri M. Selvaraj
17. Dr. Sanjeev Kumar Singari
18. Shri Atul Kumar Singh
19. Shri Pradeep Kumar Singh
20. Shri Uday Pratap Singh
21. Shri Indra Hang Subba

RAJYA SABHA

22. Shri Ayodhya Rami Reddy Alla
23. Shri G.C.Chandrashekhar
24. Dr. Anil Jain
25. Shri M.V. Shreyams Kumar
26. Shri Jaiprakash Nishad
27. Shri Anthiyur P. Selvarasu
28. Shri Arun Singh
29. Shri Vijay Pal Singh Tomar
30. Shri K. Vanlalvena
31. Vacant

SECRETARIAT

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| 1. Shri Vinod Kumar Tripahti | - | Joint Secretary |
| 2. Shri N.K. Jha | - | Director |
| 3. Shri C. Kalyanasundaram | - | Additional Director |
| 4. Shri Panna Lal | - | Under Secretary |

COMPOSITION OF THE STANDING COMMITTEE ON CHEMICALS & FERTILIZERS

(2022-23)

Dr. Shashi Tharoor- Chairperson

MEMBERS

LOK SABHA

2. Shri Dibyendu Adhikari
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4. Shri C.N. Annadurai
5. Shri Deepak Baij
6. Shri Ramakant Bhargava
7. Shri Prataprao Patil Chikhalikar
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15. Shri Muniyan Selvaraj
16. Dr. Sanjeev Kumar Singari
17. Shri Atul Kumar Singh
18. Shri Pradeep Kumar Singh
19. Shri Uday Pratap Singh
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30. Vacant
31. Vacant

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- | | | |
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| 2. Shri N.K. Jha | - | Director |
| 3. Smt. Geeta Parmar | - | Additional Director |
| 4. Shri Panna Lal | - | Under Secretary |

* Nominated w.e.f. 13.03.2023 vide Lok Sabha Bulletin Part -II 6251 dated 14.02.2023

INTRODUCTION

I, the Chairperson, Standing Committee on Chemicals & Fertilizers (2022-23) having been authorized by the Committee do present on their behalf, this Thirty Ninth Report (Seventeenth Lok Sabha) on 'Nano-Fertilizers for sustainable crop production and maintaining soil health' pertaining to the Department of Fertilizers, Ministry of Chemicals and Fertilizers.

2. The Committee (2021-22) took oral evidence of the representatives of the Department of Fertilizers on the subject on 18th April, 2022. The Committee took further oral evidence of the representatives of the Department of Fertilizers, Ministry of Agriculture and Farmers Welfare (Department of Agricultural Research and Education (DARE)) and the Ministry of Civil Aviation at their sittings held on 04th May, 2022 and 04th August, 2022.

3. The Committee considered and adopted this Report at their sitting held on 14th February, 2023.

4. The Committee wish to express their thanks to the representatives of the Ministries/Departments of the Government of India for tendering evidence and placing before the Committee all the requisite information sought for in connection with the examination of the subject.

5. The Committee also place on record their appreciation for the valuable assistance rendered to them by the officials of the Lok Sabha Secretariat attached to the Committee.

6. For ease of reference and convenience, the Observations/ Recommendations of the Committee have been printed in bold letters in the body of the Report.

New Delhi;
20, March, 2023
29, Phalguna, 1944 (Saka)

DR. SHASHI THAROOR
Chairperson,
Standing Committee on
Chemicals & Fertilizers.

ACRONYMS/ABBREVIATIONS OF THE TERMS USED IN THE REPORT

AIF	Agriculture Infrastructure Fund
APVMA	Australian Pesticides and Veterinary Medicines Authority
ATP-ADP	Adenosine tri-phosphate - Adenosine di-phosphate [Energy transfer compounds]
BVFCL	Brahmaputra Valley Fertilizer Corporation Limited
CIARI, Port Blair	Central Island Agricultural Research Institute, Port Blair
CPSU	Central Public Sector Undertaking
CSCs	Common Service Centres
CSR	Corporate Social Responsibility
CSSRI, Karnal	Central Soil Salinity Research Institute, Karnal
DAP	Di-ammonium Phosphate
DBT	Department of Biotechnology
DBT- DST	The Department of Biotechnology and The Department of Science and Technology
DDG, NRM	Director General ((Natural Resource Management)
DGCA	The Directorate General of Civil Aviation
DNA-RNA	Deoxyribonucleic acid (DNA) - Ribonucleic acid (RNA) [Genetic Materials]
DoF	Department of Fertilizers
EFSA	The European Food Safety Authority
FACT	The Fertilizers and Chemicals Travancore Limited
FAO/WHO	Food and Agricultural Organization/ World Health Organization
FCO	Fertilizer Control Order
FPOs	Farmer Producer Organizations
FSANZ	Food Standards Australia New Zealand
GLP	Good Laboratory Practice
GST	Goods and Service Tax
ICAR	Indian Council of Agricultural Research
ICAR- CIARI	Indian Council of Agricultural Research – Central Island Agricultural Research Institute
ICAR-CSSRI	Indian Council of Agricultural Research- Central Soil Salinity Research Institute
ICH	The International Council for Harmonization of Requirements for Pharmaceuticals for Human Use
IFCCO	Indian Farmers Fertilizer Cooperative Limited (IFFCO)
IRRI SARC, Varanasi	International Rice Research Institute South Asia Regional Centre, Varanasi
ISO	International Organization for Standardization
KVKs	Krishi Vigyan Kendras
MHA	Ministry of Home Affairs
MoA&FW, GOI	Ministry of Agriculture & Farmers Welfare, Government of India
MoCA	Ministry of Civil Aviation
MOP	Muriate of Potash
MoU	Memorandum of Understanding
MRP	Maximum retail price
MSP	Minimum Support Price
NARS	National Agriculture Research System
NBRC	Nano Biotechnology Research Centre

NCU	Neem coated Urea
NDA	Non-Disclosure Agreement
NFL	National Fertilizers Limited
NMR	Nuclear magnetic resonance
NOAEL	No-Observed-Adverse-Effect-Level
NPK	Nitrogen, Phosphorus and Potassium
NUE	Nutrient Use Efficiency
OECD	Organization for Economic Cooperation & Development
OECD	Organization for Economic Co-operation and Development.
PLI	Production Linked Incentive
ppm	Parts per million
PSUs	Public Sector Undertakings
R&D	Research and development
RCFL	Rashtriya Chemicals and Fertilizers Limited
Rdn	Recommended Dose of Nitrogen
REACH	Registration, Evaluation, Authorization and Restriction of Chemicals
SAU	State Agricultural Universities
SMAM	Sub Mission on Agricultural Mechanization
SMS	Short Message Service
SOP	Standard operating procedure
TFP	Total factor productivity
TGs	Testing guidelines
TNAU	Tamil Nadu Agricultural University
TSCA	Toxic Substances Control Act
UN SDGs	UN Sustainable Development Goals
USEPA	U.S. Environmental Protection Agency
USFDA	United State Food and Drug Administration

REPORT

PART- I NARRATION

I INTRODUCTORY

- 1.1 World over, agriculture is facing a wide spectrum of challenges, such as stagnation in crop yields, low nutrient use efficiency (NUE), declining soil organic matter, multi-nutrient deficiencies, shrinking arable land and water availability. Depletion and degradation of land and water resources present a serious challenge for food, livelihood and nutritional security for the ever-growing population.
- 1.2 Fertilizers provide nutrients needed by the plants for their optimal productivity. Farmers typically apply fertilizers through the soil by surface broadcasting, subsurface placement or mixing with irrigation water. However, a large portion of bulk conventional fertilizers like urea is lost to the atmosphere or surface water bodies, thereby polluting the ecosystem.
- 1.3 In India, there is a little scope of bringing in more area under cultivation; therefore, growth in food grain production has to come largely through productivity enhancement. However, fertilizer consumption in India is imbalanced, and Urea accounts for more than 82% of the nitrogenous fertilizers applied to majority of the crops. Resultantly, the Nitrogen, Phosphorus and Potassium (NPK) consumption ratio has widened from 4:3.2:1 in 2009-10 to 7:2.8:1 in 2019-20.
- 1.4 Hon'ble Prime Minister has appealed to farmers to reduce the use of urea on farm field in the interest of soil health, environment and futuristic prosperity for gradually reducing use of chemical fertilizers and eventually stop their use to protect soil health. Hon'ble Prime Minister has called for "Reduction in chemical fertilizer consumption especially Urea by 50 percent.
- 1.5 Indian Farmers Fertilizer Cooperative Limited (IFFCO) has developed nanotechnology-based Nano Urea fertilizer to address the imbalanced and excessive use of conventional Urea. Nano fertilizer has been developed indigenously for the first time in the world at IFFCO - Nano Biotechnology Research Centre (NBRC) Kalol, Gujarat through a proprietary patented technology. Nano Urea is a source of nitrogen which is a major essential nutrient required for proper growth and development of a plant. Nitrogen is a key constituent of amino acids, enzymes, genetic materials (DNA-RNA), photosynthetic pigments (i.e. chlorophyll) and energy transfer compounds (ATP-ADP) in

a plant. Typically, nitrogen content in a healthy plant is in the range of 1.5 to 4%. Foliar application of Nano Urea at critical crop growth stages of a plant effectively fulfils its nitrogen requirement and leads to higher crop productivity in comparison to conventional urea.

1.6 Nano Urea has been tested for bio-safety and toxicity as per the guidelines of Department of Biotechnology (DBT), Government of India and international guidelines developed by Organization for Economic Cooperation & Development (OECD) which are adopted and accepted globally. Nano Urea is completely safe for human, animals, birds, rhizosphere organisms and the environment at the recommended levels of application. Ministry of Agriculture & Farmers Welfare, Government of India, has notified Nano Urea as a nano fertilizer under the Fertilizer Control Order (FCO) vide notification dated 24th February, 2021 and commercial production started at Kalol, Gandhinagar w.e.f. 1st August 2021.

1.7 IFFCO had been engaged in research and development of nano fertilizers since 2017. They have developed nano fertilizer macronutrient grades - Nano Nitrogen, Nano DAP and secondary /micronutrient grades - Nano Zinc, Nano Copper, Nano Boron, Nano Sulphur, etc. at Nano Biotechnology Research Centre (NBRC), Kalol, Gujarat. Other nano fertilizers of IFFCO are in pipeline at different stages of development, demonstration and for inclusion under Fertilizer Control Order (FCO), GOI. It is expected that they would be priced considerably cheaper than the prevailing price of their conventional bulk counterparts.

1.8 The various benefits of Nano fertilizers over conventional fertilizers are enumerated as under:

- 1. Price Advantage** - They cost less than the subsidized conventional fertilizers resulting into lower input cost for the farmers.
- 2. Advantage in terms of Logistics and Warehousing** - They are easy to carry and store thus, they are economical in terms of reduced transportation and warehousing cost.
- 3. Saving of Bulk Fertilizer**-With the application of nano fertilizers per hectare, less number of subsidized fertilizer bags are required which leads to saving in fertilizer cost and additional income to the farmers.
- 4. Economic Benefit due to additional crop yield** - Application of nano fertilizers results into better crop productivity and higher income for the farmers. Based on 11,000 all India farmer field trials conducted on 94 crops by IFFCO in collaboration with the Indian Council of Agricultural Research (ICAR) – Krishi Vigyan Kendras(KVKs), average 8 % higher crop yield was achieved with the application of Nano Urea; which translates into Rs. 2000 – Rs. 5000 per hectare higher income to the farmers. Economic

benefit is even more in case of high value / high MSP crops. It will act as one of the tool to double the income of farmers as committed by our Hon'ble Prime Minister. Average 45 – 90 Kg less subsidized urea would be applied per acre of field which translates into Rs. 266 – Rs. 532 per acre cost saving for the farmers in terms of lower purchase cost for the farmers.

- 5. Enhancement in total factor productivity (TFP) of our crop production systems** – Application of nano fertilizers has commensurate benefits in term of better soil health, air and water which will ultimately benefit the farmers through improvement in total factor productivity (TFP) of our crop production systems.

II. RESEARCH AND FIELD TRIALS ON NANO FERTILIZERS

(i) Research and Field trials

2.1 As regards the research and field trials on nano fertilizers, the Ministry of Agriculture and Farmers Welfare, Department of Agricultural Research & Education (DARE) has informed that IFFCO had started trials in some of the ICAR Institutes / State Agricultural Universities (SAUs) from Rabi crops season 2019-20. However, these trials were taken only in few locations, not covering all the agro climatic zones of India. Based on the agronomic efficiency of the product, it was provisionally enlisted in FCO. Subsequently, in Kharif crop season 2021, it was felt that the trials should be conducted in all the agro climatic zones of India. Accordingly 20 experimental trials with Nano Urea were conducted in Five (5) Kharif crops viz. Rice (12 locations), Maize (4 locations), Finger Millet (2 locations), Pearl Millet (1 location) and Ginger (1 location) in selected ICAR Institutes. The experimental trials in most of the locations included the following treatments:

1. Application of 100% Recommended Dose of Nitrogen (RDN).
2. 75% of RDN + 1 Nano Urea spray.
3. 75% of RDN + 2 Nano Urea spray.
4. 50% of RDN + 1 Nano Urea spray.
5. 50% of RDN + 2 Nano Urea spray.

2.2 Further, in three locations viz. Indian Council of Agricultural Research – Central Island Agricultural Research Institute, Port Blair; (ICAR-CIARI), Indian Council of Agricultural Research- Central Soil Salinity Research Institute, Karnal; (ICAR-CSSRI), and International Rice Research Institute -South Asia Regional Centre, Varanasi; (IRRI SARC), the experimental trials had the following treatments:

1. Application of 100% Recommended Dose of Nitrogen (RDN).
2. 66% of RDN + 1 Nano Urea spray.
3. 66% of RDN + 2 Nano Urea spray.
4. 33% of RDN + 1 Nano Urea spray.
5. 33% of RDN + 2 Nano Urea spray.

(ii) Variance in crop yield on application of Nano Urea

2.3 Also, experiments were conducted in a randomizing block design with four replications. After harvesting of the kharif crops, grain yields were recorded and statistical analysis was performed. In 100% RDN treatments, conventional urea was applied through broadcasting. However, in Nano Urea plots, Nano Urea liquid was sprayed @ 2ml/L of water. The Nano Urea was sprayed in the tillering / branching stages of the crops. Crops, their varieties, duration and average yields are described in Table below:

S. No.	Location	Crop	Variety	Duration	Average Yield (q/ha)
1.	GRF, CRIDA, Hyderabad	Maize	Hybrid - DHM-117	107 days	30-35
	AICRPDA centre, Bengaluru	Finger Millet	GPU-28	112 days	25
	AICRPDA centre, Jagdalpur	Upland rice	Danteswari	100 days	33
2.	IISR-Kozhikode	Ginger	Varada	240 days	22-24 tonnes/ha
3.	IRRI-SARC-Uttar Pradesh	Rice (Rainfed)	Binadhan11	125 days	37
	-do-	Rice (Irrigated)	MTU7029	145	40
	IRRI-SARC-Assam	Rice (Rainfed)	CR Dhan 311	125	43
4.	NRRI-Cuttack	Rice	Pooja	158 days	40
5.	SKNAU-Jobner	Bajra	RHB-173	70-80 days	25-28
6.	UAS GKVK-Bangalore	Maize	BRMH-8	120-125 days	75
	-do-	Rice	KMP 220	125-130 days	55
7.	VPKAS-Almora	Finger Millet	VL Mandua352	100 – 105 days	25-28
8.	RVSKVV-Indore	Maize	Komal (Hydbrid)	80-85 days	38-40
9.	AAU-Anand	Maize	GAYMH 1	85 - 90 Days	45

2.4 The results of the trials indicated that in the case of rice, Nano Urea saved top-dressed nitrogen in the range of 25-50% with additional yield of 1.32 to 14.5%, which gave an overall benefit of Rs. 75 to Rs. 9832/ha. In the case of maize, Nano Urea application saved 25-50% top-dressed nitrogen and produced 2 to 5% additional yield, which resulted in overall benefit ranging between Rs. 531 to Rs. 1722/ha. In the case of finger millet, Nano Urea application saved 25-50% top-dressed nitrogen with 11% additional yield in Karnataka and no yield advantage in Uttarakhand. In the case of pearl millet, Nano Urea application saved 25% top-dressed nitrogen and produced 7% higher yield with overall benefit of Rs. 3070/ha. Trial conducted at Kozhikode (Kerala) saved 50% recommended nitrogen and produced 57% higher yield of ginger with overall benefit

of Rs. 50870/ha. In most of the locations there was no significant difference amongst recommended dose of nitrogen (RDN), 75% RDN + Nano Urea, and 50% RDN + Nano Urea Application. However, the best treatments in terms of fertilizer saving and the results are summarized in **Annexure- I**.

2.5 During evidence, a representative of ICAR with regard to variance in the increase of yield of different crops on application of nano fertilizers submitted as under:

“Although rice was tried in 13 locations, for the sake of brevity, I am taking one example from North, East, South, West and Central regions. For example, in Ayodhya, total grain yield obtained was 6.5 tonnes per hectare. The additional cost incurred for using the Nano Urea was Rs. 1200 but the overall benefit after calculating the economics in standard manner was Rs. 7530 and the biggest benefit was in terms of saving in top dress nitrogen and that was up to 50 per cent. Similar type of trend was obtained in different places where saving varied from 33 to 50 per cent. In one location, it was 25 per cent. But in most of the locations, besides additional cost, the Nano Urea application was able to give the benefit to farmers. The same trend was observed in some other crops also. The second crop was maize which was tried in four locations, Anand in Gujarat, Hyderabad in Telangana, Indore in Madhya Pradesh and Bengaluru in Karnataka. Here also, additional cost involved in Nano Urea was Rs. 800 to Rs. 1400 in different locations but overall benefit also varied from Rs. 300 to Rs. 1700. Besides, it had huge saving of nitrogen. So, top dress nitrogen saving ranged between 25 to 50 per cent in maize crop.”

2.6 In this context, he further added as under:

“If I put all these trials and give a summary, in rice, Nano Urea saved top dress nitrogen in the range of 25 to 50 per cent with additional yield of 1.3 to 14.5 per cent which gave overall benefit from Rs. 750 to Rs. 9832. In the case of maize crop, the Nano Urea application saved 25 to 50 per cent nitrogen and 2 to 5 per cent additional yield was obtained with the benefit range being between Rs. 531 to Rs. 1700 per hectare. In finger millet also, similar results were obtained. It saved 25 to 50 per cent top dress nitrogen with 11 per cent additional yield in Karnataka. There was yield benefit in Almora. In pearl millet, the Nano Urea saved 25 per cent top dress nitrogen and produced seven per cent higher yield with overall benefit of Rs. 3000 per hectare. The trials conducted at Kozhikode, Kerala saved 50 per cent recommended nitrogen and 57 per cent higher yield was obtained and overall benefit was more than Rs. 50,000 per hectare. If you see scientifically, there was no significant difference amongst recommended dose of nitrogen and 75 per cent of RDN with Nano Urea and 50 per cent RDN with Nano Urea application, but the real saving was in terms of top dress nitrogen which ranged between 25 to 50 per cent in various locations. However, the yield advantage of three to eight per cent has compensated whatever small additional cost was involved in Nano Urea application and 25 to 50 per cent saving in top dress nitrogen was observed due to Nano Urea application. So, these are the results in brief. As the Secretary has said, the results of rabi crops are expected shortly. The wheat crop is being harvested now.”

timelines by which these nano fertilizers are likely to be introduced in the market for use by the farmers, the Department in its reply has stated that continuous research and development efforts have been undertaken for manufacturing of nano fertilizers like Nano DAP, Nano Zinc, Nano Copper as well as establishing their efficacy vide experiments conducted under the National Agriculture research System (NARS). In view of encouraging Bioefficacy – Biosafety – Biotoxicity tests of these nano fertilizers, reports have been submitted to JS (INM), M/oA&FW, GOI for earlier inclusion in Fertilizer Control Order (FCO), GOI.

(v) Efficacy of Nano Urea

2.14 With regard to the effectiveness of nano fertilizers on different crops in different climatic conditions, soil, etc., the Department has clarified that nano fertilizers have been found effective on different crops in different agro-climatic regions as per trials conducted under National Agriculture Research System (NARS).

2.15 As regards the efforts being made by the various Agricultural Research Institutions/ State Agricultural Universities (SAUs) to expand the scope of field trials so as to cover all the food crops of the country in different agro-climatic zones in order to analyse its efficacy in a time bound manner, the DARE has stated that experiments have been laid out on major crops in different agro-climatic zones of the country. Scope of application of nano fertilizers can be increased both by undertaking farmers field trials as “Seeing is Believing” and also by increasing availability of nano fertilizers to the farmers.

2.16 It has further been stated that during 2021-22, 290 lakh bottles (500 ml) of Nano Urea have been marketed across the country and as a result farmers across different crop geographies and different seasons (*Kharif, Rabi & Zaid*) were benefitted by its application in terms of better productivity and profitability. Presently, efforts were made to undertake nano fertilizer trials in major fertilizer consuming crops of the country under different agro-climatic regions in collaboration with ICAR Institutes, SAUs and ICAR-KVKs. IFFCO had conducted 13,000 Nano Urea “On Farm” and “On Station” multi season trials with more than 22 research institutes, SAUs and ICAR-KVKs on 94 crops under major agro-climatic regions of the country.

(vi) Nano fertilizers and Conventional Fertilizers - a Comparative Analysis

2.17 The Committee desired to know how the use of Nano-fertilizers would address the issue of imbalanced and excessive use of conventional Urea and other fertilizers. In reply, it has been informed that on the basis of the field trials/research conducted, it was found that conventional urea is excessively applied in most of the agriculturally important States such as Punjab, Haryana, Telengana, Uttar Pradesh, Bihar, Uttarakhand

respectively. NPK ratio is highly skewed and distorted from the ideal NPK ratio of 4:2:1 due to imbalanced application of nutrients. A higher value of Nitrogen in NPK ratio denotes imbalanced application of nitrogen i.e. conventional urea over and above the recommended dose at the cost of other essential nutrients. These variations are more pronounced at regional, block and district level. As conventional urea is available at pocket friendly price to the farmers and they use urea more than the recommended dose. The price of Nano Urea is even less than the price of urea and farmer will use it happily without compromising ideal N:P:K ratio. Higher Nitrogen Use Efficiency (NUE) along with precision and targeted application of Nano Urea can correct imbalanced and excessive use of conventional Urea and other fertilizers leading to an improved NPK ratio and better crop productivity.

2.18 To a specific query as to what extent the use of Nano fertilizers would improve the crop productivity, soil health and nutritional quality of various crops, it has been replied that on the basis of On station and On Farm trials, it is projected that an average of 8 % yield increase is possible through application of Nano Urea in different crops. However, outcome varies with type of crop, soil and agro-climatic conditions as well as management practices. As per research trials, foliar application of Nano Urea at critical growth stages leads to increase in crop yield in the range of 3-23 % in wheat, 3-24 % in rice, 2-15 % in maize, 5-11 % in tomato, upto 5 % in cucumber and 18 % in capsicum. Also according to research institutes / state agriculture reports, the application of nano fertilizers does not have any negative effect on the soil health in terms of EC, pH, Organic Carbon and available nutrients. Root biomass is increased due to foliar application of nano fertilizers. Further, harvested grains of nano fertilizer treated plots have recorded an incremental increase in nutritional content and mineral content.

2.19 As regards the efficacy of nano fertilizer, it has further been added that foliar application of Nano Urea has use efficiency greater than 80%. Nano Urea through foliar spray at critical crop growth stages can effectively reduce the urea requirement by 50 %. Thus, 1 bag (45 Kg) of urea per acre can be reduced through application of one 500 ml bottle of Nano Urea. With average consumption of urea to the tune of 330 lakh MT every year and targeted replacement of upto 25-50% of urea, at least 83 lakh MT to 165 lakh MT of Urea is expected to be reduced by Nano Urea over the years.

2.20 During evidence, the Committee desired to know the impact of nano fertilizers on the produce, soil and health and its effect of food crops. In response, a representative of IFFCO responded as under:

“Actually, the quality has been increased. We have tested it in several crops like apples, cereals, pulses, vegetables, etc. The quality parameters are increasing. Just to take an example of apple of Kashmir, we have tested in Sher-E-Kashmir University, the firmness and sweetness has increased whereas the acidity has decreased. All nutrient parameters are increasing by using nano. So, there is no harm for the health.”

2.21 In this context, Department of Fertilizers has added that grain / harvested produce of nano fertilizers treated crops have been tested for nutritional quality and bio-safety as per DBT guidelines based on Food Safety & Standards Authority of India (FSSAI) by approved NABL accredited, GLP certified laboratories and have been found safe for consumption. Complete report had been submitted to CFC- DBT-ICAR committee **(Annexure-III)**.

2.22 As regards the long-term effects of use of Nano fertilizers on the nutritional quality of various crops, DARE has stated that the research trials being conducted have completed one year and, in most cases, only one season. So, long term effects of use of Nano fertilizers on the nutritional quality of various crops cannot be drawn based on this. Food toxicity, nutritional value and human safety tests as per nutritional analyses guidelines of FSSAI were conducted for harvested produce of crops treated with nano fertilizers and were found safe for human and animal consumption.

2.23 Elaborating on the benefits of Nano Urea for environment, a representative of Department of Fertilizers stated as under:

“Benefits in terms of environment-friendly, if you see the plant capacity and the way the plant is working and the specific energy consumption, the CO2 emission, it has an enormous benefit for the environment per se. As regards effect of Nano Urea on green house gases emission, I believe that IRRI is there and they will be very happy to share whatever their interim report has been saying that if India’s 50 per cent of rice cultivation area is brought under Nano Urea, then it would lead to reduction in green house gas emission by 4.6 million tonnes. This is an interim report, but this is certainly a game changer in terms of opportunity that is given to the nation if we can replace even 20-30 per cent of the urea that is going waste and it can be utilized, then green house gas emission can be appropriately addressed.”

2.24 Reacting to the concern expressed by the Committee of ill-effects of use of nano-fertilizers, if any, on human health, soil, environment, water bodies and marine life, etc.; a representative of IFFCO replied as under:

“We have done extensive toxicity bio-safety studies in collaboration with NABL accredited and GLP certified laboratories. There were 15 basic testing guidelines that were given by the DBT. But we have gone extensively and tested it under 21 guidelines.

Starting from human health safety, it was environmental safety and packaging compatibility test was also there. We have done additional safety assessments. To begin with human health safety, we have gone for dermal toxicity. So, these guidelines were followed.

So, these guidelines or OECD protocols were followed and as per the DBT, we have undertaken the studies. These are the studies which we have done: The Skin Absorption Study for human safety, Eye Irritation Investigation, Inhalation Toxicity Study of nanoparticles because if you are spraying, Genotoxicity Study, Cytotoxicity Study. We have done these studies extensively.

Apart from this, there is environmental safety test. It is exposed to the environment. As you are also saying, it is going to the water and all these things. So, following are the environmental safety studies which we have done. They are: Inhibition Test in fresh water alga, Immobilization Test in Daphnia, Toxicity in tropical fish, Fish Embryo Toxicity Study, Earthworm Reproduction Study, Stability Test of the nano materials for aqua, human and environment safety, Soil – water leaching – Spray Studies on soil, Soil – water leaching -- Spray on Plant.

Apart from that, we have done packaging compatibility test. They are: Packaging Compatibility Test, which is very important. It has been done as per OECD Environmental, and all ISO certifications were followed.

We have done additional safety assessment. This is apart from the 15 testing guidelines by DBT.

We have gone for Toxicity on Microbes, Toxicity on Mice and Chicken, Microbial Contamination Study, NMR Analysis of Nitrogen. We have done how it is behaving. Then, we have done Plant Uptake Studies, and Nutritional Analysis from FSSAI.

We have done all these testing studies. It was found that it is safe. Just to add to this, these DBT nano guidelines are harmonized as per international guidelines of REACH, OECD, USEPA, TSCA, APVMA, FAO/WHO, USFDA, EFSA, FSANZ and Codex, and the principles of ICH.

Sir, all these have been done. Extensive reports have been submitted to the Ministry.”

2.25 The Committee further desired to know whether any analysis was done to gauge the impact of spray of Nano fertilizers inhaled by the farmers in the form of droplets on the respiratory system. To this, a representative of IFFCO submitted as under:

“Sir, as a precaution, we have recommended mask, but practically speaking, you are inhaling oxygen because you are inhaling air which has got nitrogen. It is not having any long-term effect. So, how would these nano particles have any long-term effect? Besides this, you can bring this Nano Urea. It is only protein which will go inside. Practically speaking, we should be proud of our efforts of our scientists and engineers. They have designed something. Urea was designed 120 years back, and in these 120 years, so much development has taken place. We have opened a window on nano. With it, tomorrow, India can become a big door where the world can start following and having the Nano Urea or nano fertilizer. That is why we are coming into nano. DAP is our effort. When we will have support from the Hon. Members of Parliament, when we will have support from our Government, when we will have support of the farmers, this could become a

game changer in technology. Today, the biggest problem is environment, global warming. If we have to save humanity, we have to reduce urea consumption. Urea is the bigger polluter as NO₂ which comes out of it. That has why the International Rice Research Institute gave their recommendations. There is nobody is bigger than them in science. So, Sir, I would say that we should feel proud of something which has happened in our country.”

2.26 The witness further added as under:

“Sir, it has four per cent nitrogen only. It is as effective as one bag of urea is effective. The urea becomes toxic after 5000 ppm. After 5000 ppm and three months exposure, one disease can be seen which is the baby syndrome. So, here we are using only 80 ppm to 10 ppm. There is no issue of any toxicity at all. So, we have tested everything.....”

2.27 Observing that Nano fertilizers are a new technology and only short-term studies have been done so far, the Committee expressed a need for long-term studies so as to analyze its long-term effects, a representative of IFFCO replied as under:

“You are absolutely right....We have not stopped here only. So many agriculture research institutes are doing their studies continuously. One of them is TNAU. Some more universities are also doing their studies. DDG, NRM is also looking it and he has given me the task to make trials. We have done trials in several institutes and in future also, we will do it. We will not stop.”

(vii) Research Trials on Nano DAP

2.28 As regards the development of Nano DAP and its ongoing research trials, the Department has informed that IFFCO have indigenously developed Nano DAP using its own Proprietary Technology on a Pilot Scale. During Kharif 2021, they have conducted Nano DAP Research trials on 10 crops across 34 locations in 20 states under the National Agriculture Research System (NARS). However, the results of these trials have not been submitted to Government of India for evaluation.

2.29 When enquired whether a separate fund allocation has been envisaged in department' s Budgetary Head for research and development in the field of Nano fertilizers in order to develop more cost effective/ efficient and varied nano fertilizers (to include other macro and micro crop nutrients), the Department replied in negative.

2.30 In this regard, when further asked regarding R&D efforts made by the Department of Fertilizers or its PSUs or other entities like IFFCO to indigenously develop nano DAP and other nano complex fertilizers and progress made so far, the Department has stated that IFFCO through its R&D facility at NBRC, Kalol has indigenously developed Nano DAP using its own proprietary technology. The invention is at initial pilot scale and

efforts are being made to scale up the process and manufacture Nano DAP at a commercial scale.

III PROGRESSIVE JOURNEY OF NANO FERTILIZERS

(i) Progressive journey Nano Urea

3.1 The Department of Fertilizers has furnished the details with regard to the progressive journey of IFFCO Nano Urea, in a tabular form as under:

SN	Year	Details
1	2017	Research & Commercial Exploration of Nano fertilisers started by IFFCO.
2	2018	Initiation of Lab scale trials
3	2019	Inauguration of NBRC, Kalol & Research & Field trials undertaken.
4	2020	Steps taken for inclusion of Nano fertilisers in FCO,1985 & its commercial production.
5	2021	24th February- Nano Urea (liquid) - Liquid Notified under FCO & permission for commercial production granted.
6	May, 2021	Nano Urea (liquid) introduced by IFFCO RGB in its 50th AGM at New Delhi.
7	June, 2021	Commercial Dispatches of Nano Urea (liquid) initiated from Kalol, Gandhinagar Plant.
8	July & August 2021	Online sales of Nano Urea (liquid) began in July. Formally commercial production started at Kalol (Gujarat) on 1 st August, 2021.

3.2 IFFCO has set up the World's first manufacturing facility with a production capacity of 1,50,000 bottles per day (500 ml size) of Nano Urea fertilizers at its Kalol unit in Gujarat and the commercial production has commenced w.e.f 1st August, 2021. As on 27th November, 2021, 1,15,21,789 bottles (500 ml size) of Nano Urea fertilizer have been produced at IFFCO Nano Fertilizer Plant at Kalol. It is for the first time in the world that Nano Urea has been introduced to the farmers. It will be a step in the direction of self-reliance in terms of 'Atmanirbhar Bharat' and 'Atmanirbhar Krishi' because of Nano-fertilizers. India has also delivered 100 tonnes of Nano-fertilizers to Sri Lanka.

(ii) Measures to increase the production of Nano Urea

3.3 When the Committee enquired about the measures being taken for scaling up the production of Nano Urea, the Secretary, Department of Fertilizers submitted as under:

“..... The first plant, that is, IFFCO Kalol, Gujarat has already been set up. The scientists of IFFCO Kalol, Gujarat, have manufactured Nano Urea. The total capacity of first plant is five crore bottles per year... The IFFCO is setting up five other plants also at Phulpur, Aonla, Bengaluru, and Deoghar. With the technology transfer, NFL and RCF are also setting up their plants. The NFL is setting up its plant in Nangal in Punjab. The RCF is setting up its plant in Trombay in Maharashtra. All these eight plants will be operational by November, 2025 and 44 crore bottles will be produced every year.....There are doubts in the minds of the farmers and the officers that whether the use of Nano Urea will be in addition to the use of conventional urea or it is going to replace the conventional urea.by 2023, two plants will be operational and the total production would be eleven crore bottles every year. The expected replacement will be 50 lakh metric tonnes of conventional urea and the value will be around Rs. 20,000 crore.

By 2023-24, five plants will be operational with twenty-eight crore bottles production, and the expected replacement will be 127 lakh metric tonnes of conventional urea.

By 2025-26, all the eight plants will be operational and the total production would be 44 crore bottles every year and they are going to replace 200 lakh metric tonnes.

Now, I come to Nano DAP, Nano Zinc, and Nano Copper. Based on the technology developed by the scientists of IFFCO in their Kalol Research Centre, the DAP version and other fertilizer versions are also being developed in nano forms. IFFCO has developed Nano DAP, which is under field trial. They have conducted research trials on more than ten crops across thirty-four locations in twenty States and they have submitted the result to the Department of Agriculture for further validation and approval. A meeting is going to be held today to discuss the issues and to take necessary action in this regard.

Nano Zinc and Nano Copper have also been developed and field trials are going on. The production of Nano Urea is scaled up through transfer of technology to other Government companies. The NFL and RCF have already started the construction of the plants and within one and a half years, they will start producing it.”

3.4 The Committee drew the attention of the Department of Fertilizers to India's fertilizer imports which had been on the rise due to pandemic-related disruptions. During 2016-17, the import of urea was 54.81 Lakh MT and it has reached to 98.28 Lakh MT during 2020-21. Therefore, keeping in view the dependency of our country on the import of fertilizers, the Committee enquired about the steps taken by the Department to increase the production capacity of nano fertilizers in the country as it is stated to be less energy intensive and can be operated with non-renewable resources like solar energy, so as to build a sustainable model for achieving self-sufficiency in production of various fertilizers by involving both the Public and Private Sector Companies. The Department of Fertilizers in its reply has stated that to boost the indigenous production of Nano Urea,

two Central Public Sector Undertakings (CPSUs) viz. National Fertilizers Limited (NFL) and Rashtriya Chemicals and Fertilizers Limited (RCF), under its administrative control has signed Non-Disclosure Agreement (NDA) & Memorandum of Understanding (MoU) with Indian Farmers Fertilizer Cooperative (IFFCO) to transfer the technology of Nano Urea from IFFCO. The details of Nano Urea plants with regard to their production capacity and anticipated timings of commercial production are given as under:-

Location	Production Capacity Bottles (500 ml) per Year (in Crore)	Commercial Production/Anticipated timings for Commercial production
IFFCO Kalol Gujarat	5.0	August 2021
IFFCO Phulpur UP	6.0	Sept 2022
IFFCO Aonla UP	6.0	April 2023
IFFCO Bengaluru, Karnataka	6.0	March 2024
RCF Trombay Maharashtra	5.0	March 2024
NFL Nangal Punjab	5.0	July 2024
IFFCO Deoghar Jharkhand	6.0	Nov 2024
IFFCO Assam	5.0	Nov 2025
Capacity by 2025	44.0 Crore Bottles Per Year	

3.5 Considering the expected high usage of Nano Urea in the coming days, the Committee emphasized that more and more Public and Private Sector Companies desirous of manufacture Nano fertilizers should be promoted. To this, a representative of IFFCO responded as under:

“Certainly, we have that provision also. Our Board has passed it. There are certain guidelines and procedures which the private people should follow. Then only we can give the technology to establish a manufacturing unit. But this technology is a proprietary technology. Anyone who is not following our set procedures we cannot give him the technology. Anyone who is following all our procedures and rules, we will give the technology. It is now open. Our Board has passed this decision.”

3.6 On being further asked by the Committee, if IFFCO will share the nano fertilizers technology with the private companies and industries on profit-sharing basis, a representative of IFFCO replied as under:

“RCF and NFL are also doing. We are open to give the technology. But certainly, we will charge some royalty.”

3.7 In this context, the Department of Fertilizers has added that with the increased acceptance of Nano Urea in the farming community, more players will venture into production, distribution and marketing of Nano Urea which will further lead to enhancement in the nano fertilizer production capacities. This will also generate employment opportunities for the local communities and support the 'Atmnirbhar Bharat' campaign of the Government. The Department has also requested IFFCO to transfer the Nano Urea technology to other CPSU's viz. BVFCL and FACT without any cost. However, the matter is under consideration before the management of IFFCO.

3.8 To a specific query whether the brown field urea manufacturing units which will be completed by 2023 and the existing units producing fertilizers on old technology would continue to run with the same technology or will they be replaced with the new technology, a representative of DARE stated that new Nano fertilizer technology will not completely replace the use of urea. Actually 50 percent basal dose application is done. In the rest of 50 %, up to 25 to 50 % or 75 % urea would be replaced. Hence, the Plants which are manufacturing urea would also manufacture Nano Urea. 100 percent urea, will therefore not be replaced.

(iii) Benefits of Nano Urea in Reduction of Imports and Subsidy Savings of Bulk Urea

3.9 The Committee have been informed that it has been justified through experimental trials that 25-50 % reduction in urea usage is possible with application of Nano Urea. Conservatively, 10 % reduction in urea demand may be targeted in short term followed by 25 % in medium term and 50 % in long term as per current average figure of 330 lakh MT of Urea consumed per year in the country as shown below:

Phase	Proposed Reduction in Demand of Urea through Nano Urea(liquid)
1 st phase (2022-24)	33 lakh MT
2 nd phase (2024-26)	83 lakh MT
3 rd phase (2026-27)	165 lakh MT

3.10 When enquired about the expected budgetary savings under the fertilizers subsidy Head over the years due to sale and use of nano fertilizers in the next 5 years, it was informed that IFFCO has commissioned 01 production facility of Nano Urea and is establishing 03 (Three) more plants of Nano Urea with a total production capacity of 25 crore bottles of Nano Urea per year which will replace 112.5 lakh MT Urea. As a result of production of Nano Urea, GOI Exchequer can save approx. USD 3 Billion equivalent to Rs.22,500 crore in subsidy bill per year considering subsidy of approx. Rs. 20,000 per MT of Urea. IFFCO will be also establishing 02 plants of Nano DAP equivalent to about

66 Lakh Tonne of DAP, that would result in savings of approx. 21,800 crore in subsidy per year at current subsidy on DAP of Rs. 33,000 per MT.

3.11 With regard to prospective benefit of Nano Urea in reduction of imports of fertilizers and resultant subsidy saving of Bulk Urea, the information has been compiled and furnished to the Committee as under:

Propective Benefit of Nano Urea in terms of Reduction in Imports & Subsidy Saving of Bulk Urea over the Years (2021-22 to 2030-31)

SN	Particulars / Year	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	
A	All India Sales Urea (Million MT)	29.6	29.9	32	33.7	35	36.2	37.4	38.7	40.0	41.4	42.8	44.3	45.8	47.3	48.9	
	Sales CAGR (last 5 Years)	3.41															
B	Urea Production (Million MT)	24.20	24.02	23.90	24.46	24.60	24.7	24.8	24.8	24.9	25.0	25.1	25.2	25.3	25.3	25.4	
	Production CAGR (Last 5 Years)	0.33															
(A-B)	Urea Imports (Million MT)	4.971	6.011	7.555	9.124	9.828	11.5	12.7	13.9	15.1	16.4	17.7	19.1	20.5	22.0	23.5	
	IFFCO / Other Nano Urea Plants				Plants	Nos.	1	2	5	6	0	0	0	0	0	0	
	IFFCO Nano Urea (Million Bottles - 500 mL)				Bottles	Millions	21	80	240	340							
	Equivalent Urea (Million MT)				Urea	MMT	0.95	3.60	10.80	15.30							
	Subsidy Rs in Crore / Million MT Urea at current rate		4,618	Subsidy	Crores	4364	16626	49879	70662	0	0	0	0	0	0	0	

IV APPLICATION OF NANO UREA

(i) Best application of Nano Fertilizers

4.1 The Committee have been informed that the best application of Nano Urea, Nano Zinc and Nano copper to achieve their maximum efficacy is foliar application over crop foliage at maximum tillering / branching before flowering stages preferably during morning (9-11 AM) and evening (3-6 PM) hours. Nano DAP can be applied as seed treatment, seedling dipping and foliar application.

4.2 As regards the correct timings for use of spray of Nano Urea, the Department of Fertilizers has informed that 2 spray application of Nano Urea are recommended when sufficient crop canopy is there in field and crop is at critical growth stage of application of nitrogen viz. 1st spray at active tillering / branching stage (30-35 days after germination / 20- 25 days after transplanting) and 2nd spray 20-25 days after 1st spray or before flowering stage of the crop.

(ii) Methodology for spraying Nano Urea

4.3 On being enquired about the methodology adopted for using Nano Urea, it has been informed that spraying of liquid Nano Urea is done by the farmers with general hand operated or battery-operated knapsack sprayer of 15 or 16 litres water tank capacity. Now-a-days, farmers have also started using power or mist sprayers/boom sprayers of 200 litres or more capacity. Besides, drone can be used to spray nano fertilizers.

4.4 Asked about the cost of nano fertilizers sprayers and how it is cost effective, the Department has informed that cost of the manual sprayers vary from Rs. 1200 to 1500 per sprayer; battery operated sprayers from Rs. 3000 to 4500 per sprayer and power sprayers from Rs. 6000 to 10,000 per sprayer. Further, the cost of spray of nano fertilizer per acre would be in the range of Rs. 200-250 only.

4.5 Regarding availability of nano fertilizers sprayers in the market, the Department has stated that these sprayers are easily available in the market. Different agro chemical suppliers and manufactures supply them to the farmers so as to expand their customer base. Dealers / retailers as well as cooperative societies / Farmer Producer Organizations (FPOs) provide spraying services at nominal cost to its customers for spray of agrochemicals / fertilizers which can be utilized for spray of Nano Urea also. IFFCO is also coming up with agriculture drone spraying model at block level and is also training village youth for providing these services to farmers on custom hire basis thereby generating youth employment in rural area. Co-operative societies / FPOs/ Dealers also provide spraying services on custom hire basis. Besides, IFFCO is facilitating 1.0 lakh sprayers spraying services to the farmers through its retail points on mutually acceptable basis. It is expected that drone machine would be available on mutual basis to farmers who wish to spray nano fertilizers. Forming SOPs for use of drone to spray nano fertilizers in agriculture is also under consideration.

4.6 On the point of availability of the dispensing system for use of nano fertilizers, a representative of Department submitted as under:

“I want to make one more submission that drone is one way of using nano urea. The other knapsacks sprayers and other spray cans can also be used since we use it at the early stages. Our scientists will support whatever I am saying. So, I think sprayers can also be used, but drones will facilitate it. So, it is a major factor, but not the only one for spraying.”

4.7 During a power point presentation, a representative of Department submitted about the importance of targeted application of nano fertilizers as under:

“Infact, the precision and targeted application of nano fertilizers is a boon for the soil, air and water continuity, environmental continuity and benefits farmers. The use efficiency is more and there is easy transportation and replacement of top dressing is possible with the use of Nano Urea. So, in fact, the underlined statement is that precision and targeted application of nutrients can save our environment and lead to productivity enhancement in perpetuity.”

4.8 The Committee during their study visit to Gujarat in June, 2022 interacted with the farmers, who informed that the use of irrigation sprinklers for spray of Nano-fertilizers was very effective. When enquired about the feasibility of using irrigation sprinklers/ drip-

irrigation for spraying nano fertilizers in the fields and the steps, if any, taken to combine the delivery system of nano fertilizers(developed by IFFCO) with the fertigation technology and promote its use amongst the farmers in a big way so that the use of nano fertilizers may be made economical and convenient, the Department in its reply has stated that spraying nano fertilizers through drip irrigation is not possible as fertilizers through drip irrigation (Fertigation) are applied on soil. In this context, a representative of IFFCO clarified that nano fertilizers could be sprayed by use of sprinklers but not through drip irrigation.

(iii) Availability of drones for Nano Fertilizers spray

4.9 With regard to the development of drone industry in India for use in spray of nano fertilizers, a representative of the Ministry of Civil Aviation during evidence submitted that as the manual spray of Nano fertilizers is harmful to the hands, skin and eyes of the farmers, use of drone would eradicate practice of manual spray of Nano-fertilizers as drone works like a robot who needs the direction of the farmer.

4.10 When further asked about the number of drone manufacturers in the country, a representative of MoCA submitted as under:

“...as on date, there are about 120 manufacturers and about 180-200 and odd service providers but the service providers’ number will go into hundreds and thousands some day. Right now, we have 120 manufacturers of which - under our PLI Scheme we have done the selection process - 23 manufacturers have been found eligible for the PLI because the PLI required a turnover of Rs.2 crore. Of the 23, around 11 are drone manufacturers and the remaining are component manufacturers.”

4.11 While pointing out that the efficacy of nano fertilizers depends a lot on its proper utilization which would also depend on the availability of drones which are at present very less in the country, the Committee wanted to know the steps being taken by the Government to increase the production of drones especially in view of the fact that its import has been banned by the Government. To this, a representative of MoCA submitted as under:

“..... What do they want? They wanted good policies; we have done it. They wanted incentives, we have done it. They wanted protection from cheap Chinese drones, we have done it. So, now the industry has to do step up and do it. Even on type certification, based on industry feedback, we have outsourced that to three world famous certification bodies – Tata Quality, TQC of US and Bureau Veritas. Earlier people were cribbing that Government takes a lot of time like eight months or six months. Now, it is two months in the rules. We cannot delay it for more than two months and DGCA cannot delay it for more than 15 days without giving reasons. These three entities are also private. So, now from Government side, we have stepped ourselves and made ourselves as unemployed as possible which is good for the farmers and the producers. Now, the producers have to step

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4.14 During interaction with the Committee, one of the farmers stated that apart from reduction in manual labour and labour cost in spray of Nano fertilizers, use of drones will also enable disposal of the work in much lesser time. Nowadays labour is not easily available. He also told that since farmers cannot individually buy drones, they need to form Cooperatives in the form of FPOs which may purchase the drones for use of the farmers of the region which will be more economical. Another farmer stated that spray of nano fertilizers improves the quantity of produce and increases the income of the farmers by 15 to 20 percent. He emphasized on the need to make available more sprayers to the farmers to facilitate spray of nano fertilizers and provide subsidized loan facility to the small and marginal farmers to enable them to purchase the drones and sprayers.

4.15 During evidence, a representative of the Ministry of Civil Aviation elaborated on the cost of farm drone as under:

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4.16 The Committee held informal discussions with the farmers during their study visit to Kalol, Gujarat in June, 2022 in which the farmers inter-alia mentioned about the benefits of foliar application of Nano fertilizers. They however stated that spray of nano fertilizers by manual means is a time consuming and too costly in terms of labour cost. The farmers expressed their helplessness to use Nano-fertilizers due to its high cost of application/ spray by the drones and desired that some relief should be given by the Government to facilitate them in using the innovative product. In this regard, Department have stated that collective and community spraying with the help of cooperatives, retailers as well as custom hiring of sprayers by village level youth/ FPOs are being explored for effective spray of Nano Urea.

4.17 To a concern expressed by the Committee over the inability of over 86 percent small and marginal farmers in the country to afford agricultural drone costing about 10 lakh, a representative of MoCA commented as under:

4.22 During evidence, it was observed by the Committee that as per the guidelines issued by the Department of Fertilizers for development of entrepreneurs for drone spraying of liquid fertilizers, the rate of spraying of liquid fertilizers/pesticides through drones by the farmers would be decided by the market forces. In this regard, when the Committee suggested that instead of leaving the rate of spraying of liquid fertilizers to the market forces, the same should be fixed statutorily so that farmers may be given some relief to use the product comfortably, Department has stated that they have issued guidelines for development of entrepreneurs for drone spraying of liquid fertilizers. The Department is in regular touch with the stakeholders for promotion of the said guidelines, which will ensure availability of drones to fertilizers at cheap cost.

4.23 The Committee pointed out that the cost of Rs. 500/- for hiring of drones by the farmers for spray of nano fertilizers is on a higher side and needs to be subsidized. In reply, a representative from Tamil Nadu Agricultural University (TNAU) replied as under:

“For a drone, it takes only five minutes to complete spraying on one acre of the field. It is very effective. One drone can spray on about 80 acres of the area a day. As the hon. Member has mentioned, most of the Indian farmers are small and marginal farmers. It is like a toy. We can set the location where it needs to fly and at what height. All the safety measures can be taken.”

.....

“We can subsidize it, Sir.”

....

“We made a comparison with the manual spray. It takes about one day to complete spraying on one acre of the field.”

4.24 The Committee further pointed out that according to the guidelines on the development of entrepreneurs for drone spraying of liquid fertilizers, a drone costs Rs.6,28,000 with 5 percent GST, however, as per Ministry of Civil Aviation the drone costs about 10 lakh. Further, the guidelines says that the drone spray charge is about Rs.200/- per acre, however TNAU is charging Rs.500/- per acre. In reply, a representative of TNAU clarified as under:

“It is because we need to travel to the location. All this is included in the cost. The price that has been indicated here is the farm gate price. We have to carry drone from the institute to the farm. But it can be subsidized.”

4.25 On the issue of making use of drones more economical, a representative of IFFCO submitted as under:

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4.32 Asked about the awareness programs or outreach programs organised to educate the farmers so as to get rid of their fear that having the drone or using it would require a lot of clearances and licenses, a representative of MoCA reacted as under:

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There is no point doing twitter in English. So, we have covered 12 States so far. We will try to cover more States. So, every State is doing it, and at the district level, there are a lot of young officers who are very convinced about the humanitarian part of drones, and they are spreading the message. But, as I said, we have just opened up in August last year, it has just been one year. The rules are still being opened up. Based on feedback, in February this year itself, we came up with the first amendment. Within seven months, we did away with the pilot licence also. Earlier, for pilot licence, you had to go to DGCA. Now, you can go to any of the drone training schools across the country which is authorized. DGCA authorises the schools. When the IIT Madras gives certificates, the Government of India does not go and check that. So, you authorize the IIT Madras, then IIT Madras gives the certificate. Same concept has been used here. We only oversee 27 schools, what do they do, we leave it to them. The schools also, as per the rules, have to give a certificate within seven days after completing the training. It is online. "*

4.33 During the course of evidence, a representative of TNAU informed about the present and future aspects of use of drones for spray in agriculture activities as under:

"With regard to drones, we are really late. Most of the farmers are using combine harvester as a service; one person would come and harvest for the entire village. I do see drone becoming that kind of a thing very soon. It is not only for Nano Urea but also, for the entire application of pesticides and herbicides. We have started research work on seed spraying and sowing. Very soon, we will see direct seeding of rice. In many countries, like Vietnam and Sri Lanka, ninety per cent seeding of rice is by direct seeding. If we just work hard and use drones even for seeding purposes that can be possible. So, the scope is huge and drone, probably, would be the vehicle for taking Indian farmers to next level of technology transformation that we really think through. That would be one of the things that, probably, we should be working very fast."

(v) Corporate Social Responsibility (CSR) fund to facilitate drone spray of Nano Fertilizers

4.34 The Committee have observed that nano fertilizers have been considered as a Next Generation Smart Fertilizers which may address the imbalanced and excessive use of conventional Urea and other chemical fertilizers. When asked to state the measures taken so far to encourage the companies/ corporate houses to utilize their Corporate Social Responsibility (CSR) fund to provide the facility of drones to the farmers of a particular ear-marked area (adopted by them) for spray of Nano Urea at subsidized rates / free of cost and to impart drone pilot training to the local village entrepreneurs and farmers about its use, the Department replied as under:

"Noted by Department of Fertilizers for consideration."

V PROMOTION OF NANO UREA

(i) **Methods adopted for promotion of Nano Urea**

5.1 As regards initiatives being taken to promote use of Nano fertilizers among the farmers, the Secretary, Department of Fertilizers informed during evidence as under:

“For promotion of the use of the Nano Urea, we have taken up a lot of activities including, village level demonstration on Nano Urea application through progressive farmers. We are making the farmers aware about the use of Nano Urea in kisan sammelans. Films have also been made in different regional languages. We are extensively using the social media for dissemination of information and for the promotion of the use of Nano Urea among farmers. Call centres are also there. Regular talks and panel discussions on radio, and DD Kisan channel and other television channels, are being held. One training module is being developed for farmers for crop specific right dose of Nano Urea. Since it is a nano version, it becomes very essential that the farmers should use the right quantity or right dose of Nano Urea on the crops.

5.2 In a similar context, he submitted as follows:

“□□□ □□□□ □□□□ □□ □□□□□ □□□□□□□□□□ □□□□ □□□□□□ □□□□□□ □□□ □□□□ □□□ □□□□□ □□□□□□□□□□□□ □□ □□□□□ □□□□ □□ □□ □□□□ □□□□□□ □□□□ □□□ □□ □□□□□□□□□□□ □□ □□□□ □□□ They have also filed the patent. They are also working on different versions of nano, DAP, Zinc, Boron and other fertilizers. I am sure it is going to reduce the import of fertilizer and the farmers will be really satisfied with the use of the nano in future because we are leaving no stone unturned to popularize this product amongst the farmers and the State Governments are repeatedly requested, in our monthly meetings, to take up the initiative to popularize this product amongst the farmers.”

5.3 In a written submission, the Department has added that use of Nano Fertilizer is being promoted through awareness camps, webinars, nukkadnataks, field demonstrations, kisan sammelans and films in regional languages etc. Department has prepared a movie on Nano Urea in English, Hindi and four other regional languages to promote the use of Nano Urea. Besides, Department has extended its all kind of support to nano fertilizer manufacturers as and when required. Nano fertilizer manufacturers are educating farmers to use nano fertilizers as per the crop, soil, etc.

5.4 In this regard, IFFCO has stated that they have taken extensive promotion and popularization efforts for use of Nano Urea across the country. In this process print and electronic media, social and digital platforms, promotional and extension programmes have been organized for communicating the benefits of Nano Urea, its method of application, mode of action and its availability. IFFCO has popularized the Nano Urea and is selling it through its market channel for realizing immediate sales and feedback.

Farmers are encouraged to purchase it by undertaking sales campaigns and providing incentives to 'Buy now'. Sales promotion, complements advertising, which is being taken up at local, national and international levels. IFFCO has deployed effective sales, publicity and promotional efforts for popularizing Nano Urea through a series of programmes given below. Simultaneously, promotion and market development programmes are also being undertaken.

(a) Crop Demonstrations: India is bestowed with more than 200 crops which have distinct agronomies. In tune with the concept of 'Seeing is Believing' IFFCO had conducted on-farm and on-station trials in major agro-climatic regions and on major crops of the country. Research trials at farmers' fields have been conducted in more than 94 crops in 15 agro-climatic regions of the country. Progressive and nearby farmers have also visited these trials which helped in generating interest and awareness about the product.

(b) Short video films of Nano Urea: Technical and educational videos of short duration (4-6 minutes) displaying the unique benefits and complete package of application of IFFCO Nano Urea have been made available through online platforms. These videos are being screened to farmers or are shared in farmer's friend WhatsApp groups. Farmers testimonial videos (120 seconds; 60 seconds)) showcasing their experience and the benefits of this new fertilizer are also circulated to channel partners, cooperative officials and policy makers. To take advantage of the limited attention span of viewers, short clips or 'Feeler' Videos of Nano Urea (20-30 seconds) have been created. These videos are being screened or showcased at social, mass media and digital platforms at national and international cooperative platforms at seminars, symposiums and workshops. Product details are communicated to the farmers visiting farmers' haat, agriculture fairs and village community centres.

(c) Print & Electronic Media : The product promotion through print and electronic media has been extensively undertaken. Press releases in the print and digital media have been a regular occurrence. Advertisements have been printed in leading newspaper and also displayed on social media and digital network. Farmers success stories about use of Nano Urea have found mention in leading newspapers as well as in agriculture centric regional and local newspapers. Webinar on Nano Urea have been conducted in collaboration with State Agricultural Universities in presence of Vice Chancellor and leading agricultural scientists and cooperators. Benefits, application methodology and other details of the fertilizer are discussed and viewers' queries are suitably answered during the webinars. Research work done by the scientists is

documented in form of research as well as popular articles in local/regional magazines, newspapers, periodicals, etc. They act as a reference point for gaining knowledge and understanding about Nano Urea. To catch the imagination of young and impressionable minds, Nano Urea awareness programmes/quizzes are being conducted in village schools. Advertisements on All India Radio/Community Radio/Regional Channels are integral part towards sales promotion and marketing efforts of Nano Urea. Information about Nano Urea has been covered by international media also.

(d) Mass Media Campaigns: Mass media campaigns, Audio visual and publicity vans are in operation for promotion and last mile delivery of Nano Urea Progressive and entrepreneur farmers work as brand ambassador. Different aspects of application of Nano Urea, its content and benefits for the farmers and the environment are emphasized. Nano Urea news is also played as breaking/ troll news at the bottom of national/regional news. Selective SMS messages are being sent to IFFCO progressive farmers informing them about availability of this product. Radio Jingles /Audio Clips / Songs in local language are played at premium time at regional / All India Radio while audio messages are also circulated in various farmers WhatsApp groups. Publicity matter for creating awareness campaigns in form of catchy poems, couplets and slogans are being circulated or displayed at appropriate platforms related to salient features of the product associated with farmers. Banners and posters are displayed at prominent places in addition to wall/tractor trolley/bus panel/ rickshaw/three-wheeler paintings, hoardings, etc. Digital displays are placed at vantage and strategic points and also at places registering maximum farmers footfalls viz. at all sale points, farmer friend clubs; Krishi Vigyan Kendras; farmers' stores; Common Service Centres (CSC); farmer producer organizations, kisan mandis and haats, etc.

IFFCO is also sponsoring Nano Urea specific shows, skit, street plays and local vocal groups. Spray campaigns are being carried out where spraying cost is subsidized in line with size of landholding and group spraying or mass crop spraying operations are undertaken at farmer's plots. The awareness programmes are being conducted in the sidelines of important national / international programmes such as Amrut Mahotsav, Earth Day, World Environment Day, World Food Day, etc. Dispatches of Nano Urea from Kalol plant were started on 5th June 2021 (World Environment Day).

(e) Publicity Material, Gifts & Awards : Cooperatives and other sale points have been provided with publicity material such as stickers, display charts, brochure, pamphlets, literature of Nano Urea, replica and souvenir of Nano bottles, T-shirts, Caps, key chains, umbrella, toran, etc. Samples of Nano Urea and brochures / folders are

provided to dignitaries and scientists. Progressive farmers engaged in its promotion are honoured at various forums.

(f) Dedicated Internet Site : Dedicated internet site has been created for Nano Urea. Site is operable on all kind of internet platforms and is android / iOS-based. It works as a knowledge resource and repository on Nano Urea, its benefits, journey of IFFCO in nanotech space, nano-fertilizers, farmers' testimonials, endorsements by public figures and opinion of leaders. Apart from resources and documents specific to the product which are required by a user and buyer; a photo gallery depicts programmes being organized for Nano Urea. Queries of the visitors are also addressed. Videos of Nano Urea, usage and benefits are also available at the site.

(g) Training & Awareness programmes : Nano Urea is an innovative and novel product. Therefore, for its proper knowledge and awareness, training programmes are regularly being organized at district/ block / village level / cooperative / retailer level exercising COVID protocol. The trainings and workshops, symposium, webinar, panel discussion, 'Live in' and 'Stream in' programmes are being organized. These training programmes address the problems faced by agriculture in general and environment in particular and how Nano Urea can help mitigate some of the ill effect of intensive agriculture practices. Participants are also made aware of the safety aspects and precautions which need to be exercised. Feedback of the training is collected from trainees for possible corrections and advancement. Trainers of these training programmes are IFFCO officials and technical and extension experts are from research institutes, state agriculture universities and ICAR- Krishi Vigyan Kendras. Emphasis is also being given on training of the trainers. Participants of these programmes besides farmers are technical & extension experts; nanotechnologist; public figures; opinion leaders & influencers; celebrities; entrepreneurs; government officials; environment experts; vice-chancellors; directors of SAUs / Research Institutes etc. Nano Urea is also being noticed and mentioned by premium research institutes engaged in nanotechnology such as Indian Institute of Technology, New Delhi.

(h) State-wise Flag off Programmes & Endorsement by Opinion Leaders, Government Officials and Scientists : Unique state-wise flag off programmes involving Chief Minister, Agriculture Minister, Agriculture Commissioner, Director, Agriculture, cooperative leaders, important dignitaries of concerned states have been undertaken for 17 states/UTs. This has resulted into sensitisation of the state machinery, agricultural department, channel partners, production and distribution network in regard to Nano Urea supply and availability as well as its promotion amongst farmers and channel partners. Agriculture department of the states are also conducting trials at state farms

and at farmers' fields. Some states are also helping increase the acceptability of Nano Urea by sharing information about the product, conducting demonstrations and by promoting it amongst the farmers.

(ii) Testing Laboratories for Nano fertilizers.

5.5 The Committee had desired that quality testing laboratories should be set up throughout the country to ensure production and sale of quality nano fertilizers. In reply, the Department has stated that they may request the Department of Agriculture and Farmer's Welfare for setting up of the quality testing laboratories throughout the country to ensure production and sale of quality of Nano Fertilizers.

(iii) Equitable Distribution of Nano Fertilizers

5.6 Considering that Nano fertilizers shall be in great demand by the farmers throughout the country, the Committee desired to know how the Department has planned to meet the demand of farmers and for equitable distribution of Nano Urea throughout the country. In reply, it has been stated that Nano Urea is being sold by IFFCO at MRP of Rs. 240 per 500 ml bottle, which doesn't include any subsidy component.

(iv) Need for Relief in Basic Customs duty on fertilizer raw materials

5.7 During evidence, the Committee enquired whether the raw materials used for production of nano fertilizers are indigenous. To this, a representative of IFFCO replied as under:

"...In our country, we do not have sufficient raw materials to produce fertilizers. We do not have sufficient gas; we do not have sufficient oil; we do not have rock phosphate; we do not have potash. So, we need to think differently."

5.8 On being further asked if everything required for regular production of nano fertilizers is available in India, a representative of IFFCO conveyed as under:

"Nothing is imported."

..... Everything is indigenous. Indigenously, we have done research; indigenously we have manufactured; and it is available to the world.

..... In our country, if we have to become self-sufficient, we have to become self-sufficient right from the beginning. Otherwise, we are dependent on raw materials, and then we will be exploited. Fertilizer raw material is available only in few countries and today after Russia-Ukraine war, practically it is available only in one country, which is Canada, otherwise, Israel and Jordan are practically 20 per cent of Canada. So, roughly, 30 to 40 per cent capacity has gone. So, we need to bring all this science into play; we need to bring engineers, technologists to design the plant. There is no foreign technology design. The design is all indigenous."

5.9 When asked about the plan of the Government to promote use of nano technology based P&K fertilizers including through joint ventures abroad in countries rich in P&K raw materials and to rationalize/ exempt the basic customs duty on P&K fertilizer raw materials in coordination with the Ministry of Finance so as to incentivize setting up of nano based production plants in the country which may result in huge foreign exchange savings, the Department stated that it may consider above mentioned suggestion and will act accordingly, if required.

PART-II

OBSERVATIONS AND RECOMMENDATIONS

The Committee are gravely concerned to note that agriculture world wide is facing wide spectrum of challenges, such as stagnation in crop yields, low nutrient use efficiency (NUE), declining soil organic matter, multi-nutrient deficiencies, shrinking arable land and water availability. Fertilizers do provide nutrients needed by the plants for their optimal productivity. However, presently the farmers typically apply fertilizers through the soil by surface broadcasting, subsurface placement or mixing with irrigation water. It is worrisome that in this process, a large portion of bulk conventional fertilizers like urea is lost to the atmosphere or surface water bodies, thereby polluting the ecosystem. It is disheartening that fertilizer consumption in India is imbalanced, and Urea accounts for more than 82% of the nitrogenous fertilizers applied to majority of the crops. Furthermore, the Nitrogen, Phosphorus and Potassium (NPK) consumption ratio has widened from 4:3.2:1 in 2009-10 to 7:2.8:1 in 2019-20. Hon'ble Prime Minister has called for "Reduction in chemical fertilizer consumption especially Urea by 50%. Against this background, it is satisfying to note that Indian Farmers Fertilizer Cooperative Limited (IFFCO) has indigenously developed nano technology-based Nano Urea fertilizer and attempted to address the issue of imbalanced and excessive use of conventional Urea. Nano Urea is a source of nitrogen which is a major essential nutrient required for proper growth and development of a plant. Typically, nitrogen content in a healthy plant is in the range of 1.5 to 4%. Foliar application of Nano Urea at critical crop growth stages of a plant effectively fulfils its nitrogen requirement and leads to higher crop productivity. Ministry of Agriculture & Family Welfare (M/oA&FW) has notified Nano Urea as nano fertilizer under Fertilizer Control Order (FCO), GoI in February, 2021.

Keeping in view the significance of nano fertilizers for agricultural needs of our country, the Committee applaud the efforts of IFFCO in developing Nano Urea. It is for the first time in the world that Nano Urea has been introduced to the farmers.

The steps taken by the Department of Fertilizers (DoF)/IFFCO and other concerned Ministries for availability, usage, promotion and adaptability of nano fertilizers in the country as deliberated over by the Committee, have been detailed in the succeeding paragraphs. At the same time, the Committee would like the Department of Fertilizers to ensure that the steps so taken do not suffer from the procedural delays and such delays, if any, are avoided with efficient, proper management and timely action.

2. The Committee note that IFFCO has developed technology for bringing other nano fertilizers macronutrient grades - Nano DAP and secondary /micronutrient grades - Nano Zinc, Nano Copper, Nano Boron, Nano Sulphur, etc. in order to ensure eco-friendly sustainable agriculture. Nano DAP is under field trial. Research trials have been conducted on more than ten crops across thirty-four locations in twenty States and the results have been submitted to the Department of Agriculture for further validation and approval and its inclusion under FCO. In view of the significance of nano fertilizers in agriculture, the Committee urge the Department of Fertilizers and IFFCO to expedite the process of inclusion of other nano fertilizers, which have been developed by IFFCO and undergone sufficient field trials, under FCO to enable their commercial utilization. The Committee desire that other nano fertilizers should be priced considerably cheaper than the prevailing price of their conventional bulk counterparts.

3. The Committee observe that there are several benefits of nano fertilizers like they cost less than the subsidized conventional fertilizers. Also, IFFCO field trials have shown that a 500 ml bottle of Nano Urea can replace one 45 Kg. bag of conventional urea and thus can curtail the requirement of the same by at least 50

per cent. The current MRP of IFFCO's Nano Urea is Rs. 240 per 500 ml bottle which is approx. 10% less than the conventional 45 Kg. urea bag having subsidized price of Rs. 266.50 per bag. Further, nano fertilizers are easy to carry and store. They are economical in terms of reduced transportation and warehousing cost. Besides, application of nano fertilizers results into better crop productivity and higher income for the farmers. IFFCO in collaboration with ICAR – KVKs has conducted 11,000 all India farmer field trials on 94 crops and found an average 8 % higher crop yield with the application of Nano Urea. This translates into Rs. 2000 to Rs. 5000 per hectare higher income for the farmers. Application of nano fertilizers has commensurate benefits in terms of better soil health, air and water quality, which ultimately will benefit the farmers through improvement in total factor productivity (TFP) of crop production systems. As per interim report of the International Rice Research Institute (IRRI), if India's 50 percent of rice cultivation area is brought under Nano Urea, it would lead to reduction in Green House Gas emission by 4.6 million tonnes. Even if 20-30 per cent of the urea that is going waste can be replaced and utilised, then the issue of green house gas emission can be appropriately addressed.

Despite many benefits of nano fertilizers, which are critical for our agriculture food production systems (FPS) to sustain the burgeoning population, the Committee regret to note that no separate funds have been allocated by the Department of Fertilizers for Nanotechnology. As Nano technology is a promising field of research for developing nano fertilizers that has emerged as an innovative solution for addressing the issue of low or declining nutrient use efficiency (NUE) with minimal environment footprint, it is imperative that the Ministry/Department of Fertilizers allocate a sizeable amount for nanotechnology based research activities through its fertilizer PSUs so that it gets focused attention for developing innovative fertilizer products which are cost effective and efficient. Fertilizer PSUs should be fully supported for work on common research projects along with

IFFCO so that they contribute in development of varied nano fertilizers (both macro and micro nutrient based) and help to achieve self-reliance in the Indian Fertilizer Sector thereby saving a substantial amount of foreign exchange lost on import of fertilizers which has shown an increasing trend over the years.

4. The Committee note with concern a continuous increase in the import of urea over the years to meet the demand of fertilizers in our country. During 2016-17, the import of urea was 54.81 lakh MT and it has reached to 98.28 lakh MT during 2020-21. Subsidy burden on account of urea import constitutes 26 % of the overall urea subsidy paid in a year by the Government. Amid the prevailing circumstances, the Committee believe that judicious application of urea is the need of the day and nano fertilizers can definitely play an important role to reduce the dependency of our country on the import of urea. As submitted, with the precise application of nano fertilizers at critical crop growth stages, about 25 to 50% replacement of convention fertilizers is possible. Resultantly, with the use of Nano Urea, GOI Exchequer can save approx. 3 billion USD equivalent to around Rs. 25,000 crore in subsidy bill per year considering subsidy of approx. Rs. 20,000 per MT of Urea. The Committee are glad to learn that by the year 2023, IFFCO's two plants will be operational with total production of 11 crore bottles every year. The expected replacement is 50 lakh MT of conventional urea. By 2023-24, 5 plants will be operational with production of 28 crore bottles per year and the expected replacement is 127 lakh MT of conventional urea. By 2025-26, all the proposed eight plants will be operational and the total production would be 44 crore bottles every year and they are expected to replace 200 lakh MT of urea. The Committee find the figures for expected replacement of urea encouraging and trust that DoF/IFFCO would take further steps to enhance the production of Nano Urea towards making our country self-reliant for meeting the requirement of fertilizers.

5. The Committee draw some satisfaction from the fact that IFFCO has transferred the technology of Nano Urea to NFL and RCF and they are setting up

their plants with the technology transfer at Nangal in Punjab and Trombay in Maharashtra, respectively. Department has now requested IFFCO to transfer the Nano Urea technology to other CPSUs viz. BVFCL and FACT also without any cost. The matter is stated to be under consideration before the management of IFFCO. The Committee are aware that IFFCO has transferred the technology to NFL and RCF without any royalty. The Committee trust that a favorable decision would be taken by IFFCO this time too on an urgent basis with a view to enhance the production of nano urea to meet its increasing demand because of the multiple benefits of Nano Urea.

6. The Committee are aware that the Department of Fertilizers has a larger role to play in making available the required quantum of nano fertilizers to fulfill the need of farmers of the entire country. The Committee are of the strong conviction that Public and Private Sector Companies desirous of manufacturing nano fertilizers can do much better and should be given every possible support by the Government. In this regard, the Committee would like to impress upon the Department to take up the matter with the Ministry of Finance at the appropriate level to bring production of nano fertilizers under the Production Linked Incentive (PLI) scheme in order to give a boost to the fertilizer industry with a view to increasing the production of nano fertilizers.

7. The Committee are informed that as our country do not have sufficient raw materials, gas, oil, rock phosphate, potash needed to produce fertilizers, there is an urgent need to think differently to be self-reliant. The Committee share the apprehension of the Department that in case of dependency for raw materials on other countries, our country would be prone to exploitation as fertilizer raw material is available only in a few countries. In view of the foregoing, the Committee recommend that the Department of Fertilizers should play a proactive role to establish long term agreements for import of fertilizers' raw materials and set-up joint venture plants in countries rich in fertilizers' raw materials with buy

back arrangements thereby assuring access to acquisition of the fertilizers' raw materials abroad, through the Ministry of External Affairs, Ministry of Finance and other concerned Departments/ agencies. All necessary steps are needed to be taken by the Government to avoid any hinderances in production of nano fertilizers. This may help achieve self-reliance in the fertilizer sector while ensuring regular supply of fertilizers and raw materials at reasonable rates and saving precious foreign exchange by decreasing the import burden of the country. Besides, the Department may approach the Ministry of Finance to rationalize/ exempt the Basic Custom Duty on fertilizers' raw materials (i.e. P&K and other macro and micro nutrients) so that they are available at reasonable price thus incentivizing setting up of nano technology based plants in the country for enhancing the production of nano fertilizers.

8. The Committee are made to understand that use of Nano Urea will act as one of the tools to double the income of farmers. It has higher nutrient use efficiency which will boost crop production and would increase farmers' income. Based on 11,000 all India farmer field trials conducted on 94 crops by IFFCO in collaboration with ICAR – KVKs, an average 8 % higher crop yield was achieved with the application of Nano Urea, which translates into Rs. 2000-Rs. 5000 per hectare higher income for the farmers. Economic benefit is even more in case of high value/high MSP crops. With the use of Nano Urea, there is input cost saving for farmers in terms of purchase of less fertilizer. Average 45 – 90 Kg less subsidized urea would be applied per acre of field which translates into Rs.266-Rs.532 per acre cost saving for the farmers in terms of lower purchase cost for the farmers. Despite advantages, the practical implementation of nano-fertilizers still has a long way to go. The Committee realize that the biggest challenge for any game changer technology is its adoption on a larger scale by common masses. In the instant case, the biggest challenge being faced, is the adoption of Nano Urea by the small and marginal farmers. Department of Fertilizers is taking a lot of

activities for promotion of Nano Urea viz. village level demonstration on Nano Urea application through progressive farmers, creating awareness for use of Nano Urea in kisan sammelans. Films have also been made in different regional languages and the social media is extensively being used for dissemination of information on Nano Urea and its use among farmers. Besides, regular talks and panel discussions on radio, DD Kisan channel and other television channels are being held. One training module is being developed for farmers for crop specific right dose of Nano Urea. Further, the State Governments are repeatedly requested, in their monthly meetings, to take up the initiative to popularize Nano Urea amongst the farmers. IFFCO has also taken organised promotional and extension programmes for use of Nano Urea across the country through Crop Demonstrations, Short video films of Nano Urea, Print & Electronic, Media and Mass Media Campaigns, Publicity Material, Gifts & Awards, Dedicated Internet Site, Training & Awareness programmes and State-wise Flag off Programmes & Endorsement by Opinion Leaders, Government Officials and Scientists, etc.

While appreciating the efforts being made by DoF/IFFCO to promote use of Nano Urea, the Committee feel that a lot of work can still be done in this direction. The Committee are of the opinion that enhancement of the crop produce and income benefits to the farmers should be given adequate focus in the promotional programmes of nano fertilizers. Once farmers are convinced of these benefits, they would be open to use the related information through various promotional activities organized by Department of Fertilizers and IFFCO. The faster the farmers of our country adopt the Nano Urea, the sooner the country will be able to move towards complete Atma Nirbharta in the fertilizer sector.

9. The Committee note that an agriculture sprayer is a special type of farm equipment that a farmer uses to apply liquid or powder agricultural chemicals and fertilizers on farm fields. For spraying of liquid Nano Urea, the farmers use a hand operated or battery-operated knapsack sprayer of 15 or 16 litres water tank

capacity. They also use power or mist sprayers / boom sprayers of 200 litres or more capacity. Cost of manual sprayers, battery operated sprayers and power sprayers is in the range of Rs. 1200-1500, Rs. 3000-4500 and Rs 6000-10,000 per sprayer, respectively. In this regard, Department of Fertilizers has submitted that a collective and community spraying with the help of cooperatives, retailers as well as custom hiring of sprayers by village level youth/ FPOs are being explored for effective spray of Nano Urea. The Committee would desire the Department to speed up their efforts for provisioning of effective and cheaper means of spraying of nano fertilizers to the farmers.

10. The Committee note that drone are also used to spray nano fertilizers. Spreading fertilizer or seed spreading with a drone allows a user to reach places that traditionally would be hard to access and at a faster pace. As informed by the Ministry of Civil Aviation, import of drones has been banned to support the indigenous production of drones in the country. The Committee strongly support the decision of the Government in this regard and desire that such facilities should be encouraged and established within the country itself. As submitted, the Government has come up with good policies and have introduced incentives and engaged three world-famous type certification bodies for drones viz. Tata Quality, TQC of US and Bureau Veritas. Therefore, things have been liberalized to create demands and policy & procedural bottlenecks removed. The Committee would like to be assured that the Government has taken policy initiatives with a view to encourage drone adoption by States and Union Territories and procurement process of drones have been simplified. Keeping in view that the production of drones have just started and also in view of the initiatives taken by the Government, the Committee trust that target set by the Ministry of Civil Aviation to provide 10 drones for each village and fulfill the requirement of more than 6 lakh villages in the country would be accomplished within a reasonable time frame by

taking care of the avoidable delays. The Committee would like the Department of Fertilizers to provide an update in the matter from time to time.

11. The Committee do appreciate that the Ministry of Agriculture & Farmers Welfare have included drones as part of agricultural machinery. However, in view of the fact that a 25 kg agricultural drone costs between Rs. 8 to 10 lakh, the Committee find it extremely difficult for the small and marginal farmers, which constitute about 86% farmers, to afford the same. The Committee are aware that the Government on 15.09.2021 has approved the Production Linked Incentives(PLI) Scheme for drones and drone components. The PLI scheme allocates Rs. 120 crore for drones and drone components spread over three financial years which is almost twice the combined turnover of Rs. 60 crore of all domestic drone manufacturers during 2020-21. As submitted, out of 120 manufacturers of drones and about 180-200 service providers, 23 drone/component manufacturers having a turnover of Rs. 2 crore have been found eligible for the PLI Scheme. As the PLI scheme for drones and drone components is in place, the Committee are hopeful that the drone manufacturing industry would play a significant role and supplement the Governments' efforts. In other words, while the industry expects the Government to display a trust based facilitator attitude by way of creating a conducive manufacturing environment, the Committee expect the industry to display exemplary focus on drone manufacturing for domestic agricultural use by way of investing significantly thus ensuring the growth of the drone manufacturing industry up to the expected level.

12. The Committee note that SOP for use of drone to spray the nano fertilizers in agriculture is under consideration of the Department of Fertilizers, wherein 90% of drone price would be provided through Agriculture Infrastructure Fund (AIF) for those entrepreneurs who wish to avail the facility of drones. The Committee desire that the Department in coordination with all the concerned Ministries/Departments

and other stakeholders seek for sufficient budgetary support to the AIF for provisioning of drones at subsidized rates to the Kisan Vikas Kendras, Custom Hire Centres and Agricultural Universities, etc. The Committee would desire that SOP for use of drone for spray of nano fertilizers should be finalized at the earliest. The Committee further desire that Department of Fertilizers should take similar measures to ensure the availability of fertilizer sprayers for enhanced and better productivity of crops.

13. The Committee are further informed that Department of Fertilizers has also issued the guidelines for development of entrepreneurs for spraying of liquid fertilizers by drones and they are in regular touch with the stakeholders for promotion of the said guidelines, which will ensure availability of drones to spray fertilizers at cheaper cost. The Committee would desire that it should be closely monitored that the guidelines for development of entrepreneurs for spraying of liquid fertilizers by drones are strictly followed so that their very purpose to ensure availability of drones at cheaper price is achieved.

14. It is satisfying to note that a drone takes only 5 minutes to complete spraying on one acre of the field and a single day to spray 80 acres of the field whereas a manual sprayer takes one full day to spray one acre of the field. The Committee are, however, not happy to note that though the rates fixed for spray by drones as per the guidelines on the development of entrepreneurs for drone spraying of liquid fertilizers is Rs.200/- per acre per day, the farmers are being charged more i.e. @ Rs.500/- per acre per day inclusive of its transportation charges upto the farm gate. Hence, though the nano fertilizers have several benefits, the concern of the farmers with regard to the higher cost of drone spray application remains unattended. A representative of Tamil Nadu Agricultural University (TNAU) reacted to the concern of the Committee and submitted that the

transportation charges for drones upto the farm gates can be subsidized. The Committee would like to be assured that the Department would take all necessary steps to resolve the anomalies with regard to the rates of drone spray and address the concern of the farmers in this regard so that more farmers avail the facility of drones for spraying of fertilizers.

15. The Committee hope that as assured, the Department of Fertilizers would take up the matter with the companies/ corporate houses for utilizing their Corporate Social Responsibility (CSR) fund to provide the facility of drones to the farmers of a particular ear-marked area (adopted by them) for spray of Nano Urea at subsidized rates / free of cost and to impart drone pilot training to the local village entrepreneurs and farmers.

16. The representative of Tamil Nadu Agricultural University (TNAU) have informed that they have 40 research stations, 18 colleges and 14 KVKs and in all their units, they have a drone. They also propose to give a custom hiring and for that they have the complete SOP. Also, to improve the manpower for drone operation, the Tamil Nadu Government has taken a special initiative to include drone training in diploma course in agricultural engineering. It is a 10 hours course and within two weeks one gets trained and get license to operate drones. Tamil Nadu State Assembly has sanctioned a project worth Rs. 11 crore to buy 60 drones. There is a drone laboratory in TNAU where several parameters of flight height, swath, speed of the drones are assessed. Tamil Nadu Government has also requested the TNAU to train unemployed youth for drone usage and for that efforts are being made. Also, several companies are ready to sign MoUs to promote drone technology. The Committee welcome the initiatives taken by the State Government of Tamil Nadu/TNAU in drone usage for agricultural needs and promotion of drone technology. The Committee recommend to the Department of Fertilizers to pursue

with the other State Governments to follow suit to cater to the need of the farmers for use of drone in spraying of fertilizers/nano fertilizers.

17. The Committee find that there is limited number of drone training centres which makes it difficult for the farmers to avail the training facility. As per the submission of Ministry of Civil Aviation, they have planned for 8000 drone training schools for 800 districts in the country with an average of 10 schools per district. However, it involves certain process of approval. The Committee desire that the Department of Fertilizers should devise a definite plan in coordination with the Ministry of Agriculture & Farmers Welfare, Ministry of Civil Aviation, Krishi Vigyan Kendras, Kishan Vikas Kendras, Farmer Producer Organizations (FPOs), Customer Hire Centres, Farmers Cooperatives, Agricultural Universities, fertilizer manufacturing companies, etc. for conducting regular training programmes to train the entrepreneurs and farmers throughout the country about appropriate usage of various types of fertilizer sprayers including drones for precision and targeted application of right dosage of nano fertilizers, etc. on the crops.

18. The Committee note that the Sub-Mission on agricultural mechanization (SMAM) has been introduced by the Government of India. Eligible farmers can apply for the scheme and can buy modern agricultural equipment with 50 to 80% subsidy. This scheme, therefore, will facilitate the availability of drones in the villages with the active cooperation of the State Governments. A representative of the Ministry of Civil Aviation during evidence admitted that implementation of the SMAM scheme is little slow. The Committee recommend that the Department of Fertilizers should work in unison with the Ministry of Civil Aviation and State Governments and others concerned agencies for effective implementation of SMAM so as to achieve its objective of facilitating the availability of drones to the farmers at the Block/ village level throughout the country.

19. The Committee gather from the submission of Department of Agricultural Research & Education (DARE) that long-term effects of nano fertilizers on the nutritional quality of various crops cannot be drawn as till date the research trials being conducted have completed only one year and in most cases, only one season. The Committee would recommend that concerted long-term dedicated research may be got conducted by the Department of Fertilizers in active coordination with DARE/ ICAR, all the Agricultural universities/ fertilizer manufacturing companies, etc. by covering all the major crops in all the agro-climatic regions and soil types of the country so as to thoroughly assess the merits and demerits of the use of nano fertilizers and establish nutritional quality, bio-safety, efficacy and reliability of the harvested produce of nano fertilizers treated crops.

20. The Committee learn that during the field trials on varieties of crops with the application of Nano Urea, it was found that there was 25 to 50 percent saving in top dress nitrogen. The Committee desire that a thorough audit of the field trials on application of nano fertilizers may be got conducted by the Department in coordination with other Ministries/ organizations, to assess the reasons for huge variation (25 to 50 percent) in top dress nitrogen saving on different crops and in different regions, by the premier agricultural research institutes, etc.; the reasons for variance and effects may be scientifically analysed and a crop specific Standard Operating Procedure (SOP) for appropriate application of Nano Urea be devised so that the variance range in this regard may be minimized/ removed.

21. The Committee further desire that as assured, the Department of Fertilizers would take up the matter for setting up of quality testing laboratories throughout the country to ensure production and sale of quality nano fertilizers with the

Department of Agriculture and Farmer's Welfare. The Committee would like to be kept informed of the progress in the matter.

**New Delhi;
20, March, 2023
29, Phalguna, 1944 (Saka)**

**DR. SHASHI THAROOR
Chairperson,
Standing Committee on
Chemicals & Fertilizers.**

Summary of All India Experimental Results of Nano Urea (liquid) in Kharif 2021

SN	Crops	Location	Season	Treatments	Nitrogen Dose Applied per Plot kg	Equivalent urea Top dressed Urea Qty per Plot	Urea Top dressing Cost	Nano Appn. Cost Approx (Bottle + Foliar labour).	Subsidized Urea Cost (@ Rs 266.50 / Bag)	Total Cost (Urea cost + Nano Urea (liquid))	Add ⁿ cost in Nano Plot	Grain Yield *	Mandi Price of the produce	Addn. Yield over RDF	% Inc over RDF	Addn. Return	Overall Economic Benefit	Nitrogen Saving in Top Dressed Nitrogen Only	
																		kg / ha	Rs / ha
A	B	C	D	E	F	G	H	I	J (G x 266.5)/45	K (H+I+J)	L	M	N	O (M-Mrdf)	P (O/Mrdf*100)	Q (OxN)	R (Q-L)	S(Frdf - Fnano)	T
1	Rice	BCKV, Mohanpur(West Bengal)	Kharif, 2021	100% RDF (60:30:30 kg/ha NPK)	60	130	800	0	772	1572		3786	19					-	-
				50% basal N, P, K+ 50% of total top dressing urea at 20 DAT+ 1 st Nano Urea (liquid) spray at 27 DAT + 2 nd Nano Urea (liquid) spray at 40-45 DAT	30	65	800	3168	386	4354	2776	4208	19	422	11.15	8018	5242	30	50

2	Rice (CIARI Dhan-3)	ICAR- CIARI, Port Blair	Kharif 2021	RDN ((90 Kg N /ha)	90	196	1521	0	1159	2680	-	3593	19.5						
				RDF with 66 % N & 2 Sprays of Nano N @ 4ml / litre at AT& PI	66.5	145	507	1614	856	2977	249	4110	19.5	517	14.39	10081.5	9832.5	24	33
3	Maize (Hybrid DHM 117)	ICAR- CRIDA, Hyderabad (Telangana)	Kharif 2021	RDN (90 Kg N/ha)	90	196	800	0	1159	1959	-	2694	18.7						
				RDF with 25% N reduction & 2 Sprays of Nano N @ 2ml / litre at 25 and 45 DAS	67.5	147	800	1760	869	3429	1470	2801	18.7	107	3.97	2000.9	530.9	23	25
	Fingermillet (GPU 28)	AICRPDA Centre, Bengaluru (Karnataka)	Kharif 2021	RDN (50 Kg N/ha)	50	109	400	0	644	1044	-	2742	32						
				RDF with 25% N reduction & 2 Sprays of Nano N @ 2ml / litre at 25 and 45 DAS	37.5	82	400	1760	483	2643	1589	3038	32	296	10.80	9472	7883	13	25
	Upland rice (Dantes wari)	AICRPDA Centre, Jagdalpur(Chhattisgarh)	Kharif 2021	RDN (80 Kg N /ha)	80	174	800	0	1030	1830	-	2897	19.6						

				RDF with 25% N reduction & 2 Sprays of Nano N @ 2ml / litre at 35 and 55 DAS	60	130	800	1760	772	3332	1500	2971	19.6	74	2.55	1450.4	-49.6	20	25
4	Paddy Basmati PB-1121	CSSRI Karnal(Haryana)	Kharif 2021	RDF (90 Kg N Kg /ha)	90	196	1200	0	1159	2359	-	4466	33						
				RDF with 33% N reduction & 1 Spray of Nano N	60	130	800	1000	772	2572	215	4525	33	59	1.32	1947	1732	30	33
5	Ginger (Varada)	ICAR- IISR, Kozhikode (Kerala)	2021-22	RDN (180 kg N /ha)	120	261	2000	0	1545	3545	-	14000	12						
				RDF with 50 % N reduction & 2 Sprays of Nano N @ 2ml / litre at 90 and 120 DAP (800 ml/ha) @ Rs. 250 per bottle	60	130	500	2400	772	3672	1130	22000	12	8000	57.14	96000	94870	60	50
				RDF with 50 % N reduction & 2 Sprays of Nano N @ 4ml / litre at 90 and 120 DAP (1.6 L/ha) @ Rs. 250 per bottle	60	130	500	2800	772	4072	1530	27440	12	13440	96.00	161280	159750	60	50
6	Rice (Irrigated)	IRRI-SARC, Varanasi (U.P.)	Kharif 2021	RDN (120 Kg/ ha)	120	261	800	0	1545	2345	-	7600	19.4						

	(MTU 7029)			RDN with 34% N reduction & 1 Spray of Nano Urea (liquid) @ 4 ml/l at PI	79	172	400	1120	1017	2537	195	7900	19.4	300	3.95	5820	5625	41	34
7	Rice (Rainfed)	IRRI-SARC, Varanasi (U.P.)	Kharif 2021	RDN (80 Kg/ ha)	80	174	800	0	1030	1830	-	4400	19.4						
	(Binadhan 11)			RDN with 34% N reduction & 2 Spray of Nano Urea (liquid) @ 2 ml/l at MT and PI	52.8	115	400	1520	680	2600	770	4900	19.4	500	11.36	9700	8930	27	34
8	Rice (Rainfed)	IRRI-SARC, Jorhat (Assam)	Kharif 2021	RDN (60 Kg/ ha)	60	130	800	0	772	1572	-	4000	19.4						
	(CR Dhan 311)			RDN with 34% N reduction & 2 Spray of Nano Urea (liquid) @ 2ml / litre at MT and at PI stage	39.6	86	400	1520	510	2430	858	4400	19.4	400	10.00	7760	6902	20	34
9	Paddy	ANDUAT, Kumarganj, Ayodhya(U.P.)	Kharif 2021	RDF 150/kg N/ha	150	326	400	0	1931	2331	0	60.5	1940	-	-	-	-	-	-
	„	„	„	RDF 50% N+2 Nano Zinc spray	75	163	400	1200	966	2566	1200	65	1940	4.5	7.44	8730	7530	75	50
10	Rice (Pooja)	ICAR-NRRI, Cuttack (Odisha)	Kharif 2021	RDN (80kg N/ha)	80	174	800	0	1030	1830		4600	19.4						

				75% of RDN & one spray of Nano N @ 2 ml/litre at 78 days after transplanting (DAT)	60	130	400	1100	772	2272	443	4200	19.4	-400	-8.70	-7760	-8203	20	25
				50 % of RDN & two spray of Nano N @ 2 ml/litre at 48 and 78 days after transplanting (DAT)	40	87	0	2200	515	2715	885	3800	19.4	-800	-17.39	-15520	-16405	40	50
11	Pearl millet (RHB 173)	SKNAU, Jobner(Rajasthan)	Kharif 2021	RDN (120 Kg N /ha)	90	196	375	0	1159	1534	-	2849	22.5						
				RDF with 25% N reduction & 2 Sprays of Nano N @ 2ml / litre at 30 and 45 DAS	67.5	147	281	1768	869	2918	1385	3047	22.5	198	6.95	4455	3070.42	23	25
				RDF with 50% N reduction & 2 Sprays of Nano N @ 2ml / litre at 30 and 45 DAS	45	98	188	1768	579	2535	1001	2980	22.5	131	4.30	2947.5	1946.35	45	50
12	Maize (BRMH 8)	UAS GKVK, Bangalore (Karnataka)	Kharif 2021	RDN ((150 Kg N /ha)	0.3	1	800	0	4	804	-	8260	14.2						

				RDF with 50 % N reduction & 2 Sprays of Nano N @ 4ml / litre at 30 and 60 DAS	0.15	0	600	1944	2	2546	778	8440	14.2	180	2.18	2556	1778	0	50
	Rice (KMP 220)	UAS GKVK, Bangalore (Karnataka)	Kharif 2021	RDN ((100 Kg N /ha)	0.12	0	800	0	2	802	-	5240	17						
				RDF with 50 % N reduction & 2 Sprays of Nano N @ 4ml / litre at 30 and 60 DAS	0.06	0	600	1944	1	2545	1103	5340	17	100	1.91	1700	597	0	50
13	Finger millet (VL Mandua 352)	ICAR-VPKAS, Almora (Uttarakhand)	Kharif 2021	100% RDN	50	109	1200	0	644	1844	-	1407	33.77						
				50% RDN +2 spray of Nano Urea (liquid) @ 0.2%	25	54	800	1400	322	2522	675	1235	33.77	-172	-12.2	-5808.4	-6483.4	25	50
14	Rice	IGKV, Raipur (Chhatisgarh)	Kharif 2021	RDN (120 Kg N/ha)	120	261	900	0	1545	2445		6017	19.4						
				RDN with 50% N reduction & 2 spray of Nano N@ 4ml/L at Tillering and Before Flowering stage	60	130	600	2040	772	3412	968.9	5513	19.4	-504	-8.38	-9777.6	-10747	60	50
15	Maize (Komal Hybrid)	RVSKVV, Indore (M.P.)	Kharif 2021	RDF (120-60-40)	120	261	600	0	1545	600	-	2614	18.7	-	-	-	-	-	-

				60 kg N + 2-sprays of NU	60	130	300	1800	772	2872	727.5	2745	18.7	131	5.01	2449.7	1722.2	60	50
16	Maize (GAYMH 1)	AAU, Anand(Gujarat)	Kharif 2021	RDF (120:60:0 NPK Kg / ha)	120	261	800	0	1545	2345	-	4910	18.7						
				RDF with 50% N reduction & 2 Sprays of Nano N	60	130	400	2000	772	3172	828	4970	19.25	60	1.2	1122	294	60	50
17	Paddy	TNAU, Bhavanisa gar (Tamil Nadu)	Kharif 2021	RDF (120:60:0 NPK Kg / ha)	120	261	800	0	1545	2345	-	6030	19.4						
				RDF with 50% N reduction & 2 Sprays of Nano N	60	130	400	3200	772	4372	2028	6970	19.4	940	15.6	18236	16208	60	50

Season-wise/Crop-wise experimental trials undertaken on Nano Urea (liquid) (Nano Nitrogen)

Experiments	Season	Crops & Trials (Nos.)
“On Station” Trials	Rabi 2019-20 (24 Nos.)	Cereals: Wheat (11); Oilseeds: Mustard (1); Vegetables: Onion (2); Capsicum (1), Cabbage (1), Tomato (3); Parthenocarpic Cucumber under polyhouse (1) Sugar Crops: Suru Sugarcane (1)
	Summer 2019-20 (3 Nos.)	Cereals: Paddy (1); Maize (2)
	Kharif 2020 (16 Nos.)	Cereals: Paddy (6); Maize (5); Pear millet (3) Fibres: Cotton (1) Vegetables: Okra (1)
	Rabi 2020-21 (8 Nos.)	Cereals: Wheat (6); Oilseeds: Mustard (1); Vegetables: Onion (1)
	Summer 2020-21 (2 Nos.)	Cereals: Paddy (1); Maize (1)
	Kharif 2021 (21 Nos.)	See Table 2.
“On Farm” Trials	Rabi 2019-20	93 crops; 11224 trials (9037 recorded)
	Kharif 2020	44 crops; 1511 trials (1435 recorded)
	Rabi 2020-21	1126
	Total	11,598

SAFETY ASSESSMENT OF IFFCO NANO UREA (LIQUID) AS PER DBT NANO GUIDELINES

SN	Test Name	Guideline	Purpose
1	Dermal Toxicity – IATA for skin corrosion & irritation	OECD TG 404 & DBT	Human Safety
2	Skin Absorption study	OECD TG 428 & DBT	Human Safety
3	Eye Irritation Investigation	OECD TG 437 & DBT	Human Safety
4	Inhalation Toxicity Study of nanoparticles	OECD TG 433 & DBT	Human Safety
5	Genotoxicity study	OECD TG 473 & DBT	Human and Plant Safety
6	Cytotoxicity study	MTT & Neutral Red Assay & DBT	Human Safety
7	Inhibition test in fresh water alga	OECD TG 201 & DBT	Aquatic /Env Toxicity
8	Immobilization test in Daphnia	OECD TG 202 & DBT	Aquatic /Env Toxicity
9	Toxicity in tropical fish	OECD TG 203 & DBT	Aquatic / Environmental Toxicity
10	Fish Embryo toxicity study	OECD TG 236 & DBT	Ecological/ Environmental Toxicity
11	Earthworm reproduction study	OECD TG 222 & DBT	Ecological/ Environmental Toxicity
12	Stability test of the nanomaterials	OECD TG 318 & DBT	Aqua/Human/ Environmental safety
13	Soil – water leaching – spray on soil	OECD 312 & DBT	Environmental Safety
14	Soil – water leaching – spray on plant	OECD 312 & DBT	Environmental Safety
15	Packaging compatibility test	OECD, ENV/JM/MONO (2019)12 & DBT	Environmental & human Safety
16	Toxicity on Microbes	FCO 1985 & DBT	Rhizosphere Study
17	Toxicity on mice and chicken	OECD 407 & DBT	Food Toxicity
18	Microbial Contamination study	FCO 1985 & DBT	Contamination safety
19	NMR analyses of Nitrogen	DBT	Stability
20	Plant uptake studies	DBT	Stability and trophic transfer
21	Nutritional analyses	FSSAI	Nutritional value and human safety

STANDING COMMITTEE ON CHEMICALS & FERTILIZERS

(2021-22)

Minutes of the Seventh Sitting of the Committee

The Committee sat on Monday, the 18th April, 2022 from 1100 hrs. to 1400 hrs. in Committee Room. 'B', Parliament House Annexe, New Delhi.

PRESENT

Smt. Kanimozhi Karunanidhi- Chairperson

MEMBERS

LOK SABHA

2. Shri Dibyendu Adhikari
3. Shri Ramakant Bhargava
4. Shri Kripanath Mallah
5. Smt Aparupa Poddar (Afrin Ali)
6. Dr. M.K.Vishnu Prasad
7. Shri Arun Kumar Sagar

RAJYA SABHA

8. Shri Ayodhya Rami Reddy Alla
9. Shri G.C.Chandrashekhar
10. Dr. Anil Jain
11. Shri Jaiprakash Nishad
12. Shri Arun Singh

SECRETARIAT

1. Shri Vinod Kumar Tripathi - Joint Secretary
2. Shri C. Kalyanasundaram - Additional Director
3. Shri Kulvinder Singh - Deputy Secretary
4. Shri Panna Lal - Under Secretary

WITNESSES

Ministry of Chemicals and Fertilizers

Department of Fertilizers

1. Shri Rajesh Kumar Chaturvedi, Secretary (F)
2. Shri Satendra Singh, Addl. Secy. & FA
3. Smt. Aparna Sharma, JS
4. Smt. Neeraja Adidam, JS
5. Dr. Prathibha A., Economic Adviser
6. Shri Harvinder Singh, Director

PSUs/Autonomous Institutions

7. Shri U.S. Awasthi, MD, IFFCO
8. Shri Yogendra Kumar, Director (Mktg.), IFFCO
9. Shri S.C. Mudgerikar. CMD, RCF
10. Shri Nirlep Singh Rai, CMD, NFL
11. Shri P.S. Gahlot, MD, IPL

Other Department/Ministries

12. Shri Priya Ranjan, JS (INM), DA&FW
13. Shri A. K. Singh, Agriculture Commissioner, DA&FW
14. Shri S. K. Chaudhari, Dy. Director General, ICAR

Part - I

2. At the outset the Hon'ble Chairperson welcomed the Members of the Committee to the sitting and then the Committee discussed the proposal regarding study tour of the Committee to Ahmedabad, Pune and Kashmir. It was proposed that the details the said study tour may be worked out for approval by the Committee at its next sitting.

Part – II

Briefing by the representatives of the Ministry of Chemicals and Fertilizers (Department of Fertilizers) on ‘Nano fertilizers for sustainable crop production and maintaining soil health’.

3. Thereafter, Hon’ble Chairperson welcomed the representatives of the Ministry of Chemicals & Fertilizers (Department of Fertilizers) to the sitting. Their attention was invited to the provisions contained in the Direction 55(1) of the ‘Directions by the Speaker’ regarding confidentiality of the Committee’s proceedings.

4. After the witnesses introduced themselves, a short film showcasing the features of “Nano fertilizers” was screened for the information of the Members of the Committee. Then the Secretary of the Department briefed the Committee through a power point presentation on ‘Nano fertilizers’.

5. The power point presentation was followed by discussion on several aspects of the subject, ‘Nano-fertilizers for sustainable crop production and maintaining soil health’. During the discussion, the Hon’ble Chairperson and Members of the Committee raised questions on several issues such as:-

- (i) Research on the long term effects of use of Nano fertilizers on nutritional quality of various crops, soil, human health, etc.
- (ii) Awareness programmes for farmers and imparting training to them about the use of Nano fertilizers.
- (iii) Promotion of drone technology for efficient spray of Nano fertilizers and training of farmers for its use.
- (iv) Display of expiry date, if any, on the bottles of Nano fertilizers and precautionary warnings, thereon.
- (v) Use of recyclable plastic bottles for Nano fertilizer packing.
- (vi) Selective need based introduction and use of Nano fertilizers in various Regions of the country in a phased manner as per its present production capacity.
- (vii) Need for efforts to increase the production capacity of Nano fertilizers.
- (viii) Revival of Haldia plant in West Bengal of Hindustan Fertilizers Corporation.
- (ix) Allocation of separate Budgetary allocation for promotion and use of Nano fertilizers. Consideration of subsidy for the use of nano fertilizers.

- (x) Need for research and development of different versions of Nano fertilizers viz. Nano-DAP, Zinc, Boron, Copper, etc.
- (xi) Need for sustainable models by involving Private sector companies also for achieving self-sufficiency in fertilizers so as to reduce its import.
- (xii) Need for further Research in Nano fertilizers so as to enhance the quality parameters in all aspects to meet the export standards.
- (xiii) Need for steps to reduce the usage of Urea and to promote Nano fertilizers.
- (xiv) Effects of droplets of nano urea spray on the environment and the human beings.

Part – III

Discussion with the representatives of the Ministry of Chemicals and Fertilizers (Department of Fertilizers) on the topical issue of ‘Availability and Price volatility of fertilizers in the context of present international situation’.

6. Thereafter, the representatives of the Ministry of Chemicals & Fertilizers (Department of Fertilizers) made a power point presentation on ‘Availability and Price volatility of fertilizers in the context of present international situation’ which was followed by discussion on several aspects of the topical issue. The following important points were discussed by the Committee:-

- (i) Requirement, availability and DBT sales of various fertilizers during Rabi and Kharif seasons (2021-22).
- (ii) Budget for fertilizers subsidy.
- (iii) Increase in international prices of MOP due to war between Russia and Ukraine and sanctions against Belarus and Russia.
- (iv) Revision in NBS rates for nutrients – N, P, K and S.
- (v) Need for increase in subsidy on DAP fertilizer.
- (vi) Trends of International Prices of fertilizers during 2020-21 and 2021-22.
- (vii) Short-term and long-term arrangements to meet the fertilizers requirements due to current geo-political situations.
- (viii) Issue of Potash supply and efforts to meet the requirements.
- (ix) Need for timely measures to meet the requirements and shortage of fertilizers.
- (x) Need to increase the production capacity of Potash derived from Molasses.

- (ix) Urgent need for short-term and long-term strategic plans to achieve self-sufficiency in fertilizers and sort out the crisis.
- (xii) Need for constant monitoring the situation for availability of fertilizers.

7. The Secretary, Department of Fertilizers and other representatives accompanied him responded to the aforesaid issues raised by the members of the Committee.

8. The Chairperson thanked the witnesses for appearing before the Committee as well as for furnishing valuable information to the Committee. They were also asked to provide required information which was not readily available in writing, at the earliest.

9. A copy of the verbatim record of the proceedings of the sitting has been kept.

The Committee then adjourned.

**MINUTES OF THE EIGHTH SITTING OF THE
STANDING COMMITTEE ON CHEMICALS & FERTILIZERS**

(2021-22)

The Committee sat on Wednesday, the 04th May, 2022 from 1100 hrs. to 1230 hrs. in Committee Room 'B', Parliament House Annexe, New Delhi.

PRESENT

Smt. Kanimozhi Karunanidhi - Chairperson

MEMBERS

LOK SABHA

2. Shri Dibyendu Adhikari
3. Shri Deepak Baij
4. Shri Satyadev Pachauri
5. Shri Arun Kumar Sagar
6. Shri Pradeep Kumar Singh

RAJYA SABHA

7. Shri G.C.Chandrashekhar
8. Dr. Anil Jain
9. Shri Jaiprakash Nishad
10. Shri Arun Singh
11. Shri Vijay Pal Singh Tomar
12. Shri K. Vanlalvena

SECRETARIAT

1. Shri Vinod Kumar Tripathi - Joint Secretary (VT)
2. Shri N.K. Jha - Director (CF&GP)
3. Shri C. Kalyanasundaram - Additional Director (CF & JC)

4. Shri Kulvinder Singh - Deputy Secretary
5. Shri Panna Lal - Under Secretary

LIST OF WITNESSES

I. MINISTRY OF CHEMICALS AND FERTILIZERS

(DEPARTMENT OF FERTILIZERS)

1. Shri Satendra Singh, Addl. Secy. & FA
2. Smt. Neeraja Adidam, JS
3. Smt. Aparna Sharma, JS
4. Dr. Prathibha A., Economic Adviser
5. Shri Johan Topno, DS

II. MINISTRY OF AGRICULTURE AND FARMERS WELFARE

(DEPARTMENTN OF AGRICULTURAL RESEARCH & EDUCATION (DARE)]

1. Dr. T. Mohapatra, Secretary, DARE & DG, ICAR
2. Dr. Suresh K. Chaudhari, Deputy Director General, ICAR
3. Dr. K.S. Subramanian, Director of Research, TNAU Coimbatore
4. Dr. V.K. Singh, Director, ICAR-CRIDA, Hyderabad
5. Dr. Ashwani Kumar, Scientist (PP), ICAR-CSSRI, Karnal, Haryana
7. Dr. Parveen K. Upadhayay, Scientist (Agronomy), ICAR – IARI, New Delhi
8. Dr. J.K. Parmar, Associate Professor (Agri Chemistry & Soil Science)
AAU, Anand, Gujarat
9. Dr. N.B. Prakash, Professor & Dean (Agriculture), UAS, GKVK, Karnataka
10. Dr. Sanjay K. Sharma, Director of Research, RVSKVV, Gwalior
11. Dr. A.K. Singh, Agri Comm, DA&FW

III REPRESENTATIVES OF PSUs/AUTONOMOUS INSTITUTIONS (FERTILIZER SECTOR)

1. Dr. Yogendra Kumar, Director (Mktg), IFFCO
2. Dr. Tarunendu Singh, Head, Agriculture Services, IFFCO

Part - I

2. At the outset, the Hon'ble Chairperson welcomed the Members of the Committee to the sitting. Thereafter, the Committee discussed the proposal regarding the proposed study tour of the Committee. After deliberations, the Committee decided to undertake a study visit to Srinagar, Pune, Mumbai and Ahmedabad from 10th to 15th June, 2022.

Part – II

Briefing by the representatives of the Ministry of Agriculture and Farmers Welfare (Department of Agricultural Research & Education); Ministry of Chemicals and Fertilizers (Department of Fertilizers) and the prominent Agricultural Research Institutes/ State Agricultural Universities on 'Nano fertilizers for sustainable crop production and maintaining soil health'.

3. Thereafter, Hon'ble Chairperson welcomed the representatives of the Ministry of Agriculture and Farmers Welfare (Department of Agricultural Research & Education); Ministry of Chemicals & Fertilizers (Department of Fertilizers) and the prominent Agricultural Research Institutes/ State Agricultural Universities to the sitting. Their attention was invited to the provisions contained in Direction 55(1) of the Directions by the Speaker regarding confidentiality of the Committee's proceedings.

4. After the witnesses introduced themselves, the Secretary, Department of Agricultural Research & Education made a power point presentation to the Committee on the subject 'Nano fertilizers for sustainable crop production and maintaining soil health'.

5. The power point presentation was followed by discussion on several aspects of the subject. During the discussion, the Hon'ble Chairperson and Members of the Committee raised questions on several issues such as:-

- (i) Need for detailed audit of field trials conducted in various agro-climatic regions of the country based on soil test, etc. due to variation shown in the results for Nitrogen savings, crop yield, etc.
- (ii) Need for research on the long term effects of Nano fertilizers on human health, environment, soil, water bodies, marine life, etc.
- (iii) Efforts made to enhance the standards and quality parameters of Nano fertilizers so that it may over the time completely replace the use of conventional Urea.
- (iv) Need to expand the scope of field trials to cover the other food crops, regions of the country, etc.
- (v) Results of R&D and field trials on Nano DAP, Nano Zinc, and other P&K fertilizers, etc.
- (vi) Regarding MoUs signed by IFFCO with the fertilizer PSUs and status of setting-up of plants by them.
- (vii) Need to boost the production of Nano fertilizers by sharing of Nano fertilizers technology by IFFCO with the PSUs and private fertilizers companies to make it abundantly available at cheaper rates.
- (viii) Need for enhanced field trials of Nano fertilizers in the areas having high crop productivity.

- (ix) Steps to be taken to increase awareness of farmers about the benefits of Nano fertilizers and to organize training programmes for them so that they may shift to its use.
- (x) Need for publicity to the study results of the use of Nano fertilizers to gain the trust of the farmers and allowing conduct of trials by the private farmers as well.
- (xi) Framing of plans for future of fertilizers industry in the country.
- (xii) Initiatives for easy availability of drones to the farmers and imparting training to rural entrepreneurs for its efficient use and application.
- (xiii) Need for grant of subsidy for the purchase of drones by the farmers as part of farm machinery.

6. The Secretary, Department of Agricultural Research & Education and other representatives from the Departments and the Agricultural Research Institutes/ State Agricultural Universities responded to the aforesaid issues raised by the Members of the Committee.

7. The Chairperson thanked the witnesses for appearing before the Committee as well as for furnishing valuable information to the Committee. They were also asked to provide required information which was not readily available in writing, at the earliest.

8. A copy of the verbatim record of the proceedings of the sitting has been kept.

The Committee then adjourned.

STANDING COMMITTEE ON CHEMICALS & FERTILIZERS

(2021-22)

Minutes of the Ninth Sitting of the Committee

The Committee sat on Thursday, the 04th August, 2022 from 1500 hrs. to 1645 hrs. in Committee Room 'C', Parliament House Annexe, New Delhi.

PRESENT

Smt. Kanimozhi Karunanidhi, Chairperson

Lok Sabha

2. Shri Ramakant Bhargarva
3. Shri Rajeshbhai Naranbhai Chudasama
4. Shri Ramesh Chandappa Jigajinagi
5. Shri Kripanath Mallah
6. Shri Satyadev Pachauri
7. Dr. M. K. Vishnu Prasad
8. Shri Arun Kumar Sagar
9. Shri Indra Hang Subba

Rajya Sabha

10. Shri Ayodhya Rami Reddy Alla
11. Dr. Anil Jain
12. Shri Arun Singh
13. Shri Vijay Pal Singh Tomar
14. Shri K. Vanlalvena

SECRETARIAT

- | | | |
|---------------------------|---|------------------|
| 1. Shri Vinay Kumar Mohan | - | Joint Secretary |
| 2. Shri Nabin Kumar Jha | - | Director |
| 3. Shri Kulvinder Singh | - | Deputy Secretary |
| 4. Shri Panna Lal | - | Under Secretary |

LIST OF REPRESENTATIVES

Ministry of Chemical and Fertilizers:

(Department of Fertilizers)

1. Ms. Arti Ahuja, Secretary (Fert.)
2. Shri Satendra Singh, AS & FA
3. Ms. Neeraja Adidam, JS
4. Shri K. Gurumurthy, JS

Ministry of Civil Aviation:

1. Shri Amber Dubey, Joint Secretary
2. Shri Sufiyan Ahmed, Assistant Secretary

Scientists:

1. Dr. K.S. Subramanian, Director of Research & Head Nano Science Technology, Coimbatore, Tamil Nadu.
2. Dr. Sudhanshu Singh, Director, IRRI-ISARC, Varanasi, UP

Farmers:

1. Shri Ram Narayan, Rewari, Haryana
2. Shri Ketanbhai Jashbhai Patel, Anand, Gujarat
3. Shri Ram Sharan Verma, Barabanki, Uttar Pradesh

REPRESENTATIVES OF DARE/ICAR

1. Dr. Suresh K. Chaudhary, DDG, ICAR

REPRESENTATIVES OF IFFCO

1. Shri Yogendra Kumar, Director Marketing, IFFCO
2. Shri Rajneesh Pandey, Chief Manager, IFFCO
3. Dr. Tarunendu Singh, Sr. Manager (AS), IFFCO

2. At the outset, the Chairperson welcomed the Members to the sitting of the Committee, convened for consideration and adoption of the following Draft Action Taken Reports:

- i. Thirty-Fifth Report on Action Taken by the Government on the observations/recommendations contained in the Thirty-First Report (17th Lok Sabha) on 'Availability of Medicines & Medical devices for COVID Management' of the Ministry of Chemicals and Fertilizers (Department of Pharmaceuticals).
- ii. Thirty-Sixth Report on Action Taken by the Government on the observations/recommendations contained in the Thirty-Second Report (17th Lok Sabha) on 'Demands for Grants 2022-23' of the Ministry of Chemicals and Fertilizers (Department of Fertilizers).
- iii. Thirty-Seventh Report on Action Taken by the Government on the observations/recommendations contained in the Thirty-Third Report (17th Lok

- Sabha) on 'Demands for Grants 2022-23' of the Ministry of Chemicals and Fertilizers (Department of Chemicals and Petrochemicals).
- iv. Thirty-Eighth Report on Action Taken by the Government on the observations/recommendations contained in the Thirty-Fourth Report (17th Lok Sabha) on 'Demands for Grants 2022-23' of the Ministry of Chemicals and Fertilizers (Department of Pharmaceuticals).

3. Giving an overview of the important Observations/ Recommendations contained in the Draft Reports, the Chairperson solicited the views/suggestions of the Members.

4. The Committee, then, took up the Draft Action Taken Reports one by one for consideration and after some discussions adopted them.

5. The Committee then authorized the Chairperson to finalise the Action Taken Reports and present the same to the Parliament.

Part II

6. Thereafter the representatives of the Ministry of Chemicals and Fertilizers and Ministry of Civil Aviation were called in and the Chairperson welcomed them to the sitting of the Committee, convened to hear their views on the Subject 'Nano Fertilizers for sustainable crop production and maintaining soil health'. Impressing upon the witnesses to keep the proceedings of the Committee 'Confidential', the Chairperson asked them to present their views/suggestions on the subject.

7. The representatives of the Ministry of Chemicals and Fertilizers and Ministry of Civil Aviation accordingly submitted their views covering various aspects. The representatives of Ministry of Civil Aviation gave a Power Point Presentation. They also responded to the queries of the Members.

8. The Joint Secretary, Ministry of Civil Aviation, accordingly gave an overview and made a power point presentation of various issues pertaining to benefits of Nano Urea to Farmers; Commercial production of nano Urea (liquid); promotion, publicity and Marketing efforts for Nano urea (Liquid); Promotional & Awareness Programmes of Nano Urea; efforts in terms of Promotion of Nano Urea spraying; farmers' field trials; Brief results of nano fertilizer trials; benefit of Nano Urea for environment; benefit in terms of less environment footprints; effect of Nano urea on GHGs emission and safety assessment of IFFCO Nano fertilizers.

9. The Members then raised certain specific queries on various issues, which inter-alia included use of drones in spraying of Nano urea, steps initiated to reduce

the spraying cost of Nano urea, price of drones their maintenance and use by farmers, increase in production of various crops by the use of Nano urea, benefits of Nano Urea to the farmers etc. The representative of both the Ministries responded to the queries raised by the Members.

10. The Chairperson thanked the witnesses for appearing before the Committee and furnishing their comments/suggestions on the subject. The Chairperson also asked the representatives to furnish their written replies/additional information within a week.

A copy of the audio recorded- verbatim proceedings was kept in record.

The Committee then adjourned.