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COMMITTEE ON AGRICULTURE
(2013-2014)

FIFTEENTH LOK SABHA

MINISTRY OF AGRICULTURE
(DEPARTMENT OF AGRICULTURAL RESEARCH AND EDUCATION)

‘NATIONAL AGRICULTURAL RESEARCH SYSTEM – AN EVALUATION’

FIFTY-EIGHTH REPORT

LOK SABHA SECRETARIAT

NEW DELHI

FEBRUARY, 2014 / MAGHA, 1935 (Saka)

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Vice Shri A. Elavarasan who ceased to be the Member of the Committee on his retirement from Rajya Sabha on 24 July, 2013.

COMPOSITION OF THE COMMITTEE ON AGRICULTURE (2011-12)

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30. **Shri Rajpal Singh Saini**
31. **Shri S. Thangavelu**

*** Nominated to the Committee on 04.05.2012.**

INTRODUCTION

I, the Chairman, Committee on Agriculture having been authorized by the Committee to submit the Report on their behalf, present this Fifty-eighth Report on 'National Agricultural Research System – An Evaluation'.

2. The Committee held a sitting for briefing on the subject on 07.10.2011 by the representatives of the Ministry of Agriculture (Department of Agricultural Research and Education). The Committee took evidence of the representatives of the Ministry of Agriculture (Department of Agricultural Research and Education) at their sittings held on 21.05.2012 and 05.07.2012.

3. The Committee held 13 Sittings in connection with the examination of the subject. The Committee received memoranda from 16 stakeholders/experts including representatives of State Agricultural Universities, Head of agricultural research institutions at Central and State level, former Directors Generals, Indian Council of Agriculture Research, Agriculture Scientist Recruitment Board. The list of experts and organizations whose representatives appeared before the Committee is given at Annexure.

4. The Committee wish to express their thanks to the Ministry of Agriculture (Department of Agricultural Research and Education) for furnishing requisite information and to the representatives of the Ministry who appeared before the Committee to tender evidence in connection with examination of the Committee.

5. The Committee also wish to thank all the experts who appeared before the Committee for personal hearing or submitted their memorandum in connection with the examination of the subject.

6. The Report was considered and adopted by the Committee at their Sitting held on 17 February, 2014.

7. For facility of reference, the observations/recommendations of the Committee have been printed bold at Part II of the Report.

NEW DELHI;
18 February, 2014
29 Magha, 1935 (Saka)

BASUDEB ACHARIA
Chairman,
Committee on Agriculture

CHAPTER-I

INTRODUCTION

Introductory :

The Famine Commission Report of 1880 led to the creation of the Departments of Agriculture at the Centre as well as in the Provinces with the primary duties of undertaking scientific enquiry and improvement in agriculture apart from famine relief. Most importantly, was the establishment of the Imperial Agricultural Research Institute in 1905 at Pusa, Bihar. Agricultural Colleges were also established at Pune, Kanpur, Sabour, Nagpur, Coimbatore, and Lyallpur. Organized scientific research on the problems of livestock started with the establishment of the Imperial Bacteriological Laboratory (now known as Indian Veterinary Research Institute) at Pune in 1889. This was preceded by the establishment of Veterinary Colleges at Lahore (1882) and Bombay (1886), later in Calcutta (1893) and Madras (1903). With the constitutional changes of 1919, responsibility for agriculture was transferred to the Provincial Governments. On the recommendations of the Royal Commission on Agriculture (1928), the Imperial Council of Agricultural Research (ICAR) was established as a Registered Society in 1929. After independence, the council was renamed as the Indian Council of Agricultural Research (ICAR) on June 10, 1948.

1.2 After independence, the National Agricultural Research System has undergone major changes. First, a number of State Agricultural Universities were established following the recommendations of the first Joint Indo-American Team in 1955. The first one was established in 1960 at Pant Nagar in the then State of Uttar Pradesh. There are now 69 Agricultural Universities (including ICAR, DUs, one State supported Institute, Deemed-to-be University status, 4 Central Universities having agricultural faculty and 1 Central Agricultural University) and 637 Kisan Vikas Kendras spread over different States. There are 6 National Bureaux, 17 National Research Centers, 25 Project Directorates, 80 All India Coordinated Research Projects/Network Projects. In addition, the NARS comprises of 47 research institutes of ICAR and four National Institutes of the ICAR, having status of Deemed-to-be Universities which are involved in

higher agricultural education at the postgraduate level. These are: (i) Indian Agricultural Research Institute (IARI), New Delhi; (ii) Indian Veterinary Research Institute (IVRI), Izatnagar; (iii) National Dairy Research Institute (NDRI), Karnal; and (iv) Central Institute of Fisheries Education (CIFE), Mumbai. These Institutes offer degrees in agriculture and allied areas. There is also a Central Agricultural University (CAU) at Imphal to cater to the needs of North-Eastern States.

1.3 On the basis of critical reviews and specific policy issues emanating from the recommendations of various Review Committees, the ICAR was reorganized first in 1965 to bring centrally sponsored research activities relating to crops, commodities, animal sciences, and fisheries under one umbrella. ICAR is an apex scientific research organization for planning, promotion, execution and coordination of agricultural research and education in the country.

1.4 Department of Agricultural Research and Education (DARE) was set up in the Agriculture Ministry to provide the ICAR with necessary linkage to deal directly with the Central and State Governments on the one hand and the International Organizations on the other. The Director General of the Council concurrently became the Ex-officio Secretary (DARE) to the Government.

1.5 The present agricultural research system comprises of two main streams, viz. the ICAR at the national level and the Agricultural Universities at the state level. Besides, several other agencies such as the Conventional / General Universities, Scientific Organizations, and various Ministries / Departments at the Centre, and also Private or Voluntary Organizations participate directly or indirectly in research activities related to agriculture. Among the major scientific organizations in the country, ICAR is unique in having concurrent responsibility for both research and education. Just as the University Grants Commission (UGC) plays a major role for the general education in the country, ICAR plays a similar role in the area of agricultural education. The Charter of the ICAR also includes extension education, which is carried out through a network of projects and other mechanisms.

1.6 The research programmes under the umbrella of the ICAR are designed and undertaken for harnessing power of science that ensures food, nutrition and livelihood security for all. Research and technology development has enabled the country to increase production of foodgrains by 4 times, horticultural crops by 6 times, fish by 9 times, milk by 6 times, and eggs by 27 times since 1950-51; thus making a visible impact on the national food and nutritional security. It has also played a major role in promoting excellence in higher agricultural education. NARS is engaged in cutting-edge science and technology development, and is internationally acknowledged in several agriculture and allied sectors.

Organizational Structure

1.7 As a Registered Scientific Society, ICAR now enjoys an autonomous status and it follows *mutatis mutandis* Government of India rules and regulations. It observes all procedures for the preparation of its plan, their scrutiny and approval by the Planning Commission, Finance Department, etc. The Minister for Agriculture in the Government of India is the President and the Minister of State for Agriculture is the Vice-President of ICAR. In its functioning, ICAR is assisted by a number of bodies which provide direction and guidance on policy, technical, administrative, financial and other matters concerned with the national agricultural research and education efforts.

I. **General Body:** It is the supreme body, which transacts the business of ICAR. It is presided over by the Minister for Agriculture in his capacity as the President of the Society and its membership is large. It is represented by many Ministers in the Centre as well as the States, elected representatives of the people, representative of rural interests, farmers, Chairmen of Scientific Organizations, Director General (ICAR), Vice-Chancellors of Agricultural Universities, Directors of ICAR Institutes, technical representatives, and others. It meets at least once in a year and reviews the progress and performance of ICAR and gives such policy directions as it may deem fit to the Governing Body and other constituent units of the Society.

II **Governing Body:** It is the chief executive and decision-making authority, and is responsible for the governance of ICAR as a whole. It is pre-eminently a body of scientists and those with interest in or knowledge of agriculture, and is presided over by the Director General. It manages, administers, directs, and controls all the affairs and funds of ICAR, subject to the byelaws and orders of the Society. It prescribes polices, approves all research

programmes and exercises control over the budget of ICAR. It meets once in three months and its decision will be final after approval by the President of ICAR.

III. **Standing Finance Committee:** It is a subsidiary of the Governing Body with members drawn from it, and is presided over by the Director General of ICAR. It examines the annual budget of ICAR and the financial implications of all the proposals, including research projects, before submitting to the Governing Body for approval. Similar to the Governing Body, this Committee also meets once in a quarter and its decision become final after approval by the President of the Society.

IV. **Regional Committees*:*** The Governing body of ICAR has constituted eight Regional Committees on the basis of eight agro-ecological regions identified in the country. The Director General, ICAR is the Chairman of these Committees. Other members of the Regional Committee comprise of; i) members of the ICAR Society residing in the region, ii) Chairmen of the Development Councils constituted by the Department of Agriculture of the Government of India located in the region, iii) Directors of ICAR Institutes in the region, iv) Scientists / Technical representatives of the Agricultural Universities, State Development Departments related to agriculture, animal husbandry, fisheries, *etc*., Central Institutes, and Department of Agriculture of the Union Ministry of Agriculture, and v) farmers nominated by the President of the Society. One of the Directors of the ICAR Institutes in the Region acts as the Member-Secretary. These Committees meet once in two years. The primary functions of these Committees include; i) to review the status of agricultural research and education in the region, and ii) to analyze, discuss and make recommendations on the location-specific problems of agriculture, animal husbandry, fisheries and forestry peculiar to the region. The proceedings and recommendations of these Committees are put up to the Governing Body for information.

To encourage participation of State Govt. officials in the Regional Committee Meetings, these meetings are being planned to be organized in State Capitals and Chief Ministers/Governors are being requested to inaugurate the meeting. Principal Secretaries of Agriculture, Animal Husbandry, Fisheries etc. of concerned State Governments are being invited by Secretary (DARE) and also a letter from the Secretary, DoAC, is sent to the State Govt. Secretaries for active participation. The state specific interactions are also being arranged.

V. **Accreditation Board:** To improve and sustain the quality of agricultural education, and in pursuance of Rule 51 of the ICAR Society, an Accreditation Board was established in 1996. The DG, ICAR is the Chairman of Board and the other members include DDG (Edn) as Vice Chairman; three Vice Chancellors of SAUs, two eminent agricultural/animal scientists, two eminent individuals representing agriculture/industry, secretaries of UGC, AICTE and

VCI, and Director of ICAR-DUs and members, and the ADG (Accreditation) as Secretary. The Board is assisted by three Sectoral Committees on (i) Accreditation norms, and new institutions and programmes, (ii) Curricula and equivalence, and (iii) Governance, and personnel and financial policies.

1.8 On the technical side, the Director General is assisted by eight Subject Matter Divisions, one each in the fields of i) Crops, ii) Natural Resources Management iii) Education, iv) Animal Science, v) Extension, vi) Horticulture, vii) Fisheries, and viii) Agricultural Engineering. A Deputy Director General (DDG) heads each Division, and they are entrusted with the overall responsibility for the preparation, scrutiny, review, and technical supervision and guidance of the research schemes, educational programmes and projects within their respective disciplines. They are, in turn, assisted by 24 Assistant Directors General (ADGs) and other senior scientists dealing with sub-disciplines within these eight major areas. These Technical Divisions guide and service all the ICAR institutes. There is a Plan Implementation and Monitoring Unit and a Coordination Unit headed by ADGs. There is yet another National Director (NAIP), who looks after the World Bank-aided National Agricultural Innovation Project. On the Administrative side, the Director General is assisted by the Secretary, ICAR in administrative matters including international cooperation and personnel, and a Financial Advisor on financial matters and control of budget.

1.9 A new personnel policy was evolved and an All India Service called the Agricultural Research Service (ARS) was created in 1975 to facilitate optimum utilization of the available manpower. Consequently, a new Agricultural Scientists Recruitment Board (ASRB), with an eminent scientist as a full-time Chairman and assisted by two scientists as Members, was established to recruit scientists to various positions in the ICAR.

Research Infrastructure and Programmes

1.10 Although agriculture is a State subject, ICAR has established many Central Research Institutions over the years to meet the agricultural research needs of the country. These are essentially meant for: (i) implementing research mandates extending beyond the administrative boundaries of the States; (ii) pursuing basic research not

undertaken by most Agricultural Universities; (iii) evaluating research results through multi - location testing; and (iv) developing manpower for Agricultural Universities and other agricultural institutions.

1.11 The **Central Research Institutes** are engaged in basic and applied research on specific crop/animal/ commodity/discipline and transferring the results thereof. Some institutes undertake multi-crop and multi-disciplinary research, teaching and training for manpower development. The **National Bureaux** collect, conserve and initiate such measures as would lead to long-term productivity of basic resources like plants, animals, fish, microorganisms, soil and water.

1.12 The concept of **National Research Centres** (NRCs) revolves around the need for concentrated attention with a mission approach by a team of scientists from different disciplines. They work under a senior leader on selected topics, which have direct or indirect relevance to resolving national problems in a particular crop or commodity or a problem area of research. Some of the NRCs grew into full-fledged institutes once their standard of work has established and their subjects assumed greater national importance.

1.13 Because of the importance and magnitude of the work involved in a single commodity like rice, wheat or poultry, or a group of commodities like oilseeds, pulses and vegetables, ICAR has upgraded some of its research infrastructure/projects with added responsibilities, and designated them as Directorates. The Directorates undertake some research besides playing such national service roles like maintenance and supply of germplasm, organizing off-season nursery to promote and speed up research interests, monitoring pests and diseases, forecasting and issuing clearly warning about the pests and diseases outbreak, and performing such duties as a lead centre in relation to their respective subject matter, and so on.

1.14 In addition to its institute-based research, ICAR promotes research schemes / projects in agriculture and allied areas to resolve location-specific problems. It is involved in a cooperative endeavor with other research organizations in carrying out

multidisciplinary research programmes. Such promotional schemes fall under the following categories :

A. All India Coordinated Research Projects (AICRPs)/ Network Projects

1.15 These projects have been essentially conceived as an instrument to mobilize available scientific resources to find effective solutions for the national problems of agricultural production through inter-institutional interactions. The projects are developed as multidisciplinary and problem-oriented projects with a major emphasis on multi-location testing of new materials/production systems. They provide opportunities for scientists working on similar problems in different institutions to come together, discuss and exchange ideas, information, and materials for mutual benefit. They also provide them with facilities for multi-location testing of improved technologies developed by various subsystems in different agro-climatic regions. The projects constitute an effective national grid of coordinated experiments by integrating different institutions and disciplines.

1.16 The All India Maize Improvement Project, launched by the ICAR in 1957 to improve maize production using hybrids, was the forerunner of this approach. Its remarkable success led to the extension of this approach to all the major crops and other areas like animal science, fisheries, soils, agricultural engineering, horticulture, etc. Subsequently, many such coordinated projects were initiated. Each project is generally sanctioned for a period of 5 years and is headed by a full-time Project Coordinator with a Coordinating Unit to assist him. These Units are located either in the ICAR Institutes or the Agricultural Universities depending upon the location of the project. The technical programmes of the individual projects are carried out by many cooperating centres located in the participating institutions. Regular workshops, either annual or biennial, are organized by the individual projects in which the technical programmes are finalized. The Project Coordinator is guided and serviced on all matters by the concerned Assistant Director General in the ICAR headquarters. There are 80 such projects currently.

1.17 The expenditure on these projects has increased steadily and nearly one-fourth of the ICAR's budget is now used on these projects. The expenditure is shared by the ICAR and the collaborating institutions on 75:25 basis. A high degree of accountability, based on continuous monitoring, is a noteworthy feature of these projects. Outstanding achievements have been made through these projects, and the development of such an approach has been a source of inspiration to many developing countries.

B. Sectoral Programmes

1.18 There are 74 main Schemes of ICAR which could be classified as (a) deemed and central universities of ICAR for conducting basic and strategic research and imparting higher education, (b) national institutes for upstream research, (c) bureau for collection, conservation, evaluation, classification and documentation of natural resources and strategic research support for their management and effective utilization, (d) national research centres for basic and strategic mission-oriented research for feeding into the coordinated research system, (e) directorates/project directorates to support research through coordinated programmes for location, situation and system specific technologies and (f) centres for frontline extension. Out of them, there are 15 schemes in crop science, 9 in Horticulture, 14 in Animal Sciences, 13 in Natural Resource Management, 6 in Fisheries, 3 in Agricultural Extension, 5 in Agricultural Engineering, 3 in Agricultural Education and 6 in ICAR, Headquarters including DARE and World Bank funded project.

C. Landmark Institutional Evolution in NARS

1.19 The Department giving details of critical analysis of the mandate of NARS and the achievements since 1950 upto 2010, stated that in pursuance of its mandate, the Council, over the years has taken several initiatives that have contributed significantly towards development and spread of agricultural technologies in the country. Some of

the landmarks institutional set up for technologic upgradation in agriculture sector are as follows:

- First All-India Co-ordinated Research Project - 1957
- Status of Deemed University accorded to IARI in 1958
- First State Agricultural University on land grant pattern at Pantnagar - 1960
- Agricultural research institutes under the purview of ICAR- 1966
- Department of Agricultural Research and Education, Ministry of Agriculture- 1973
- National Demonstration Project- 1964
- First Krishi Vigyan Kendra (KVK) at Puducherry (Pondicherry)- 1974
- Operational Research Project (ORP) - 1974
- Agricultural Research Service and Agricultural Scientists' Recruitment Board- 1975
- Lab-to-Land Programme – 1979
- National Agricultural Research Project (NARP) - 1979
- Division of Agricultural Extension, ICAR-1984
- Division of Horticulture, ICAR -1987
- Division of Fisheries, ICAR -1988
- Division of Agricultural Engineering, ICAR -1988
- Central Institute of Fisheries Education, Mumbai and National Dairy research Institute, Karnal, got the Deemed University Status – 1989
- Central Agricultural University, Imphal Established - 1993
- Institution-Village Linkage Programme (IVLP) – 1995
- Accreditation Board Established in ICAR - 1996
- National Gene Bank at New Delhi-1996
- National Agricultural Technology Project (NATP)- 1998
- Agriculture Technology Information Centres- 1998
- National Agricultural Innovation Project (NAIP) - 2006
- AgrInnovateIndia-2011
- National Initiative on Climate Resilient Agriculture Launched – 2011
- Quality Management Systems Certification ISO 9001:2008 conferred to ICAR headquarter and DARE - 2013

CHAPTER-II

ALLOCATION TO NARS

The ICAR in consultation with all the stakeholders have prepared a 1st ever policy framework for Research and Development in Agriculture and Allied areas. It spells out the key note of public sector governance, funding and execution of agricultural research and education.

ELEVENTH PLAN ALLOCATION AND EXPENDITURE

2.2 The details of funds proposed, allocated to various constituents of National Agricultural Research System during the Eleventh Plan period and the funds allocated at RE stage and the actual utilization are at **Annexure I and II.**

2.3 The Eleventh Plan Working Group for DARE / ICAR had recommended an amount of Rs. 31,672.00 crore. However, only Rs.12,023 crore was communicated against the proposal of Rs. 12,176.40 crore as per the instructions of Planning Commission. Further, an amount Rs. 10,325.76 crore (RE) was allocated during the Eleventh Plan for the purpose. The fact that Agricultural Research and Education is underfunded has been emphasized and Parliamentary Standing Committee on Agriculture has been recommending an allocation equivalent to atleast one per cent of Agricultural GDP.

2.4 During the XI Plan, resources were broadly allocated across commodities in accordance with relative economic importance of commodities. Research on crops received relatively more resources and Foodgrains and Horticultural Crops together account for about 22 percent of the resources, the livestock and fisheries received nearly 8.4 per cent. The natural resource management including National Initiative on Climate Resilient Agriculture and agricultural engineering component accounted for around 12 per cent of the total allocation. The World Bank funded National Agricultural Innovation Project has also been given due importance with about 10 percent allocation. Support to higher agricultural education and extension education have also received substantial allocations which come to around 41 per cent of the resources.

2.5 When asked about utilization of funds the Ministry stated that the Department was able to utilize only Rs 9800.36 crore against the allocation of Rs. 10325.76. As such, there is no significant reduction in achievement of targets because of under utilization of actual allocation.

2.6 During the oral evidence, Secretary DARE submitted before the Committee as follows :-

> "We had also submitted in what way we went about prioritising our research programmes and we achieved most of the things. At the same time, we also had some activities, which we told that we would take it to the next Plan."

2.7 When asked non achievement of 4% growth projected in XIth Plan and the difficulties faced to achieve the same, the Secretary informed the Committee as follows:

> "Against the projected 4 per cent growth rate, in the fist year as well as in the second year, it was only hovering around 1.5 per cent to 1.8 per cent. The closing figure at the end of XIth Five Year Plan end is 3.3 per cent. That is the agriculture's growth rate at the end of the 11thPlan. This is what the review says because the sub-sectors of agriculture like horticulture showed more than six per cent. For example, milk, meat and so on. They all showed 6 to 6.5 per cent, fishery, and aqua culture showed 6 to 6.5 per cent. These have contributed to something and this figure virtually doubled from 1.5, 1.6, 1.8 to 3.3 per cent".

2.8 In support of the above the Director National Centre for Agricultural Economics and Policy Research added :

> " The model which was prepared for 11th Plan to achieve 4 per cent growth was based on four or five assumptions. The fist assumption was that public investment in agriculture in the form of infrastructure, irrigation, water conservation, and land etc. which at that time had dripped to 2. 5 per cent, recommended to be increased to the 4 per cent.
>
> Then, the second aspect was that the R&D expenditure was around 0.5 per cent. Dr. Hanumantha Rao prepared that model under his guidance. It was a strong recommendation that the R&D expenditure must also increase from 0.5 per cent of agriculture GDP to one per cent. Then, there was the recommendation about agriculture credit for seed, hybrid and all these things. Within those five or six recommendations, we could achieve only in agriculture credit and seed. The other recommendations which were underlying that model that we would be achieving four per cent growth rate fell a bit short. I think that has been a major factor because we did not increase the total public investment, R&D investment and also hybrid growth. Of course, hybrid growth is there but not to the desired extent. We just settled at a growth rate of 3.2 per cent. We could not go to 4 per cent. My own analysis is that had we done those things, there

would have been a prospect of moving closer to 4 per cent. Though the DG (ICAR) is not saying this thing directly, yet it is a fact. Had those things been done, we would have been closer to 4 per cent growth rate".

2.9 During oral evidence witness informed the Committee :

"xxx xxx within ICAR also there is a problem. It is skewed distribution, it is not inclusive distribution, it is not equitable distribution. The other problem in the ICAR is, there are 6,000 scientists and there are 97 institutes. They have opened very small commodity-based institutions. This commodity-based institute concept we inherited from the British because the British were interested only in a few commodities. They were interested in jute, they were interested in cotton, they were interested in sugarcane and so they have opened small commodity-based research institutes. But that does not suit our needs now. I think ICAR should move away from that concept. Instead of having commodity-based research institutes, they should open more comprehensive institutes. In Patna we have opened an institute where everything has been taken care of. So, we have to open more comprehensive institutes. We have to reduce the number of crop institutes because they do not have work throughout the year. A crop is only for four months. So, what will they do in the remaining period? Therefore, if you want to make full use of the scientific manpower and the resources available in the ICAR, then we have to do away with commodity institutes. We have to make reasonably viable units and then we can work into the farming system approach which is very essential.

Ultimately, I come to the real issues. One is, out of 18 crops, 75 per cent of the crops have registered a decline in their factor productivity and it must be reversed with good research. We want some good research and we want to spread research to other commodities also not only to wheat and rice.

2.10 The Committee when desired to know the reason for the decline in productivity, he stated as follows:

"It is because it is not inclusive distribution of the budget and scientists. Most of the scientists and budget have gone to the crop sector. Then, within the crop sector also, allocation has gone to rice and wheat only and it has not gone to other crops. Other crops have not been given that much attention. That is why, there is a decline in factor productivity in 75 per cent of the crops."

2.11 About the inter disciplinary and inter sectoral approach of research a non-official witness stated as follows :

"जब मैंने कहा कि **system-wise approach in a system perspective,** उसमें मेरा सीधा मतलब था कि किसान अपने खेत पर गेहूं, धान, चना वगैरह उगाता है, साथ में वह पशुपालन भी

करता है, कोई-कोई किसान मछली-पालन भी करने लगे हैं, कोई-कोई किसान वेजीटेबल और हॉर्टीकल्चर भी करने लगे हैं। मेरे कहने का मतलब यह है कि किसान का ऑल्टरनेट मॉड्यूल बना दीजिए, जिसमें सिर्फ तथाकथित क्रॉप्स ही न हों, और चीजें भी समन्वित कर दी जायें। हमारा जो रिसर्च का स्ट्रक्चर है, वह क्रॉप बेस्ड है, हमारी रिसर्च का जो स्ट्रक्चर है, वह एनीमल बेस्ड है, डिसिप्लिन बेस्ड है, इसको इण्टर डिसिप्लिनरी-इण्टर सैक्टोरल कर दीजिए और वह कैसे होगा, उसके लिए मेरा सुझाव है कि इस स्ट्रक्चर को तोड़ने की आवश्यकता नहीं है, प्रागमिटी का एलाइनमेंट कर दीजिए कि यह प्रोग्राम है, **10, 15, 20** प्रोग्राम्स विभिन्न परिस्थितियों के लिए हैं और हर व्यक्ति उस अनुसंधान में अपना योगदान दे तो साइंस के एक्सीलेंस के लिए वह डिसिप्लिनरी मोड के जो लोग, जहां टैक्नोलोजी की बात आती है, वहां थ्रू प्रोग्राम मोड ऑफ ऑपरेशन इण्टर डिसिप्लिनरी और इण्टर सैक्टोरल मोड में आ जायें, इसके लिए प्रोग्राम बनाने की जरूरत है और उसके लिए एलाइनमेंट करने की जरूरत है, ताकि ये डिफरेंट संस्थान अपना योगदान दे सकें।

TWELFTH FIVE YEAR PLAN

2.12 The Department has stated that the funds sought by the department for the entire XII Plan is Rs. 57887.21 crore in December 2012 and extensive interactive meetings with the Working Groups and Steering Committee on Agriculture and allied sectors were held at various locations wherein DARE/ICAR participated after which a figure of Rs. 25,553 crore was communicated. Pending approval of XII Plan, the Planning Commission has made an allocation of Rs 3220 crore (BE) in the Ist year of the XII Plan i.e. for the year 2012-13, which is 13 per cent higher than the terminal year of the Eleventh Plan. A proportionate fund allocation (BE) for the first year of the plan was conveyed to various divisions. At RE stage, it was reduced to Rs. 2520 crore. This reduction happened across all Divisions of the Department. Rs. 3415 crore has been allocated for 2013-14 (2nd year of XIIth Plan).

2.13 The XIIth Plan Working Group on Agriculture Research and Education has recommended that a sum of Rs.55,000 crore should be provided to various sectors, which in addition to EAPs / World Bank Aided Projects like National Agricultural Education Project and National Agricultural Entrepreneurship Project also include the funding under Extra Mural fund, Farmer Innovation, Public-Private Partnership, Inter-Department Platform etc.

2.14 On being asked about the allocation made to DARE/ICAR during the XIIth Plan Period the Ministry in their written replies stated as follows :-

"The funds sought by the Department for entire XIIth Plan was Rs. 55,000 crore the Secretary during the evidence explained the major heads where the money would be required. We are trying to project 20 consortia platforms in a very aggressive manner bringing together expertise from all over the country. No duplication, but bringing real capacity, whether it is Haryana, or Pant Nagar or whatever. So, for that there is exclusive Rs. 5000 to 6000 crore. The next point is Technology Forecasting Centre. We have a kind of a global search, global scouting for technology, equipments and so on, extra mural funding. Bird flew comes and we don't have 01 crore so that we can invest immediately, post doctoral fellowships. We have set aside Rs. 4000 to 5,000 crore for this. Then the next thing is whatever we have invested in crops, horticulture, animal, fish, sector-wise, that is a clear doubling because with the pay commission increase, the real money available for research should be much more.

For example, we have said that Rs. 3 lakhs should be given per scientist per year so that we can do active research. The next is the State Agricultural Universities. Today, unless we put something like Rs. 200 crore into each university, our infrastructure will not improve. So, our infrastructure has to improve. In the last five years, we have started doing some modernisation in the farms in the agricultural university. We have attempted it. But they require real investments to make as state-of –the-art laboratories. Our universities should be at a high level. In 1960s we started with the pattern of US at a very advanced level. Now, over the years, infrastructure has to be upgraded. So, we said that universities clearly need about Rs. 10,000 crore.

Then as regards KVKs, 634 KVKs are there. Today, our annual average contingency available for each KVK is not more than Rs. 5 lakhs. With this Rs. 5 lakhs, with just Rs. 45,000 per month, what can we deliver really? So, we have said that it should be at least Rs. 25 lakhs. This is the break-up of the Rs. 55,000 crore.

As regards the national initiative climate resilient agriculture, we are running a national fund for basic strategic research, the national agricultural innovation project and the national agricultural education project. This is the break-up of the Rs. 55,000 crore".

2.15 The Secretary DARE pleaded the Committee as follows :

" At this stage, our submission again is for the allocation to DARE and ICAR. xxxx xxxx xxxx. At this stage we are seeking more flexibility in operations in terms of reallocation between the heads, between the sectors and so on. xxxx xxxx xxxx. From the Department side whether they are consortia platforms, extra mural funding, post doctoral fellowships, technology forecast centre, all these kinds of things we are trying to bring up as new initiatives. If the funds are available, we would like to take up every single aspect".

2.16 Giving details of the challenges faced by the Agriculture sector the Ministry in their written replies stated that the Agriculture Sector in India faces various type of challenges viz. small farm holdings, varied kind of climate, upland-lowland problems, natural disasters like several districts reeling under floods with several others experiencing drought at the same time. We are constantly studying the effect of structural change in land holdings on agricultural productivity and performance. The ways and means to improve livelihood of small holders are also being worked out.

RESEARCH INVESTMENT IN AGRICULTURE

2.17 According to the DARE the Indian NARS is one of the largest in the world. Public spending on agricultural research and education (R&E) was estimated at Rs. 30,600 million annually (2005). It is backed by 22,000 scientists in the research/education/extension education in public sector alone. However, in relation to the size of the agricultural sector, the investment intensity is low at 0.6% of agricultural GDP. Further, there is considerable inter-state variability in intensity of state funding, ranging from 0.8% in UP to 1.4% in HP. With the exception of a few states, commitment to R&E is not strong.

2.18 The Secretary, DARE during the oral evidence submitted before the Committee as follows :

> "Globally one or two percent of the GDP should be invested in the R&D xxxx xxxx xxxx here also. We have been pleading for 1% of Agricultural GDP. xxxx xxxx xxxx. The DARE is mandated for funding for the SAUs xxxx xxxx xxxx one is the SAUs being State Government's creation, need to invest more. We have requested the Dy. Chairman Planning Commission and he has written to State Governments to make a higher allocation and also for the budget hike for the agricultural research education in the States xxxx xxxx xxxx. From the DARE, we have pleaded that the investment into universities for infrastructures should be at much higher level".

2.19 According to the DARE the cultivated land areas in the country is 140 million hectare for last 6 decades and it has not increased while the population of the country has increased to 121 crore people. According to the Department to attain 4%

agricultural growth, as targeted by the Planning Commission, at least one-third of this growth must come through technological innovations and the remaining two-thirds has to be achieved through additional use of agricultural inputs. To meet these targets, investments on agricultural research need to be doubled by 2015 and tripled by 2020 in relation to the investment level of 2002.

PROMOTING INVESTMENT IN AGRICULTURE BY PRIVATE SOURCES OTHER THAN FARMERS.

2.20 Partnership with private sector has seen a new approach for growth in ICAR. It is based on the principles of joint IPR ownerships and pre-decided licensing rights on mutually agreed terms as illustrated in the ICAR guidelines for IP management and technology transfer/commercialization. The World Bank-supported National Agriculture Technology Project (NATP), followed by National Agriculture Innovation Project (NAIP) has also provided impetus to these efforts. The public-private partnerships in the ICAR have largely been used as a vehicle to enhance technology transfer/ commercialization through MoU/MoA/MTA/Agreements/ Licensing/ Consultancy contracts etc. The XI Plan scheme on 'Intellectual Property Management and Transfer/ Commercialization of Agricultural Technologies Scheme' has facilitated developing a decentralized system. Accordingly, the Institute Technology Management Units established in all institutes have been empowered to enter into partnerships with the private sector within the overall policy framework of ICAR rules and guidelines.

2.21 A middle-tier of five Zonal Technology Management & Business Planning and Development (ZTM&BPD) Units has been established for reorienting the Business Planning and Development pursuits and thereby improving efficiency for effective execution of technology transfer/commercialization. Consequently, as per information received, about 385 technologies/knowhow have been transferred/commercialized through more than five hundred partnerships developed with external agencies. In 203 sub-projects of various components of National Agricultural Innovation Project (World Bank-supported), there are 212 private sector organizations including NGOs participating in these consortia. The partnerships for such transfer include *inter alia*, commercialization of both IP protected and non- IP protected technologies.

2.22 The complementary strategies being proposed in the XII Plan Scheme include creation of Innovation Fund and Incubation Fund for appropriate technology development and its faster dissemination by creating an interfacing and networking mechanism between R&D institutions, industries, farmers and grassroots innovators.

2.23 AGRINNOVATE INDIA LIMITED, a registered Company under the Companies Act, 1956 owned by the Government of India in Department of Agricultural Research and Education (DARE) has been established to work on the strengths of DARE's Indian Council of Agricultural Research (ICAR) and promote the development and spread of R&D outcomes through IPR protection, commercialization and forging partnerships, both in the country and outside, for the public benefit.

2.24 Capital investment in agriculture by private sources (by farmers) has undergone an increase after 2003-04. It has increased from less than 10% of GDP agriculture in 2003-04 to close to 14% during 2009-10. Similarly, public sector capital investments have also increased after 2003-04. There is also a need to promote investment in agriculture by private sources other than farmers that is by private business particularly in post harvest infrastructures and facilities. Agriculture research can contribute in attracting capital to the agriculture in two ways: (i) by improving profitability and efficiency of investment in agriculture; and (ii) by forging public-private partnership particularly in technology up-scaling and dissemination.

2.25 The Ministry have in regard to the agricultural research in PPP modification and projects in NARS stated that the public-private partnership in the National Agricultural Research System (NARS) has mainly been used as a vehicle to enhance technology validation and transfer/commercialization, and not research per se.

2.26 For research per se, there have been cases of such initiatives, mainly in the areas of farms implements and machinery and processing and value addition; and under the World Bank supported National Agriculture Innovation Project (NAIP) – again mainly in value chain related projects, and some on research for sustainable livelihood security. Accordingly, 21 projects have been listed from the Agriculture Engineering Discipline and under NAIP, 203 sub-projects involving 212 numbers of private sector

organizations including NGOs participating in the consortia formed. Additionally, there have been PPP programs for joint testing of products e.g. hybrids in crops and growth promoting products; to arrive at suitable location-specific interventions/technologies.

2.27 ICAR have signed MoUs with private partners limited to commercialization of varieties, hybrids and products. It is realised that the potential to obtain system wide impact could be much higher in the new approaches of consortia and partnerships, rather than the traditional approach of undertaking R&D separately by the public sector system. The approach has been to widen the focus, from research for technological innovation, to building a complete value-chain around the innovation spectrum. A modest beginning under NAIP.

CHAPTER-III

RESEARCH PLANNING AND MONITORING

The DARE provides Government linkages to the ICAR – an apex and autonomous organization for planning, promotion, execution and coordination of agricultural research and education in the country. It also discharges other governance responsibilities like coordination of Central and State Government agencies on International matters relating to agricultural research and education. The mandate of ICAR inter-alia involves responsibility to plan, undertake, aid, promote, cooperate, education and research and its application in agriculture, animal sciences, fisheries, agroforestry, home science and allied science.

ICAR & SAUs Linkages

3.2 Regarding the factual position on a growing opinion that the national agricultural research strategies and plans have not recognized the potential role of SAUs and have not provided mechanisms to link and integrate SAUs research into the overall National Plan, the Ministry in their reply stated that DARE/ICAR has always worked in close coordination with the State Agricultural Universities, and addressed the ICAR Institutions and the State Agricultural Universities as an integrated National Agricultural Research System. ICAR holds Vice Chancellors' Conference biannually, which are attended by the Vice Chancellors of all the Agricultural Universities, and where the agenda for discussion revolves around the strategy and direction of agricultural research in the country. ICAR also assists the State Agricultural Universities financially. In the XI Plan for example, it had a plan scheme called "Strengthening and Development of Higher Agricultural Education in India" under this schemes funds have been provided to the State Agricultural Universities for the purposes such as strengthening of agricultural farms, niche area of excellence, etc.

Year wise allocation of SAU under this scheme is as under :-

Year	Amount (₹ lakhs)
2007-08	35849.56
2008-09	37697.94
2009-10	36499.96
2010-11	44600.00
2011-12	48689.00
Total	203336.46

3.3 ICAR also provides voluntary accreditation to the State Agricultural Universities if they meet the basic academic standard. So far thirty five universities have been accredited with ICAR. ICAR also selects and provides 15% Under-graduate students and 25% post-graduate students to State Agricultural Universities, and these students are drawing fellowship from ICAR.

3.4 ICAR has established a large number of All India Coordinated Research Projects (AICRPs), that link up research programmes in the ICAR research institutes and the State Agricultural Universities in a co-ordinated framework and cover areas like, crop improvement, soil test crop response, tillage management, water management, microbiological decomposition, cropping systems, saline soils, agricultural byproducts and micronutrients, prototypes and engineering equipment, dryland agriculture, optimization of ground water, medicinal and aromatic plants, long term fertilizer experiments, floriculture, buffalo, cashew nut, spices, post-harvest technology, energy requirement, sheep, goat, pigs and subtropical fruits, etc. At present 61 AICRPs and 17 Networks Projects along with their cooperative centres are operated in different ICAR Institutes as well as in SAUs. Such coordinated approach of effective integration of AICRPs in SAUs and ICAR Institutions and Network projects have yielded very valuable technologies as well as crop varieties, ICAR has also fully involved the State Agricultural Universities in its National Agricultural Innovation Project (NAIP) as it also did in its NATP earlier. ICAR and the State Agricultural Universities also cooperate closely in the assessment and refinement of technologies produced by National

Agricultural Research System, through the network of KVKs, most of which are established by ICAR in partnership with the State Agricultural Universities.

3.5 While submitting his suggestion to strengthen the coordination between ICAR and the Agriculture Universities to improve the situation so that there can be better coordination between these two a non official witness stated as follows:

> "Today also there is coordination, but today it is little loosely bound because they are not bound by what ICAR says. One thing is, can we implement our model Act in the universities, which ICAR has already developed – if all the universities uniformly accept that the administrative set up provided by the ICAR is accepted, then we are releasing it, it would be good. For example, some universities receive 10 per cent grant while some others receive 15 per cent. My question is the total grants that are given to the universities should commensurate with the 20-25 per cent from the ICAR side, with their total budget – this should be from the ICAR side so that the ICAR will have a say – we are giving this much money, and so, kindly follow these norms. That is one type of coordination which we can follow. Technically otherwise, we are following whatever is the best between the two."

3.6 Regarding the functional autonomy required for the universities as well as ICAR for taking decisions independently, a non-official witness submitted as follows:

> "xxx xxx xxx the funding is done by the State Government or by the Central Government and the ICAR. They should be given autonomy. Once the budget is given to them, they should have full powers. But accountability should also be there. It is not that they are given the freedom to do everything they want. When the Government gives the funds and when they have given the freedom to exercise the powers given in the Act, every university or every institution is bound by their Act, rules and regulations or ordinances that have been framed. They should be accountable to that extent".

3.7 The National Agricultural Research System has played a key role in initiating and sustaining the science-driven green revolution in India which led to significant economic and social changes over the last 50 years. In recent times, the issues surrounding agricultural development have changed and the sector faces several new challenges arising from an inter-related and complex set of problems. These challenges arise from markets increasingly driving growth of agriculture, and resulting changes in crop diversification, mechanization, food quality preferences, technological changes, regulatory controls, and changes across the entire agricultural supply chain systems.

3.8 The future agricultural policy, research, education and technology transfer in India would therefore be driven by concerns for inclusiveness of growth, food security and sustainability, innovation, food safety and quality, enterprise promotion and skill development. All of these imply that agriculture has become more pluralistic than in earlier years, and involves a wide range of actors from public and private sectors.

Thrust Areas Identified for the Twelfth Plan

3.9 The Thrust Areas identified in the Approach Paper for the XIIth Plan in the Agricultural R&D Sector are the following:

- Policies and activities for adoption and mitigation to the climate change.
- Mission-Mode projects on: National Solar Mission, National Mission for Enhancement energy Efficiency, National Mission on Sustainable Habitat, National Water Mission, National Mission for assessing the Himalayan Eco-system, National Mission for Green India, National Mission for Sustainable Agriculture and National Mission on Strategic knowledge for climate change.
- Poverty reduction in Farm Sector.
- Focus on rainfed areas.
- Diversification of food basket.
- Rising expenditure on frontier areas like vegetables, egg, meat (high value commodities thereby reducing dominance of Cereals.
- Water management utilizing rain water harvesting and enhancing efficiency of irrigation through micro-irrigation.
- Emphasis on soil nutrient management, efficient use of chemical fertilizers.
- Synergy between ICAR institutions, State Governments, fertilizer and seed companies and other agencies.
- Innovation in technology as technology is the prime mover of productivity in agriculture, where natural resources are fixed.

3.10 During XII Plan, NARS has planned to prioritize the activities as follows:

- More emphasis and budgetary provision for conservation agriculture, integrated farming systems, climate resilient agriculture and management of wastes (agricultural and municipal).
- To promote integrated nutrient management and organic farming for specific commodities/regions through some sort of incentives to apply nutrient through organic sources (similar to the nutrient based subsidy scheme for inorganic fertilizer) and also for adoption of resource conservation technologies.

- Capacity building of stakeholders including HRD will be made an integral part.
- Quality assurance for higher agriculture education.
- Implementing existing policy on encouraging non-farm income generation in addition to farming as livelihood resort.
- Post-harvest operations, as envisaged to be useful for reduction of rural poverty is workable, if only entrepreneurship environment (agro-forestry, social forestry), is built in along with adequately improving skills for this end in rural youths, especially amongst the womenfolk.
- Convergence of government plans and schemes within the same ministry as well as across various ministries towards rural livelihood enhancement, especially of remote and unconnected villages, shall be mandated. The prioritisation of deploying ICT for making modern science and technology developments for rural welfare shall be achieved through all the converging government programmes, policies and initiatives.
- Classification of Nutritional security of the food baskets of the various regions, based on ethos, culture and food habits in order to modulate public distribution system and make it goal-oriented towards enhancement of human and animal health.
- Equitable production patterns, optimally utilising available natural resources.
- Adequate ICT support to take new technologies in farm sector, which could be the drivers of achieving higher production of commodities to rural clusters for farmers' validation and adoption with suitable moderations to fit local requirements.
- To organise inputs (including seeds) by any means to achieve the optimum productivity rather to end up with poor plant stand per unit farm area as well as poor productivity due to inefficient inputs, right purity and quantity in all agro-chemicals that are deployed as technological innovations will be looked into.
- Promotion of farming system approach in order to make marketing of farm products organised and farmer-enabled.
- Strengthen the seed chain especially at the level of seed production of foundation and certified seed.
- Farm mechanization for sustaining agricultural growth especially in the context of shortage of agricultural labour, efficient use of inputs and timeliness of critical farm operations to the benefit of a large section of small and marginal farmers. Options are being explored for creating congenial policy framework that would incentivize establishment of custom hiring centres as small business enterprises.
- Genetic improvement for milk production to overcome a great diversity both within breeds as well as between breeds.
- Fodder mission to boost the milk production of indigenous, crossbreds and buffaloes in the times to come.
- Efforts to increase milk production by dairy farmers.
- Strengthening of dairy industry by the induction of state-of-the-art technologies from overseas.
- Better operational efficiencies needed to improve yields, reduce waste, minimize fat/protein losses during processing, control production costs, save energy and

extend shelf-life through the adoption of Good Manufacturing Practices (GMP) conforming to international standards and thus make their exports competitive.

- Prioritized research on animal and veterinary public health, forage crops and the utilization of crop by-products, improved husbandry and production systems and possibly on breeding.
- Socio-economic research for land tenure, credit, labour hire, input delivery and product marketing together with methods of research prioritization.
- Strengthening the research and instructional capabilities of the SAUs with quality assurance.
- Strengthening of Extension System through Krishi Vigyan Kendras (KVK) including on-farm testing to identify the location specificity of agricultural technologies under various farming systems, frontline demonstrations to establish the production potentials of improved agricultural technologies on the farmers' fields, and training of farmers and extension personnel to update their knowledge and skills.
- Broadening the scope of KVK activities to work as resource and knowledge centre of agricultural technology for supporting initiatives of public, private, voluntary sector and other key stakeholders for improving the agricultural economy of the district.
- Focus on rainfed agriculture and convergence between livelihood, availability and access to food, ecosystem and human health.
- A 3 tier model emphasizing both top down and bottom-up approaches is in place for the development of organizational and process models that deliver to people the benefits of technologies. A company namely, AgrInnovate India has been formed for this purpose.

Impact of Agricultural Research and Development Activities

3.11 Giving the assessment of DARE/ICAR about the R&D activities undertaken by NARS and the impact R&D activities made on the agriculture and allied sectors in the Country, the Department in their written reply stated as follows :

Table: Trend growth rate in Agriculture output since 1950 to 2010: Per cent/year

Decade	Total agriculture	Crop sector	Livestock sector
1950s	2.72	3.06	1.57
1960s	1.47	1.70	0.55

1970s	2.18	1.79	3.70
1980s	2.83	2.24	4.88
1990s	3.21	3.02	3.77
2000s	3.01	2.63	3.98

Source: National Accounts Statistics, CSO, GOI

3.12 The estimates of current contribution of research in selected commodities are presented below:

Increase in productivity of selected crops during different decades kg/hectare: Difference in average yield of two years in the beginning and at the end of decade

Decade	Rice	Wheat	Maize	Gram	Arhar	Ground nut	Soya bean	R&M	Cotton	Jute	Sugar cane	Onion	Potato
1950s	242.5	122.5	288.0	131.5	-74.0	56.0	0.0	15.0	8.5	31.0	4432.0	NA	366.0
1960s	141.0	408.0	107.5	40.5	10.0	-81.5	0.0	85.5	27.0	-102.0	12142.5	NA	1201.0
1970s	126.5	313.5	45.0	-48.0	-24.5	133.5	771.5	-13.0	41.5	194.0	57.5	NA	3904.0
1980s	516.0	680.5	486.0	89.5	91.5	211.0	75.0	400.5	63.5	411.5	14066.0	80.5	3468.0
1990s	236.5	501.5	281.0	115.5	15.5	-41.0	272.5	46.0	-2.5	186.0	7767.0	272.0	2343.0
2000s	198.0	216.0	424.5	87.0	-95.5	87.0	-86.5	248.5	178.5	570.5	-3782.5	5499.5	1216.0

Impact of R&D of NARS on Agriculture & Allied Sectors

Returns to Public Investment in Research

3.13 It has been found that an additional investment of one rupee in research generated more than 1 on an average in major crops and the highest marginal product of research was achieved in Arhar where additional investment of 1 generated additional output worth 12.82. Further, return to research investments in foodgrains were found higher during 1995-2005 compared to 1975-85.

Estimated value of marginal product of research stock, India: 1975-2005

(in Rupees)

Period	1975-85	1985-95	1995-05	1975-05
Rice	2.01	1.80	2.25	2.02
Wheat	2.86	5.78	3.45	4.03
Maize	1.63	1.40	2.53	1.85
Jowar	3.80	3.05	5.98	4.28
Bajra	2.85	0.80	3.23	2.29
Gram	0.23	0.88	7.42	2.84
Arhar	13.42	10.78	14.26	12.82
Cotton	5.65	2.79	4.02	4.15

3.14 The Ministry further stated that the research and technology led output growth has helped in a decline in real cost of production in the range of 1.0-2.3% per annum during the past three decades in the case of cereals. This has helped in keeping the prices of cereals low for consumers and benefiting the producers also through a decline in real cost of production. A recent study covering the recent two decades indicate 42 to 46% internal rate of return to public investment in agriculture research and education. All these studies prove high pay off from public sector R&D investments.

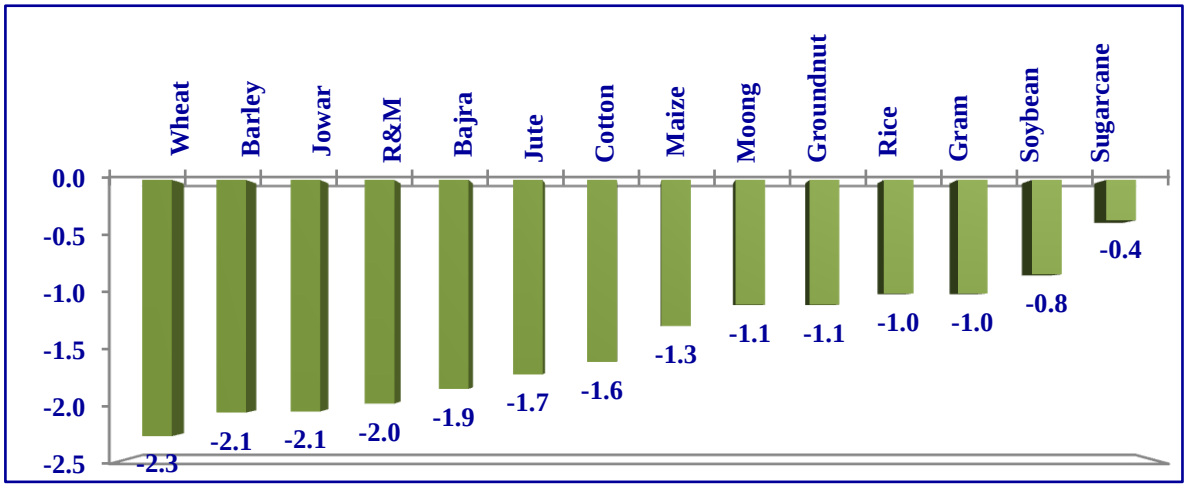
3.15 Investment in agricultural research has been found to be a highly paying proposition. The growth in food production induced by research in India, has not only reduced the import dependency but has also added to export capacity. Agriculture research has also contributed in various ways to change production practices, reduction in drudgery, shift from heavy manual work towards mechanization, increase in resource use efficiency etc. Livelihood of farmers has been affected in several ways. Increase in farm income has contributed to changes in consumption pattern, improvement in

dwelling houses, ownership of household durables and comforts, and improvement in living standard and education.

Reduction in Real Cost of Production

3.16 The most beneficial contribution of R&D to growth is through improvement in total factor productivity. This results in reducing cost of production by either enabling higher output for same bundle of inputs or same output for lower amount of inputs. This gain, in turn, reduces cost of production in real terms contributing to resource saving and lowering of price for consumers. Role of R&D in reducing real cost of production of various crops during 1975 to 2005 is presented in the chart below. The highest gain is in wheat which experienced 2.3 per cent annual decline in cost of production; similar decline was in barley, jowar, bajra and rapeseed/mustard; while rice, moong, groundnut and gram showed annual decline of around one per cent.

Annual growth rate in real cost of production of various crops at 2005-06 prices (1975 to 2005)



Monitoring and Regulation of Agricultural Research

3.17 According to the DARE there is an intricate network and combination of research institutes, commodity wise and agricultural universities state wise and frontline extension system in terms of KVKs. The Department has categorically stated that All India Coordinate Research Projects cut across the country, the systems and affiliations.

In regard to the procedure for assessment of schemes/projects and the frequency of assessment/reassessment the Department stated that progress of research schemes/projects are reviewed by Research Advisory Committee (RAC) meeting, Institute Research Committee (IRC) and Institute Management Committee (IMC) at the institute level. The recommendations are reviewed at Subject Matter Division level for need based revision. Besides, the Annual Group Meeting of All India coordinated Research Project Scheme assesses the operational cost of projects. The overall requirement and expenditure for any possible revision and mid-course correction towards the operational cost of the projects are reassessed in the Senior Officers' Committee (SOC) meeting held every month at the ICAR Hqrs. Based on the expenditure monitoring in various schemes, the reassessment was undertaken to cover for the projected operational costs.

3.18 The Secretary DARE during the oral evidence explained the prevailing monitoring of the institutions involved in Agricultural Research by ICAR.

> "ICAR is an 84 year old organisation, which is at the helm of the national agricultural research system. We operate from the Department of Agriculture Research and Education, Government of India. There are four national institutes or deemed universities, 45 Central institutes, 17 national research centres, six national bureaus, 25 project directorates, 8 zonal project directorates, 61 all India coordinated research projects and 17 networks, 53 State agricultural universities. Earlier, there were also Central Universities, like BHU, AMU and Shanti Niketan, with agricultural component. Now with these 53 State agricultural universities, we have our own one Central agricultural university in the North-East".

He further added :

> "We have prioritization monitoring and evaluation cells in each of these institutes" xxxx xxxx xxxx with regard to the regional committees, this is one mechanism which brings the ICAR with all the State Governments. So, while 8 regional Committees meets once in two years in a given region, that brings together three to four States. While this has been largely working well, our concern is also with regard to participation of the State Governments more effectively while we go along with all universities, institutes.
>
> xxxx xxxx xxxx ICAR doing the job of coordination, facilitation, support but not regulation. Till now, we have not got into that exact role of regulation. We have got the accreditation board and once in five years, the universities have to get accredited to get the development grants. We provide development grants but beyond that, can we close a college if it is not performing? We have not got into that question.

Having heard this, everybody is feeling that our accreditation board should be further strengthened. We have got 11 disciplines of agricultural which we are offering for under graduate courses. So, we thought that we can have 11 standing committees and in our policy document also, we have submitted that ICAR also assumes a form of regulatory role".

In this context, regarding overlapping in research by these universities/institutes, the secretary DARE elaborated :-

"Some times it appears that two universities are doing a similar job. In agriculture, it is a necessity many a times. Working on a given aspect in different universities for the same given concern may be a duplication. But when we look at the varietal performance under different climatic conditions and under different soil zones, we ourselves set up this kind of experiments. That is why it is good to have a Central Coordination mechanism. We are trying to ensure that there is no unnecessary duplication of efforts. Some overlap some times is intended so that we get research for comparisons, etc.".

Regarding accreditation DDG (Education) ICAR stated :

"we have very strong accreditation network. In this case, the Committees going on to different universities, evaluating their programmes. Not only the college, even a particular Department, if it is not up to the mark, we are not accreditating. Every five years we are doing it. We fully agree with your suggestion that we need to make it more strong and more stringent because ultimately agriculture education is a State subject. Basically many times we feel it is a problem. Therefore, we have developed a model Act. We have written to the Chief Secretaries, Dy. Chairman, Planning Commission. They have also written that the adoption of model Act is a pre-requisite. In fact, if they adopt the model Act, many problems are solved, with respect to the governance issues, institutional mechanism, student involvement".

CHAPTER – IV

SECTORAL EVALUATION

Agriculture Sector has made a paradigm shift in the focus by the Department since independence.

4.2 During the evidence, the Secretary summing up the agricultural scenario in the country stated

> "in the '70s, it was always the time of food shortages and imports of foods. In '80s, we started talking about productivity enhancement and so on. In '90s, the talk was about more access, nutrition and that kind of an approach. In '90s, trade, global competition, shortage of food globally etc. also came to the fore.
>
> In 2000s, everybody in the whole world is talking about climate change and their impact. It immediately came up that productivity is there. So, what about profitability?
>
> Recently, we are also dealing with that kind of system called intellectual property commercialisation and so on. These are the kind of broad concerns that we had to address".

I. CROP SCIENCE:

4.3 The Crop Science Division has been piloting research in order to attain the demanded production patterns in the country so as to notify high yielding crop varieties with desired quality of commodities.

4.4 The Department has furnished the following decade wise major achievements of Crop Science

1951-60

- The decade saw adaptation research for evolving various crop varieties that were suited for various agro-ecologies.
- The innovations in population selection in field crops paved the way for development of good crop varieties.
- The Indian Agricultural Research Institute, the country's premier national institute attained for the status of Deemed University under the UGC Act of 1956.
- Many premier institutes such as Central Rice Research Institute (established in 1946), Jute Agricultural Research Laboratory, later called Central Research Institute for Jute and Allied Fibres became very active in contributing to the development of improved crop varieties.

- The need for All India Coordinated Research Projects (AICRP) for multi-location evaluation of crop breeding materials was felt and the first AICRP was started on Maize improvement programme.
- Short duration summer mung bean varieties: T 44 and T 465 could fit into cropping systems in various states. Semi-spreading, large seeded Urdbean, D 6-7, the first long duration Pigeonpea varieties, T-7 and T-17; Chapa, C 235 and Dohad yellow chickpea varieties stole the market attention.
- M-27 variety of toria was widely cultivated.

1961-1970

- The first cereal crop hybridisation in maize resulted in Ganga series, Ranjit and Deccan hybrids.
- India became the first country to develop composite maize in 1967.Quality protein maize (QPM) composite variety, Opaque-2, Protina was released.
- First Sorghum hybrid, CSH-1 released in 1964. First sunflower BSH 1 was released in 1982.
- The Indian Council of Agricultural Research commenced AICRPs in crop commodities such as rice, cotton, Pearl millet, small millets, etc. to generate breeding materials using various germplasm including wild species of crops.
- Landmark wheat varieties such as SD 227, C 306, and Sonalika changed the prospects for higher harvest in the country. The seeds of green revolution were sown. Introduction of Sonara 64 and Lerma Rojo in 1964 and release of Kalyan Sona in 1970 rocketed the green revolution process.
- Soybean immunity bacterial pustule and resistant to other diseases. T-42 high yielding yellow sarson became popular.
- Short-duration summer mungbean variety, Pusa Baisakhi, first short duration Piegeonpea variety, UPAS 120, first Kabuli chickpea, L 550 and short duration chickpea variety, JG 62 made a dent in the yield improvement of pulses.
- Released extra-long staple variety MCU-5 in 1968.
- Introduction of semi-dwarf rice varieties for cultivation was done.
- Crop Improvement was the major thrust for higher yields. The resultant crop varieties with high yielding and tolerance to a number of biotic and abiotic stresses resulted in the process of yield enhancement of crops. Wheat varieties such as HD-27 and Sonalika brought new concepts in high yielding crops.
- The Project on Intensification of Research in Cotton, Oilseeds and Maize (PIRCOM) was launched and various centres were established under IARI.
- Development of high yielding varieties of all major crops such as rice, wheat, cotton, oilseeds crops, pulses and sugarcane was taken up.
- High yielding varieties under the five year plan periods during which generation and standardization of their production techniques, integrated pest management and integrated soil-water-nutrient management have been the hallmarks of the Institute’s research.

- Seed Act, 1966 based crop variety notification system was introduced for developing strong seed supply chain.

1971-1980

- World class extra-long staple variety, Suvin that fetches maximum price Rs 6000 per 100 Kg, in the current international market, LRA-5166, Varalaxmi hybrid, DCH 32 were superfine cotton varieties and hybrids that caught textile world by storm.
- Integrated pest control, based on the pest bionomics was launched in various high yielding crop varieties. Many modern pesticides were screened for being registered as useful agro-inputs for reaping better yields.
- Cotton bollworm control, pyrethroid resistant management, downy mildew management in sunflower, rust resistance breeding, rice blast resistance breeding, brown plant hopper resistance and sugarcane pyrilla management could be achieved to fetch the country savings in crop commodity loss for hundreds of crore rupees.
- Co 6304 released in 1970 revolutionised sugarcane productivity.
- Kopargaon was large seeded mung bean variety, with widely adopted PS 16 and K 851 in the country.
- High yielding Varuna variety of Indian Mustard occupied largest acreage in trhe county.
- First short duration Urdbean varieties, T-9 and KM 1-1 and first sterility mosaic virus resistant Bahar variety of Pigeonpea.
- AICRP multi-location research on biological control was commenced. Bollworms, rice yellow stem borers, army worms and coconut wilt, cashew tea mosquito bug, wheat rust, rice blast, root knot nematodes, red spider mites, rodents and agriculturally important birds were effectively contained.
- The first cotton hybrid, H-4 developed, that revolutionised cotton production. Hybrid crop seeds in Pearl millet, sorghum and maize were attempted.
- Wheat varieties such as Kalyan Sona, WL 711, WH 147, UP 262, and HD 2189 and HD 2009 were significant contributions along with their production technologies to achieve green revolution in the country.
- National Seed Project was launched to make available quality nucleus and breeders seed production of different crops.

1981-1990

- World’s first high yielding dwarf variety, Pusa Basmati-1 was released in 1989.
- Integrated Pest management (IPM) principles were taken up. Pest management based on agro-ecologies became principle for protecting non-target pests.
- Hybrid crop seeds in Pearl millet, sorghum and maize were attempted.

- Crop varieties such as HUW 234, Lok-1 and HD 2285, HD 2329, UP 2338 in wheat were landmark varieties along with their production technologies that changed the course of the country's food production.
- In 1980, the total breeders production was 391 tonnes and was increased to 2012 tonnes in all the crops.
- Pusa Bold variety of Indian mustard, Late sown mustard variety, Vardsan and RH 30 variety for intercropping became technological breakthrough in oilseed sector.
- Impacting crop improvement was possible due to the utilisation of catalogued plant genetic resources that were characterised and kept in medium and long term storage modules.

1991-2000

- Wheat varieties such as WH 542, Raj 3765, PBW 343 and HD 2687 with genetic improvement for rust disease resistance supported the country's increasing demand.
- From 2102 tonnes of breeders seed in 1989, 3950 tonnes in 1999 of all the crops was achieved.
- Co 86032 was one sugarcane variety that attained national spread in popularity. Similar esteem could be achieved with CO 99004 and CO 94012.
- Salinity tolerant CS-52 variety of mustard and short duration SEJ 2 became popular.
- Sieve size for grading various sized seeds of crops was designed and seed production industry deploys this for packing good quality seeds.
- Dip-stick based GM kits were developed and commercialised for detecting Bt gene in cotton seeds.
- National test guidelines for 35 crops were developed. 14 crop guidelines have been notified by Protection of Plant Varieties and Farmers' Rights Authority.
- 1500 varieties of 14 crops have been characterised using these guidelines and has impacted in maintaining purity standards.
- Maruti as first short duration pigeonpea, Narendra-1 as long duration sterility mosaic varieties

2001-2010

- Wheat varieties HD 2733, GW 322, DBW17 and HD 2967 revolutionised the wheat production system of the country.
- New approaches such as double-haploidy and embryo rescue could enable enhanced widening of genetic base in wheat.
- Molecular tools deployed for selection and identification of biotic and abiotic stress tolerance, yield determinant genes resulted in improved Pusa Basmati-1, Samba.
- First mustard hybrid, NRCHB-506 and Low erucic acid containing mustard variety, Pusa Karishma changed the productivity complexion of the country.

- Updated DNA finger printing-based data base of 2263 crop varieties in 35 crops was undertaken by trained scientists in ICAR.
- The annual breeder seed production, during 2011-12 was 11835 tonnes.

4.5 The production of various crop commodities did have progressive improvement during 2006-11, as given below. The trend of increase has greatly been due to the high yielding genetic enhancement of crop varieties/hybrids along with various technological support.

Production of selected crops during 2006-07, 2010-11 and 2011-12

Crop	Production (million tonnes)		
	2006-07	2010-11	2011-12
Rice	93.35	95.98	104.32
Wheat	75.81	86.87	93.90
Maize	15.10	21.28	21.76
Ground Nut	4.86	7.54	6.96
Rapeseed/ Mustard	7.44	7.66	6.61
Soybean	8.85	12.60	12.21
Chickpea	6.33	7.38	7.70
Pigeonpea	2.31	3.15	2.65
Mungbean	1.12	1.37	1.63
Urdbean	1.44	1.82	1.77

Source: Directorate of Economics and Statistics, Department of Agriculture and Cooperation

4.6 The Department specifying the achievements in the cropping sector stated as follows:

Crop diversification

- Crop diversification for different agro-ecological regions of the country developed for higher profitability and productivity.
- Efficient alternatives to rice-wheat system at 13 locations with productivity ranging from 12-43 t/ha/year.
- In arid-ecosystem, efficient alternatives as identified are cotton-wheat (Hisar), cotton-groundnut (S.K.Nagar), pearlimllet-potato –clusterbean (Bichpuri), soybean-checkpea (Rahuri) and pearlmillet-barly-vegetable guar (Durgapura) with yield potential of 12-29 t/ha/year.
- Identified efficient alternatives to rice-rice system of humid and coastal ecosystem with potential productivity of 12-21 t/ha/year.
- Crop diversification in drought prone areas in rainfed upland with average rice equivalent yield of 7.5 t/ ha identified to replace traditional rice only 1.9 t/ha yield.

Rainfed/Dryland Farming

- Characterized and delineated dryland/rainfed areas including drought prone areas of the country.
- Developed contingent cropping strategy for major rainfed agro eco-zones of the country to cope up with delay in monsoon and mid season droughts.
- Developed crop weather relationships and climate based crop planning to issue regular agro-advisories through the website www.cropweatheroutlook.ernet.in.
- Developed location specific in-situ and ex-situ moisture conservation practices for major rainfed agro-ecological regions of the country.
- Developed contingency plan for 427 vulnerable districts of the country to cope up with different climatic abrasions.

4.7 Important crop varieties developed in recent years under NARS are mentioned below:

1. New varieties of rice capable of withstanding drought (Sahbhagi Dhan) and water submergence (Swarna-Sub1) developed to contain crop loss due to droughts and floods, PRH-10, a fine grain rice hybrid has gained prominence. Similarly, Pusa Basmati-1121 increased the export earnings. Development of NDR-359, PR-116, HKR-127, Vandana, MTU-1010, KRH-2, CSR-23 rice varieties also enhanced the production.
2. To ward off threat to wheat production from the globally spreading menace of wheat stem rust, Ug99, resistant varieties (DBWI7, PBW550, LoK-1 and Turja) identified. PBW-621 and HD-2967 varieties had resistance to yellow

rust. For saline soils, KRL 1-4, KRL-19 are some important wheat varieties developed.

3. A high sugar-yielding cane variety, Birender with tolerance to water logging, drought and topborer developed.
4. Developed marker-assisted selection based improved Basmati possessing resistance to bacterial blight.
5. Single cross hybrids of different maize types evolved and quality protein maize developed leading to food and nutritional security. Hybrid QPM, 1, 5 and 7 are adapted to climate change. Baby Corn- HM 4, Sweet Corn HSC-1 and Yellow Maize (HM-10, 11 and DHM-117) are other prominent maize types.
6. Early maturing (60-65 days) summer moong bean varieties (SML-668 and 832) developed. In chick pea Aruna, Ankur, JG-6, JG Kabuli-1, Anuradha, Pusa Subra are some new varieties. In pigeon pea Pusa-992, GTH-1, NDA 98-1 and TGJ-501 are also promising types.
7. A medium drought and wilt resistant Castor hybrid – DCH-19 developed. Early maturing soybean varieties (JS 95-60 and NRC-7 particularly for rain fed areas) developed. Other prominent varieties include JS-335, JS 93-05 and JS 97-52.
8. Groundnut variety – CG-16, tolerant to bud necrosis and root rot diseases suitable for cultivation in sourthern India developed.
9. Cytoplasmic male sterile lines in *Brasica juncea* with total fertility restoration developed and hybrid produced. Early maturing (110 days) mustard varieties, Pusa Agrani, JD-6 and Kanti) released.
10. New high yielding and salt tolerant varieties of rice (CSR – 36) and Indian mustard (CSR-54) released for the saline/alkali soils.
11. DNA finger printing of about 3100 varieties of over 35 field and horticultural crops undertaken to deter bio-piracy.

4.8 Besides, process of compiling district wise contingent crop plans to facilitate appropriate agro-advisories to farmers in the event of adverse climatic situations is in progress and besides, improved agro-advisories are being provided on real time weather data for appropriate agronomic practices to enhance the crop productivity. The Council has strengthened the mechanisms of agro-advisories by setting up of Automatic Weather Stations (AWS) in KVKs located in 100 vulnerable districts under National Initiative on Climate Resilient Agriculture (NICRA).

4.9 It is also significant to note that the ICAR is abreast with the anticipated and projected demand for food, as given below, the anticipated quinquinneal analysis and projection show that there is need to produce more from lesser resources through

higher efficiency of crop genetic system by exploiting the efficiency of natural resources and monsoon systems.

Projected demand for various food commodities and expected population – quinquinneal analysis (million tonnes)

Crop commodities	2015	2020	2025
Rice	118.43	125.23	127.50
Wheat	89.06	97.8	107.18
Maize	18.7	21.5	23.7
Sorghum	14.6	17.6	20.6
Bajra	10.48	11.53	12.69
Important Cereals	251.27	273.66	291.66
Pulses	21.31	24.26	29.43
Expected Population (Billion)	**1.29**	**1.36**	**1.42**

Quality Seed Profile in different Crops

4.10 The Crop Science research led to release of 257 crop varieties during the last four years of the current five year plan period. The quantity of breeder seed that is more than sufficient to be put in the seed production chain so as to attain essential seed replacement ratio in each crop variety. National capacity to utilise the ICAR supported breeder seed production, need to be enhanced through empowering farmers' self help groups in all states to attain perfect replacement of seed stocks to garner full genetic potential of crops.

Number of crop varieties released and Breeder Seed produced in different field crops during 2007 to 2010

Crop	No. of Varieties released	Breeder Seed Production* (in Quintals)
Wheat	26	128705.6
Paddy	33	19738.7
Sorghum	7	739.6
Maize	33	866.7
Barley	5	11347.3
Pearl millet	25	112.5
Small millet	7	115.1
Pulse Crops	32	53854.2
Jute/ Sunhemp & Mesta	14	68.8
Cotton	7	416.5
Forage crops	16	4609.4
Oilseed crops	52	111321.0

*Includes all the varieties in seed chain

4.11 The Committee when asked a non-official witness to elaborate the details of competition being faced by seed producers from the international organizations and private sectors. The witness stated as follows :

> "what I am speaking about is that there is a competition in supply of seeds, insecticides and pesticides. We have seen now that the multinational companies are in the market for vegetable seeds. They are taking almost about 80 per cent of the market share. पंत नगर का बीज अभी बाजार में बहुत ज्यादा है। अगर आप वैस्ट-बंगाल में, बिहार में किसानों से पूछेंगे तो वे बताएंगे कि यह तो पंत नगर का बीज है, वह नर्स की सफलता है to some extent. But in vegetable seeds and flower seeds, we have not been able to do so. The multinational companies are taking the whole market. Their rate is Rs. 40,000 per kilo, Rs. 50,000 per kilo whereas my university is selling the vegetable seeds at Rs. 100 a kilo. वहीं हम जो भिंडी का बीज बेचते हैं वह 100 रुपये किलो में बेचते हैं जबकि मल्टी नेशनल कंपनियां जो बीज बेचती हैं वह 3500 रुपये किलो में बेचती हैं। There is a tremendous difference in the rates. It is a big threat for us until and unless we address this issue".

He further stated that:-

> " we have to do vigorous marketing or we have to even go private. We have tried to sell our technology to private companies restrict the price. For example, Pant Sugandh Rice 5. We have sold it to a private company. We have put our conditions. We have said that the price would not be more than this in India. Outside, they may sell as they like. Then, this will be the kind of royalty given to us. We are putting these conditions. Now, I am going in for more number of varieties to be made available to the private companies but with conditions."

4.12 During personal hearing another witness also stated that the main constraint appears to be the lack of seed, production of seed, timely availability of seed, good quality seed. A seed pool has to be maintained by the NARS along with the private players in the system by maintaining of course a good quality of the newer varieties which are disease resistant, which are much more productive, better quality fibre for jute and so on and so forth.

II. HORTICULTURE

4.13 Horticulture is considered as a sunrise sector in Indian economy and growing rapidly by virtue of exhibiting an ever increasing crop diversity pattern in the country. A large proportion of our population is tending to depend on horticulture for survival. This sector alone provides livelihood to over 30-40% of India's population. The horticulture alone contributes, 30.04 percent to the GDP of Agriculture only from 11 per cent area. Performance of this sector is a key to livelihood and nutritional security and this is specially the case for those landless, small and marginal farmers, homesteads etc., subsisting below or near below the poverty line.

4.14 Horticulture (fruits including nuts, vegetables including potato, tuber crops, mushroom, ornamental plants including cut flowers, spices, plantation crops and medicinal and aromatic plants) has become a key driving force for economic development in many of the states of the country. However, there is a need to produce "more from less for more" without affecting food safety and environment. This calls for technology-led development, where Horticulture Division of ICAR is playing a pivotal

role. The research priorities are for genetic resource enhancement and its utilization, increasing input-use efficiency and food and environment safety.

4.15 Horticulture, which includes fruits, vegetables, spices, ornamental crops, medicinal and aromatic plants and plantation crops, has made a rapid stride during the last decade, recording appreciable growth in production, productivity, availability and export.

Globally, India is second largest producer of fruits and vegetables. It is largest producer of mango, banana, coconut, cashew, papaya, pomegranate etc. It is also largest producer and exporter of spices. India ranks first in productivity of grapes, banana, cassava, peas and papaya. Export growth of fresh fruits and vegetables in term of value is 14% and of processed fruits and vegetables is 16.27%.

4.16 The Department has also furnished the following achievements of Horticulture Sector 1951 onwards:

1951-60

- Nine varieties of different horticultural crops developed.
- The major research work done on identification of root stock of citrus, bud wood certification programme for cleaning against viruses, understanding citrus declined and coconut wilt disease.
- For carrying out research in plantation crops, Central Plantation Crop Research Institutes, Kasaragod (Kerala) established, besides some network programmes were also initiated.

1961-70

- Establishment of Indian Institute of Horticultural Research, Bangalore, besides creation of a Horticulture Division at IARI, New Delhi for carrying out systematic research in the field of Horticulture.
- The vegetative propagation techniques of various fruit crops and nursery management technologies of various horticulture crops standardized.
- Sixteen varieties of different horticultural crops were developed including famous variety of potato Kufri Jyoti.

1971-80

- To coordinate horticultural research in the country, Division of Horticulture was formed at ICAR, New Delhi.
- Various All India Coordinated Research Projects like AICRP on Tropical Fruits, AICRP on Sub-tropical fruits, AICRP on Arid Zone Fruits, AICRP on Tuber Crops, AICRP on Palms etc. were established for development of location and situation specific varieties and technologies.
- To carry out research on spices, tuber crops and vegetables, Indian Institute of Spices Research, Calicut; Central Tuber crops Research Institute, Thiruvananthapuram (Kerala) and Indian Institute of Vegetable Research, Varanasi (formally Directorate of Vegetables) were established.
- A total of 129 varieties including 86 vegetables, 10 ornamental plants, 49 plantation and species crops, 16 fruit crops and 3 medicinal and aromatic plants; including famous mango variety Amarpalli.

1981-90

- Besides creation of infrastructural facilities in horticulture, some commodity based National Research Centres were established.
- For mass multiplication of quality planting materials, tissue culture protocol in banana, chrysanthemum, strawberry etc. were developed.
- Released 218 varieties of various horticultural crops.
- Developed rootstocks of grapes (Dogridge, Salt Creek, St.George) and citrus (Rangpur Lime, Citranges, Trifoliate orange).
- Standardized training and pruning techniques in different fruit crops.

1991-2000

- Released 289 varieties of different horticultural crops including mango variety Arka Anmol and grape variety Pusa Navrang.
- Standardized microirrigation and protected cultivation for few selected crops.
- The IPM strategy for management of major pests and diseases as well as post harvest handling technique for mango, guava, pineapple, tomato etc. were standardized.
- The canopy architecture modules in some temperate, tropical and sub-tropical fruits were developed.
- The high density orcharding in mango, Guava, banana, pineapple etc. were standardized.
- For increasing shelf life of various fruits and vegetable during storage, modified atmosphere packaging standardized.

2001-2010

- For the first time, potato genome sequenced by CPRI, Shimla in collaboration with International Organizations.

- A total of 322 varieties of different horticultural crops identified for high yield, quality, pest & disease resistant and also tolerant to high temperature.
- For the first time, two triple resistant F_2 hybrids of tomato (Arka Samrat and Arka Rakshak) against bacterial blight, ToLCV, early blight with yield potential of 101 to 119 t/ ha were identified.
- Dip stick kit developed for two potato viruses which enables for the field testing.
- PCR based diagnostic technique for detection of latent infection of potato blight has been developed.
- Technology for mango wine standardized from three mango varieties viz., Dashehari, Langra and Chausa using *Saccharomyces cerevisiae.*
- Blending of potato flour with banana flour (50% + 50%) enhanced nutrients value (free amino acid, soluble protein, total phenols, carotenoids, starch and glucose) in the resultant mix.
- 31,22,900 disease free quality planting materials and 31405.26 q seeds of different horticultural crops were produced during 2011 for distribution to farmers/ state departments.

4.17 The area and production in the year 2011-12 had an increase of 24.28% and 40.71% respectively, over that in the previous Plan period ending 2005-06. Besides fruits and vegetables, a significant increase of 152.6% is seen in flower production than in the year 2005-06, which indicated emergence of a third sub-sector of horticulture due to increase in demand of flowers in the urban and peri-urban areas. It is also notable that increase of 8.96% in area and 45.25% in production of nuts (coconut, cashewnut and arecanut) was due to increase in their demand.

Table: Area (m ha) and Production (m tonnes) of horticulture crops during 2001-02 to 2011-12

Crops	2001-02		2005-06		2011-12		2005-06 increase over 2001-02 (%)		2011-12 increase over 2005-06 (%)	
	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.
Fruits	4.01	43.00	5.32	55.36	6.71	76.42	32.7	28.7	26.13	38.04
Vegetables	5.78	80.62	6.85	102.48	8.99	156.30	17.1	26.2	31.24	52.52
Tuber crops	0.378	7.646	0.367	8.921	...	...	-0.99	16.7	...	...
Flowers	0.106	0.535	0.129	0.654	0.254	1.652	21.6	22.2	96.90	152.60
Nuts (Almonds) & walnuts	0.117	0.114	0.130	0.149	...	...	1.9	30.7	...	...

Aromatic & Medicinal Plants	**NA**	**NA**	**0.262**	**0.202**	**0.506**	**0.566**	**…**	**…**	**93.13**	**180.20**
Plantation Crops (Coconut, Cashewnut, Coca Arecanut)	**2.984**	**9.697**	**3.283**	**11.263**	**3.577**	**16.359**	**10**	**16.1**	**8.96**	**45.25**
Spices	**3.220**	**3.765**	**2.366**	**3.705**	**3.212**	**5.951**	**-7.3**	**-9.8**	**35.76**	**60.62**
Mushroom		**0.040**	**…**	**0.035**	**...**	**...**	**…**	**-8.7**	**...**	**...**
Honey	**…**	**0.010**	**…**	**0.052**	**...**	**...**	**…**	**...**	**...**	**...**
Total	**16.592**	**145.785**	**18.707**	**182.816**	**23.249**	**257.248**	**12.7**	**25.4**	**24.28**	**40.71**

4.18 The plantation crops recorded a marginal decline of 0.9% in area but an increase of 6.2% in production, which could be achieved due to increased productivity. The targets for the annual growth rate estimation for the XII plan period have been computed on the assumptions of population projections growing at 1.34%, changes in urbanisation pattern and consumption pattern. The target for production of horticultural produce has been appearing as 345 million ton with target growth rate of 6.7% volume wise and in value terms, the growth to be achieved is 9.5% by the end of 2016-17.

Crop Category wise Projected Production of Horticulture Produce (Production in million tonne)

Crop group	**Base period production 2009-10**	**Target production at the End of XII Plan 2016-17**
Fruits & Nuts	71.4	104.00
Vegetables (including potato, excluding tuber crops)	128.3	199.19
Tuber crops (Sweet potato, Tapioca and others)	12	15.36
Flowers (cut & loose)	0.146	0.2993
Coconut	10.81	15.35
Plantation crops (Cashew, Acrecanut, Cocoa & Oil palm)	1.54	2.18
Spices	4.01	5.14

Miscellaneous (Honey, Mushroom, Medicinal & Aromatic crops)	0.6	1.02
Total Horticulture	225.62	345.237

- Coconut conversion 1450 nuts/ton.
- Cut flowers converted as 15000 Nos= 1 ton

Seeds/Planting Materials Produced during XI Plan

4.19 For supply of quality planting materials of different horticultural crops and breeder seeds of different vegetables, spices, potato and tuber crops to the State Departments and farmers; all Institutes/ NRCs/ Directorates under Horticulture Division are involved. During XI Plan (2007-2011), 2,58,588.75 planting materials and 9,43,352 q of breeder seeds were produced. The details are as under:

A. Production of planting materials

Crops	**No. of varieties**	**Quantity produced (Numbers)**
Fruit Crops-Vegetatively propagated plants	51	95,81,668
Clonal Rootstocks		13,50,000
Scion budwood		2,50,000
Plantation Crops	**1**9	91,90,316
Spices	**1**3	19,77,450
Tuber Crops	8	15,34,441
Ornamental Plants	**3**9	3,00,000
Medicinal and Aromatic Plants	**1**6	8,00,000
Hybrid Vegetable Seedlings	**1**2	8,75,000
Total	**158**	**2,58,58,875**

B. Production of seeds

Crops	**No. of varieties**	**Quantity produced (q)**
Potato	9	1,48,062
Spices	12	7,25,111.2
Vegetable Seeds	72	7,705.89
Tuber Crops	-	61,233
Mushroom Spawn	6	1,240.00
Total	**99**	**9,43,35,214**
Grand Total	**257**	

Varieties Developed with Specific Purpose

- Mango: Arka Arunika – Export purpose
- Papaya: Arka Prabhat – Better storage life
- Coconut: Kalpa Sankra, Kalparaksha, Kalpashree – Resistant to root wilt
- Tomato: Arka Samrat, Arka Rakshak-Triple resistant to ToLCV=BW=EB
- Onion: Bhima Super, Bhima Subhra – Kharif season
- Carrot: Arka Suraj – Resistant to powdery mildew and tolerant to nematode
- French bean: Arka Anoop – Resistant to bacterial blight
- Water melon: Arka Madhura – Seedless type
- Potato: Kufri Chipsona – 3, Kufri Chipsona-4, Kufri Himsona – Chip making and Kufri Frysona – French fries
- Taro: Jhankari, Sonajuli – Tolerant to blight, drought and salt
- Chrysanthemum: Anmol, Royal Purple – Pot culture
- Gladiolus: Arka Amar – Fusarium wilt resistant

Research Achievements

4.20 Enumerating the achievements of agricultural research the Ministry in their note stated as follows :

- A total of 72,974 genetic resources consisting of 9240 accessions of fruits, 25,400 accessions of vegetables and tuber crops, 25,800 accessions of plantation and spices, 6250 accessions of medicinal and aromatic plants, 5300 accessions of ornamental plants and 984 accessions of mushroom were collected and conserved.
- A total of 1,596 high yielding varieties and hybrids of horticultural crops (fruits – 134, vegetables – 485, ornamental plants – 115, plantation and spices – 467, medicinal and aromatic plants – 50 and mushrooms – 5) were developed. As a result the productivity of banana, grapes, potato, onion, cassava, cardamom, ginger, turmeric etc. has increased significantly in last 5 years.
- A total of 168 recommendations were made on improved technologies which included 55 in fruit crops, 15 in plantation crops, 37 in vegetable crops, 15 in spices, 19 in tuber crops, 20 in ornamental crops, 6 in mushroom and 2 in medicinal and aromatic plants. Out of them, 128 recommendations were mainly on production management like planting density, plant propagation, rootstocks, canopy management, water, nutrient and weed management, cropping systems, PGR application while 40 were on plant protection aspects.
- Eighty post harvest technologies on various aspects like extending shelf life, packaging, storage, standardization of process etc. were developed. Among them, 32 on fruit crops, 5 on plantation crops, 8 on vegetables and spices, 16 on tuber crops, 14 on ornamental crops and 5 were on mushroom. Twenty new value added products from various horticultural crops were developed.

- To improve working efficiency and minimizing drudgery, some farm implements/tools were designed, fabricated, developed and evaluated in Horticultural Institutes. These included tractor drawn raised bed former cum seedling transplanter for vegetable crops; onion seed drill; tractor drawn vacuum precision seeder, pomegranate aril remover, clipper type bael harvester, guava harvesting device, aonla harvesting device, low cost portable type fruit ripening chamber, coconut chips slicing machine and machineries for virgin coconut oil production, spawn incubation machine, grain cleaner, grain filling machine, boiled and chalk powder mixture machine, pasteurization and moisture moving machine, paddy straw filling and spawning machine and casing soil machines for mushroom; a power (motor) operated prototype machine for preparation of French fry cuts.
- About 2,58,58,875 (no.) planting materials of different fruit, plantation, spices and ornamental crops and 9,43,352 q of breeders seed of potato, vegetables, seed species, tuber crops and mushroom spawns were produced.
- Molecular diagnostics for potato virus developed.
- Diagnostic technique and kits for important viruses in papaya, watermelon and banana developed.
- Developed molecular markers for testing genetic purity of commercial hybrid of tomato, brinjal and chilli.
- Developed meadew orchard system for guava with 5000 plants/ha to achieve higher productivity.
- Onion planting on raised bed with drip irrigation increased yield of quality bulbs.
- Complete genome sequence of an Indian strain of potato virus X generated.
- For dissemination of technologies, region and crop-specific training and demonstration programmes are being taken up by the concerned Institutes/ Directorates / NRCs.

III. NATURAL RESOURCE MANAGEMENT

4.21 The Department of Research and Education has informed the Committee that the following activities are being undertaken under Natural Resource Management : -

(a) Soil Health and Soil Mapping

(i) GIS based district-wise soil fertility maps of 20 states (Uttar Pradesh, Uttarakhand, Punjab, Haryana, Himachal Pradesh, Madhya Pradesh, Maharashtra, Rajasthan, Gujarat, Chhattisgarh, Bihar, West Bengal, Orissa, Assam, Jharkhand, Andhra Pradesh, Tamil Nadu, Karnataka, Kerala and Pondicherry) have been completed. Out of these 20 states, Tehsil-wise soil fertility maps are available for 11 states (Punjab, Haryana, Himachal Pradesh,

Maharashtra, Rajasthan, Gujarat, Chhattisgarh, Orissa, Andhra Pradesh, Tamil Nadu, and Karnataka).

(ii) On-line fertilizer recommendation systems have been completed for 13 states, namely, Maharashtra, Andhra Pradesh, Karnataka, Chhattisgarh, Kerala, Orissa, Himachal Pradesh, West Bengal, Jharkhand, and Tamil Nadu. This on-line fertilizer system has been uploaded on the NIC as well as ICAR websites i.e. e-connectivity.

(iii) GPS based geo-referenced soil fertility maps for all nutrients are also under preparation and mapping has been completed for 169 districts in the country.

Some of the other recent research achievements are as follows.

Land Resource Characterization, Management & Land Use Planning

- Prepared soil maps of the country (1:1 million scale), states (1:250,000 scale) and several districts (1:50,000 scale).
- Twenty agro-ecological regions and sixty agro-ecological sub-regions of the country have been delineated and mapped on 1:4.4 million scale.
- Prepared soil degradation map of the country (1:4.4 million scale) and soil erosion maps for states (1:250,000 scale) for effective resource conservation planning.
- The soil carbon stocks under different land use systems of the country documented.

Soil Health & Nutrient Management

- Digitized soil fertility maps (Macro & micronutrients) for different states/districts prepared.
- Developed ready reckoners for soil test based fertilizer recommendations.
- Documented integrated nutrient management packages for major cropping systems of the country to promote balanced fertilization.
- Developed biofertilizer technology for mass multiplication and adoption by the farmers.
- Standardized Vermi/enriched-composting including bio-enriched compost technology.
- Identified fungi (*Aspergillus terreus/flavus/heteromorphu* and *Rhizomucor pusillus*) for rapid composting within 75 days of segregated munucipal solid wastes.
- Developed liquid biofertilizer formulations and a quality control kit for testing the biofertilizers based on genetically marked strains.

4.22 The representatives of the Ministry during evidence informed the Committee

"for balanced nutrient application and Site Nutrient Management, we have initiated geo-reference mapping for all nutrients for the entire country. In addition we have completed 20 districts level maps of major nutrients and for 11 states, we have got tehsil level fertility maps which are also available on ICAR website. In addition, we are also developing decision support systems 'which will help state level officer or even farmer depending upon crop, the soil and the region he can precisely be told that this amount of fertilizer to be added. As far as the Integrated Nutrient Management is concerned. We are also recommending that around 25% of the organic fertilizer be substituted by organic sources, the sustainability of the production would be maintained".

Management of Problematic Soils – Saline, Alkaline, Acidic and Waterlogged

- Prepared acid soils map (1:1million scale) and salt affected soils of the country (1:1million scale) and eight states (1: 2,50,000 scale).
- A technology package for amelioration of 25 million ha of critically degraded acid soils has been developed. Liming @ 2-4 q/ha along with the recommended fertilizers has potential to double food grain production in the areas.
- Developed cost effective amelioration technology for salt affected soils.
- Developed salt tolerant varieties for major crops like rice, wheat, mustard and gram.
- Feasibility of sub-surface and bio-drainage technologies for waterlogged saline soils has been demonstrated.
- Dorovu technology for skimming fresh water overlying the saline water perfected for coastal saline areas.

Soil and Water Conservation- Watershed Management

- A network of 47 model watersheds developed, making a basis for the National Watershed Development Programme for Rainfed Areas (NWDPRA).
- Location specific bio engineering measures for different degraded lands including mine spoils developed reducing runoff and soil loss to a great extent.

Agroforestry Management

- Agroforestry models developed for efficient management and sustainable productivity of waste/degraded lands.
- A comprehensive on-line database on agro-forestry entitled "Agro-forestry BASE" generated.
- Standardized different agro-forestry modules linking to paper, pulp wood and herbal medicines based industries for marginal rainfed lands.
- Suitable biofuel tree species have been identified for energy plantations.

- Suitable agroforestry system for higher C- sequestration have been identified.

Weed Management

- Developed National database on weeds.
- Appropriate weed management practices developed for different agro-ecological situations of the country.
- Developed biological control of water hyacinth using *Neochetina* weevils.
- Control of *Parthenium hysterophorus* using bio-agent Mexican beetle *Zygogramma bicolorata*.
- Pinoxaden, a new weedicide, found effective for controlling grassy weeds especially *Avena ludoviciana* and *Phalaris minor* in wheat.
- A safe rust bio-agent (*Puccinia sp*. isolate NRCWSR-3) was identified for the control of exotic weed Velvet bush (*Lagascea mollis*) spreading fast on cropped and non-cropped lands in India.
- A weed collector unit was developed for engine-operated aquatic weed cutter / harvester.

Arid Land Management (Hot and Cold deserts)

- Developed desertification and wind erosion maps.
- Developed techniques of sand-dune stabilization and shelter-belt plantation for arid zone.
- Developed CAZRI Moth-3 variety giving higher yield of 4.4 q/ha without any fertilizers and seed treatment and benefit : cost ratio of 3:1.
- Intercropping of Aloe vera , a medicinal plant, in ber orchards promised additional returns of Rs 26,000/ha in arid regions.
- Two hair care products (Aloe Shampoo and Aloe Hair Cream) and two skin care products (Aloe Moisturizer and Aloe Crack Cream) developed from the Aloe vera juice.
- Thorn less Cactus (*Opuntia Ficus Indica*) - an unconventional feed source for arid region livestock identified.
- Prepared value -added products like peelu squash and peelu jam from Salvadora oleoides fruits.
- Developed aromatic coffee powder and biscuits from the pods of thorn less variety of vilayati babool (*Prosopis juliflora*).
- Established regional station of CAZRI at Leh to cater the research need of cold desert.

4.23 “According to an expert, who was examined by the Committee, for efficient production system three major components are critical. They are: the component of soil on which the plants are to grow, the nutrients that is supplied and the soil and plant healthcare that is incorporated into production system. The fact remains that soil health

has been a major casualty because it has been treated like a stray milch animal, that is milked when it is available and then left to nature. The nutrient supply for optimal results will need to be supplied in relation to the demands of the crop.

He categorically stated :

"The native capacity of the soil is to supply these nutrients. Unless one does this, one will be handling the job inadequately. Therefore, it is important that one monitors the requirement of nutrients in relation to what the native nutrient stage of the soil is and what the requirement of that crop that we want to grow on it will be. It should be in a form which becomes available to the plant during its growth without it being depleted by factors like leaching out and so on. I entirely agree with you that this is important. But unfortunately it is not being adequately addressed because we are making recommendations in terms of quantum of nutrients that we should supply without taking into account what the other factors of requirement are, and this needs to be balanced."

4.24 Another expert also gave his views on the subject before the Committee as follows:

"There has been a large number of soil testing laboratories across the country under State Governments, ICAR, State agricultural universities and KVKs. My humble opinion is that there is no need for soil testing laboratories. But the functioning of the soil testing laboratories leave a big question to be desired.

For example, in many soil testing laboratories farmers bring soil samples but they do not know how to collect it. They are not trained about how to sample the soil. When they bring the soil, naturally they will be in a hurry to know the results before going in for sowing for the next season. Sometimes they are not given the results but most of the times they are given the results after a period of about 7 months. It is when there is no more need to have such soil testing results to obtain. This is the story of almost every State in the country.

So, the soil testing *per se* facility available is not less. But the proper implementation of the work and the utilisation of the facility are very much wanting. There should be a drastic improvement in the delivery of the soil test advisories. Now, the soil test results will be given and based on that some advisories must be given to a farmer about the sowing of crop. At the time of submitting a soil sample, he should mention that he plans to go in for raising this crop. It is better if he is able to mention that what yield he expects, like a low yield of two tonnes and five tonnes per hectare. So, based on that soil testing, recommendations will be made".

He further added :

"In many cases, recommendations are faulty. They are not given along with the soil tests results. So, they make no use to the farmers. In my opinion, there is no more need for the new soil testing laboratories. But the soil testing laboratories' work should be oriented, reoriented, focussed and made operative at the ground level.

The issue of the soil health card is a separate issue altogether. It does not deal only with the chemical nutrients. It deals with biological attribute of the soil. The soil testing laboratories exists at the Central level under DAC, KVKs, State level, Fertilizer Association of India and several other non-Government organisations. They do not have the facility to measure the biological activity. It is a very simple hydrogenous activity – one enzyme, which gives an overall health condition whether it is a good or bad soil. It is possible to obtain biologically.

I think you should know about earthworm casts. If a soil has got a lot of earthworm casts, then one knows that this soil is fertile biologically also. But these days nobody watches for it, modernisation has come. Earthworm casts are not counted. They are not present in very many soils these days. It is because of pollution, too much of chemical fertilizer, less of organic manure, too much of plant protection chemicals being used indiscriminately. Dealers have now become advisors. They tell you about the mixture of fertilizers and what pesticide you should go in for. Here again, the weakness of the extension system comes to the fore. The delivery, extension and awareness system of the farmers is very important. So, there is no need for extra soil testing programme, it is already there."

4.25 Regarding the distance covered by the farmers for testing their soil from their field to laboratories and the extent to which these testing laboratories are fully utilised an expert stated as follows :

"The Mobile Testing Van should be pressed into service for such remote areas. So far static laboratories have not justified their existence to fullest possible extent. So, the laboratories have to reach the farmers, not farmers have to come to the laboratories. Here again, local self-Government should also be integrated hand in hand with State agricultural officials, who are there at the ground level with them. Until and unless, the panchayat is not tied down into delivery services, the farmers will not get the benefit."

Resource Conservation Technologies (RCTs)

- Standardized raised & sunken bed system for higher productivity in waterlogged lands.
- Resource conservation technologies viz., zero-tillage, bed planting, laser land levelling recommended for Indo-Gangetic Plains (IGP) to save time, labour, energy, water, and nutrients and, thereby, reduce cost of cultivation.

- Leaf Colour Chart (LCC), a simple device for nitrogen management (saving 15 kg N/ha in rice), developed.
- The System of Rice Intensification (SRI) with 20x20 cm spacing saved about 22-35% of water, 14% labour inputs and gave higher yield (about 6 t/ha) than conventional transplanted crop at Bhubneswar.

(b) Water Use Efficiency

4.26 In accordance of the Finance Minister's Budget Speech (Para 55 of Budget speech, 2007), an interest free loan has been provided to Indian Council of Agricultural Research. A corpus fund of Rs 96 crore has been created and deposited in fixed interest earning instrument; the yield from the fund has been used for implementing the scheme in 32 centres (Rs 28.5 lakh per annum per centre). To initiate the scheme an initial fund of Rs 3.2 crore (Rs 10 lakh to each centre) was given in first year to the implementing centres; thereafter from second year onwards annual interest earning from corpus fund has been the source of funding for the scheme with yearly budgetary allocation of Rs 28.5 lakh for each centre. A Central Scheme on "Scaling up of Water Productivity in Agriculture for Livelihoods through Teaching cum Demonstration, Training of Trainers and Farmers" implemented during XI Plan period in 32 centres (27 SAUs and 5 ICAR Institutes) across the country. Under the scheme farmers' trainings of one week duration and trainers/ state officials of two week duration are imparted by each of the 32 implementing centres for creating awareness on water use efficiency and increasing water productivity in agriculture.

4.27 The technologies for improving water use efficiency have been developed under AICRP on Water Management having 25 centres and AICRP on Groundwater Utilization having 9 centres in the country. The Directorate of Water Management, Bhubaneswar has also developed technologies for improving water use efficiency. These developed technologies for improving water use efficiency are disseminated to the line department officials as well as to the farmers through the training programmes and demonstrations in ORP mode and also under the scheme "Scaling up of Water Productivity in Agriculture for Livelihoods through Teaching cum Demonstration, Training of Trainers and Farmers".

4.28 Besides, a central scheme on 'Participatory Action Research Programme' (FPRAP) has been implemented during XI Plan period throughout the country with the help of SAUs/ICAR Institutes/WALMIs etc. to demonstrate the technologies to the farmers at their farm for increasing the productivity and profitability of agriculture through generating synergy among water, crop, agronomic practices, soil nutrients, suitable crop variety and implements etc. This scheme is implemented by Ministry of Water Resource with the help of 60 institutes in 25 states/UTs at the cost of Rs 24.46 crores.

4.29 Some of the achievements with regard to water management are as follows:

- Developed micro level water resource through rainwater harvesting in tank cum well system for plateau region. (Rs 30,000 extra gross income /year with additional employment generation of 115 man days/ ha).
- Sub surface water harvesting structure (SSWHS) and micro-tube well technology in coastal waterlogged areas. (Net income Rs 77646/ha with benefit: cost ratio 1.78.).
- Devised drip and sprinkler irrigation systems saving water (30-50%), labour (50%), fertilizer (30-40%) and increasing yields (12-76%).
- Gravity and pressurized irrigation systems namely low energy water application (LEWA) device designed, evaluated and popularized.
- Technologies for using poor quality waters for irrigation developed.

(c) Climate Resilient Agriculture and Organic Farming

4.30 The Council had a Network Project on Impacts, Adaptation and Vulnerability of Indian Agriculture to Climate Change at 15 locations which was extended to 23 locations during XI Plan. To augment the efforts, ICAR launched National Initiative on Climate Resilient Agriculture (NICRA) with a total budget of Rs 350 crores for the period 2010-2012. This mega project aims to assess the impact of climate change on agriculture and allied sectors in the country and evolve cost effective adaptation and mitigation strategies.

4.31 Researches being conducted in different research Institutes and state and central agricultural universities are required to be consolidated in order to focus on the above issues. Moreover, due to rapid urbanization and changes in lifestyle, several

environmental issues are coming up like generation of solid and liquid wastes which needs rapid and safe disposal so as to protect our natural resources from getting deteriorated. Carbon fractions of such wastes have the potential for their sequestration in soil as well as reducing fertilizer demand if recycled back efficiently with appropriate technology. For this, researches need to be consolidated and conducted under consortium mode involving different potential and relevant research institutes and agricultural universities under NARS.

4.32 The Economic Survey 2010-11 also admits that the most pressing of the emerging challenges is that of conservation. Enactment of laws for ecological foundations for climate resilient agriculture, management of agricultural waste, building carbon sequestration of soil and overall natural resource management is urgently needed. In the present NARS system, several research Institutes/AICRPs have been established to address several issues related to natural resource management including climate resilient agricultural, management of agricultural wastes and improving soil health including carbon sequestration in soils. To mention specifically, some of the Institutes engaged on these aspects are CRIDA, Hyderabad; IISS, Bhopal; CSWCR & TI, Dehradun; PDFSR, Modipuram; NBSS & LUP, Nagpur; ICAR-RC-ER, Patna; ICAR-RC-NEH Region, Umiam, etc. Several agricultural universities of the country are also conducting researches on these aspects. In the mega programme launched in 2010-11, the National Initiative on Climate Resilient Agriculture, the Council is addressing all aspects of climate resilience in agriculture through multi location, multidisciplinary consortia that are engaged in research in developing technologies related to climate resilient agriculture. ICAR has finalized two new initiatives in platform mode on `Conservation Agriculture' and `Water Management during the XII Plan.

4.33 According to the Department stated that sustainable use of natural resources, enhancement of ecosystem service like reduction in green house gases, and building resilience to climate change are essential for sustainable agricultural growth. The use of bio-agents need to be encouraged in order to sustain the soil health. Additionally, technologies that will increase the population of beneficial microbes in the soil should be developed and encouraged which will sustain the health of soil. The biological

desertification occurring due to indiscriminate pesticide use, lack of application of organic matter and excess irrigation need be reversed.

4.34 A Network Project on Organic Farming (NPOF) has been formulated in X Plan and it is working on the multi-disciplinary, multi-locational and multi-cropping system mode to generate the scientific inputs in organic farming. The technologies generated from the centres are being transferred to farmers. Apart from technology development, human resource development through training of students, farmers, extension functionaries is being organized by the centres. AICRP on Integrated Farming Systems have also been started in April 2010 with 31 main and 32 on-farm centres to address the scientific issues of integrated crop-livestock-fish production systems which offers scope for larger adoption of organic farming.

(d) Research on Panchgavya and its Utility

4.35 Several research programmes have been under ICAR and NARS system for utilization of Panchgavya and some value added products have been developed. In Tamil Nadu, traditional Ayurvedic growth-promoters, Panchagavya and Amrit Pani, were compared. The use of Panchagavya as an organic growth-promoter for small and marginally profitable vegetable-crop farmers has been advocated to the farmers. In the Agricultural University, Dharwad, the use of cow urine either alone or in combination with plant products was evaluated for its efficacy against *Spodoptera litura* in comparison with recommended insecticide, quinalphos (0.05%). At GBPUAT, Pantnagar, the Sahiwal cow urine in comparison to that of buffalo, sheep and goat was found to be rich in phenol compounds and copper, and less in urea content, thus making a useful bactericide against *Salmonella, Staphylococcus* and *E coli* in plants and animals.

4.36 During oral evidence held on 10 February 2012 the Committee when desire to know the manner in which the change can be made in the pattern of Organic farming a non-official witness stated as follows:

"The waste of the biogas plant becomes solid but we developed a technology where the biogas waste will be fluid. Today you can take that fluid and attach it with irrigation water to go straightaway. Knowledge is available. It is a matter that somebody should take it up and make it available. But, the entire India cannot be organic. आबादी इतनी ज्यादा है कि भारत में आर्गेनिक फार्मिंग या पुरानी फार्मिंग करेंगे तो मुश्किल हो जाएगी। जहां जरूरत है वहां जरूर करना चाहिए। We can make a blend of both. Just like we are a plurality in our culture and system, agriculture should also be a plurality. It should not be only fertilizer-based one. I would like to encourage organic farming and all types of farming with a national objection that our food security must be achieved".

(e) <u>Biotic Stress Management Research</u>

4.37 The research on biotic stress management in crops also has equal emphasis. The output of this research enriched models of integrated pest management (IPM) that are suited to all the agro-ecologies, or contain serious biotic stress in all crops. Internalisation of the IPM models have become the practice of good agricultural practices, and has now led to the notification of Indian Standards from Bureau of Indian Standards during 2011. Crop health research has taken a new challenge with the invasion of many minor pests in many crops, becoming major issues in challenging crop production, in the current plan period. Polyphagous pests such as papaya mealy bug, cotton mealy bug; cereal cyst nematode in wheat, root knot nematodes in rice, wheat, fruit trees and vegetables; mites in floriculture, vegetables, rice and in fruit trees became issues of farmers agony in different states. There appears to be three-decade cyclic upsurge in some of them such as coccid pests, and crop diseases such as yellow rust in wheat makes come back; mildews in many crops, phytophthora in potato, citrus etc., pomegranate nodal blight, and wilts in pulses and oilseed crops. Weeds have become pernicious, as in the case of *Phalaris minor* in wheat or *Parthenium* in all the villages of any topography. New species of weeds that are reported to be introduced cause alarm bells to ring for posterity. Viral diseases became prominent in horticultural crops, especially in polyhouse cultivation along with nematode pestilence in various states.

4.38 According the Department of Agricultural Research and Education approximate losses caused to crops by various pests are - pod borer 10-90%, pod fly 70-80%, webber 5-10%, pod bug 2-5%, cutworm 5-30%, termites 5-15%, semilooper 0-10%,

wilt/root rot complex 20-25%, sterility mosaic 20-40%, leaf spot < 5%, Ascochyta blight 5-10% and Botrytis grey mould 5-10%.

4.39 A National Institute of Abiotic Stress Management has also been established at Baramati (Maharashtra) to cater to different Abiotic Stresses including heat, cold, drought, flood etc. on soil, crop, microbes, fisheries, livestock.

4.40 Emerging scenario of biotic stresses also is a cause of concern due to the impact of climate changes. New cropping patterns and practices as well as intensification of horticultural cropping in uplands and midlands have led to the development of suitable environment build up for newer pest complexes or hitherto minor pests to become major. Challenging herbivory of nature has been the major effort of plant protection in agriculture and allied sectors. Label claim-based deployment of pesticides is major challenge for states to make sure that the BIS-mark of Good Agricultural Practice (GAP) becomes the goal of the country for safe commodity supply into the national food basket. The achievements in successful biotic stress management in the recent past, include-

- Successful containment of papaya mealy bug with classical biological control in a global record duration of five months and saved more than Rs 1900 crores of crop loss.
- Developed *in situ* real time scouting techniques of pests and diseases through hand-held devices to enable mobilisation of adequate plant protection measures.
- Crop resistance is exploited in a large way in food crops such as rice, wheat, sorghum, maize, tomato, potato, tuber crops, and in sugarcane for key pests was exploited in designing integrated pest management.
- National Bureau of Agriculturally Important Insects has spearheaded the DNA bar coding support of taxonomic confirmation.
- Plant protection research developed suitable bio-control agents of which many strains of fungal pathogens of insects could be formulated and commercialised.
- Therapeutic approach in crop protection for preventing pathogenesis of perennial crops was favoured with the introduction of new range of triconozole fungicides and imazythepyr insecticide against pod borer in pulses, hairy caterpillar or Spodoptera caterpillar in soyabean etc. as a useful approach in epizootic condition.

- Mites in paddy, vegetables, chillies etc. have been managed using new chemistry pesticides such as fipronil. Predatory mites were utilised to contain mite population in protected agriculture.
- Nematode management using crop plant resistance in various crops has been a major research theme and could provide a number of crop breeding lines for this purpose. Interest to utilise RNAi techniques to reduce penetration process of nematodes in crop roots is building up.
- Supervisory pesticide trials to generate location-specific residue data of new chemistries of pesticides have been completed. National monitoring of pesticide residues in 19 commodities through 21 laboratories continued to generate data on violation of maximum residue limits of more than 103 commonly used pesticides.

4.41 In spite of diversified and difficult scenario, the ICAR technologies have contributed significantly to agricultural growth in the country that has led to successful experiences as indicated below:

Successes of varieties in agricultural production are reflected through development of single cross hybrids (SCH) in maize over the open pollinated varieties/ composites. Due to promotion of SCH in maize during the last 4-5 years, production has increased from 15.1 million tonnes in 2006-07 to 21.28 million tonnes during 2010-11. Development of high yielding varieties with rust resistance in wheat had enhanced its production from 69.4 million tonnes in 2005-06 to 85.93 million tonnes in 2010-11. In rice varieties, Improved Pusa Basmati 1 and Improved Samba Mahsuri, resistante to bacterial leaf blight has been developed to enhance productivity. The demand of breeder seed of Improved Pusa Basmati for the year 2012-13 has gone to 117 quintals against 47 quintals of Pusa Basmati. For submergence, variety Swarna Sub-1 has been developed to withstand submergence for about two weeks. Variety 'Sahbhagidhan' yields 3.8 to 4.5 t/ha in about 100 days and can withstand terminal drought for at least two weeks. Considering all the food crops, the varietal improvement with respect to yield and resistance to biotic and abiotic stresses has led to enhanced food production from 208.60 million tonnes in 2005-06 to 259.3 million tonnes in 2011-12. The short duration, large seeded Yellow Vein Mosaic virus resistant mung bean varieties, IPM 2¬03 and IPM 02-14 for spring / summer cultivation been popularised through technology demonstrations of 2010 and 2011. Sizeable acreage under these varieties has increased pulse production. The early maturing groundnut varieties, JL 501, Vijetha, Greeshma and Girnar¬3; mustard varieties Pusa mustard 27, Pusa mustard 25 and NRC DR 601; sunflower hybrids KBSH 53, CO2 and DRSHI; castor hybrids DCH 591 and YRCH.1 have been successfully integrated into seed chain for enhancement of cultivated area in the last three years.

IV. AGRICULTURAL ENGINEERING

4.42 Agricultural engineering and technological inputs in agriculture have made significant contribution in increasing agricultural production and productivity through timely farm operations, better placement of inputs, increasing irrigation potentialities and efficiencies, reducing losses of produce by providing improved storage structures and technologies and by conserving soil and water resources from further degradation. In future, Indian agriculture will face more challenges to increase its production substantially from almost the same cultivated land to feed its growing population, reduce the cost of production, reduce losses, add value to the farm produce and maintain the quality of raw and processed products to a high standard to compete with foreign goods, both for the domestic and export markets. The biggest challenge is to make agriculture profitable. This will be possible only by reducing cost of cultivation through enhanced input use efficiency and by higher returns to the farmers through value addition in production catchments and adopting loss prevention measures.

4.43 During the past two decades, more than 200 technologies and equipment have been developed, tested and popularized under the National Agricultural Research System. These comprise of manual, animal drawn, power tiller drawn, tractor operated/mounted and self-propelled types for different agro-climatic regions. Some of the important equipment are: rice seeder, wheel hoe, dibbler, serrated sickle, zero till seed cum fertilizer drill, animal drawn multipurpose tool carrier, bullock drawn sprayer for cotton and other crops, animal drawn inclined plate planter, tractor mounted rotary tiller, tractor operated zero-till seed-cum-fertilizer drill, self-propelled power weeder, solar-energy based dryers, biogas plants, charring kiln, briquetting machine, sun tracker for photo-voltaic panels, biomass based gasifiers etc. The equipment developed at Central Institute of Agricultural Engineering, Bhopal, and different agricultural engineering institute/departments have greatly facilitated mechanisation of labour intensive farm operations. The monetary value of outcome of the technology developed is estimated to be over Rs 7000 million per annum.

4.44 According to the DARE the growth of agricultural engineering in India leading to improvements in farm practices and development of agricultural implements for improving agriculture outputs is as follows :

1951-60

- Research and Development activities in agricultural engineering were mainly carried out at Allahabad Agricultural Institute and were directed towards manual and animal operated tools and implements.

1961-70

- Land Grant based institutions were established at some Agricultural universities to carry out teaching and research activities in the field of agricultural engineering
- ICAR conducted state-wise survey of tools and implements used by farmers for bench marking the status.
- 17 research, training and testing centres were established to promote R&D on farm implements
- With the introduction of high yielding wheat varieties , cultivator, disc harrow, seed drill and threshers were developed for Indian conditions.

1971-80

- Central Institute of Agricultural Engineering was established at Bhopal to conduct R&D work in farm mechanization and post harvest engineering
- All India Coordinated Research Project on Post Harvest Technology, and Farm Implements and Machinery were initiated to conduct R&D activities on developing post harvest technologies of agro-produces, farm tools and equipment
- Improved tools and equipment such as improved seed drills, planters, axial flow threshers, tubular maize sheller root crop harvesters etc were developed and introduced to promote farm mechanization
- Research on renewable energy was initiated on biogas and solar energy and gadgets, like solar water heater, solar cooker, dryer etc were developed

1981-90

- Vertical conveyor reaper, pneumatic planter, multicrop thresher, potato planter, ULV sprayer, direct rice seeder, decorticator, mini dal mill, grain cleaner and grader were developed

- Combine harvesters were introduced for the harvesting wheat and paddy.
- Three All India Coordinated Research Project on Renewable Energy Sources, Utilization of Animal Energy and Application of Plastics in Agriculture were initiated to conduct R&D activities on developing need-based technologies.
- Central Institute of Post Harvest Engineering and Technology was established to conduct R&D activities in the area of post harvest technology

1991-2000

- Farm equipment like self-propelled rice transplanter, animal loading car, solar tracking device etc were developed and introduced.
- All India Coordinated Research Project on Ergonomics and Safety in Agriculture was initiated to conduct R&D activities on human engineering aspects in the design of farm tools and equipment.

2001-2010

- R&D work on straw reaper , manure spreader, vegetable transplanter plastic mulch laying machine, animal feed block making machine, laser land leveler, pomegranate aril extractor, evaporative cool storage system, modified atmosphere packaging, improved technologies for processing and diversified uses of natural fibres, gums and resins etc was carried out.
- An All India Network Project was initiated at IINRG, Ranchi to conduct research on harvesting, processing and value addition of natural gums and resins.

4.45 According the budget 2013-14 an outlay of Rs. 75 crore has approved at BE stage against the proposal of Rs. 99.30 crore which is more than 25% of the proposal of the Division based on the demands for fund from various units/schemes under SMD of Agricultural Engineering. Further out of allocation Rs. 52 crore for 2012-13, the Division has been able to utilize Rs. 34.35 crore upto January, 2013.

4.46 Custom hiring of farm machinery is being promoted to meet the mechanization needs of small farms. This mode enables the small farmer to get the farm operation done without making investment in the machinery. Besides, development and demonstration of animal drawn equipment for small farms are being carried out under the ongoing scheme, AICRP on Utilization of Animal Energy. This scheme will continue in the XII Plan to give thrust for developing need-based small farm equipment.

V. ANIMAL SCIENCE

4.47 Animal Science Division of ICAR coordinates and monitors research activities covering all major species of livestock and poultry available in India which contribute in agriculture and food production. These are cattle, buffalo, sheep, goat, equines (Horses and ponies, donkey and mules), camel, yak, mithun, pigs, poultry (chicken, ducks, Guinea fowl, Turkey, Japanese quails and Emu). The genetic improvement, conservation and sustainable management is carried out by species specific institutes and through SAUs, SVUs, State AH Departments and NGOs by means of All India Coordinated, Net Work, out-Reach and Mega Seed projects. The Division coordinates 7 All India Coordinated Research Projects and 7 Network Research Programmes. In addition, 3 outreach programmes and 4 mega seed projects (poultry, sheep, goat and pig) are also being operated in different parts of the country at different ICAR institutes, State Agricultural / Veterinary Universities and Non-Governmental Organizations.

(a) <u>Livestock Products Technology and Animal Health</u>

4.48 The vision is “Development of technologies to support production enhancement, profitability, competitiveness and sustainability of livestock and poultry sector for providing food and nutritional security to Indian masses”. The future thrust areas of the Division are Molecular signatures for indigenous livestock resources, reducing embryonic losses and improvement in reproductive efficiency in livestock, exploitation of genetic resistance through marker assisted selection for disease management, buffalo and goat genomics, Stem cell research for animal health and production, Improvement of utilization of low quality roughages through *in vivo* and *in vitro* manipulations, production of nutrigenomics, nutraceuticals, functional foods, probiotics, mitigation of methane production from livestock, development of diagnostics and immuno prophylactics for various diseases using biotech and nanotech tools, recombinant DNA vaccines, monitoring and surveillance for transborder and zoonotic diseases, transgenic chicken and pigs for pharmaceutical production, allele mining for biotic and abiotic stresses, development and improvement of technologies for value addition, shelf life enhancement and quality assurance of livestock and poultry products. The s*alient achievements have been as given below.*

- *Information system on Animal Genetic Resources of India (AGRI-IS 2.0) developed.*

- *More than 90% of descript breeds characterized and breed descriptors developed and registered 135 breeds of livestock and poultry and given accession numbers.*

- *Improved twinning rate in Malpura, Deccani and Bakharwal sheep crossed with Garole sheep from Sundarban by introgression of Fec B genes.*

- *Poultry strains cross developed laying 305 eggs up to 72 weeks of age developed.*

- *Vanraja and Grampriya strains for rural poultry production developed, popularized and propagated in different areas of the country.*

- World's third cloned buffalo calf named 'Shresth' born on August 22, 2010 using embryonic stem cell through hand guided technique

- Frieswal cattle having 305 day milk yield and peak yield were 3308.65 kg and 15.40 kg respectively have been developed.

- Murrah progeny tested bulls have been produced and tested at different locations in farmer's herds and 65,000 frozen semen doses of progeny tested bulls are available

- Elite herds of Nili-Ravi, Jaffarabadi, Surti, Bhadawari, Pandharpuri and Swamp buffaloes established at various participating centres under Network Project on Buffalo Improvement

- Developed complete feed block technology using locally available unconventional feeds for mithuns and yak

- Protocol for deep freezing of yak semen developed and first calf produced by ETT

- Semen collection by "Gloved Hand Method" and preservation technique for pigs standardized and AI has been introduced in farmer's animals

- Estrus synchronization kit using cervical sponge for sheep, goat, yak and mithun developed, patented and marketed for improving reproductive performance.

- Diagnostic kits for early pregnancy in equines developed and marketed.

- Amelioration of heat stress in broiler chickens has been productively achieved through supplementation of vitamin-C and potassium chloride in diet.

- Indigenous technology developed for FMD vaccine production and recombinant DIVA kit for differentiation of FMD virus in infected and vaccinated animals released

- Eradication of Rinderpest and contagious pleuro-pneumonia from India

- FMD and HS adjuvanted oil vaccine commercialized

- Inactivated pentavalent bluetongue vaccine using indigenous virus strains developed and commercialized

- FORGIN Model for precise forecasting of *Heamonchus contortus* in sheep for semi-arid and arid zones of Rajasthan developed

- Achieved Hundred percent import substitution for FMD diagnosis and control

- Poly-herbal post-milking teat dip developed for prevention of sub-clinical mastitis

- Designer paneer (low fat) developed from yak milk which can be stored upto 12 days at refrigeration temperature (4 ± 1^0C)

- Developed retort pouch processed ready to eat meat products (mutton and chicken curries, nuggets, sausages) requiring no refrigeration for transport and marketing

- Developed cost effective detoxification technologies for oil cakes

4.49 There is AICRP on Cattle Improvement run by the Project Directorate on Cattle, Meerut where genetic improvement of indigenous cattle breeds is being done in collaboration with State Veterinary Universities by field and associated herd progeny testing programmes. Following genetic improvement in some selected indigenous cattle breeds has been undertaken by ICAR.

(b) Role of indigenous animals in organic farming

4.50 Organic farming is a natural method of farming system which primarily aims at cultivating the land and raising crops in such a way as to keep the soil alive and in good

health by use of organic wastes (crop, animal and farm wastes, aquatic wastes) and other biological materials along with beneficial microbes (biofertilizers) to release nutrients to crops for increased sustainable production in an eco-friendly pollution free environment. The dung and urine produce compost for organic crop production. A niche area project on organic farming is being run at CSKPHKV, Palampur where they use organic manure from Hill cattle for producing organic tea and other vegetable and horticultural crops.

(c) Programmes for using cow dung for vermicompost

4.51 The vermicomposting is a simple biotechnological process of composting in which animal and farm waste harbour species of earthworms and microorganisms which are used to enhance and accelerate the process of waste conversion into value added products. Several research programmes on earthworm culture and its role in developing vermicompost are in progress at IVRI. Value added products and technologies such as vermicompost, vermiculture, voelomic fluid, vermiwash, prolific breeder line (Eisina foetida), Voracious feeder line (Eudrilus eugeniae), Heat and cold tolerant line (Eudrilus eugeniae), New Earthworm selected line (IVRI Earthworm), and Vermicompost Sieving Machine have been developed. Training is provided to farmers and other dairy entrepreneurs on the process of vermicompost preparation, vermiwash preparation, Coelomic fluid preparation and the maintenance of breeding stock of earthworm.

(d) Frieswal Breed Project

4.52 The Frieswal breed project under All India Coordinated Research Project (AICRP) was launched since 1987 at Military Farm Meerut. The Bull Rearing Unit (BRU) was established at Military Farm Meerut for rearing of young male calves born out of elite females maintained at different Military Farms. The semen collection and freezing is being done by PDC, Meerut. ICAR is providing quality frozen semen, technical guidance, feed testing facilities, and financial support besides training to Military Farm staff. Under All India Coordinated Research Project (AICRP), no research programme on Indigenous cattle has ever been undertaken by ICAR with the Military Farm, Meerut. However, regional specific indigenous breeds are being improved in collaboration with

State universities under NARS. The farming community is being benefited from AICRP project by use of frozen semen of Frieswal under component of Field Progeny Testing of the AICRP. The project is currently in operation in four locations of the country. These are (1) Kerala Veterinary and Animal Sciences University, Thrissur, Kerala (2) BAIF Development Research Foundation, Uruli-Kanchan, Pune, Maharashtra, (3) Guru Angad Dev Veterinary & Animal Sciences University , Ludhiana, Punjab, and (4) Govind Ballabh Pant University of Agriculture & Technology, Pantnagar, Uttrakhand. Through this project, farmers of the adjoining areas of operating centre are being benefited with respect to improvement in milk production.

4.53 Besides Frieswal semen produced by ICAR has been distributed to a number of State Govt Departments, Livestock Boards, NGOs, paravets etc. More than 2.2 Lakhs doses of Frieswal semen has been distributed for using in different herds of farmers in field conditions which have improved the production level of local cattle population

VI. FISHERIES

4.54 Total fish production in India was 0.75 million t in 1950-51 that has increased to 8.67 million t presently. Inland fish production increased from 0.218 million t in 1950-51 to about 5.3 million t in 2011-12, marine fisheries also registered a phenomenal growth during last 5-6 decades both quantitatively and qualitatively from 0.5 million t in early 50's, to the current production of about 3.37 million t.

4.55 Research, education, training and extension pertaining to fisheries and aquaculture have led to 11-folds increase since 1950-51 in fish production (presently touching about 8.67 million tonnes). Fisheries and aquaculture contributes more than 1% to the National GDP and 4.7% to the agricultural GDP. In addition to contribution in fish export of worth Rs 16,597 crores in 2011-12, fisheries and aquaculture are also playing important role in food, nutritional and livelihood security of particularly poor section of this country. Various technologies, skills and knowledge generated from fisheries and aquaculture sector under National Agricultural Research System are

useful for the developmental activities of various states of this country to enhance the overall production and productivity of agriculture. The significant achievements include-

- Multiple breeding in carps for year round fish seed availability has been achieved.
- Developed Jayanti rohu with 17% higher annual growth by selective breeding.
- Low cost, zero water exchange technology for shrimp farming has been developed.
- Successful trials have been completed for shrimp farming in inland saline area with good production. This has led to the development of technology for better utilization of waste land of our country due to higher salinity(which is other wise unfit for agriculture cropping).
- Seed production and culture technology for Asian Seabass for brackishwater aquaculture has been perfected.
- Developed the suitable technology for open sea cage farming of Seabass, Cobia and lobsters along the west and east coast of India.
- First time breeding and larval rearing of Cobia and Pompano have been successfully demonstrated in our country.
- Juvenile and turtle excluder device in trawl nets has been developed.
- Development of big mesh size purse seine for deep sea pelagic fishing.
- Production process of value added products from cuttlefish, squids, threadfin breams, Tilapia and major carps standardized.
- Developed packaging system for cooked fish products in retortable flexible pouches to maintain and preserve quality of products for more than a year.
- Standardized mitochondrial DNA sequence-based species identification and PCR- based sex determination of marine mammals.
- Developed a method for detection of White Spot Disease in shrimp as well as RT-PCR technique for detection of Yellow Head Virus.
- Kuruma shrimp *Marsupenaeus japonicus*, a potential candidate species for aquaculture during winter months was successfully cultured registering a survival of 83 % and a production of 1018 kg/ha/4 months.
- Successful breeding of yellow catfish, *Horabagrus brachysoma* and freshwater eel *Mastecemebelus aculeatus* was carried out.
- Giant Freshwater Prawn, *Macrobrachium rosenbergii* was bred in captivity using inland saline water and post-larvae raised with suitable ionic amendments.
- Larval rearing protocol were developed for honey comb grouper *Epinephelus merra.*
- In vitro marine pearl production through tissue culture technique was successfully carried out in Indian Pearl Oyster Pinctada fucata and abalone, Haliotis varia
- Two species of sand lobster (*Thenus orientalis, Scyllarus rugosus*) were successfully bred in captivity.

(a) <u>Introduction of improved strains of common carp in hill states</u>

4.56 The existing Bangkok scale carp strain was not showing good growth in hill areas. Hence, Directorate of Coldwater Fisheries Research, Bhimtal imported two Hungarian strains (Ropsa scale carp and Felsosomogy mirror carp) and introduced at field centre Champawat. Growth performance of these Hungarian strains and existing local strain of scale carp (Bangkok strain) has been evaluated at Champawat. Highest growth has been recorded in Hungarian mirror carp (352 g) under poly-culture system followed by Hungarian scale carp (304gm). The growth of the existing strain was low being 187 gm.

4.57 Both the strains were successfully bred after two years (May, 2010) of its transplantation and rearing at Champawat and seed has been produced. They have been named as Champa 1 and Champa 2. The fingerlings of these strains have been supplied to different hill departments particularly the Dept. of Fisheries of Arunachal Pradesh and Sikkim and to ICAR Research Complex for NE region, Barapani (Meghalaya) to evaluate the growth performance in different eco-climatic conditions. After successful trials, this species will be released for commercial purposes.

(b) Introduction and Aquaculture of Tilapia in India

4.58 Experimental trials conducted with stocks of Genetically Improved Farmed Tilapia (GIFT) from World Fish, Philippines at CIFA, Bhubaneswar during 1997-2000 demonstrated production levels of 5-6 tonnes/ha in four months culture period and ensuring monosex populations through 17-a methyl testosterone treatment with feed for initial one month. It may be stated that production of monosex population of Nile tilapia and its farming has been one of the most important commercial activity in several countries over the years.

(c) Introduction and Aquaculture of Pangus catfish, *Pangasianodon hypophthalmus*

4.59 Pangus catfish, *Pangasianodon hypophthalmus* (*Pangasius sutchi*) is a recent entrant in freshwater aquaculture. *P. hypophthalmus* was illegally brought into the aquaculture systems of the country during late nineties through Bangladesh (first reported in 1997), which, however, was legalized for farming in the freshwater aquaculture systems in the country due to its very high growth and production potential

under monoculture system and comparatively low risk to the environments. Studies have also shown that the growth rate of the species is significantly higher than the indigenous pangus species, i.e. *Pangasius pangasius.*

(d) Breeding and larval production of the silver pompano, *Trachinotus blochii*

4.60 The Central Marine Fisheries Research Institute has successfully accomplished broodstock development, induced breeding and larval production of the silver pompano, *Trachinotus blochii*. It can be considered as a milestone towards the development of pompano aquaculture in the country. The present success in the pompano breeding is a major step in the development of seed production technology. It is felt that pompano is a potential mariculture giant which has vast domestic and global business prospects.

4.61 Silver pompano is caught only sporadically in the commercial fishery and hence, its natural availability in the sea is rather scarce. It is a much sought after species and hence, the demand can be met only through aquaculture. The farming of pompano can be successfully carried out in ponds, tanks and floating sea cages. The species is able to climatise and grow well even at a lower salinity of about 10 ppt and hence, it is suited for farming in the vast low saline and brackish waters of our country besides its potential for sea cage farming.

(e) Breeding and seed production of Cobia (Rachycentron canadum) at Mandapam

4.62 Cobia is a marine finfish species with very high potential for aquaculture in India. Fast growth rate, adaptability for captive breeding, lowest cost of production, good meat quality and high market demand especially for *sashimi* industry are some of the attributes that make cobia an excellent species for aquaculture. In recent years, the seed production and farming of cobia is rapidly gaining momentum in many Asian countries. The availability of its seed in good quantity will help in diversifying the mariculture activities in India. Envisaging the prospects of cobia farming in India, broodstock development was initiated at the Mandapam Regional Centre of Central Marine Fisheries Research Institute in sea cages during 2008, and the first successful induced breeding and seed production was achieved in March – April 2010. It was necessary to repeat these trials for perfecting the seed production technology for this

very fast growing fish. Second successful spawning and larval production of cobia was achieved at Mandapam Regional Centre of CMFRI in September 2011. On 6-9-2011, one of the females with intra-ovarian eggs of around 700 µ size, from the broodstock cage was selected for induced breeding. The species now has been bred in recirculatory aquaculture system, recently.

VII. INTEGRATED FARMING

4.63 Adoption of Integrated Farming System is considered to be the most appropriate approach in meeting the challenges of small-farm-agriculture and fulfill the requirements of adequate healthy and nutritious food, feed, fodder and other value added commodities vis-a-vis resource sustainability and improvement of farmers' economy. In order to have a systematic integration of multi-enterprise systems in a scientific manner, the Council has initiated an AICRP on Development of Integrated Farming System (IFS) models for different agro-ecological zones during XI Plan and is being further strengthened during the current Plan.

Integrated Farming Systems

4.64 The Ministry have stated that health management should be given more and more attention be it horticulture or animals especially with regard to pests and diseases.

- Developed integrated Farming systems involving crops, horticulture, agroforestry, fisheries, poultry, piggery, mushroom cultivation and bee-keeping etc. with potential to increase productivity by 2-7 times.
- Developed several location specific IFS models for small and marginal farmers.
- Developed watermill based integrated farming system for north western Himalayas.
- Fish trench cum raised bed based horticulture-fish farming system generated for seasonally waterlogged areas.
- Developed multi enterprise farming system model for reclaimed sodic land.
- Rice, coconut and rabbit based integrated farming system packages developed for Western Ghats region.

CHAPTER - V

AGRICULTURAL EXTENSION

Elaborating the reasons behind the gap in delivery from lab to land, the Department stated that Agriculture in India is complex, diverse and risk prone with 123 million cultivators predominated by small and marginal farmers across 638,596 villages in 131 agro-climatic zones subjected to vagaries of monsoon, changing climatic conditions, regional variations in terms of natural resources, regional imbalances, isolated/difficult areas (hill, arid and dryland, floodprone areas) and other socio-economic factors, and multi-agency extension system.

5.2 Agriculture Extension is a major scheme (Agricultural Technology Management Agency Model) which aims at making extension system farmer driven and farmer accountable by way of new institutional arrangements to disseminate knowledge and information to the farmers. It enables transfer of technology and knowledge and researches in the labs to the farmers on the field and has active participation of farmers, farmer's groups, NGOs, KVKs, Panchayati Raj Institutions and other stake holders operating at district level and below.

5.3 The Indian Council of Agricultural Research has established 637 Krishi Vigyan Kendras (KVKs) in the country under the administrative control of different host organizations including 431 under State/Central Agricultural Universities, 54 under ICAR Institutes, 99 under NGOs, 35 under State Governments and remaining 18 under other educational institutions/Other Organizations. Major programmes taken up by KVKs, during 2012-13 include on farm trials, front line demonstrations, training of farmers and extension personnel, awareness creating extension activities, production of technology inputs for availability of farmers. During 2012-13 KVKs has undertaken testing and demonstration of agriculture technologies, 29428 on farm trials and 1.31 lakh front line demonstrations in different farming systems besides training of 18.80 lakh farmers and extension personnel and creation of awareness on improved technology to 170.16 lakh

farmers and other stakeholders through various extension programmes. KVKs also produced 1.74 lakh quintal seeds and 206.59 lakh planting materials for its availability to farmers; They also analysed 3.78 lakh samples of soil, water, plants and manures and provided mobile agri-advisory to 11.14 lakh farmers by sending 1.47 lakh messages. Under NICRA project 100 KVKs also demonstrated a number of climate resilient technologies through 23441 demonstrations in farmers field covering 132 villages.

The Ministry have stated that objectives of KVKs in XIIth Plan are as follows :-

- Identification of the location specificity of agricultural technologies and establishing their production potential in farmers field.
- Updating the knowledge and skill of farmers and orientation of extension personnel in frontier areas of technology development and application.
- Identification and entrepreneurial development of rural youths through vocational training programmers for livelihood security.
- Creation of awareness through e-extension and other programmers.
- Strengthening of research related to technology application and its impact on farmers through eight Zonal Project Directorates.

5.4 During the oral evidence a non-official witness stated about process of dissemination of knowledge as follows :-

> xxxx xxxx I feel that we should prepare a new framework wherein we should have entrepreneurs as technology agents and they should be imparted vocational training so that they can pass on complete knowledge to the farmers and nothing gets lost in the process of dissemination of knowledge. We can set up agriclinics or have technology agents for the purpose. We need to give priority to our education system which we adopted on land grant system almost 50 years ago. We need to revisit it and plug in the loopholes to strengthen it. We have to prioritise our system of education, extension and research and we need to look at sectoral allocations too because so far emphasis has been on crops and food security. Livestock and fisheries sector is important too and there is a lot of scope for development in horticulture too so resource allocation for these sectors should be as per their contribution to the national GDP".

5.5 Concerning working of existing Research linkages and coordination between ICAR and the research apparatus of States the Department stated that it is working satisfactorily. In regard to the linkage between ICAR institutes and State Agricultural Universities the secretary DARE and DG (ICAR) explained to the Committee as follows:

> "All Indian Co-ordinated Research Projects cut across the country, the systems and the affiliations and so on no system has responded like the National Agriculture Research System every time whether it was the National Agriculture Research Project that we had to bring in or the National Agriculture Technology project that we brought in or for the last 4 ½ years we are operating the National Agriculture Innovation Project. Every time, it is looking into the needs of what should be done at the country-level and duly addressing the global concerns, but at the same time the small farm holding in remote parts of the country. So, we try to link up the global changes whether it is climate or trade with your small farmer in remote villages of the country. This is the capacity that is the linkage that the National Agriculture Research System has brought out".

The Secretary, DARE and DG(ICAR) informed the Committee

"SAUs and ICAR Institutes through the All India Coordinated Research Projects and the KVKs through many other schemes are working closely xxxx xxxx xxxx and more than 50% of the Budget that is given to DARE is going to SAUs xxxx xxxx xxxx. The only thing that is not happening is that movement of teachers and the scientists between the institutions and universities, xxxx xxxx xxxx in this context, we are trying to build up some incentives".

5.6 The Department have clearly stated that better participation of the State functionaries is desired in aspects such as : Indenting and timely lifting of breeder seeds, incorporating improved varieties in technology package, ensuring healthy seed chain and effective transfer of technologies developed from the National Agricultural Research System.

5.7 The location specific problems can also be addressed more professionally and purposefully by strengthening the Regional Research Stations which were established under National Agricultural Research project and fall under the jurisdiction of respective SAUs. These research stations were mandated to develop location specific technologies and address regional issues but after the completion of NATP such research stations are not being strengthened in terms of infrastructure, manpower, research contingencies etc. to meet the desired objectives.

5.8 During the evidence before the Committee the witness while expressing his view on the Krishi Vigyan Kendras has stated as follows:

> "About 80 per cent farmers are very small farmers. For them, you require both on-farm and non-farm income. If they have only farm income, they will not be able to have enough money. So, some degree of non-farm income will be necessary. So, the *Krishi Vigyan Kendras* should become *Krishi-Aur-Udyog Vigyan Kendras.* In other words, they should also concentrate on post-harvest technology, processing, value addition, primary products and so on. This can be done in each area. For example, for West Bengal, we are now preparing a complete map of processing because the Indian Institute of Technology, Kharagpur was the first one to start Agriculture Engineering and Food Technology long ago in Dr. B.C. Roy's time. They have a lot of knowledge which has not gone out even nearby. So, I suggested that with the Ministry of Food Processing, let us make a plan, for the whole of West Bengal, of small food processing areas. We require more and more non-farm income also. Both on-farm and non-farm income are important to have enough income for a family. In other words, the KVK must be upgraded. *Udyog* means not all the industries but the agro-based products industry and so on. This is becoming important in terms of training.

5.9 On being asked about the proposal to expand the activities of KVKs to enable them to function like Krishi-Aur-Udyog Vigyan Kendras to increase the on farm and non farm income of farmers in the country, the Government did not agree to the proposal, however, they have stated that with a view to realise full potential of farming and enable farmer to get value, secondary agriculture including primary processing and value addition are contemplated, for which, KVKs are proposed to be suitably equipped during the XII plan.

5.10 Regarding the assessment of the Department about the performance of KVKs, the Department in their written replies stated that the performance of KVKs are reviewed by the Department through Independent Evaluation and Impact Assessment of KVKs, Quinquennial Review Team (QRT), Scientific Advisory Committee meetings, Annual Action Plan and Review Workshops, Activity Training cum Workshops, Site visits by the scientists of Zonal Project Directorates, Directors of Extension of SAUs and Scientists from ICAR Headquarters, Annual National Conferences, linkage and convergence meetings/discussions.

5.11 At present, the KVKs are funded on 100% basis from the Council. The funds allocated during XI Plan were Rs 237420.04 lakh. Each KVK is provided with a staff strength of 16 including one Programme Coordinator, six Subject Matter Specialists depending upon the important thrust areas of a district, out of the disciplines of Agronomy, Horticulture, Veterinary Science, Home Science, Agricultural engineering, Fishery, Soil Science, Agro-forestry and Plant protection; three Programme Assistants, and six other staff. The KVK is provided financial help for the building infrastructure depending upon its needs including a main building, trainees' hostel, two demonstration units and 6 residential apartments for the staff, fencing and farm development.

5.12 Enumerating the steps taken by the Department to improve the functioning of KVKs in the Country, the Department stated that the KVK is an intermediary institutional arrangement created between Research and Extension Systems of the country to assess, refine and demonstrate the technological options in the farmers' fields to establish the production potential and identify location specificity of the technologies generated by National Agricultural Research System (NARS). The broad basing and expansion of mandates of KVKs will dilute its functioning in scientific mode. In order to improve the functioning of KVKs during Twelfth Plan, there is a proposal to provide additional manpower, and infrastructural facilities including provision of e-connectivity, establishment of Soil & Water Testing Labs, Rainwater harvesting structures, Basic Plant Health Diagnostic facility, Minimal Agro-processing facility, Portable Carp Hatchery, Integrated Farming Systems, Seed Processing facility. Besides, all KVKs will be provided need based farm machinery and equipments including generator for power backup.

5.13 Concerning issues such as the number of posts in various KVKs lying vacant and the number of Kendras functioning with their full strength and the extent to which these KVKs have failed to obtain their objectives due to shortage of staff, the Ministry in their reply stated that there is a provision of 16 staff in each KVK. Therefore, the total sanctioned staff strength of 634 KVKs is 10,144 out of which 2513 posts are lying vacant. During the last six months 120 staff positions have been filled up. As the staff in KVKs is borne on the establishment of various host organizations, therefore, filling-up of

the positions is done by these organizations. As many as 96 KVKs are having full staff strength, 410 KVKs are having a staff strength of 10 to 15 and 124 KVKs are having a staff strength of less than 10, most of which include new KVKs sanctioned in 2011-12. Large majority of the KVKs are functioning under Agricultural Universities, which are not able to fill-up the posts due to ban on recruitment imposed by State Governments from time to time. While there has been no failure in achieving the objectives of KVKs, shortage of staff at certain locations has led to slightly inadequate levels of interaction with the farmers.

5.14 The Ministry has furnished a list of KVKs sanctioned till October, 2011 to the Committee in which they have categorized them performance wise in the categories of Excellent, Very Good, Good etc. The Government have stated that the categorization of KVKs is generally based on the performance of different parameters like achievements of mandatory activities, regular and timely submission of reports, availability of infrastructure, staff strength, maintenance and productivity of KVK farm, resource generation, technical support extended to other programmes/organizations and linkages with various stakeholders and innovative extension approaches used in transfer of technology etc.

5.15 Giving details of the performance of KVKs in 2012-13 the Ministry stated that in crops and livestock, 328 technological interventions were refined under different thematic areas in 395 locations. Besides, five women-specific income-generating technologies were also refined in eight locations. As many as 73,175 frontline demonstrations were undertaken on cereals, millets, oilseeds, pulses, and other important crops; 4,710 on improved tools and farm implements; 14,390 on livestock; and 5,991 on other enterprises including gender-specific technologies. Under the National Initiative on Climate Resilient Agriculture (NICRA), 26, 218 demonstrations were also carried out. However, the Committee find that out of 632 KVKs in the country, the Department has been able to provide Administrative buildings to 554 KVKs, Trainees hostel to 490 KVKs, Staff Quarters to 442 KVKs, demonstration units to 394 KVKs and soil and water testing facilities to 389 KVKs only.

(a) Agricultural Technology Management Agency (ATMA)

5.16 The Department of Agriculture Research and Education (DARE) has not analysed the causes behind the sub-optimal performance of ATMA as the Scheme is being implemented by Department of Agriculture and Cooperation (DAC). The DAC has been implementing a Centrally Sponsored Scheme "Support to State Extension Programmes for Extension Reforms" which aims at promoting decentralized, demand-driven and farmer-accountable extension system through a new institutional arrangement for technology dissemination in the form of Agricultural Technology Management Agency (ATMA) at the district level.

- ATMAs must fully involve Farmer Advisory Committees being set up at the Block, District and State level in getting farmers perspectives in planning and also have provision for continuous feedback on the status of implementation of planned activities at various levels.
- ATMAs need to have more dedicated extension personnel at the Block level.

5.17 Regarding the role of State Governments and their agencies in dissemination of the research of ICAR and its institutes to farmers in time, a non-official witness states as follows:

> "after talking to the farmers about their problems and the Department officials I feel that coordination and convergence is an important issue. We need to build a framework at centre level or state level so that knowledge is disseminated to the farmers with everybody's cooperation. That is why when we took up world bank project which was named National Agricultural Technology Project at that time and was the largest world bank project worth 240 million US dollars, we included the important component of Krishi Vigyan Kendras. These are institutional mechanism at district level for dissemination of knowledge and demonstration of agriculture technology for farmers. We come up with a concept that on an experiment basis Krishi Vigyan Kendras should be named Agriculture Technology Management Agency which should be owned jointly with the District Collector as the Chairman of the organising committee and universities and institutions related with development and agricultural research etc should be involved in it. This concept was considered at length. I thought all Krishi Vigyan Kendras would be converted into ATMAs and it would be a good opportunity for coordination but I found out later that Krishi Vigyan Kendra and ATMAs were functioning separately. ATMA is under Department of Agriculture and

Cooperation and Krishi Vigyan Kendras are under ICAR system. I still feel that there should be coordination between these two and other development programmes and there should be coordination committees at state level and the Center. Be it the Development of Agriculture, Water Resources or Post harvest Mechanism, there should be a coordination mechanism in place for all of them. This is a weak link. Our process of promoting our individual programmes does not help the farmers though it mobilises funds and strengthens the programmes. For example scientific universities or institutions should carry out the technical supervision and coordination of water shed programme but it is not being done. MGNREGA and other agriculture related activities should promote technologies which may increase the income of the farmers and improve their lifestyle".

5.18 Regarding the issue of integrating the activities of KVKs and ATMA the Department stated that a Joint Circular, signed by Secretary DAC and Secretary DARE, has been issued for strengthening the convergence of activities of KVKs and ATMA. The Joint Circular has been found to be effective in integrating the activities of KVKs and ATMA. Some of the salient features of the Joint Circular are as follows:

- KVK Programme Coordinator and ATMA Project Director in the District have an interface meeting once a month during the cropping season and work out a strategy of providing crop advisories to farmers for various stages of crop growth.
- KVK Scientists advise and mentor Block Technology Teams in identifying technological needs in various Blocks.
- District Agriculture Action Plan (DAAP) under ATMA developed on the basis of the Strategic Research and Extension Plan (SREP) should be refined in the process jointly by ATMA and KVKs from the Block level and acted upon for the purpose.
- Project Director ATMA and Programme Coordinator of KVK jointly visit at least five villages every month in the District to guide and supervise the extension related work.
- ATMA and KVK coordinate with each other in the conduct of Field Days, Kisan Melas, Goshties and setting up of Farm Schools, so that there is no duplication in coverage and they should ensure percolation of appropriate scientific practices down to the field level.
- KVK provide an Agricultural Technology Update (ATU) on half yearly basis i.e. before the start of Kharif and Rabi crop seasons to the ATMA for its wider dissemination among the farmers of the district.
- KVKs provide advice to ATMA and the District Administration for the implementation of Flagship programmes of the DAC namely – NFSM, NHM, RKVY, NAIS etc.
- The KVK Scientists technically advise the Block Technology Teams (BTTs) and are actively involved in preparation of Block Action Plans (BAPs), especially with regard to research related issues/gaps and strategies.

5.19 However, in order to further streamline the integration of activities of KVKs and ATMA as specified in the Joint Circular, the KVKs need to be strengthened in the following manner:

- Increase the number of Subject Matter Specialists to 10 (from the existing 6) in each KVK.
- Increase the office contingency amount to each KVK to about Rs 25 lakh per year.
- Improve the KVK infrastructure by expanding e-connectivity to all the KVKs.
- KVK Instructional Farm and Demonstration units need Integrated Farming System (IFS) models and Technology Cafeteria for show-casing technologies relevant to each District.
- The KVK also need Soil and Water Testing Laboratory, Micro-nutrient Analysis facility, Minimal Processing and Mini Seed Processing facilities to enhance their technical back-up to ATMA in every district.

(b) <u>Major hurdles experienced by the Department in effective transfer of technology</u>

5.20 However, the Department enumerating major hurdles in functioning of KVKs stated that the inadequate staffing at the district level for effective co-ordination, poor access to information, lack of human resource development and training are the major hurdles which need to be relooked. A Joint Circular, signed by Secretary DAC and Secretary DARE, has been issued for strengthening the convergence of activities of KVKs and ATMA. This has been found to be effective in integrating the activities of KVKs and ATMA. Interaction with the Govt. officials of various Line Departments twice, during the Kharif and Rabi campaign programme, is held each year. Bi-annual ICAR regional committee meetings are being organized involving clusters of different states for convergence and planning the research and developmental strategy. The state level ICAR/SAUs departmental meetings are also arranged regularly for reviewing the various programmes for effective delivery and sharing the information. The proposed convergence between KVKs, ZARC and ATMA shall also be helpful for improving the participation. In addition, interaction with various State Developmental Departments through institutional interaction at major ICAR hubs is also envisaged.

5.21 During oral evidence when the Committee desired to know the manner in which MNERGA can be involved to assist Agriculture in the Country. The witness stated as follow:

''मनरेगा में अमूमन 40,000 करोड़ रुपये प्रतिव-र् होते हैं, इस व-र् 60,000 करोड़ रुपये हैं, जो काफी बड़ी धनराशि है। जैसी आपकी मंशा है, मेरा दृढ़ मत है कि मनरेगा को अगर आप एसेट क्रिएशन में लगा देंगे, तो आने वाली शताब्दियां आपको याद करेंगी और अगर इसको मूल रूप से सैफ्टी नेट के रूप में ले जाएंगे, तो लोग कहेंगे पैसा कहां खर्च हो गया। वाटर कांस्टेंट है, जब से पृथ्वी बनी है और जब तक रहेगी, **H2O** कांस्टेंट है, वह न एक बूंद बढ़ा है, न एक बूंद घटा है। पूरी दुनिया में जितना जल है, भारतव-र् में जितना जल है, उसका 70 प्रतिशत कृ-ि में चला जाता है। आने वाले 15 व-ोंर् में, क्योंकि आपको एग्रीकल्चर को इंटेंसिफाई करना है, तो 25 प्रतिशत अधिक पानी की आवश्यकता होगी जबिक आपकी एक्चुअल जल उपलब्धता 12 प्रतिशत घट जाएगी। मनरेगा को अगर आप वाटर हार्वेस्टिंग स्ट्रक्चर्स बनाने में लगाएं, कुछ बन तो रहे हैं, लेकिन वे कितने वायबल है, यह देखना होगा। वाटर हार्वेस्टिंग स्ट्रक्चर्स में लगाएं तो बहुत बड़ी एसेट इस देश में क्रिएट हो जाएगी। आज हम बारिश का 29 प्रतिशत पानी हार्वेस्ट कर रहे हैं, वह बढ़कर 35 प्रतिशत हो जाए, तो इस देश में आमूल परिवर्तन हो जाएगा क्योंकि कहते हैं अगर इस देश का वाटर टेबल एक मीटर नीचे चला जाए, तो उस पानी को ऊपर लाने में 6000 करोड़ रुपये की बिजली ज्यादा लग जाएगी। इसके लिए आपको प्रोग्राम बनाना पड़ेगा, उसकी वायबिल्टी एसेस करनी होगी, यह नहीं है कि किसी वाटरबॉडी का आधा पोर्शन आप बनाएं और आधे पर काम रुक गया, ऐसे में वह इनफ्रक्चुअस एक्सपेंडिचर हो जाएगा। यही कारण है कि पिछली पंचव-ीय योजना में इरिगेशन पर जितना पैसा था, सारा खर्च हो गया और नेटएडिशन टू इरिगेशन जीरो रहा। **XXXX XXXX XXXX**, लेकिन मूलमंत्र यही है कि गरीब आदमी जिसको रोजगार नहीं मिलता है, उसे रोजगार तो मिले, पर वह रोजगार का सृजन एसेट क्रिएशन में हो। आप मनरेगा में कहते हैं कि 100 दिन का रोजगार देंगे, रोजगार तब दीजिए, जब उसके पास काम न हो।

महोदय, इस समय धान की फसल हो रही है और रबी की फसलें बोई जा रही हैं। इसी समय अगर आप मनरेगा भी चलाते रहेंगे, तो कृ-ि का काम एडवर्सिली इफेक्टेड होगा।''

5.22 When asked whether ICAR hired or engaged agricultural labour for their farm field in various institutes, Universities, KVKS etc. and criteria for engagement of such agricultural labours, the Ministry in their written replies stated casual labourers were earlier engaged by the ICAR Institutes, as per guidelines issued by the Government of India from time to time. Subsequently, as per the Department of Personnel and Training (DoP&T) guidelines vide OM No. 51016/2/90-Estt.(C) dated 10.09.1993, all the eligible labourers working in ICAR Institutes were given Temporary Status. Those who fulfilled the eligibility criteria were also considered for regularization against regular vacancies, in terms of the aforesaid guidelines dated 10.09.1993 of DoP&T. The State Agricultural

Universities are governed by the rules/ regulations issued by the respective State Governments from time to time and therefore, they engage labourers as per the labour laws of the respective State Governments. KVKs are functioning under ICAR Institutes, State Agricultural Universities and some NGOs located all over the country and therefore, they are governed by the rules and regulations prescribed by the Central/ respective State Governments.

5.23 On being asked about the service conditions, wages and remuneration paid to the labourers deployed on ICAR farms for research work, the Ministry stated that casual Labourers with Temporary Status engaged in ICAR are governed by the service conditions, wages and remunerations as prescribed by the Government of India from time to time through separate and specific orders. As regard remuneration paid for the last five years, it is submitted that this information is not readily available at the ICAR Headquarters.

5.24 When further asked whether the service conditions and minimum wages for the labourers are in accordance with the Contract Labour Regulation Act, and the reasons in case of non-compliance the Ministry in their written replies stated that institutes of ICAR have also out-sourced various labour intensive services as per the Government of India guidelines on contract labourers issued from time to time.

CHAPTER VI

AGRICULTURE EDUCATION

(a) History of Agricultural Education in India

As agriculture is a State subject, the responsibilities for research, education and extension rest with the State Governments. Prior to 1960, agricultural research in the States, essentially on local problems, was carried out by the State Departments of Agriculture supported by Agricultural Colleges. During the past 50 years, research and education have been transferred to the Agricultural Universities, and the State Departments of Agriculture organize extension services. The Universities are supported by their respective State Governments. ICAR provides partial financial support and assists their research and education programmes. The University Education Commission (1949) recommended the setting up of `Rural Universities'. This was endorsed by the two Joint Indo-American Teams in 1955 and in 1959, as well as the Ford Foundation Study Team in 1959. In 1960, the Agricultural Universities Committee constituted prepared certain guidelines for the establishment of Agricultural Universities in different States, and the ICAR gave necessary support. The first Agricultural University was established at Pant Nagar in Uttar Pradesh in 1960, patterned on the Land-Grant System of the United States. The Second Education Commission (1964-66) recommended at least one Agricultural University in each State, and ICAR prepared a Model Act in 1966. All the major States have now at least one Agricultural University each. Though the Model Act specifies that only one University shall be established in each State, which was later endorsed by the National Commission on Agriculture, many States have established multiple Universities to meet regional needs. There are at present 69 Agricultural Universities, including the Central Agricultural University in the North Eastern Region. These also include sectoral universities on Veterinary and Animal Science, Horticulture, and Fisheries Science in some of the States. Some Agricultural Universities, as in Maharashtra and Chhattisgarh States, have affiliated colleges. This goes against the provisions of the Act.

6.2 Explaining about the existing network of Universities the Ministry stated :-

" There are 59 State Agricultural Universities (SAUs), one Central Agricultural University (CAU), five Institutes having Deemed-to-be-Universities (DUs) status and four Central Universities (CUs) with Agriculture faculty. Out of them, there are 12 Veterinary Universities, three in Horticulture, two in Fisheries and 48 integrated agricultural universities. They have embraced education, research and extension education as integral to their functioning and have contributed a great deal in propelling agricultural growth in the country. With about 265 constituent colleges having about 35,000 student-intake capacity, the AUs impart education in 11 major disciplines at undergraduate and about 95 subjects at post-graduate level. In higher agricultural education, about 55% students are from rural back ground and, on an average, 36% are the girl students. Besides, the IIT, Kharagpur imparts education in the field of Agricultural Engineering, and about 158 privately owned colleges, majority of them particularly in the States of Maharashtra and Chhattisgarh, affiliated to SAUs impart higher agricultural education.

6.3 To reduce the inbreeding in Agricultural Education and talent promotion an All India Entrance Examination is annually held for UG level course and PG level courses for 15% (2285) and 25% (2851) seats respectively. Admission to 11 bachelor degree programmes namely Agriculture, Horticulture, Fisheries, Forestry, Home Science, Sericulture, Biotechnology, Agricultural Engineering, Dairying Technology, Food Science and Agricultural Marketing and Cooperation are done through entrance examination. Admissions are also done for 95 Master Degree Programme awarded by Agricultural Universities in 20 major disciplines. The Human capital availability and requirements in Agriculture and Allied Sector has been worked out through a study by National Academy of Agricultural Research Management (NAARM), Hyderabad and Institute of Applied Manpower Research, New Delhi. The discipline-wise supply (2010) of Human Capital requirement for the Agricultural Sector is as under.

Annual out turn by education level in 2010:

Discipline	UG	PG	Ph.D	Total
Crop science	11852	3514	583	15949
Horticulture	1001	409	55	1465
Veterinary	1761	797	125	2683

Fisheries	285	109	30	424
Dairy	255	30	25	310
Agri Biotech	558	156	20	734
Agriculture Engineering	1218	262	27	1507
Forestry	386	275	55	716
Total	17316	5552	920	23787

6.4 The Department plans to undertake following activities for improvement in Agricultural Education :-

- Institution Development- Renovation, remodelling, modernization of classrooms, laboratories and experimental farms.
- Hostels/boarding facilities including International Student Hostels and other works related to modernization and strengthening of teaching and learning.
- For building excellence in specific strategic areas in education and research through Niche Area of Excellence.
- Entrepreneurship skills through experiential learning units and related training.
- Provision for visiting faculty/ adjunct faculty and exchange of faculty and students,excellence/promotion and enhancement of faculty learning resources.
- Strengthening libraries and support for writing university textbook.
- Strengthening old/ historical universities/colleges.
- Linkages with national and international institutions for faculty and students exchange and teaching and learning resources management.
- Faculty Development.
  i. International and national training
  ii. Orientation programme for newly recruited faculty in AUs
  iii. Faculty recognition and awards including Young Faculty awards
- Integration of the NAIP consortia such as CeRA, e-granth and e-learning modules with additional tools such as video-lecture, e-books and video-conferencing.
- Some project based funding for promoting young and bright teachers.
- Man-power need assessment and management.
- Central instrumentation facilities, auditoriums etc.
- Need based special grants for strengthening education.
- Education Olympiad/Agri-sports/Agri-fests (zonal/national)
- Involvement of PPP in higher agricultural education.
- Support to new universities, centre of excellence, identification /creation of Innovation Departments/Universities for special funding.
- Best college award and recognition.
- Attracting Talents to Higher Agricultural Education by new schemes like Agriculture Sciences Pursuit for Inspired Research Excellence(ASPIRE), ICAR

Post Doctoral Fellowships, Broadening scope of NTS to PG students, increasing the number of ICAR JRF/ SRF, contingency support for practicals to students.

- Enhancement of stipend of RAWE/ Internship etc.
- Capacity building of NARS by Establishment of National Faculty Development Center at NAARM. Initiation of Centres of Faculty Excellence in AUs and ICAR Overseas Associateship, strengthening of CAFTs. Faculty exposure to International Conferences/ Symposia and institutionalizing Best Teacher Award at AU level.
- Accreditation of AUs and quality assurance.
- Promoting international co-operation & Fellowship.

6.5 During a personal hearing in January, 2012 a non-official witness while briefing the Committee stated as follows:

> "xxx xxx apart from under-graduates and post-graduates which we are producing, we should start a course of para-agriculture, like paramedics and para-veterinary. If we can start a course for para-agriculture, where 10+2 boys can come through the institutions and through the universities and get trained for year and then go back and work with farmers."

6.6 In this context, the Department stated that to handle a variety of day to day jobs at grass root level, the para–agriculture technical manpower is required not only in regard to farm practices, simple and routine veterinary services, routine testing services and various other rural occupations but also on aspects like agro-processing, marketing, escort services, etc. The demand can be met by diploma/ certificate holders in agriculture and allied sciences to great extent. The SAUs would provide guidance and necessary support to these diplomas and certificate programmes after proper need assessment in consultation with respective state government. These multi-skill development programmes can be dovetailed with government's Skill Development Mission or an integrated course can be started through existing institutional systems. The para staff can be trained in agriculture schools, finishing schools imparting specific skills and vocational training institutions. There is a need for certification and promotion of programmes for para staff.

6.7 The Department further stated that the skills need to be developed preferably among the rural youth themselves who have completed the 10+2 level either through the regular school, open school or vocational streams. This would be possible by

promoting diploma level education on the lines of engineering education in ITIs and polytechnics. The XII Plan Working Groups on various agriculture and allied sectors has also pointed to the need for large numbers of para-agricultural professionals and capacity building /education programs to meet this requirement. They further stated that some of the State Agricultural Universities offer two year courses in agriculture and allied sciences leading to diploma and some have certificate courses of short duration. The outturn has increased from about 1,040 in 1992 to about 6,500 in 2010. However, the region wise supply is highly skewed as more than 80 per cent of diploma holders are produced in the state of Maharashtra. Thus, there is vast scope for expansion of diploma education in other states.

(b) Justification for Para-professionals

6.8 A number of plan schemes envisage need for para professionals to them. Some are illustrated below:

> Various government schemes like national afforestation programme, green India mission, intensification of forest management scheme, national rural livelihood mission activities, etc. envisage strengthening of village level community forest management organizations (Vana Samrakshana Samitis or Joint Forest Management Committees). In 2010, there are about 1,50,000 joint forest management committees (JFMC) across the country (Planning Commission XII Plan Working Group Report on Forestry, 2011, P41). Therefore, the community forest resource management needs about 1,00,000 para-professionals in the next decade.

6.9 In the agro processing sector, there would be requirement for about 2.5 million persons in the organized horticulture industry (nurseries, production, cold stores and processing) by 2020, of which about 60,000 would be graduates and the rest being diploma holders and informally trained.(Kachru, R.P. 2006, Agro-processing Industries in India: Growth, Status and prospects). Availability of para-vets and other supporting staff is only 52,000 against the requirement of 2, 59,000 ((Planning Commission XII Plan Working Group Report on AH& Dairying, 2011, P9).

6.10 The required number of para professionals in both the organised and unorganised sectors is about 17.6 lakh (Approx) by 2020s. Micro-level organizations at

grass roots, bulk of which may not be organized, such as agri-clinics/agribusinesses and expected to grow at over 1000 per annum may need about 5000 graduates and 2-4 times that number of para staff. These organizations can also function as intermediaries for corporate and Govt. departments in agribusiness operations. In addition, it is proposed to establish Village Service Centres for every 10-15 villages, if not in each revenue village. Each Village Service Centre may have one technical expert each in various sub-sectors of agriculture supported by para staff. A number of activities that are unorganized do not get covered by established institutional systems in NARS. Considering this, over five lakh para staff would be needed by 2020 for various services at micro level. Although the requirement of para staff in the organized and unorganized categories emanate from different perspectives, the capacity development of these two streams may be complementary. Thus, the capacity building efforts need to plan for developing para-staff stock of about 17.6 lakh by 2020.In ideal case; it is desirable to have institutions with capacity development of about 1.7 lakh paraprofessional per year. Considering the low base of only 6,500 diploma holders per year now, the supply of paraprofessionals can be planned to develop both diploma education at 10+2 level (polytechnic) and some at next lower level, i.e. at secondary level (ITI eq) supplemented with certificate trainings producing the required 17.6 lakhs para-professionals by 2020 as shown below. This translates to having ratio of graduates to diploma holders of about 1:3 by 2020.

Sector	**Requirement of Stock by 2020**	**Required Annual Supply**
Agriculture	211489	21149
Horticulture	275315	27532
Forestry	27918	2792
Veterinary & AH	138846	13885
Fisheries Science	261146	26115
Dairy Sci. & Tech.	638530	63853
Agri-Engineering	103366	10337
Agri-biotechnology	1064	106
Nutrition	100000	10000
All sectors	**1757674**	**175767**

Source: Rama Rao D, Rashmi Agrawal, Nanda SK, Awasthi IC, Joshi GP, Sanchita Bhattacharya, Indra Kumar D. 2011. Assessment of Future Human Capital Requirements in Agriculture and Allied Sectors .NAIP Project Report, National Academy of Agricultural Research Management, Hyderabad.

Diploma level Education in Agricultural Sciences in 2010

Discipline	**1992**		**2010**	
	Intake	**Outturn**	**Intake**	**Outturn**
Agriculture	1622	1021	4348	3235
Horticulture	7	7	172	10
Veterinary & AH	-	-	4925	3136
Fishery	-	-	26	NA
Dairy	14	12	131	67
Agri –Engineering	-	-	31	NA
Home Science	-	-	83	42
Grand Total	**1643**	**1040**	**9716**	**6490**

NA = Data not available and - indicates course does not exist

6.11 At the school level, under the scheme of Vocationalization of Secondary Education, subjects are taught, inter alia, in agricultural vocations. For example, the courses approved by Central Board of Secondary Education (CBSE) include those in Inland Fisheries, Basic programme in Fruits and Vegetables, Agriculture and Farm Mechanics and Engineering. Pandit Sunderlal Sharma Central Institute of Vocational Education (PSSCIVE), Bhopal under National Council of Educational Research and Training (NCERT) is involved in research training and development of Syllabi for vocational education in various branches including agriculture related sectors. Indira Gandhi National Open University (IGNOU) provides training in a number of certificate and higher level courses in agricultural subjects through distance learning mode. These

include (a) Awareness Programmes on Dairy Farming for Rural Farmers and on Value Added Products from Fruits and Vegetables; b) certificate programmes in Organic Farming, Sericulture, Water Harvesting and Management, Poultry Farming, and Bee-keeping, c) diploma programmes in Value Added Products from Fruits and Vegetables, Meat Technology, Dairy Technology, Fish Products Technology and Value Added Products from Cereals, Pulses and Oilseeds, in addition to post graduate diploma programmes in Food Safety and Quality Management, and Plantation Management. Institutions like the Gandhigram RuralUniversity offer courses in Diploma in Agriculture, Commercial Horticulture and Certificate Course in Maintenance and Servicing of Farm Power Equipment.

6.12 The National Institute of Open Schooling (NIOS) has Diploma courses in Agriculture, and one-year courses in Jute Production Technology, Oyster and Mushroom Production Technology and Poultry Farming. A number of NGOs have programmes of training youth in the field of agriculture and related subjects. In the field of poultry science, there are several institutes offering diploma/certificate and skill development training programmes. These include Central Poultry Development Organization (CPDO), (Mumbai, Bangalore, Bhubaneswar, Chandigarh), Indira Gandhi National Open University (IGNOU), Central Avian Research Institute (CARI) and Indian Veterinary Research Institute (IVRI), Izatnagar, Poultry Diagnostic Research Centre (PDRC), Pune, National Institute of Open Schooling and Dr B. V. Rao Institute of Poultry Management & Technology (IPMT), Pune. In the field of fisheries science too, there are diploma and certificate programmes offered. The Central Institute for Fisheries Technology, Cochin, offers a two-year course in collaboration with Ministry of Labour's Craftsmen Training Programme. Apart from the above, several short term training programmes area also being conducted.

(c) Training of Scientists

6.13 During the XI Five Year Plan, 7729 Scientists of NARS in various levels have been imparted training on various aspects at the NAARM, Hyderabad. As an approved activity under National Agricultural Innovation Project (NAIP) 610 Scientists have been

deputed abroad for training in frontier areas and above 1000 Scientists have been imparted trainings in different areas of specialization in reputed research institutions and laboratories within the Country.

(d) Diploma Courses in Agriculture

6.14 The universities in several states are offering undergraduate diploma and short-term courses in agriculture and allied areas like Agricultural Sciences, Organic farming, Animal welfare, Veterinary pharmacy, Bakery products technology, Agriculture extension service, Agronomy, Agriculture marketing, Aquaculture, Dairy technology, Sales & marketing, Export & international marketing, Financial management & accounting, Agriculture engineering, Home Science, Fish products technology, Fisheries engineering, Fisheries aquaculture, Fisheries management, Horticulture & nursery management, Veterinary science & Animal husbandry, Floriculture & landscape gardening and Dairy farming etc. In order to provide para-technical staff to corporate farms and the food processing industry.

HUMAN RESOURCES

6.15 ICAR, is vested with the authority to regulate and ensuring quality assurance in agricultural education and in discharge of this function has taken a number of initiatives for agricultural education. During Agricultural Human Resource Development Project (1995-2000), many reforms were put in motion which include among others establishment of the Accreditation Board, measures for reducing inbreeding, new curriculum and delivery, faculty competence enhancement, infrastructure development, access to information, modernisation of libraries, emphasis on education technology etc. Subsequently, new initiatives implemented include new curriculum based on IV Deans' Committee and National Core Group recommendations, introduction of experiential learning and support for the infrastructure, introduction of Niche Areas of Excellence, availability of 1700 Journals online through CERA, fellowships (SRF and International Fellowships) and NTS, strengthening Center of Advanced Studies, introduction of the Adjunct Professor Scheme etc., In addition good support has been provided under X and XI Plan for having state of the art infrastructure in many areas.

Though these measures have led to reversing the decline in the quality of agricultural education and in some cases substantial improvement but the situation still in many institutions is much below the expectations of the stake holders. The new challenges faced by the Indian Agriculture are formidable and these call for development of a new breed of human resource who are equipped with new skills and knowledge to propel agricultural growth.

6.16 The Ministry explaining the state of affairs regarding the quality of agricultural education the DARE stated as follows :

> The pace and quality of technology generation and human capacity building in most of the SAUs have slackened owing mainly to inadequate state funding, depleted faculty strength, inadequate faculty development programmes, specific lack of competence of existing faculty in new and emerging areas, extensive inbreeding in faculty, lack of modern infra-structure for education and research. Establishment of new and sectoral state agricultural universities and new colleges without matching resources has compounded the problem.

6.17 The Committee when desire to know the major shortcomings in the present recruitment procedure which is inhibiting intake of the best people into NARS the Department in their written reply stated that the present recruitment procedure for the scientific category is very objective and professional. It is a continuous process centrally carried out through the Agricultural Scientists' Recruitment Board (ASRB). The positions in the Entry level are filled up based on an All India Open Written Competitive Examination followed by viva-voce. All other senior scientific positions are filled up based on personal discussions / interview. The present procedures and practices adopted by the ASRB are on the lines of those of UPSC and the best talent is being selected. The existing practice of recruitment, career progression and awards has adequate in-built incentives. The Agricultural Scientists are governed by the UGC Pay Package and Career Advancement Scheme (CAS) wherein there is an in-built flexible complementing process of periodical assessment and subject to fulfilment of certain parameters and criteria, a Scientist is placed in the next higher grade, irrespective of occurrence of vacancies. The Grade Pay(s) as per the UGC scheme is

higher than the approved Grade Pay(s) of the Central Government. Further, Scientists are entitled for the following incentives during their career:-

- Five Advance increments at the entry level for selectees with Ph.D.
- Two advance increments at the entry level for selectees with M.Phil / M.Tech / M.Sc.(Ag.) / M.V.Sc. / M.F.Sc.
- Three advance increments on acquiring Ph.D. while in service.
- One advance increment on acquiring M.Phil. while in service.
- The age of superannuation for Scientists has been enhanced to 62 years w.e.f. October, 2003. Further, an elaborate scheme of awards to motivate and bring out cutting edge Research output has been instituted.

With these service conditions and career progression as elaborated above there has been no abnormal attrition to suggest further incentives for retention of scientific manpower.

6.18 The ICAR has established the National Academy of Agricultural Research Management (NAARM) in 1976 at Hyderabad to address the needs of human resources development in NARS. The Academy's major role is in capacity building of individuals and institutions of NARS to address emerging challenges of Indian and global agriculture. The agriculture sector is dynamic and is changing continually in response to changing demands for food and agricultural commodities, need for conserving the environment and the requirements of the society. The Academy has continually reviewed and reorganized its programmes and activities during the various Five Year Plans in accordance with the changing needs of NARS. The training and refresher course modules of the National Academy of Agricultural Research Management (NAARM) have been reoriented and fine-tuned to address emerging challenges in the R&D requirements and management of research in the agricultural sector.

- Institutionalizing a viable capacity building framework for leadership succession and research excellence in NARS. The new capacity building framework, comprising a remodeled Foundation Course (FOCARS), Pre-RMP programmes to train future research managers, Refresher courses for lateral entrants to ICAR, EDPs for new Directors, MDPs for new Heads of Divisions, has been put in place towards the end of the XI Plan after approval by the Governing Body of ICAR.
- Parallel capacity building frameworks have been designed for Faculty of SAUs and KVKs, which can be implemented from the XII Plan period.

- Several new thrust areas for research have been identified towards the end of XI Plan to enhance leadership, governance and innovation in NARS, which need to be implemented in the XII Plan.

Category	Sanctioned	In Position	%age filled	Vacancies
Scientific	6470	5093	79 %	1377
Technical	6635	5096	77 %	1539
Administrative	4886	4162	85 %	724

6.19 The State Agricultural Universities (SAUs) are governed by the statutes of the respective State Governments and the ICAR have no direct role in their recruitments. In as far as the vacancies in the ICAR and its units are concerned, non-availability of qualified scientific personnel befitting the specified requirements in certain specializations has been a concern. However, this has been addressed to by resorting to broad-basing the essential and desirable requirement and introduction of the concept of flexi-disciplines which shall be tailor-made matching the specific requirements and needs of the respective individual projects. Regarding the vacancies in NARS though the Council has a very limited role, it has been decided to conduct the NET Examination twice in a year so that the SAUs have adequately qualified and competent applicants for various teaching positions.

6.20 During the oral evidence the DDG (Education) ICAR confessed before the Committee as follows :

> "The Zonal Agricultural Research Stations about 127, those were established under the National Agricultural Technology Project and those have become old. The infrastructure is not there, the faculty shortage is there. So, invariably these regional/zonal stations in order to build up the regional capacity of the research and teaching is also required to be taken up in the 12th Plan. Similarly, as regards the quality and faculty shortage is concerned, this is a big issue. Invariably, 35 per cent to 40 per cent vacancies do exist and the State Governments many times are not allowing to fill up these vacancies. Although we have written to the State Governments and we have emphasised again and again, but still this is a critical issue and we have planned that like a post-doctoral fellow or teaching associate ship or inter institutional movement of faculty, we have thought some of the programmes which we can take up so that we can

reduce the in-breeding. We can have better visibility and better utilisation of our existing faculty. But definitely there is a shortage of faculty and the recruitment needs to be improved".

6.21 The Secretary, DARE during the oral evidence submitted to the Committee :

"At this point, mobility of researchers and teachers between the universities and the institutes would be much more desirable. In that context, we are trying to build up some incentives".

PART – II

RECOMMENDATIONS

STATES REPRESENTATION IN REGIONAL COMMITTEES

1 The Committee note that the Governing Body of ICAR has constituted eight Regional Committees for eight different Agro-ecological regions of the country to analyse, discuss in depth and make recommendations on the location specific problems of Agriculture, Animal Husbandry, Fisheries and Forestry peculiar to the Region. These Committees meet once in two years. The Committee find that the meeting of the regional committees are too few and far between and the representation of the State Government officials is not adequate. This leads to inadequate inclusiveness and the view of the State Government representing their location specific difficulties is not clearly brought out. The Committee, therefore, desire that the Government should hold the of meetings of these Committees annually instead biennally and that too adequately represented by State representatives. They also desire that the Department should encourage State participation and incentivise the officials of the States to participate in the meetings of Regional Committees by offering workable solutions to their regional agro problems including coordination with concerned agencies, if required.

AICRP/NETWORK PROJECTS

2. AICRP/Network Projects are constituted to mobilise available scientific resources to find effective solutions for the national problems of agricultural production. These are developed as multidisciplinary and problem oriented projects on multi-location testing of new material/production system. These projects also provide opportunities for scientists working on similar problems in other institutions to come together discuss, exchange their ideas, information, material and solutions to similar problems for mutual benefits. They also provide them with facilities for multi-location testing of improved technologies by various subsystems in different agro-climatic regions. AICRPS/NP are generally sanctioned for a period of 5 years and are headed by a full time Project Coordinator with a Coordinating Unit to assist him. Presently there are about 61 projects in the country. The project coordinator and his unit is thereby, wholly responsible for timely completion and commissioning of the project(s). The Committee are of the opinion that since the projects constitute an effective national grid of coordinated experiments by integrating different institutions and disciplines, it is vital that regular interactions take place and the projects be completed within the stipulated time frame so that the objectives of each of such projects are achieved.

3. The Committee desire that the project coordinator and his team should regularly incorporate the ideas and solutions in implementation of these projects from the AICRP exchanges. They also urge the Ministry that in case of failure to adhere to the time schedules for the completion of these projects, the reasons

be analysed and the responsibility be fixed so as to avoid time and cost escalations.

STRENGTHENING OF ICAR

4. A large number of State Agriculture Universities, State supported Institutes, Central Universities, National Institutes, National Bureaux, Projects, NRC, AICRP, AINP and KVKs are functioning under the guidance of DARE/ICAR in various parts of the country to meet the demand of Agriculture and allied sectors. It is the Research and Technology development by DARE/ICAR which has enabled an increase of 4 times in production of foodgrains, 6 times horticultural crops, 9 times fish, 6 times eggs since 1950-51. However, there is still a lot of scope to strengthen the NARS to meet new challenges and that there is a need to compare ourselves with some of countries which are moving much faster than us like China, Brazil, Malaysia etc. The Committee, therefore, emphasise that instead of being complacent about their achievements the Government should strengthen the ICAR network to meet the new challenges regarding food security. The Committee recommend the DARE to study in depth the methods/ technologies adopted by some of the progressing aforesaid countries in this field and adapt them to our given conditions so as to augment the production and productivity in agricultural sector besides improving the economic conditions of farming community of the country. The Committee also urge the Ministry of Agriculture to lay more emphasis and focus on the agriculture research in the 12th Five Year Plan and provide adequate financial support to meet the much required research work.

5. The Committee have been apprised that prioritization monitoring and evaluation cells are there in Agricultural Institutes. Further ICAR co-ordinates, facilitates and support research work in Agriculture but do not play the role of regulator. They informed the Committee that ICAR have accreditation boards and the universities have to get accredited to obtain development grant. Since Agriculture is a State subject and therefore, the problems of co-ordination and overlapping of research comes up, the Deputy Chairman, Planning Commission has written to Chief Secretaries for adoption of model Act which is said to solve issues with respect to the governance, institutional mechanisms involvement. The Committee desire that the Department should pursue the adoption of the model Act with the State Governments and the Committee may be apprised of the same.

XIIth PLAN ALLOCATIONS

6. The Committee find that the funds sought by the Department for the entire 12th Plan was Rs.57,887.21 crores. However, the Planning Commission has made an allocation of Rs.25,553 crores for the entire 12th Plan. In the first year Rs.3,220 crores was allocated (BE). However, against this only Rs.2,520 crore were provided at RE stage (9.81% of the revised allocation for 12th Plan). For the second year of the 12th Plan Rs.3,415 crore has been allocated (13.36% of the allocation for 12th Plan). While formulating the 12th Plan the Ministry have apprised the Committee that various programmes and research agendas in each

sector have been formulated and detailed discussions have been held for formulating flagship programmes, addressing major concerns in sub-sectors and commodities. The Ministry have also sought higher allocation of resources for revitalizing of NARS in general and SAUS in particular including strengthening of regional capabilities of regional research stations modernization research infrastructure, augmentation of operational funds and restructure the faculty under various programmes. The Committee are concerned to note that in the first place the Planning Commission has allocated less than 50% of the funds sought by this Department. The Ministry have stated that since the funds have been allocated for the first two years of the 12th Five Year Plan there will be no adverse effect on carrying out the technical activities. However, the Committee would like to bring out the fact that only 23.22% (9.81% in the first year and 13.36% in the second year of the 12th Plan) of the total has been allocated for the first two years of the 12th Five Year Plan. They, therefore, urge the Department to request the Planning Commission for grant of more funds i.e. at least 1% of GDP and to grant these funds evenly over the years so as to achieve the stated targets of XIIth Plan relating to ambitious schemes on conservation agriculture, nutrient management, organic farming, resource conservation technologies, water management, higher agriculture education, post harvest operations etc. The Committee, therefore, desire the Department to re-visit their priorities, re-work their programmes and research agenda and inform the Committee in this regard.

INVESTMENT IN AGRICULTURE SECTOR

7 The Committee find that during the XIth Plan Period only Rs.10,325.76 crore was allocated to DARE vis-à-vis demand for Rs.31,672 cr. The ulitisation of funds by the Government was only Rs.9,800 cr. The agricultural growth rate at the end of XIth Plan was only 3.3% vis-à-vis target of 4% and the stated reason was that total low public investment in agriculture in R&D sector in the form of infrastructure irrigation water conservation and land etc. Further, the other reason was R&D expenditure was only 0.5% of agricultural GDP. The Committee urge the Ministry of learn their lessons and ensure that the allocated amount is utilized fully and the expenditure on research should be enhanced at least 1% of the agriculture GDP in the XIIth Plan. They also emphasize that the Department should focus on not only planning but actually enhancing investment in research infrastructure, irrigation water conservation and land etc.

8. The Ministry have apprised the Committee that additional investment of one rupee in research generated more than rupee one on an average in major crops, and the highest marginal product was achieved in 'Arhar' where additional investment of rupee one generated additional output worth Rs.12.82. They have also informed the Committee that a recent study covering two decades indicate 42-46% internal rate of return in public investment in agricultural research and education. All these studies prove high pay-off from public sector R&D investments. Research and technology driven output growth has also led to the decline in real cost of production in the range of 1.0-2.31% per annum during the past three decades in case of cereals. This has helped in keeping the prices of cereals low and benefitting consumers and producers.

In view of the above, the Committee feel that the importance and significance of agricultural R&D in the development process cannot be underestimated. They desire that the investment in agricultural R&D should be enhanced so as to obtain higher returns, besides reducing the import dependency and adding to the export capacity of the country. The Committee desire that the Department should prepare an action plan to attract investment in agriculture research in the country. They should also approach the Ministry of Finance to provide monetary and fiscal incentives for the same. Further, DARE should take concrete steps to publicise the return from investment in Agriculture sector.

9. The Committee feel that there is an urgent need to promote investment in agricultural sector by the private players other than the farmer, especially in the post-harvest infrastructure and facilities besides the machinery, processing and value chain related products. They emphasise that the investment in agriculture sector should be made in partnership with private sector and implement the National Agricultural Innovation Project (NAIP) model with proper monitoring mechanisms.

They also urge the Department to expedite the proposal(s) of Public-Private-Partnership in agricultural research and education and apprise the Committee of the same.

10. The Committee note that ICAR have been consciously developing farmer friendly technologies and assuring quality higher education. They are satisfied

that the Council in consultation with all the stake holders have prepared the first ever policy framework for R&D in agriculture and allied areas. While appreciating the work of ICAR in bringing out a clear cut policy in order to support the farmers, the Committee urge the Ministry to ensure implementation and execution of the policy so as to play a vital role in agricultural research and education besides dissemination of information and technologies to the farmers at the ground level. They also emphasize that this R&D policy articulated by ICAR should be appropriately integrated and synchronized with the National R&D System and Science and Technology Innovation Policy 2013. They further desire that the contents and the benefits flowing from this policy to the farmers should be publicized and awareness be created among the farmers through KVKs and other on-field agencies.

11. The Committee are aware that 50 years back the Agriculture Education System was mainly based on Land Grant System. So far, the emphasis has been on crops and food security, however, now there has been a change and priority has to be given to the development of livestock, fisheries and horticulture etc. also The Committee feel that the resource allocation to these sectors should be proportionate to their contribution to National GDP. These are important components to improve the economic conditions of farming community. They also desire that concrete steps be taken during the 12th Plan to give Research priorities to sectors like livestock, fisheries and horticulture, which hold promising areas of growth in future and enhance the non-farm incomes of the farmers.

PUBLIC PRIVATE PARTNERSHIP

12. The Committee find that so far the Public Private Partnership, National Agricultural Research system has mainly been used as a vehicle to enhance technology validation and transfer/commercialization through MoUs/MoAs/NTA/Agreements/Licensing/Consultancy Contracts etc. They also find that in research there have been initiatives mainly in the areas of farm implements, machinery processing and value addition. They note that partnership with private sector has seen a new approach for growth in ICAR. It is based on the principles of joint IPR ownership and pre-decided licensing rights. The Ministry informed the Committee that about 385 technologies / know-how have been transferred / commercialized through more than 900 partnership developed with external agencies. In 203 sub-projects of various components of National Agricultural Innovation Project (World Bank supported) there are 212 private sector organizations including NGOs participating in 6 consortia. The Committee were also informed that a Cabinet Note on "In-Principal approval of the Public-Private-Partnership in Agricultural Research and Education" has already been initiated to provide the much needed stronger foundation to meet these requirements. While appreciating the efforts of ICAR in involving private partnerships through various modes they feel that the role of these partnerships is limited for commercialization/transfer / technology validation only. The Committee feel that the potential to obtain systematic impact could be much higher in new approaches of consortia and partnership rather than traditional approach of undertaking R&D separately by the public sector system. This

approach will widen the focus from research and technological innovation to building a value chain around the innovation spectrum. The Committee however, would like to empahsise on keeping close watch, the efficacy of management and monitoring the role of the private partners.

CROP SCIENCES

13. The Committee were informed that focus of the Department has been skewed to the extent that most of the scientist and budget of ICAR have gone to crop sector especially in rice and wheat crops. Further, out of 18 crops 75% have registered a decline in their factor productivity. There are 6000 scientists and there are 97 institutes. However, these institutes are commodity based research institutes. The Committee urge the Department to develop these commodity based research institutes into more comprehensive and superspeciality research institutes so as to optimize use of scientific manpower and the resources available with ICAR.

SEEDS

14. The Committee note that 257 crop varieties including 26 varieties of wheat, 33 varieties of paddy, 33 varieties of maize, 32 pulses crop, 25 pearl millet and 52 varieties of oilseeds crops have been released during 2007-10 by the Crop Science Division. During the year 2011 98,481 quintal of breeder seeds were produced. The Committee find that the States do not have adequate seed plan as a result of which the poor farmers are compelled to produce from farmer saved

seeds or are compelled to buy seeds from the open market at exorbitant rates, where multi-national companies have taken over the whole market. They emphasise that a comprehensive and authentic database of seeds production and distribution in India by public and private sector has to be developed so that all stakeholders/ farmers have enough information. Further, the Government should have adequate control over the prices of the seeds and not leave it on the whims of private companies to charge exorbitant prices for seeds.

15. The Committee are of the opinion that the Department and the ICAR should pursue the States to prepare long term seed plan for their States on the basis of farmers' economic status, agro-climatic conditions, desire to adopt quality seeds, State crop calendar or any other contingent situation. In order to ensure availability of quality seeds in right quantity and at right time to the farmers, they urge the Government to take all necessary steps to prepare seed plans for 5 years in consultation with the respective State Governments. Further the Committee desire the Department to enhance the seed production and upgrade the infrastructure for breeder seed production in accordance with the projection made by National Seed Plan. The services of KVKs should be used to showcase quality seed production programme to the farmers/seed growers and their self help groups to meet the domestic demand and avoid any hardship being faced by farmers in the country in this regard.

16. The Committee feel that the Department have to make available quality seeds and high breeder varieties / high bred planting material having good genetic potential at affordable price across the country to the farmers so that they are able to yield maximum harvest under the given agro-climatic conditions. The release of crop varieties and the breeder seed production has not been able to meet the domestic demand of quality seeds in the country. The Committee urge the Ministry to encourage research and development to adopt new technologies for the development of quality seeds varieties / high bred planting materials. They desire that the technology should be appropriate enough to enable large scale production of planting materials / varieties/highbred with genetic potential in the shortest possible time and maintain uniformity of quality across the production line. They should be able to address the productivity, stress tolerance, pest and disease tolerance by use of technology for higher productivity. The Committee would, however, like the Ministry to ensure adoption of appropriate measures for safety and safeguards of such seeds. They desire that adequate research and development and incubation time for the pests/diseases liable to be incorporated in these crops be tested in labs before marketing it on full scale to the farmers for operations on fields. The Department should ensure and pursue all the States/UTs to maintain high quality of seeds being sold to the farmers. The implementation of the provisions of the Seeds Act by the States has to be ensured especially regarding seed certification and distribution of certified seeds. The seed certification agencies and Seed Inspectors who are the implementing agencies for provisions of quality seeds of

Seeds Act have to be more vigilant to check the sale of spurious seeds in the market. The Committee strongly recommend that in case of non-germination of seeds the farmers should be duly compensated for the loss of their crop. The Committee recommend that a proper monitoring mechanism regarding the seed certification and distribution should be put in place in order to ensure quality compliance. They also emphasise that with the increase in demand for supply of quality planting material accreditation of nurseries be expedited.

HORTICULTURE

17. Horticulture sector which includes fruits, vegetables, spices, ornamental crops, medicines and aromatic plants and plantation crops has been providing livelihood to 30-40% of the population and contributing more than 30% to the GDP of agriculture that too by utilizing only 11% area in the country. The area of cultivation and production in this sector has increased 24.28% and 40.71% respectively during 2011-12 as compared to previous plan period ending in 2005-06. They find that there has been a significant increase of 152.6% in flower production over the year 2005-06. The targets for production of horticultural produce in the annual growth has been 345 million tones computed at 6.7% volume wise and in value terms the growth to be achieved is 9.5%.

18. They, however, feel that with the increasing population, declining land and water and increasing pressure on biotec and abiotec stresses in the climatic change, effective conversion of natural resources it is only important to focus on

enhanced production in this sector. In view of the above they desire the Department to make an upward revision in the production targets. Further they desire that more investment / allocation may be made for research and development in this sector so as to improve post harvest technologies, to contain post harvest losses, extend shelf life, packaging, storage and standardization of processes etc. They would also urge the Government to provide enough financial / fiscal incentives to the farmer community for meeting the enhanced targets. They would also desire that the Department should ensure for full utilization of funds available at their disposal and strengthen the implementation of their ongoing schemes on ground.

SOIL MAPPING

19. The Committee appreciate that the Department has completed the GIS based district wise soil fertility maps of 20 states. Tehsil-wise soil fertility maps of Punjab, Haryana, Himachal Pradesh, Maharashtra, Rajasthan, Gujurat, Chhattisgarh, Orissa, Andhra Pradesh, Tamil Nadu and Karnataka are also available. The on line fertilizer recommendation systems have been completed for 13 states. However, a large number of farm area of the country are yet to be taken up for soil mapping by the Department. The Committee, therefore, recommend the Department to prepare an action plan under which GIS based district/tehsil wise soil fertility mapping, on line fertilizer recommendation system, GPS based geo-reference soil fertility maps, soil degradation maps and

soil erosion maps etc. be completed on a fast pace in the country. This time bound action plan will help the Department to achieve the goal of systematic agriculture growth of the country. Awareness about soil fertility mapping the soil degradation and erosion mapping may be provided to the farmers at the earliest so that they may plan their crops accordingly. The Committee urge the Government to ensure that farmers have easy access to this information.

SOIL TESTING

20. The Committee observe that sustainable use of natural resources, enhancement of ecosystem service like reduction in green house gases and building resilience to climate change are essential for sustainable agricultural growth in the country. The component of soil on which the plants are grown, the nutrients and also soil and plant healthcare are necessary for efficient production system. The Committee find that the laboratories engaged for testing soil in the country are not functioning appropriately and the farmers even after covering a large distance do not get the soil testing results timely. The timely delivery, extension and awareness system for the farmers is very important. The Committee, therefore, desire the Department to fix responsibility and accountability of existing laboratories to provide information/results regarding the soil health status and information of crop compatibility regionwise to farmers in a time bound manner. They further urge that for prompt delivery of results before sowing time it is important to set up soil testing laboratory in each

Development Block and also have Mobile Testing Van facility. They expect the Government to develop more soil testing laboratories for easy access by the farmers. They recommend that farmers should also be educated of the major cropping systems of the country to promote balanced fertilization and the method of collection of soil. They emphasise that at the time of testing the information about the crop for which testing is required should enquired from the farmers.

21. The Committee observe that at certain places there is over use of fertilizer / use of banned fertilizers by the farmers like in Punjab and Andhra Pradesh. They feel that due to ignorance the farmers not only harm their produce but also add to their production costs besides leaving the soil devoid of nutrient. At time, it also leads to various dangerous diseases transmitted through use of banned fertilizers. The Committee, therefore, recommend that volunteers be deputed to inform the farmer of the right quantity and right quality of fertilizers to be used by them on their soil.

WATER MANAGEMENT TECHNOLOGY

22. ICAR Institutes and State Agriculture Universities are implementing a scheme on Scaling up of Water Productivity in Agriculture for Livelihoods through teaching cum demonstration, training of trainees and farmers across the country. There are 32 centres across the country providing training to farmers to create awareness on water use efficiency and increase water productivity in Agriculture. The technologies for improving water use efficiency have been developed under 25 centres of AICRP on water management and 9 centres on

ground water utilization. The Committee emphasise that with the kind of spread of agriculture in India the present awareness centres for providing training to farmers on water use efficiency and increase of water productivity in agriculture as also the centres of AICRP on water management and water utilization are too limited and requires much more vigorous awareness campaign on water management, water conservation (through the developed technology and optimum utilization of water in agriculture). Further, a large quantity of our rain water remains unutilized by the Agriculture and Allied Sectors in the country. The Committee, therefore, recommend the Department to examine the optimum utilization of water, bringing about more centres tranining farmers and make vigorous efforts to create awareness in this regard. They also emphasise that the Government should proritise on promoting developing of water harvesting structures in the Indian farming system and also probe the manner in which these productive work can be covered under the MNREGA by deploying persons for fruitful employment for the purpose of building rain water harvesting.

FARM MECHANISATION

23. The Committee find that improvement in farm practices by using novel agricultural implements/machineries are pre-requisite for improving agricultural output, an alternate to increasing labour costs and enhancing productivity. Farm mechanization can be fruitfully used by farmers with large land holdings thereby utilizing economies of scales. However, for small land holding farmers machineries and implements may not be suitable option. In India large proportion of farming is done by small and marginal farmers possessing small

and fragmented land holdings and the farm mechanization is expensive and inaccessible. The Committee urge the Department to call for research in developing low cost, light weight, multi purpose farm equipments and tools for the benefit of small and marginal farmers or farmers with fragmented land holdings. The Committee also recommend that Department should probe the possibility of promoting youth to combine (bankable) stock of machines and rent out through custom made hiring system and allow small land holders to utilize mechanization for enhancing their productivity and reduce cost of cultivation.

ORGANIC FARMING

24. The Committee are aware of the benefits of organic produce in terms of health and nutrition. They note that a natural project on Organic Farming is working on the multi disciplinary, multi-location and multi-cropping system. To address the scientific issues of integrated crop including livestock, fish production system to offer scope for larger adoption of organic farming on-farm centres have started in the country. Research institutes have been established to address the issue related to management of natural resources. The Committee note that the Department is taking certain steps to encourage the organic farming in the country. The Committee recommend that there is a need to further spread and encourage the adoption of organic farming and bring more farmers / farmers' groups under organic farming, research for production of organic products and proper organic management so as to enhance the quantity and quality of the produce and bring down their prices besides putting aside the toxic effects of the

harmful chemicals / inorganic fertilizers. They also urge the Government to pursue State Agricultural Universities through ICAR to develop courses on organic farming and its promotion and development. The Committee desire the Department to formulate a policy to strengthen National Project on Promotion of Organic Farming in the country. The Committee urge the Department to create awareness among the farmers to adopt practices of using organic insecticides/ pesticides such as panch gavya (organic growth promoter) and technology where in waste of the bio-gas plant become liquid instead of solid which can be easily spread in the farm.

LIVE STOCK/ ANIMAL GENETIC AND ANIMAL PRODUCT RESEARCH MANAGEMENT

25. The Committee are aware that this sector supplement family income and generate gainful employment in rural parts of the country. ICAR coordinates and monitors research activities covering all major species of livestock and poultry from its Research Institutes and Regional Centres. Livestock is an integrated component of agricultural activities particularly when food preferences has been changed in the society, the demand of various animal products has increased in the country and to meet the increasing demand there is a need to improve the performance of livestock sector. The Committee therefore, recommend that the Department has to develop innovative and alternative livestock research system in various fields such as dairy production, processing and value addition, genetically improved conservation of indigenous cattle and buffalo for higher milk production, establishment of open nucleus herds for improved indigenous

breeds in their native tract in their genomics and mechanization of equipment for indigenous dairy products for small scale sector so as to meet the future challenges to ensure food and income security particularly of the small and marginal farmers.

26. The Committee were apprised that the Ministry have progressed to a certain extent relating to animal genetic resource such as whole genome mapping of Indian water buffalo was carried out and assembly with more than 90 GB DNA sequence data generated. 6 new breeds viz. four cattle breeds and two of buffalo breed were registered. Phenotypic characterization and evaluation of hill cattle as well as Bundelkhandi goat and goat of Uttarakhand was completed so also for Spiti donkey. Genotypic characterization of Indian horse breeds and phylogenetic tree were prepared. The microsatellite genotyping of 50 individuals in each of the Bikaneri, Jaisalmeri, Kachchhi and Mewari breed was carried out and phylogenetic tree constructed. . The Committee however, feel that much of the research is still required for genetic improvement and conservation of indigenous cattle and buffalo as also for the establishment of open nucleus herds for improved indigenous breeds in their native tracts. The Committee desire that the Department should focus on development of climate resilient housing and shelter for improved dairy production and improving buffalo productivity by assisting re-productivity and biotechnological tools. The Committee would like the Ministry to especially develop and maintain databank on the diseases related to the animals and also initiate research work on diagnostic kits for various animal related diseases. They would also like the Ministry to invest into onland

quarantine stations for such animals suffering from contagious diseases. The Committee urge the Department to regularly monitor the diagnostic regional centres and make available the diagnostic equipments to these centres/network units besides ensuring the quality of the supply from the manufacturing companies. The main focus of research in respect of animal health should be in developing landscape genetic of indigenous disease, disease forecasting models and economic impact analysis relating to disease control strategies.

The Committee recommend that ICAR should promote research for the post harvest management and value addition also wherein the animal products are processed and utilized to an optimum level. Research for value addition of animal products and development of cold storage chain for biological product, safe transportation and safer food products from livestock and poultry should be the focus areas of the Department in the XIIth Five Year Plan.

BIOTIC STRESS MANAGEMENT RESEARCH

27. Biotic stress has been highly challenging for the growth of agriculture in the country. The Committee appreciate the successful achievements of the ICAR in management of such challenges. The losses caused to crops by various pests like pod borer10-90% pod fly 70-80% wilt/root rot complex 20-25% sterility mosaic 20-40% are still causing a hurdle in the farming in the country. The Committee desire the Department to complete the issues like conducting national survey for mapping of different pests, establishment of modified light and pheromone trap network in key pulse growing areas, harmonize seed production system with bio-

fertilizer in pulses and bio-pesticide application in a time bound manner to meet the challenge of biotic stress by the farming community in the country.

28. The Committee find that the National Institute of Abiotic Stress Management has started functioning partially and will implement important research programmes in a thematic mode namely Drought Stress Management, Atmospheric Stress Management, Adaphic Stress Management and Policy Research Support Management. The Institute will also focus on strategic human research development for long term tackling of different stresses in the frontier areas with participation of wide network of India and International Institutes. The Institute was to function fully by the end of 11th Plan/beginning of 12th Plan. Similarly, the Indian Institute of Agricultural Biotechnology Ranchi and National Biotic Stress Management Institute, Raipur are also upcoming Institutes with frontier research in various basic aspects using modern scientific tools in various national laboratories. These are frontier research institutes and likely to develop repository of information in their respective areas. The Committee would desire to be apprised of the status of completion in each of these two management Institutes as also achievements of the time schedules. The Committee would also like to know whether the proposal of affiliating these laboratories to the Institute of Biotech Stress Management have been undertaken so as to encourage high and post graduate degrees, post doctoral and extra moral programmes.

AGRICULTURE EXTENSION

29. The Committee are aware that Agriculture in India is complex, diverse and risk prone with 123 million cultivators. Predominantly small and marginal farmers across 638,596 villages in 131 agro-climatic zones subjected to vagaries of monsoon, changing climatic conditions, regional variations in terms of natural resources, regional imbalances, isolated and difficult areas, other socio-economic factors and multi-agency extension system. They find that despite the research having been done in diverse areas relating to agriculture in the laboratories, it do not get transferred timely to the ground level fields. Even they are transferred, their adoption by farmers is not at the optimal level. The agencies responsible for the transmission of research/research information like KVKs, Zonal Project Directorates, Directorate of Extension Education of SAUs, ATMA etc. are functioning in isolation. During 1950s and 1960s when there were not so many agencies for dissemination of information relating to research work, the research activities were easily transferred to farmers and were promptly adopted by the farmers. The Committee, therefore, desire that there is an urgent need to review the functioning of the agencies responsible for transmission of information, knowledge and research activities to the farmers, so that the gap in delivery of research results from lab to land and acceptance of the same by the farming community can be addressed in the country. They also desire that the Government should set up a Coordination Committee represented by various agencies at appropriate level for dissemination of research information. This Co-ordination Committee comprising of KVKs, ATMA, SAUs, Zonal Project

Directorates, Department of Agriculture Cooperation, Department of Water Resources, Department of Post Harvest Management should meet frequently at regular intervals so that the research work/techniques/ information are easily and promptly transferred/disseminated to the farmers, who can adapt and implement the same and improve their economic condition along with the agricultural produce.

KVKs

30. In our country there are about 80% small and marginal farmers. For the survival of such farmers we have to explore the possibility to increase their on-farm and non-farm income. To improve the economic condition of the small farmers there is a need to explore avenues to generate non farm income besides the subsistence level farm incomes of the farmers. The Committee, therefore, recommend the Department to research and disseminate information on the non-farming activities like processing, post-harvest technology etc. that can be included in the mandate of KVKs which will not only increase the economic conditions of the farmers but also strengthen the functioning of KVKs in the country.

31. The Committee note that one of the main causes of delay in making provision for infrastructure is that the entire expenditure of KVKs is booked under Plan head. They feel that much of the time is lost in bureaucratic redtapism in making provision / allocating the money for the expenditure of KVKs as it comes from the Plan head. The Committee, therefore, desire that

Department should persuade the Ministry of Finance for funding KVKs from the Non-Plan allocation for expeditious availability of the funds and also granting flexibility at the same time.

32. The Committee are aware that KVKs is an important agency responsible for transmission of research / research information. In crops and livestock, 328 technological interventions were refined under different thematic areas in 395 locations. Besides, five women-specific income-generating technologies were also refined in eight locations. As many as 73,175 frontline demonstrations were undertaken on cereals, millets, oilseeds, pulses, and other important crops; 4,710 on improved tools and farm implements; 14,390 on livestock; and 5,991 on other enterprises including gender-specific technologies under the National Initiative on Climate Resilient Agriculture (NICRA), 26, 218 demonstrations were also carried out. However, the Committee find that out of 634 KVKs in the country, the Department has been able to provide Administrative buildings to 554 KVKs, Trainees hostel to 490 KVKs, Staff Quarters to 442 KVKs, demonstration units to 394 KVKs and soil and water testing facilities to 389 KVKs only. The deficiencies in operations of KVKs is also a matter of concern. The Committee are concerned that in view of inadequate infrastructure and unavailability of project co-ordinator, the KVKs will not be able to contribute towards providing extension services or transmit research and research information to the farmers. The Committee, therefore, emphasise that the infrastructure such as Administrative buildings staff quarters, demonstration units and soil and water testing facilities etc. be built up expeditiously with a prescribed time limit. It may also be ensured that

project co-ordinators and other administrative staff are deputed by providing incentives to them.

33. The Committee are aware that ICAR has created a network of 634 KVKs to assess refined and demonstrate new technologies and products developed by National Agricultural Research System. The KVKs play the role of intermediary institutions to finetune the research conducted under controlled conditions before the farmers adopt the same. The entire process is carried out in participatory mode involving the farmers with the objective of developing location specific technology models. The Committee find that there is acute shortage and exorbitant prices of recommended agro inputs affecting the technology transfer and applications very difficult. They also find that it is a long drawn process for the KVKs to upscale the assessed refined technology which are found fit for adoption by farmers on large scale. The Committee also find that in the changing agricultural scenario the marketing support to farmers for primary processing storage, grading, packing, conservation, transportation is equally important for successful technology transfer adoption and benefits to the farmers at large.

The Committee desire that ICAR should focus on the area of research so as to reduce the prices of such technology transfer including inputs and the applications. The Committee also recommend that the Department/ICAR should strengthen marketing intelligence, EDP and Consultation through EDP, packaging project report preparation, consultancy industry and enterprise relations and

partnerships. They should also focus on establishing local market network on prices and establishment of value chain demonstration units.

34. The Committee find that in order to create awareness among farmers and other stakeholders KVKs organize large number of extension programmes like Field Days, Exhibitions, Kisan Melas, Kisan Gosthis, film shows , group meetings and discussions, workshops, lectures, and use of mass media for wider dissemination of farming technologies. However, the Committee note that out of 630 KVKs only a few out of them are working properly and the functioning of the other KVKs is just satisfactory and much remains to be done. During the 11th Plan the Department has allocated Rs.237.42 crores to meet the expenditure incurred by the State owned KVKs/ KVKs functioning under NGOs. The Committee desire that ICAR should fix the responsibility for non performing KVKs functioning under their administrative control to improve their performance so as the objective for which the KVKs have been set up is achieved. They further urge the Department to make assessment of the KVKs activities and performance on regular basis at the same time necessary feedback should be obtained for the KVKs regarding the requirement of the farmers so that necessary changes, if any, can be made in the on-going programmes and research work for the benefit of the farmers. The Committee desire that the Government should ensure that all KVKS both private and State supported KVKs should provide all mandated activities including extending professional advice, information/knowledge to contain ill-effects of weather conditions. The Committee also advice the Department to enhance allocations for KVKs so that more and more State supported KVKs

function without any personal or vested interest rather they have holistic approach of dissemination of information and farm knowledge / technology adaptation to farmers.

AGRICULTURAL UNIVERSITIES

35. Indian agriculture system has a network of 55 State Agricultural Universities, one Central Agricultural University, five Deemed-to-be-Universities Status and four Central Universities with agriculture faculty. The Agricultural Universities impart education in 11 major disciplines at undergraduate and about 95 subjects at post-graduate level. The State Agricultural Universities are established through the legislative Act of the respective States. These universities function under the administrative control of respective State Governments with major financial support. The Secretary, DARE submitted before the Committee that more than 50% of the budget of DARE/ ICAR is granted to the State Agricultural Universities. During 2007-08 to 2011-12 the ICAR has provided a sum of Rs.2033.36 crore to the State Agricultural Universities. The Ministry have informed the Committee that the pace, quality of technology generation and human capacity building in most of the SAUs have decline due to inadequate State funding, depleted faculty strength, inadequate faculty development programmers, lack of modern infrastructure for education and research. During the evidence, the Secretary, DARE confessed before the Committee that there is shortage of faculty and that invariably 35% to 40% vacancies exist and the State Governments many a times are not allowing to fill up these vacancies. The Committee desire that the Department should focus

on the standard of agricultural education to be improved by ensuring that the vacant academic posts in the State Agricultural Universities are filled up promptly. The Committee, recommend the Department to ensure that all the vacancies are fulfilled in consultation with State Governments in these SAUs before the release of any financial support to them so that the pace, quality of technology generation and human capacity building is attained at the desired level in these SAUs. They also advice the Government to probe the possibility of mobility of researchers and teachers between the universities and emphasise that the institutes if feasible, provide proper incentives to the researchers / teachers for such arrangements. They desire to be kept abreast of the status and the outcome of the decision taken to conduct NET Examinations twice in a year so that SAUs have adequately qualified and competent applicants for various teaching positions.

36. The Committee in their earlier Report No.44 (15th Lok Sabha) had agreed that Central Agricultural Universities should be established only after ascertaining their need and viability and keeping in view the availability of human resource, both in scientific and technical streams. However, they were apprehensive that there could be a possibility of some comparatively more backward regions besides Bundelkhand seeking Central Agricultural Universities resulting in proliferation of CAUs in various backward regions and there could be a resultant burden on exchequer. They were also concerned so as not to render such institutions as while elephant. While reiterating their earlier recommendation, the Committee strongly recommend that before contemplating

any future venture about setting up of CAU Government should come up with a well considered and well laid out policies on CAUs before the Parliament expeditiously.

37. The Committee find that the diploma education holders have increased from 1040 in 1992 to about 6,500 in 2010. However the regionwise supply is skewed. They feel that new courses for rural youth, to handle day to day jobs at grassroot level is required for farm practices small and veterinary services, routine testing services and various other rural occupations, agor processing, marketing etc. The Department have estimated that capacity building effort need to plan for developing para staff stock of about 17.6 lakh by 2020 in ideal case and it is desirable to have institutions with capacity development of 1.7 lakh para professional per year. The Committee, therefore, recommend that multi skilled development programmers/ para-agriculture (like it is, polytechnics and paramedics) be dovetailed like Govt's skill Development Mission or an integrated course can be started through existing institutional systems. They also emphasise expansion of such diploma courses in all the States of the country to meet the growing demand for such workforce.

38. The Committee find that the casual labourers were earlier engaged by ICAR Institutes as per guidelines issued by the Government of India from time to time. The Committee have been informed that subsequently as per DoPT guidelines dated 10.09.1993 all eligible workers working in ICAR were given temporary status and those who fulfilled the eligibility criteria were also considered for regularization against regular vacancies vide the aforesaid

guidelines. SAUs engage labourers as per Labour Laws of the respective State Governments. KVKs are functioning under ICAR Institutes and SAUs and some NGOs are governed by Rules and Regulations prescribed by Central/State Governments. The Committee were also informed that casual labourers with temporary status engaged in ICAR are governed by service conditions, wages and remunerations as prescribed by the Government of India from time to time through separate and specific orders. The Ministry have informed the Committee that information regarding remuneration paid for the last five years is not readily available at ICAR Headquarters. They have further informed that Institute of ICAR have outsourced various labour intensive services as per the Government of India guidelines on contract labourers issued from time to time. The Committee are surprised that ICAR does not have readily available information regarding agricultural labourers for their farm fields in various Institutes, universities and KVKs at their Headquarters. They feel that if the basic information is not available with ICAR Headquarters how does the ICAR monitor that the wages are being paid to such labourers or that the minimum wages/remuneration are being paid to them as per DoPT guidelines, State Labour Laws or Contract Labour Regulation Act. They fail to understand as to how the Ministry ensures that the Rules and Regulations governing the contract labourers are not violated. The Committee urge the Government to ensure that the ICAR should develop database regarding the contract labourers and their service conditions relating to wages and remunerations which is not only authentic but also readily available for necessary monitoring. The Committee strongly recommend that the laws

governing the casual labourers / contract labourers engaged by the ICAR Institutes should be strictly enforced so that Minimum Wages are paid to such labourers. The Committee also urge that ICAR should ensure regularisation of such casual labourers working directly under them who fulfil the eligibility criteria against regular vacancies as and when they arise.

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28 Magha, 1935 (Saka)

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