

1	2	3	4	5	6
12.	Maharashtra	13	21	21	24
13.	Mizoram		3		
14.	Orissa	13	8		25
15.	Rajasthan	25	16		17
16.	Punjab		13		13
17.	Tamil Nadu		23		21
18.	Tripura		3	3	
19.	Uttar Pradesh		29		37
20.	West Bengal		6		
Total		94	251	43	282

STATEMENT-II

(Rs. in crore)

S.No.	State	Assistance sought		Central Share of CRF Released	
		1993-94	1994-95	1993-94	1994-95
1	2	3	4	5	6
1.	Andhra Pradesh	645.00	559.00	49.21	49.21
2.	Arunachal Pradesh	-	74.00	1.50	1.50
3.	Bihar	1014.00	-	26.25	26.25
4.	Gujarat	-	303.00	63.75	63.75
5.	Haryana	205.00	-	19.125	6.375
6.	Himachal Pradesh	390.00	604.00	16.875	10.125
7.	Karnataka	350.00	422.00	20.25	10.12
8.	Kerala	-	100.00	11.62	23.25
9.	Maharashtra	-	945.00	66.00	-
10.	Madhya Pradesh	-	200.00	27.75	27.75
11.	Mizoram	27.00	-	1.125	0.375
12.	Orissa	-	376.00	29.78	29.78
13.	Punjab	574.00	-	31.50	10.50
14.	Tamil Nadu	666.00	221.00	29.25	29.25
15.	Tripura	25.00	-	2.81	1.69
16.	Uttar Pradesh	414.00	281.00	39.96	39.96
17.	West Bengal	165.00	-	30.00	30.00

*[Translation]***Agricultural Research Projects**

*214 SHRI SURENDRA PAL PATHAK : Will the Minister of AGRICULTURE be pleased to state :

(a) the expenditure incurred on Agricultural Research Projects during the last three years; year-wise and project-wise;

(b) the achievements made under these projects during the above period;

(c) the names of the Agricultural Research Projects introduced during 1994-95;

(d) whether any foreign Agriculture Universities/ research laboratories have also been associated with some projects; and

(e) if so, the terms and conditions thereof?

THE MINISTER OF AGRICULTURE (SHRI BALRAM JAKHAR) : (a) The expenditure incurred on Agricultural Research Projects during the last three years, is given in the Statement-I attached.

(b) The achievements made in each project during the period under reference are given in the Statement-II attached.

(c) Statement-III lists the names of research units started during 1994-95.

(d) Yes, Sir.

(e) International Cooperation Projects that have elements of research with their basic terms of reference are in the Statement-IV attached.

STATEMENT-I

Expenditure Incurred on Agricultural Research Projects During Last Three years

NAME OF THE PROGRAMME/PLAN SCHEME	(Rs. in lakh)		
	1991-92	1992-93	1993-94
1	2	3	4
A. CROP SCIENCE			
1. PLANT GENETIC RESOURCES	315.95	368.86	223.98
2. FOOD CROPS	7103.00	5907.42	6394.87
3. FORAGE CROPS	319.83	385.90	545.31
4. COMMERCIAL CROPS	1629.95	1745.65	2172.60
5. OIL SEED	684.54	661.45	762.10
6. PLANT PROTECTION	193.81	243.18	377.54
7. HYBRID RESEARCH AND SEED DEVELOPMENT	393.57	214.02	155.32
8. GENETIC ENGINEERING AND BIOTECHNOLOGY FOR CROP IMPROVEMENT	27.68	54.32	43.43
9. SEED TECHNOLOGY RESEARCH AND BREEDER SEED PRODUCTION	83.79	230.27	248.00
TOTAL (C.S)	10752.12	9811.07	10923.15
B. HORTICULTURE			
10. FRUITS	671.40	730.49	832.28
11. VEGETABLE	308.32	310.28	448.72
12. POTATO AND TUBER CROPS	575.09	654.49	398.08
13. PLANTATION CROPS	650.13	650.26	421.34
14. SPICES	196.89	184.09	268.07
15. FLORICULTURE, MEDICINAL AND. AROMATIC PLANTS	130.42	133.53	197.77
16. POST HARVEST TECHNOLOGY OF HORTICULTURAL CROPS	145.02	109.76	225.15
TOTAL (HORT)	2677.27	2772.90	2791.41
C. SOIL, AGRONOMY AND AGRO-FORESTRY			
17. RESOURCE INVENTORY	355.78	388.14	442.58
18. CROPPING SYSTEM RESEARCH	2016.85	1611.42	1856.12
19. SOIL MANAGEMENT	836.61	1014.15	696.87
20. WATER MANAGEMENT	587.80	563.77	722.66
21. NUTRIENT MANAGEMENT	603.70	618.02	829.26
TOTAL (S.A. AND A.F.)	4400.74	4195.50	4547.49

	1.	2.	3.	4.
D. AGRICULTURAL ENGINEERING				
22. FARM IMPLEMENTS AND MACHINERY		318.34	325.57	448.56
23. POST HARVEST TECHNOLOGY		684.84	728.69	903.56
24. ENERGY MANAGEMENT IN AGRICULTURAL ENGINEERING		94.94	122.22	136.10
25. DRAINAGE ENGINEERING		15.04	20.00	25.21
TOTAL (AGRICULTURAL ENGINEERING)		1113.16	1196.48	1513.43
E. ANIMAL SCIENCE				
26. ANIMAL GENETIC RESOURCES		67.44	68.01	123.89
27. LIVESTOCK IMPROVEMENT		2584.46	2956.24	3276.74
28. LIVESTOCK PRODUCT TECHNOLOGY		4.90	16.55	4.51
29. ANIMAL HEALTH		1652.87	1905.56	2485.11
TOTAL (A.S)		4309.67	4946.36	5890.25
G. FISHERIES				
34. CAPTURE FISHERIES		848.21	949.35	1230.00
35. CULTURE FISHERIES		424.15	565.57	620.42
36. FISH AND FISH PROCESSING TECHNOLOGY		292.50	365.12	469.00
37. FISH GENETIC RESOURCES		50.16	73.44	62.49
38. FISHERIES EDUCATION		287.36	284.94	754.18
TOTAL (FISH)		1902.38	2238.42	3136.09
H. AGRICULTURAL STATISTICS AND ECONOMICS				
I. SUPPORT SERVICES				
		6570.72	9960.96	14914.95
GRAND TOTAL		32201.95	35545.96	44198.85

STATEMENT-II*Achievements Made Under Agricultural Research Projects/Programmes***A. CROP SCIENCE RESEARCH****1. Plant Genetic Resources**

India is one of the eight important gene centres in the world and is a major participant in the international germplasm exchange programmes. A national gene bank equipped with long-term and medium-term storage facilities has been commissioned at the National Bureau of Plant Genetic Resources, New Delhi. More than 1 lakh accessions have been stored in this facility.

In all the crops genetic base has been widened through conventional methods of breeding as also use of newer techniques including tissue culture. A large number of germplasm has also been imported practically in all the crops through bilateral and international programmes with the help of National Bureau of Plant Genetic resources. Most of the germplasm has been utilized for upgradation of the genetic base in respect of high yield, quality and resistance to biotic and abiotic stress.

2. Food Crops

A number of improved varieties of different crops

have been developed under various programmes and have been released/identified as per the recommendations of the respective crop workshops. The number of varieties released during the VII plan in major crops are: Rice (118) including four rice hybrids, Wheat (37), Sorghum (23), Maize (23), Barley (9), Bajra (20) and Pulses (45). These varieties also possess in addition to high yield resistance to major pests and diseases of the respective crops. Some of them are also tolerant to abiotic stresses like drought, salinity, temperature stresses and submerged field conditions etc.

3. Forage Crops

Sixteen varieties of forage crops have been developed. These include 4 varieties of forage sorghum, 2 of fodder Bajra, 2 of Baffel grass, 3 of fodder cowpea and one each of fodder maize, fodder guar, lablab bean and berseem.

For intensive forage production year round the most productive rotation for tarai region of U.P. was found to be dinanath grass-berseem-maize-cowpea.

It was found that productivity of winter forages in Central, Peninsular, Western and Eastern India could

be increased by 50-100 per cent by growing winter maize intercropped with oat and lucerne.

4. Commercial Crops

The productivity of cotton has increased from 196 kg/ha to 265 kg/ha; sugarcane from 59.88 t/ha to 65.36 t/ha; tobacco 1111 kg/ha to 1340 kg/ha and jute and mesta 1524 kg/ha to 1656 kg/ha. Newly released varieties of sugarcane are making great impact on productivity and sugar production in the country. India has produced highest sugarcane and sugar in the world during 1989-90 and 1990-91.

In cotton, where India has the distinction of evolving the world's first hybrid cotton, a break-through has been achieved by development of inter-specific hybrid in "desi" cotton.

5. Oilseeds

In oilseeds, sunflower hybrid MSFH-17 has recorded over 16 per cent higher seed yield and 23 per cent higher oil yield per hectare over the best hybrids available. Although the crop went into commercial cultivation over a decade back, sufficient choice has only now become available in the sunflower belts with the recent released and notification of 7 hybrids. The crop has penetrated in the non-traditional irrigated areas in spring season, viz., Punjab, Haryana and U.P. in a big way. For the first time, 2 double purpose linseed varieties (Gaurav and Jeewan), having fiber and seed yielding abilities at par to the best flax and seed types, have been released and notified. With this, a long awaited dream of thirties is now fulfilled. In the linseed crop once again the very first powdery mildew resistant variety Jawahar-23 and first multiple resistant (wilt, rust and powdery mildew) variety kiran are in the great demand in the Central and Peninsular regions of the country.

6. Plant Protection

Plant protection is an essential and integral part of all crop improvement programmes. Greater efforts are necessary to reduce our dependence on use of chemical pesticides alone or preventing or minimising the disease/pest incidence. The concept of Integrated Pest Management (IPM) emphasising all round strategy to combat the health hazards to crop/horticultural plants i.e. resistant varieties, cultural practices, and application of bio-control agents minimizing the need for the application of chemical agents which have a potential to pollute the environment were pursued. Easily adaptable and economically viable IPM strategies have been developed for the control of major Pests in rice, cotton, pulses, sugarcane etc. Large scale success in biological control of crop pests had been in the conservation of biologically useful organisms through either selective use of pesticides or their avoidance. Control of *Pyrilla* and top borer of sugarcane, mealybug of coffee, lepidopterous pests affecting cotton, tobacco coconut, sugarcane, etc. are a few examples where success has been achieved through the release of bio-

control agents. Spectacular success has been achieved in biological control of two aquatic weeds, viz., water hyacinth in Karnataka and Kerala and water fern in Kerala.

Waiting periods for recommended pesticides on major crops have been determined and pesticide residues in agricultural products are being monitored in the market.

The Italian honey bee, *Apis mellifera* has been successfully established in Punjab, Haryana, Himachal Pradesh and Bihar. An eight-fold increase in honey production has been realised.

7. Hybrid Research and Seed Development

A special scheme has been launched for promotion of hybrid research in rice, pigeonpea, maize, bajra, sorghum, castor, sunflower, cotton and rapeseed/mustard for acceleration of hybrid seed development in a time bound manner. The first pigeonpea hybrid in the world was recently released and notified. Male sterility system based cotton hybrid MECH-4 has been developed. Similarly, promising hybrids in maize and pearl millet have been released. The on farm trails have demonstrated the potential of promising hybrids for their large scale adoption.

8. Genetic Engineering and Biotechnology for Crop Improvement

Simple, stable and easily identifiable morphological characters have been identified in maize during seedling and grand period of growth for identification of inbreds during field inspection. Appropriate isolation distances for seed production of various categories of seed in a number of crops and region/seasons have been standardised and production technologies worked out. It is established that genetic purity of cotton hybrid seeds can be ascertained by polyacrylamide gel electrophoresis of soluble seed proteins as well as of enzymes esterases.

9. Seed Technology Research and Breeder Seed Production

Efforts were made to strengthen research capabilities through assistance from sister national institutions/departments and international agencies. Beginning was made for giving momentum to the development of hybrids in important crops like rice, maize, sorghum pearl millet pigeonpea etc.

There has been distinct increase in the production of breeder seed of oilseeds (28023 q), pulses (14603 q), cereals (26040 q), and coarse cereals (1242 q). It is hoped that this would go a long way in fulfilling the quality seed requirement of improved varieties and hybrids in the country.

B. HORTICULTURE RESEARCH

10. Fruits

Three promising mango hybrids (Arka Aruna, Arka Puneet and Arka Anmol), 6 varieties of grapes, two

varieties (Arka Amulya and Arka Mridula) of guava, and improved acid lime selection (selection 49) have been developed and recommended. Ber cultivar 'Gola' and 'Kaithli' have been found to be promising in South India. In sapota, a hybrid was released for Tamil Nadu.

Softwood grafting has been commercially successful in mango, sapota and cashew in Maharashtra. Soil drench of 5g of paclobutrazol per plant improves flowering and fruit production in mango. In banana, high density (4444) plants per ha is possible for Dwarf Cavendish variety.

11. Vegetable

In vegetable crops 22 high yielding varieties in 10 vegetable crops namely brinjal, onion, garlic, peas, cowpea, bittergourd, bottlegourd, carrot, tomato and spongegourd; 24 F-1 hybrids in 5 vegetable crops brinjal, cabbage, cauliflower, carrot and tomato; 6 disease resistant varieties in 4 vegetable crops namely brinjal, tomato, pea and okra were developed and recommended for release.

In production technology, 17 improved agro-techniques were standardised and recommended.

Disease control measures against important diseases in cabbage, tomato, chillies, brinjal, okra were standardised and recommended.

High yielding strains of mushrooms, namely NCB-6, NCB-13 of *Agaricus* and five strains viz. NCS-1, NCS-5, NCS-12, P-1 and MS-39 of white button mushrooms were identified and recommended. Cultivation technology for oyster mushroom, *Shitake auricularia* and *Calocybe* has been standardised.

12. Potato and Tuber Crops

Two potato hybrids PJ-376 and JEX/C1 66 were recommended for release.

An alternate technology for raising potato crops through true potato seed (TPS) has been standardised and two populations of TPS viz. HPS 1/13 and TPS-3 have been recommended for commercial cultivation.

Onion in Satpura plateau and mustard in eastern UP were good companion crops. In Kangra region of HP Maize-Radish-Potato rotation was most remunerative.

The chemical control against late blight disease and cultural practices against brown rot disease in the hills were developed and recommended.

Three varieties of sweet potato viz. Kiran, Rajendra Shakarkand-47 and Bhuvan Gori and lesser yam variety Sree kala were recommended for release.

13. Plantation Crops

Coconut hybrids WCT X MoD, MYD, WAT showed better tolerance to drought conditions. Hybrids using West Coast Tall (WCT) and Chowghat Green Dwarf palm seems to be a promising variety/hybrid for the root wilt affected area.

In Cashew four varieties were approved for release

viz. BP8, Chintamani-1, Dhana and Ullal Cashew-3. These varieties have a yield potential of over 1 tonne/ha.

14. Spices

In black pepper, the promising hybrids 732 and 813 and cultivars 1558, 5128, 5834 were released. Improved varieties recommended for release are black pepper-Panniyur-5 (1255 kg dry pepper/ha). Cardamom ICR 1-1, ICR 1-2 and ICR 1-3; coriander DH-5, Fenu greek HM-57 and Lam Sel-1, Turmeric-Ranga and Rasmi, Ginger-Suruchi and Suravi are the improved varieties recommended.

15. Floriculture, Medicinal and Aromatic Plants

Rose varieties namely Benjamin Pal, Nurjahan, Raktagandha, Banjaran and Sindoor, Chrysanthemum varieties viz. Ajay, Sonali, Ratna, Swarna, Ravi, Kiran, Akash, Yellow Start, Chandrakant, gladilous varieties kumkum, Rangoli, Darshan and Dhiraj, Tambai and Rim Jhim were released for cultivation.

New variety released in Spearmint (*Mentha sicata*) is Punjab Spearmint-1 with 119-20 1/ha of oil. In Pipali (*Piper longum*) "Cheemathipalli is the first ever variety released. In Palmaroa oil grass-CI-80-68 and IW-4498 and in Vetiver NC-66403 and NC-66416 were released.

16. Post Harvest Technology of Horticultural Crops

Among various methods of precooling, forced air cooling was found to be most suitable for Nagpur orange packed in ventilated (FB cartons, destined for refrigeration, storage and transport).

Onion kept for curing in perforated plastic crates @10 kg/crate and stacking 5 crates in 5 columns with forced air circulation, one hour in morning and one hour in the evening resulted in very low spoilage.

A small scale palm-oil extraction unit costing Rs. 3 lakhs and to cater a plantation of 30 ha was developed.

C. SOIL, AGRONOMY AND AGROFORESTRY RESEARCH

17. Resource Inventory

An agro-ecological country map delineating the 20 agroecological regions (AER) based on physiography, soil and length of growing period has been prepared. The resource map of different states in 1:250,000 scale and the country map in 1:1 million scale have been prepared. The status of land degradation including degree and distribution of different kinds of degradation has been evaluated and depicted in the map. The information of these maps is being increasingly used for developing strategies and programmes for rehabilitation of degraded soils and for research on land use.

18. Cropping System Research

The Cropping System Research has resulted in development of sustainable cropping systems capable of producing 10-12 t/ha from irrigated areas. The intercropping systems involving cereals and legumes in different ratios has resulted in higher economic returns under reinfed conditions. Integrated management

strategy for control of weeds using tillage implements and herbicides has been evolved.

The research efforts resulted in identification of some multi-purpose tree species for different regions. Agro-forestry systems such as agri-horti-silvi pastoral, silvi pastoral, agri-pastoral, agri-horticulture etc. have been developed for different agro-ecological regions of the country. Intercropping of forest species such as *Prosopis cinneraria*, *Acacia nilotica*, *Tecomella undulata* etc. with annual crops such as sesamum, guar, bajra etc. were found suitable combinations under arid and semiarid ecosystems. Similarly intercropping of poplar with rice and wheat has been found profitable under northern plain eco-region.

19. Soil Management

Soil and water conservation techniques have been developed and promoted widely in watershed-based programmes which aim at resource conservation and productivity increase. Technologies for arresting wind erosion and stabilizing sand dunes have been developed. Salt affected soils are widespread in both irrigated and rainfed areas. Technologies for reclamation of alkali soils have been developed. Location-specific management strategies have been evolved for overcoming soil related constraints.

20. Water Management

The research efforts have resulted in evaluation of water requirements of crops, efficient irrigation schedules and methods of water application, identification of critical growth stages in respect of water demand and efficient cropping system to match water supply available on farm. Under high rainfall areas technologies have been developed for harvesting and storage of excess rainfall and its utilisation for crop production. Sprinkler and drip irrigation methods have been researched for their adoption under different agro-ecological regions. Technologies for profitable use of poor quality water have been developed.

21. Nutrient Management

A methodology for application of fertilizers based on soil-test values for obtaining desired yield targets of crops has been developed. Emerging micro and secondary nutrients deficiency in the soils have been delineated and methods for their amelioration have been developed and promoted. Nutrient management strategies for major cropping sequences have been identified. Research on biological nitrogen fixation by symbiotic, non-symbiotic organisms, blue-green algae and azolla have resulted in technologies that have been adopted widely.

D. AGRICULTURAL ENGINEERING RESEARCH

22. Farm Implements and Machinery

Notable development in agriculture machinery are bullock drawn tool frame, disc harrow-cum-puddler, bullock and tractor drawn seed-cum fertiliser drills, grain planters, long handle weeders; manual, tractor and

power tiller operated paddy transplanters, groundnut and potato planters, serrated sickles, sugarcane setcutter-cum-planter, sugarcane harvester, mango harvester, potato/groundnut diggers, self propelled reaper harvester and threshers harvesters.

23. Post Harvest Technology

Research achievements in post-harvest technology include development of grain separators, graders, shellers, decorticators, coconut/arecanut dehusker, mango/potato peelers, rice mills, dal mills, grain pearlers, low cost grain mills, seed extractors, say products and grain dryers, etc.

The lac in India enjoyed special importance as a natural resin for decorative, varnish, paints and as a sealing wax. Researches are being carried out to increase lac production through breeding insects and propagation of host plants. Diversified lac products are being developed for domestic and export market. The edible grade lac dye, aleuritic acid, perfume compounds, juvenile hormone analogues, agro-chemical are few products which have industrial application and export potential.

The jute is mainly utilised as packaging material though at present it is facing stiff competition from synthetic fibres. Its future lies not only as a packaging material but also in diversified application including export of yarns and products. The research and development have led to the design of products made from jute as decoratives, upholsteries, carpet backing, blanket, geo-textile etc. Technology has also been developed to utilise jute for making newsprints and packaging boxes.

Technical support for evaluation of fibre quality for development and release of cotton varieties. Technology of particle board, utilising cotton stick as raw material was transferred to a Farmer's Cooperative Society in Karnataka.

24. Energy Management

Equipment have also been developed for energy conservation/supplementation through appropriate renewable energy equipment, gadgets substituting/supplementing commercial energy in agriculture. Solar dryers, bio-gas, producer gas, solar cooker, solar heaters are few examples which are commercially available.

25. Drainage Engineering

Surface and sub-surface drainage technology was developed for waterlogged soil in the states of Madhya Pradesh, Andhra Pradesh, Kerala, Punjab, West Bengal. The experiments were conducted with the cooperation of farmers for increasing the crop productivity of paddy, wheat and soybean.

E. ANIMAL SCIENCE RESEARCH

26. Animal Genetic Resources

National Bureau of Animal Genetic Resources in

collaboration with species wise institutes, State Animal Husbandry Departments and State Agricultural Universities has developed programmes for their evaluation, characterisation, conservation and improvement. Improvement programmes on Haryana, Ongole, Tharparkar and Gir are going on. Programmes on improvement of indigenous breeds of sheep and goats are in progress. Data bases/banks were created by collecting and collating all types of information on animal germplasm resources available in the country. Animal gene banks have been established.

27. Livestock Improvement

Cross Breeding with improved exotic breeds was adapted to improve the low productivity of Indian breeds. In cattle, a number of new genotypes namely, karan Swiss, karan Fries and Frieswal have been evolved and are being improved through selection and progeny testing.

Programmes for improvement of Murrah and Surti breeds through progeny testing by associating the existing herds in the Country are in progress.

Three new high producing strains of sheep viz. *Avikalin*, *Anivashtra* and *Bharat Merino* have been evolved and are being improved through selection.

Two hybrids of poultry layer strain crosses, IIR-90 and ILM 90 with production level of more than 280 eggs per annum have been developed and released. Considerable amount of organised research on equines, camels, pigs, goats, quails, yak and mithun/production has been carried out at respective species institutions and encouraging results are available.

Studies on sorghum as a source of energy in poultry diet for replacing maize revealed that sorghum contains slightly less energy than maize but superior to maize in its protein content. Replacing maize at 50 to 100 per cent level by yellow sorghum resulted in comparable or better performance of broilers compared to those raised on only maize diet.

Methane production by Indian ruminants is slower than generally reported for India/Asia by the Scientists of developed countries. Through dietary manipulations, especially by increasing the quantity of concentrate in straw based diets, the ruminal methane production can be reduced.

Leucaena leaf meal (LLM) can be used as a sole protein supplement in the ration for economical milk production in goats without any visible adverse effect on their health and milk production performance.

The studies on Embryo Transfer Technology were continued. Technology was developed to achieve oestrus synchronisation by introducing vaginal passaries containing hormonal drugs. This could avoid periodic injections of the hormonal drugs for the purpose. During nonbreeding season also the ewes could be brought under oestrus and superovulation by using this

technique. The techniques of oestrus synchronisation, superovulation, embryo collection and transfer in ewes have been standardised. About 20 lambs have been produced so far through Embryo Technology.

For quick pregnancy diagnosis and reproductive evaluation, an enzyme immunoassay (EIA) for progesterone determination in whole milk and plasma was developed. An indigenous pregnancy diagnosis kit "Praman" using this technology was developed and further evaluated and test tried for rugged field use. The accuracy of pregnancy diagnosis using the kit was 75 per cent and non pregnancy diagnosis was 100 per cent.

28. Livestock Products Technology

The shelf life of raw milk could be enhanced upto 8-10 hour by adding 1 tablet containing potassium thicyanate and sodium per carbonate to 40 litres of milk.

Technologies using ultra filtration process have been developed for the manufacture of lassis powder (Plain and fruit flavoured) and mango shake powder and also Rasogolla mix powder.

Meat technology studies were conducted at the IVRI, Izatnagar on the transport practices of buffalo carcasses for long distances. A method for the estimation of succinate dehydrogenase and myoglobin in skeletal muscles was standardised for further studies related to damage of tissue during handling of meat for export.

New Zealand wool was more compressible and had less recovery compared to Beaver Chokla (BC) wool. Addition of BC helped in better performance. Coarser wools would resist compression better and give better recovery in carpets.

29. Animal Health

Details of achievements made during the last three years (1991-94) include the development of diagnostic and techniques, diagnostic kits, vaccines against rinderpest, foot and mouth disease, peste petits des Ruminants (PPR) equine influenza, equine infections, anaemia, equine herpes virus I, bluetongue disease, goat pox, infections bursal disease (IBD) theiheriosis, babesiosis etc. Besides encouraging research results have been made on cloning and subcloning of FMD types 'O', 'AZZ' and Asia I; *Theileria annulata*, *Babesia equi*, *Mycobacterium bovis* (Tuberculosis) and other important major diseases at the national level.

F. FISHERIES

30. Capture Fisheries

Stock assessment of 45 major exploited marine finfish and shellfish species is made and strategies for obtaining maximum sustainable yield suggested. Using the satellite data on sea truth, potential fishing grounds were located and results of fishing in these areas studied through vessel based investigations.

By adopting management strategies though detailed ecological studies of various reservoirs, a record fish

production of 220 kg/ha/yr has been achieved from a small reservoir as against the national average of 20 kg/ha/yr. Success in artificial fecundation of hilsa of the Hoogly and the Narmada estuaries and rearing of its young ones in freshwater habitat has been achieved. A modified portable plastic hatchery has been designed and fabricated for artificial fecundation of hilsa technology for rearing giant garden snails to marketable size as a potential foreign exchange earner has been standardized.

31. Culture Fisheries

Standardized techniques for induced breeding and hatchery technologies of Indian major carps, exotic carps, catfishes and freshwater prawns, advancement of maturity and multiple breeding of carps round the year and use of synthetic hormones (LHRH-A with dopamine antagonist) in fish breeding. Production rates of 17 tonnes/ha/year in intensive carp culture achieved. The technology of rearing seed at the rate of 10 million per ha with 80 per cent survival has been taken up commercially. Production of cultured freshwater pearls regular, half-round, irregular, pearl images from freshwater mussel, *Lamellidens spp.* Technology has been standardized for intensive raising of stocking material of golden mahseer (*Tor putitora*) in a flow through hatchery with ari water lift aeration system with 99 survival.

Shrimp seed production technology has been developed for *Penaeus indicus* and *Penaeus monodon* to the production levels ranging from 2 million to 20 million postlarvae per annum. The semi-intensive shrimp farming technology relating to *P. monodon* and *P. indicus* yielded a production rate of 3-4 tonnes/ha/crop. Microparticulate feeds (200-1000 μ m) for post-larval (PL-1 to PL-20)) rearing; and culture feeds of different grades and composition for shrimp grow-out system were produced. Standard diagnostic techniques for shrimp disease investigations through microbiological and histopathological preparations and examination has been developed. Successful demonstration of milkfish (*Chanos chanos*) culture in ground saline water ponds at Sultanpur in Haryana, yielded a production of about 3500 kg/ha.

Technologies for breeding, seed production, sea ranching and culture of commercially important shrimp species, pearl oyster and pearl production, edible oyster, milluscs, clam, seaweeds and seacucumber were commercialized.

32. Fish and Fish Processing Technology

A 15.5 m multi-purpose steel fishing vessel based on CIFT design has been launched. A new fuel efficient 4 blade propeller designed and fabricated for installation in medium size fishing vessel resulting in fuel saving upto 20-35 per cent. Designed and developed Ship Borne Data Acquisition System for monitoring 10 important parameters relating to marine meteorology, water quality and performance of the vessel. A 50 m high opening trawl designed, fabricated and operated

for off bottom fishes. Surgical sutures from fish gut were developed and technology perfected for commercialisation. Chitin/Chitosan and fish collagen developed under ICAR has been commercialized.

33. Fish Genetic Resources

Under long-term cryopreservation programme for Gene Banking, the milt of endangered mahseer and Indian major carps are being maintained for the last 3 to 5 years. Three years old cryopreserved rohu milt and one year old milt of mahseer used in breeding experiments yielding healthy offsprings indicating the viability of the cryopreserved milt.

34. Fisheries Education

CIFE has the distinction of being the first Fishery University in India. Besides conducting regular diploma and certificate courses in fisheries science, fisheries development and administration, fisheries extension and operational management, the institute also offers M.Sc. and P.HD programmes in different disciplines of fisheries sciences.

G. 35. AGRICULTURAL ECONOMICS AND STATISTICS RESEARCH

Some useful methods of construction of balanced incomplete block designs with nested rows and columns for test treatment-control comparison have been developed by extending the methodologies available for construction of such designs for all the elementary contrasts.

Some results have been obtained on optimality of block designs under mixed models. Results have also been obtained on optimality of designs for making test treatment-control comparisons under mixed models. A catalogue of designs which are optimal or have high efficiency has also been prepared.

The satellite data from Landsat (TM) for February 26, 1986 was used for obtaining improved estimators of wheat crop yield for district Sultanpur (U.P.).

A study was undertaken to evolve a suitable sampling methodology to measure the impact of command area irrigation project on agricultural products. The crops studied were paddy and groundnut. The index of the effect of command area was highly variable over the reached of canal as well as overtime being, in the range of 3 and 77, fertilizer use was of a much low order compared to the recommended levels. Both the average yield and fertilizer use did not show any association with the size of holding.

Software for mixed models useful in animal and plant breeding research has been developed. In the project Statistical modelling for comparing genetic groups of crossbred goats for growth studies based on multiple traits, genetic parameters such as genetic correlation, heritability for component traits as well as composite characters based on body weight, pin shoulder length, growth velocity and growth rate upto one month of age of animal were worked out.

National Research Centre for Agricultural Economics and Policy Research (NCAP) had undertaken (i) Preparation of National Agricultural Research Policy and (ii) Methodology for Prioritisation of Agricultural Research in the ICAR System. A study conducted on Rice Eco-System in India for sustainable Agricultural and Environment revealed a sharp decline in average response of fertilizers in rice in the major rice growing states. Besides, the study cautioned against nitrate pollution of the ground water, due to indiscriminate use of chemical fertilizers. Salinisation/alkalinisation of soils in the command areas has been caused by over irrigation and it was advocated that Integrated Fertility Management (IFM) and Integrated Pest Management (IPM) with increased use of bio-fertilizers, bio-pesticides, proper irrigation scheduling as well as choice of optimal crop-mix should be followed so that the adverse effect of the chemical technology on ecology could be minimised and the production system is made more sustainable.

The centre organised a 2-days workshops to review the current status of agricultural economics research in various ICAR Institutes on September, 21-22, 1993.

H. 36. SUPPORT SERVICES

To support agricultural research projects/programmes these are support services including Management and Information, Agricultural Education and Extension Education activities.

STATEMENT -III

Names of The Agricultural Research Projects Introduced During 1994-95.

The following project/research units under 8th plan have been sanctioned during 1994-95.

- i. National Research Centre on Orchids
- ii. Network - Micronutrient (Animal Science)
- iii. Network - Embryo Transfer in Animal Production
- iv. Network - Animal Genetic resources
- v. Network - R and D Support for Process Upgradation of Indigenous Milk Products for Industrial Application
- vi. Network - Crop Based Animal Production System
- vii. Strengthening of Monitoring Mechanism and Training of Scientists and Technicians (Animal Science)
- viii. Operation Research Project on use of Organic Waste in Aquaculture
- ix. National Research Centre for Women in Agriculture
- x. Establishment of 78 new Krishi Vigyan Kendras

STATEMENT -IV

Name of the International Cooperation Unit/Project	Basic Terms of Reference
1. Formulation and Commercialisation of Molasses Urea Block with Appropriate Technology International (ATI), Washington DC by National Dairy Research Institute, Karnal.	To initiate a research programme based upon previous technology and exploring formulation to take care of previous deficiency; To adopt an energy saving methodology using cold techniques for molasses urea block preparation. To develop a prototype for commercial production of molasses urea block.
2. Development of technologies for processing and formulation of Nuclear Polyhedrosis Virus of American Bollworm (<i>Heliothis</i>) with Natural Resources Institute (NRI), UK at TNAU, Coimbatore	To develop, process and formulation technology for NPV of <i>H. armigera</i> to enable field demonstration of wettable powder and oil based formulations on a large scale in the farmers fields in different agro-ecosystem
3. Use of Pheromones for the Control of stem borers by mating disruption with NRI, UK at Directorate of Rice Research, Hyderabad	To formulate pheromone based management techniques for the control of yellow stem borer, <i>S. incertulas</i> in rice. To develop monitoring methods using pheromones

Note : Each International Cooperation Project comes in operation only after proper negotiation and signing of a Memorandum of Undertaking (MOU).

Hazardous Chemicals

*215 SHRI KHELAN RAM JANGDE : Will the Minister of ENVIRONMENT AND FORESTS be pleased to state :

(a) Whether incidents of deaths, diseases, physical disabilities and major accidents are increasing in the

country, particularly in major cities due to hazardous chemicals;

(b) If so, the details of such chemicals which are identified as dangerous and which are used and produced in bulk;

(c) The steps taken to check storage and handling