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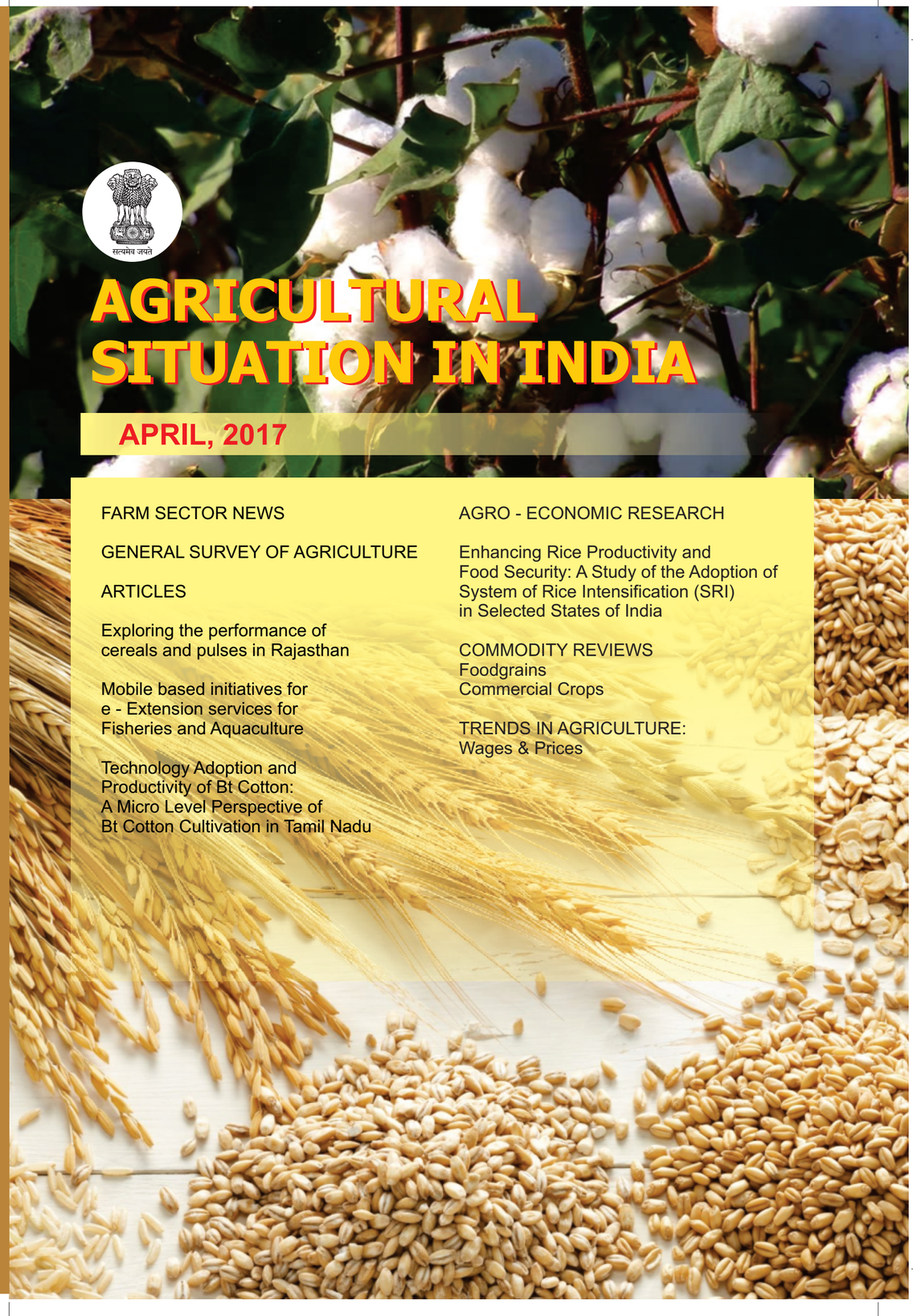

AGRICULTURAL SITUATION IN INDIA

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Contents

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Note to Contributors

Articles on the State of Indian Agriculture and allied sectors are accepted for publication in the Directorate of Economics & Statistics, Department of Agriculture, Cooperation & Farmers Welfare's monthly Journal "Agricultural Situation in India". The Journal intends to provide a forum for scholarly work and also to promote technical competence for research in agricultural and allied subjects. Good articles in Hard Copy as well as Soft Copy (agri.situation@gmail.com) in MS Word, not exceeding five thounsand words, may be sent in duplicate, typed in double space on one side of foolscap paper in Times New Roman font size 12, addressed to the Editor, Publication Division, Directorate of Economics and Statistics, M/o Agriculture & Farmers Welfare, C-1, Hutments Dalhousie Road, New Delhi-110 011 along with a declaration by the author(s) that the article has neither been published nor submitted for publication elsewhere. The author (s) should furnish their e-mail address, Phone No. and their permanent address only on the forwarding letter so as to maintain anonymity of the author while seeking comments of the referees on the suitability of the article for publication.

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Disclaimer: Views expressed in the articles and studies are of the authors only and may not necessarily represent those of Government of India.

STATISTICAL TABLES

Abbreviations used

N.A.	—	Not Available.
N.Q.	—	Not Quoted.
N.T.	—	No Transactions.
N.S.	—	No Supply/No Stock.
R.	—	Revised.
M.C.	—	Market Closed.
N.R.	—	Not Reported.
Neg.	—	Negligible.
Kg.	—	Kilogram.
Q.	—	Quintal.
(P)	—	Provisional.

Plus (+) indicates surplus or increase.

Minus (–) indicates deficit or decrease.

We are pleased to inform that our monthly journal *Agricultural Situation in India* has been accredited by the National Academy of Agricultural Sciences (NAAS) and it has been given a score of 3.15 out of 6. The score is effective from January, 2017 onwards. The score may be seen in the following website: www.naasindia.org

The Journal *Agricultural situation in India* has been included in the UGC approved list of Journals for promotion and recruitment in academic and non-academic posts.

Soft copy of the journal may be seen in PDF at the following URL : eands.dacnet.nic.in/publication.htm

Farm Sector News

First SAARC Meeting on Epidemiology Networking Forum held on 27-28 February, 2017

The First SAARC Epidemiology Networking Forum Meeting was jointly organized by the Government of India (Division of Livestock Health, Department of Animal Husbandry, Dairying and Fisheries (DAHDF), Ministry of Agriculture & Farmers Welfare), the SAARC Secretariat and FAO through CCS National Institute of Animal Health (CCS NIAH) during February 27-28, 2017 at NASC Complex, New Delhi. The objective of this first forum meeting was primarily to operationalize a sustainable and functioning veterinary epidemiology network among the eight SAARC Member States to build trust and foster collaboration between the Member States to achieve a more effective and efficient TADs, including zoonoses, control. The Epi Focal point (13) from the 07 member states, except Pakistan, participated in the meeting. The resource persons (11) from the international agencies like FAO, OIE, WHO, RSU-SAARC and SAC participated and facilitated the forum.

The inaugural session was presided over by Shri Devendra Chaudhary, Secretary (ADF), Govt of India. Dr. Suresh S. Honnappagol, Animal Husbandry Commissioner, Govt of India; Dr A.V.J Prasad, IAS, Joint Secretary,DAHDF, Govt of India and Dr. Ashok Kumar, ADG (Animal Health) ICAR graced the function. Shri Chaudhary, IAS, Secretary (ADF), Govt of India, emphasised on the economic upgradation of SAARC member states through control of TADs and suggested to make disease-free zones. Shri Devendra Chaudhary highlighted the significance of harmonizing the reporting systems of the member states of SAARC. He stressed that the policies be framed may be oriented towards Farmers First goal. He has shown the commitment of India towards strengthening this forum and building collaborations through joint R&D programmes and joint disease surveillance & control programmes.

The two-day meeting was chaired by Dr S S Honnappagol, Animal Husbandry Commissioner. The meeting included presentations from experts and interactive group exercises, besides informal discussions on various aspects to indentify and control TADs and EIDs.During the meeting, experts from various SAARC MSs expressed their commitment to make the forum self sustainable and identified the respective capacities in lab and field epidemiology in each country for mutual sharing and benefits. Experts from FAO(Dr Peter Black), including those from ECTAD-Bangaldesh& Bangkok (Dr Holy TenegAkwar, Dr KachenWongsathapornchai), Eu-FMD(Dr Keith Sumption), SAC(Dr MdNure Alam Siddiky), WHO-SEARO (Dr Gyanendra Gongal) as well as RRAP OIE(Dr Caitlin Jacobs Holley) besides RSU-FAO (Dr Santanu K Bandyopadhyay, Dr Pasang Tshering)shared their experiences to make the forum successful. It was decided to hold regular meetings using ICT tools to develop specific agenda and build further trust till next physical meeting. The forum agreed to make India as Secretariat for the forum for one year till the next face to face meeting of the forum.

Pre-Kharif Interface objective : To jointly identify emerging researchable areas and evolve strategies for better implementation of the schemes and programmes

A Pre-Kharif Interface between Department of Agriculture, Corporation & Farmers Welfare and ICAR (Indian Council of Agricultural Research) was held on 7th March, 2017, in Delhi, chaired by the Secretary (AC&FW) and co-chaired by the Secretary (DARE). It was attended by senior officials from the Departments of Agriculture, Cooperation & Farmers Welfare; Animal Husbandry, Dairying and Fisheries; and ICAR/Agricultural Research and Education.

The objective of Interface was to jointly identify emerging researchable areas and evolve strategies for better implementation of the schemes and programmes of the Ministry during the coming crop season. The Ministry has a well established institutional mechanism for identifying critical and contemporary issues for research and technology/farm management practices. It begins with a Zonal Conference on agricultural inputs in the month of January, wherein the Divisional Heads of Department of Agriculture, Cooperation & Farmers Welfare/Department of Animal Husbandry, Dairying & Fisheries supported by their counterpart from ICAR hold meetings with State representatives and identify critical issues. These are deliberated further at the Ministry level and brought up before the Interface chaired by Secretary, DAC&FW. The issues deliberated upon and recommendations made during the Pre-Kharif Interface would be further shared with the State representatives during the forthcoming National Conference for Kharif Campaign 2017, scheduled on April

Source: www.pib.nic.in

25-26, 2017. Simultaneously, all researchable issues would be shared with ICAR for appropriate research based solutions.

During the Interface, joint/common issues relating to Crops, Seeds, Plant Protection, Horticulture, Farm Mechanization & Technology, Natural Resource Management, Rashtriya Krishi Vikas Yojana, Integrated Nutrient Management, Extension and DAHD&F were deliberated upon. A few important decisions taken include:

- Crop varieties released by ICAR after 2011 should be promoted throughout India. The purpose is to achieve higher rate of varietal replacement.
- It was decided to request all the State governments to put seed indents for all the recommended varieties of various crops for their respective State, released after 2011.
- It was also agreed to have DNA fingerprint of all the released varieties for ascertaining their varietal identity and genetic purity.
- The Secretary, DAC&FW directed to identify different sources of supply of Gypsum, so that it is made available for enhancing the productivity of Oilseeds and Pulses, besides treating all problem soils.
- The Secretary, DARE stressed on developing transgenic groundnut, sunflower and castor varieties resistant to peanut bud/ stem necrosis disease, Alternaria and Botrytis diseases, as the search for resistance sources in the germplasm has not given the desired result so far.
- Among many issues discussed, the issue of application of drip irrigation technology in sugarcane cultivation throughout the country was stressed by the Secretary, DAC&FW, who referred to the law made by the Government of Maharashtra in this regard.
- It was also jointly decided that the consolidated laboratory for honey-testing would be established at IARI, New Delhi to promote the enterprise and take advantage of its positive impact on crop productivity.
- Both the Secretaries agreed to work for addressing the problems of the farming community by providing appropriate technology through proper dissemination mechanism.

The close coordination and cooperation amongst the three Departments of the Ministry was recognised by all participating members and it was agreed, that the same spirit should be brought to bear upon the working to ensure food and nutrition security of the country in particular and growth of agriculture sector at large. The Chairman also highlighted the need to work jointly for realising the vision of the Hon'ble Prime Minister of doubling the farmers' income by 2022.

Provide financial help to women to strengthen women cooperatives in the country: Shri Radha Mohan Singh

The Union Minister of Agriculture and Farmers Welfare, Shri Radha Mohan Singh, said that it is imperative to provide financial help to women so as to strengthen women cooperatives in the country as there is great potential for the development and success of women cooperatives. Shri Singh further said that if this movement continues, more and more women will be benefitted through women cooperatives. Shri Singh briefed it on a national workshop on the subject of strengthening of women cooperatives organized by National Cooperative Development Corporation (NCDC) in New Delhi. Almost 200 women linked with cooperatives across the country participated in the workshop and interacted with each other about different schemes related to women cooperatives.

Agriculture Minister stated that there is 1.2 billion population in India out of which about 70% population of India resides in rural areas. Women play an important role in sowing and harvesting process and in the aftermath scenario as well. Shri Singh further added that only about 20,014 cooperatives are run by women out of the 8 lakh cooperatives in the country. Shri Singh said that the Ministry of Agriculture and Farmers Welfare ascertains partnership of women in all of its schemes as well as its programs and earmarks 30% funds for women. Since, 2013-14, States and implementing agencies have been advised to utilize 10 to 20% of the funds for the livestock owned by women under the existing Centrally Sponsored/ Central Sector Schemes for the empowerment of them.

In addition to this, the deployment of one female scientist in every Kendra has been made compulsory in 668 Krishi Vigyan Kendras spread all over the country. 3.1 lakh female agriculturists have been trained during 2016-17 by these Krishi Vigyan Kendras across the country. Apart from this, the participation of women agriculturists has been ascertained in different programmes like frontline demonstration and agricultural demo being conducted by Krishi Vigyan Kendras. Now, the Ministry of Agriculture and Farmers Welfare has decided to celebrate 15th October of every year as Female Farmer Day. A gender knowledge portal has been developed for women farmers in which the data and information related to women farmers have been displayed. Apart from this, the women have been linked actively with fisheries related activities like collection of fishery seeds, catch of small fishes, mussel, eatable oaster, collection of marine vegetation, fisheries marketing, fisheries processing as well as products development etc. They are providing training and micro financing for increasing their partnership and participation in fisheries sector so that their potentialities

might be raised by organizing them in a cluster resulting in a spirit of inspiration towards this end.

Shri Singh further stated that the National Cooperative Development Corporation (NCDC) specifically aims to provide funds for the production of agricultural yield, processing, marketing, storage, export as well as import etc. NCDC provides financial assistance to women under the several programmes being run for weaker sections. NCDC provides loan upto Rs. 50 lakh for programmes related to women cooperatives. Further, the schemes above the range of Rs. 50 lakhs enjoy the loans available on 0.50% and 0.25% less interest rates, respectively. On this occasion, the Minister said that a Central Institute for Women in Agriculture, Bhubneshwar has been established for women agriculturalists by Indian Council for Agricultural Research. This is the first and only institute for the women associated with agriculture in the world.

Thereafter, Shri Radha Mohan Singh also chaired the 81th meeting of General Council of the National Cooperative Development Corporation. On this occasion, Shri Singh stated that financial sanctions amounting to Rs. 17,334 crore had been given till 28.02.2017 as well as a sum of Rs. 11,579 crore had been distributed. This amount is almost double as compared to the distribution target of Rs. 6000 crore this year. During this period, the net NPA of the corporation had been nil and the recovery rate of the loans is more than 99.59%. Shri Singh congratulated the Managing Director, NCDC and her team for performing even better during the current year 2016-17. While expressing his expectations, Agriculture Minister said that NCDC will continue its endeavors for the weaker sections through programmes related to fisheries, dairy, poultry, handloom, cooperatives concerned with SC/ST and specifically for the development of the cooperatives located in North-Eastern region as well as underdeveloped areas.

Press Release of the Conference on India - Poland Bilateral Cooperation in Agriculture & Allied Sectors held on 8th March 2017, at NASC Complex, Pusa, New Delhi

A one day Conference on India - Poland Bilateral Cooperation in Agriculture & Allied Sectors was held on 8th March 2017, at NASC Complex, Pusa, New Delhi. The conference was co-chaired by Dr. S. K. Pattanayak, Secretary, Department of Agriculture & Famers Welfare and Ms. Ewa Lech, Hon'ble Deputy Minister of Agriculture of the Republic of Poland.

Shri Jalaj Srivastava, Additional Secretary, Department of Agriculture, Cooperation and Farmers Welfare in his welcome address underscored the importance of this bilateral conference, which offers a highly effective platform to conduct fruitful exchanges on topics of common interest between the two countries.

While addressing the Conference, Shri Vinay Mathur, Deputy Secretary General, FICCI informed that India and Poland share some similarities and both the countries have tremendous opportunities for the agriculture trade. Mr. Tomasz Lukaszuk, H.E. Ambassador of the Republic of Poland focused on the issue of phytosanitary regulations governing the export of Polish apples to India. He said that he would like to see an intensification of agricultural trade between the two countries. Ms. Ewa Lech, Hon'ble Deputy Minister of Agriculture of the Republic of Poland said that using Polish technologies to enhance food processing capacity in India could be a win-win formula for companies on both sides. She emphasized that food produced in Poland is safe, healthy and of the highest quality. Polish food producers use only one third of the amount of fertilizers used elsewhere within the EU. About 75 per cent of the agricultural and food exports are absorbed by the very demanding European market. This conference would bring out clear understanding of the rules and regulations which would be very much helpful in promoting trade and economic cooperation between the two countries.

Dr. S. K. Pattanayak, Secretary, Ministry of Agriculture & Famers Welfare, in his inaugural address said that India and Poland share a long-standing friendly relationship, marked by high level political contacts, vibrant economic engagement and a strong partnership in the field of agriculture and allied sectors. The Union Cabinet has already approved signing of agreement between India and Poland on cooperation in agriculture and allied sectors. The agreement would likely to be signed in April 2017. The agreement covers exchange of information between the two countries on various aspects of agriculture and allied sectors including agri food trade, plant health and phytosanitary regulations as per international trade requirements, participation in fairs, exhibitions, seminars related to agriculture and agri-food processing etc.

The conference was attended by Government Officers, Scientists and Industry representatives of both the countries. The conference apprised both sides on the latest developments of their activities in the field of Seed, Horticulture, Animal Husbandry, Plant Protection, Mechanization, food processing and allied agriculture sector. Finally, both the sides reaffirmed their commitment to maintain close contacts through the established channels. Both sides will continue to foster cooperation in priority fields of mutual interest. Polish officials and business delegation held a meeting with members of the Forum of Indian agriculture industries and during the meeting; the Indian partners expressed their interest in purchasing of Polish products and transfer of Polish technologies for agricultural and food processing industry.

Centre to Launch Pilot Project on Ornamental Fisheries with total outlay of Rs. 61.89 crore

Recognizing the potential and scope of ornamental fisheries, the Department of Animal Husbandry, Dairying and Fisheries, the Ministry of Agriculture and Farmers Welfare, envisaged a program to unlock the country's ornamental fisheries sector through a special drive by launching a pilot scheme for the development of ornamental fisheries with a total outlay of Rs. 61.89 crore. Implementation of the pilot-scale Ornamental Fisheries Project focuses mainly on creating an enabling environment for a sustainable and holistic development of Ornamental Fisheries for the socio-economic development of the people involved in this activity as well as for exports. The thrust areas have been identified for enhancing ornamental fisheries production through cluster-based farming and conservation of natural resources, both inland and marine, through habitat restoration and creating awareness amongst the stakeholders.

The major objectives of the pilot project are: (i) to promote ornamental fish culture with cluster-based approach, (ii) to augment ornamental fisheries trade and export earnings, (iii) to create employment opportunities for the rural & periurban population and (iv) use of modern technology and innovation to make ornamental fisheries a thriving activity.

For the purpose of implementation of the pilot project, a total of 8 potential States have been identified, viz., Assam, West Bengal , Odisha, Maharashtra , Gujarat, Karnataka , Tamil Nadu and Kerala. All the activities under the pilot project are classified into four major groups, viz., (a) activities related to production of ornamental fish, e.g. setting up of backyard rearing units, medium scale units, integrated breeding-cum-rearing units, etc., (b) activities related to aquarium fabrication, trade and marketing; (c) activities for promotion of ornamental fisheries sector, and d: activities related to skill development and capacity building.

The pilot project on ornamental fisheries should be implemented by the National Fisheries Development Board (NFDB) through the Fisheries Departments of States/UTs. The broad funding patterns proposed under the pilot project on ornamental fisheries are in line with the funding patterns under CSS Blue Revolution: Integrated Development and Management of Fisheries. The financial resources required to meet the Central Govt. liability towards implementation of the proposed pilot project on development of ornamental fisheries should also be mobilized through dovetailing of funds under other schemes implemented by the GoI, in a convergence mode, wherever feasible. The implementation of proposed pilot project on ornamental fisheries would require a minimum time frame of one year.

Ornamental fishery, on the other hand, is a sub-sector of the fisheries sector dealing with breeding and rearing of coloured fish of both freshwater and marine water. Though ornamental fisheries do not directly contribute to the food and nutritional security, it generates livelihood and income for the rural and peri-urban population, especially women and unemployed youth as part-time activities. The ornamental fish industry in India is small but vibrant, with potential for tremendous growth. The low production cost and high returns within a short span of time and the ever growing demand, both in domestic and international markets, etc. are the major attractions. About 400 species of marine ornamental fishes and 375 freshwater ornamental varieties are available in various parts of our country. Fisheries and Aquaculture sector mainly focus on the production of table fish. Consequently, the major funding, both in the Government & private sector, is aimed at increasing the production and productivity of fish.

To cater to the needs of the local farmers, the Central Government has established Banana Research Centre: Shri Radha Mohan Singh

Union Agriculture and Farmer's Welfare Minister Shri Radha Mohan Singh said that Bihar and particularly Vaishali district is very suitable for the cultivation of bananas and large scale production of banana can change the fate of farmers. The Minister made this statement on the occasion of the laying the foundation stone of the Banana Research Centre at Gorole, Vaishali, Bihar Centre.

Shri Singh stated that Rajendra Krishi Viswavidyalaya, Pusa has got the status of Central Agriculture University only in October, 2016. After that, the Government has established this Banana Research Centre to fulfil the aspirations of the banana growers of Vaishali. Banana Research Centre, Vaishali falls under Garole area and because of the ecological conditions of Garole, it had been selected for the establishment of this centre. He further stated that this centre would work in the areas of finding reasons of less production in banana, enhancement in acreage for cultivation, suitable utilization of the various parts of the plants, different products, marketing and value addition.

Shri Singh said that Dr. Rajendra Prasad Central Agricultural University has already started the research work for doubling the income from banana cultivation. With starting this centre, the research work will get more momentum. He was hopeful that with the cooperation of the researchers of this centre and with the participation of farmers, it would help to bring a new era of banana cultivation in Bihar and surrounding states like it happened in Maharashtra.

Union Agriculture and Farmer's Welfare Minister further stated that the farmers of Maharashtra have

developed a domestic and export market with the help of 26 cooperative societies operating in the state and thus has given a new direction in the field of banana cultivation. By adopting high density cultivation, tissue culture, drip irrigation etc., Maharashtra is transporting high quality bananas to the entire country through 12-15 thousand Railway Wagons.

Shri Singh further informed that the total production of banana in the country is around 14.2 million tons. India holds number one position in the world in the area of banana production and stands at number three in acreages which is 13 per cent of the entire acreage and 33 per cent of the total production. Among the states, Maharashtra is the largest producer followed by Tamil Nadu. Productivity of Maharashtra is 65.7 ton/ha, which is more than the average national production of 34.1 ton/ha. Banana is grown in Bihar in around 27.2 thousand hectare, production is around 550 thousand tons and average productivity is 20.0 ton/ha, which is very less than the national average.

Mission Fingerling with a total expenditure of about Rs. 52000 lakh to achieve Blue Revolution

Recognizing the potential and possibilities in the fisheries sector, Government of India has envisaged a program named "Blue Revolution" to unlock the country's latent potential through an integrated approach. The Blue Revolution, in its scope and reach, focuses on creating an enabling environment for an integrated and holistic development and management of fisheries for the socio economic development of the fishers and fish farmers. Thrust areas have been identified for enhancing fisheries production from 10.79 mmt (2014-15) to 15 mmt in 2020-21.

Greater emphasis would be on infrastructure with an equally strong focus on management and conservation of the resources through technology transfer to increase the income of the fishers and fish farmers. Productivity enhancement would also be achieved through employing the best global innovations and integration of various production oriented activities such as: Production of quality fish seeds, Cost effective feed and adoption of technology etc.

Fish Fingerling production is the single most important critical input visualized to achieve fish production targets under the Blue Revolution. We need to establish more hatcheries to produce Fry/PL required for different categories of water bodies. Barring few States that's to in terms of fry (15-20 mm size), all States are in need of Fingerling production (standard size 80-100 mm). Use of High Yielding Verities of brooders is another significant aspect to be addressed on priority.

The Department has identified 20 States based on their potential and other relevant factors to strengthen the Fish Seed infrastructure in the country. This program with a total expenditure of about Rs. 52000 lakh would facilitate the establishment of hatcheries and Fingerling rearing pond to ensure the fish production of 426 crores fish fingerling, 25.50 crores Post Larvae of shrimp and crab in the country. This would converge in the production of 20 lakh tonnes of fish annually and would benefit about 4 million families. The implementation of this program would supplement the requirement of stocking materials in the country up to a large extent, which is a much needed input to achieve the enhanced fish production.

Krishi Unnati Mela 2017

Indian Agricultural Research Institute (IARI) every year has been organising Krishi Vigyan Mela(Agriculture Science Fair) to display and popularise the latest advancement in agricultural research and technology development among farmers and end users since 1972. It continues to be a highly important annual event for receiving feedback from the farming community, which helps in deciding the Institute's future research strategy. Thousands of farmers and visitors from across the country are participating in the mela every year.

This year Krishi Unnati Mela 2017 was organised from 15-17 March at the campus of IARI, New Delhi in jointly by ICAR and Ministry of Agriculture & Farmers Welfare. The mela was inaugurated by Hon'ble Minister of Agriculture and Farmers' Welfare, Sh. Radha Mohan Singh on 15th March, 2017. A large number of farmers and other visitors are expected to participate in the mela.

Some important issues of the Mela are given below:

- Digitization in agriculture
- Organic farming
- Agribusiness models
- Precision farming
- Skill building and entrepreneurship development
- Live demonstrations on production technologies of crops, horticulture, Integrated Farming System, Protected cultivation
- Farmers' visits to experimental fields of IARI
- Water use efficient technology: micro irrigation and sensor based irrigation system
- Recycling of waste water for agriculture
- Display and sale of various products (farm equipments, quality planting materials, bio-fertilisers, agro-chemicals, innovative farmers' products) and machinery
- On-spot Soil and water testing
- KisanGosthi
- Recognition of Innovative farmer

Development and Upliftment of Farmers is the first priority of the Government: Shri Radha Mohan Singh

The Union Minister for Agriculture & Farmers Welfare, Shri Radha Mohan Singh, said that development and upliftment of farmers is the first priority of the government and to achieve it, the government's aim is to double the income of farmers by 2022. Shri Singh said this on the inauguration of 3 days Krishi Unati Mela being held in Indian Institute of Agriculture Research. On this occasion, Secretary, Department of Agricultural Research and Education (DARE) and Director General, ICAR, Dr. Trilochan Mohapatra, Secretary, Department of Agriculture, Cooperation & Farmers Welfare (DAC&FW), Secretary, Department of Animal Husbandry, Dairying & Fisheries (DADF), Deputy Director General, Director, Indian Institute of Agriculture Research, Scientist and official were present. Information was given for crops and new species of cattle, special schemes and programmes prepared keeping in view of the protection, empowerment and their progress in the mela.

Shri Singh said on this occasion that it is essential to maintain fertility of the land for sustainable agriculture development. Hon'ble Prime Minister launched soil health card in Feb., 2015 itself and till now, 460 soil testing laboratory has been sanctioned. The government has made the production of neemcoated urea mandatory in May 2015. Further the cost of DAP and MOP has been reduced. Pradhan Mantri Fasal Bima Yojana has been launched to safeguard the farmers from natural disaster like drought, flood etc. It includes cereals, oilseeds and commercial, horticulture crops. About 366.64 lakh farmers have been covered in kharif 2016.

Union Agriculture & Farmers Welfare Minister said that Ministry has made arrangements for conducting whole sale market through e-platform (e-NAM) in the whole country so that the farmers may sell their products at reasonable price. To overcome the problem of drought, Prime Minister Krishi Sichae Yojna has been launched under which water is being provided to every khet. To encourage agriculture and to strengthen the rural livelihood many scheme of agriculture and farmers welfare have been launched. The main schemes are Pradhan Mantri Krishi Sichae Yojana, agriculture mechanization, national agriculture marketing, kisan suvidha mobile app, Rashtirya Krishi Vikas Yojna, Fisheries Developmnent Management, Integrated Agriculture System Model etc.

Shri Singh said that the country is self-sufficient in foodgrains and exporting foodgrains to the other countries. India is number one in milk production in the world. Milk production had increased from 137.61 million tonnes during 2013-14 to 146.31 million tonnes during 2014-15 and during 2015-16; milk production was 155.49 million tonnes. New Scheme "National Bovine Productivity Mission" has been started in November, 2016 with an amount of Rs. 825 crore. A production of 82, 930 million eggs was made during year 2015-16. Seeing the unlimited scope of development in fisheries, the Modi government has called for Blue Revolution in the fisheries sector. For Blue Revolution scheme, central budget of Rs. 3000 crore has been earmarked for the period of five years. The number of Krishi Vigyan Kendra has reached to 665 so that the farmers may adopt from training to agriculture technique. Cabinet has approved Rs 3960 crore for running the Krishi Vigyan Kendras. Hon'ble Prime Minister, Shri Narnedra Modi has given special emphasis on lab to land, water, soil productivity, food processing. Prominent among them are Farmer First, Arya, Student Ready Mera Gaon, Mera Gaurav.

Implementation of Crop Insurance Scheme

Various suggestions have been received from time to time both from individuals and farmer organisations to provide insurance coverage for specific crops/specific risks for their respective areas. Taking these into account, Pradhan Mantri Fasal Bima Yojana (PMFBY) was launched from Kharif 2016 to provide comprehensive insurance coverage for all food crops (cereals, millets & pulses), oilseeds crops and annual commercial/horticultural crops against all non-preventable natural risks. This is, however, subject to yield data being made available for the particular crop for a sufficient number of years and the capacity of State Governments to conduct requisite number of Crop Cutting Experiments (CCEs) to assess the yield loss. Perennial horticultural crops can also be insured under Restructured Weather Based Crop Insurance Scheme (RWBCIS). Inclusion of crops and areas under the PMFBY/RWBCIS are however, decided/notified by the concerned State Governments. The Central Government on its part, has continuously persuaded the State Governments to notify maximum number of crops and areas under crop insurance schemes, so that the coverage can be enhanced from the present level of about 30% of cropped area in 2016-17 to 50% of cropped area over the next two years.

This is the first year of implementation of PMFBY/ RWBCIS and 23 States implemented the schemes during Kharif 2016 and 25 States and 3 Union Territories during Rabi 2016-17 coverage of number of farmers during Kharif and Rabi 2016-17. Disparities among States in coverage is attributable to the schemes being optional for States, notification by States of food and oilseeds crops & annual commercial/horticultural crops on selective basis, poor infrastructure of insurance companies for coverage of non-loanee farmers etc. Apart from these factors, coverage of farmers differs from State to State also due to perception of risk of areas and crops, being higher in more risky areas and crops. Government is keeping a close watch on the implementation/progress of the schemes which are being monitored at the highest level and through weekly video conferences with State Governments, insurance companies

and financial institutions. Due to the improved features of the new schemes and efforts made by the Government, coverage under PMFBY/RWBCIS had increased substantially over that of the erstwhile schemes.

Promoting the Use of Organic Manure

Organic fertilizers have been tested scientifically in Indian Council of Agriculture Research (ICAR), institutions and State Agricultural Universities (SAUs) on various crops and soil types and found suitable for improving soil health and crop productivity. The organic fertilizers presently available may supplement (N,P) by nearly 20-25%. Bio-fertilizers, when applied along with compost @ 5t/ha or vermicompost @ 2t/ha, fertilizer saving is almost 50%. The advantages of these organic fertilizers are that they are eco-friendly and not only provide nutrients for maintaining soil fertility but also improve soil physical & biological health. Government is promoting judicious use of chemical fertilizers in conjunction with organic manures and biofertilizers to maintain soil health and productivity.

Organic fertilizers are largely produced on-farm by the farmers. When on-farm organic inputs are used, cost of production per unit area is less than 13% under organic agriculture than inorganic management. However, if organic inputs from outside the farm are purchased and utilized, the cost of production increases by about 15-20% depending on the nature of inputs used. Integrated Organic Farming System (IOFS) models being developed under National Project on Organic farming (NPOF) promises to meet 70-80% of organic inputs within the farm thus reducing the market input cost considerably.

Government is promoting the use of Organic manures under the scheme Paramparagat Krishi Vikas Yojana (PKVY) of National Mission for Sustainable Agriculture (NMSA). The Government is promoting the use of organic inputs in the country, through assistance as under:

(i) Financial assistance is provided under the component Integrated Manure Management of Paramparagat Krishi Vikas Yojana (PKVY) for Phosphate Rich Organic Manure (PROM) as per specification given in FCO, 1985 @Rs.1000/acre for procuring and application of PROM to soil to meet phosphorus/Zinc deficiency in soil.

(ii) Financial Assistance is provided for vermi-compost (size 7x3x1) @Rs.5,000/- unit for procurement of earth worms, preparation of pits, construction of brick wall etc.

(iii) Promotion of Organic Inputs under Organic & INM Components of Soil Health Management, assistance is provided for Vermi-compost, Bio-fertilizers (Liquid / solid), Waste compost, Herbal extracts etc. including PROM @ 50 % of cost subject to a limit of Rs. 5000/- per ha and maximum Rs.10,000 per beneficiary.

(iv) Government is also promoting the production of organic manures by providing 100% financial assistance to State Governments/ Government Agencies upto a maximum limit of Rs.190.00 lakh per unit and 33% of project cost maximum limited to Rs.63 lakh per unit for individuals/private agencies through NABARD as capital investment for establishment of agro/vegetable waste compost production units of 3000 Total Per Annum (TPA) production capacity.

(v) Under the Rain fed Area Development (RAD) component of NMSA, 50% of cost subject to limit of Rs 125/- per cubic ft. and maximum permissible assistance of Rs.50,000/- per unit for permanent structure and Rs 8,000/- per unit for High Density Polyethylene (HDPE) vermi bed is provided for construction of compost unit and, organic input production unit.

(vi) The Government of India is providing a Market Development Assistance @ Rs.1500/-per metric ton (MT) to Fertilizer Companies for sale of City Compost.

Union Minister for Agriculture and Farmers Welfare addressed the 5th International Convention on "Changing Dynamics of Commodities Market"

The Union Minister for Agriculture and Farmers Welfare, Shri Radha Mohan Singh said the Government is working on a concrete plan to link the farmers with the markets. Addressing the 5th International Convention on "Changing Dynamics of Commodities Market", he said this would help the farmers' participation in the trading of food grains.

Shri Radha Mohan Singh said Forward Trading is an index of predictive pricing and as a result both the buyer and seller can plan their futures trading. This would help farmers plan their crop planting and also do away with the role of middlemen.

The Minister said marketing in farm produce is carried out through State Government designated 6,746 Mandis spread across the country. He said the Government is leveraging the APMC Mandis and at the same time amending the Marketing laws to facilitate setting up of Mandis by the private sector.

Shri Radha Mohan Singh said the e-NAM offers an online commodities trading platform that helps the farmer fetch optimum price for his farm produce and the money is also credited directly to his account. He said a total of 277 Mandis spread across 12 States have been linked on the e-NAM portal and 585 Mandis will board the platform by the next year.

The Minister said India is not only self-sufficient in agricultural production but also exports food grains and the Agricultural Growth has more than doubled from 2% to 4.4%. In the 2017-18 Budget, the funding provision for Rural, Agricultural and Allied sectors has jumped 24% to Rs.1,87,223 crores.

The Union Minister of Agriculture and Farmers Welfare Shri Radha Mohan Singh, while inaugurating the new Krishi Vigyan Kendra (KVK) in Western Tripura, said that the second green revolution would have to come from the eastern region of the country

The Union Minister of Agriculture and Farmers Welfare Shri Radha Mohan Singh, while inaugurating the new Krishi Vigyan Kendra (KVKs), West Tripura said that the second green revolution would have to come from the eastern region of the country and to realise it, the north-eastern states would have to be brought under the national mainstream for the equitable agricultural development in this region. He further said that the Government is committed to developing the agriculture sector of the region.

On this occasion, the minister said that the Government has sanctioned 7 KVKs for the state of Tripura of which 5 are already functional and with this inauguration 6 KVKs would become operational in the state and one more would also be operational soon. In addition, the site selection committee is also visiting the state for the selection of site for the 8th KVK. With this, all the districts in the state should have a KVK each. Shri Radha Mohan Singh said that he is confident that the KVKs would equip the farmers of the state with the desired skills and build their capacities through on farm testing and demonstration of the new technologies developed by Agricultural Scientists. He said that the Government is committed to provide at least 1 KVK in each of the districts of the Country. The total number of KVKs in the country has now gone up to 668, from 637 about 2.5 years ago, of which 78 KVKs are functional in the north-eastern states.

Speaking on the occasion, the Minister said that the health of the soil affects the health and the productivity of crops and the animals and in view of this the Government has established mini soil testing labs in KVKs. For strengthening the KVKs, the staff strength of the KVKs has also been increased from 16 to 22.

He said that the KVKs are playing a pioneering role in the area of front line extension in extending various agricultural technologies amongst farming community and the state line departments. During the past one year, the KVKs have organized a total of 48,983 training programmes through which 13.21 lakh farmers and extension personnel have benefitted.

The Minister further said that Government is committed towards doubling the farmers' income in next 5 years' period. To achieve this goal, the union budget this year has laid major focus towards integrated agricultural development. Key focus areas of the Government are; making available agricultural credit at easier terms to the farmers, ensuring availability of the quality seeds and other essential inputs, creating irrigation infrastructure, improving soil health through distribution of soil health cards, creating market network through National Agricultural Market (E-NAM) and ensuring remunerative price for the farmer's produce.

The Minister said that owing to the favourable monsoon and implementation of several policy initiatives and reforms by the Government of India, the country has achieved highest ever food grain production this year (271.89 Million tonnes) this year which is 6.94 million tonnes higher than the previous best of 265.04 million tonnes achieved during 2013-14.

On this occasion, the Minister urged the State Government to fast track the implementation of the flagship schemes of the Government. For example, he said that the distribution of soil health cards under the Soil Health Card Scheme of the Government was below par, and the farmers have not been able to benefit from the Pradhan Mantri Krishi Sinchayee Yojna (PMKSY) to the extent that they should have. The progress of the Paramparagat Krishi Vikas Yojana is also very slow. He also mentioned that no proposal has been received by the Government of India from the Government of Tripura to link with the E-NAM so far and urged the Government of Tripura to take urgent corrective action in this regard.

Cabinet approves hike in MSP for Copra for 2017 season

The Cabinet Committee on Economic Affairs, chaired by the Prime Minister Shri Narendra Modi, gave its approval for the Minimum Support Price (MSP) for Fair Average Quality (FAQ) of "Milling Copra" to Rs.6500/- per quintal for 2017 season from Rs. 5950/-per quintal in 2016. The MSP for FAQ of "Ball Copra" has been increased to Rs.6785/- per quintal for 2017 season from Rs. 6240/- per quintal in 2016.

The MSP of Copra is expected to ensure appropriate minimum prices to the farmers and step up investment in Coconut cultivation and thereby production and productivity in the country.

The approval is based on recommendations of Commission for Agricultural Costs and Prices (CACP). CACP, which is an expert body, takes into account the cost of production, trends in the domestic and international prices of edible oils, overall demand and supply of copra and coconut oil, cost of processing of copra into coconut oil and the likely impact of the recommended MSPs on consumers, while recommending the MSPs.

The National Agricultural Cooperative Marketing Federation of India Limited (NAFED) and National Cooperative Consumer Federation of India Limited (NCCF) would continue to act as Central Nodal Agencies to undertake price support operations at the Minimum Support Prices in the Coconut growing states.

Cabinet approved proposal for Amendments to the NABARD Act, 1981

Union Cabinet, chaired by the Prime Minister Shri Narendra Modi, approved the following proposals:

(a) Amendments to National Bank for Agriculture and Rural Development Act, 1981 as proposed in the draft Bill with such changes of drafting and of consequential nature, as may be considered necessary by Legislative Department. The Amendments, include provisions that enable Central Government to increase the authorized capital of NABARD from Rs. 5,000 crore to Rs. 30,000 crore and to increase it beyond Rs. 30,000 crore in consultation with RBI, as deemed necessary from time to time.

(b) Transfer of 0.4 per cent. equity of RBI in NABARD amounting to Rs. 20 crores to the Government of India.

The proposed amendments in NABARD Act, include, certain other amendments including changes in long title and certain Sections to bring Medium Enterprises and Handlooms in NABARD's mandate.

The proposed increase in the authorized capital would enable NABARD to respond to the commitments it has undertaken, particularly in respect of the Long Term Irrigation Fund and the recent Cabinet decision regarding on-lending to cooperative banks. Further, it would enable NABARD to augment its business and enhance its activities which would facilitate promotion of integrated rural development and securing prosperity of rural areas including generation of more employment.The transfer of entire shareholding in NABARD held by RBI to the Central Government would remove the conflict in RBI's role as banking regulator and shareholder in NABARD.

Need to ensure focused attention for harnessing available potential through scaling up ongoing interventions- Shir Radha Mohan Singh

The Union Minister of Agriculture and Farmers Welfare, Shri Radha Mohan Singh said that there is tremendous potential for development of the horticulture sector and there is need to ensure focused attention for harnessing available potential through scaling up ongoing interventions. Shri Singh stated this during the inter-session meeting of the Parliamentary Consultative Committee of the Ministry of Agriculture and Farmers Welfare, in New Delhi. The strategy for making Horticulture sector a key driver in transforming India's agrarian landscape by ensuring convergence between research institutions, state horticulture missions, livelihood programmes and entrepreneurship was also discussed during the meeting.

Shri Singh said that the session deliberated on the achievements and challenges facing the horticulture sector, including Mission for Integrated Development of Horticulture (MIDH) and discussions were held about the Horticulture sector in the country with reference to a wide variety of crops, such as fruits, vegetables, tuber crops, mushroom, ornamental plants including cut flowers, spices, plantation crops, medicinal and aromatic plants..

Agriculture Minister stated that India is currently producing about 286 million tonnes of horticulture produce from an area of about 24.4 million hectare, accounting for about 13 percent of the total world production of fruits and leads the world in the production of mango, banana, papaya, sapota, pomegranate, acid lime and aonla.

Shri Singh informed the session that India is the second largest producer of vegetables after China and is a leader in production of vegetables like peas and okra. Besides, India occupies the second position in production of brinjal, cabbage, cauliflower and onion and third in potato and tomato in the world. Special thrust is being given for production of vegetables under protected cultivation under Mission for Integrated Development of Horticulture (MIDH).

The Minister said that there are numerous success stories, for example, banana in Maharashtra and Tamil Nadu, guava & tomato in Chatisgarh, pomegranate and mango in Gujarat, pineapple in Nagaland, kiwi in Arunachal and orchids in Sikkim, off season vegetables in Uttarakhand, etc - the challenge is to complement the sector with food processing, cold-chain agro logistics, agri-business, input related services, agricultural lending, insurance and value chain related services.

Shri Singh said that in case of Horticulture, cold-chain strengthens the total value chain system and enables socio-economic transformation of farmers. To double farmer's income, cold-chain plays an important role in ensuring that farmers can recover value from produce to result in gainful economic productivity.

Agriculture Minister also added that it is equally essential to ensure the development of trained and skilled manpower and availability of quality planting material suitable to the local agro climatic conditions. Human resource development needs to be given thrust for capacity building of farmers, horticulture entrepreneurs/supervisors and field functionaries. Establishment of crop based Centres of Excellence is being encouraged in each of the states to serve as a hub for supply of planting material and dissemination of technology to farmers. So far 27 CoEs have been established with Indo-Israel collaboration and

more are in the pipeline with collaboration with other countries.

The Minister hoped that deliberations of the In-Session Consultative Committee would help bring a clearer insight of the lead role that horticulture must play in improving livelihood options, diversification of agriculture, and higher income to farmers.

Shri Singh launched Coffee Table Book titled "50 Years-The Great Indian Milk Revolution"

The Union Minister of Agriculture and Farmers Welfare, Shri Radha Mohan Singh said that the growth in dairy production is the result of dairy cooperative societies' hard work. Shri Singh said it at the launch of Coffee Table Book titled "50 Years - The Great Indian Milk Revolution" commemorating National Dairy Development Board's (NDDB) Golden Jubilee year. Shri Radha Mohan Singh also said that since 1998, the poor and marginal milk producers have worked hard to make the country world's top milk producer. The success was not achieved overnight; it's the result of milk producers' constant efforts, support of committed professionals, and the vision and expertise of NDDB.

Shri Singh also said that NDDB's sustained efforts through Operation Flood and the present National Dairy plan helped the country's dairy sector in maintaining a steady growth. There has been a marked increase in the contribution of livestock to agricultural GDP and livestock's in the dairy sector. In terms of value, milk is the largest agricultural commodity in India.

Shri Radha Mohan Singh also said that India's milk production has crossed 155 million tonnes mark. This has resulted in the rise of per capita milk availability to about 337 gm/day. In the last two years, milk production grew at 6.5 % annually as against 4.5 % per annum in the previous 10 years, which is almost double as compared to the growth in milk production in the world. About 1.7 lakh dairy cooperatives are serving almost 15.8 million milk producers, one-third of them being women, across the country by providing them market access and input services, thereby strengthening their livelihoods.

Union Agriculture Minister said NDDB's efforts have contributed in bringing nutritional security to the country, attaining self-sufficiency in milk and delivering milk and dairy products to the consumers at affordable prices. NDDB has adopted a scientific approach and systematic processes to create a favourable environment for the growth of the dairy sector. NDDB's aim has been to improve productivity, profitability, sustainability, and thus improve the livelihoods of small milk producers.

This book encapsulates NDDB's remarkable 50-year journey and the value it has created for millions of dairy farmers in this country. The book highlights NDDB's belief that cooperative principles are as relevant as they were in the past and the institutions which follow these will form the structural framework for the growth of the dairy sector in the future. It also highlights the Dairy Board's efforts towards bringing about socio-economic change in rural India. Shri Singh said that it is our collective responsibility to create awareness about the merits of cooperative dairy business. We should strive to reach out to the smallest and farthest milk producer so that they become self-sufficient.

Six Crore Soil Health Cards Distributed

The Government introduced Soil Health Card (SHC) Scheme with an aim to provide soil health cards to all farm holdings across the country once in a cycle of two years. Uniform norms of 10 hectares for rainfed areas and 2.5 hectare for irrigated areas constitute the grid for soil sample collection. Uniform norms of testing 12 parameters is followed namely major nutrients (N, P, K), secondary nutrients (S), micro-nutrients (Fe, Zn, Cu, Mn & B) and others (pH, EC & OC). The State Government through its Department of Agriculture is nodal agency to issue soil health card to farmers.

So far against the target of 14 crore cards distribution, 6 crore cards have been distributed and remaining cards are under printing. Adequate funds have been released to all States, funds amounting to Rs 23.89 crore, Rs 96.44 crore and Rs 126.47 crore have been released during 2014-15, 2015-16 and 2016-17 respectively under the scheme.

NBPGR conserved 64,829 traditional seed varieties in Gene Banks

The Government has a policy to encourage conservation of the seeds of traditional varieties of various crops. The National Bureau of Plant Genetic Resources (NBPGR) has conserved 64,829 traditional varieties in Gene Banks located in different States.

The Protection of Plant Varieties and Farmer's Rights Authority (PPV & FRA) has also registered 1070 traditional varieties of different crops. PPV & FRA encourage the community and individuals engaged in conservation, improvement and preservation of plant genetic resources of economic plants and their wild relatives particularly in the areas identified as agro-biodiversity hotspots by awarding the community and individuals who have played stellar roles in such activities.

NBPGR and PPV & FRA organize biodiversity awareness programmes and training for farmers to strengthen community seed system and create awareness to conserve indigenous crop varieties and climate resilient traditional land races of local crops every year. As collection and conservation of traditional varieties is a continuous activity, 42 exploration and collection missions will be undertaken mainly to collect traditional varieties from tribal areas in the next year by NBPGR.

Cabinet approved Grants-in-aid of Rs. 25 crore to Agro-Economic Research Centres and Agro-Economic Research Units beyond 2016-17

The Cabinet Committee on Economic Affairs,chaired by the Prime Minister Shri Narendra Modi approved to extend the grants-in-aid support to the existing network of 12 Agro-Economic Research Centres (AERCs) and three Agro-Economic Research Units (AERUs) for one more year that is up to 2017-18.

An amount of Rs.25 crore would be required to continue the grants-in-aid to the existing 15 AERCs/ AERUs. The employees of 12 AERCs and three AERUs situated in different states would be benefited. This would provide policy oriented Agro Economic Research inputs through field studies and reviewing / monitoring of Flagship programmes of the agriculture and allied sector. This would lead to better agricultural development policy and programmes which in turn would raise employment potential in both Farm and Non-Farm areas.

It would be reviewed after one year for taking the final decision on the recommendations of the Review Committee, chaired by Dr. S.M. Jharwal, Chancellor, Indira Gandhi National Tribal University. This Committee was set up by the Department of Agriculture, Cooperation & Farmers Welfare (DACFW) to review the functioning of AERCs/AERUs. The Review Committee has recommended that the AERCs/AERUs must be retained and strengthened and that the present pattern of grant-in-aid to these grass-root research institutions must be continued. The Committee has also made recommendations regarding functioning and improving governance of the AERCs/AERUs.

General Survey of Agriculture

Trends in Food Grain Prices

During the month of February, 2017 the All India Index Number of Wholesale Price (2004-05=100) of Food grains decreased by 2.29 percent from 279.2 in January, 2017 to 272.8 in February, 2017.

The Wholesale Price Index (WPI) Number of cereals increased by 0.39 percent from 254.9 to 255.9 and WPI of pulses decreased by 10.42 percent from 393.4 to 352.4 during the same period.

The Wholesale Price Index Number of wheat decreased by 1.04 percent from 250.3 to 247.7 while that of rice increased by 1.38 percent from 246.0 to 249.4 during the same period.

Weather, Rainfall and Reservoir Situation during March, 2017

Rainfall Situation

Cumulative Pre-Monsoon Season rainfall for the country as a whole during the period 01st March to 29th March, 2017 has been 11% lower than the Long Period Average (LPA). Rainfall in the four broad geographical divisions of the country during the above period has been higher than LPA by 94% in South Peninsula and 14% in East & North East India but lower than LPA by 39% in North-West India and 33% in Central India.

Out of total 36 meteorological Sub-divisions, 07 subdivisions received large excess rainfall, 13 subdivisions received excess/normal rainfall, 08 sub-divisions received deficient rainfall, 05 sub-divisions received large deficient rainfall and 03 subdivisions received no rainfall.

Water Storage in Major Reservoirs

Central Water Commission monitors 91 major reservoirs in the country which have total live capacity of 157.80 Billion Cubic Metre (BCM) at Full Reservoir Level (FRL). Current live storage in these reservoirs (as on 30th March, 2017) is 52.63 BCM as against 39.64 BCM on 30.03.2016 (last year) and 51.58 BCM of normal storage (average storage of last 10 years). Current year's storage is higher than the last year's storage by 33% and 2% higher than the normal storage.

ECONOMIC GROWTH

- As per the 2nd advance estimates of national income, released by CSO on February 28, 2017, growth- rate of Gross Domestic Product (GDP) at constant market prices is placed at 7.1 per cent in 2016-17 as compared to 7.9 per cent in 2015-16.
- The growth in Gross Value Added (GVA) at constant (2011-12) basic prices for the year 2016-17 is estimated to be 6.7 per cent, as compared to 7.8 per cent in 2015-16. At the sectoral level, agriculture, industry and services sectors grew at the rate of 4.4 per cent, 5.8 per cent and 7.9 per cent respectively in 2016-17.
- The share of total final consumption in GDP at current prices in 2016-17 is estimated to be 69.3 per cent, as compared to 68.1 per cent in 2015-16. The fixed investment rate (ratio of gross fixed capital formation to GDP) declined from 29.2 per cent in 2015-16 to 26.9 per cent in 2016-17.
- The saving rate (ratio of gross saving to GDP) for the years 2015-16 was 32.2 per cent, as compared to 33.0 per cent in 2014-15. The investment rate (rate of gross capital formation to GDP) in 2015-16 was 33.2 per cent, as compared to 34.2 per cent in 2014-15.

AGRICULTURE AND FOOD MANAGEMENT

- **Rainfall:**The cumulative rainfall received for the country as a whole during the period 1st to 15th March, 2017 has been 39 per cent above normal. The actual rainfall received during this period was 18.7 mm as against the normal at 13.5 mm. Out of the total 36 meteorological subdivisions, 11 subdivisions received large excess, 6 subdivisions received excess rainfall, 5 subdivisions received normal rainfall, 5 subdivisions received deficient rainfall, 3 subdivisions received large deficient rainfall and remaining 6 subdivisions received no rainfall.
- **All India production of food-grains:** As per the 2nd Advance Estimates released by Ministry of Agriculture & Farmers Welfare on 15th February 2017, production of foodgrains during 2016-17 is estimated at 272.0 million tonnes, as compared to 251.6 million tonnes in 2015-16 (Table 3).
- **Procurement:** Procurement of rice as on 8th

March 2017 was 31.1 million tonnes during Kharif Marketing Season 2016-17 whereas procurement of wheat was 23.0 million tonnes during Rabi Marketing Season 2016-17 (Table 4).

- **Off-take:** Offtake of rice during the month of January, 2017 was 26.5 lakh tonnes. This comprises 24.1 lakh tonnes under TPDS/NFSA and 2.4 lakh tonnes under other schemes. In respect of wheat, the total offtake was 22.4 lakh tonnes comprising 18.0 lakh tonnes under TPDS/NFSA and 4.4 lakh tonnes under other schemes. The cumulative offtake of food grains during 2016-17 (till January, 2017) is 56.2 million tonnes (Table 5).
- **Stocks:** Stocks of foodgrains (rice and wheat) held by FCI as on March 1, 2017 was 40.9 million tonnes, as compared to 46.1 million tonnes as on March 1, 2016 (Table 6).

TABLE 1: Growth of GVA at Basic Prices by Economic Activity at Constant (2011-12) Prices (in per cent)

Sectors	Growth Rate (%)			Share in GVA or GDP (%)		
	2014-15 2nd RE	2015-16 1st RE	2016-17 2nd AE	2014-15 2nd RE	2015-16 1st RE	2016-17 2nd AE
Agriculture, forestry & fishing	-0.3	0.8	4.4	16.5	15.4	15.1
Industry	6.9	8.2	5.8	31.3	31.4	31.1
Mining & quarrying	14.7	12.3	1.3	3.2	3.3	3.1
Manufacturing	7.5	10.6	7.7	17.4	17.8	18.0
Electricity, gas, water supply &	7.2	5.1	6.6	2.2	2.1	2.1
other utility services Construction	3.0	2.8	3.1	8.5	8.1	7.9
Services	9.5	9.8	7.9	52.2	53.2	53.8
Trade, Hotel, Transport Storage	8.6	10.7	7.3	18.5	19.0	19.1
Financial, real estate & prof servs	11.1	10.8	6.5	21.3	21.9	21.9
Public Administration, defence and other services	8.1	6.9	11.2	12.4	12.3	12.8
GVA at basic prices	6.9	7.8	6.7	100.0	100.0	100.0
GDP	7.2	7.9	7.1	--	---	---

Source: Central Statistics Office (CSO). 2nd RE: Second Revised Estimates 1st RE: First Revised Estimates, 2nd AE: as per second advance estimates of GDP released on 28th February 2017.

TABLE 2: Quarter-wise Growth of GVA at Constant (2011-12) Basic Prices (per cent)

Sectors	2014-15				2015-16				2016-17		
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
1	2	3	4	5	6	7	8	9	10	11	12
Agriculture, forestry & fishing	3.4	4.9	-1.7	-0.2	2.6	2.3	-2.2	1.7	1.9	3.8	6.0
Industry	8.2	5.8	3.6	6.1	7.4	7.4	9.5	8.6	6.1	5.1	6.6
Mining & quarrying	22.3	9.3	12.1	14.7	11.2	13.9	13.3	11.5	-0.3	-1.3	7.5
Manufacturing	9.1	7.2	2.7	7.7	8.5	10.3	12.8	10.8	9.0	6.9	8.3
Electricity, gas, water supply & other utility services	8.4	7.0	7.0	2.7	2.5	5.9	4.1	7.8	9.6	3.8	6.8
Construction	1.6	1.9	1.6	0.6	4.8	0.0	3.2	3.0	1.7	3.4	2.7
Services	7.9	9.8	11.9	8.5	9.5	10.4	9.4	10.1	8.8	8.2	6.8
Trade, hotels, transport, communication and services related to broadcasting	9.3	6.2	3.9	10.8	10.6	8.9	9.6	13.2	8.2	6.9	7.2

TABLE 2: QUARTER-WISE GROWTH OF GVA AT CONSTANT (2011-12) BASIC PRICES (PER CENT)—CONTD.

1	2	3	4	5	6	7	8	9	10	11	12
Financial, real estate & professional services	10.2	14.1	14.0	10.9	10.2	13.1	10.4	8.9	8.7	7.6	3.1
Public administration, defence and Other Services	1.5	7.2	21.8	1.3	6.3	7.2	7.5	6.7	9.9	11.0	11.9
GVA at Basic Price	7.3	7.9	6.3	6.1	7.8	8.4	7.0	8.2	6.9	6.7	6.6
GDP at market prices	7.4	7.8	6.1	6.5	7.8	8.4	6.9	8.6	7.2	7.4	7.0

Source: Central Statistics Office (CSO).

TABLE 3: PRODUCTION OF MAJOR AGRICULTURAL CROPS (2ND ADV. EST.)

Crops	Production (in Million Tonnes)				
	2012-13	2013-14	2014-15	2015-16 (Final)	2016-17 (2nd AE)
Total Foudgrains	257.1	265.0	252.0	251.6	272.0
Rice	105.2	106.7	105.5	104.4	108.9
Wheat	93.5	95.9	86.5	92.3	96.6
Total Coarse Coarse Cereals	40.0	43.3	42.9	38.5	44.3
Toral Pulses	18.3	19.3	17.2	16.4	22.1
Total Oilseeds	30.9	32.8	27.5	25.3	33.6
Sugarcane	341.2	352.1	362.3	348.4	310.0
Cottor#	34.2	35.9	34.8	30.0	32.5

Source: DES, DAC&FW, M/o Agriculture & Farmers Welfare, # Million bales of 170 kgs. each.

TABLE 4: PROCUREMENT OF CROPS IN MILLION TONNES

Crops	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Rice#	35.0	34.0	31.8	32.2	34.2	31.1[$]
Wheat@	28.3	38.2	25.1	28.0	28.1	23.0[$]
Total	63.3	72.2	56.9	60.2	62.3	54.1

Kharif Marketing Season (October-September), @ Rabi Marketing Season (April-March,), [$] Position as on 08.03.2017
Source: FCI and DFPD, M/o Consumer Affairs and Public Distribution.

TABLE 5: OFF-TAKE OF FOOD GRAINS (MILLION TONNES)

Crops	2012-13	2013-14	2014-15	2015-16	2016-17 (Till Arpil)
Rice#	32.6	29.2	30.7	31.8	29.7
Wheat	33.2	30.6	25.2	31.8	26.5
Total (Rice & Wheat)	65.8	59.8	55.9	63.6	56.2

Source: DFPD, M/o Consumer Affairs and Public Distribution.

TABLE 6: STOCKS OF FOOD GRAINS (MILLION TONNES)

Crops	March 1, 2016	March 1, 2017
1. Rice	19.4	20.4
2. Unmilled Paddy #	14.6	16.5
3. Converted Unmiled Paddy in terms of Rice	9.8	11.1
4. Wheat	16.9	9.4
Total (Rice & Wheat) (1+3+4)	46.1	40.9

#Since September, 2013 FCI gives separate figures for rice and unmilled paddy lying with FCI & state agencies in terms of rice.

Articles

Exploring the Performance of Cereals and Pulses in Rajasthan

Dr. Shirish Sharma*

Abstract

The state of Rajasthan has a characteristic feature of erratic and unevenly distributed low rainfall. This is also reflected by the crop performance mostly in case of pulses, and fluctuating yield levels have been observed for almost all the cereals and pulse crops. Overall performance of the crop in terms of growth in area, production and productivity indicated a significant positive growth and low instability. In this paper, we tried to explore the performance of cereals and pulses in Rajasthan. The crops such as maize, bajra, jowar, paddy, wheat, barley, moth, urd, moong, gram, arhar, were found to have attained positive growth in production due to positive growth in yield in Rajasthan during the study period. During the first period, in case of cereals, only maize, bajra and jower; and in pluses, only moth is found to have registered negative growth in production. Rest of the cereals and pulses were found to have experienced positive growth in production due to positive growth in yield. During the second period, all the cereals and pulse crops are found to have recorded positive growth in production due to positive growth in yield. The crops maize, bajra, wheat, barley, moong, are found to have attained positive and significant trend in the production during the first period. Yield of the crops like bajra, jowar, moth, moong, arhar, are found to have high values of Coefficient of Variation (CV) in Rajasthan during year 1990-91 to 2013-14.

Keywords: Production, yield, cereals, growth, performance, instability, coefficient of variation, Rajasthan.

Introduction

Economic development is generally accompanied by an increase in living standards, improvement in food habits, with gradual reduction of dietary deficiencies. Pulses, being a major plant-based protein supplement to high-nutritional food supplies, can play a strategic role in the health and productivity of the people in general, and the workforce in particular, in such a nation. The world's major producers of pulses are India (23.1%), Canada (6.7%), China (12.08%), Myanmar (7.57%), and Brazil (4.03%), which together account for half of the global output. The pulse industry in India generally refers to a number of crops like chickpeas (locally known as chana), tur, masur, urad, moong, and peas. According to 2012 statistics from the United Nation's Food and Agriculture Organization (FAO), the most important pulses by production are dry beans (29.4%), dry peas (24.5%), chickpeas (13.7%), dry cow peas (8.5%), pulses (nes) (7.2%), and broad beans (5.7%). These together contributed 89% to the total global output of 70 million tonnes in 2012. In world production, dry bean is the most important on the basis of area and production, followed by chickpea and pea. Lentil, which constitutes 4.6% of the global pulses output, is mainly produced in India, Australia, and Canada.

Agriculture, like in most developing economies, is the core sector providing livelihood to a significant proportion of the rural population. The relevant literature suggests that a growing agriculture and allied sector is expected to contribute immensely to the overall growth and poverty alleviation of an agrarian economy. As it is generally well-acknowledged fact that in most of the developing countries, agriculture has been experiencing serious difficulties in the recent years. These have been primarily due to neo-liberal macroeconomic policy frame work followed by these countries. One major element of such policy regimes has been relative neglect of agriculture in particular and the rural areas in general. Being dependent on weather conditions technology and infrastructure, production and productivity of crops are subject to substantial variations across time and space. The nature and extent of variability of agricultural production, its sources and implications have however not received systematic attention till recently, at any rate in Rajasthan. However, increase in production of food grain and crop stability is the key challenges to Rajasthan's agriculture which is open to the vagaries of monsoon and highly susceptible to natural calamities. Despite progress in irrigation and technology, the agriculture production and income are subject to large year-to-year fluctuations, playing havoc with farmers' livelihood and adversely affecting their decisions to invest in farming. These fluctuations also undermine the viability of agriculture sector and its potential to contribute to economic growth as well as food and nutritional security. Most of the studies on Indian agriculture have looked at the instability in agricultural production at aggregate level and have focused only on production (Sharma et al., 2006).

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Since the onset of the Green Revolution in the late 1960s, India has been treading on a path towards self-sufficiency in food. The achievements have remained highly skewed towards wheat and rice on account of technological as well as policy support towards these two crops. With high and assured prices paid through public procurement encouraging farmers to increase output, the production of cereals in India has generally been greater than the domestic demand since the mid-1990s. The per capita production of cereals has steadily increased in each decade from 145 kg during the 1970s to 158 kg during the 2000s. Meanwhile, Per capita production of pulses in India has declined from 18.5 kg during 1965-1970 to about 15 kg during 2011-2014. It touched the lowest level of 10.5 kg in year 2002-03. Even with imports, India was not able to meet the domestic demand for pulses. The per capita net availability of pulses in the country, after factoring in for imports and exports, has declined from 18.15 kg during 1965-70 to 15.4 kg during 2011-14.

In India, pulses are mainly grown under rain-fed and low input compared to cereal crops (i.e., wheat, maize, rice, barley, sorghum and millet), Also, compared to cereal crops, pulse are grown in marginal areas where water is a scarce resource. Moreover, in India, as pulses are considered as secondary crops, they do not receive investment resources and policy attention from governments, unlike cereal crops (e.g., maize, rice, wheat), which are often considered food security crops and thus receive priority attention from the research and policy making communities (Byerlee and White 2000). Consequently, the productivity of pulses is one of the lowest among staple crops.

This study intends to measure the extent of instability in the production of cereals and pulse in this state. The paper is divided in three sections. It begins with an examination of growth in area of cultivation, production and trend in the production of cereals and pulse crops in Rajasthan. Secondly, it measures the instability in cereals and pulse production. And the last section presents classification of cereals and pulses in term of growth and instability in yield.

Methodology

The study is based on secondary data. The time series data on area, production, productivity of cereals and pulses crop was available from 1990-91 onwards. The period of study is 1990-2014 which is characterized by wider technology dissemination. The entire study was split into two sub periods. The sub period was framed as period I- 1990-91 to 2001-2002, period II- 2002-03 to 2013- 14, Overall 1990 - 2014. Hence the analysis was covered for the period from 1990-91 to 2013-14. Data used for the study was collected from various published sources, like Directorate of Economics & Statistics, Directorate of Horticulture, Rajasthan and Revenue records of area, production and yield of crops for 2013-14.

Estimation of Trend in Production of cereals and pulses

For working out the trend in production of cereals and pulse, the following linear trend equation was used:

$Y_t = a + bt$

Y_t = Production of crops in t^{th} year

a = Intercept

b = Slope

t = Years (1990-91, 1991-92 …….. 2013-14)

Estimation of Compound Growth Rates of Area, Production and Productivity of cereals and pulses

Growth Rates: The compound growth rates of area, production and productivity of crops were worked out using exponential function of the form,

$Y = AB^x$

By taking logarithm of both sides, the equation takes the following linear form:

Log Y = Log A + X Log B

Let Log A = a, Log B = b and Log Y = y,

The equation becomes

y = a + bx

Where;

y = Dependent variable (Area, production and productivity)

x = Time/Year (independent variable)

a = Constant/intercept

b = Regression coefficient of y on x

The compound growth rate (r) is = (B-1) x 100

The standard error of growth rate was estimated and tested for its significance with't' statistic.

Measurement of Instability in Productivity of cereals and pulses

The measure that is used to estimate instability in a variable over time should satisfy two minimum properties. Firstly, it should not include deviations in the data series that arise due to secular trend or growth. Secondly, it should be comparable across data sets having different means. The measurement of instability in time series data requires an explicit assumption of what constitutes the acceptable and unacceptable components. A systematic component which can be predicted does not constitute instability and hence, it should be eliminated from the data. The remaining

unpredictable component represents the variability. There are a number of techniques available to measure the index of instability. Such techniques are found in Coppock (1962), Mac-Bean (1966), Singh and Byerlee (1990) and Cuddy-Della Valle (1978).

This paper preferred to use the agricultural instability index (AII), as developed by Ray (1983) and used by Chand and Raju (2008), to estimate instability in agricultural production. This method is given by:

Instability index = Standard deviation of natural logarithm (Y_{t+1}/ Y_t)

Where,

Yt is the area / production / yield in the current year

Y_{t+1} is for the next year

This index is unit free and very robust, and it measures deviations from the underlying trend (log linear in this case). When there are no deviations from trend, the ratio of Y_{t+1}/ Y_t is constant and thus standard deviation is zero. As the series fluctuates more, the ratio of Y_{t+1} and Y_t also fluctuates more, and standard deviation increases.

Identification of Crops According to Pattern of Growth and Instability

Crops were identified according to the pattern of growth and instability by grouping the crops in two way classification table based on high and low growth and instability.

Compound growth rates of area, production and yield of Rajasthan

The compound growth rates of area, production and productivity of cereal and pulses crop in Rajasthan are given in table 1. The production of bajra recorded significant growth by 5.37 per cent per annum which is significant growth in productivity by 4.75 per cent per annum and non-significant growth in area by 0.59 per cent per annum. The kharif cereal jowar recorded non-significant growth in production by 1.08 per cent per annum which is largely due to negative and non-significant growth in area by 0.70 per cent and non-significant growth in productivity by 1.80 per cent per annum. The production of paddy remained almost static during the period due to negative growth in area by 0.93 per cent per annum despite positive and significant growth in yield by 1.27 per cent per annum. The production of rabi cereal crop wheat recorded significant growth rate of 3.16 per cent per annum during the period. It is largely due to the significant growth in productivity to the tune of 2.02 per cent per annum which was supplemented by significant area growth of 1.12 per cent per annum. The barley recorded slow and significant growth in production by 3.68 per cent per annum with higher and significant productivity growth of 2.85 per cent and significant area growth by 0.80 per cent per annum. In production, bajra recorded paramount growth rate, barley recorded moderate growth rate and paddy recorded trivial growth rate. All cereals recorded positive growth rate in production. Only maize and wheat recorded significant growth in area, production and yield. Remarkably, the kharif cereal jowar and paddy recorded negative growth in area. On the other side, pulse crop moth registered non-significant and positive growth in production by 1 per cent per annum which is non-significant growth in area by 0.37 percent and non-significant, positive growth in productivity with 0.63 per cent annually. The production of urad recorded non-significant, positive growth rate of 0.93 per cent per annum during the study period. It is largely attributed to the negative and non-significant growth in area to the tune of 0.42 per cent per annum which was supplemented by non-significant productivity growth of 1.36 per cent per annum. The moong recorded significant growth rate in production by 7.70 per cent which was largely attributed to significant area growth by 5.78 per cent per annum with non-significant and positive growth in productivity by 1.81 per cent per annum. The rabi pulse crop gram recorded non-significant positive growth rate in production by 0.80 per cent per annum which is largely due to negative and non-significant growth in area by 1.42 per cent (Singh and Chandra 2001 observed same growth rate). The production of arhar remained almost static during the period though productivity recorded non-significant positive growth of 1.73 per cent per annum, due to negative and significant growth in area by 1.95 per cent per annum. In production, moong recorded grand growth rate, moth recorded moderate growth rate and arhar recorded trivial growth rate. While the positive growth in production of kharif pulse crops like urad and arhar are attributed to negative growth in area, the rabi pulse crop gram recorded positive growth in production slowly due to negative growth in area. The losing ground for pulse in Rajasthan especially for urad, arhar and gram is a matter of concern especially in the context of meeting the requirement of protein by the rural masses.

Period wise CGAR were also presented in the table 1. The table revealed that in period I, production of paddy recorded significant and highest growth rate of 5.99 per cent per annum, significant growth in area by 4.07 per cent per annum which corroborates with the results of Singh and Chandra 2001. The production of jowar recorded lowest, negative and non-significant growth rate of 5.94 per cent per annum during the period, non-significant and negative growth in productivity by 1.53 per cent per annum and non-significant and negative growth in area by 5.03 per cent per annum. In production, wheat recorded paramount growth rate, paddy recorded moderate growth rate and jowar recorded trivial growth rate. On the other hand, the productivity of arhar recorded

significant highest growth rate of 9.46 per cent per annum. The kharif pulse crop moong recorded non-significant negative growth rate in production by 1.95 per cent per annum and positive and significant growth rate of area was recorded 4.73 per cent per annum. In production, arhar recorded paramount growth rate, gram recorded moderate growth rate and moth recorded trivial growth rate.

Among the year 2002-03 to 2013-14 (second period), all cereals recorded positive growth rate. The production of bajra recorded highest and non-significant growth rate of 8.55 per cent per annum but the productivity of jowar recorded highest and non-significant growth rate of 7.42 per cent per annum and in area, barley recorded significant and highest growth rate of 4.53 per cent per annum. The production of paddy recorded lowest and non-significant growth rate of 2.81 per cent per annum which is non-significant growth in productivity by 1.40 per cent per annum. In short, we can say that all cereals recorded positive growth rate in production. In case of pulses crop, moong registered the highest and non-significant positive growth in production by 13.71 per cent per annum, significant growth in area by 7.28 per cent per annum and positive and non-significant growth in productivity with 6.90 per cent annually. The production of arhar recorded lowest and non-significant growth rate of 3.35 per cent per annum which is largely due to negative and non-significant growth in area by 1.18 per cent per annum. The gram recorded lowest and non-significant growth rate in productivity by 1.10 per cent per annum. In production, moong recorded paramount growth rate, moth recorded moderate growth rate and arhar recorded trivial growth rate.

TABLE 1: Compound Growth Rates of Area, Production and Productivity of Cereals and Pulses in Rajasthan

Crops	First Period (1990-2002) Area	Second Period (2003-14) Production	Overall (1990-2014) Yield	First Period (1990-2002) Area	Second Period (2003-14) Production	Overall (1990-2014) Yield	First Period (1990-2002) Area	Second Period (2003-14) Production	Overall (1990-2014) Yield
Cereals									
Maize	-0.25	0.46	0.71	0.83	3.88	3.02	0.81	3.31	2.48
	(0.2804)	(2.3626)	(2.1709)	(0.3490)**	(2.4464)	(2.2282)	(0.1366)***	(0.8612)***	(0.7722)***
Bajra	-1.66	-0.82	0.86	1.58	8.55	6.86	0.59	5.37	4.75
	(0.7001)**	(4.7105)	(4.1676)	(1.296)	(5.3518)	(4.2750)	(0.4110)	(1.8390)***	(1.4916)***
Jowar	-5.03	-5.94	-1.53	0.21	7.67	7.42	-0.70	1.08	1.80
	(0.7719)***	(4.5025)	(4.0532)	(0.9831)	(5.6566)	(5.4419)	(0.4510)	(1.9321)	(1.7658)
Paddy	4.07	5.99	1.84	1.02	2.31	1.40	-0.93	0.32	1.27
	(0.8370)***	(2.0223)**	(1.6442)	(1.7441)	(2.2018)	(1.8973)	(0.6639)	(0.8553)	(0.6257)**
Wheat	4.93	6.47	0.63	2.98	5.85	2.74	1.12	3.16	2.02
	(0.7487)***	(1.7044)***	(1.7554)	(0.9450)**	(1.0870)***	(0.3228)***	(0.4574)**	(0.5757)***	(0.3759)***
Barley	-1.86	0.20	2.11	4.53	7.89	3.16	0.80	3.68	2.85
	(1.5372)	(2.2949)	(1.2889)	(1.2387)***	(1.3979)***	(0.8086)***	(0.5985)	(0.7476)***	(0.3443)***
Pulses									
Moth	-4.64	-13.35	-9.12	4.06	8.91	4.62	0.37	1.00	0.63
	(1.3064)***	(6.8607)*	(6.2621)	(2.8180)	(10.2248)	(7.9128)	(0.9470)	(3.3514)	(2.6621)
Urd	0.32	1.42	1.11	-0.67	3.94	4.98	-0.42	0.93	1.36
	(1.9561)	(3.9591)	(2.5951)	(2.7610)	(4.7422)	(3.3202)	(0.8763)	(1.5431)	(1.0974)
Moong	4.73	-1.95	-6.40	7.28	13.71	6.90	5.78	7.70	1.81
	(1.8236)**	(7.1843)	(5.7247)	(1.3442)***	(8.9817)	(7.9902)	(0.5409)***	(2.9860)**	(2.6108)
Gram	3.14	5.93	2.70	6.95	8.43	1.10	-1.42	0.80	0.63
	(3.7111)	(4.5288)	(1.4680)*	(2.3822**)	(3.1412**)	(1.6651)	(1.2925)	(1.5623)	(0.5756)
Arhar	1.91	11.55	9.46	-1.18	3.35	4.58	-1.95	0.26	1.73
	(3.3266)	(7.6434)	(4.9270)*	(1.0550)	(3.6263)	(3.3304)	(0.7466**	(0.8935)	(1.4281)

Note: Figure in parenthesis is standard error.
* Significant at 10%, ** Significant at 5%, *** Significant at 1%

For clear understanding of the growth scenario, we discuss the association between growth in cereals and pulses area and productivity (Table 2). All crops under study were classified into four types of association on the basis of growth rates of area and productivity. AA-positive growth rate of area associated with positive growth rate of productivity. This would indicate that one crop is either replacing other crop or is grown in the newly cultivated area and the overall productivity of crop(s) increased. AB-positive growth rate of area associated with negative growth rate of productivity. BA -negative growth rate of area associated with positive growth rate of productivity. This would indicate that one major crop area has been replaced by other major crop or has gone out of cultivation and the productivity on the remaining area has increased. BB-negative growth rate of area associated with negative growth rate of productivity. It can be seen from Table 2 that only five cereals crops fall in the AA category, one pulse crop moong in AB category, and maize, bazra and barely crops in BA and jower and moth in BB category during period I. In period II, the number of crop increased to nine in AA category and only one crop (moong) in AB category compared to period I. No crops fall in BA and BB category in second period.

TABLE 2: Association Between Growth in Cereals and Pulses Area and Productivity in Rajasthan

Types of Association	Cereals			Pulses		
	First Period (1990-2002)	Second Period (2003-14)	Overall (1990-2014)	First Period (1990-2002)	Second Period (2003-14)	Overall (1990-2014)
AA: Positive area positive productivity	Paddy, Wheat, Urd, Gram, Arhar	Maize, Bajra, Jowar, Paddy, Wheat, Barley, Moth, Moong, Gram,	Maize, Bajra, Wheat, Barley, Moth, Urd, Moong, Gram, Arhar	Nil	Nil	Nil
AB: Positive area negative productivity	Nil	Nil	Nil	Moong	Nil	Nil
BA: Negative area positive productivity	Maize, Bajra, Barley,	Nil	Nil	Urd, Arhar	Nil	Nil
BB: Negative area negative productivity	Jowar,	Nil	Nil	Moth	Nil	Nil

Source:Table1

Trend in the production of cereals and pulses in Rajasthan

The estimated crop wise linear trend equations are given in table 3 and it is revealed from the table that positive and significant trend in the production was found in cereal crops like maize, bajra, wheat and barley during the study period 1990-91 to 2013-14. The production trend of jowar and paddy was positive and non-significant, despite the fact the maize was largely grown under rain fed condition. The technological support followed by the policy interventions appeared to have positive effect on all cereal crops. However, for the crops like jowar and paddy, the production trend was found non-significant. The estimates of the coefficient of determination (R^2) of the regression line to the given data, ranged from as low as (0.006) for paddy crop to as high as (0.6057) for wheat crop including that the time element alone explained 0.6 per cent to 60.57 per cent variation in production. The trends in the production of paddy in Rajasthan during the 1990-91 to 2013-14 do not show any increment. This decrease in production under paddy poses great concern for the policy makers as well as economists. In case of pulses, the table shows the positive and significant trend in the production that was found in moong during the study period. The moth and urad recorded positive and non-significant trend in the production. Gram and arhar was found to have negative and non-significant trend in the production. The estimates of the coefficient of determination (R^2) of the regression line to the given data ranged from as low as 0.0102 for gram to as high as 0.557 for urad including that the time element alone explained 1.02 to 55.7 per cent variation.

In the First study period (1990-91 to 2001-2002), the positive and significant trend in the production was found in paddy and wheat crop but in case of pulse, there are positive and significant trend in the production which was not observed. The production of maize and barley was found to have positive and non-significant trend. The production of bajra, jowar, moong and moth was found to have negative and non-significant linear trend during the period. However, for the pulse crops like urad, gram and arhar, the production trend was found positive and non-significant. In Second period (2002-03 to 2013-14), it was observed that the positive and significant trend in the production was found in wheat, barley and moong and gram. Positive and non- significant trend in the production was found in some cereal crops like maize, bajra, jowar, paddy and some pulse crop like moth, urad and arhar during the period.

TABLE 3: LINEAR TREND IN THE PRODUCTION OF MAJOR CROPS DURING NEW ECONOMIC REGIME IN RAJASTHAN (1990-91 TO 2013-14)

Crop	First Period (1990-2002)		Second Period (2003-14)		Overall (1990-2014)	
	Estimated linear trend equation	R^2	Estimated linear trend equation	R^2	Estimated linear trend equation	R^2
Maize	Yt= 964668 + 1506t (22619.61)	0.0006	Yt=1123827 + 52102.3t (34347.58)	0.1871	Yt=760138+41725t*** (11091.43)	0.4144
Bajra	Yt= 2087514 + 31299t (83319.63)	0.0173	Yt= 2125544 + 248994t (147429.1)	0.2219	Yt=1059012+161199t*** (47429.36)	0.3661
Jowar	Yt= 370423 + 20708t (12679.69)	0.25	Yt= 176794 + 18149t (12244.53)	0.1801	Yt=236073 +3592.4t (4749.73)	0.0278
Paddy	Yt= 168358 + 15556t** (4693.94)	0.5786	Yt= 207745 + 3831.5t (3625.62)	0.1005	Yt=235106 +626.99t (1802.23)	0.006
Wheat	Yt= 3685039 + 340813t*** (74359.84)	0.724	Yt= 4355580 + 418932.6t*** (79054)	0.7374	Yt=4061217+202340t*** (36507.32)	0.6057
Barley	Yt= 401485 + 218.41t (8215.08)	0.00008	Yt= 290718 + 45873t*** (8874.87)	0.7277	Yt=273729+20046t*** (4056.43)	0.5498
Moth	Yt= 338567-20810t (13072.61)	0.2406	Yt= 175951+21199t (21329.28)	0.0899	Yt=186088+7557.9t (6954.63)	0.0558
Urd	Yt= 50064 + 1199t (2207.65)	0.0356	Yt= 43443 + 3073.5t (3031.97)	0.0932	Yt=48085+1066.2t (981.89)	0.557
Moong	Yt= 111008-454.77t	0.0004	Yt= 61869+36366t** (7695.38)	0.3499 (15675.68)	Yt= -2896.8+18687t*** (5133.78)	0.3985
Gram	Yt= 706901+79462t	0.23	Yt= 371593+62994t** (22621.16)	0.4368	Yt=1026650-7012t (15471.24)	0.0102
Arhar	Yt= 8232.8+1729.2t	0.2201	Yt= 9934.8+309.21t (319.96)	0.0854	Yt=16672-181.87t (284.65)	0.02

Note: Figure in parenthesis is standard error of slope.

* Significant at 10%, ** Significant at 5%, *** Significant at 1%.

Measures of instability in productivity of cereals and pulse

Instability is a major problem of every sector of the economy. Agriculture sector is prone to risk and uncertainties, which makes it necessary to measure the growth coupled with instability so as to access the real improvement in agricultural parameters in the past. It is important to have quantitative measures of instability, so that the seriousness of the problem can be assessed objectively. The coefficients of variation were computed for measuring the degree of instability in the above parameters after removing the trend from the data. The coefficient of variation (CV) is a statistical measure to access the extent of variation in a set of data. Due to technological intervention and other policy support, the positive trend in the yield is expected. Therefore, the coefficient of variation for the trend estimated yield could be more meaningful wherever trend is significant, however, wherever trend is non- significant, the CV of original data could reflect the extent of variation in the yield of such crops. A lot of study concluded that the coefficient of variation of original yield data and the coefficient of variation in de-trended yield data for these crops having significant trend.

The CV of original and de-trended yield data are given in table 4. The yield instability in the state for various cereal crops varied from as low as 10.04 per cent to as high as 41.86 per cent. Barley recorded the lowest instability (10.04%) closely followed by wheat (10.29%) and paddy (17.07%). Jowar with 41.86 per cent coefficient of variation adjusted for trend (CVT) was estimated to be the highest instability for cereal crop in the state followed by bajra (40.36%) and maize (22.57%). The portable reasons for high yield instability may be attributed to lack of assured irrigation facilities, erratic rainfall and incidence of pests and diseases on cereal crops. The yield instability for various pulse crops varied from as low as 15.84 per cent to as high as 60.03 per cent. Gram recorded the lowest instability (15.84 %) closely followed by urd (31.15 %). Moth with 60.03 per cent coefficient of variation adjusted for trend (CVT) was estimated to be the highest instability for pulse crop in the state followed by moong (56.43%) and arhar (40.16%).

The yield instability of the first period in the state for various cereal crops varied from as low as 11.39 per cent to 41.97 per cent. Barley recorded the lowest instability (11.39%) closely followed by paddy (13.11%) and wheat (14.93%). Bajra recorded the highest instability (41.97%) closely followed by jowar (38.75%) and maize (21.02%). The yield instability for various pulse crops (in first period) varied from as low as 14.25 per cent to as high as 58.27 per cent. Gram recorded the lowest instability (14.25%) closely followed by urd (21.87%). Moong recorded the highest instability (58.27%) closely followed by moth (53.51%) and arhar (46.15%). The yield instability of the second period in the state for various

cereal crops varied from as low as 4.41 per cent to 46.12 per cent. Wheat recorded the lowest instability (4.41%) closely followed by barley (9.26%) and paddy (20.37%). Jowar recorded the highest instability (46.12%) closely followed by bajra (40.59%) and maize (24.70%). The yield instability of the second period in the state for various pulse crops varied from as low as 17.53 per cent to as high as 67.47 per cent. Gram recorded the lowest instability (17.53%) closely followed by arhar (32.27%) and urd (38.75%). Moth recorded the highest instability (67.47%) closely followed by moong (57.22%).

TABLE 4: Inter Year Yield Instability of Cereals and Pulses in Rajasthan (1990-91 to 2013-14)

Crops	Yield Instability Overall Rajasthan (1990-2014)					
	Original yield			De-trended yield		
	Mean (kg/ha)	SD (kg/ha)	CV (%)	Mean (kg/ha)	SD (kg/ha)	CV (%)
			Cereals			
Maize	1225.68	344.66	28.12	1.00	0.23	22.57
Bajra	587.41	301.03	51.25	1.01	0.41	40.36
Jowar	422.27	189.57	44.89	1.00	0.42	41.86
Paddy	1806.18	350.04	19.38	1.00	0.17	17.07
Wheat	2662.64	448.32	16.84	1.00	0.10	10.29
Barley	2203.45	446.05	20.24	1.00	0.10	10.04
			Pulses			
Moth	211.68	133.92	63.26	1.00	0.60	60.03
Urd	362.91	127.91	35.25	1.00	0.31	31.15
Moong	314.82	200.99	63.84	1.01	0.57	56.43
Gram	700.59	113.72	16.23	1.00	0.16	15.84
Arhar	612.41	246.31	40.22	1.00	0.40	40.16

TABLE 5: Inter Year Yield Instability of Cereals and Pulses in Rajasthan (1990-91 to 2001-02)

Crops	Yield Instability First Period (1990-91 to 2001-02)					
	Original yield			De-trended yield		
	Mean (kg/ha)	SD (kg/ha)	CV (%)	Mean (kg/ha)	SD (kg/ha)	CV (%)
			Cereals			
Maize	1029.8	185.70	18.03	1.00	0.21	21.02
Bajra	413.6	132.72	32.09	1.04	0.44	41.97
Jowar	373.2	128.65	34.47	1.05	0.41	38.75
Paddy	1657.5	229.86	13.87	1.00	0.13	13.11
Wheat	2308.4	314.27	13.61	1.00	0.15	14.93
Barley	1838.5	211.43	4.56	1.00	0.11	11.39
			Pulses			
Moth	164.7	94.58	51.21	1.01	0.54	53.51
Urd	338.9	74.43	21.96	1.05	0.23	21.87
Moong	235.7	121.85	51.70	1.05	0.61	58.27
Gram	697.5	104.21	14.34	1.02	0.15	14.25
Arhar	617.1	302.51	49.02	1.09	0.50	46.15

TABLE 6: Inter Year Yield Instability of Cereals and Pulses in Rajasthan (2002-03 to 2013-14)

Crops	Yield Instability First Period (2002-03 to 2013-14)					
	Original yield			De-trended yield		
	Mean (kg/ha)	SD (kg/ha)	CV (%)	Mean (kg/ha)	SD (kg/ha)	CV (%)
			Cereals			
Maize	1388.92	366.91	26.42	1.00	0.25	24.70
Bajra	732.25	328.99	44.93	0.99	0.40	40.59
Jowar	463.17	225.94	48.78	0.97	0.45	46.12
Paddy	1930.08	392.22	20.32	1.00	0.20	20.37
Wheat	2957.83	3060.21	10.35	1.00	0.04	4.41
Barley	2507.58	348.25	13.89	1.00	0.09	9.26
			Pluses			
Moth	234.17	160.33	68.47	1.00	0.67	67.47
Urd	382.92	160.45	41.90	0.96	0.37	38.75
Moong	380.75	233.54	61.34	0.99	0.56	57.22
Gram	703.17	125.65	17.87	0.98	0.17	17.53
Arhar	608.50	202.27	33.24	0.93	0.30	32.27

Identification of Crops According To Pattern of Yield Growth and Instability in Rajasthan

Table 7 furnishes the growth instability matrix for yield of cereals and pulse crop in Rajasthan states. The description of trend, growth rate and instability would help to assess the past performance of area, production and productivity of crops. Generally, the CV value more than 30 (Ramdas 2012) is considered as high instability in agriculture. Classification of crops in terms of growth and instability in yield are given in Table 7.

TABLE 7: Classification of Crops in Terms of Growth and Instability in Productivity of Cereals and Pulses in Rajasthan (1990-91-2000-14)

CGAR/CV	Yield growth (Original)		Yield growth (De-trended)	
Instability	+ve High≥(2.28%)	+ve Low (< 2.28%)	+ve High (2.28%)	+ve Low (< 2.28%)
More Instable (≥ 30%)	Bajra	Jowar,Moth, Urd, Moong, Arhar	Bajra	Jowar, Moth, Urd, Moong and Arhar
Less Instable (< 30%)	Maize, Barley	Paddy, Wheat, Gram	Maize and Barley	Wheat, Paddy and Gram

The yield of Bajra was found to have high growth coupled with high inter year instability. For the raw yield data it is desirable because high growth rate of crops due to technology and policy support causes high instability also. Jowar, Moth, Urd, Moong and Arhar were having low growth and high instability in yield. Maize and Barley were found in the category of high growth and low instability. The area and productivity of these crops increased and market support and policy implications were also favorable for these crops. The crops such as Paddy, Wheat and Gram were found to have low growth and low instability. Absence of growth leads to less fluctuations in the productivity of crops. In terms of the trend in yield, Bajra falls in the category of high growth and high instability. The technological thrust for this category must aim to reduce the inter year fluctuations in productivity without hampering the high yield growth potential of these crops in the state.

The cereal crops like jowar, pulses crops Moth, Urd, Moong and Arhar come under the category of low growth and high yield instability as the productivity of these crops declined drastically over the years. These crops require strategy for upgrading productivity level as well as ensuring high inter-year stability in production. Wheat, Paddy and Gram were found under the category of low growth and low instability in yield of these crops. Crops

like Maize and Barley were found to have high growth and low instability in yield which is desirable. Among these crops, Maize and Barley fall common in both the methods.

The crops Maize and Barley were found to have the ideal pattern of growth and instability as these crops emerged with high growth in productivity and low rate of instability. The crops with the low growth rates in yield such as Wheat, Paddy and Gram require adequate technological support to push up the growth in productivity of these crops indicating that the available technology are not adequate to push up the yield of these crops. The only cereal crop which performed well in the state during new economic regime was bajra.

Conclusion

The maize, bajra, jowar, paddy, wheat, barley, moth, urad, moong, gram, arhar, attained positive growth in production that is attributed to positive growth in yield in Rajasthan during the study period. During the first period, in cereals, only maize, bajra, jower and in pluses, and moth were found to have negative growth in production. All other cereals and pulses recorded positive growth in production contributed by positive growth in yield in Rajasthan. During the second period, all the cereals and pulse crops attained positive growth in production to positive growth in yield. The crops like maize, bajra, wheat, barley, moong were found to have positive and significant trend in the production in Rajasthan during the first period. The crops like bajra, jowar, moth, moong, arhar, were found with high CV values in Rajasthan during year 1990-91 to 2013-14.

Policy implications

Alongwith the green revolution technologies, the country moved ahead in a fast phase in cereals mostly in wheat and Paddy production and reached its self-sufficiency status eons ago. The state of Rajasthan has a characteristic feature of erratic and unevenly distributed low rainfall. This is also reflected by the crop performance mostly in case of pulses, and fluctuating yield levels have been observed for almost all the cereals and pulse crops. Efforts are needed for the development of crop varieties and technologies that can perform better under such conditions. Overall performance of the crop in terms of growth in area, production and productivity indicated a significant positive growth and low instability. Support price is the deciding factor for the area under wheat, and yield growth is attributed to increase in area under irrigation and adoption of high yielding varieties that are responsive to resource use. The study identified that barring Rajasthan, productivity in rest of the states were below the national level.

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Mobile based initiatives for e-Extension Services for Fisheries and Aquaculture

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Abstract

A study on impact evaluation of three innovative initiatives for mobile based e-Extension services was undertaken in Tamil Nadu and Andhra Pradesh using a structured and field- tested questionnaire. A snap shot of all the three e-Extension initiatives is given, and the comparative analysis of the strengths, weaknesses, opportunities, of these programmes are discussed. Fisher Friend Mobile Application is managed by the M.S.Swaminathan Research Foundation, Chennai, for providing lifesaving information for fishermen in the marine sector. Mobiaqua is administered by a technology entrepreneur to provide services to the brackish water farmers about purchase or sale of any of the aqua products. Teleaqua is a commercial initiative to provide information to freshwater farmers. These e-Extension initiatives are relatively different in the subject matter and delivery contrivance, but objective is similar that is to enhance the income and livelihood security of fishermen/fish farmers. The study suggests the most efficient structure of an e-Extension initiative, taking cues from the three systems studied.

Key words: *e-Extension initiative, fish farmers/fishermen*

Information and Communication Technologies (ICTs) are efficient tools for reaching rural farm holders and enhancing fisheries development. ICTs play a key role in communicating knowledge and information to large number of small farm holders with least time requirement and at minimal expenditure. Globally, the use of mobile phones is increasing day by day for educational, health, agricultural, emergency alerts and marketing purposes (Srivastava, 2005). In India, total wireless subscriber base of 1,033.16 million was active in 2016 and teledensity in rural areas is more than 50% which means every second person in villages is owner of mobile phone and currently an active wireless service user (TRAI,2016). In the fisheries sub-sector, they are being used to coordinate fishing efforts (Adogla, 2009), support product marketing and improve safety (Spore, 2008); link fisherman and wholesalers together for business transactions (Scheen, 2008), pushing communication to fishermen for selling their produce in different places of the market for realizing higher prices (Shepherd, 2000), offer opportunities for selling their product in market as well as contact buyers to get appropriate price from the market (Boadi et al. 2008) increase the capacity of fishermen (Shaffrilet al. 2012), increase monthly profit with access to mobile phone and other related technologies in the business (Sullivan, 2006), decreased price dispersion and wastage by facilitating the spread of information (Jensen 2007). The fisher folk benefited in several ways (MSSRF 2009a; 2010b; 2011c and Mittal et al 2010),receipt of prompt alerts on weather and weather forecasts which made fisher folk less vulnerable to risks through FFMA model (Vimala & Ravisankar 2010), provide service to the brackish water farmers about purchase or sale of any of the aqua products (Udaya, 2010; Vimala, 2011.). Information and Inputs for Sustainable Aquaculture' (IIFSA) provide advisory and laboratory services covering all activities of aquaculture for sustainable fresh water fish farming. Based on the farmers need requirement, information on seed, feed, aerator, probiotics, management practices, and soil/water is required during every stage of shrimp/fish culture. Moreover, every day updates on prices of shrimps/fishes in the domestic markets and adjacent places are also required during the harvest period to decide the place of marketing.

In India, the public fisheries extension system hardly provides the production related advisories and services to the aqua farmers. The public extension system is less effective, more time consuming and a gap exists between the extension officials and the farm holders (Mruthunjaya et al. 2005). In contrast, farmer friendly ICT-based fishery e-Extension initiatives are being implemented by NGOs and private agencies. The following few initiatives are functioning effectively - Mobile telephone Fisher Friend Model operated by M.S. Swaminathan Research Foundation [MSSRF], in Tamil Nadu and Puducherry; Mobiaqua operated by M/S A.A. Bioteh, Chennai; e-Sagu Aqua operated by IIIT, Hyderabad; V-Aqua Model modified as Teleaqua model and operated by private entity,. against this background, the present study focused on socioeconomic characters of the users and an evaluation of the three models that were taken up among

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the users and the strengths, weaknesses, opportunities and threats (SWOT) of the models that were taken up with an idea to evolve a most suitable model for application in brackish water aquaculture sector. It is also expected that the findings will be helpful to extension workers, planners and policy makers in formulation of strategies to bring into use of good ICT model based on strengths of these three models.

METHODOLOGY

The operation of three mobile based ICT initiatives - Fisher Friend Mobile Application (FFMA) (marine), Mobiaqua (brackishwater) , and Telequa(fresh water) were chosen for evaluation. The study was carried out in Nagapattinam district of TN, concerning FFMA, Nagapttinam,Pattukottai and Thiruvallur districts of TN with reference to Mobiaqua and West Godavari district of Andhra Pradesh regarding Teleaqua. A sample of 228 farmers comprising of 56, 89 and 83 representing the three services, respectively were used for the study. Detailed information was collected from the farmers through a well-structured and field tested questionnaire developed for the purpose. Based on the data collected, a SWOT analysis was carried out for each of the three models by calculating the Rank Based quotient (RBQ) as per the following formula.

$$\sum_{i=1} \frac{(fi)(n+1-i)}{nR} * 100$$

Where, n = total number of users, R = total number of ranks, fi = frequency of users reporting the problem under ith rank, i = concern rank

TABLE 1. Socio -Economic Profile of The Users of These e-Extension Initiatives

Variables	FFMA N= 56	Mobiaqua N= 89	Teleaqua N= 83	Total N=228
Age				
Young	2(3.57)	57(64.04)	47(56.62)	101(44.29)
Middle	3(5.35)	7(7.86)	16(19.27)	26(11.40)
Old	51(91.07)	25(28.08)	20(24.09)	96(42.10)
Gender				
Male	54 (96.42)	87(97.75)	80 (96.38)	221(96.92)
Female	2 (3.57)	2(2.24)	3(3.61)	7(3.07)
Education				
Primary School	43(76.78)	2(2.24)	6 (7.22)	41(17.98)
High school	12(21.42)	-	-	-
SS	1 (0.17)	21(23.59)	21(25.30)	59(25.87)
HSC	-	37(41.57)	24(28.91)	68(29.82)
Collegiate	-	29(32.58)	22(26.50)	52(22.80)
Occupation				
Primary	56(100.00)	49(55.05)	61(73.49)	166(72.80)
Secondary	-	40(44.94)	22(26.50)	62(27.19)
Type of farmers				
Small	56(100.00)		16(19.27)	75(32.89)
Medium	(Fishers)	59(66.29)	49(59.03)	79(34.64)
Big	--	30(33.70)	18(21.68)	18(7.89)
Experience of farming /fishing				
< 5 years				
5-10years	3(5.35)	13(14.60)	4(4.81)	17(7.45)
>10 years	31(55.35)	56(62.92)	53(63.85)	115(50.43)
	22(39.28)	20(22.47)	26(31.32)	94(41.22)
Awareness about mobile telephony models				
Aware	56(100.00)	89(100.00)	83(100)	100
Unaware	0	0	0	0
Utilization of ICT models	-	-	-	-
Aqua choupals Mobile phones	56(100.00)	83(93.25)	83(100)	220(96.49)
VKC Information Kiosk	56(100.00)	42(50.60)	-	-
	14(25.00)	39(46.98)	-	-

The analysis of the data presented in Table 1shows that most of the users (about 44.29%) were young followed by 42.10% old aged. Majority (91%) of the farmers were male while only few (9%) were female. The higher proportion of male farmers could be due to the fact that most male farmers were mainly responsible for doing farming while women were supporting the males in some of the farming activities such as feeding and monitoring. This result can be justified by the assertion of Brummett et al.,(2010) that fisheries activities are mostly dominated by men.The majority of them were with the education level of higher secondary followed by secondary and collegiate.FFMA is meant only for fishers and hence the majority of them are with the education level of primary school only. It implied that a majority of them had the knowledge of reading and writing in vernacular language. Assessing the occupational status of the respondent, majority (72.80%) of the fishers/fish farmers engaged in aqua/fish farming actives as prime activity and 27.19% were occupied in business, agriculture, services and poultry rising as the secondaryoccupation.In the present study area other than the fishers, 34.64% of farmers possessed 2-5ha, followed by 32.89% had up to 2 ha. Most of the farmers are medium level owning about 2 ha of farming area with experience of more than 5 years. This indicated that the farmers in India are generally small and marginal farmers (Surabhi and Gaurav, 2009; Surabhi et al. 2009). Nearly half of the total sample had been involved in the farming activities above ten years which clearly suggests that farmers have got sufficient experience in farming.All the fishers were aware of the Village Knowledge Centers of MSSRF and had contact with them and were benefited by the same with regard to the lifesaving and general information regarding their welfare. Among the users of three models, fisher folk was well acquainted with the FFMA model and got benefitted out of the same, and also the Village Knowledge Centers of MSSRF (Vimala and Ravisankar 2010) and 25% had awareness about the information kiosk installed by CIBA,Chennai at Nagapattinam district of Tamil Nadu.The users of the Mobiaqua (50.60%) are well aware of the services of Village Knowledge Centres (VKC)of MSSRF and 46.98% about CIBA Information Kiosk. Teleaqua users do not have any access either to Information Kiosk or to VKC.

Details of the basic characteristics of the three e-Extension initiatives are summarized in Table 2.

Table 2. Basic Characteristics of The Three e-Extension Initiatives

Locations of the Project	Tamil Nadu	Andhra Pradesh	Tamil Nadu
Particulars	**Mobiaqua**	**Teleaqua**	**Fisher Friend Mobile Application**
Implementing agency	A.A.Biotech ,Chennai	IIFSA proprietor	MSSRF,Nagapattinam
Sponsoring Agency	A.A.Biotech	IIFSA proprietor	MSSRF,Nagapattinam
Year of start	2008	2008	2009
Focus sector	Brackishwater Aquaculture	Freshwater + BrackishwaterAquaculture	Marine
Beneficiaries	Farmers/Dealers/ End user	Fish/prawn Farmers	Fishermen/Fisherwomen
Cost/Subscription fee	Free as of now	Subscription is paid on ha basis	Free as of now
Nature of delivery	SMS	Mobile + web base + print conversation	SMS
Mode of delivery	Mobile phone	Mobile phone + web based + print &conversation (Field Coordinator)	Mobile phone
Language	English	Telugu / English	Tamil
Time of sending	Not limited to any time	Not limited to time	
No. of daily messages	As per requirement	As per requirement	As per requirement
Nature of information provided	Buying/ selling /requirement	Disease diagnosis reports along with advises	Routine messages & during emergency
Sources of information	As per the buyer or seller	Aquaculture adviser	INCOSIS
Other services offered	Field data transmission to server, mail and mobile	Sale of pond selling inputs like feed, compost , lime materials etc.	
*Subscribers	984	1417	1200

TABLE 2. BASIC CHARACTERISTICS OF THE THREE E-EXTENSION INITIATIVES—Contd.

Locations of the Project	Tamil Nadu	Andhra Pradesh	Tamil Nadu
Particulars	**Mobiaqua**	**Teleaqua**	**Fisher Friend Mobile Application**
Subjects covered	Shrimp, Fish, Feed, Equipment, Products, Seeds	Site selection , pond preparation , seed stocking , feed management , disease management , harvesting	Wave length, wave height, market information, potential fishing zone, global positioning system, Government schemes, clips of the day
Area covered*	Nellore, Nagapattnam, Pattukkotai.	West Godavari , East Godavari , Puri (Orissa)	Nagapattinam, ramanatahpuram, Kanyakumari,Cuddalore
Status of project	On going	On going	On going

*At the time of data collection

Results and Discussion

The functional efficiencies of the three e-Extension initiatives were studied through SWOT analysis on the basis of the information gathered from the users. The results of the study are provided in Table 3.

TABLE 3: SWOT ANALYSIS OF FISHERIES MODEL

S.No	Statements	FFMA n=56		Mobiaquan n=89		Teleaqua n=83	
		RBQ Score	Rank	RBQ Score	Rank	RBQ Score	Rank
				Strength			
1	Quick deployment of services during the time of crisis	0.99489	I	1	I	0.99638	I
2	Accountability of advices	0.84949	II	0.727528	II	0.87831	II
3	Exchange of Information among the major stakeholders	0.701531	III	-	-	0.70361	IV
4	ICT enables access to update information	0.57398	IV	-	-	0.34277	VI
5	Provides a strong database to support decision making	0.357143	V	-	-	0.79638	III
6	ICT can reach even remote areas	0.168367	VI	0.317416	IV	-	-
7	Cost effective method of interactive system	0.056122	VII	0.516854	III	-	-
8	It enables farmers to cultivate like experts	-	-	-	-	0.56626	V
				Weakness			
1	Too many scrolls required to read the full content-	0.970238	I	-	-	-	-
2	Prefer voice enabled messages often	0.678572	II	-	-	-	-
3	Only few users attracted by market information	0.2500	III	-	-	-	-
4	Lack of publicity among farmers	-	-	0.853933	I	-	--
5	Language	-	-	0.707865	II	-	-
6	Lack of adequate field coordinator (O)	-	-			0.997591	I
7	Small Farmers are not covered(O)	-	-			0.696385	II
8	Limited coverage of subjects.	-	-			0.539759	III
9	Women farmers are not covered(O)	-	-			0.272289	IV
10	Poor bandwidth availability/Network coverage	-	-			0.113253	V

TABLE 3: SWOT ANALYSIS OF FISHERIES MODEL—Contd.

	Opportunities						
1	Helps the fishermen/farmer to solve his problems	0.996136	I	0.842697	II	0.9951	I
2	Better services and more tangible benefits	0.723214	II	0.674157	III		
3	Expert technical advice for producing Crops	-	-	0.966292	I	0.7927	II
4	Investigation of new business models	0.504464	III	-	-	0.5923	III
5	Scaling up operations	0.183066	IV	-	-	0.1662	IV
	Threats						
1	Beyond 12 km it could not reach	0.973215	I	-	-		
2	Older version becomes outdated with the changing technologies	0.473214	II	-	-		
3	Negative perception about the enterprise among other sections.	-		-	-	0.9839	I
4	Might minimize the personal communication with farmers.	-		-	-	0.6626	II
5	Farmers' loss of faith in extension service provided.	-		-	-	0.1124	III

Strengths

Among strength, deployment of services during the time of crisis was ranked first and provision of services with accountability was ranked second by all the users of three initiatives. With reference to FFMA, exchange of information among the major stakeholders ranked third followed by ICT enabled access to update information, provides a strong database to support decision making, ICT can reach even the non-reachable remote areas, and as a cost effective method of interactive system, the users ranked it third as the cost effective method of interactive system followed by cultivating like experts. Concerning Mobiaqua model, the users felt that it was cost effective method of interactive system and that IT can reach even the non-reachable remote areas. The users of Teleaqua model was content and offered third rank for the strong database to support decision making, followed by exchange of information among the stakeholders, they believed that the service of this initiative helped them to cultivate like experts. From this analysis, it is clear that among the eight strengths mentioned by the users, Mobiaqua users did have only four strengths compared to FEMA which had seven of the strengths and Teleaqua had six and Mobiaqua had four. Mobiaqua's strength lies in ICT that can reach even the remotest area and the most cost effective manner which is not seen in Teleaqua. But Teleaqua has the unique strength of enabling the farmers to cultivate like that of experts.

Weaknesses

Regarding FFMA, too many scrolls to read the full content was the major weakness expressed by the users followed by preferred voice enabled messages towards which often and only few users were attracted by available market information. For Mobiaqua, Lack of publicity among farmers was the major constraint followed by the language used. The availability of farm inputs and service for the aqua farmers is the need of the hour for better growth of aquaculture and development of the farming community. The survey results indicated that most of the aqua cultural farmers were conversant only in the mother tongue hence the use of English language was a notable constraint in Mobiaqua.

It can be observed from Table 3 that in Tele Aqua model, the farmers felt lack of adequate field coordinator was first weakness followed by non-coverage of small Farmers, limited coverage of subjects and non-coverage of women farmers and poor bandwidth availability/network coverage.

In this model, the field coordinator visits the farm on a weekly basis and mails the crop details in the form of a text and digital photographs. So, if adequate co-ordinators were available then regular farm visits could be undertaken. The sample collected has ignored the women and small farmers. Due to poor bandwidth and network coverage, the digital photographs could not be sent on time.

Opportunities

With regard to FFMA, it could be inferred from the data in Table 2 that it helps the fishermen to solve their problems since it got the first ranking followed by better services and more tangible benefits. Investigation of new business models and scaling up operations are underway.

It helped the fishermen community to solve the life threatening problems by predicting very high speed wind and high waves and they were satisfied with better services and tangible benefits. When fishermen venturing into the sea would be able to get updates on potential fishing zone, they can move on the direction of PFZ and cast the net.

Due to timely knowledge, they felt that there is an opportunity of bulk catches, which is a new business model.

From Table 3, it is found that the major opportunity got by the brackish water farmers was the technical advice for producing crops, followed by help for the farmer to solve his problems, and better services and more tangible benefits. It could be observed from the Table 2 that it helps the farmer to solve his problems (0.9951), by receiving expert technical advice for producing crops

Threats

It is seen from the Table 2 that beyond 12km, mobile could not reach the fishermen followed by the use of mobile might minimize the personal communication with the fishermen which ranked first in Teleaqua model followed by farmers' loss of faith in the extension service provided.

The FFMA marine e- Extension initiative not only has increased the income of fishermen but has also updated the farmers about upcoming events and danger. Mobile phone has brought optimistic changes which have supported the fishermen and have improved the living standard. This initiative should be introduced to the fishermen in all states so that this community could get benefit from information and communication technology.

Regarding Mobiaquabrackishwater e-Extension initiative, it can be used by the fisheries sector in an economical way and over a vast geographical area. SMS messaging has transformed the way people receive and disseminate information. The need to provide market reports, prices, product details, weather reports etc., has made the SMS application a more suitable form of technology that can be applied in an economical way.

With the Teleaqua (Freshwater) e-Extension initiative, it aims to improve the farm productivity by delivering farm-specific aqua-expert advice in a timely manner to each farm at the farmers' door steps. Farm advice is provided on a regular basis from pond preparation till harvest.

Conclusion

The models discussed in this study overall demonstrated novelty and creativity in the dissemination services of farmers based on their specific needs requirement. The novelty in technology adoption within the model provided farmer centric services in local language, with local content transparently. By scaling up such e-Extension initiatives the fisheries sector will help to evaluate the workability of the innovation made. The implementer looks at ease of use, effectiveness of the system, needs of the user, and cost effectiveness of the services and whether it has commercial potential. The effect of these services on users will improve their standard of living directly. The study clearly indicates that the strength is in FFMA followed by TELEAQUA. MOBIAQUA scored third in strength. Among the weaknesses, Teleaqua had most of the weakness while Mobiaqua had a major weakness i.e., the use of only English Better opportunities were found in the case of FEMA and Teleaqua. Integrating the strengths and utilizing unused opportunities addressing weaknesses with caution towards threats, we could easily develop a new e-Extension initiate which is more efficient and highly suitable for fisheries and aquaculture.

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Technology Adoption and Productivity of Bt Cotton: A Micro Level Perspective of Bt Cotton Cultivation in Tamil Nadu

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Abstract

A major challenge in the production of cotton in India is the pest attack. The main pest is cotton bollworm. To control the pest incidence, farmers have applied more than recommended levels of pesticides. After the introduction of Bt cotton in India, the production of cotton has increased due to increasing number of farmers adopting it. In the present study, it is found that relationship between farm size and yield is higher in the case of Bt cotton (r= 0.76) compared to non-Bt (r= 0.63). The production function analysis revealed that the cost of pesticide influenced yield more than other variables in the non-Bt cotton, whereas the magnitude of coefficients indicate that cost of seed influenced yield more than other variables in the case of Bt cotton. The results indicate that those farmers who adopted Bt cotton with the recommended technology are able to get more yield per hectare.

Keywords: Bt cotton, bollworm, pesticide, Tamil Nadu, India.

Introduction

The production of cotton plays an important role in terms of generating direct and indirect employment as well as earning foreign exchange. This raw material sustained the healthy functioning of the textile sector. In other words, cotton is centrally positioned in the growth of both agri-based and agro-based industries in India. Given the significance of cotton apart, its production is threatened from pest attack. The main pest is cotton bollworm and due to this, the farmers apply higher levels of pesticides. Further, inventions of cotton varieties that resist pest attack came in the form of the technological breakthrough, namely, Bt cotton. The innovation in bio- technology in the form of Bt cotton controls the bollworms which has now occupied the centre stage. In 2014, the adoption of Bt cotton in India increased by 600,000 hectares to a record 11.6 million hectares, equivalent to a high adoption rate of 95% of 12.25 million hectares total cotton area. In 2014, India planted the largest ever area of cotton - 105,000 ha, more than the previous record cotton area of 12.1 million ha in 2011. Thus, in 2014, India achieved a near- optimal adoption rate of 95% at the national level, and this was distributed evenly among the ten cotton growing States. The number of Bt cotton farmers increased to 7.7 million in 2013-2014 from 7.3 million in 2012- 2013.

Bt Cotton in India

Bt Cotton is genetically engineered with Bt (Bacillus thuringiensis), a bio-toxin which comes from soil bacterium. Bt, which was isolated from soil in 1911, has been available to farmers as an organic pesticide since 1930[1] .The engineered Bt gene produces a protein that cuts into the guts of specific insects, rendering the cotton resistant to these insects. Biotechnology for control of bollworms is made available in the seed itself. Farmers have to just sow the Bt cotton seeds as they do with conventional seeds. The resulting plants have the in-built ability to produce Bt protein within their body and defend themselves from bollworms. No extra efforts or equipment are needed to utilize this technology.

Bt cotton in India: Issues in Adoption of Bt cotton in India

India is one among the 16 countries where commercial plantation of Bt cotton happens. It has the largest cotton production area in the world but yield levels are generally low because of low productivity and lack of availability of water, as only about one third of the total cotton area cultivated in irrigated and the remaining mostly produced under rain-fed conditions. Dry land agriculture in India covers 67 per cent of the net cultivated area and currently accounts for more than 60 per cent of food grains, 80 per cent of oil seeds, 90 per cent of green legumes and 70 per cent of cotton and even 50 per cent of paddy grown under rain-fed conditions[2] . Because of this, nearly 60 per cent of farmers prefer to leave agriculture if alternative was available due to the policy regime of agriculture[3]. An additional reason for low productivity was the limited supply of seeds and poor management practices. Due to

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declining production, the farmers have to spray more pesticide to control the pest problem, and as a result, the cost of production increased in addition to environmental and human health impacts. In India, out of Rs 2800 crores spent for pesticide consumption, about Rs 1600 crores (57%) were spent on cotton alone, and within this, Rs 1100 crores (68%) were spent only to control the bollworms[4]. In India, about 166 species of insect pest were identified in the cotton field at different stages of its growth[5]. In China, 31 insect species were found at Bt fields, among that, 23 were beneficial[6]. It has been mentioned that cotton cultivation was reduced by almost 75 per cent in the last few years of decade of 1990s due to pest attack and water scarcity[7].

Under Indian conditions, bollworm had a high critical capacity that is not well controlled in conventional cotton. On an average, pest damage was about 60 per cent on the conventional trial plots in 2001. On the other hand, in United States and China, losses in conventional cotton due to insect pests accounted for approximately 12 per cent and 15 per cent, respectively, as it was observed that higher pesticide application and lower pest pressure prevail in United States and more favourable soil and climatic conditions prevail in China. More than that, in China, pesticides have been subsidized but in India, in contrast, farmers were often indebted due to credit constrains and do not have access to chemical pesticides at the right time (Qaim and Zilberman,2003)[8]. Under this background described above, Bt cotton came into India in 2002.

Adoption and Participation in Bt Cotton Cultivation

The adoption of Bt cotton had increased from 50,000 hectares in 2002, (when Bt cotton was first commercialized) to 11.6 million hectares in 2014 and the percentage of area under Bt cotton also increased from 1 per cent to 95 per cent during the same years. In the initial period, only 0.05 million farmers cultivated Bt cotton and this had increased to 7.7 million in 2014. A cumulative 54 million small-holder cotton farmers planted Bt cotton in the thirteen-year period.

Table .1 Adoption and Participation of Bt Cotton in India

Year	Adoption of Bt cotton (Mha)	Total cotton area (Mha)	% Bt cotton area	Bt cotton farmers (Million) `
2002-03	0.05	7.7	1	0.05
2003-04	0.1	7.6	1	0.08
2004-05	0.5	8.9	6	0.3
2005-06	1.3	8.9	15	1.0
2006-07	3.8	9.2	42	2.3
2007-08	6.2	9.4	66	3.8
2008-09	7.6	9.4	81	5.0
2009-10	8.4	10.3	81	5.6
2010-11	9.4	11.0	85	6.2
2011-12	10.6	12.2	88	7.0
2012-13	10.8	11.6	93	7.2
2013-14	11.6	12.25	95	7.7

Source : Choudhary & Kadambini, 2014

State-wise Cultivation of Bt Cotton in India

In the year 2002, the first year of approval, three Bt-cotton hybrids, namely, Mech 12, Mech 162 and Mech 184, were commercially planted on about 29,415 ha (72,685 acres) of land in six states viz, - Maharashtra, Madhya Pradesh, Karnataka, Andhra Pradesh, Gujarat and Tamil Nadu. After that, it spreads to all the other states.

Over the years, the area under Bt cotton cultivation has been on the increase (Table 2). In 2002, the area under cultivation was 50,000 hectares, and it has been reported that 9.4 million hectares were under Bt in 2010. The major states growing Bt cotton in 2014, listed in order of hectarage, were Maharashtra (3.9 million hectares) followed by Gujarat (2.5 million hectares), Andhra Pradesh

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and Telangana (2.3 million hectares , Northern Zone (1.4 million hectares), Madhya Pradesh (560 thousand hectares), and the remaining 835 thousand hectares in Karnataka, Tamil Nadu and other cotton growing States. It has been noted that in Madhya Pradesh, Tamil Nadu and others, the area under Bt cotton had decreased in 2014.

TABLE 2 STATE-WISE ADOPTION OF BT COTTON IN INDIA FROM 2002-2014 (000'HA)

State	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Maharashtra	25	30	200	607	1840	2800	3130	3396	3710	3960	3995	3860	3950
Andhra Pradesh	8	10	75	280	830	1090	1320	1049	1650	1820	1935	2011	1175
Gujarat	10	36	122	150	470	908	1360	1682	1780	1930	2015	2130	2525
Madhya Pradesh	2	13	80	146	310	500	620	621	610	640	605	620	560
Northern Region	-	-	-	60	215	682	840	1243	1162	1340	1390	1365	1425
Karnataka	3	4	18	30	85	145	240	273	370	570	520	580	610
Tamil Nadu	2	7	5	27	45	70	90	109	110	220	220	194	110
Other	-	-	-	-	5	5	5	8	8	120	120	146	115
Total	50	100	500	1300	3800	6200	7605	8381	9400	10600	10800	10995	11570

Source : Choudhary & Kadambini, 2014 and Various Issues

Statement of the Research Problem

The area under cotton as well as its production has declined over the last three decades (1980-2000) due to increasing cost of cultivation particularly of pesticide cost. In this situation, Bt cotton was allowed to be cultivated in India. Afterwards, the area under Bt cotton has steadily increased. The claims of Bt cotton were that the usage of chemical pesticides to control cotton bolloworm will decline and hence also the cost of cultivation. The productivity of Bt cotton over the traditional varieties will be more. To examine these claims a study has been felt necessary at the field level. Hence the present study.

Objectives

1. To study the differentials in cost, yield and income from the cultivation of Bt cotton and Non-Bt Cotton in the Tamil Nadu

Hypotheses

I. Productivity of Bt cotton is scale (farm -size) neutral

Survey Research Design

A multi-stage sampling technique was used to select the respondents for the study. Among the 32 districts in Tamil Nadu, three western districts viz, Coimbatore, Tirupur and Dindigul were identified to conduct the survey as the cultivation of Bt cotton in these districts was widespread.

In Coimbatore district, among the 12 blocks, Kinnathukkadavu and Madukkarai blocks were purposively selected as larger number of farmers cultivated Bt cotton in these blocks Vadapudur revenue village in Kinathukkadavu block and Valukkupparai revenue village in Madukkarai block were ramdomly selected. Similarly, Kottadurai revenue village in Thoppampatti block of Dindigul district and Ponnapuram revenue village in Dharapuram block of Tirupur district were selected randomly.

From the records made available by the VAO Office and the information obtained from the Village Panchayat Office of respective villages, 120 farmers (87 Bt growers and 33 Non-Bt growers) from Vadapudur, 57 farmers (46 Bt growers and 11 Non-Bt growers) in Valukuparai , 36 farmers(20 Bt growers and 16 Non-Bt growers) in Kottadurai and 34 (25 Bt growers and 9 Non-Bt growers) in Ponnapuram revenue village were taken up as the respondents of the study. The total number of farmers came to 247 (178 Bt & 69 non-Bt). When classified on the basis of size of land holdings the sample consisted of 7 big farmers (>5 hectares), 37 medium farmers (2-5 hectares), 153 small farmers (1-2 hectares) and 50 marginal farmers (<1 hectare).

Method of Data Collection and Analysis

Data was collected by personal interview method. The collected data was processed and analyzed by using correlation and regression analysis.

Production function for regression analysis

In general, the principle of regression is to find out relationship of inputs to output. Increased profitability of production is due to a reduction in production costs and or higher levels of output or better quality of output using the same input level. (Better quality of output may also increase the profitability in the competitive market). To capture the impact of inputs on cotton yield in the selected

farms, the following Cobb-Douglas production function was fitted.

$$Y=aX_1^{b1}.x_2^{b2}.x_3^{b3}.x_4^{b4}$$

y = *Yield*

X_1 = *Seed*

X_2 = *Fertilizer*

X_3 = *Pesticide*

X_4 = *Labour*

b_1,b_2, b_3,b_4 are output elasticity with respect to the particular factor of production indicated above.

Results and Discussions

The null hypothesis framed that there is no significant relationship between farm size and yield (cotton yield is neutral to scale) was tested by calculating Correlation coefficients. The correlation (r) coefficient between farm size and yield came to 0.76 for Bt and 0.63 for non-Bt both at one per cent level of significance. This result revealed that there is a statistically significant relationship between farm size and yield of cotton.

TABLE 3 CORRELATION BETWEEN LAND SIZE AND YIELD - BT COTTON

		Land	Yield
Land	pearson correlation	1	0.763**
	sig (1-tailed)		0.000
	N	178	178
Yield	pearson correlation	0.763**	1
	sig (1-tailed)	0.000	
	N	178	178

** Significant at the 1% level.

TABLE 4 CORRELATION BETWEEN LAND SIZE AND YIELD - NON-BT COTTON

		Land	Yield
Land	pearson correlation	1	0.630**
	sig (1-tailed)		0.000
	N	69	69
Yield	pearson correlation	0.630**	1
	sig (1-tailed)	0.000	
	N	69	69

** Significant at the 1% level.

Regression Analysis

Two log - linear production functions were fitted. The yield was taken as the dependent variable. The independent variables taken into consideration were the cost of seed (X_1), fertilizer (X_2), pesticides (X_3), and labour (X_4),

Non-Bt cotton

The regression co-efficient i.e, the output elasticities for non-Bt cotton are worked out.

TABLE 5 PRODUCTION FUNCTION FOR NON- BT COTTON

Regressor	Co-efficient	t-statistic	P-value
Constant	0.289	0.330	0.742
Seed X_1	0.455**	3.990	0.000
Fertiliser X_2	0.386**	3.629	0.001
Pesticide X_3	0.105	0.793	0.431
Labour imputed X_4	0.343**	3.582	0.001
R2	0.743		

** Significant at 1% level.

Here the model is (log transformed Cobb-Douglas production function)

Log Y = 0.455 log X_1 + 0.386 log X_2 + 0.105 log X_3 + 0.343 log X_4

The regression coefficients b1, b2 and b4 are significant since sig (p) <0.01 the level of significance. Pesticide (sig >0.01) is influenced the yield.

The magnitude of co-efficients indicate that the cost of pesticide influenced yield more than other variables (fertiliser and labour) .

Bt cotton

Similarly, the co-efficient i.e the production elasticities for Bt cotton are worked out.

TABLE 6 PRODUCTION FUNCTION FOR BT COTTON

Regressor	Co-efficient	t-statistic	P-value
Constant	0.065	0.075	0.940
Seed X_1	-0.091	-1.183	0.239
Fertiliser X_2	0.571**	13.847	0.000
Pesticide X_3	0.397**	4.647	0.000
Labour imputed X_4	0.428**	5.929	0.000
R 2	0.717		

**Significant at 1%level.

Here the model is

Log Y = -0.091 log X_1 + 0.571 log X_2 + 0.397 log X_3 + 0.428 log X_4

The regression coefficients b_2, b_3 and b_4 are significant since sig (p) <0.01 the level of significance.

The magnitudes of the regression coefficients indicate that the cost of seed influenced yield more than other variables (i.e., fertiliser, pesticide and labour). It indicates that the quality of seed influenced the yield.

Conclusion

From the study, it was found that the relationship between farm size and yield for Bt cotton and Non-Bt cotton both were significant at one per cent level of significance. It was understood from the regression function analysis that the cost of pesticide influenced yield more than other variables in case of non-Bt cotton, whereas the magnitude of coefficients indicate that the cost of seed influenced yield more than other variables in case of Bt cotton.

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AGRO-ECONOMIC RESEARCH

Enhancing Rice Productivity and Food Security: A Study of the Adoption of the System of Rice Intensification (SRI) in Selected States of India*

POORNIMA VARMA

Rice is the most important staple food, consumed by half of the world's population every day. Around 90% of the rice produced is consumed in the Asian region. Therefore, rice security-ensuring enough rice for everyone-is equivalent to food security. Within the Asian region, India occupies a vital position as a major producer and consumer. However, rice cultivation in India in recent times suffers from several interrelated problems such as stagnation in productivity and concomitant environmental problems due to salinisation and waterlogging of fields. Since virtually all suitable land is already under cultivation, raising productivity seems to be the only way of ensuring food security.

System of Rice Intensification (SRI), which originated in Madagascar, is widely recognized as a promising systemic approach to enhance rice production by simultaneously reducing negative environmental externalities. By requiring less of the inputs, SRI is introduced through change in the management of plants, soil, water and nutrients. Since SRI is a knowledge-based innovation, it does not require any costly investment. Therefore, one would naturally expect SRI to be widely disseminated and adopted. But in reality this is not the case. Despite the potential benefits of SRI, its adoption rate is very low and also varies from region to region. Existing studies point out factors such as poor water control, lack of awareness, skill-intensive nature of the method, difficulty in getting labourers etc., as constraints in adoption. These could be the reasons for the common practice of partial adoption of components observed in most of the regions that adopted SRI. These constraints are even more severe in a developing country like India. Against this backdrop, the present study analysed the factors influencing the adoption of SRI as well as the impact of SRI adoption on household income and yield. The analysis is undertaken under three dimensions. First was the analysis of the factors that influence the intensity and depth of adoption by explicitly considering constraints which are relevant to SRI. Second was the analysis of the factors that influence the adoption of various components of SRI and the combinations of various components of SRI. Third was the analysis of the adoption and impact of SRI on income and yield in a joint framework.

The intensity is defined in terms of the number of acres devoted for the cultivation of SRI, whereas the depth is defined as the number of SRI components adopted. In a developing country, it is quite possible that markets function in an imperfect manner. Therefore, any technology adoption can be plagued by multiple constraints. Most of the earlier studies on technology adoption in agriculture assume that markets function perfectly and, therefore, agents do not face any information asymmetry. Although few recent studies have incorporated the multiple constraints in technology adoption in agriculture, there are hardly any such studies on SRI in general and for SRI in India in particular. Farmers who function in an imperfect market setting may lack information and access to seed, credit etc., which are crucial for adoption. Therefore, even a farmer with positive demand for adoption may not be able to adopt a new technology owing to several constraints. These could result in inconsistent parameter estimates. Therefore, the present study developed a multi hurdle model which is a modified double hurdle model.

The descriptive analysis showed that out of 386 household interviewed, only 38 farmers did not have any information regarding SRI. This constitutes only 10 per cent. The results, therefore, provide us with some policy relevant insights. The main reason for non-adoption was not lack of information about SRI; rather, it could be mainly due to other constraints. Around 63 per cent of non-adopters did not have access to extension services, thus pointing to the importance of extension services in the dissemination and adoption of SRI. Unlike other agricultural technologies, SRI is not a technology or an improved variety of a seed; instead, it is a set of innovative ideas. Similarly, around 60 per cent of non-adopters faced difficulty in getting labourers and in irrigation. Difficulty in getting labourers was a problem even among adopters of SRI. As far as the irrigation is concerned, although SRI is supposed to be less irrigation intensive, the analysis showed that the type of land is very important for effective irrigation. Land selected for SRI should be well levelled and should not have the problem of waterlogging. Also, while irrigating the plot, water should spread evenly across the field. Additionally, farmers must have their own

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irrigation facility so that irrigation can be done whenever needed.

As observed during the field visits, and as also highlighted in the existing literature, the present study decided to explicitly consider the above-mentioned constraints in our model. The constraints that are also generally highlighted in the adoption literature are access to seed, access to credit etc. Nonetheless, in the context of our present study, we do not consider these as major constraints in the adoption of SRI. This is due to the fact that neither SRI is specific to any seed variety nor does it require costly investment.

The results from the multi hurdle analysis showed that younger and large farmers had greater access to information. Gender of the head of the household, education, membership in farmers' organisations etc., were crucial factors in getting access to extension services. Age of the head of the household, cultivation of only rice, farming as main occupation, access to off-farm activity etc., were found to be important in increasing the likelihood of access to labourers. The farmers with farming as main occupation and rice as main farming crop, face relatively less difficulty in getting access to labourers indicating that social network and long-standing relationship with labourers play an important role. As far as the disparities among districts in terms of constraints were concerned, the disparities were the highest in the case of access to information and this was followed by extension services. This study, therefore, indicates the lacunae of information and extension services in wider dissemination and adoption of SRI practices.

The results from the final adoption decisions showed that the factors influencing the intensity of SRI adoption was slightly different from the factors influencing the depth of SRI adoption. Nonetheless, the common factors that influence both intensity and depth were assets owned and rented, number of improved rice varieties known, membership in input supply cooperatives, and the fear of poor yield. So, it is clear that financial capital such as initial wealth and social capital such as membership in farmers' organisations are very crucial in terms of their effect on the adoption of SRI. Wage rates for labourers were crucial in the depth of adoption of SRI. Wage rates of woman labourers were negatively related to adoption whereas wage rate for male labourers were positively related to adoption. This is perhaps due to the fact that the shift away from manual weeding to mechanical weeding creates more demand for male labourers. So, the skill-intensive nature of mechanical weeding leads to higher demand for male labourers and, thus, to higher wage. This indicates a gender-biased nature of technical change.

This article analysed the probability and level of adoption of multiple packages of SRI. SRI is a package of components and partial adoption is commonplace. Therefore, it is important to understand why farmers adopt only some and not all modified practices. We used multivariate probit (MVP) and ordered probit models to jointly analyse the adoption of multiple packages and the number of SRI packages adopted while taking into account the interrelationship among them. Our approach extends the existing empirical studies by allowing for correlations across different packages of SRI. The results show that various economic, institutional and access-related factors shape farmers' adoption of SRI packages.

The adoption of agricultural technologies in developing countries is mostly dependent on farmers' economic ability to access new technologies. The present study found a significant and positive relationship between households' assets and adoption of SRI packages. In line with the results from multi hurdle model, the results from MVP and ordered probit model also showed that certain fixed social bias and gender disparities were affecting the adoption. Despite considerable disparities in wage rates between male and female labourers, the analysis showed that female wage rates reduced the likelihood of adoption of almost all packages. Interestingly, the male wage rate generally increased the likelihood of adoption. The results highlight the skill-intensive nature of SRI adoption and the gender implications of SRI adoption.

Information and extension services are also very important driving-forces in enhancing adoption of SRI. Our results showed the importance of extension services in influencing adoption decisions. The insignificant impact of NFSM (National Food Security Mission) districts dummy on SRI adoption is an eloquent testimony to the fact that the objective of increasing rice production by promoting SRI under the Government's food security mission was not yielding the desired results. Additionally, most farmers who had been in farming for several years were not attracted to new methods. Also, farmers who were remotely located from the main market had higher likelihood of adopting SRI. This indicates the possibility of cultivating commercial crops by those farmers who were located close to the market. Most farmers interviewed did not consider rice farming as a commercially-viable venture and instead reported that the production was mainly for self-consumption and sale in the local markets.

The study also revealed the importance of investment in such infrastructure as irrigation in promoting SRI. Although, SRI requires less water as compared to traditional method, farmers require their own irrigation facility for the purpose of proper water management which is an essential component of SRI.

The need for social capital and networks were also observed in our analysis. The membership in farmers' organisations such as input supply cooperatives increased the likelihood of SRI adoption. This implies that policy makers need to focus on establishing and strengthening

local collective institutions. Local institutions can play a crucial role in providing farmers with timely information, inputs and technical assistance.

The study analysed the determinants and impacts of the adoption of five mutually-exclusive combinations of SRI on yield and household income using a multinomial endogenous treatment effects model. As in most adoption studies in general and in SRI adoption studies in particular, we find that the decision to adopt is a function of household assets, irrigation facility, information about SRI, contact with extension services, fear of poor yield, cultivation of other crops etc. Household assets, irrigation, information, extension services etc., increased the likelihood of household adopting SRI, whereas fear of poor yield, cultivation of other crops etc., decreased the likelihood of adopting SRI.

The outcomes of SRI adoption on yield and household income showed all the three principles of SRI and its various combinations-plant management, soil management and water management-enhanced the rice yield. The positive impact of SRI adoption on household income was observed only when farmers adopted all the principles of SRI.

The impact analysis also showed that there were considerable differences in the impact of adoption across different States. Even with a greater adoption of SRI in states like Orissa and Madhya Pradesh as compared to Karnataka, the welfare outcomes of adoption was relatively low. This highlights the inherent differences in development. Although, education level of the farm households plays a key role realising the full benefits of SRI, an enhancement of irrigation management practices also assumes significance. Briefly put, the three set of analysis undertaken in the study did not show any conflicts; instead, they provided more or less similar insights into the factors affecting the adoption. Although, lack of information did not turn out to be a major cause for non-adoption, there were considerable disparities in level of information across different districts studied. Extension services were found to be crucial and the results were consistent in all the models. Both the social and the economic capital of the farmers were found to be very important. Infrastructure-related issues such as irrigation also played a dominant role. Farmers who were in farming for several years were found to be very sceptical of adopting SRI, and risk aversion also played a role. But the most important revelations were in terms of fixed social bias and gender disparity. Despite considerable disparities in wage rates across male and female labourers, the study in general observed that female wage rate reduced the likelihood of adoption whereas male wage rate, in most cases, increased the likelihood of adoption. As mentioned earlier, this is due to the fact that the shift away from manual weeding to mechanical weeding resulted in greater demand for male labourers. The government's interventions in promoting SRI through the national food security mission did not seem to have had any impact.

The impact of SRI in enhancing rice yield and household income were observed in the analysis. The wider adoption of SRI can contribute to promoting not only sustainable agricultural practices but also for greater food security provided the constraints farmers are addressed with appropriate policy interventions.

COMMODITY REVIEWS

Foodgrains

During the month of February,2017 the Wholesale Price Index (Base 2004-05=100) of pulses decreased by 10.42%, cereals increased by 0.39% & foodgrains decreased by 2.29% respectively over the previous month.

ALL INDIA INDEX NUMBER OF WHOLESALE PRICES

(Base: 2004-2005=100)

Commodity	Weight (%)	WPI for the Month of February, 2017	WPI for the Month of January, 2017	WPI A year ago	Percentage change during	
					A month	A Year
1	2	3	4	5	6	7
Rice	1.793	249.4	246.0	238.9	1.38	4.40
Wheat	1.116	247.7	250.3	228.6	-1.04	8.36
Jowar	0.096	325.0	317.4	284.7	2.39	14.16
Bajra	0.115	299.0	296.1	283.6	0.98	5.43
Maize	0.217	275.1	280.1	273.8	-1.79	0.47
Barley	0.017	291.9	291.6	253.3	0.10	15.24
Ragi	0.019	487.9	484.9	339.5	0.62	43.71
Cereals	3.373	255.9	254.9	241.2	0.39	6.09
Pulses	0.717	352.4	393.4	355.2	-10.42	-0.79
Foodgrains	4.09	272.8	279.2	261.2	-2.29	4.44

Source : Office of the Economic Adviser, M/O Commerce and Industry.

Procurement of Rice

3.02 million tonnes of rice (including paddy converted into rice) was procured during February 2017 as against 2.95 million tonnes of rice (including paddy converted into rice)procured during February 2016.The total procurement of rice in the current marketing season i.e 2016-2017, up to 27.02.2017 stood at 30.24 million tonnes, as against 24.47 million tonnes of rice procured, during the corresponding period of last year. The details are given in the following table :

PROCUREMENT OF RICE

(*In Thousand Tonnes*)

State	Marketing Season 2016-17 upto 27.03.2017		Corresponding Period of last Year 2015-16		Marketing Year (October-September) 2015-16		2014-15	
	Procurement	Percentage to Total	Procurement	Percentage to Total	Procurement	Percentage to Total	Procurement	Percentage to Total
1	2	3	4	5	6	7	8	9
Andhra Pradesh	2342	7.74	2644	9.64	4326	12.65	3591	11.17
Chhatisgarh	4662	15.41	3972	14.49	3442	10.06	3423	10.64
Haryana	3570	11.80	2861	10.43	2861	8.36	2015	6.27
Maharashtra	214	0.71	129	0.47	230	0.67	199	0.62
Punjab	11044	36.51	9349	34.10	9350	27.33	7786	24.21

PROCUREMENT OF RICE — CONTD.

(In Thousand Tonnes)

1	2	3	4	5	6	7	8	9
Tamil Nadu	64	0.21	561	2.05	1191	3.48	1049	3.26
Uttar Pradesh	2039	6.74	2624	9.57	2910	8.50	1698	5.28
Uttarakhand	648	2.14	597	2.18	598	1.75	465	1.45
Others	5666	18.73	4683	17.08	9301	27.19	11936	37.11
Total	30249	100.00	27420	100.00	34209	100.00	32162	100.00

Source: Department of Food & Public Distribution.

Procurement of Wheat

The total procurement of wheat in the current marketing season i.e 2016-2017 up to June, 2016 is 22.93 million tonnes against a total of 27.89 million tonnes of wheat procured during last year. The details are given in the following table:

PROCUREMENT OF WHEAT

(In Thousand Tonnes)

State	Marketing Season 20116-17 (upto 30.06.2016)		Corresponding Period of last Year 2015-16		Marketing Year (April-March)			
					2015-16		2014-15	
	Procurement	Percentage to Total	Procurement	Percentage to Total	Procurement	Percentage to Total	Procurement	Percentage to Total
1	2	3	4	5	6	7	8	9
Haryana	6722	29.32	6692	24.00	6778	24.13	6495	23.20
Madhya Pradesh	3990	17.40	7195	25.80	7309	26.02	7094	25.34
Punjab	10645	46.42	10346	37.10	10344	36.83	11641	41.58
Rajasthan	762	3.32	1300	4.66	1300	4.63	2159	7.71
Uttar Pradesh	802	3.50	2267	8.13	2267	8.07	599	2.14
Others	9	0.04	85	0.30	90	0.32	6	0.02
Total	22930	100.00	27885	100.00	28088	100.00	27994	100.00

Source: Department of Food & Public Distribution.

Commercial Crops

Oil Seeds and Edible Oils

The Wholesale Price Index (WPI) of nine major oilseeds as a group stood at 211.1 in February, 2017 showing a decrease of 0.1% over the previous month and an increase of 0.7% over the year. The WPI of copra (coconut) increased by 8.6%, gingelly seed by 2.0%, safflower (kardi seed) by 0.8%, cotton seed by 0.6% and niger seed by 0.6% over the previous month. The WPI of rape & mustard seed decreased by 2.0%, soybean by 1.9%, sunflower by 1.4% and groundnut seed by 1.0% over the previous month.

The WPI of edible oils as a group stood at 157.6 in February, 2017 showing a decrease of 0.4% over the previous month and an increase of 5.7% over the year. The WPI of copra oil and soybean oil increased by 7.9% and 0.1% respectively over the previous month. The WPI of mustard & rapeseed oil decreased by 1.7%, groundnut oil by 1.1%, gingelly oil by 0.7%, sunflower oil by 0.7% and cotton seed oil by 0.6% over the previous month.

Fruits & Vegetable

The WPI of fruits & vegetable as a group stood at 230.9 in February, 2017 showing an increase of 4.8% and 0.5% over the previous month and year respectively.

Potato

The WPI of potato stood at 137.1 in February, 2017 showing a decrease of 9.3% and 8.8% over the previous month and year respectively.

Onion

The WPI of onion stood at 251.4 in February, 2017 showing a decrease of 0.4% and 18.9% over the previous month and year respectively.

Condiments & Spices

The WPI of condiments & spices (group) stood at 334.6 in February, 2017 showing a decrease of 6.4% and 6.3% over the previous month and year respectively. The WPI of chillies (dry) decreased by 10.2%, black pepper by 4.4% and turmeric by 1.2% over the previous month.

Raw Cotton

The WPI of raw cotton stood at 240.3 in February, 2017 showing an increase of 2.6% and 30.0% over the previous month and year respectively.

Raw Jute

The WPI of raw jute stood at 404.1 in February, 2017 which shows an increase of 0.2% over the previous month and decrease of 18.2% over the year.

WHOLESALE PRICE INDEX OF COMMERCIAL CROPS

Commodity	Latest	Month	Year	% Variation Over	
	February, 2017	January, 2017	February, 2016	Month	Year
OIL SEEDS	211.1	211.3	209.6	-0.1	0.7
Groundnut Seed	248.7	251.3	236.9	-1.0	5.0
Rape & Mustard Seed	226.0	230.6	227.5	-2.0	-0.7
Cotton Seed	224.2	222.8	211.5	0.6	6.0
Copra (Coconut)	151.6	139.6	125.0	8.6	21.3
Gingelly Seed (Sesamum)	311.4	305.3	276.8	2.0	12.5
Niger Seed	316.5	314.5	356.8	0.6	-11.3
Safflower (Kardi Seed)	165.6	164.3	159.1	0.8	4.1
Sunflower	168.7	171.1	199.3	-1.4	-15.4
Soyabean	174.7	178.1	207.8	-1.9	-15.9
EDIBLE OILS	157.6	158.2	149.1	-0.4	5.7
Groundnut Oil	210.7	213.0	190.3	-1.1	10.7
Cotton Seed Oil	203.3	204.5	192.3	-0.6	5.7
Mustard & Rapeseed Oil	180.4	183.5	180.4	-1.7	0.0
Soyabean Oil	162.5	162.3	150.6	0.1	7.9

WHOLESALE PRICE INDEX OF COMMERCIAL CROPS — CONTD.

Commodity	Latest	Month	Year	% Variation Over	
	February, 2017	January, 2017	February, 2016	Month	Year
Copra Oil	153.4	142.2	143.3	7.9	7.0
Sunflower Oil	132.4	133.4	135.0	-0.7	-1.9
Gingelly Oil	182.4	183.7	162.1	-0.7	12.5
FRUITS & VEGETABLES	230.9	220.3	229.7	4.8	0.5
Potato	137.1	151.2	150.4	-9.3	-8.8
Onion	251.4	252.4	309.8	-0.4	-18.9
CONDIMENTS & SPICES	334.6	357.4	357.2	-6.4	-6.3
Black Pepper	694.8	726.7	702.4	-4.4	-1.1
Chillies(Dry)	357.2	397.6	408.5	-10.2	-12.6
Turmeric	237.9	240.9	262.1	-1.2	-9.2
Raw Cotton	240.3	234.3	184.8	2.6	30.0
Raw Jute	404.1	403.4	493.8	0.2	-18.2

1 Daily Agricultural Wages in Some States (Category-wise)

(In Rs.)

State	District	Centre	Month & Year	Daily Normal Working Hours	Field Labour		Other Agri. Labour		Herdsman		Skilled Labour		
											Carpenter	Black Smith	Cobbler
					M	W	M	W	M	W	M	M	M
Andhra Pradesh	Krishna	Ghantasala	Nov, 16	8	300	200	500	NA	250	NA	NA	NA	NA
	Guntur	Tadikonda	Nov, 16	8	290	231	350	NA	300	NA	NA	NA	NA
Telangana	Ranga Reddy	Arutala	Feb, 16	8	800	217	300	190	NA	NA	400	300	NA
Karnataka	Bangalore	Harisandra	Sep, 16	8	360	340	400	350	400	300	600	450	NA
	Tumkur	Gidlahali	Sep, 16	8	250	200	250	200	250	NA	300	280	NA
Maharashtra	Nagpur	Mauda	Sep, 14	8	100	80	NA	NA	NA	NA	NA	NA	NA
	Ahmednagar	Akole	Sep, 14	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
Jharkhand	Ranchi	Gaitalsood	March, 14	8	120	120	100	100	75	75	200	200	NA

1.1 Daily Agricultural Wages in Some States (Operation-wise)

(In Rs.)

State	District	Centre	Month & Year	Type of Labour	Normal Daily Working Hours	Ploughing	Sowing	Weeding	Harvesting	Other Agri-Labour	Herdsman	Skilled Labours		
												Carpenter	Black Smith	Cobbler
Assam	Barpeta	Laharapara	Sep, 16	M	8	300	250	250	250	250	200	350	300	250
				W	8	NA	200	200	200	200	NA	NA	NA	NA
Bihar	Muzaffarpur	Bhalui Rasul	June,16	M	8	300	300	300	300	300	300	400	400	NA
				W	8	NA	300	NA	NA	300	NA	NA	NA	NA
	Shekhpura	Kutaut	June,16	M	8	250	NA	225	100	NA	NA	500	NA	NA
				W	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chhattisgarh	Dhamtari	Sihava	Jan, 17	M	8	150	140	NA	NA	150	175	250	150	200
				W	8	NA	NA	NA	NA	110	120	NA	100	NA
Gujarat*	Rajkot	Rajkot	Oct, 16	M	8	248	254	235	223	203	197	488	475	463
				W	8	NA	200	229	216	197	178	NA	NA	NA
	Dahod	Dahod	Oct, 16	M	8	279	279	164	164	150	NA	371	321	286
				W	8	NA	243	164	164	150	NA	NA	NA	NA
Haryana	Panipat	Ugarakheri	Nov, 16	M	8	400	400	400	400	400	NA	NA	NA	NA
				W	8	NA	300	300	300	300	NA	NA	NA	NA
Himachal Pradesh	Mandi	Mandi	June,16	M	8	NA	182	182	182	182	182	300	300	NA
				W	8	NA	182	182	182	182	182	NA	NA	NA
Kerala	Kozhikode	Koduvally	Aug,16	M	4-8	845	685	NA	685	915	NA	885	NA	NA
				W	4-8	NA	NA	485	585	485	NA	NA	NA	NA
	Palakkad	Elappally	July,16	M	4-8	NA	500	NA	500	466	NA	600	NA	NA
				W	4-8	NA	NA	300	300	300	NA	NA	NA	NA
Madhya Pradesh	Hoshangabad	Sangarkhera	Sep, 16	M	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
				W	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Satna	Kotar	Sep,16	M	8	200	200	200	200	200	200	300	300	300
				W	8	NA	200	200	200	200	200	NA	NA	NA
	Shyopurkala	Vijaypur	Sep,16	M	8	NA	300	300	300	300	NA	300	300	NA
				W	8	NA	300	300	300	NA	NA	NA	NA	NA

1.1 Daily Agricultural Wages in Some States (Operation-wise)—*Contd.* (In Rs.)

State	District	Centre	Month & Year	Type of Labour	Normal Daily Working Hours	Ploughing	Sowing	Weeding	Harvesting	Other Agri-Labour	Herdsman	Skilled Labours		
												Carpenter	Black Smith	Cobbler
Odisha	Bhadrak	Chandbali	Aug, 16	M	8	300	300	300	250	300	300	350	300	250
				W	8	NA	200	200	220	250	200	NA	NA	NA
	Ganjam	Aska	Aug, 16	M	8	300	200	200	250	200	200	400	400	400
				W	8	NA	150	150	150	150	150	NA	NA	NA
Punjab	Ludhiyana	Pakhowal	Nov, 15	M	8	395	NA	395	395	380	100	400	400	200
				W	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
Rajasthan	Barmer	Kuseep	Aug,15	M	8	NA	NA	300	NA	NA	300	700	500	NA
				W	8	NA	NA	200	NA	NA	200	NA	NA	NA
	Jalore	Sarnau	Aug,15	M	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
				W	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tamil Nadu*	Thanjavur	Pulvarnatham	June, 16	M	8	NA	343	NA	355	344	NA	NA	NA	NA
				W	8	NA	NA	110	133	128	NA	NA	NA	NA
	Tirunelveli	Malayakulam	June, 16	M	8	NA	350	375	400	491	NA	NA	NA	NA
				W	8	NA	NA	171	180	329	NA	NA	NA	NA
Tripura		State Average	June, 16	M	8	294	280	280	281	279	295	328	291	297
				W	8	NA	216	218	216	215	225	NA	NA	NA
Uttar Pradesh*	Meerut	Ganeshpur	Dec,16	M	8	268	265	268	280	264	NA	398	NA	NA
				W	8	NA	200	215	212	211	NA	NA	NA	NA
	Aurraiya	Aurraiya	Dec,16	M	8	170	175	150	235	171	NA	350	NA	.NA
				W	8	NA	NA	150	235	171	NA	NA	NA	NA
	Chandauli	Chandauli	Dec,16	M	8	200	200	200	200	200	NA	400	NA	NA
				W	8	NA	NA	200	200	200	NA	NA	NA	NA

M-Man W-Woman
NA- Not Available
* States reported district average daily wages

2. Wholesale Prices of Certain Agricultural Commodities and Animal Husbandry Products at Selected Centres in India

Commodity	Variety	Unit	State	Centre	Feb. 17	Jan. 17	Feb. 16
Wheat	PBW 343	Quintal	Punjab	Amritsar	1800	1800	1600
Wheat	Dara	Quintal	Uttar Pradesh	Chandausi	1825	1870	1590
Wheat	Lokvan	Quintal	Madhya Pradesh	Bhopal	1872	1980	1675
Jowar	-	Quintal	Maharashtra	Mumbai	2200	2400	2300
Gram	No III	Quintal	Madhya Pradesh	Sehore	4476	5500	3968
Maize	Yellow	Quintal	Uttar Pradesh	Kanpur	-	1440	1425
Gram Split	-	Quintal	Bihar	Patna	13000	13200	5850
Gram Split	-	Quintal	Maharashtra	Mumbai	7600	8700	5750
Arhar Split	-	Quintal	Bihar	Patna	9200	9800	14735
Arhar Split	-	Quintal	Maharashtra	Mumbai	6200	6400	10850
Arhar Split	-	Quintal	NCT of Delhi	Delhi	6450	7200	12500
Arhar Split	Sort II	Quintal	Tamil Nadu	Chennai	7000	8000	11900
Gur	-	Quintal	Maharashtra	Mumbai	3850	3850	3100
Gur	Sort II	Quintal	Tamil Nadu	Coimbatore	4300	5300	3800
Gur	Balti	Quintal	Uttar Pradesh	Hapur	2720	2800	2375
Mustard Seed	Black (S)	Quintal	Uttar Pradesh	Kanpur	4175	4175	4250
Mustard Seed	Black	Quintal	West Bengal	Raniganj	4500	4500	4700
Mustard Seed	-	Quintal	West Bengal	Kolkata	3800	4200	4500
Linseed	Bada Dana	Quintal	Uttar Pradesh	Kanpur	5500	5875	4460
Linseed	Small	Quintal	Uttar Pradesh	Varanasi	4900	4730	4250
Cotton Seed	Mixed	Quintal	Tamil Nadu	Virudhunagar	2300	2300	2100
Cotton Seed	MCU 5	Quintal	Tamil Nadu	Coimbatore	2750	2750	2500
Castor Seed	-	Quintal	Telangana	Hyderabad	3450	3400	3250
Sesamum Seed	White	Quintal	Uttar Pradesh	Varanasi	7770	8160	11300
Copra	FAQ	Quintal	Kerala	Alleppey	8300	8850	6050
Groundnut	Pods	Quintal	Tamil Nadu	Coimbatore	5500	5500	4500
Groundnut	-	Quintal	Maharashtra	Mumbai	6200	6000	5700
Mustard Oil	-	15 Kg.	Uttar Pradesh	Kanpur	1365	1400	1485
Mustard Oil	Ordinary	15 Kg.	West Bengal	Kolkata	1475	1535	1485
Groundnut Oil	-	15 Kg.	Maharashtra	Mumbai	1470	1510	1335
Groundnut Oil	Ordinary	15 Kg.	Tamil Nadu	Chennai	1860	1950	1725
Linseed Oil	-	15 Kg.	Uttar Pradesh	Kanpur	1440	1470	1455
Castor Oil	-	15 Kg.	Telangana	Hyderabad	1200	1163	1050
Sesamum Oil	-	15 Kg.	NCT of Delhi	Delhi	1515	1510	1435
Sesamum Oil	Ordinary	15 Kg.	Tamil Nadu	Chennai	2200	2175	1695
Coconut Oil	-	15 Kg.	Kerala	Cochin	1845	1935	1305
Mustard Cake	-	Quintal	Uttar Pradesh	Kanpur	2325	2325	2250
Groundnut Cake	-	Quintal	Telangana	Hyderabad	3000	2929	3393
Cotton/Kapas	NH 44	Quintal	Andhra Pradesh	Nandyal	5350	5500	4000

2. WHOLESALE PRICES OF CERTAIN AGRICULTURAL COMMODITIES IN ANIMAL HUSBANDARY PRODUCTS AT SELECTED CENTRES IN INDIA"—CONTD.

Commodity	Variety	Unit	State	Centre	Feb. 17	Jan. 17	Feb. 16
Cotton/Kapas	LRA	Quintal	Tamil Nadu	Virudhunagar	5200	5266	4100
Jute Raw	TD 5	Quintal	West Bengal	Kolkata	3810	3720	5460
Jute Raw	W 5	Quintal	West Bengal	Kolkata	3860	3770	5400
Oranges	-	100 No	NCT of Delhi	Delhi	542	542	500
Oranges	Big	100 No	Tamil Nadu	Chennai	550	500	400
Banana	-	100 No.	NCT of Delhi	Delhi	350	350	292
Banana	Medium	100 No.	Tamil Nadu	Kodaikkanal	501	500	499
Cashewnuts	Raw	Quintal	Maharashtra	Mumbai	80000	80000	82000
Almonds	-	Quintal	Maharashtra	Mumbai	70000	70000	95000
Walnuts	-	Quintal	Maharashtra	Mumbai	95000	95000	82000
Kishmish	-	Quintal	Maharashtra	Mumbai	11000	11000	23000
Peas Green	-	Quintal	Maharashtra	Mumbai	3250	3200	4200
Tomato	Ripe	Quintal	Uttar Pradesh	Kanpur	475	560	700
Ladyfinger	-	Quintal	Tamil Nadu	Chennai	4000	2700	2300
Cauliflower	-	100 No.	Tamil Nadu	Chennai	1500	1500	1400
Potato	Red	Quintal	Bihar	Patna	1000	1000	780
Potato	Desi	Quintal	West Bengal	Kolkata	380	475	950
Potato	Sort I	Quintal	Tamil Nadu	Mettuppalayam	1793	1270	2219
Onion	Pole	Quintal	Maharashtra	Nashik	500	600	550
Turmeric	Nadan	Quintal	Kerala	Cochin	15000	15500	14500
Turmeric	Salam	Quintal	Tamil Nadu	Chennai	8600	8300	9000
Chillies	-	Quintal	Bihar	Patna	8000	8000	10500
Black Pepper	Nadan	Quintal	Kerala	Kozhikode	55000	58000	61000
Ginger	Dry	Quintal	Kerala	Cochin	14000	15000	18500
Cardamom	Major	Quintal	NCT of Delhi	Delhi	125000	124000	130500
Cardamom	Small	Quintal	West Bengal	Kolkata	140000	140000	100000
Milk	Buffalo	100 Liters	West Bengal	Kolkata	3800	3800	3600
Ghee Deshi	Deshi No 1	Quintal	NCT of Delhi	Delhi	36685	34017	33017
Ghee Deshi	-	Quintal	Maharashtra	Mumbai	46000	46000	46000
Ghee Deshi	Desi	Quintal	Uttar Pradesh	Kanpur	37000	36400	35650
Fish	Rohu	Quintal	NCT of Delhi	Delhi	14500	14500	12000
Fish	Pomphrets	Quintal	Tamil Nadu	Chennai	33000	35000	33000
Eggs	Madras	1000 No.	West Bengal	Kolkata	4000	3900	4500
Tea	-	Quintal	Bihar	Patna	21250	21250	21150
Tea	Atti Kunna	Quintal	Tamil Nadu	Coimbatore	35000	35000	33000
Coffee	Plant-A	Quintal	Tamil Nadu	Coimbatore	26000	26000	25000
Coffee	Rubusta	Quintal	Tamil Nadu	Coimbatore	17500	17500	12000
Tobacco	Kampila	Quintal	Uttar Pradesh	Farukhabad	—	4500	4600
Tobacco	Raisa	Quintal	Uttar Pradesh	Farukhabad	—	3600	3450
Tobacco	Bidi Tobacco	Quintal	West Bengal	Kolkata	13800	13800	—
Rubber	-	Quintal	Kerala	Kottayam	13000	12600	9000
Arecanut	Pheton	Quintal	Tamil Nadu	Chennai	32700	32700	32000

3. Month end Wholesale Prices of Some Important Agricultural Commodities in International Markets during Year, 2017

Commodity	Variety	Country	Centre	Unit	Jan.	Feb
1	2	3	4	5	6	7
CARDAMOM	Guatmala Bold Green	U.K.	-	Dollar/MT	9000.00	9000.00
				Rs./Qtl	61335.00	60219.00
CASHEW KERNELS	Spot U.K. 320s	U.K.	-	Dollar/MT	10612.51	10691.56
				Rs./Qtl	72324.26	71537.23
CASTOR OIL	Any Origin ex tank Rotterdam	Netherlands	-	Dollar/MT	1453.70	1498.40
				Rs./Qtl	9906.97	10025.79
CHILLIES	Birds eye 2005 crop	Africa	-	Dollar/MT	4100.00	4100.00
				Rs./Qtl	27941.50	27433.10
CLOVES	Singapore	Madagascar	-	Dollar/MT	7500.00	8400.00
				Rs./Qtl	51112.50	56204.40
COCONUT OIL	Crude Phillipine/Indonesia, cif Rotterdam	Netherlands	-	Dollar/MT	1840.00	1590.00
				Rs./Qtl	12539.60	10638.69
COPRA	Phillipines cif Rotterdam	Phillipine	-	Dollar/MT	905.00	838.00
				Rs./Qtl	6167.58	5607.06
CORRIANDER		India	-	Dollar/MT	1650.00	1650.00
				Rs./Qtl	11244.75	11040.15
CUMMIN SEED		India	-	Dollar/MT	2500.00	2500.00
				Rs./Qtl	17037.50	16727.50
MAIZE		U.S.A.	Chicago	C/56 lbs	366.25	371.00
				Rs./Qtl	980.93	975.57
OATS		CANADA	Winnipeg	Dollar/MT	336.74	332.74
				Rs./Qtl	2294.88	2226.36
PALM KERNAL OIL	Crude Malaysia/Indonesia, cif Rotterdam	Netherlands	-	Dollar/MT	1820.00	1330.00
				Rs./Qtl	12403.30	8899.03
PALM OIL	Crude Malaysian/Sumatra, cif Rotterdam	Netherlands	-	Dollar/MT	822.50	760.00
				Rs./Qtl	5605.34	5085.16
PEPPER (Black)	Sarawak Black lable	Malaysia	-	Dollar/MT	7900.00	7700.00
				Rs./Qtl	53838.50	51520.70
RAPESEED	Canola	CANADA	Winnipeg	Can Dollar/MT	522.40	518.30
				Rs./Qtl	2719.61	2634.52
	UK delivered rapeseed, delivered Erith(buyer)	U.K.	-	Pound/MT	330.00	334.00
				Rs./Qtl	2832.72	2783.22
RAPESEED OIL	Refined bleached and deodorised ex-tanks,broker price	U.K.	-	Pound/MT	827.00	765.00
				Rs./Qtl	7098.97	6374.75
SOYABEAN MEAL	UK produced 49% oil & protein ('hi-pro') ex-mill seaforth UK bulk	U.K.	-	Pound/MT	325.00	329.00
				Rs./Qtl	2789.80	2741.56
SOYABEAN OIL		U.S.A.	-	C/lbs	34.87	32.72
				Rs./Qtl	5237.56	4825.21
	Refined bleached and deodorised ex-tanks, broker price	U.K.	-	Pound/MT	807.00	709.00
				Rs./Qtl	6927.29	5908.10

MONTH END WHOLESALE PRICES OF SOME IMPORTANT AGRICULTURAL COMMODITIES IN INTERNATIONAL MARKETS DURING YEAR, 2017 — CONTD.

1	2	3	4	5	6	
SOYABEANS		U.S.A.	-	C/60 lbs	1055.25	1022.75
				Rs./Qtl	2639.29	2511.46
	US NO.2 yellow	Netherlands	Chicago	Dollar/MT	425.60	425.60
				Rs./Qtl	2900.46	2863.01
SUNFLOWER SEED OIL	Refined bleached and deodorised ex-tanks,broker price	U.K.	-	Pound/MT	796.00	786.00
				Rs./Qtl	6832.86	6549.74
Wheat		U.S.A.	Chicago	C/60 lbs	424.50	441.25
				Rs./Qtl	1061.72	1083.53

Source: Public Ledger.

Foreign Exchange Rates

Currency	Jan	Feb
Can Dollar	52.06	50.83
U.K. Pound	85.84	83.33
US Dollar	68.15	66.91

Crop Production

4. Sowing and Harvesting Operations Normally in Progress During May, 2017

State	Sowing	Harvesting
(1)	(2)	(3)
Andhra Pradesh	Autumn Rice, Sugarcane, Groundnut	Summer Rice, Onion.
Assam	Winter Rice, Maize, Tur (R), Cotton.	Summer Potato (Hills).
Bihar	Autumn Rice, Jute, Mesta. Castoresed.	Summer Rice, Wheat, Barley, Gram. Linseed.
Gujarat	Sugarcane, Ginger, Turmeric.	Onion
Himachal Pradesh	Maize, Ragi, Small Millets (K), Summer Potato (Hills), Sugarcane, Ginger, Chillies (Dry), Tobacco, Sesamum, Cotton, Turmeric.	Wheat, Barley, Gram, Other Rabi Pulses, Linseed, Onion.
Jammu & Kashmir	Autumn Rice, Jowar (K), Maize, Ragi, Small, Millets (K), Mung (K), Tur (K), Other Tobacco, Sannhemp.	Wheat, Barley, Small Millets (R) Tur (K). Sesamum, Rapeseed and Mustard, Linseed. Onion.
Karnataka	Autumn Rice, Jowar (K), Maize, Ragi, Urad (K), Mung (K), Summer Potato (Hills), Tobacco, Castorseed, Sesamum, Cotton, Sweet Potato, Turmeric, Sannhemp, Onion, Tapioca.	Summer Rice, Ragi (R), Winter Potato (Plain), Tapioca.
Kerala	Autumn Rice, Ragi, Small Millets (K), Tur (K), Urad (K), Mung (K), Other Kharif Pulses, Ginger, Turmeric, Tapioca (Early).	Summer Rice, Other Rabi Pulses. Tapioca (Late).
Madhya Pradesh	Sugarcane, Ginger, Chillies (Dry), Turmeric.	Winter Potato (Plains), Onion.
Maharashtra	Termeric.	—
Manipur	Autumn Rice, Groundnut, Castorseed, Cotton, Turmeric.	—
Orissa	Autumn Rice, Sugarcane, Chillies (Dry), Jute.	Summer Rice, Cotton, Chillies (Dry).
Punjab and Haryana	Autumn Rice, Summer Rice, Ragi, Small Millets (K), Tur (K), Summer Potato (Hills) Chillies (Dry), Cotton, Sweet Potato.	Wheat, Barley, Winter Potato (Plains) Summer Potato, Tabacco,Onion.
Rajsthan	Sugarcane	Wheat, Small Millets (R), Tabacco.
Tamil Nadu	Autumn Rice, Bajra, Summer Potato, Sugarcane, Chillies (Dry), Groundnut, Turmeric, Sannhemp. Tapioca	Summer Rice, Jowar (R), Winter Potato (Hills), Sugarcane, Chillies (Dry). Sesamum, Onion.
Tripura	Autumn Rice, Maize, Sugarcane, Ginger, Chillies (Dry), Seasmum, Cotton, Jute, Mesta.	—
Uttar Pradesh	Autumn Rice, Tur (K), Chillies (Dry), Groundnut, Cotton, Jute, Mesta, Linseed.	Summer Rice, Wheat, Barley, Sugarcane, Tabacco, Rapeseed and Mustard, Sannhemp, Onion.
West Bengal	Autumn Rice, Winter Rice, Tur (K), Ginger, Chillies (Dry), Jute, Mesta.	Summer Rice Chillies (Dry). Sesamum.
Delhi	Jowar (K), Onion.	

(K)— Kharif. (R)— Rabi.

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