ISSN 0002-1679
Regn.No.:840

P. Agri. 21-08-2017
450

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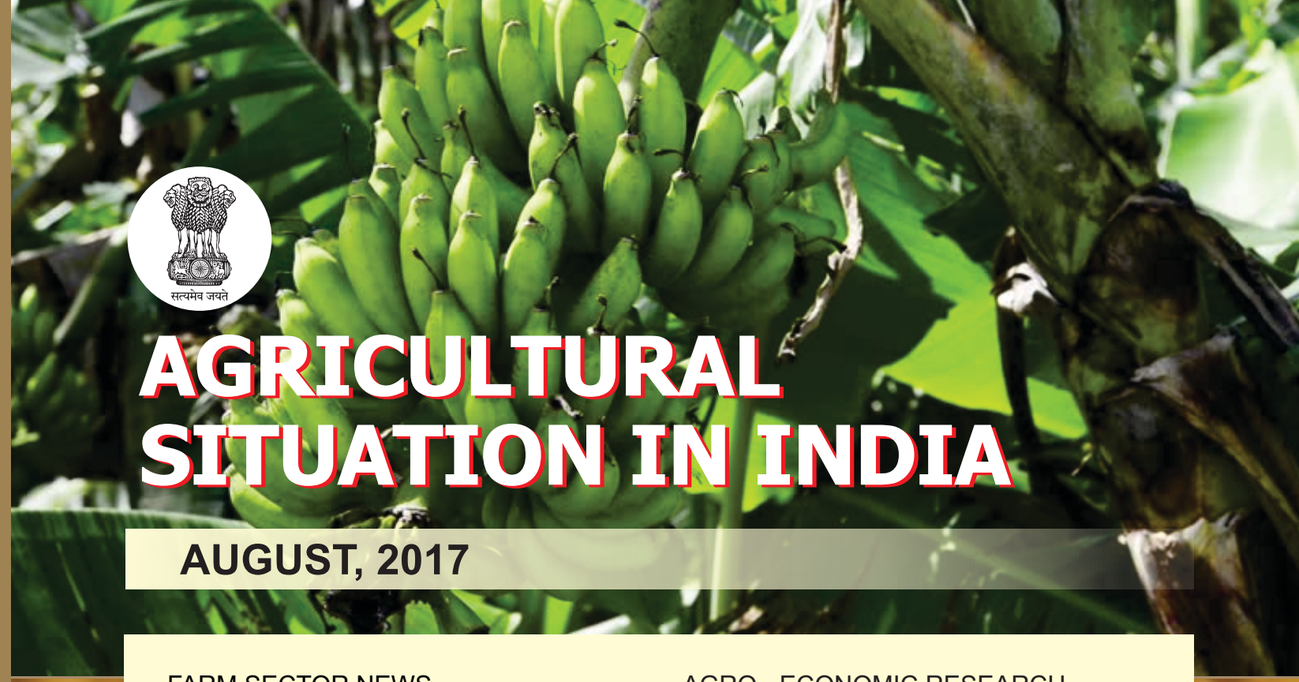
PRINTED BY THE GENERAL MANAGER GOVERNMENT OF INDIA PRESS, MINTO ROAD, NEW DELHI-110002
AND PUBLISHED BY THE CONTROLLER OF PUBLICATIONS, DELHI-110054-2017



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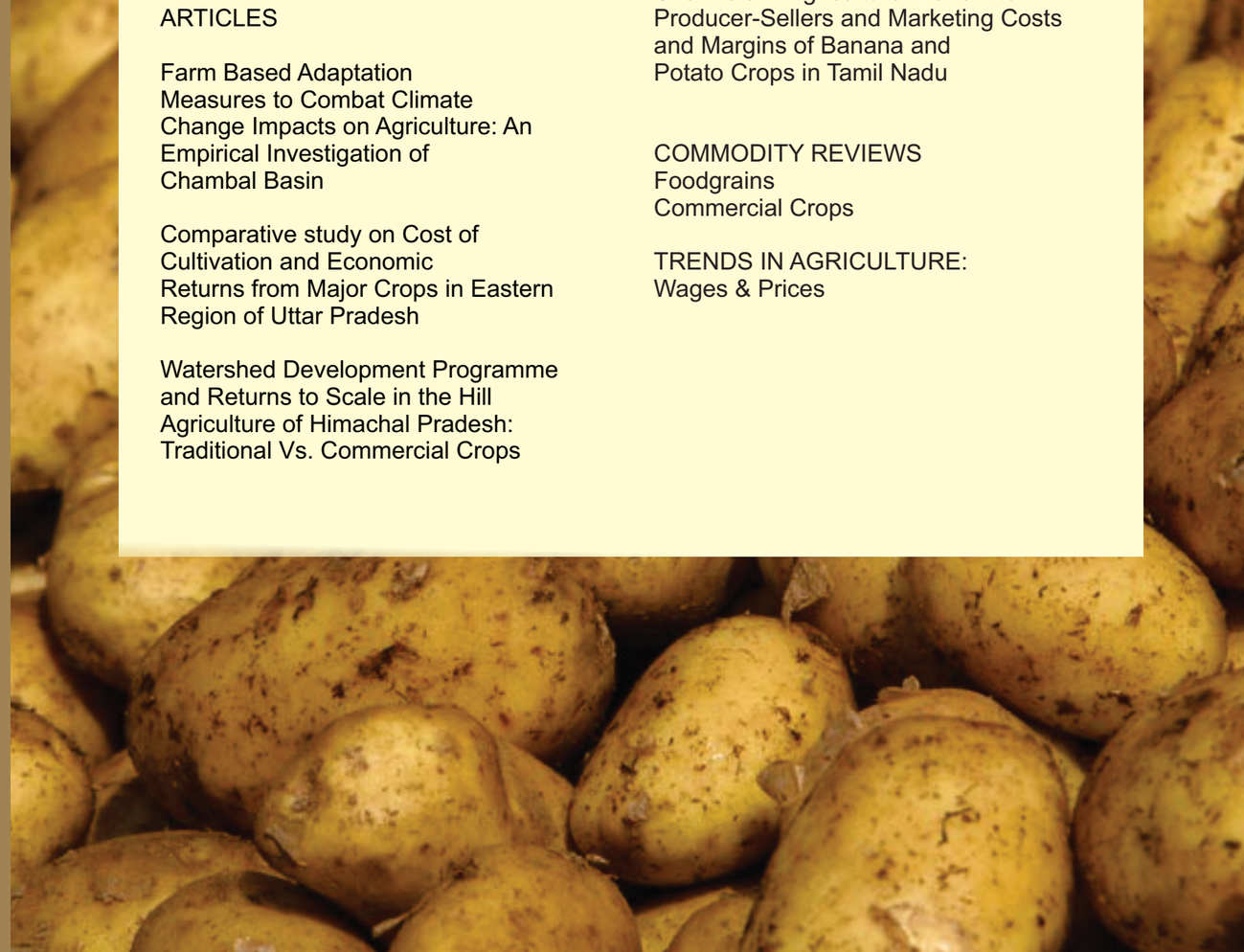
AGRICULTURAL SITUATION IN INDIA

AUGUST, 2017



Publication Division
DIRECTORATE OF ECONOMICS AND STATISTICS
DEPARTMENT OF AGRICULTURE, COOPERATION & FARMERS WELFARE
MINISTRY OF AGRICULTURE & FARMERS WELFARE
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Subscription

	Inland	Foreign
Single Copy	: ₹ 40.00	£ 2.9 or $ 4.5
Annual	: ₹ 400.00	£ 29 or $ 45

Available from

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Agricultural Situation in India

VOL. LXXIV **August, 2017** No. 5

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The Journal is brought out by the Directorate of Economics and Statistics, Ministry of Agriculture & Farmers Welfare, it aims at presenting an integrated picture of the food and agricultural situation in india on month to month basis. The views expressed are not necessarily those of the Government of India.

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 Dara Shukoh 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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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

Union Minister for Agriculture and Farmers Welfare Shri Radha Mohan Singh addressed Textiles India 2017 Conference on 2nd July, 2017 in Gandhi Nagar, Gujarat.

Union Minister for Agriculture and Farmers Welfare Minister Shri Radha Mohan Singh said that the overall growth of natural fibre sector is important for the country's economy. They have economic importance and enormous impact on the development of the society. He was speaking at the Textiles India 2017 Conference in Gandhi Nagar, Gujarat.

He said that natural fibres are backbone of the Indian textile industry. It constitutes more than 60% of the total fibre industry. After the agricultural industry, the Indian textile industry gives direct employment to millions of people. Several small and medium industries use by products of natural fibres. More than 75 million households worldwide are directly involved in the production of natural fibres. In India, 30 million farmers are involved in the production of natural fibres.

The Agriculture Minister informed that at present, natural fibres face a tough competition from artificial fibres such as acrylic, polyester, etc. A century ago, the fibres brought in use were natural, whereas now natural fibre share is less than 40%. Cotton alone contributed for 50% of apparel use during 1990s. However, at present, the share of cotton has declined to less than 30% in world apparel market.

He said that synthetic fibres are making a strong hold on the market due to their cost effectiveness and tailormade properties. The cost of production of natural fibre is comparatively higher than the synthetic fibres. In view of the rapid increase in population, countries are giving importance to increase the area of food grains cultivation as compared to fibre crops. The demand for natural fibre is steadily increasing due to the increase in the population and due to the greater awareness among public to use eco-friendly natural fibres. As there is a limitation in increasing the cultivation area of natural fibres, the only way to increase the availability of above fibres is to increase their productivity.

The Minister added that currently 90 countries are producing cotton in the world. Cotton accounts for about 60% of the total fibre consumed by Indian textile industries which is less than 40% share in global scenario. India is the leading producer of cotton in the world accounting for around one-third of the area and one fourth of the global production. During 2016-17, India produced around 5.8 million tonnes of cotton from 10.5 million hectares with productivity of around 550 kg lint/hectare. There is an urgent need to increase the productivity of cotton with the introduction of high yielding plants, best agronomic practice and innovative technologies.

He further said that jute is one of the most important natural fibres used for industrial applications. Jute farming and jute industry are providing livelihood to about 5 million people. At present, jute is attaining success in controlling soil erosion in the form of geo-texture, use in the automobile industry for the manufacture of interior of cars etc and in the new applications of technical wear. The demand for natural geo-textiles manufactured from jute and sisal fibres is going to have a steady and sustainable growth in coming decades. Apart from fibre, the cultivation of these fibres has many advantages like carbon sequestering capacity, improved soilhealth, economic importance to the farmers etc. Across the world, countries are making efforts to reduce the greenhouse gas like carbon dioxide. The average productivity of jute is around 2300-2400 kg fibre/hectare.

The Additional Demand for Energy for Agricultural Works should be met through Agro Mechanisation and for this, the Agricultural Mechanisation Sector needs to grow rapidly: Shri Singh

Union Agriculture and Farmers Welfare Minister Shri Radha Mohan Singh said that agricultural mechanisation is one of the important factors for sustainable development of the agricultural sector which helps in increasing production through agricultural works, reducing the deficit, reducing the cost of various agricultural works through better management of costly inputs, increasing the productivity of natural resources and helps to reduce the difficulties related to various agricultural activities. This was stated by the Minister during the Inter Session Meeting of the Consultative Committee held at the Sher-e-Kashmir International Conference Center. The subject chosen for discussion during this meeting was 'Farm Mechanisation'. On this occasion, Union Minister of State for Agriculture, Sudarshan Bhagat, and members of the Consultative Committee were also present.

Source: www.pib.nic.in

Shri Singh said that in the last few years, there has been a shift towards the use of mechanical and electrical sources of power. While in 1960-61, about 92.30% farm power was coming from animate sources, in 2014-15 the contribution of animate sources of power reduced to about 9.46% and that of mechanical and electrical sources of power increased from 7.70% in 1960-61 to about 90.54% in 2014-15.

Union Agriculture and Farmers Welfare Minister further said that the degree of farm mechanisation is expressed as a ratio of mechanical power to cultivable unit area, which in India during last 43 years has increased at a very slow pace from 0.48 kW/ha in 1975-76 to 1.84 kW/ha in 2013-14. However, from the year 2014-15 to 2016-17, there has been an increase to 2.02 kW/ha which is mainly due to the concerted efforts for promotion of agricultural mechanisation through various schemes of the Department of Agriculture, Cooperation & Farmers Welfare.

Shri Singh informed that there has been a record production of food grain this year. However, the demand for food grain is increasing and it has been estimated that by 2025, India were have to produce more than 300 million tonnes. According to the 2011 census, 263 million people (54.6%) were engaged in the agriculture sector, which will likely decline to 190 million (33%) by 2020. Shri Singh said that these figures show that during important seasons such as sowing and harvesting, there will be a decrease in the work force and it will have an adverse effect on production. Thus, the additional demand for energy for various agricultural works need to be completed through the medium and for this, the agricultural mechanisation sector needs to grow rapidly.

The Minister added that due to continuous shrinkage in the average size of the agricultural lands, more lands will fall in the adverse category, which will make individual ownership of agricultural machinery gradually more informal. Therefore, ensuring availability of sufficient farm power for small farms will be a big challenge. The other challenges in the field of agricultural mechanisation are how to overcome skill barriers to provide adequate support to modern technology. In future, it is necessary to establish a link between the possibility of sustainable development of agricultural mechanisation without neglecting the lack of energy and environmental degradation due to low availability of fossil fuels and its high cost.

Agriculture and Farmers Welfare Minister further informed that in the years 2012-13 and 2013-14, two small schemes were being run on agricultural mechanisation for which the allocation of the fund was only Rs 24.10 crore, and Rs.38.49 crore respectively. But considering the importance of agricultural mechanisation, the Ministry of Agriculture and Farmers Welfare started the Sub-Mission on Agricultural Mechanisation in the year 2014-15 with an objective to promote agricultural mechanisation among small and marginal farmers and in the areas where the level of mechanisation is very low. In addition to the Agricultural Mechanisation Submissions (SMM), farm mechanisation is also promoted through various other schemes and programmes of the Ministry such as RKVY, NFSM, NHM, NMOOP etc.

The Government is Committed to the Continuous Development of the Indian Economy: Shri Radha Mohan Singh

Union Minister for Agriculture and Farmers and Welfare, Shri Radha Mohan Singh said that the government is committed to the continuous development of the Indian economy. India can become one of the world's major economic powers by developing the enterprises related to agriculture, where the products can be stored, processed and are brought to the market. Shri Singh said this while speaking to the farmers in Srinagar.

Shri Radha Mohan Singh said that Prime Minister Shri Narendra Modi, too, is well aware of the importance of agriculture and its contribution to the Indian economy. Hence, he has initiated a series of schemes for the betterment of the farmers. In the last three years, the new schemes introduced include distribution of soil health card, expansion in irrigation facilities, low-cost Organic Farming, National Agriculture Market, Horticultural Development, Agroforestry, Beekeeping, Milk, fish and egg production and agricultural education on a priority basis.

Shri Singh informed that Prime Minister shared his dream of doubling the income of the farmers by 2022 in Bareilly in February 2016. For which he not only initiated new schemes but also made necessary funds available. In the last three years, the government has worked on five main areas to increase the agricultural produce and farmers' income by adopting effective strategies which are as follows:

- Production of Neem Coated Urea.
- Reducing the cost of cultivation by promoting Organic Farming. The Government has reduced the cost of DAP by Rs.2500 per tonne and MOP by Rs. 5000 per tonne.
- Increasing production by successfully launching Soil Health Card Scheme, providing water to every field under Prime Minister Krishi Sinchai Yojana and reducing production costs by implementing Paramparagat Krishi Vikas Yojana.
- The government has started the e-NAM to provide a country-wide and transparent market for the farmers.

- In the same way, the government started many programs on animal husbandry, milk production, horticulture, agroforestry, poultry, fisheries, beekeeping, Medh Per Ped.

Union Agriculture Minister further added that Jammu and Kashmir (J&K) is a food deficit state, as a result, the State has to import nearly 7 lakh MT of food grains every year. The deficit in production is mainly due to geographical and climatic conditions as most of the area is mono-cropped. Other reasons for this are small fragmented holdings which restrict the scope of mechanisation and other scientific practices as well as the conversion of agricultural lands for non-agricultural purposes. In order to bridge the gap between the production of food grains and consumption, the State is striving to increase production level of various crops including food crops. To achieve this goal, the State is implementing a number of centrally sponsored schemes for which the Government is providing support. Available data shows that during the last few years, the State has achieved remarkable success in enhancing the production level of some important crops like Paddy, Maize, Vegetables and Saffron.

Shri Singh further informed that the Government had announced a special package of Rs. 500 crore on November 7, 2015, for rehabilitation and development of damaged horticulture areas of the state for which the state Government had submitted its plan for 2016-19. The National Horticulture Board is entrusted with the task of establishing Rs. 24.45 crore Saffron Park in Pampore, Pulwama. The park will have facilities of Quality Control Lab, Export Promotion Activity and e-auction Centre. The park is likely to become operational by November 2017.

Union Agriculture Minister Reviewed the Progress of Two Flagship Schemes - National Agricultural Markets (E-NAM) and Soil Health Card

Union Agriculture and Farmers Welfare Minister, Shri Radha Mohan Singh said that the idea of development of agriculture sector was being contemplated for a long time, but since independence, this is the first government that has been working at the ground level for the development of agriculture and the economic growth of the farmers. Shri Singh said this at a meeting of the State Ministers in-charge of Agricultural Marketing and Agriculture Ministers from different states in New Delhi. In this meeting, the progress of two flagship schemes, namely, National Agricultural Markets (E-NAM) and Soil Health Card was reviewed.

Shri Radha Mohan Singh said that Prime Minister, Narendra Modi's dream is to double farmers' income by 2022 and that farmers should realize their contribution in the mainstream development. To achieve this, the Central Government and all the State Governments need to make multi-faceted joint efforts.

Shri Singh informed that the first pillar is that the cost of production should be reduced and productivity should be increased. The second pillar is that farmers need to diversify and adopt other agricultural activities such as animal husbandry, poultry, goat rearing, bee keeping, and timber plantation. The third and the most important pillar is that farmers get regulated markets close to their farms to sell their produce and earn profitable returns.

Union Agriculture Minister pointed out that Soil Health Card (SHC) Scheme is a flagship scheme of the Government to promote the use of fertilisers based on analysis of Soil Health and enable farmers to get maximum yields at lower cost with minimum damage to the ecosystem. The central Government launched this scheme in February 2015 to provide SHC to more than 12 crore farmers once every 2 years. Comprehensive testing of soil samples on 12 parameters including the status of micro-nutrients is being carried out for each and every soil sample under the scheme. The first cycle (2015-17) of the scheme had been expected to be completed by July 2017. Shri Singh said that States have reported 100% collection of soil sample i.e., 253 lakh soil samples and testing of 244 lakh soil samples. So far, 9 crore soil health cards have been distributed to farmers.

Shri Radha Mohan Singh further said that after the formation of the government, they have taken several important decisions to accelerate the economic condition of the farmers. In order to double the income of the farmers, the Cabinet Committee on Economic Affairs (CCEA) approved the National Agricultural Markets (e-NAM) scheme on July 1, 2015, with a budget allocation of Rs.200 crore. As part of the pilot project, 21 Mandis of 8 states were linked to e-National Agricultural Markets (e-NAM) Scheme on 14/04/2016 by the Prime Minister. This scheme provides an online portal to the farmers for electronic trading and provides a transparent market enabling price discovery and competition. Under the scheme, each Mandi is provided assistance of Rs. 30 lakh for the purpose of preparing necessary infrastructure in the integrated regulated markets. In this year's budget, this amount has been increased to Rs.75 lakh. The main objective of this scheme is to give farmers access to prices of different Mandis and facility to sell their products in a transparent manner to those who offer the best price. One important component of this scheme is that the farmer gets the value of his yield according to the quality as the quality is checked before the electronic bidding.

Shri Singh informed that his ministry and the officers are making efforts to make e-NAM scheme successful. The Agriculture Minister himself visited the states and conducted meetings and reviewed various schemes related to the progress of farmers. Some State Governments like Chhattisgarh and Telangana are doing good work to ensure that farmers are benefitted by e-NAM. There is no lack of

commitment by the State Governments, but the way Chief Minister of Chhattisgarh is taking an interest, all states should take inspiration from him.

India Declared itself free from Highly Pathogenic Avian Influenza (H5N1 and H5N8)

India had reported outbreaks of Highly Pathogenic Avian influenza at various epicenters in Delhi, Gwalior (MP), Rajpura (Punjab), Hissar (Haryana), Bellary (Karnataka), Allappuzha and Kottayam (Kerala), Ahmedabad (Gujarat), Daman (Daman) and Khordha and Angul (Odisha during October, 2016 to February, 2017.

All the outbreaks of Avian Influenza (HPAI) mentioned above were notified to OIE and the control and containment operations were carried out as per the Action Plan on Preparedness, Control and Containment of Avian Influenza.

Surveillance was carried out throughout the country and around the areas of the outbreaks since completion of the operation (including culling, disinfection and clean-up) and surveillance in the states showed no evidence of presence of Avian Influenza Virus.

In view of the above, India declared itself free from Avian Influenza (H5N8 and H5N1) from 6thJune, 2017 and notified the same to OIE.

JICA ODA Loan Assistance Proposal for 'Dairying through Cooperatives-National Dairy Infrastructure Plan'' Project

India ranks first among the world's milk producing Nations since 1998 and has the largest bovine population in the World. Milk production in India during the period 1950-51 to 2014-15, had increased from 17 million tonnes to 146.31 million tonnes. The milk production during 2015-16 was 155.49 million tonnes. About 54% of the milk produced in the country is surplus for marketing in the domestic market, of which only 20.5% is procured/ processed by the organized sector equal and an amount is shared by Cooperatives and Private dairy organizations.

To meet the growing demand which is estimated to be in the range of 200 - 210 million MT by 2021-22, the country needs to upgrade its infrastructure at the village level particularly for milk procurement and production of high valued milk products. Government is mandated to double milk producers' income at farm level by providing rural milk producers with greater access to the organised milk processing sector. Department of Animal Husbandry, Dairying & Fisheries has formulated a Draft National Action Plan for Dairy Development which includes creation of milk chilling facilities including bulk milk cooling, processing infrastructure, Value added products (VAP), organisation of milk collection centres/dairy cooperative societies, milk transportation facility and marketing infrastructure to meet the requirement of increased milk handling.

Government had therefore submitted a proposal for availing loan from Japan International Cooperation Agency for 'Dairying through Cooperatives-National Dairy Infrastructure Plan'' in line with the mandate of Government to double farmers income in next five years. The total outlay of the proposal is Rs 20,057 crores. The proposal primarily aims to cover additional 1.28 lakh villages, 121.83 lakh additional milk producers, setting up of 1.05 Lakh bulk milk coolers at village level by creating 524.20 lakh Kg milk per day capacity of milk chilling and creation of milk & milk product processing infrastructure of 76.5 lakh Kg per day capacity. Besides, the programme would modify/expand old milk and milk product plants created 20-30 years ago under Operation Flood and also create milk & milk products plants for value added products which would benefit 160 lakh existing farmers. The fund will be routed through National Dairy Development Board for the development of dairy sector. The proposal had been forwarded by Department of Economic Affairs to Japan International Cooperation Agency (JICA).

National Livestock Mission (NLM) Provides assistance to Improve Availability of Quality Feed and Fodder, Risk Mitigation and Extension, Skill Development and Training for Livestock

Union Agriculture and Farmers Welfare Minister, Shri Radha Mohan Singh presided over the second General Council meeting of the National Livestock Mission (NLM) on 13th July, 2017. Shri Singh said that Department of Animal Husbandry, Dairying and Fisheries is implementing National Livestock Mission for sustainable development of Livestock Sector, especially for poultry, goats, sheep, pig, pack animals, etc.

Shri Radha Mohan Singh said that NLM provides assistance to improve availability of quality feed and fodder, risk mitigation and extension, skill development and training for livestock sector including cattle and buffaloes. The livestock rearers and farmers, especially women, are unorganized, as these activities are primarily backyard in nature. However, rearing small ruminants, backyard poultry, pigs and other minor livestock offers tremendous opportunities for improving both nutritional and livelihood security of livestock rearers with specific scientific interventions.

Shri Singh further said that one of the reasons for setting up NLM from scheme-mode to mission-mode is to provide the necessary flexibility to all States and UTs in undertaking appropriate interventions suited to their conditions. Taking into account the overall requirement of the livestock sector, there is a need to augment resources for the sector and synergise activities through appropriate

convergence, under the umbrella of NLM to supplement the efforts of the States and UTs to take care of the activities which cannot be accommodated within other ongoing schemes.

The minister informed that all components under the NLM are made flexible and modular, looking into the needs of farmers and stake holders, and as per the geographical and regional requirements so that even the small and marginal farmers can also avail the benefits of the activities proposed under NLM. The distribution of resources and subsidies are also made equitable with considerations for APL, BPL beneficiaries and beneficiaries of North Eastern Region, Hilly, Left Wing Extremism areas so that the beneficiaries in more disadvantageous position could get equitable benefits for sustainable livelihood.

The National livestock Mission is organized into the following four sub-Missions:

i. Sub-Mission on Livestock Development

ii. Sub-Mission on Pig Development in North-eastern Region

iii. Sub-Mission on Fodder and Feed Development

iv. Sub-Mission on Skill Development, Technology Transfer and Extension

A detailed presentation was given on various components of NLM sub-missions in the meeting.

Shri Singh said close alignments of the guidelines is mandatory for the smooth execution of various programs and effective implementation of interventions.

NLM's last three years achievements and milestones are as follows:

— 32,981 Beneficiaries have been assisted under Entrepreneurship Development & Employment Generation (EDEG).

— 3.68 lakh beneficiaries funded for assistance under Rural Backyard Poultry Development.

— 35.64 lakh animal insurance has been under taken.

— 3.00 lakh Goat and 9.80 lakh pig has been given health support.

— 41 state Poultry /Sheep/ Goat Piggery Breeding Farms have been supported.

— 54,930 Chaff Cutter has been distributed.

— 96,321 Qtls seed has been distributed.

— 3823 silage units have been established.

— Organization of 519 Livestock Mela has been supported.

— 223 Livestock Farmers Group and 121 Farmers Field School has been established & 8420 Farmers have been covered under exposure visit.

Milestones achieved under the Leadership of Hon'ble Agriculture & Farmers Welfare Minister

— The Risk Management and Insurance as a component of Sub-Mission on Livestock Development of National Livestock Mission (NLM) is implemented in all the District of the Country instead of 300 selected District earlier.

— All animals are now covered such as indigenous/ crossbred milch animals, Pack animals (Horse, Donkey, Mules, Camels, Ponies and Cattle Buffaloes male) and other livestock (Goat, Sheep, Pigs, Rabbit, Yak and Mithun instead of only milch animals earlier.

— The benefit of subsidy has been enhanced and is restricted to 5 cattle unit per beneficiary per household, in case of Goat, Sheep, Pigs and Rabbit, one cattle unit is equal to 10 animals instead of only 2 milch animals per household earlier.

Record Production of Foodgrains in 2016-17 and All Previous Records were Broken: Shri Radha Mohan Singh

Union Agriculture and Farmers Welfare Minister, Shri Radha Mohan Singh said that only through cross-pollination of expertise and innovations and thereafter synergy during implementation of the programs conceived we would be able to achieve the goal set for the country by Prime Minister, through his farsightedness, of doubling farmers' income by 2022. Shri Singh said it on 14th July, 2017, during National Summit on Smart Agriculture Marketing Solutions to Double the Farmers Income organised in Federation of Indian Chambers of Commerce and Industry FICCI. The representative from Rajasthan, Haryana, Assam, Goa, Maharashtra, Andhra Pradesh, Telangana and Bihar were also participated in the conference.

Shri Singh said that as per the Third Advance Estimates, food grain production in the country had increased to 273 MT in 2016-17, oil seeds to 32.5 MT, and sugarcane to 306 MT. Fruits & Vegetable production had increased to 287 MTs, according to the Second Advance Estimate. He said that there had been a record production of foodgrains in 2016-17 and all previous records were broken.

Shri Singh informed that farmers have not been getting the corresponding increase in remuneration. The Government is seized of the urgent requirement of strengthening market systems to reduce post-harvest losses

to enable farmers to tide over both situations of bumper production leading to a glut and abrupt price fall and incidences of less production resulting in the availability of meagre marketable surplus.

The Agriculture Minister further said that the approach adopted encompasses both adoptions of cost effective production and diversifying agriculture towards growing of high-value crops, agroforestry, rearing of livestock, poultry, fisheries, etc, as well as creating accessible and efficient markets to ensure better price realization to the farmers through a robust value supply chain. We empathize with the farmers and for that purpose we have formulated farmer welfare centric programs and policies, which are equally related to food security and price security.

National Cooperative Development Corporation released Rs.28771.31 crore in the year 2014-17 compared to Rs.15143.76 crore in the year 2011-14: Shri Singh

Union Agriculture and Farmers Welfare Minister Shri Radha Mohan Singh said that the Indian cooperative movement has sustained itself as one of the biggest cooperative movements in the world. The reach of cooperative in India is from village to national level. Shri Singh said it at the inauguration of Cooperative Conference organised by Amreli District's Milk Producers Association Limited in Amreli, Gujarat. The Minister of State for Agriculture & Farmers Welfare and Panchayati Raj Shri Parshottam Rupala was also present at the event.

The Minister further said that there are more than 7 lakh cooperatives are operational in the country, which extends from village level committees to national level co-operative organisations. The cooperatives membership is over 40 crores and it includes about 97% villages and 71% rural households. On 15th July, 2017, 16.9 per cent of agricultural cooperation, 29 percent of fertiliser production, 40 percent of sugar production, and 54 percent of weavers' cooperatives etc. have been contributed to the Indian economy.

Shri Singh further said that Indian cooperatives have firmly established themselves in many sectors of the economy like dairy, banking, sugar, fertilisers, marketing, handloom, fisheries and construction. The cooperative societies facilitated the way of farmers by providing them with the inputs like loan, fertilisers and seeds. Today, the dairy cooperatives have carved an exclusive identity in the country and abroad. If there has been the growth of sugar mills, credit committees along with dairy in Gujarat and Maharashtra, the southern states witnessed the growth of fisheries and forests based cooperatives.

The Agriculture Minister added that the National Cooperative Development Corporations provides assistance to the cooperatives for their overall development, which includes grants and loans from the Government. In Gujarat, financial assistance has been provided for the computerization of dairies, storage and cold storage cooperatives as well as sugar, textile and consumer cooperatives. Under these schemes, Rs.663.23 crore had been approved during the year 2014-2015, 2015-16 and 2016-17; and Rs.133.45 crore, Rs.272.97 crore and Rs.424.04 crore were released, respectively. Rs.15143.76 had been released by National Cooperative Development Cooperation during the three years (2011-14). On the other hand, the NDA Government increased this by 89.98% and released Rs.28117.31 crore during the three years (2014-17). The Minister called for the representatives of all cooperatives to seek assistance from different development programmes related to NCDC for the economic improvement of the cooperatives thus removing the regional imbalances.

ICAR set Target for Achieving the Goal of Doubling Farmer's Income

DARE/ICAR has developed 596 high yielding climate resilient crop varieties/ hybrids of field crops for cultivation in different agro-ecologies of the country during past 3 years. During 2016-17, a record 313 field crop varieties, 51 horticultural crop varieties, 51 new farm implements, 3 vaccines, 15 diagnostic kits and breeding technology for two new fish species were developed. Nutrient rich (zinc, iron, protein) varieties viz., DRR Dhan 45 (18.18 ppm Zinc) and CRR Dhan 310 (10.3% protein) of rice; WB-2 (42 PPM Zinc and 40 PPM Fe) and HPBW-01 (40.6 PPM Zinc and 40.6 Fe) of wheat, Pusa Mustard 30 (zero erucic acid) and Pusa Mustard 31 (Double zero) of Indian mustard had been developed. Rice variety IR-64 Drt-1 (DRR Dhan 42) resistant to drought and Samba Sub-1 tolerant to submergence had been developed. IPM 205-7 (Virat), an extra-early (52-55 days) maturing summer mungbean variety, first-of-its-kind globally, developed. Being short duration variety, it would help in increasing the cropping intensity and diversify the rice-wheat cropping system. Pusa Basmati 1609, Pusa Basmati 1509, Pusa Basmati 1637 and Pusa Basmati 1728 had been developed by using new biotechnological tools. ICAR also developed 51 new equipment/technologies/products and processes; 219 new prototypes for farm machinery/new farm implements; established 51 agro processing centres; and supplied 16500 units of multiplied prototypes, in the frontier areas of agricultural engineering with great potential to increase productivity, reduce cost of cultivation, reduce drudgery, improve value addition, conserve resources, provide alternate means for energy generation.

DARE/ ICAR has set targets, both for short and long term for complementing the efforts of the Govt. by providing technology back up for achieving the goal of doubling farmer's income. Targets for next 2 years include, evaluation of 20000 germplasm and breeding lines and

conservation of 4000 Germplasm for long term storage, conservation of 200 microbial genetic resources, to identify 30 genotypes and register for unique traits, clone and characterize 10 genes, testing 2000 entries in AICRP multi-location trials, identification of 40 varieties including pulses and oilseeds by AICRP varietal identification committees, production of 56000 quintal Breeder seed, developing and testing 25 new technologies, conducting 10000 front line demonstrations and organizing 220 farmers' trainings.

The horticulture sciences targets for next 2 years include, collection of 400 germplasms and characterization of 500 germplasms, development of 100 pre-breeding lines, Identification of 60 promising/elite breeding lines, release of 30 varieties/hybrids, standardization of 50 production technologies, organization of 155 frontline demonstrations, developing 167 modules for capacity building of farmers and other stakeholders, production of 2261 kg breeders/truthfully levelled seed, production of 2250 tonne breeders seed of tuber crops and production of 12.5 lakh quality planting materials and 5 lakh rooted cuttings.

Ensuring Minimum Support Price (MSP) to farmers

The Government ensures Minimum Support Price (MSP) through procurement operations undertaken by the Central, State and Cooperative agencies in the States. State Governments have been alerted from time to time to make adequate arrangements to ensure MSP to farmers.

Government offers to procure farmers' produce at MSP; however, they are free to sell it to Government agencies or in the open market as is advantageous to them.

In addition, Government has taken several steps to ensure MSP for all agricultural produce which, inter alia, includes setting up of procurement centre keeping in view the potential in the areas; creating awareness among the farmers of the MSP operations; making payment through arthias/co-operative societies to the farmers through A/c payee cheque/electronic mode as per prevailing situation in the states; encouraging decentralized procurement; adopting e-procurement system; engaging private players in certain States to participate in procurement operation etc.

To ensure remunerative price to farmers, the Government procured 38.65 million tonnes of rice, 22.93 million tonnes of wheat and 1.3 million tonnes of pulses during 2016-17 across various States.

Government has also launched a scheme developing a pan India electronic trading platform under 'National Agriculture Market' (NAM) aiming to integrate 585 regulated markets with the common e-market platform to ensure remunerative prices to the farmers. Each State is being encouraged to undertake three major reforms, namly, - allow electronic trading, have a single license valid throughout the State and a single entry point market fee. 455 markets in 13 States had already been brought on the e-NAM platform.

Farmers Welfare Schemes

Government of India is according high priority for welfare of the farmers and is implementing several farmers' welfare schemes to revitalize agriculture sector and to improve their economic conditions. The Government has rolled out a number of new initiatives like Soil Health Card Scheme, Neem Coated Urea, Paramparagat Krishi Vikas Yojana (PKVY), Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), National Agriculture Market (e-NAM), Pradhan Mantri Fasal Bima Yojana (PMFBY) and Interest Subvention Scheme. These schemes are for the benefit of all farmers. The details of the schemes are as below:

(i) Soil Health Card Scheme

Launched in 2015, the scheme has been introduced to assist State Governments to issue Soil Health Cards to all farmers in the country. The Soil Health Cards provide information to farmers on nutrient status of their soil alongwith recommendation on appropriate dosage of nutrients to be applied for improving soil health and its fertility.

As on 11.7.2017, against target of 253 lakh soil samples, all 253 lakh soil samples had been collected and 245 lakh (97%) samples had been tested. Against target of 12 crore Soil Health Cards, so far 9 crore (76%) cards had been distributed to farmers.

(ii) Neem Coated Urea (NCU)

This scheme has been promoted to regulate use of urea, enhance availability of nitrogen to the crop and reduce cost of fertilizer application. NCU slows down the release of fertilizer and makes it available to the crop in an effective manner. The entire quantity of domestically manufactured and imported urea is now neem coated. The reports from field are positive. The expected saving is 10% of urea consumption, thereby resulting in reduced cost of cultivation and improved soil health management.

(iii) Paramparagat Krishi Vikas Yojana (PKVY)

Paramparagat Krishi Vikas Yojana (PKVY) is being implemented with a view to promote organic farming in the country. This would improve soil health and organic matter content and increase net income of the farmer so as to realise premium prices. Under this scheme, an area of 5 lakh acre is targeted to be covered though 10,000 clusters of 50 acre each, from the year 2015-16 to 2017-18.

So far, 7208 clusters have been formed and remaining clusters would be formed during 2017-18.

(iv) Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)

Launched on 1st July, 2015 with the motto of 'Har Khet Ko Paani', the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) is being implemented to expand cultivated area with assured irrigation, reduce wastage of water and improve water use efficiency. PMKSY not only focuses on creating sources for assured irrigation, but also creating protective irrigation by harnessing rain water at micro level through 'Jal Sanchay' and 'Jal Sinchan'. Micro irrigation is also incentivized through subsidy to ensure 'Per drop-More crop'. The target under micro-irrigation for the year 2016-17 was 8 lakh ha. against which 8.39 lakh ha had been covered.

(v) National Agriculture Market (e-NAM)

The National Agriculture Market scheme (e-NAM) envisages initiation of e-marketing platform at national level and to support creation of infrastructure to enable e-marketing in 585 regulated markets across the country by March 2018. This innovative market process is revolutionizing agri markets by ensuring better price discovery, bringing in transparency and competition to enable farmers to get improved remuneration for their produce moving towards 'One Nation One Market'. A target of integrating 400 markets to e-NAM had been set for March, 2017 against which 455 markets in 13 States have been on boarded as on 30.6.2017. As on 2.7.2017, 47.95 lakh farmers and 91,500 traders have registered on e-NAM portal.

(vi) Pradhan Mantri Fasal Bima Yojana (PMFBY)/ Restructured Weather Based Crop Insurance Scheme (RWBCIS)

Pradhan Mantri Fasal Bima Yojana (PMFBY) & Restructured Weather Based Crop Insurance Scheme (RWBCIS) were launched from Kharif 2016 to provide comprehensive crop insurance coverage from pre-sowing to post harvest losses against non-preventable natural risks. These schemes are only risk mitigation tools available to farmers at extremely low premium rates payable by farmers at 2% for Kharif crops, 1.5% for Rabi Crop and 5% for annual commercial/horticultural crops. The balance of actuarial premium is shared by the Central and State Governments on 50: 50 basis. The schemes are voluntary for States and available in areas and crops that are notified by the State Governments. Further, the schemes are compulsory for loanee farmers and voluntary for non-loanee farmers.

During Kharif 2016 season, a total of 23 States implemented both PMFBY (21) and RWBCS (12) and during Rabi 2016-17, 24 States and 3 Union Territories implemented PMFBY (25) and RWBCIS (9). Overall coverage of both the schemes is 401.52 lakh farmers and 385 lakh ha. area insured for a sum of Rs. 133106 crore in Kharif 2016 and 172.67 lakh farmers and 195 lakh ha. area insured for a sum of Rs. 71696 crore during Rabi 2016-17 season.

(vii) Interest Subvention Scheme (ISS)

The Government provides interest subvention of 3% on short-term crop loans up to Rs.3.00 lakh. Presently, loan is available to farmers at an interest rate of 7% per annum, which gets reduced to 4% on prompt repayment. Further, under Interest Subvention Scheme 2016-17, in order to provide relief to the farmers on occurrence of natural calamities, the interest subvention of 2% shall continue to be available to banks for the first year on the restructured amount. In order to discourage distress sale by farmers and to encourage them to store their produce in warehouses against negotiable warehouse receipts, the benefit of interest subvention will be available to small and marginal farmers having Kisan Credit Card for a further period of upto six months post harvest on the same rate as available to crop loan.

Rs. 834.71 Crores had been Allocated for NFSM-Pulses

For the year 2017-18, an amount of Rs.1720.00 crores (Government of India Share) has been earmarked for National Food Security Mission (NFSM), out of which an amount of Rs.834.71 crores had been allocated, so far, for NFSM-Pulses to States for increasing the production of pulses in the country. An amount of Rs.169.28 crores has been released so far to States for implementation of the pulses programme.

In order to create awareness among the farming community with regard to cultivation of pulses, Government of India has been taking steps like organization of cluster/cropping system based demonstrations on latest crop production technology, cropping system based training, etc. through State Governments and Indian Council of Agricultural Research (ICAR). Besides, seed production of pulses through seed-hubs has also been taken up by ICAR Institutes/Krishi Vigyan Kendras (KVKs)/State Agricultural Universities (SAUs).

Step taken by the Government of increase the Country Production of Lychee

The details of lychee production in various states of the country during the last three years and the current year, State and rank-wise is given below.

Several steps that have been taken by the Government to increase the Country's production of fruits and vegetables including lychee are as under:

Mission for Integrated Development of Horticulture (MIDH), a Centrally Sponsored Scheme had been implemented during XII Plan w.e.f. 2014-15, for holistic growth of the horticulture sector covering

all the horticulture crops including fruits and vegetables.

The Mission envisages production and productivity improvement of horticulture crops including fruit and vegetable crops through increased coverage of area with improved cultivars, rejuvenation of senile orchards, protected cultivation, creation of water resources, adoption of Integrated Pest Management (IPM), Integrated Nutrient Management (INM), organic farming, including insitu generation of organic inputs. Capacity buildings of farmers and technicians are also provided for adopting improved technologies.

Details of related research and new schemes implemented by the Government are as under:

The Government of India, Ministry of Agriculture, Cooperation & Farmers welfare had established National Research Centre on Lychee at Muzaffarpur in 2001 which is taking care of research needs for improving production and productivity of litchi in the Country, along with monitoring and management of pests and diseases and development of protocol to reduce the post-harvest loss in lychee fruits.

The Centre in collaboration with AICRP-Fruits, is monitoring the location specific research on litchi in six states which are Sabour in Bihar, Mohanpur in West Bengal, Ranchi in Jharkhand and Firojpur in Punjab, Kodugu in Karnataka along with central monitoring of research activities from ICAR-NRC on Litchi, Muzaffarpur wherein the Director of the Centre is functioning as Crop Coordinator for Lychee. Additionally, the Govt. has also opened/in process of opening voluntary Centres of lychee research in Ambikapur (Chhattisgarh), Medjifema (Nagaland), Araku (Andhra Pradesh), Kangra (Himachal Pradesh).

For improvement in production, the ICAR-NRC on Litchi has developed protocol for Good Agricultural Practices and also imparting training and developing skills to various stakeholders for development of quality plant material and adopting Good Agricultural Practices.

The Centre is operating network project on management of fruit borers, National Training Programme on rejuvenation of litchi orchard, AICRP on Honey Bee for improvement in pollination, collaborative programme with BARC to enhance shelf life of litchi fruits and area expansion scheme in non-traditional and tribal regions which in turn will improve the production of litchi in different parts of the Country.

National Bamboo Mission renamed as National Agro-Forestry & Bamboo Mission (NABM)

National Bamboo Mission renamed as National Agro-Forestry & Bamboo Mission (NABM) is being implemented as per the set objectives and targets of the Mission. As per available reports 3,61,791 ha. area have been covered in forest & non-forest land, 91,715 ha. area taken up for improvement of existing stock for higher productivity (forest & non-forest areas) under the Mission against targets of 3,62,848 ha., 69,410 ha., respectively.

State-wise details of allocation and funds released during the last three years & current year under National Agro-forestry & Bamboo Mission (NABM) are given below.

Under the Mission, 108 nos. of markets (Bamboo wholesale & retail markets near villages, etc.) have been established for providing marketing avenues to bamboo farmers for their raw bamboo as well as finished products. Besides, efforts are being made to popularize bamboo products through participation in domestic/national/ international trade fairs.

Under the Mission, Steps have already been taken & are being taken to provide assistance to farmers/bamboo growers for nursery establishment, plantations in non-forest area, imparting training for preparation of nurseries & bamboo plantations, establishing of bamboo markets for farmer products, etc.

To Enable Farmers to get Maximum Yields at Lower Cost, Government Launched Ambitious Soil Health Card Scheme: Shri Radha Mohan Singh

Union Agriculture and Farmers Welfare Ministers, Shri Radha Mohan Singh said the growth of agriculture sector is being discussed for a long time, but for the first time since independence, the development work in agriculture sector along with the improvement in the economic condition of farmers have been accelerated at the grass root level. Shri Radha Mohan Singh said it here on 22nd July, 2017 at the Consultative Committee meeting. The agenda of the meeting was Soil Health Card (SHC).

Shri Singh said that it is the dream of the Hon'ble Prime Minister, Shri Narendra Modi to double the income of farmers by 2022 and make to farmers realise their significant contribution to the nation building. To achieve this goal, action on three pillars needs to be taken.

Shri Singh opined that for the first time a uniform soil specimen parameter has been adopted. In the irrigated areas, samples will be drawn on a grid of 2.5 ha. In rainfed areas, sampling will be done in a 10 ha. grid. GPS-based soil sample collection has been made mandatory to create a systematic database to monitor changes in soil and compare it to the previous years.

The Minister said uniform Soil Health Card norm is being adopted. Scientific soil health management practices are being adopted to provide soil test based fertiliser recommendations. In the first two years (205-17), 253 lakh soil samples have been collected till 25-7-2017 against the target of 253 lakh samples and 248 lakh samples (98%) have been tested. So far nine crore Soil Health Cards have been distributed to (75%) farmers as against the target of 12 crore cards.

Shri Singh informed that the scheme is not only reducing the cost of production, but also identification and utility of nutrients have also increased. During 2014-17, Rs.253.82 crore has been released for the scheme. Chemical fertilisers consumption dropped by 8 to 10 percent during the year 2016-17 as compared to 2015-16. Overall production increased by 10 to 12 percent.

Kharif Crop Sowing Crosses 791 Lakh Hectare Area

The total sown area as on 28th July 2017, as per reports received from States, stands at 791.34 lakh hectare as compared to 765.79 lakh hectare at this time last year.

It is reported that rice has been sown/transplanted in 216.23 lakh ha, pulses in 114.88 lakh ha, coarse cereals in 150.19 lakh ha, sugarcane in 49.15 lakh hectare and cotton in 111.55 lakh ha.

The details of the area covered so far and that covered during this time last year are given below:

(In lakh hectare)

Crop	Area sown in 2017-18	Area sown in 2016-17
Rice	216.23	211.20
Pulses	114.88	107.44
Coarse Cereals	150.19	145.40
Oilseeds	142.31	156.65
Sugarcane	49.15	45.22
Jute & Mesta	7.03	7.55
Cotton	111.55	92.33
Total	791.34	765.79

General Survey of Agriculture

Trends in Foodgrain Prices

During the month of June, 2017 the All India Index Number of Wholesale Price (2011-12=100) of food grains decreased by 0.90 percent from 144.8 in May, 2017 to 143.5 in June, 2017. The Wholesale Price Index (WPI) Number of cereals decreased by 0.42 percent from 143.2 to 142.6 and WPI of pulses decreased by 2.83 percent from 151.8 to 147.5 during the same period. The Wholesale Price Index Number of wheat decreased by 1.02 percent from 137.5 to 136.1 while WPI of paddy increased by 0.34 percent from 147.9 to 148.4 during the same period.

Weather, Rainfall and Reservoir Situation during July, 2017

Rainfall Situation

Cumulative Monsoon Season rainfall for the country as a whole during the period 01st June to 26th July, 2017 has been 5% higher 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 20% in North-West India, 13% in Central India but lower than LPA by 14% in South Peninsula and 5% in East & North East India. Out of total 36 meteorological Sub-divisions, 02 subdivisions received large excess rainfall, 05 subdivisions received excess rainfall, 26 subdivisions received normal rainfall and 03 Sub-divisions received deficient rainfall. Out of 631 districts for which rainfall data available, 61(10%) districts received large excess rainfall, 106(17%) received excess rainfall, 291(46%) received normal rainfall, 149(23%) districts received deficient rainfall and 24(4%) received large deficient 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 27th July, 2017) was 60.91 BCM as against 58.57 BCM on 27.07.2016 (last year) and 60.67 BCM of normal storage (average storage of last 10 years). Current year's storage is 104% of last year's storage and 100% of the normal storage.

Sowing Position during Kharif 2017

As per latest information available on sowing of crops, around 75% of the normal area under Kharif crops has been sown up to 28.07.2017. Total area sown under Kharif crops in the country has been reported to be 791.34 lakh hectares as compared to 765.79 lakh hectares in the corresponding period of last year. This year's area coverage so far is higher by 25.5 lakh ha. than the last year and 37.9 lakh ha. than the normal as on date. As compared to normal area as on date, total area coverage this year is higher by 14.9 lakh ha. under Urad, 8.8 lakh ha. under Moong, 4.5 lakh ha. under Arhar, 9.6 lakh ha. under Bajra, 2.4 lakh ha. under Maize, 1.9 lakh ha. Groundnut, 10.0 lakh ha. under Cotton and lower by 8.9 lakh ha. under Rice, 2.1 lakh ha. under Jowar and 7.5 lakh ha. under Soyabean. A statement indicating comparative position of area coverage under major crops as on 28.07.2017 during current Kharif season vis-a-vis the coverage during the corresponding period of last year is given in the following table..

All India Crop Situation - Kharif (2017-18) as on 28.07.2017

(In lakh hectares)

Crop Name	Normal Area for whole Kharif Season	Normal Area as on date	Area sown reported			Absolute Change over (+/-)	
			This Year 2017	% of Normal for whole season	Last Year 2016	Normal as on date	Last Year
Rice	395.94	226.10	216.23	54.6	211.20	-8.9	5.0
Jowar	23.45	16.14	14.02	59.8	16.15	-2.1	-2.1
Bajra	76.63	51.74	61.37	80.1	50.08	9.6	11.3
Maize	73.30	66.76	69.14	94.3	72.94	2.4	-3.8
Total Coarse Cereals	192.03	141.77	150.19	78.2	145.40	8.4	4.8
Total Cereals	588.01	366.87	366.42	62.3	356.60	-0.5	9.8
Tur	39.24	30.34	34.88	88.9	41.28	4.5	-6.4
Urad	24.79	19.43	34.38	138.7	25.43	14.9	8.9
Moong	23.41	18.81	27.58	117.8	27.07	8.8	0.5
Kulthi	2.40	0.27	0.20	8.3	0.45	-0.1	-0.3
Others	15.74	11.78	17.84	113.3	13.21	6.1	4.6
Total Pulses	105.58	80.63	114.88	108.8	107.44	34.2	7.4
Total Foodgrains	693.59	447.50	481.30	69.4	464.04	33.8	17.3
Groundnut	41.49	31.16	33.05	79.7	37.32	1.9	-4.3
Soyabean	110.33	103.20	95.66	86.7	106.66	-7.5	-11.0
Sunflower	2.29	1.05	1.12	48.8	1.27	0.1	-0.2
Sesamum	17.97	10.07	9.65	53.7	10.05	-0.4	-0.4
Nigerseed	2.92	0.39	0.43	14.7	0.31	0.0	0.1
Castorseed	11.84	1.66	2.41	20.3	1.04	0.7	1.4
Total Oilseeds	186.88	147.54	142.31	76.15	156.65	-5.2	-14.3
Cotton	122.45	101.55	111.55	91.1	92.33	10.0	19.2
Sugarcane	50.05	48.97	49.15	98.2	45.22	0.2	3.9
Jute & Mesta	8.39	7.92	7.03	83.7	7.55	-0.9	-0.5
All- Crops	1061.34	753.47	791.34	74.6	765.79	37.9	25.5

Source Crops & TMOP Divisions, DAC&FW

Note: Area figures are as per eye assessment of State Agriculture Departments.

Normal Area: 5 years average of the area during the period of 2011-12 to 2015-16.

Normal Area as on date: 5 years average of the area during the corresponding period of 2012-13 to 2016-17.

Economic Growth

As per the provisional estimates of national income, released by CSO on 31st May, 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 8.0 per cent in 2015-16 (Table 1).

The growth in Gross Value Added (GVA) at constant basic prices for the year 2016-17 is estimated at 6.6 per cent, as compared to 7.9 per cent in 2015-16. At the sectoral level, agriculture, industry and services sectors grew at the rate of 4.9 per cent, 5.6 per cent and 7.7 per cent respectively in 2016-17 (Table 1).

The share of total final consumption in GDP at current prices in 2016-17 is estimated at 70.4 per cent, as compared to 68.3 per cent in 2015-16. The fixed investment rate (ratio of gross fixed capital formation to GDP) declined from 29.3 per cent in 2015-16 to 27.1 per cent in 2016-17.

The saving rate (ratio of gross saving to GDP) for the year 2015-16 was 32.3 per cent, as compared to 33.1 per cent in 2014-15. The investment rate (rate of gross capital formation to GDP) in 2015-16 was 33.3 per cent, as compared to 34.4 per cent in 2014-15.

Agriculture and Food Management

Rainfall: The cumulative South West Monsoon rainfall received for the country as a whole during the period 1st June - 23rd July 2017, has been 3 per cent above normal. The actual rainfall received during this period has been 387.8 mm as against the normal at 376.3 mm. Out of the total 36 meteorological subdivisions, 2 subdivisions received large excess rainfall, 5 subdivisions received excess rainfall, 26 subdivisions received normal rainfall, and 3 subdivisions received deficient rainfall.

All India production of food grains: As per the 3rd Advance Estimates released by Ministry of Agriculture & Farmers Welfare on 9th May 2017, production of foodgrains during 2016-17 is estimated at 273.4 million tonnes as compared to 251.6 million tonnes in 2015-16 (Table 3).

Procurement of rice as on 3rd July 2017 was 38.6 million tonnes during kharif marketing season 2016-17 whereas procurement of wheat was 30.8 million tonnes during rabi marketing season 2017-18 (Table 4).

Off-take: Offtake of rice during the month of May 2017 was 28.4 lakh tonnes. This comprises 27.1 lakh tonnes under TPDS/NFSA and 1.3 lakh tonnes under other schemes. In respect of wheat, the total offtake was 20.5 lakh tonnes comprising 20.1 lakh tonnes under TPDS/ NFSA and 0.5 lakh tonnes under other schemes.The cumulative offtake of foodgrains during 2016-17 is 61.9 million tonnes (Table 5).

Stocks: Stocks of foodgrains (rice and wheat) held by FCI as on 1st July 2017 was 58.7 million tonnes, as compared to 54.8 million tonnes as on 1st July 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	2015-16	2016-17 PE	2014-15	2015-16	2016-17 PE
Agriculture, forestry & fishing	-0.2	0.7	4.9	16.5	15.4	15.2
Industry	7.5	8.8	5.6	31.2	31.5	31.2
Mining & quarrying	11.7	10.5	1.8	3.0	3.1	3.0
Manufacturing	8.3	10.8	7.9	17.4	17.8	18.1
Electricity, gas, water supply & other utility services Construction Services	7.1	5.0	7.2	2.2	2.1	2.2
Construction	4.7	5.0	1.7	8.6	8.4	8.0
Services	9.7	9.7	7.7	52.2	53.1	53.7
Trade, Hotel, Transport Storage	9.0	10.5	7.8	18.5	19.0	19.2
Financial, real estate & prof services	11.1	10.8	5.7	21.4	21.9	21.7
Public Administration, defence and other services	8.1	6.9	11.3	12.4	12.2	12.8
GVA at basic prices	7.2	7.9	6.6	100.0	100.0	100.0
GDP	7.5	8.0	7.1	--	---	---

Source: Central Statistics Office (CSO). PE: as per provisional Estimatesof GDP released on 31st May 2017.

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

Sectors	2015-16				2016-17			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Agriculture, forestry & fishing	2.4	2.3	-2.1	1.5	2.5	4.1	6.9	5.2
Industry	7.3	7.1	10.3	10.3	7.4	5.9	6.2	3.1
Mining & quarrying	8.3	12.2	11.7	10.5	-0.9	-1.3	1.9	6.4
Manufacturing	8.2	9.3	13.2	12.7	10.7	7.7	8.2	5.3
Electricity, gas, water supply & other utility services	2.8	5.7	4.0	7.6	10.3	5.1	7.4	6.1
Construction	6.2	1.6	6.0	6.0	3.1	4.3	3.4	-3.7
Services	9.3	10.1	9.6	10.0	9.0	7.8	6.9	7.2
Trade, hotels, transport, communication and services related to broadcasting	10.3	8.3	10.1	12.8	8.9	7.7	8.3	6.5
Financial, real estate & professional services	10.1	13.0	10.5	9.0	9.4	7.0	3.3	2.2
Public administration, defence and Other Services	6.2	7.2	7.5	6.7	8.6	9.5	10.3	17.0
GVA at Basic Price	7.6	8.2	7.3	8.7	7.6	6.8	6.7	5.6
GDP at market prices	7.6	8.0	7.2	9.1	7.9	7.5	7.0	6.1

Source: Central Statistics Office (CSO).

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

Crops	Production (in Million Tonnes)				
	2012-13	2013-14	2014-15	2015-16 (Final)	2016-17 (3rd AE)
Total Foodgrains	257.1	265.0	252.0	251.6	273.4
Rice	105.2	106.7	105.5	104.4	109.2
Wheat	93.5	95.9	86.5	92.3	97.4
Total Coarse Cereals	40.0	43.3	42.9	38.5	44.4
Total Pulses	18.3	19.3	17.2	16.4	22.4
Total Oilseeds	30.9	32.8	27.5	25.3	32.5
Sugarcane	341.2	352.1	362.3	348.4	306.0
Cotton#	34.2	35.9	34.8	30.0	32.6

Source: DES, DAC&FW, M/o Agriculture & Farmers Welfare, 3rd AE, 3rd Advance Estimates, # Million bales of 170 kgs. each.

TABLE 4: PROCUREMENT OF CROPS (MILLION TONNES)

Crops	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Rice#	35.0	34.0	31.8	32.0	34.2	38.6$	0.0
Wheat@	28.3	38.2	25.1	28.0	28.1	23.0	30.8$
Total	63.3	72.2	56.9	60.2	62.3	61.5	30.8

Kharif Marketing Season (October-September), @ Rabi Marketing Season (April-March,), $ Position as on 03.07.2017
Source: FCI and DFPD, M/o Consumer Affairs and Public Distribution.

Table 5: OFF-TAKE OF FOODGRAINS (MILLION TONNES)

Crops	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18*
Rice	32.6	29.2	30.7	31.8	32.8	8.5
Wheat	33.2	30.6	25.2	31.8	29.1	5.7
Total (Rice & Wheat)	65.8	59.8	55.9	63.6	61.9	14.2

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

TABLE 6: STOCKS OF FOODGRAINS (MILLION TONNES)

Crops	July 1, 2016	July 1, 2017
1. Rice	19.4	21.0
2. Unmilled Paddy #	7.8	8.1
3. Converted Unmiled Paddy in terms of Rice	5.2	5.4
4. Wheat	30.2	32.3
Total (Rice & Wheat) (1+3+4)	54.8	58.7

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

Articles

Farm based Adaptation Measures to Combat Climate Change Impacts on Agriculture: An Empirical Investigation of Chambal Basin

Dr. Ganesh Kawadia* and Ms. Era Tiwari**

Abstract

The study aims to empirically investigate the adaptation measures adopted by the farmers in the catchment area of River Chambal also known as Chambal basin with respect to changing climate in the region. It specifically tries to analyse how farmers in the region are coping with the effects caused due to climate-change by changing their agricultural practices. Detailed irrigation profiles of the farmers have been traced in the study in this regard. Sampling survey method of investigation has been used in the study. Four representative districts of Indore, Dewas, Neemuch and Mandsaur have been selected by using control sampling and a representative sample of 470 farmers was finally selected from 28 villages of these districts through stratified snowball sampling techniques in the agricultural year 2014-2015. Descriptive statistics and Case Study methods have been used for results and analysis. The paper also presents the context of maladaptation of soyabean and wheat based monoculture in the region and severe ground water depletion associated with this practice in recent decades. The study concludes that water harvesting is the most important adaptation measure used by the farmers of the region followed by crop diversification along with soil conservation, changing planting dates and increased plantation. The study directs suggests to strengthen water-harvesting measures in the study region to facilitate adaptation measures to cope with effects of changing climate on the agricultural sector of the region.

Key Words - Climate-Change, Agriculture, Adaptation, Farmers, Maladaptation, Survey, Case Study, Water Harvesting, Crop Diversification, Empirical

Introduction

Climate change is confirmed by a global scientific consensus and the catchment area of river Chambal or Chambal basin is no exception to it. The real challenge of climate change is not to produce a world without it, but to sustain ourselves despite it, i.e., to get adapted with the climate-change. Adaptation is a process of adjustment to actual or expected climate-change and its effects. In human systems, adaptation seeks to moderate or avoid harmful activities and exploit beneficial opportunities. Adaptations takes place at all levels from changes in global systems to changes at national and regional levels through adaptations made by local communities and individuals. The development of adaptation strategies need to recognise the appropriate mix of actions at different levels.

Agriculture is one of the most important sectors to be severely impacted by climate change and thus an enquiry into the adaptation measures in this sector in relation to climate-change is a must. It is all the more significant to be carried out on a regional basis as regional climate has its own peculiarities which leads to significant alteration in crop selection and irrigation-management at the most basic level. This study is an attempt to fulfill this objective in the Chambal basin which has faced significant climatic and related cropping pattern changes in recent decades in the aftermath of construction of Gandhi Sagar Dam on River Chambal.

Adaptation to Climate Change in Agriculture: A Review of Literature

Agriculture is inherently sensitive to climatic conditions, and is among the most vulnerable sectors to the risks and impacts of global climate change. (Parry et al. 1989) (Reilly et al. 1999). Studies show that without adaptation, climate change is generally problematic for agricultural production and for agricultural economies and communities; but with adaptation, vulnerability can be reduced and there are numerous opportunities to be realised (Rosenzweig et al. 1994) (Mendelsohn, 1998)

Farmers generally adapt swiftly in order to averse their losses in the agricultural production process. The adaptation of different farm level practices (changing the sowing dates, adopting different crop varieties and improving water supply) was used to reduce the adverse impacts of climate change on Indian agriculture (Kumar et al. 2001). Adaptation measures could be simple ones like shifting planting calendars or changing crops, or more costly ones like investing in protective infrastructures such

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as damming rivers to provide assured water supply for irrigation. Farm level resource management innovations such as the development of irrigated drainage systems, land contouring, reservoirs and recharge areas, and alternative tillage systems are also used to minimise the impact of climate change on agriculture (Easterling, 1996).

About the Study Area

The study area considered here is the Catchment Area of River Chambal lying in the state of Madhya Pradesh. Catchment area is the entire geographical area drained by a river and its tributaries; an area characterized by all run-off being conveyed to the same outlet. It is also known as catchment basin, drainage area or drainage basin. River Chambal, a principal tributary of river Yamuna, originates in the Vindhyan ranges near Mhow in Indore District of Madhya Pradesh. The river flows through the states of Madhya Pradesh, Rajasthan and Uttar Pradesh. The basin is roughly rectangular in shape, with a maximum length of 560 km in a northeast- southwest direction. Broadly, the catchment area of river Chambal may be termed as Malwa region. It located in the South-Western part of the Madhya-Pradesh and generally slopes towards the North. It is spreads across 45,628 square Kms. Region mainly covers is the districts of Indore, Dewas, Ujjain, Dhar, Mandsaur, Ratlam, Neemuch and Shajapur. Rainfed farming is the traditional practice with cultivation of grains, pulses (moong, blackgram and pigeonpea) and groundnut. In Rabi season, wheat and gram are cultivated mostly under irrigated condition. The natural vegetation comprises of tropical dry and moist deciduous forests. However, rich farmers grow rice, wheat and gram and, sometimes cotton using irrigation facilities.

The catchment area of river Chambal is the severely affected area due to the climate change. This area was once known for its good climate and also for abundant water and employment opportunities 'pag pag roti dag dag neer'. The area is now facing severe water shortage and extreme weather conditions (Gupta et al. 2003). Most of the agriculture is rainfed and the region does not possess adequate mechanism for the use of surface water for agriculture. As a result; farmers are forced to exploit ground water for the domestic as well as for agricultural purposes. No proper facilities have been developed to recharge the ground water. The river has become the source of water exporting to the nearby states. This has created the conditions of deforestation and desertification of the area. Water withdrawal from the ground is much more than the recharge (Gupta, et al. 2007). The area thus presents a good case study for the adaptation practices to fight against the adverse impact of climate change.

Objectives of the Study

1. To present an overview of the adaptation measures adopted by the farmers to cope with changing climate in the study-region.
2. To trace detailed irrigation-profile of the farmers of the region.
3. To discuss about the maladaptation in the study-region and its implications for the region as a whole.
4. To present actual experiences of the farmers about various adaptation measures in relation to changing climate in the region with the help of selected case studies.
5. To direct policy with respect to strengthening of specific adaptation practices in the study-region.

Research Methodology

The study has followed a sampling survey method for investigation. Out of the eight districts of the catchment area of River Chambal; Indore, Dewas, Mandsaur and Neemuch districts were selected following the control sampling. Expert advice was sought to ensure that these four districts gave adequate representation to the different agro climatic and farming systems in the study region. A representative sample of 470 farmers was finally selected from 28 villages of these districts through stratified snowball sampling techniques in the agricultural year 2014-2015. The farm household survey was conducted in two steps, viz. a field pretest and actual data collection. Enumerators conversant with local language and traditions in the study area were engaged to conduct the field survey. Each survey schedule had seventy questions in it. In this study; farm household was the unit of analysis. The study makes use of descriptive statistics and case study method for analysis and presentation of results.

Results and Analysis: Adaptation Strategies in the Chambal Basin

Farm level adaptation is pivotal in translating climatic challenges and agricultural responses into changes in production, prices, food supply, and welfare. Farmers maximise net revenue or the value of their land by choosing farm type (rainfed, irrigated, etc.) or cropping and livestock mixes.

Chambal basin is an area which is currently dependent primarily on rain-fed agriculture and is suffering from continuously declining ground water level in the area. With climate change, pressure on available water resources for irrigation requirements has increased manifold. Improved water management is thus one of the most important long-term adaptation as well as protection options that region must pursue. A wide range of adaptation measures have been highlighted in this regard like

improving water distribution strategies; changing crop and irrigation schedules; using rainwater more effectively; water recycling and the conjunctive use of groundwater. In this respect, some major strategies were identified from the literature. These are: (i) Planting Trees (ii) Soil Conservation (iii) Different Crop Varieties (iv) Early and Late Planting / Changing Plant Dates (v) Water Harvesting / Improved Water Management.

The farmers were thus inquired about their chosen adaptation strategy to protect crop against climate-change. Table 1 explains various adaptation practices used by the farmers of the region. They are not mutually exclusive as farmers are practicing multiple adaptations techniques simultaneously as per their suitability.

TABLE 1.DISTRIBUTION OF SAMPLE FARMERS AS PER THEIR ADAPTATION STRATEGIES TO FIGHT CLIMATE CHANGE

Adaptation strategies	Number of Farmers
Water Harvesting	395(84.02)
Irrigation Management	272(57.87)
Early and late planting	205(43.62)
Planting trees	119(25.32)
Different Crop Varieties	114(24.25)
Soil conservation	61(12.98)
No Adaptation	16(3.40)

Note - Figures in the parentheses show percentages calculated from the total sample of 470 farmers.

Water Harvesting / Improved Water Management

Water harvesting emerges to be the most popular adaptation strategy among the farmers of Chambal basin. It is adopted by 84 percent of the sampled farmers. It has specifically become popular since the launch of ambitious schemes like Khet Talab yojana and Balram Taal yojana. Water harvesting can be defined as a range of techniques for collecting and concentrating precipitation. Water harvesting is economically beneficial for local farmers because it is the only feasible method of farming for degraded land lacking irrigation water. It is also significant as a sustained source of irrigation for Rabi crops. Furthermore, it helps significantly in the recharge of groundwater resources of the region, adds greenery and in this way, acts as a positive externality towards the overall ecology.

Irrigation Management

Improving the use of irrigation is generally perceived as an effective means of smoothing out yield volatility in rainfed systems. It has the potential to improve agricultural productivity through supplementing rainwater during dry spells and lengthening the growing season (Orindi et al. 2005). Overall, improving the use of irrigation aids to avert the crop losses in areas subjected to recurrent cycle of drought.

Around 58 percent of the sample farmers have used this method to fight against the climate change. The farmers of the region are using plastic pipes for transporting water from the source of supply to the farm. They are also using sprinkler facilities to get the maximum advantage from the available water. The government subsidy programmes for proper water management has played a major role in developing best practices of water usages (Orindi et al. 2005).

Early and Late Planting / Changing Plant Dates

Altering the length of the growing period and varying planting and harvesting dates are among the crop management practices that can be used in agriculture (Orindi et al. 2005). This includes early and late planting options as a strategy to fight harmful effects of changing climate. The strategy helps to protect sensitive growth stages by managing the crops to ensure that these critical stages do not coincide with very harsh climatic conditions such as mid-season droughts. Early and Late planting comes third in the sequence of importance among major adaptation strategies with a support of 44 percent of the total farmers. Malwa region is now strictly following a Soybean-Wheat based annual crop cycle. As Soybean is a Kharif crop and its growth cycle is strictly regulated by rainfall; hence changes in precipitation cycle certainly changes its sowing and harvesting dates for the farmers. For example, many farmers have started opting now for the 95-60 Soybean varieties instead of the regular variety of soybean planted earlier. Wheat can be sown only after the harvesting of Soybean in Rabi season; so it's planting dates also change accordingly. Farmers are practicing early sowing date and quicker maturing variety of soybean so that they can use the moisture of the rainy session of their farms for the next crop like wheat, gram, mustered and other crops of Rabi sessions. The monsoon season of the region normally extends up to the end of the September or some time to the early October. This provides enough moisture for the cultivation of the next crop. This has not only increased the cropping intensity but made the Malwa the bowl of wheat and soybean.

Plantation

Planting trees or a forestation in general provides a particular example of a set of adaptation practices that are intended to enhance productivity in a way that often contributes to climate change mitigation through enhanced carbon sequestration. It also has a role to play in strengthening the system's ability to cope with adverse impacts of changing climate conditions. It also acts as temperature stabilization in the region. The farmers of the region thus have used plantation particularly at the side of the pond used for water harvesting. Almost 25 percent of the sampled farmers have used plantation as a method to protect against the climate change. This has increased the degree of vegetation and intensity of plants in the area.

Crop Diversification Varieties

Switching over to early maturing crop varieties and increasing diversification by planting crops that are drought tolerant and/or resistant to temperature stresses serves as an important form of insurance against rainfall fluctuations (Orindi et al. 2005). It has been supported by evidence that growing different crop varieties on the same plot or on different plots reduces the risk of complete crop failure as different crops are affected differently by climate events, and this in turn gives some minimum assured returns for livelihood security. The pattern of crop diversification and its emerging trends in the Malwa region have already been discussed in detail in a previous section. In the survey; approximately 24 percent of the farmers favoured adoption of different crop varieties and 25 percent support planting of trees in their fields as an essential strategy to ward-off negative impacts of climate-change. Farmers from Harnawada village in Dewas district succinctly mention that the only way to ensure sustained production in the wake of climate-change, it is a must to have a pond in the field to capture rainwater and to plant trees in the field.

Soil Conservation

The adoption of practices and technologies that enhance vegetative soil coverage and control soil erosion are crucial to ensuring greater resilience of production systems to increase rainfall events, extend intervals between rainfall events, and to potential soil loss from extreme climate events. Improving soil management and conservation techniques assist to restore the soil while also capturing soil carbon and limiting the oxidation of organic matter in the soil. Soil conservation automatically gets ensured by following all the above mentioned strategies; hence soil conservation issue was highlighted by only around 13 percent of the sample farmers. Only a miniscule (3 percent) number of the farmers said that they are not going for any specific adaptation strategy. This makes it clear that almost all the farmers of Chambal basin are aware of negative impact of climate change on production trends and therefore are taking appropriate steps to get adapted for the same.

Maladaptation: Soybean and Wheat based Monoculture

A 'maladaptation' is basically a trait that is (or has become) more harmful than helpful, in contrast with adaptation, which is more helpful than harmful. So, adoption of practices in the farming, which though have increased farmers' production and income in the short run but can become a severe danger in the long run if it is continued to be unabated; can be effectively called as maladaptation. One such maladaptation in Malwa region is 'monoculture'. Monoculture is the practice of producing a single crop over a long period of time in a certain area. The practice of monoculture usually gets stimulated by political and economic incentives. Specialisation brings obvious benefits to the economy of scale in terms of higher yields and easier mechanisation techniques; however, there are disadvantages associated with monocultures. Monocultures lead to easier spread of diseases and pests thereby decreasing resilience to climate-change variability that often induces additional stress on plants. In addition, when the produced crop is negatively affected by changing weather or biophysical conditions, farm income may be severely affected. For these reasons, moving towards diversification reduces the risks of maladaptation (Lin, 2011)

Malwa region is a classic text-book example of such kind of monoculture. Since 1980's, the area has become a specialised zone of soybean-wheat annual cycle based production. Soybean plants usually grow at ambient temperatures between 15°C and 27°C although temperature below 21°C and above 32 °C may reduce flowering. Temperatures exceeding 40°C (104°F) are detrimental to seed production. Soybeans are adapted to grow in a wide range of soils and climates but require adequate soil moisture for germination and seedling establishment. Soybean has flourished well in the Malwa region with many growth conditions getting satisfied simultaneously.

The soybean success story has caught headlines not only at regional but also at national level. Malwa has practically given up on production of crops like Maize, Sugarcane and especially cotton after soybean experiment went successful. However, it needs to be considered that this specialisation has reduced crop-diversification in the region as well as it has been sustained by continuous groundwater exploitation. Since the 1980's, Malwa region has become increasingly tube-well dependent to sustain its crop-cycle. During survey, it came out that villages like Jalodiya, Panth in Depalpur Tehseel of Indore district have as much as 500-600 tube wells with a depth ranging from 250 to 500 feet. The whole region is sustaining on irrigation from groundwater resources and in recent times it is suffering from severe water shortage not only for irrigation but also for drinking purposes due to its fast depletion.

Hence the survival of this crop-cycle suffers a serious threat. The maladaptation thus needs to be balanced by another suitable adaptation of any sort which may ensure sustained water supply to the field. The soybean-wheat annual cycle faces of elimination by widespread pest and disease attack aroused due to vagaries of climate-change. Many farmers from the survey corroborated to such incidences. Parmaran Ramcharan from Dhaturiya Village in Dewas district puts it that Soybean in recent times has suffered from severe Caterpillar attack and Fungal attack. Soybean crop has also suffered severely due to acute

shortage of rainfall during growing stage. This has been coupled with rise of temperatures much more than 32°C and many times crossing 40°C, the crop growth gets severely affected. The cause of rust is fungus. Rust development is favoured by warm temperatures and periods of high humidity. Finally, Soybean gets totally destroyed in case of untimely torrential rains and this is known as 'jal jaana' in local language, as farmers from Dhaturiya village, Dewas district puts it. Thus, both extreme drought conditions with high temperatures as well as torrential excessive rains are harming the crop severely.

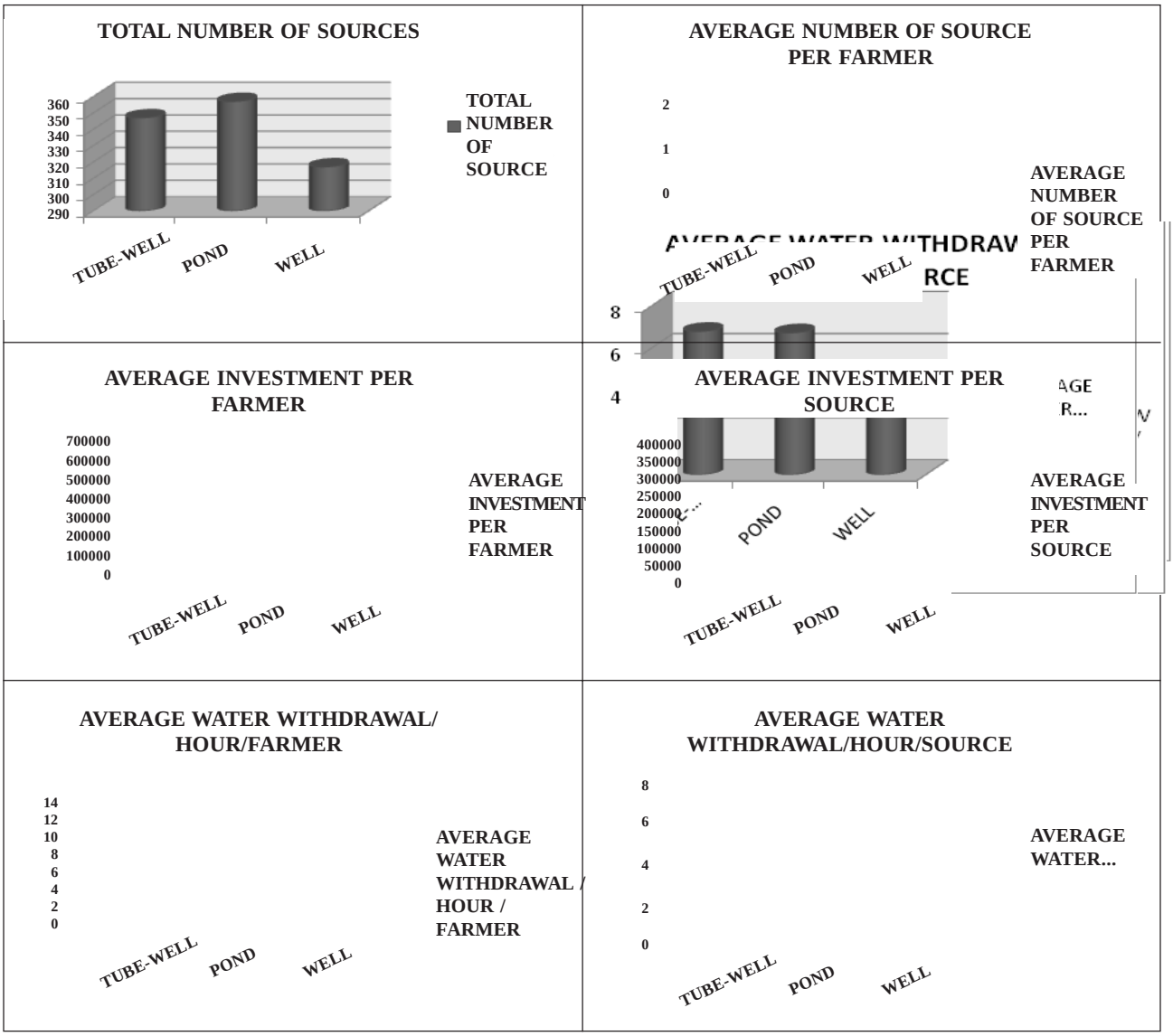
Irrigation Profile of the Farmers

The beneficial adaptation to fight with these problems is to work on an optimum irrigation and better rainwater harvesting facilities. In this study, emphasis was laid on knowing the irrigation profile of surveyed farmers as a whole with respect to irrigation sources of tube-well, pond and well. This has been shown in Table 2 and Figure 1 (all parts).

TABLE 2.PROPORTION OF SAMPLE FARMERS AS PER THEIR IRRIGATION SOURCES

Source of irrigation	Tube-well	Pond	Well
Number of farmers	177 (37.66)	307(65.32)	219 (46.60)
Total number of source	347	357	317
Average number of source per farmer	1.96	1.16	1.45
Average investment per source	220288.18	263674.35	385063.09
Average investment per farmer	441849.71	299003.27	610325.00
Average water withdrawal/ hour per source	6.81	6.74	4.42
Average water withdrawal/ hour per farmer	13.74	6.81	6.48

FIGURE 1.BAR GRAPH BASED REPRESENTATION OF IRRIGATION PROFILE OF FARMERS



A majority of farmers are using pond as their major mode of irrigation (65 percent) followed by well (47 percent) and tube-well (25 percent). This shows that importance and usage of ponds has greatly accelerated in recent times and has reduced farmers' dependence on ground water resources. Thus, rain water harvesting as an adaptation has lived up to the expectations of the farmer. In the words of farmers from Harnawada village in Dewas district; since the ponds have been constructed in the village on the fields of the farmers, they have performed symbolic death ceremony of the tube-well - "we have performed antyeshthi of the tube-well as well as its pagdi rasm." So, villagers testify their reduction of dependence on the tube-wells since the adoption of rain-water harvesting techniques. The technique has helped significantly in retaining moisture in the fields. The table 2 clearly indicates that rainwater harvesting is not only ecologically beneficial but also cost effective in terms of per unit water withdrawal and its irrigation capacity.

Tracing Farmers' Responses on Effectiveness of Varied Adaptations (Case Studies)

The farmers of Indore district are main beneficiaries of recently launched Balram Taal yojana. Villages like Semaliya, Raimal and Kampel can be noted as example villages for excellent work of water harvesting. Yashwant Patel from Semaliya Raimal underlines its importance by saying that it has helped in maintaining stock of water in fields, it has enhanced profits significantly, fulfils our irrigation needs and is really a profitable venture. Krishnapal Singh Daangi from the same village added a new dimension to the benefits received from rain water harvesting by stating that it has made him self-dependent as production has increased by leaps and bounds. Vishnu Daangi has thrown light on the fact that this is an area with soil full of stones; hence even if precipitation is abundant, tubewell-recharge is not possible. In such situations, technique of rain water harvesting is really a blessing. Dilip Patel states that because of water-harvesting he has stopped borrowing for agricultural needs as it has made taking two-three crops in year possible and is thus increasing his total income. Finally; Kansingh Daangi sums up the spill over benefits of water harvesting in every arena of his life by saying that the venture has been profitable to him, he has made his own pakka house and now his kids are going to good schools for education.

Shadadev is a village adjacent to Semaliya Raimal and farmers like Pawan Singh over there describe that the advantages of water harvesting had been even beyond the scope of their imagination. He says that there has been no permission of irrigation from the River Shipra. So, before adoption of water harvesting they were compelled to do irrigation from taking water directly from Shipra. It even led to fine of Rs.20, 000 to Rs. 25,000 to them. But, now the situation is so favourable and they do not have to resort to any illegal activity. The experiences from Kampel village have also been on the similar lines. Sunil Nimadia states that it does not lead to wastage of water and nearby tubewells of the area gets easily recharged. Other villages of Indore district where water harvesting has been carried out substantially are Paaliya, Faraspur, Rawad, Balodatakun, Atawada, Nevary, Matabarodi and Kadwaali Bujurg. The responses of the farmers have been on similar lines here with reporting of increased water-level, tubewell recharge, less dependence on precipitation, greater area under production, sustained irrigation facility for Rabi crops and last but not the least, upliftment of socio-economic status with better educational facilities for their children.

Villagers from some other villages of Indore district have given responses with respect to other adaptation options. Arjun Singh from Pedmi village explains that in his area Kumbi, Beed are big Naalas but there is no dam on them. If stop dams are made on them, wastage of water could get minimised. Mahendra Singh Chouhan from Mhowgoan village gives an overview of different adaptation measures by saying that adaptation in essence is a long-term process with so many benefits. It includes a wide range of measures like plantation, construction of ponds, soil conservation, soil testing, save water campaign etc. These would contribute to farming as well as to environment.

Dewas district is a pioneer district in terms of carrying out of water harvesting activities in the Chambal basin. Tonk Khurd Tehseel is world famous for the ponds being constructed here under ambitious Khet Talab or Rewa Sagar yojana. Jujhaar Singh Tomar from Harnawada village states that there has been a great increase in the yield of wheat and gram in the area along with a substantial increase in greenery in the vicinity since the practice of rain water harvesting began. He suggests more investment in water harvesting along with planting of trees. Forak Singh Tomar from the same village urge that Government should increase subsidy on construction of pond in the field from eighty thousand to two lakhs. Mansigh Tomar states that there has been 200 percent increase in production in his field due to rainwater harvesting. All the farmers state that plantation of trees in their fields as the next major adaptation measure after rainwater harvesting. Sheshnarayan Patel from Gorwa village states that his production has got doubled. Water harvesting is extremely important for water conservation and ecology. Varied types of animals and plants are now habituating in the village. Deers are now easily visible in the area. Vishnu from the same village has emphasised on Soil Conservation along with Water harvesting activities. Uday Singh Khiswi from the same village emphasises that now there is a desire in him to do hard-work. Water harvesting has made it possible

to expect sure returns from farming. He further says that Government should ban deep tube-wells in the area and encourage construction of ponds instead.

The districts of Mandsaur and Neemuch are in the vicinity of dams like Gandhi Sagar and Retam Barrage. Substantial amount of work in water harvesting and well-recharge activities have been done here. Villages of Kachnara, Borkhedi and Haripura were covered in Mandsaur district. Gobar Singh from Kachnara states that the water stored in pond through rainwater harvesting, is further used for well-recharge. He also says that he has planted many trees in his field to minimise pollution due to increased number of vehicles. Kishan Singh says that through well-recharge, there has been an additional production of fruits like Mangoes, Papaya and Pomegranate in his fields. Madho Singh Borona from the same village emphasises that the crop yield has been better due to water harvesting. He suggested that water can be transferred from one dam to another as well as linkage of canals can be carried out. Earlier, the region was continuously under droughts. Now, the farmers are also prosperous while earlier they used to work in the capacity as dihaadi majdoor i.e. daily wage labourers. The farmers from Borkhedi also told a similar story. Kamal Singh Shamsawat from the village state that production has increased up to a great extent. Three crops in a year have now become possible. Under Kapildhara scheme, 28 wells have been constructed and all farmers have been provided Kisan Credit Cards. With the construction of Retam Barrage in the year 2000, farmers have benefited up to a great extent. The water supply is now ensured with fee charges on the basis of hectare. He also emphasised on Soil Conservation as a major adaptation measure in saving agriculture from the harmful impacts of climate-change. Hiralal Ojha and Deepsingh Sattawat also cited the advantage of building dam and informed that they have started sugarcane farming because of it. They have also started cultivating coriander. They also supported soil conservation and plantation of trees. Ramcharan Rewari from Haripura have said that water harvesting has considerably increased his basket of production which now includes crops like wheat, coriander, gram, isabgol, flaxseed, mustard, fenugreek etc. He supported soil conservation and proper soil testing as the major method of adaptation apart from water harvesting and implementation of new and improved methods of irrigation.

Lastly, an overview of the district of Neemuch can be traced with respect to efficacy of varied adaptation measure. The villages covered here include Barlai, Hatunia, and Pipliya Ghota. Rahul Patidar from Barlai state that the formers now have an orange orchard of his own due to water harvesting. He also favoured plantation of trees as an adaptation measure. Vishnu Prasad Patidar has said that he is raising a variety of crops like orange, garlic, wheat, coriander and fenugreek only because of water harvesting. Shambhulal Patidaar emphasised that one pond is giving him a benefit of at least four lakh rupees per annum. He emphasised organic farming and plantation of trees as an adaptation measure.

In the village of Hatunia, there are around 280-300 ponds. Here, tubewell and hand-pumps are not successful. Farmers are engaged in agricultural activities only because of water harvesting. Satyanarayan from this village supports construction of more ponds as well as plantation of trees as the main adaptation measure to sustain in the face of climate change. Villagers from Pipliya Ghota also support mainly water harvesting and enhancement of subsidy. For that, plantation of trees and soil conservation are their adaptation measures to cope with changing climate.

Conclusions and Policy Implications

Adaptations to climate change impacts in general, and in agricultural sector in particular, is not a new phenomenon. Natural and socio-economic systems have continuously been adopting autonomously or in accordance with a plan, to a changing environment throughout history. Adaptation to climate-change and variability (including extreme events) at the national and local levels is regarded as a pragmatic strategy to strengthen capacity to lessen the magnitude of climate change impacts that are already occurring and could increase gradually (or suddenly), and may be irreversible. Adaptation can be anticipatory, where systems adjust before the initial impacts take place, or it can be reactive, where change is introduced in response to the onset of impacts.

From the responses, this study considers crop diversification; changing plant dates; soil conservation and soil testing; increasing rain water capture, construction of stop dams on nalaas and planting trees as the major adaptation strategies farmers perceive as appropriate for rain-fed agriculture. Water Harvesting came out to be the most important adaptation measure followed by Crop Diversification. It also became clear from the survey of farmers that adaptation measures to climate change cannot be considered in isolation, but relative to the impacts of other exogenous sectoral changes. In short, the key lesson that emerges is that the prioritisation of appropriate adaptation measures needs to be contextual and fit the capacity of local institutional and legal frameworks. Water harvesting measures thus, should be especially strengthened by the policy in the study region to cope with changing climate and its effects on the agricultural sector.

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Comparative Study on Cost of Cultivation and Economic Returns from Major Crops in Eastern Region of Uttar Pradesh

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Abstract

An investigation was made to work out the, cost of production, cost of cultivation, returns and profitability from sugarcane, wheat and paddy crops to identify which crop is more profitable and economical for the farmers of Uttar Pradesh. On an average, the cost of production was Rs.78.29 per quintal and the net return per hectare after subtracting total cost (Cost C3) from gross return was Rs.54956.01per hectare. On the other hand, production and returns from wheat and paddy crop was Rs.714.13 per quintal, Rs.8614.32 per hectare and Rs. 614.93 per quintal, Rs. 10870.71 per hectare, respectively. The observations indicated that per quintal cost of production for sugarcane crop was less than that of wheat and paddy crop, while on the other hand, per hectare net return was highest for sugarcane as compared to wheat and paddy crop. All the major crops viz., paddy, wheat and sugarcane were profitable for the farmers, but sugarcane was the most profitable crop as compared to other crops, because the per quintal cost of production as well as per hectare return were more economical than for wheat and paddy crops.

Key Words: Production, productivity, return, profitability, economic, cropping pattern, cost concepts.

Introduction

Agriculture has been a way of life and continues to be the single most important livelihood of the masses in India. During 2011-12, there was record production of foodgrains at 259.32 million tonnes, of which 131.27 million tonnes was produced during Kharif season and 128.05 million tonnes was produced during the Rabi season. Of the total foodgrains production, production of cereals was 242.23 million tonnes and pulses 17.09 million tonnes. As per 2nd advance estimates for 2012-13, total foodgrains production is estimated at 251.42 million tonnes (124.68 million tonnes during Kharif and 125.47 million tonnes during Rabi seasons). The 6.59 million tonnes (about 5.02 percent) decline in kharif production has been on account of late onset of monsoon and deficient rainfall in several states affecting kharif production in Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Maharashtra, Rajasthan, Tamil Nadu and West Bengal.

The production of rice (both kharif and rabi) is estimated at 101.8 million tonnes, pulses at 17.58 million tonnes, oilseeds at 29.46 million tonnes, sugarcane at 334.54 million tonnes and cotton at 33.80 million bales (of 170 kg. each). Though, production of rice, sugarcane and cotton during kharif 2012-13 has been lower than that of the last year, these are better than the average production during the last five years.

Agricultural policy in India across decades has been focusing on self-sufficiency and self-reliance in food grains production. Considerable progress has been made on this front. Food grains production rose from 52 million tonnes in 1951-52 to 251.42 million tonnes in 2012-13. The share of agriculture in real GDP has fallen given its lower growth rate relative to industry and services. However, what is the matter of concern is that growth in the agricultural sector has quite often fallen short of the Plan targets. During the period 1960-61 to 2012-13, food grains production grew at a compounded annual growth rate (CAGR) of around 2 percent. In fact, the Ninth and Tenth Five Year Plans witnessed agricultural growth rate of 2.44 percent and 2.30 percent, respectively compared to 4.72 percent during Eighth Five Year Plan. During the current Five Year plan, agricultural growth is estimated at 3.28 percent against the target of 4 percent. The Approach Paper to the Twelfth Five Year Plan emphasises the need to "redouble our efforts to ensure that 4.0 percent average growth" is achieved during the Plan if not more. Without incremental productivity gains and technology diffusion across regions, achieving this higher growth may not be feasible and has implications for the macroeconomic stability given the rising demand of food for the 1.2 billion people.

Achieving minimum agricultural growth is a pre-requisite for inclusive growth, reduction of poverty levels, development of the rural economy and enhancement of farm incomes. For five consecutive years, i.e., from 2004-05 to 2008-09, food grains production recorded an increasing trend. However, it declined to 218.11 million tonnes in 2009-10 due to severe drought conditions in various parts of the country. Normal monsoon in the subsequent year, i.e., 2011-12, helped the country to reach a significantly higher level of (251.42 million tonnes) food grains production. As per the second Advance Estimates,

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production of food grains during 2011-12 is estimated at an all time record level of 251.42 million tonnes which is a significant achievement mainly due to increase in the production of rice and wheat. The compound growth a rate of the indices of area, production, and yield of sugarcane during 2000-01 to 2011-12 has declined compared to the 1980s. The decline in yield during this period is because of relatively higher decline in growth rate of production (Department of Agriculture and Cooperation, Govt. of India- 2011-12). Accelerated growth in agricultural production and productivity is essential for overall stability of the Indian economy. Green revolution has brought a significant change in the pattern of agricultural production and productivity. The development of new varieties during the sixties has been associated with considerable risk and instability in the output and income of farmers particularly the small and marginal one, who have been unable to bear the risks involved and to get the benefit of new technology (Narayana, B. 2009).

During the initial period of green revolution, resource rich farmers reaped good harvest that prompted them to adopt new farm technologies, but in India, more than 70 percent of farmers are marginal, small and land less and their financial condition is not as good as large farmers which leads low adoption of new farm technology and due to poor adoption rate, they get lower yield and less returns, so there is a need to identify the crops which involve less cost of production or more economic for farmers and give higher returns, and we know that profitability of crops serves as an incentive for the farmers to adopt new farm technologies at a faster rate. Thus keeping in mind the aforementioned facts, the study was conducted to find out the answers of some researchable issues as follows:

1. Whether farmers have benefited or not from the existing cropping pattern?
2. Which crop is more suitable and profitable as compared to other crops for a particular region?
3. Is there any difference of profit margin between the large farmers and marginal farmers?
4. If there are large differences of profitability prevailing among the different categories of farmers then what are the reasons for these differences?
5. How much percent of total cost is shared by labor cost for cultivating per hectare of land?
6. How much percent of total cost is shared by variable cost?
7. How this comparative analysis will help the farmers for planning their cropping pattern?

For searching the answers of above questions, the study had focused on the following objectives.

1. To find out the cost of production and returns of sugarcane, wheat and paddy crops
2. To estimate the profitability of selected crops
3. To find out the most economical and profitable crop for the farmers

Data and Methodology

Source of Data

The study was conducted in Deoria district of Uttar Pradesh (UP) and it is situated in the eastern region of Uttar Pradesh. The district is located between 26°6′ north to 27°8′ north latitude and 83°29′ east to 84°26′ east longitude. The study area is surrounded by district Kushinagar in North, district Gopalganj and Siwan (Bihar state) in east, district Mau and district Ballia in south and district Gorakhpur in west. The headquarter of Deoria city is situated at 53 Km. milestone from Gorakhpur by road towards east.

Keeping in mind the objectives of the study, multi stage stratified random sampling technique was used. Firstly, a list of all 16 developmental blocks of the district was prepared and two blocks, namely, Gauri bazaar and Rudrapur were selected randomly. In the second stage, one village from each selected block i.e., Pananha village from Gauri bazaar and Dharauli from Rudrapur block were selected randomly. Then two adjoining villages of Pananha and Dharauli, namely, Surajpur, Khairabanwa and Gahila, Tarasara were selected, respectively. Thus in this way, cluster of three villages were formed in each selected block. In third stage, farmers were classified into different categories such as marginal (less than 1 ha of land), small (1-2 ha) medium (2-4 ha) and large (more than 4 ha). Then 20 farmers from each category were selected on the basis of probability proportion to their size from both the clusters of villages, respectively. Thus the total 80 farmers were surveyed who were raising sugarcane, wheat and paddy crops in their field for the year 2009-10.

Modeling

To fulfill the objectives, the cost of production and returns have been worked out on per hectare basis for different major crops in each category of farmers. Return from the crop was estimated by calculating gross return from each selected crop.

$$GR_j = MP_j \times MPP_j + BP_j \times BPP_j$$

$$NR_j^* = GR_j - COP_j^*$$

Where,

GRj = Gross returns from jth crop (Rs/ha).

MPj = Main products of jth crop (Qt/ha).

BP_j = By products of jth crop (Qt/ha).

MPP_j = Price of main product of jth crop (Rs/Qt).

BPP_j = Price of by-product of jth crop (Rs/Qt).

NR_j = Net returns from jth crop (Rs/ha).

COP_j = Cost of production of jth crop.

j = Selected crop (1, 2 and 3)

(* denotes cost levels i.e., CostA1, Cost B1, Cost C1, C2, C2*, C3)

Cost A1 : All variable cost excluding family labors cost and including land revenue, depreciation and Interest on working capital.

Cost A2 : Cost A1 + Rent paid for leased in land.

Cost B1 : Cost A1 + Interest on value of owned capital assets (excluding Land).

Cost B2 : Cost B1 + imputed rental value of owned land, (net of land revenue) + Rent paid for leased in land.

Cost C1 : Cost B1 + Imputed value of family labour.

Cost C2 : Cost B2 + Imputed value of family labour.

Cost C2* : Cost C2* will be estimated by taking into account statutory minimum wage rate or actual wage rate whichever is higher.

Cost C3 : Cost C2*+ 10 percent of cost C2* on account of managerial function performed by the farmers.

Cost of Production: Cost of production was calculated by estimating all the costs which are incurred in producing one quintal of produce or output.

Cost of cultivation: It includes operational costs, material costs and other costs in crop production. In operational costs, the cost of hiring human labour, machine power, bullock charges have been estimated by prevailing rate at that particular period of time in the study area. Hired labour charge at actual wage paid in cash and kind of payments was converted into monetary terms at the prevailing price. Imputed value of family labour was also calculated using the prevailing wage rate in the study area. In case of bullock, tractor and other machinery, hiring charges were applied to those who don't own these and cost of fuel, repairing and maintenance cost were calculated who own these. In case of material costs; cost of seeds, manure, chemicals, fertilizers irrigation charges were calculated for those at prevailing price at the time of application on per hectare basis for different categories of farmers. Owned seed was priced as prevailing seed price in the study area. Other costs includes land revenue, interests on fixed assets, interest on working capital, depreciation and rental value of land. Simple interest was calculated on working capital at a flat rate of 7 percent per annum as it prevailed at the time of investigation. Rental value of land prevailed in the study area was taken during study period. Depreciation on fixed asset per hectare was calculated on the basis of hours used for the crop.

Results and Discussion

Cropping pattern on sample farms: Table 1 represents the cropping pattern adopted on the sample farms in the study area. It is evident from the table that wheat was the major cereal crop in the study area on the basis of the share of gross cropped area. Wheat crop alone shared 28.87 percent of per farm gross cropped area on overall basis. Paddy was appeared as the second major crop after wheat which constituted to 23.92 percent of the gross cropped area.

TABLE 1. CROPPING PATTERN ON SAMPLE FARMS

(Ha/farm)

Categories/Crops	Marginal	Small	Medium	Large	Overall
Paddy	0.60 (37.59)	0.90(22.33)	1.80(30.87)	2.50(19.54)	1.45(23.92)
Maize	0.002(0.13)	0.002(0.049)	0.05(0.86)	0.15(1.16)	0.05(0.82)
Groundnut	0.0010(0.06)	1.015(25.16)	0.023(0.39)	0.19(1.47)	0.31(4.95)
Wheat	0.65(40.73)	1.20(29.74)	2.05(35.16)	3.10(23.94)	1.75(28.87)
Mustard	0.065 (4.07)	0.12 (2.97)	0.75(12.86)	1.25(9.67)	0.54(8.91)
Potato	0.012(0.76)	0.02(0.49)	0.061(1.03)	1.95(15.09)	0.51(8.42)
Sugarcane	0.235(14.72)	0.736(18.25)	1.046(17.91)	3.28(25.37)	1.32 (21.70)
Other crops	0.031(1.94)	0.041(1.02)	0.059(1.01)	0.50(3.85)	0.15 (2.41)
Gross cropped area	1.59	4.034	5.83	12.92	6.06
Net sown area	0.90	1.95	3.98	9.92	4.18
Cropping intensity	177.33	206.87	146.70	130.24	144.97

Note: Figures in parentheses indicate percentage of gross cropped area.

Sugarcane was the third major annual crop in the study area. On an average, sugarcane shared 21.70 percent of gross cropped area across the farm size groups. These three crops viz., wheat, sugarcane and paddy together shared more than 74 percent of gross cropped area on sample farms in the study area. On the basis of information

on cropping pattern at the district level, these three crops taken together constituted more than 90 percent to the gross cropped area, and hence, selected as major crops for the study.

Cost of Cultivation of Paddy Crop

In the study area, paddy was planted predominantly during the kharif season. Table 2 depicts the cost of cultivation of paddy crop in the study area. Due to scarcity of labour in peak period, wage of labour was high (Rs.120/man day) and for this reason, expenditure incurred on hired labour was high enough. The overall average expenditure worked out for human labour was Rs.10344.5 per ha. While the expenditures made on hired labour for one hectare were Rs. 5075, Rs.7525, Rs.10010 and Rs.11250 in case of marginal, small, medium and large farms, respectively. Overall average expenditure on bullock labour and machinery was Rs1558.75 per ha. From this table it is also observed that in paddy cultivation, the farmers of the study area had made very less expenditure on irrigation due to sufficient rain. If total expenditure on human labour of different categories of farmers are compared, then it has been found that marginal farmers used less hired labour than other categories of farmers because they spent only 21.39 percent of total cost (Cost C3) on hired human labour while small, medium and large farmers had spent 27.96, 34.13 and 36.04 percent of total cost (Cost C3), respectively.

TABLE 2. COST CONCEPT WISE COST OF CULTIVATION OF PADDY CROP (RS. /HA)

Particulars	Farm size groups				
Cost of cultivation	Marginal	Small	Medium	Large	Overall
(a) Cost A1	9091.87 (38.32)	12447.97 (46.25)	15859.04 (54.07)	17990.52 (57.63)	14027.8 (50.11)
(b) Cost A2	17562.27 (74.03)	20918.37 (77.72)	24329.44 (82.95)	26460.92 (84.77)	22498.2 (80.37)
(c) Cost B1	10153.91 (42.82)	13517.2 (50.22)	16930.49 (57.73)	19069.8 (61.09)	15097 (53.93)
(d) Cost B2	18624.31 (78.51)	21987.6 (81.69)	25400.89 (86.61)	27535.2 (88.21)	23567.4 (84.22)
(e) Cost C1	13093.91 (55.2)	15995.2 (59.43)	18190.49 (62.02)	19904.8 (70.14)	16976.5 (60.64)
(f) Cost C2	21564.31 (90.89)	24466.6 (90.89)	26660.89 (90.90)	28375.2 (90.90)	25446.9 (90.89)
(g) Cost C2*	21564.31 (90.89)	24466.6 (90.89)	26660.89 (90.90)	28375.2 (90.90)	25446.9 (90.89)
(h) Cost C3	23720.74 (100)	26913.26 (100)	29326.97 (100)	31212.72 (100)	27991.59 (100)

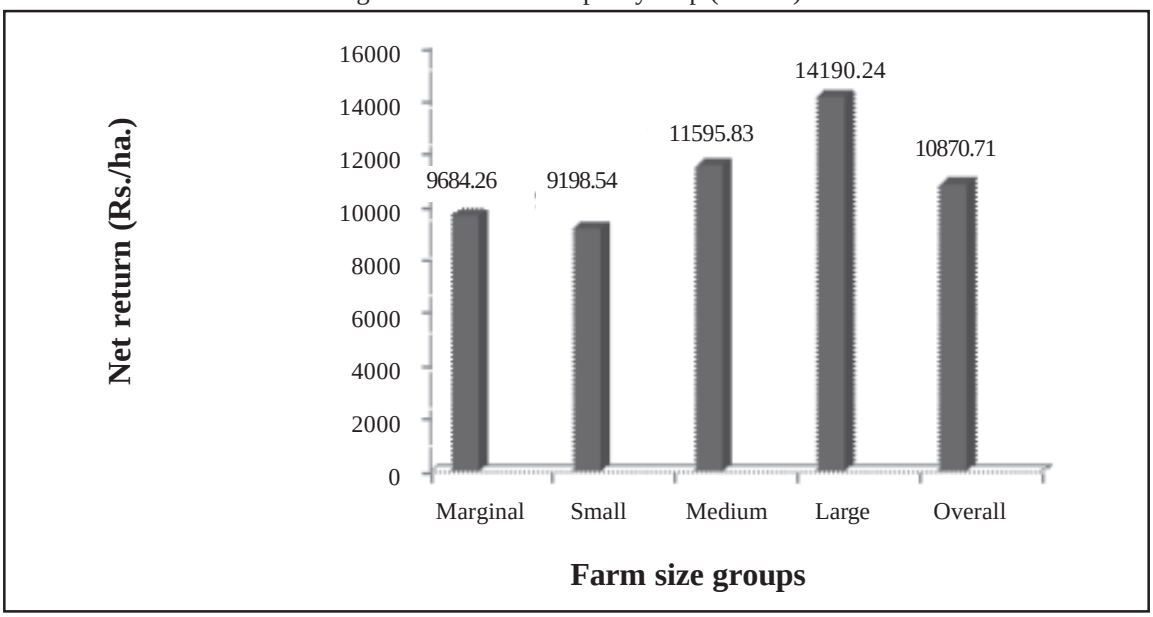
Note: Figures in parentheses indicate percentage of total cost

TABLE 3. COST OF PRODUCTION AND RETURNS FROM PADDY CROP

Particulars	Farm size groups				
	Marginal	Small	Medium	Large	Overall
Yield of main product (qt/ha)	32.75	35.06	38.9	40.83	36.88
Yield of by product (qt/ha)	32.75	35.06	38.9	40.83	36.88
Price of main product (Rs./qt)	820	830	852.5	912.5	853.75
Price of by product (Rs./qt)	200	200	200	200	200
Return from main product (Rs./ha)	26855	29099.8	33142.8	37236.96	31486.3
Return from by product (Rs./ha)	6550	7012	7780	8166	7376
Gross return (Rs./ha)	33405	36111.8	40922.8	45402.96	38862.3
Net Return (Rs./ha)) at					
(a)Cost A1	24313.13	23663.83	25063.76	27912.44	24834.5
(b) Cost A2	15842.73	15193.43	16593.36	18942.04	16364.1
(c)Cost B1	23251.09	22594.6	23992.31	26338.16	23765.3
(d)Cost B2	14780.69	14124.2	15521.91	17867.76	15294.9
(e) Cost C1	20311.09	20116.6	22732.31	25498.16	21885.8
(f) Cost C2	11840.69	11645.2	14261.91	17027.76	9682.27
(g)Cost C2*	4709.62	3843.73	14261.91	17027.76	9682.27
(h) Cost C3	9684.26	9198.54	11595.83	14190.24	10870.71
Cost of production at Cost C3 (Rs./qt)	582.2	618	610.57	626.96	614.93

However, per hectare Cost A1 on marginal, small, medium and large farms were found to be Rs. 9091.87, Rs. 12447.98, Rs. 15859.04 and Rs. 17990.52, respectively. It was found that actual wage rate (Rs.120/ man day) was higher than minimum statutory wage rate (Rs. 104/man day), thus the Cost C2 and Cost C2* same for all the farms size groups in the study area. Per hectare cost C3 is the total cost of cultivation of paddy crop which includes the managerial cost of farmers also. Large farmers were found to spend highest on paddy cultivation (Rs. 31212.72), which was 1.3 times more than that of marginal farmers (Rs. 23720.74). The average cost of cultivation on one hectare of paddy was Rs. 27991.57 for all the farms in the study area.

Fig1. Net returns from paddy crop (Rs./ha.)



It is clearly presented in figure 1 that on an average, all the farmers in the study area were getting net returns of more than Rs. 10000/ ha over total cost (Cost C3). Highest return over total cost (Cost C3) was received by large farmers. It is deduced from the figure that the yield of paddy was highest on large farms (40.83qt/ha) followed by medium, small and marginal farms.

TABLE 4. COST CONCEPT WISE COST OF CULTIVATION OF WHEAT CROP (RS. /HA)

Particulars	Farm size groups				
Cost of cultivation	Marginal	Small	Medium	Large	Overall
(a) Cost A1	8957.8	11746.8	15478.84	18561.9	14545.35
	(42.33)	(48.46)	(55.74)	(60.49)	(54.05)
(b) Cost A2	16428.2	19217.2	22949.24	26032.3	22015.75
	(77.6)	(79.28)	(82.64)	(84.84)	(81.810)
(c) Cost B1	9894.97	12703.2	16452.5	19544.02	15508.92
	(46.76)	(52.41)	(59.25)	(63.69)	(57.63)
(d)Cost B2	17365.37	20173.6	23922.95	27014.42	22979.32
	(82.06)	(83.23)	(86.155)	(88.04)	(85.39)
(e) Cost C1	11766.97	14563.2	17772.55	20424.02	16991.92
	(55.60)	(60.07)	(64.005)	(66.56)	(63.14)
(f) Cost C2	19237.37	22033.6	25242.95	27894.4	24462.32
	(90.90)	(90.90)	(90. 89)	(90.90)	(90.90)
(g) Cost C2*	19237.37	22033.6	25242.95	27894.4	24462.32
	(90.90)	(90.90)	(90.89)	(90.90)	(90.90)
(h) Cost C3	21161.10	24236.96	27767.3	30683.8	26908.55
	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)

Note: Figures in parentheses indicate percentage of total cost (cost C3).

It was noticed that the total cost (Cost C3) in wheat cultivation was lower than paddy cultivation. Per hectare cost A1 was found Rs. 14545.35 (54.04 percent) in aggregate level. Large farmers have highest cost A1 compared to other categories of farmers in the study area. Cost A1 was also observed to increase with increase in the size of holding (and also with increase in area under wheat cultivation). Both Cost B1 and Cost B2 showed the increasing trend, in other words, positive relationship was observed between the magnitudes of per hectare cost and operational size of holdings. As far as the Cost C1 and Cost C2 were concerned, it was found that in terms of per hectare; these two costs were sharing a larger proportion to the total cost (Cost C3).

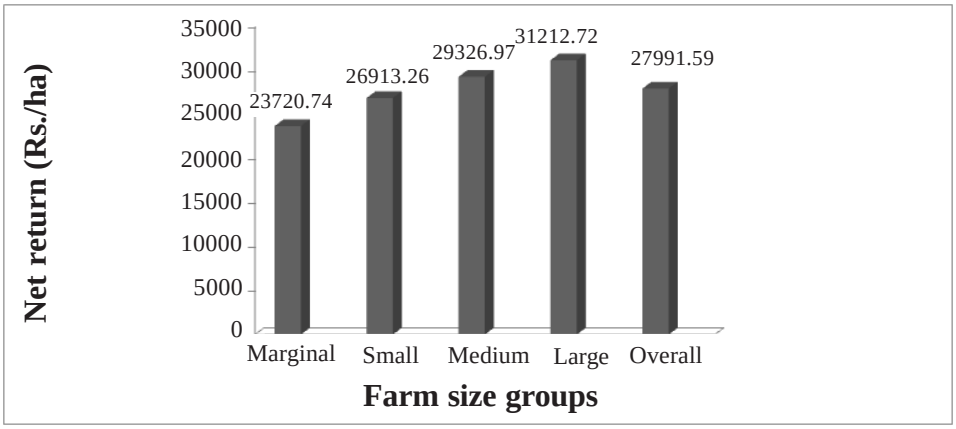
The total cost of cultivation (Cost C3) came out to be Rs. 21161.10, Rs. 24236.96, Rs. 27767.3 and Rs. 30683.8 on marginal, small, medium and large farms, respectively. It was found that the per hectare cost of cultivation for wheat crop was less than that of paddy cultivation.

TABLE 5. COST OF PRODUCTION AND RETURNS FROM WHEAT CROP

Particulars	Farm size groups				
	Marginal	Small	Medium	Large	Overall
Yield of main product(qt/ha)	32.95	37.08	39.44	41.28	37.68
Yield of by product (qt/ha)	32.95	37.08	39.44	41.28	37.68
Price of main product (Rs./qt)	900	935.5	940.5	995.0	942.75
Price of by product (Rs./qt)	–	–	–	–	–
Return from main product (Rs./ha	29655	34669.8	37093.32	43085.24	35522.82
Return from by product (Rs./ha)	0	0	0	0	0
Gross return (Rs./ha)	29655	34669.8	37093.32	43085.24	35522.82
Net Return (Rs./ha) at					
(a)Cost A1	20697.2	22923	21614.48	24523.34	20977.47
(b) Cost A2	13226.8	15452.6	14144.08	1052.94	13507.07
(c)Cost B1	19760.03	21966.6	20740.77	23541.22	20013.9
(d)Cost B2	12289.63	14496.2	13170.37	16070.82	12543.5
(e) Cost C1	17888.03	20106.6	19320.77	22661.22	18530.9
(f) Cost C2	10417.65	12636.2	11850.37	15190.82	11060.5
(g)Cost C2*	10417.65	12636.2	11850.37	15190.82	11060.5
(h) CostC3	8493.9	10432.8	9326.08	12401.38	8614.32
Cost of production (Rs./qt)	642.2	653.6	704.03	743.31	714.13

The table 5 reveals that the per hectare productivity of wheat crop was marginally higher (8.33 quintals) on large farms compared to marginal farms. table further reveals that per hectare gross returns for wheat crop on marginal, small, medium and large farms were Rs. 29655, Rs. 34669.8, Rs. 37093.32 and Rs. 43085.24, respectively. The net return per hectare after subtracting total cost (Cost C3) from gross return were found to be Rs. 8493.9, Rs. 10432.8, Rs. 9326.08 and Rs. 12401.38 for marginal, small, medium and large farms, respectively.

Fig 2. Net returns from wheat crop (Rs. /ha.)



On the other hand, when we see the per quintal cost of production of wheat crop then we found that the large farmers were spending relatively large amount of money for producing one quintal of wheat than other categories of farmers.

TABLE 6. COST CONCEPT WISE COST OF CULTIVATION OF SUGARCANE CROP (RS. /HA)

Particulars	Farm size groups				
	Marginal	Small	Medium	Large	Overall
(a) Cost A1	13022.14	18441.81	23635.86	32014.88	21573.82
	(37.99)	(46.19)	(52.63)	(59.77)	(50.24)
(b) Cost A2	26822.41	32242.08	37436.13	45815.15	35374.09
(c) Cost B1	14713.99	20180.71	25376.02	33786.95	23311.36
	(42.93)	(50.55)	(56.50)	(63.08)	(54.28)
(d)Cost B2	28514.16	33980.98	39176.29	47587.22	37111.63
	(83.20)	(85.12)	(87.23)	(88.85)	(86.42)
(e) Cost C1	17353.99	22491.51	27026.02	34887.04	25236.58
	(50.63)	(56.34)	(60.17)	(65.14)	(58.77)
(f) Cost C2	31154.18	36291.51	40826.29	48687.31	39036.85
	(90.89)	(90.89)	(90.89)	(90.89)	(90.86)
(g)Cost C2*	31154.18	36291.51	40826.29	48687.31	39036.85
	(90.89)	(90.89)	(90.89)	(90.89)	(90.86)
(h) CostC3	34269.57	39920.66	44908.91	53556.04	42940.53
	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)

Note: Figures in parentheses indicate percentage of total cost (cost C)

Cost A1 was found to be Rs. 21573.82 for overall size group of farms. However, per hectare Cost A1 on marginal, small, medium and large farms were found to be Rs. 13022.14, Rs. 18441.81, Rs. 23635.86 and Rs. 32014.88, respectively. Expenditure on operational cost was highest for large farmers and it has been observed that as the land holding size increases, the Cost A1 also increases, employing direct relationship between the two. It was also found that Cost A2, Cost B1, Cost B2, Cost C1 and Cost C2 also showed the increasing trend with the increase in area operated by the farmer. It was found that actual wage rate (Rs. 120/man day) was higher than minimum statutory wage rate (Rs. 104/man day) thus the Cost C2 and Cost C2* remained same for all the farms size groups in the study area. Per hectare cost C3 is the total cost of cultivation of paddy crop which includes the managerial cost of farmers also. Large farmers were found to spend highest on sugarcane cultivation (Rs. 53556.04), which was 1.5 times more than that of marginal farmers (Rs. 34269.57). The average cost of cultivation on one hectare of sugarcane was Rs. 42940.53 for all the farms in the study area.

TABLE 7. COST OF PRODUCTION AND RETURNS FROM SUGARCANE CROP

Particulars	Farm size groups				
	Marginal	Small	Medium	Large	Overall
Yield of main product (qt/ha)	432.75	480.92	542.80	632.01	522.12
Yield of by product (qt/ha)	129.82	144.27	162.84	189.60	156.60
Price of main product (Rs./qt)	190.75	183.98	169.25	170.03	178.50
Price of by product (Rs./qt)	30	30	30	30	30
Return from main product (Rs./qt)	82547.06	88479.66	91868.9	107460.66	93198.42
Return from by product (Rs./ha)	3903.86	4328.1	5085.2	5688.09	4698.00
Gross return (Rs./ha)	86450.92	92807.76	96954.1	113148.75	97896.54
Net Return (Rs./ha) at					
(a)Cost A1	73428.78	74365.95	73318.24	81133.87	76322.72
(b) Cost A2	59628.51	60565.68	59517.97	67333.6	62522.45
(c)Cost B1	71736.93	72627.05	71578.08	79361.8	74585.18
(d)Cost B2	57936.76	58826.78	57777.81	65561.53	60784.51
(e) Cost C1	69096.93	70316.25	69928.08	78261.71	72659.96
(f) Cost C2	55296.76	56516.25	56127.81	64461.44	58859.69
(g)Cost C2*	55296.76	56516.25	56127.81	64461.44	58859.69
(h) CostC3	52181.35	52887.1	52045.10	59592.71	54956.01
Cost of production (Rs./qt)	75.23	79.13	78.39	80.47	78.29

Fig 3. Net returns from sugarcane crop (Rs. /ha.)

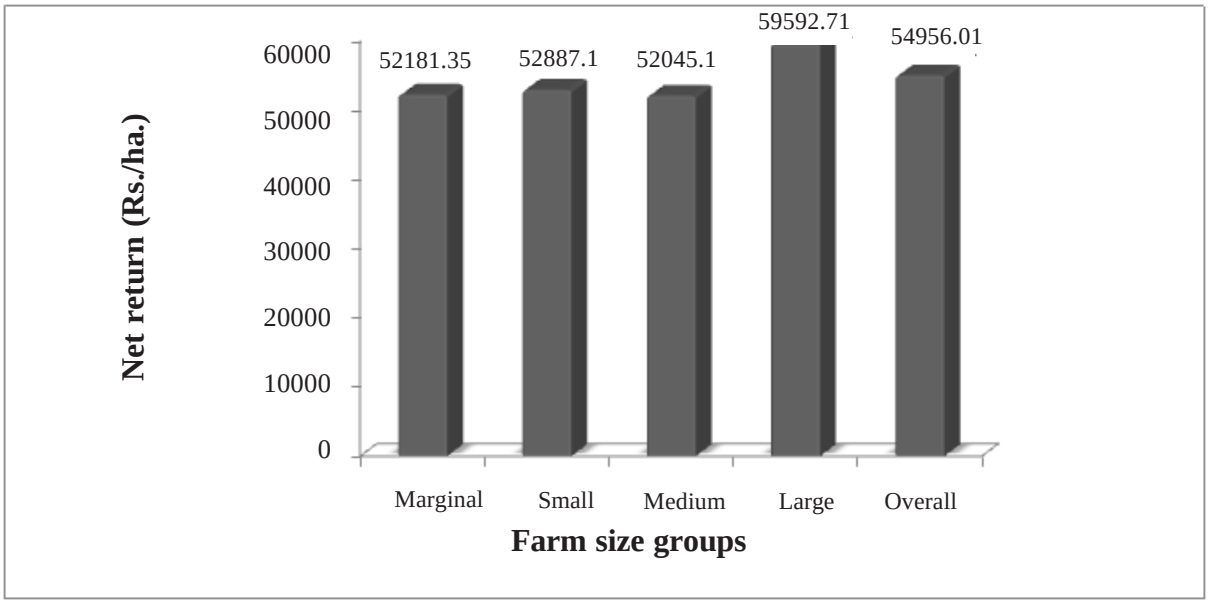


Figure 3 reveals that the per hectare productivity of sugarcane crop was higher (1.44 times) on large farms compared to marginal farms. Table 7 further reveals that per hectare gross returns for sugarcane crop on marginal, small, medium and large farms were Rs. 43085.24, Rs. 37093.32, Rs. 34669.8 and Rs. 113148.75, respectively. The net return per hectare after subtracting total cost (Cost C3) from gross return were found to be Rs. 52181.35, Rs. 52887.1, Rs. 52045.10 and Rs. 59592.71 on marginal, small, medium and large farms, respectively. On the other hand, when we see the per quintal cost of production of sugarcane crop then we found that the large farmers were spending relatively large amount of money for producing one quintal of sugarcane than other categories of farmers. Table 7 further reveals that the cost of per quintal production of sugarcane was much lower than in paddy and wheat crop production.

Thus it can be concluded that all the major crops viz., paddy, wheat and sugarcane were profitable for the farmers of the study area, but sugarcane was most profitable crop as compared to other crops, because the per quintal cost of production for sugarcane was lowest in comparison to wheat and paddy crops.

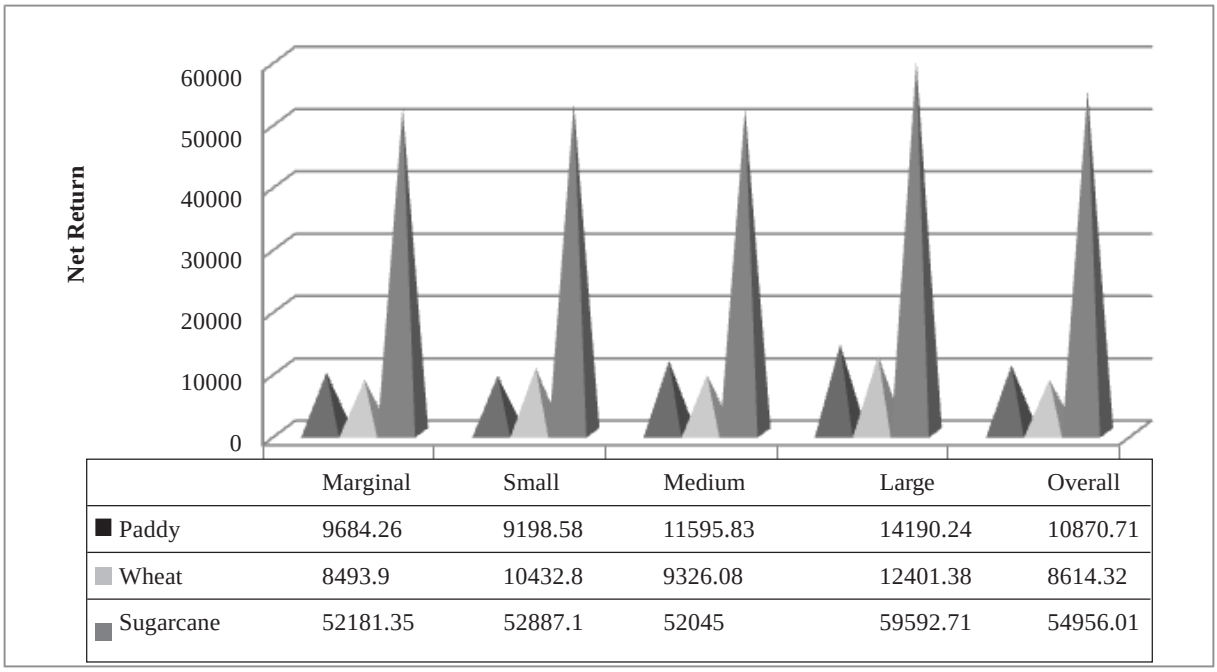
Comparison of Net Return Obtain from Wheat, Paddy and Sugarcane Crops

The net return per hectare after subtracting total cost (Cost C3) from gross return were found to be Rs. 52181.35, Rs. 52887.1, Rs. 52045.10 and Rs. 59592.71 for marginal, small, medium and large farms, respectively. On the other hand, when we see the per quintal cost of production of sugarcane crop then we found that the large farmers were spending relatively large amount of money for producing one quintal of sugarcane than other categories of farmers. Table 7 further reveals that the cost of per quintal production of sugarcane was much lower than paddy and wheat crop production.

Table 8. Net Return Obtain from Wheat, Paddy and Sugarcane crops (Rs./ha)

Crops	Farm size groups				
	Marginal	Small	Medium	Large	Overall
Paddy	9684.26	9198.54	11595.83	14190.24	10870.71
Wheat	8493.9	10432.8	9326.08	12401.38	8614.32
Sugarcane	52181.35	52887.1	52045.10	59592.71	54956.01

Fig 4. Net Return Obtain from Wheat, Paddy and Sugarcane crops (Rs./ha.)



	Marginal	Small	Medium	Large	Overall
Paddy	9684.26	9198.58	11595.83	14190.24	10870.71
Wheat	8493.9	10432.8	9326.08	12401.38	8614.32
Sugarcane	52181.35	52887.1	52045	59592.71	54956.01

It is clearly depicted from figure 4 that net return obtain from sugarcane is almost five times higher than the net returns obtained from paddy and wheat crops.

Concluding Remarks

The study was confined to three major crops of the Deoria district of UP, namely, paddy, wheat and sugarcane. The selected crops taken together accounted for more than 90 percent of the gross cropped area of the district .The study is based on information available through both primary and secondary sources and made use of farm level cross-sectional data collected from 80 sample farmers of different farm size groups (marginal, Small, medium and large). Wheat emerged as the main foodgrain crop in the study area with its percentage share of 28.87 percent in the gross cropped area while paddy (23.92 percent) and sugarcane (21.78 percent) crop were the second and third major crops in the study area, respectively. Whereas the cost of cultivation (Rs/ha) of wheat was less than that of paddy and sugarcane crops, the cost of production of sugarcane (Rs/qt) was lowest among all the three crops on an overall basis. Per hectare net return was found to be higher for sugarcane crop (Rs. 54956.01/ha) as compared to wheat (Rs.8614.32/ha) and paddy(Rs.10870.71/ha) crops, As sugarcane is an annual crop while wheat and paddy are half yearly crops but still together both the crops (paddy +wheat) were not meeting out the net returns obtained from sugarcane crop alone, As the combined net return from wheat and paddy obtained from the same piece of land was Rs. 19485.14/ha. while sugarcane alone gave Rs. 54956.01/ha.

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Watershed Development Programme and Returns to Scale in the Hill Agriculture of Himachal Pradesh: Traditional Vs Commercial Crops

Dr. Anil Kumar*

Introduction

Since 1951 onwards, Indian economy witnessed structural changes in the process of economic development. In this process, agricultural sector contributed significantly to the national income, output and employment. The most important fact of Indian agriculture is that it has large potential for development. Technological changes, new and superior resources in the mode of cultivation viz. new and better agricultural implements, improved seeds and better irrigation facilities have helped in the fast growth of agricultural sector in India. Agricultural progress is normally regarded as a precondition of economic development. Agriculture has been the major source of livelihood in Indian economy. Watershed refers to a hydrological unit area which drains the runoff into a river or a reservoir or a pond or a common point. It has its own natural drainage system and responds more effectively to the various management techniques to maximize production. Watershed management is the balanced utilization of land and water resources for optimum production. It essentially relates to soil and water conservation in the watershed which means land use according to land potential, protection of land, maintaining soil fertility, conserving water use, proper management of water drainage, flood protection and increasing productivity from all kinds of land use. The benefits of watershed management are; increase in cropping intensity, increase in production and productivity of crops, shifts in cropping pattern from less remunerative crops to profitable crops, increase in yield and income of the farmers, creation of employment, rise in wages, and increase in the number of working days per year for labour. The watershed planning involves evaluation of alternative uses of land at the micro-level for maximizing income and employment and improving the quality of life of the people living in a particular watershed. Watershed Planning may be defined as optimization of land use according to its production capacity, subject to proper conservation measures. The farm can be considered as a production unit producing various crops. The production of crops requires the combination of various inputs, some of which are fixed in nature and others are variable owing to the period of time. It is important for the production unit to co-ordinate, combine and utilize these inputs in such a way that the maximum possible net returns can be achieved.

Objectives and Methodology

In this study, an attempt has been made to examine the impact of watershed development programme on returns to scale of cereals and pulses, vegetables and horticultural crops among the beneficiary and non-beneficiary sample households. The present study has been carried out during agricultural year 2014-15. A multistage random sampling technique has been adopted in order to select a representative sample of households. At the first stage, all districts have been arranged in ascending order on the basis of the number of watershed in each district. After this, one tribal district i.e., Kinnaur and two non-tribal districts viz. Mandi and Shimla have been selected randomly. At the second stage, all the blocks in the selected districts have been arranged according to their watershed numbers in an ascending order on the basis of treated area and one block has been selected randomly from each selected district i.e., Kalpa block in Kinnuar district, Dharmpur block in Mandi district and Mashobara block in Shimla district. At the third stage, all the watersheds have been arranged according to their treated area in an ascending order and then watershed randomly in each selected block i.e., Pangi Watershed in Kalpa block, Sajao-Piplu Watershed has been selected one in Dharmpur block and Sheepur Nala Watershed in Mashobara block. After this, a sample of 250 beneficiaries and 120 non-beneficiaries farmers from all the selected watersheds have been selected randomly in proportion to the total number of households falling in each land holdings category. Further, the selected farmers have been divided into three categories according to their size of holdings, i.e., marginal farmers having less than 1 hectare, small farmers having 1-2 hectares and medium farmers having 2-10 hectares. In the present study, among the beneficiary households, 125 farmers fall under the marginal holding, 75 in the small holding and 50 farmers fall in the medium size of holding group. Whereas among the non-beneficiary households, 50 farmers fall in the category of marginal holding, 40 farmers in the small holding and 30 farmers fall in the medium size of holding group. It is important to mention here that there is no large size of holding in this study.

The production function for cereal, vegetables and horticultural crops in the present study has been worked out by using the Cobb-Dougals production function. The value of output has been taken in money terms which has been regressed against the explanatory variables viz. land

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in hectares (X1) human labour(X2), bullock and machine labour(X3), cost of seeds (X4) cost of manure (X5) cost of fertilizer (X6), irrigation cost (X7) and cost of insecticides-pesticides (X8). The value of factors like bullock and machine labour were added together because one of the two has been missing in some cases and it would have not been possible to use Cobb-Douglas function for zero values.

Results and Discussions

1. Returns to Scale of Cereal and Pulses Crops Among the Sample Households

This section deals with returns to scale in the production of cereal and pulses crops among the beneficiary and non-beneficiary sample households.

1.1 Returns to Scale of Cereal and Pulses Crops Among the Beneficiary Sample Households

The returns to scale, in the production of cereal and pulses crops among the beneficiary sample households, has been presented in Table 1. This table reveals that the value of multiple determination (R2) has been found to be 0.3359, 0.5125 and 0.4748 on the marginal, small and medium size of holdings, respectively. Among all the holdings taken together, this value came out 0.2972. The rest of the variations in the production of cereal and pulses crops may be due to the factors not included in the model. On the marginal size of holdings, the regression co-efficient of manure has been observed to be maximum among all the variables with a value of 0.6737 which is statistically significant at one percent level and indicates that considering all other factors constant, 100 percent increase in manure would bring 67.37 percent increase in the production of cereal and pulses crops. The regression co-efficient of land, seeds, fertilizer and insecticides-pesticides has been found to be statistically significant at one percent level with a value of 0.1866, 0.0974, 0.0127 and 0.1881 respectively. The regression co-efficient of human and bullock-machine labour has been found to be statistically insignificant with a value of 0.1050 and 0.5804. The negative co-efficient of irrigation indicates its excessive use. The sum of regression co-efficient came out to be 1.2853 and deviation from unity i.e., 0.2853 shows increasing return to scale.

TABLE 1-RETURNS TO SCALE OF CEREAL AND PULSES CROPS AMONG THE BENEFICIARY SAMPLE HOUSEHOLDS

Particulars	Marginal Holdings	Small Holdings	Medium Holdings	All Holdings
Constant	1.1614***	0.9422***	1.1275	1.2084*
	(1.6327)	(1.2212)	(0.7151)	(2.3937)
Land (X_1)	0.1866*	0.6618*	0.7141*	0.1055*
	(3.8449)	(5.6508)	(2.5812)	(3.8312)
Human Labour (X_2)	0.1050	0.1601**	0.2480***	0.1992*
	(1.1109)	(1.7060)	(1.4799)	(3.1253)
Bullock and Machine	0.0384	0.1194*	-0.0370	0.0657*
Labour (X_3)	(0.8122)	(2.5995)	(-0.4081)	(2.0369)
Seeds (X_4)	0.0974*	0.1403*	0.2037	0.0799*
	(6.8098)	(7.6233)	(0.8486)	(8.7942)
Manure	0.6737*	0.8046*	0.9533*	0.7090*
(X_5)	(2.3648)	(2.5182)	(2.0689)	(3.4752)
Fertilizer (X_6)	0.0127**	-0.0112	-0.0556	0.0112**
	(1.4754)	(-0.4709)	(-0.2349)	(1.8234)
Irrigation (X_7)	-0.0167	0.0126	-0.0881	-0.0157
	(-1.8852)	(0.5215)	(-0.2050)	(-2.4739)
Insecticide and	0.1881*	0.0126	0.0029	0.0395**
Pesticide (X_8)	(3.3080)	(0.7596)	(0.0715)	(1.9806)
$\sum bi$	1.2853	1.9049	1.9414	1.1943
R^2	0.3359	0.5125	0.4798	0.2972
Deviation From Unity	0.2853	0.9049	0.9414	0.1943
Returns to Scale	Increasing	Increasing	Increasing	Increasing

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

On the small size of holdings, the regression co-efficient of manure has been maximum among all the variables. It has been worked out to be 0.8046 which is statistically significant at one percent level and indicates that considering all other factors constant, 100 percent increase in manure would bring 80.46 percent increase in the production of cereal and pulses crops. The regression co-efficient of land, bullock-machine labour and seeds has

been worked out to be 0.6618, 0.1194 and 0.1403, respectively, which is statistically at one percent level and the regression co-efficient of human labour has been come out to be 0.1601, which is significant at 5 percent level. The regression co-efficient of insecticides-pesticides and irrigation has been worked out to be insignificant with a value of 0.0126 and 0.0126. The negative co-efficient of fertilizer indicates their excessive use. The sum of regression co-efficient came out to be 1.9049 and deviation from unity i.e., 0.9049 shows increasing return to scale.

On the medium size of holdings, the regression co-efficient of manure has been worked out to be maximum among all the variables with a value of 0.9533 which is significant at one percent level and it indicates that considering all other factors constant, 100 percent increase in seeds would bring 95.33 percent increase in the production of cereal and pulses crops. The regression co-efficients of land and seeds have been worked out to be 0.7141 and 0.2037, respectively, which are significant at one percent level. The regression co-efficient of human labour has been significant at 10 percent level with a value of 0.2480. The negative co-efficient of bullock-machine labour, fertilizer and irrigation indicates their excessive use. The sum of regression co-efficient has been came out to be 1.9414 and the deviation from unity i.e., 0.9414 shows increasing return to scale.

Considering all the holdings together, the regression co-efficient of manure has worked out maximum among all the variables with a value of 0.7090 which is significant at one percent level and indicates that considering all other factors constant, 100 percent increase in manure would bring 70.90 percent increase in the production of cereal and pulses crops. The regression co-efficient of land, human labour, bullock-machine labour and seeds has been worked out to be 0.1055, 0.1992, 0.0657 and 0.0657, respectively, which are significant at one percent level of probability, whereas the regression co-efficient of fertilizer and insecticides-pesticides came out to be 0.0112 and 0.0395 which is significant at 5 percent level. The negative co-efficient of irrigation indicates its excessive use. The sum of regression co-efficient came out to be 1.1943 and deviation from unity i.e., 0.1943 shows increasing return to scale.

1.2 Returns to Scale of Cereal and Pulses Crops Among the Non-Beneficiary Households

The returns to scale in the production of cereal and pulses crops among the non-beneficiary households have been presented in Table 2.

TABLE 2RETURNS TO SCALE OF CEREAL AND PULSES CROPS AMONG THE NON-BENEFICIARY HOUSEHOLDS

Particulars	Marginal Holdings	Small Holdings	Medium Holdings	All Holdings
Constant	6.2340*	6.5855*	4.1678***	3.9964*
	(13.8461)	(401794)	(1.6826)	(11.5679)
Land (X_1)	0.2186**	0.1248	0.1160	0.0255
	(1.8680)	(0.3965)	(0.2314)	(0.2016)
Human Labour (X_2)	0.7241*	-0.3794	0.1495	0.6239*
	(11.6443)	(-0.6464)	(0.1985)	(10.9596)
Bullock and Machine Labour (X_3)	-04374	0.3474*	0.6440*	0.1225
	(-1.7620)	(1.5011)	(2.0183)	(1.0756)
Seeds (X_4)	0.3934**	-0.6437	-1.1845	0.1656*
	(1.9036)	(1.6992)	(-2.0964)	(2.2842)
Manure (X_5)	-0.2182	0.5047***	0.6565***	-0.2132
	(-2.7117)	(1.5259)	(1.6176)	(-4.5609)
Fertilizer (X_6)	-1.0911	-0.2367	-0.0963	-0.1299
	(-11.5517)	(-1.8966)	(-0.5927)	(-1.9108)
Irrigation (X_7)	0.3566*	0.0825	0.1106***	-0.0725
	(5.0112)	(1.1314)	(1.3103)	(-1.5407)
Insecticide and Pesticide (X_8)	-0.2497	-0.4212	-0.4039	-0.4730
	(-2.6460)	(-3.3619)	(-2.8431)	(-7.1973)
$\sum bi$	-0.3037	-0.6263	-0.0081	0.0490
R^2	0.9740	0.5232	0.5963	0.6858
Deviation From Unity	-1.3037	-1.6223	-1.0081	-1.0490
Returns to Scale	Decreasing	Decreasing	Decreasing	Decreasing

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

This table reveals that the value of multiple determination (R2) has been worked out to be 0.9740, 0.5232 and 0.5963 on the marginal, small and medium size of holdings, respectively. Among all the holdings together, this value came out to be 0.6858. The rest of the variations in the production of cereal crops may be due to the factors not included in the model. On the marginal size of holdings, the regression co-efficient of human labour has been found maximum among all the variables. It has been worked out to be 0.7241, which is significant at one percent level. It indicates that considering all other factors constant, 100 percent increase in human labour would result in 72.41 percent increase in the production of cereal and pulses crops. The regression co-efficient of land has been worked out to be 0.2186 and significant at 5 percent level. The regression co-efficient of seeds and irrigation has been worked out to be 0.3934 and 0.3566 which is significant at one percent level. The negative co-efficient of bullock-machine labour, manure and insecticides-pesticides indicate their excessive use. The sum of regression co-efficient came out to be -0.3037 and its deviation from unity i.e. -1.3037 shows decreasing return to scale. On the small size of holdings, the regression co-efficient of manure has been worked out to be maximum among all the variables. It has been found 0.5047 which is significant at 10 percent level. It indicates that considering all other factors constant, 100 percent increase in seed will bring 50.47 percent increase in the production of cereal and pulses crops. The regression co-efficient of land and irrigation has been found to be insignificant with a value of 0.1248 and 0.0825, respectivly. The negative co-efficient of human labour, seeds, fertilizers and insecticides-pesticides indicate their excessive use. The sum of regression co-efficient came out to be -0.6223 and its deviation from unity i.e., -1.6223 shows decreasing returns to scale.

On the medium size of holdings, the regression co-efficient of manure has been found maximum among all the variables. It has been found 0.6565 which is significant at 10 percent level. It indicates that considering all other factors constant, 100 percent increase in manure would bring 65.65 percent increase in the production of cereal and pulses crops. The regression co-efficient of land and human labour has been found insignificant with a value of 0.1160 and 0.1985, respectively. The regression co-efficient of bullock and machine labour has been 0.6440 and significant at one percent level of probability. The regression co-efficient of irrigation has been worked out0.1106 and significant at ten percent level. The negative co-efficient of seeds, fertilizer and irrigation indicate their excessive use. The sum of regression co-efficient came out - to be 0.0081 and its deviation from unity i.e., -1.0490 shows decreasing returns to scale.

Among all the holdings together, the regression co-efficient of human labour has been found to be maximum among all the variables. It has been 0.6239 which is significant at one percent level. It indicates that considering all other factors constant, 100 percent increase in seeds would bring 62.39 percent increase in the production of cereal and pulses crops. The regression co-efficient of land and bullock-machine labour has been found insignificant with the value of 0.0255 and 0.1225. The regression co-efficient of seeds has been worked out to be significant with a value of 0.1656, which is significant at one percent level. The negative co-efficient of manure, fertilizer and irrigation indicates their excessive use. The sum of regression co-efficient came out to be 0.0490 and its deviation from unity i.e., -1.0490 shows decreasing return to scale.

2. Returns to Scale of Vegetable Crops Among the Sample Households

This section deals with returns to scale in the production of vegetable crops among the beneficiary and non-beneficiary sample households.

2.1 Returns to Scale of Vegetable Crops Among the Beneficiary Sample Households

The returns to scale in the production of vegetable crops among the beneficiary sample households has been presented in Table 3. This table reveals that the value of multiple determination (R2) has been worked out to be 0.7011, 0.5692 and 0.8494 on the marginal, small and medium size of holdings, respectively. Among all the holdings together, this value came out to be 0.6145. The rest of the variations in the production of vegetable crops may be due to the factors not included in the model. On the marginal size of holdings, the regression co-efficient of land has been worked out to be maximum among all the variables. It has been found to be 0.8658 which is significant at one percent level. It indicates that considering all other factors constant, 100 percent increase in land would bring 86.58 percent increase in the production of vegetable crops. The regression co-efficient of human labour and seeds has been worked out to be 0.5323 and 0.6797, respectively which is significant at one percent level. The regression co-efficient of manure has been found significant at ten percent level with a value of 0.1489. The negative co-efficient of bullock-machine labour, fertilizer, irrigation and insecticides-pesticides indicate their excessive use. The sum of regression co-efficient came out to be 1.5390 and deviation from unity i.e., 0.5390 shows increasing returns to scale. On the small size of holdings, the regression co-efficient of land has been observed maximum among all the variables. It has been worked out to be 0.8532 which is significant at one percent level. It indicates that considering all other factors constant, 100 percent increase in land would bring 85.32 percent increase in the production of vegetable crops. The regression co-efficient of human labour and seeds has been found significant at one percent level with the value of

0.6927 and 0.3997, respectively. The regression co-efficient of fertilizer has been found significant at 5 percent level with a value of 0.6654. The negative co-efficient of bullock-machine labour and manure indicate their excessive use. The sum of regression co-efficient came out to be 2.0965 and deviation from unity i.e., 1.0965 shows increasing returns to scale.

TABLE 3 RETURNS TO SCALE OF VEGETABLE CROPS AMONG THE BENEFICIARY SAMPLE HOUSEHOLDS

Particulars	Marginal Holdings	Small Holdings	Medium Holdings	All Holdings
Constant	3.5093*	1.7341	3.8036*	2.1698*
	(3.7496)	(0.9539)	(3.9092)	(3.4022)
Land (X_1)	0.8658*	0.8532*	0.7826*	0.8910*
	(7.6325)	(5.3351)	(5.3136)	(10.6575)
Human Labour (X_2)	0.5323*	0.6927*	0.2899*	0.4854*
	(4.6046)	(2.2421)	(2.4839)	(5.5486)
Bullock and Machine Labour (X_3)	-0.0287	-0.2498	0.0249	-0.0648
	(-0.4760)	(-1.8609)	(0.3407)	(-1.3843)
Seeds (X_4)	0.6797*	0.3997*	0.5001*	0.5961*
	(7.3278)	(2.1828)	(5.3862)	(8.8545)
Manure (X_5)	0.1489***	-0.5500	0.2634*	-0.0364
	(1.4516)	(-3.2015)	(2.0185)	(-0.4686)
Fertilizer (X_6)	-0.5855	0.6654**	-0.1373	0.1798***
	(-2.1652)	(1.8193)	(-0.9446)	(1.4208)
Irrigation (X_7)	-0.0489	0.0375	-0.0597	-0.0569
	(-0.1209)	(0.1211)	(-0.5519)	(-0.6014)
Insecticides and Pesticides (X_8)	-0.0245	0.2479**	-0.4820	0.0239
	(-0.4053)	(1.8489)	(-3.9382)	(0.5052)
$\sum bi$	1.5390	2.0965	1.1818	1.9702
R^2	0.7011	0.5692	0.8494	0.6165
Deviation From Unity	0.5390	1.0965	0.1818	0.9702
Returns to Scale	Increasing	Increasing	Increasing	Increasing

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

On the medium size of holdings, the regression co-efficient of land has been worked out maximum among all the variables. It has been found 0.7826 which is significant at one percent level. It indicates that considering all other factors constant, 100 percent increase in land would bring 78.26 percent increase in the production of vegetable crops. The regression co-efficients of human labour, seeds and manure has been worked out 0.2899, 0.5001 and 0.2634, respectively, which are significant at one percent level. The regression co-efficient of bullock-machine labour has been found insignificant with a value of 0.0249. The negative co-efficient of fertilizer, irrigation and insecticides-pesticides indicate their excessive use. The sum of regression co-efficient came out 1.1818 and deviation from unity i.e., 0.1818 shows increasing returns to scale.

Among all the holdings together, the regression co-efficient of land has been worked out maximum among all the variables. It has been found 0.8910 which is significant at one percent level of probability. It indicates that considering all other factors constant, 100 percent increase in land will bring 89.10 percent increase in the production of vegetable crops. The regression co-efficient of human labour and seeds has been worked out 0.4854 and 0.5961, which is significant at one percent level of probability. The regression co-efficient of fertilizer has been found significant at ten percent level with a value of 0.1798. The negative co-efficient of bullock-machine labour, manure, irrigation and insecticides-pesticides indicate their excessive use. The sum of regression co-efficient came out 1.9702 and deviation from unity i.e., 0.9702 shows increasing returns to scale.

2.2 Returns to Scale of Vegetable Crops Among the Non-Beneficiary Sample Households

The returns to scale in the production of vegetables crop among non-beneficiary sample households has been presented in Table 4. This table reveals that the value of multiple determination (R2) has been worked out 0.4507, 0.4051 and 0.7798 on the marginal, small and medium size of holdings, respectively. Among all the holdings together, this value came out at 0.5503. The rest of the

variations in the production of vegetable crops may be due to the factors not included in the model. On the marginal size of holdings, the regression co-efficient of human labour has been worked out maximum among all the variables with the value of 0.5808 which is significant at ten percent level. It indicates that considering all other factors constant, 100 percent increase in human labour would bring 58.08 percent increase in the production of vegetable crops. The regression co-efficient of manure and irrigation has been found insignificant with a value of 0.0969 and 0.0896, respectively. The regression co-efficient of insecticides-pesticides has been observed significant at one percent level of probability with the value of 0.4215. The negative co-efficient of bullock-machine labour, seeds and fertilizer indicate their excessive use. The sum of regression co-efficient came out 0.1711 and its deviation from unity i.e., -0.8289 shows a decreasing returns to scale.

TABLE 4 RETURNS TO SCALE OF VEGETABLE CROPS AMONG THE NON-BENEFICIARY HOUSEHOLDS

Particulars	Marginal Holdings	Small Holdings	Medium Holdings	All Holdings
Constant	6.1167*	4.6035*	10.3929*	5.3092*
	(2.8001)	(7.1856)	(6.1603)	(17.4937)
Land (X_1)	0.3588*	-0.0047	0.0991***	0.2516*
	(2.3293)	(-1.2604)	(1.3596)	(2.8704)
Human Labour (X_2)	0.5808***	-0.0109	-1.2406	0.0017
	(1.4852)	(-1.8910)	(-2.9149)	(0.0671)
Bullock and Machine Labour (X_3)	-0.4656	0.0010	0.3803*	0.0600
	(-1.7502)	(0.9913)	(4.1066)	(0.7543)
Seeds (X_4)	-0.3961	0.2176***	0.0617	-0.3689
	(-2.9945)	(1.6107)	(0.4239)	(-4.9213)
Manure(X_5)	0.0969	0.0887	-0.0059	0.0808
	(0.7916)	(0.4819)	(-0.4838)	(1.1864)
Fertilizer (X_6)	-0.5147	0.0322	0.0179	0.1187**
	(-2.5190)	(0.9951)	(0.9388)	(1.6738)
Irrigation (X_7)	0.0896	-0.0082	0.1188*	0.0680***
	(1.0093)	(-0.2201)	(2.1862)	(1.2341)
Insecticides and Pesticides (X_8)	0.4215	0.0004	-0.0373	0.1166*
	(3.1431)	(0.4294)	(-1.5063)	(3.2962)
$\sum bi$	0.1711	0.3160	-0.6060	0.3285
R^2	0.4507	0.4051	0.7798	0.5503
Deviation From Unity	-0.8289	-0.6840	-1.6060	-0.6715
Returns to Scale	Decreasing	Decreasing	Decreasing	Decreasing

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

On the small size of holdings, the regression co-efficient of seeds has been worked out maximum among all the variables. It has been worked out 0.2176 which is significant at ten percent level. It indicates that considering all other factors constant, 100 percent increase in seeds would bring 21.76 percent increase in production of vegetable crops. The regression co-efficient of bullock-machine labour, manure, fertilizer and insecticides-pesticides has been found insignificant with a value of 0.0010, 0.0887, 0.0322 and 0.0004, respectively. The negative co-efficient of land, human labour and irrigation indicates their excessive use. The sum of regression co-efficient came out 0.3160 and its deviation from unity i.e., -0.6840 shows decreasing returns to scale.

On the medium size of holdings, the regression co-efficient of bullock-machine labour has been worked out maximum among all the variables. It has been worked out 0.3803 which is significant at one percent level and indicates that considering all other factors constant, 100 percent increase in bullock-machine labour would bring 38.03 percent increase in the production of vegetable crops. The regression co-efficient of land has been worked out significant at ten percent level with a value of 0.0991. The regression co-efficient of seeds and fertilizer has been found insignificant with a value of 0.0617 and 0.0179. The negative co-efficient of human labour, manure and insecticides-pesticides indicate their excessive use. The sum of regression co-efficient came out -0.6060 and its deviation from unity i.e., -1.6060 shows decreasing returns to scale.

Among all the holdings together, the regression co-efficient of land has been worked out maximum among all the variables. It has been found 0.2516 which is significant at one percent level of probability. It indicates

that considering all other factors constant, 100 percent increase in land would bring 25.16 percent increase in the production of vegetable crops. The regression co-efficient of human labour and bullock-machine labour has been worked out insignificant with a value of 0.0017 and 0.0600, respectively. The regression co-efficient of irrigation has been worked out significant at ten percent level with a value of 0.0680, whereas the regression co-efficient of insecticides-pesticides came out 0.1166 which is significant at one percent level. The negative co-efficient of seeds indicate their excessive use. The sum of regression co-efficient came out 0.3285 and its deviation from unity i.e., -0.6715 shows decreasing returns to scale.

3. Returns to Scale of Horticultural Crops Among the Sample Households

This section deals with returns to scale in the production of horticultural crops among the beneficiary and non-beneficiary sample households.

3.1 Returns to Scale of Horticultural Crops Among the Beneficiary Sample Households

The returns to scale in the production of Horticultural crop among the beneficiary sample households has been in presented in Table 5. This table reveals that the value of multiple determination (R2) are 0.5225, 0.6572 and 0.5835 on the marginal, small and medium size of holdings, respectively. Among all the holdings together, this value came out 0.4927. The rest of the variations in the production of horticultural crops may be due to the factors not included in the model. On the marginal size of holdings, the regression co-efficient of fertilizer has been worked out maximum among all the variables. It has been found 0.5391 which is significant at one percent level. It indicates that considering all other factors constant, 100 percent increase in fertilizer would bring 53.91 percent increase in the production of horticultural crops. The regression co-efficient of land, human labour and seeds has been worked out 0.4104, 0.3015 and 0.2108, respectively, which is significant at one percent level. The regression co-efficient of seeds and insecticides-pesticides has been worked out insignificant with a value of 0.7264 and 0.0844, respectively. The negative co-efficient of bullock-machine labour and irrigation indicate their excessive use. The sum of regression co-efficient came out 1.3910 and deviation from unity i.e., 0.3910 shows increasing returns to scale. On the small size of holdings, the regression co-efficient of fertilizer has been worked out maximum among all the variables. It has been found 0.6256 which is significant at one percent level of probability. It indicates that considering all other factors constant, 100 percent increase in human labour will bring 62.56 percent increase in the production of horticultural crops. The regression co-efficient of land has been worked out 0.2561 and significant at 5 percent level of probability.

TABLE 5 RETURNS TO SCALE OF HORTICULTURAL CROPS AMONG THE BENEFICIARY SAMPLE HOUSEHOLDS

Particulars	Marginal Holdings	Small Holdings	Medium Holdings	All Holdings
Constant	2.3606*	1.3793*	4.3930*	2.0912*
	(4.0666)	(2.2472)	(3.6136)	(5.0930)
Land (X_1)	0.4104*	0.2561**	0.8416*	0.3033*
	(3.9936)	(1.8916)	(3.7076)	(4.1309)
Human Labour (X_2)	0.3015*	0.4554*	0.4760*	0.3619*
	(3.1232)	(2.4839)	(2.4099)	(5.2837)
Machine Labour (X_3)	-0.1716	-0.3177	-0.3501	-0.1434
	(-1.6315)	(-2.5617)	(-0.5348)	(-1.9145)
Seeds/plants (X_4)	0.0875	0.1765*	0.1486	0.0655
	(0.7264)	(1.2031)	(0.7323)	(0.7619)
Manure(X_5)	0.2108*	0.1892*	0.6967	0.2240*
	(3.3149)	(3.2034)	(0.9805)	(4.9348)
Fertilizer (X_6)	0.5391*	0.6256*	0.0650	0.5179*
	(5.4559)	(3.5235)	(0.4192)	(7.2368)
Irrigation (X_7)	-0.0712	0.1194	-0.0415	-0.0702
	(-0.9010)	(1.1679)	(-0.2960)	(-1.2411)
Insecticides and Pesticides (X_8)	0.0844	-0.0801	-0.1306	0.0850
	(0.4654)	(-0.3537)	(-0.4697)	(0.6542)
$\sum$bi	1.3910	1.4244	1.4084	1.3440
R^2	0.5225	0.6572	0.5835	0.4927
Deviation From Unity	0.3910	0.4244	0.4085	0.3440
Returns to Scale	Increasing	Increasing	Increasing	Increasing

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

The regression co-efficient of seeds, manure and human labour has been worked out significant at one percent level with a value of 0.1765, 0.1892 and 0.4554, respectively. The regression co-efficient of irrigation has been found insignificant with a value of 0.1194. The negative co-efficient of bullock-machine labour and insecticides-pesticides indicate their excessive use. The sum of regression co-efficient came out 1.4244 and deviation from unity i.e., 0.4244 shows increasing returns to scale.

On the medium size of holdings, the regression co-efficient of land has been maximum among all the variables. It has been found 0.8416 which is significant at one percent level. It indicates that considering all other factors constant, 100 percent increase in human labour would bring 84.16 percent increase in the production of horticultural crops. The regression co-efficient of human labour has been worked out 0.1486 which is significant at one percent level of probability. The regression co-efficient of seeds, manure and fertilizer has been worked out insignificant with a value of 0.4760, 0.6967 and 0.0650, respectively. The negative co-efficient of bullock-machine labour, irrigation and insecticides-pesticides indicate their excessive use. The sum of regression co-efficient came out 1.4084 and its deviation from unity i.e., 0.4085 shows increasing returns to scale.

Among all the holdings together, the regression co-efficient of fertilizer has been came out maximum among all the variables. It has been worked out to be 0.5179 which is significant at one percent level. It indicates that considering all other factors constant, one percent increase in fertilizer will bring 51.79 percent increase in the production of horticultural crops. The regression co-efficient of land, human labour and manure has been worked out 0.3033, 0.3619 and 0.2240, respectively, which is significant at one percent level. The regression co-efficient of seed and insecticides-pesticides has been worked out insignificant with the value of 0.0655 and 0.0850, respectively. The negative co-efficient of machine labour and irrigation indicates their excessive use. The sum of regression co-efficient came out 1.3440 and its deviation from unity i.e., 0.3440 shows increasing returns to scale.

3.2 Returns to Scale of Horticultural Crops Among the Non-Beneficiary Sample Households

The returns to scale in the production of Horticultural crops among the non-beneficiary sample households has been presented in Table 6. This table reveals that the values of multiple determination (R2) have been worked out 0.2240, 0.4850 and 0.9669 on the marginal, small and medium size of holdings, respectively. Among all the holdings together, this value came out 0.5847. The rest of the variations in the production of horticultural crops may be due to the factors not included in the model.

TABLE 6-RETURN TO SCALE OF HORTICULTURAL CROPS AMONG THE NON-BENEFICIARY HOUSEHOLDS

Particulars	Marginal Holdings	Small Holdings	Medium Holdings	All Holdings
Constant	5.4512	4.4494*	4.4988*	2.6782*
	(0.8555)	(7.0644)	(9.9106)	(4.3789)
Land (X_1)	0.3099	-0.1031	-0.0002	0.1240
	(0.2350)	(-0.8263)	(-0.8231)	(0.5435)
Human Labour (X_2)	0.2054	0.3276*	0.1172	0.2941*
	(0.1832)	(4.5341)	(1.1442)	(2.3825)
Machine Labour (X_3)	-1.6716	-0.0107	-0.0021	0.1475***
	(-1.1248)	(-0.2041)	(-1.0632)	(1.2871)
Seeds/plants (X_4)	0.2535	0.1037	0.0004***	-0.0864**
	(0.5743)	(0.7241)	(1.6031)	(-0.6993)
Manure(X_5)	0.8713*	0.1648	0.2431*	0.4010*
	(2.3342)	(0.1543)	(3.4739)	(2.8362)
Fertilizer (X_6)	0.3328	0.1820*	-0.0015	-0.2293
	(0.3027)	(3.2988)	(-1.4651)	(-1.2900)
Irrigation (X_7)	-0.5511	-0.1605	0.0005	-0.2293
	(-0.6698)	(-1.9201)	(0.0081)	(-1.2900)
Insecticide and Pesticide (X_8)	-0.0173	-0.1083	0.0001	0.0455
	(-0.0661)	(-1.7025)	(0.3352)	(0.5583)
$\sum$bi	-0.2670	0.0659	0.3575	0.9349
R^2	0.2240	0.4850	0.9669	0.5847
Deviation From Unity	-1.2670	-0.9344	-0.6425	-0.0651
Returns to Scale	Decreasing	Decreasing	Decreasing	Decreasing

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

On the marginal size of holdings, the regression co-efficient of manure has been worked out maximum among all the variables. It has been worked out 0.8713 which is significant at one percent level. It indicates that considering all other factors constant, 100 percent increase in human labour would bring 87.13 percent increase in the production of horticultural crops. The regression co-efficient of land, human labour, seeds and fertilizer has been worked out insignificant with a value of 0.3099, 0.2054, 0.2535 and 0.3328, respectively. The negative co-efficient of machine labour, irrigation and insecticides-pesticides indicate their excessive use. The sum of regression co-efficient came out -0.2670 and its deviation from unity i.e., -1.2670 shows decreasing returns to scale. On the small size of holdings, the regression co-efficient of human labour has been worked out maximum among all the variables. It has been worked out 0.3276 which is significant at one percent level and indicates that considering all other factors constant, 100 percent increase in human labour would bring 32.76 percent increase in the production of horticultural crops. The regression co-efficient of fertilizer has been worked out 0.1820 which is significant at one percent level. The regression co-efficient of seeds and manure has been found insignificant with a value of 0.1037 and 0.1648, respectively. The negative co-efficient of land, bullock-machine labour, and irrigation indicate their excessive use. The sum of regression co-efficient came out 0.0659 and its deviation from unity i.e., -0.9344 shows decreasing returns to scale.

On the medium size of holdings, the regression co-efficient of manure has been worked out maximum among all the variables. It has been found 0.2431 which is significant at one percent level. It indicates that considering all other factors constant, 100 percent increase in human labour would bring 24.31 percent increase in the production of horticultural crops. The regression co-efficient of seeds has been worked out 0.0004 which is significant at 10 percent level. The regression co-efficient of human labour, irrigation and insecticides-pesticides has been worked out insignificant with a value of 0.1172, 0.0005 and 0.0001, respectively. The negative co-efficient of land, machine labour and fertilizer indicate their excessive use. The sum of regression co-efficient works out to be 0.3575 and its deviation from unity i.e. -0.6425 shows decreasing returns to scale.

Among all the holdings together, the regression co-efficient of manure has been came out maximum among all the variables. It has been found 0.4010 which is significant at one percent level of probability. It indicates that considering all other factors constant, 100 percent increase in manure would bring 40.10 percent increase in the production of horticultural crops. The regression co-efficient of human labour has been worked out significant at one percent level with a value of 0.2941. The regression co-efficient of land and insecticides-pesticides has been worked to be insignificant with a value of 0.1240 and 0.0455, respectively, whereas the regression co-efficient of machine labour came out 0.1475 which is significant at 10 percent level. The negative co-efficient of seeds and irrigation indicate their excessive use. The sum of regression co-efficient came out 0.9349 and its deviation from unity i.e., -0.0651 shows decreasing returns to scale.

Conclusions and Recommendations

It is found that there is a positive impact of watershed development programme on the returns to scale. The returns to scale are comparatively high among the beneficiary households in-comparison to non-beneficiary households. This may happen due to the watershed development works on beneficiary farms such as soil conservation works, provision of irrigation facilities, provision of high yielding variety of seeds, manure, fertilizer, insecticides, pesticides and awareness camps regarding farm management and different cultivation techniques and methods. The ecological heritage of the hill region is under pressure from natural and human-induced stresses such as earthquakes, landslides, construction activities. The impact of these pressures is illustrated by the declining forest cover in the Himalayan region, the loss of wildlife habitat as well as the loss of life and property caused due to natural disasters. Deforestation has led to the loss of many species of flora and fauna in the region. The increasing population and economic development have accentuated the fragility of hill areas. The cultivation of marginal lands due to increasing population pressure has led to ecological degradation in the hill region, thereby putting a question mark on the very sustainability of hill agriculture. The population and ecological problem are closely related. The economic development should not be at the cost of ecological balance. It should be designed for sustainable use of natural resources to achieve the best possible quality of living for not only the present generation of mankind but also for future generation. The people are not fully aware of the programme and their participation is inadequate. The implementing agencies are mainly dominated by the big farmers and this biasness could affect watershed programmes in a big way. There is a need for increasing the efficiency and effectiveness of expenditure. The lack of professionalism is seen in managing the funds and maintaining the accounts. Government must provide desired high yielding variety of seeds on cheap rate, open more fertilizer outlets in the watershed areas, distribute organic manure to the households to overcome the problem of manure, provide more adequate supply of plant protection material on cheap rate and more extension services regarding agriculture should be provided to households to keep them up to date. Government must open horticulture nurseries in the watershed areas. The sapling of desired variety must be distributed in the watershed areas on cheap rate to overcome the problem

of high cost of orchard establishment and more extension service regarding horticulture should be provided to orchardists through various awareness camps, training seminar etc. Thus it can be concluded that the watershed development programme is an area based approach which works toward inclusive growth and sustainable development. The adoption of watershed approach has improved the production, productivity and thereby the income of the beneficiary households in the study areas. The outcome and results of the study will be significant to the policy makers and economic planners for designing and implementing of watershed management strategies in Himachal Pradesh. This study would also be helpful to the academicians and research scholars to understand the role and importance of watershed development projects in hill agriculture.

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AGRO-ECONOMIC RESEARCH

Impact of Emerging Marketing Channels in Agriculture:Benefit to Producer-Sellers and Marketing Costs and Margins of Banana and Potato Crops in Tamil Nadu*

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The area under potato cultivation shrunk and production declined over the period (1985-86 to 2013-14), however, there was an increase in yield (kg/ha.) or productivity over the period in Nilgiris and Tamil Nadu because of technological advancement and incentives provided by the government.

The area under banana in Trichirapalli increased from 21.27 percent in 1985-86 to 26.68 percent in 1990-91, thereafter; it declined to 10.84 percent in 2001-02 and 8.35 percent in 2006-07 and 8.87 percent in 2011-12. The area under banana declined by 12.4 percent during three decades due to urbanisation of Trichirapalli and conversion of farm lands into real estate. The yield rate (kg./ha.) of Trichirapalli district is higher than that of Tamil Nadu. There is overall decrease in area, production and increase in productivity (kg./ha.) of banana in Trichirapalli district over the study period.

A majority of the farmers are growing banana crop among the Traditional Marketing Channels (TMC) (98 percent) and Emerging Marketing Channels (EMC) (87 percent). 70 percent of OBC farmers belonged to TMC and 54 percent of farmers belonged to EMC, respectively. This implies that the majority of the farmers cultivating banana in Trichirapalli district are Hindus. Farmers who belonged SC/STs also participated in cultivation of banana in proportion to their size in the population. 96 percent and 93 percent of farmers are growing potato in Nilgiris district for TMC and EMC, respectively. The SC farmers who cultivate potatoes form 24 percent and 20 percent in TMC and EMC, respectively. The ST farmers constitute 14 percent and 13 percent for TMC and EMC, respectively. More than 50 percent of farmers who cultivated potato in Nilgiris belonged to OBC category.68 percent of TMC and 73 percent of EMC of farmers are in BPL category. They live in kuccha and semi-kuccha houses (52 percent of TMC and 53 percent of EMC). About 48 percent and 47 percent live in pucca houses. About 64 percent and 73 percent use the mobile phone. But computer and internet facilities are used by a small percentage of farmers. It is observed that the majority of them are having poor knowledge of the use the modern technology and they do not have adequate marketing channels in the district.

The median sizes of farms under banana in Trichirapalli are 2.82 ha. and 2.62 ha. for TMC and EMC categories, respectively. More than 80 percent own land and leased out land is only 14 percent. 71 percent of the area in the TMC is irrigated and 66 percent of area in the EMC is irrigated through groundwater. Land irrigated through surface water is not much (9.35 percent in TMC and 17 percent in EMC).

The medium size of farm in Nilgiris district is 3.27 ha. in TMC and 4.61 ha. in EMC. The farmers who own land in the sample farm are of 50 percent and 64 percent in TMC and EMC, respectively.

The leased land accounted for 50 percent and 36 percent in TMC and EMC, respectively. Nearly, three-fourth of the area under potato is irrigated with groundwater in Nilgiris. Only a small area is irrigated with surface water. A majority of them (TMC, EMC) cultivate groundnuts. Next to groundnuts, they prefer to cultivate bananas; about 41 percent and 43 percent are marginal farmers. The small farmers constitute 29 percent and 30 percent among the farmers. The medium size farmers form 26 percent and 19 percent. During kharif season, the majority of the farmers grow potato, beetroot, carrot, cabbage and garlic. Generally, cauliflowers, beans, beetroot and cabbage are grown during rabi season. A majority of the TMC farmers grow cauliflower during rabi season.Among EMC farmers, 44 percent, 28 percent and 23 percent are small, medium and large farmers, respectively who are engaged in potato cultivation during kharif season. Carrot is a main vegetable cultivated by small (33 percent), medium and large farmers (12 percent). During rabi season, 18 percent and 14 percent of large and medium farmers grow beans, respectively.

The small and semi-medium farmers occupy the highest share (36 percent) of TMC and 47 percent of EMC, and are followed by marginal farmers who occupy moderate share in banana cultivation. For the potato crop, small and semi-medium farmers are found to be 40 percent and 20 percent in TMC and EMC, respectively. On the contrary, the lowest share is occupied by large farmers. It is found in the study that majority of the small and semi-medium farmers use land for cultivators of banana and potato crops in a productive way.

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The consumption of fertilizers for banana crop is estimated to be 138.6 kg/ha. and 144 kg/ha. for TMC and EMC, respectively. In the case of potato crop, it was 533 kg/ha. and 556 kg/ha. Banana crop cultivation depends on ground water and canal water source like Cauvery water sources; but for potato crop cultivation, farmers depend upon ground water and surface water. The share of hired labour cost in total labour cost incurred by banana growing farmers is 55.5 percent and 62.3 percent for TMC and EMC, respectively. It is 54.6 percent and 73.9 percent, respectively for potato growing farmers. Banana growing farmers incur more labour cost than potato growing farmers. The total labour cost for banana crop is calculated to be Rs.46,792 per ha. and Rs. 45,568 per ha. for both marketing channels and it is Rs.36,349 per ha. and Rs.38, 539 per ha.for potato growing farms. The banana cultivators spend more on labour cost than potato cultivators due to long gestation period taken for cultivation of banana crop (12 months) than potato crop (3 months).

The total cost of cultivation per hectare incurred by banana cultivators are worked out to Rs.84,803 and Rs.79, 629 for TMC and EMC, respectively, whereas, for potato crop, it is worked out to Rs.83, 300 and Rs. 87,927. It is found that banana cultivators have incurred higher cost to hired labour, which accounts for 30.64 percent and 35.67 percent for TMC and EMC, respectively.

The production for banana crop worked out to be 24,500 quintal for TMC and 6,670 quintal for EMC, while production for potato crop is worked out to be 14,593 quintal and 5,760 quintal for both the channels. The overall productivity of banana crop is worked out to be 173.51 qt/ha. and 165.92 qt/ha. for TMC and EMC, respectively. But for the potato crop, it is found to be 89.09 qt/ha. and 82.53 qt/ha. The banana cultivators in the study area do not cater to be emerging marketing. Emerging marketing is expecting quality in product; top priority should be given to high quality product only, otherwise, the product would be rejected by EMC in the farm field alone. On the other hands, in the TMC, traders also accept the moderate, high and low quality products.

The farmers growing banana realised a gross return of Rs. 2,59,780 and Rs. 2,85,970 per ha.for TMC and EMC, respectively, while it is Rs. 1,42,675 and Rs.1,38,771 per ha. for potato Cultivators. It is found that the EMC cultivators are enjoying higher gross return (9.16 percent) than TMC for banana cultivators. But the potato cultivators under TMC are enjoying higher gross return (2.73 percent) than that of potato cultivators under EMC. The average yield of banana is 173.5 qtl./ha. and 166 qtl./ ha., whereas that of potato crop is 89.1 qtl./ha. and 82.5 qtl./ha. The cost of cultivation for banana crop is Rs. 84,803 per ha. and Rs.79,628 per ha. for TMC and EMC. But for the potato cultivation, it is Rs.83,300 and Rs.87,927 per ha. Among the banana growers, TMC farmers spend more amount of Rs. 5,175 (6.10 percent) than EMC farmers. TMC farmers spend more amounts for banana crop. Within potato growing farmers, EMC farmers spend more amount of Rs.4, 627 (5.26 percent) than TMC. This implies that the EMC farmers incur higher cost on cultivation than TMC farmers.The market prices received by banana cultivators are found to be Rs. 1197 and Rs. 1120 for TMC and EMC, respectively. Within the marketing cost, commission is the leading cost incurred by the sample farmers, which is Rs.18 per quintal for TMC; transport cost is Rs.12 per quintal, while it is Rs. 3.12 for EMC. The average net price received by banana crop farmers is Rs.1164 for TMC and Rs.1116 for EMC. It is observed that the majority of the sample farmers only prefer TMC system. The average market price received by potato cultivators is worked out to be Rs.1320 and Rs.1187 for TMC and EMC, respectively. TMC farmers have spent more on marketing cost than that of EMC. The commission is one of the important costs is in TMC, while there is no commission charge in EMC. The transportation cost is calculated to be Rs.51 and Rs.46 for TMC and EMC, respectively.

The Benefit-Cost ratio for banana cultivators is 5.78 percent and 5.09 percent for EMC and TMC, respectively. But for the potato cultivators, it is 2.25 percent and 1.44 percent. The banana cultivators benefited more than the potato cultivators. About 26 percent of TMC and 27 percent of EMC banana cultivators had chosen it due to the force of habit. Remaining 20 percent cultivators had chosen such a marketing channel due to the influence of their friends. For potato cultivators, 24 percent and 27 percent preferred such a marketing channel because of assured sale. About 76 percent of TMC and 67 percent of EMC farmers reported that the post-harvest losses are main problems for all banana cultivators. The post-harvest losses are arising due to the perishable nature of the commodity and lack of storage facilities in the farm field. About 78 percent and 93 percent of the farmers were of the opinion that the long distance to market place is one of the important causes. A majority of them (70 percent and 87 percent) expressed the view that they wait some times for better prices; if there is no increase in prices, they incur huge losses. In the case of potato cultivators, 66 percent and 67 percent emphasized the perishable nature of the commodity and 76 percent and 93 percent of them reported lack of storage facilities in the market as a major handicap. Lack of storage facilities, long distances from farm field to market place and perishable nature of the commodity in the both districts are the major problems faced by the sample farmers during post-harvest period. A majority of the banana and potato cultivators for both TMC and EMC reported that they received information regarding prices at the time of sale alone. About 80 percent of the potato cultivators in both marketing channels reported that they

accepted existing price in the market. Banana cultivators, in both TMC and EMC system reported that they received information regarding existing price in the market. It is noted that the majority of the potato cultivators received correct information regarding price than that of banana cultivators in both marketing channels. Among banana and potato cultivators, about 50 percent of the banana cultivators in TMC expressed the view that commission agents /whole sale dealers/ retailers are involved in price fixation. On the other hand, 40 percent of banana cultivators and 47 percent of potato cultivators in the EMC reported that self-help groups and retailers participate in price fixation. It is observed that the majority of the sample farmers in TMC depend upon agents (like commission agents /whole sale dealers/ retailers) than farmers in EMC in the study area.

A majority of the banana cultivators sell their produce within the State as Trichirapalli is famous for banana cultivation. Within the district the farmers intend to sell their produce in Kattuputhur Co-operative Banana Market. On the contrary, potato cultivators sell their produce within the district and also in neighbouring States like Kerala and Andhra Pradesh. A majority of them sell their produce in Metupalayam co-operative potato market federation and to other private agents and to Kerala whole sale dealers. About 73 percent and 87 percent of banana and potato cultivators reported that they had received inputs from buyers in EMC. On other hand, in both the districts TMC cultivators reported that they received minimum level of inputs than in the case of EMC for banana and potato cultivation. A majority of them reported that they utilized the money for purchase of fertilizers, pesticides alone and not for other purposes. About 48.3 percent and 50 percent of banana cultivators received fertilizers from the buyer. About 84 percent and 50 percent of potato cultivators belonging to both the marketing channels borrowed the amount from buyers. About 74 percent and 80 percent of banana cultivators and 40 and 80 percent of potato cultivators (TMC and EMC) expressed the view that the conditions of the roads were very bad. A majority of them in Trichirapalli expressed the view that they sell away their produce within a distance of 10 to 25 kms. For the potato crop, they travel 10 to 50 kms for selling their produce from hilly area to plains.A majority of them reported that they sell their produce in Mettupalayam co-operative market and to private agencies in Nilgiris district. It may be noted that the majority of Nilgiris farmers travel long distance (25 to 50 KMs) to sell their produce than farmers of Trichirapalli district (10 to 25 KMs). About 82 percent and 80 percent of the banana cultivators and 42 percent and 73 percent of the potato cultivators in TMC and EMC, respectively reported that there is lack of godown facilities.

A majority of them reported that they need adequate godowns to preserve their farm produce. Farmers reported that they do not have any adequate cold storage facilities. About 36 percent and 67 percent of banana cultivators and 44 percent and 73 percent of potato cultivators of both the channels, respectively, expressed that cold storage facility is not available in the market. About 50 percent and 82 percent of banana and potato cultivators of TMC depend upon the commission agents and 88 percent and 80 percent of EMC cultivators reported that nearly three to four kinds of agents are involved in the buying activities. In EMC, 70 percent and 77 percent reported that they have dealing with SHGs/ direct sale, respectively. 76 percent and 73 percent of the cultivators in the EMC sell their produce without any intermediaries. 74 percent of TMC and 93 percent of EMC cultivators sell their banana produce within the district. A majority of them sell in Trichy open market, Kattuputhur banana crop co-operative society. In case of potato crop, majority of them sell in the Mettupalayam potato co-operative society. The remaining cultivators sell their produce to Kerala wholesalers and other State sellers. About 100 percent and 80 percent of banana crop cultivators and 74 percent and 80 percent of potato cultivators of TMC and EMC, respectively agreed and reported that the government should help them by fixing fair market price. About 100 percent and 74 percent of TMC farmers reported that the government should stop the involvement of commission agents in marketing the produce. About 88 percent, 80 percent of banana cultivators and 60 percent and 80 percent of potato cultivators (TMC and EMC) reported that the government should create cold storage facilities. A majority of them expect that government should interfere in the problem and should enact the measures to ameliorate the situation. About 48 percent and 40 percent of banana cultivators and 26 percent and 40 percent of potato cultivators reported that produce of good quality is accepted. A lot of farmers accept the TMC as a better marketing system than the EMC system. In popularization of EMC in the market, the government can face a number of problems. Immediately, we cannot change the farmer's regular practices in the market. The farmers have to be induced by the facilities like subsidies, physical and financial supports for spending among the farmers EMC. About 40 percent of banana cultivators reported that they needed support for the EMC farmers. About 56 percent and 20 percent of banana cultivators of TMC and EMC reported that they are willing for a reduced role of the commission agents. This indicates that the commission agents give more hurdles to the farmers. The government should take more steps to reduce commission agents. About 24 percent and 13.3 percent of TMC and EMC reported that they are provided with cold storage facilities for potato crop. It is noted that the majority of the cultivators in could not get adequate cold, storage facilities.

Policy Implications

As a result of the impact of emerging marketing system, both producers and sellers of banana and potato crops are benefited. The farmers and consumers are really exploited by the middle men during the transaction of commodities in the traditional marketing system. Over a period of time, in spite of a number of acts, rules and regulations enacted by the union and state governments in India, there is not much improvement in the farmers' level of living. In India, the agriculture and other markets are fully controlled by middle men and whole sale dealers. Therefore, there is urgent need for the government intervention to address the concerns of the farmers. The main objective of the emerging marketing system is to promote direct selling of agriculture produce in the market. The crucial objective of emerging marketing system is increasing profits to the farmers in Tamil Nadu. Against such backdrop, the following are some of the specific policy suggestions.

The Government should encourage the direct selling of agricultural produce in the market The government should build rural infrastructural facilities to connect the rural areas to market place. The cold storage facilities may be made available at least in every village panchayat free of cost. Government should open procurement centres at least within a distances of 10 kms at the time of harvest seasons of banana and potato crops. Government can fix the price rate for banana and potato crops based on cost-benefit ratio. Government can create banana processing company in Trichirapalli district because of the high production of banana crop in the district.

Government should create potato processing company in Nilgiris district.

The government should create the procurement centres at different hill stations in Nilgiris district to avoid harvest losses for farmers during transportation.

Government should encourage farmers through subsidies.

The co-operative system should be strengthened for selling their agricultural produce (banana and potato crops) in the districts.

A separate board of inspection committees should be established at every block level to control the role of middlemen. Awareness camps should be organised by the government, corporate companies and NGOs among the farmers and consumers.

The agricultural marketing system could be totally controlled by the union and state governments for the welfare of the farmers, consumers and for controlling inflation.

The middle men and wholesalers should be controlled by the government with the help of strict rules and regulations. The rules and regulations are implemented rigorously by the government officials.

Government should give compensation to the farmers whenever there is damage to crops due to heavy rainfall (if any) for banana cultivators and land slips for potato cultivators. Price information could be given to the farmers at the village level.

Regulated markets could be strengthened in Tamil Nadu for the welfare of the farmers. Government should make export zone for banana crop in Trichirapalli and for potato crop in Nilgiris districts.

The export of bananas and potatoes through CARCO should be provided incentives.

In the export of bananas and potatoes to the foreign countries, the government should provide guidance and support to the farmers.

In Tamil Nadu, traditionally, the farmers have been using the TMC system because of customs and habits of the farmers. Therefore, they are familiar with system. The conclusion is that the majority of the sample farmers in the study area are using mostly TMC and not EMC. There is no doubt that the EMC would promote the marketing of quality produce (e.g., bananas and potatoes) and will save the producers-sellers from exploitation by the middlemen (e.g., commission agents).

COMMODITY REVIEWS

Foodgrains

During the month of June,2017 the Wholesale Price Index (Base 2004-05=100) of pulses decreased by 2.83%, cereals decreased by 0.42% & foodgrains decreased by 0.90% respectively over the previous month.

ALL INDIA INDEX NUMBER OF WHOLESALE PRICES

(Base: 2004-2005=100)

Commodity	Weight (%)	WPI for the Month of June, 2017	WPI for the Month of May, 2017	WPI A year ago	Percentage change during	
					A month	A Year
1	2	3	4	5	6	7
Paddy	1.793	148.4	147.9	142.2	0.34	4.36
Wheat	1.116	136.1	137.5	136.5	-1.02	-0.29
Jowar	0.096	126.9	130.6	120.9	-2.83	4.96
Bajra	0.115	149.7	153.5	158.7	-2.48	-5.67
Maize	0.217	132.6	134.2	136.6	-1.19	-2.93
Barley	0.017	138.1	137.7	151.8	0.29	-9.03
Ragi	0.019	237.5	245.0	169.3	-3.06	40.28
Cereals	3.373	142.6	143.2	139.9	-0.42	1.93
Pulses	0.717	147.5	151.8	197.9	-2.83	-25.47
Foodgrains	4.09	143.5	144.8	150.6	-0.90	-4.71

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

The following Table indicates the state wise trend of wholesale Prices of cereals during month of May, 2017.

Commodity	Main Trend	Rising	Falling	Mixed	Steady
Rice	Rising & Steady	Kerala		Karnataka	A.P.
		U.P.			Gujarat
		West Bengal			Jharkhand
Wheat	Mixed	Punjab	M.P.	Gujarat	Karnataka
			Maharashtra	Rajasthan	
				U.P.	
Jowar	Mixed	Gujarat	Maharashtra	Karnataka	
				Rajasthan	
Bajra	Falling	Maharashtra	Gujarat		Karnataka
			Rajasthan		
Maize	Falling & Steady	Karnataka	Gujarat	Rajasthan	M.P.
			U.P.		Punjab

Procurement of Rice

1.20 million tonnes of Rice (including paddy converted into rice) was procured during June 2017 as against 0.98 million tonnes of rice(including paddy converted into rice)procured during June 2016.The total procurement of Rice in the current marketing season i.e 2016-2017, up to 30.06.2017 stood at 38.57 million tonnes, as against 34.03 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 30.06.2017		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	3701	9.60	4299	12.63	4326	12.65	3591	11.17
Chhatisgarh	4662	12.09	3442	10.12	3442	10.06	3423	10.64
Haryana	3583	9.29	2861	8.41	2861	8.36	2015	6.27
Maharashtra	304	0.79	227	0.67	230	0.67	199	0.62
Punjab	11052	28.66	9350	27.48	9350	27.33	7786	24.21
Tamil Nadu	141	0.37	1097	3.22	1191	3.48	1049	3.26
Uttar Pradesh	2354	6.10	2910	8.55	2910	8.50	1698	5.28
Uttarakhand	706	1.83	597	1.75	598	1.75	465	1.45
Others	12063	31.28	9245	27.17	9301	27.19	11936	37.11
Total	38566	100.00	34028	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 2017-2018 up to June, 2017 is 30.80 million tonnes against a total of 22.96 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 2017-18 (upto 30.06.2017)		Corresponding Period of last Year 2016-17		Marketing Year (April-March) 2016-17		2015-16	
	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	7411	24.06	6752	29.41	6722	29.32	6778	24.13
Madhya Pradesh	6724	21.83	3992	17.39	3990	17.40	7309	26.02
Punjab	11705	38.00	10649	46.38	10645	46.42	10344	36.83
Rajasthan	1243	4.04	762	3.32	762	3.32	1300	4.63
Uttar Pradesh	3699	12.01	797	3.47	802	3.50	2267	8.07
Others	17	0.06	10	0.04	9	0.04	90	0.32
Total	30799	100.00	22962	100.00	22930	100.00	28088	100.00

Source : Department of Food & Public Distribution.

Commercial Crops

Oil Seeds: The Wholesale Price Index (WPI) of nine major oilseeds as a group stood at 129.9 in June, 2017 showing a decrease of 1.6% and 13% over the previous month and year respectively. The WPI of safflower (kardi seed) increased by 1.2% niger seed by 1.0% and copra (coconut) by 0.5% over the previous month. WPI of sunflower decreased by 4.2%, groundnut seed by 2.2%, soyabean by 1.8%, cotton seed by 1.8%, gingelly seed by 1.7% and rape & mustard seed by 0.6% over the previous month.

Manufacture of Vegetable and Animal Oils and Fats: The WPI of manufacture of vegetable and animal oils and fats as a group stood at 105.7 in June, 2017 showing a decrease of 0.9% over the previous month and an increase of 1.5% over the year. The WPI of Copra Oil increased by 0.3% over the previous month. The WPI of groundnut oil decreased by 4.3%, mustard & rapeseed oil by 1.4%, cotton seed oil by 1.1%, soybean oil by 0.9% and sunflower oil by 0.3% over the previous month.

Fruits & Vegetable: The WPI of fruits & vegetable as a group stood at 137.3 in June, 2017 showing an increase of 6.4% over the previous month and a decrease of 12.5% over the year.

Potato: The WPI of potato stood at 112.9 in June, 2017 showing an increase of 4.5% over the previous month and a decrease of 47.3% over the year.

Onion: The WPI of onion stood at 111.8 in June, 2017 showing an increase of 9.3% over the previous month and a decrease of 9.5% over the year.

Condiments & Spices: The WPI of condiments & spices (group) stood at 118.3 in June, 2017 showing a decrease of 2.6% and 16.8% over the previous month and year respectively. The WPI of turmeric and black pepper increased by 9.0% each over the previous month. wpi of chillies (dry) decreased by 1.7% over the previous month.

Raw Cotton: The WPI of Raw Cotton stood at 110.7 in June, 2017 showing an increase of 1.2% and 5.9% over the previous month and year respectively.

Raw Jute: The WPI of raw jute stood at 163.3 in June, 2017 a decrease of 0.1% and 34.9% over the previous month and year respectively.

Wholesale Price Index of Commercial Crops for the Month of June, 2017

(BASE YEAR: 2011-12=100)

COMMODITY	LATEST	MONTH	YEAR	% VARIATION OVER	
	JUNE, 2017	MAY, 2017	JUNE, 2017	MONTH	YEAR
OIL SEEDS	125.4	127.4	144.2	-1.6	-13.0
Groundnut Seed	133.2	136.2	146.1	-2.2	-8.8
Rape & Mustard Seed	129.9	130.7	150.8	-0.6	-13.9
Cotton Seed	145.4	148.1	164.0	-1.8	-11.3
Copra (Coconut)	132.7	132.1	100.6	0.5	31.9
Gingelly Seed (Sesamum)	114.3	116.3	117.2	-1.7	-2.5
Niger seed	206.7	204.7	210.6	1.0	-1.9
Safflower (Kardi Seed)	129.3	127.8	111.8	1.2	15.7
Sunflower	98.3	102.6	112.7	-4.2	-12.8
Soyabean	121.2	123.4	165.1	-1.8	-26.6
MANUFACTURE of VEG AND ANIMAL OILS & FATS	105.7	106.7	104.1	-0.9	1.5
Groundnut Oil	112.3	117.4	123.0	-4.3	-8.7
Cotton Seed Oil	96.9	98.0	97.4	-1.1	-0.5
Mustard & Repeseed Oil	116.8	118.5	120.4	-1.4	-3.0
Soyabean Oil	102.3	103.2	101.8	-0.9	0.5
Copra Oil	143.1	142.7	124.6	0.3	14.8
Sunflower Oil	101.4	101.7	104.0	-0.3	-2.5
FRUITS & VEGETABLES	137.3	129.0	157.0	6.4	-12.5
Potato	112.9	108.0	214.3	4.5	-47.3
Onion	111.8	102.3	123.5	9.3	-9.5
CONDIMENTS & SPICES	118.3	121.4	142.2	-2.6	-16.8
Black Pepper	165.4	163.9	192.3	0.9	-14.0
Chillies (Dry)	100.1	101.8	142.9	-1.7	-30.0
Turmeric	108.0	107.0	120.5	0.9	-10.4
Raw Cotton	110.7	109.4	104.5	1.2	5.9
Raw Jute	163.3	163.5	251.0	-0.1	-34.9

STATISTICAL TABLES

Wages

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	Dec,16	8	300	250	500	NA	250	NA	NA	NA	NA
	Guntur	Tadikonda	Dec,16	8	270	225	300	NA	275	NA	NA	NA	NA
Telangana	Ranga Reddy	Arutala	Jan, 17	8	800	186	375	NA	NA	NA	400	300	NA
Karnataka	Bangalore	Harisandra	Nov, 16	8	360	340	400	350	400	300	600	450	NA
	Tumkur	Gidlahali	Nov, 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	June, 16	8	179	179	179	179	179	179	227	227	NA

1.1 Average 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	Nov, 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	April, 17	M	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
				W	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gujarat*	Rajkot	Rajkot	Dec, 16	M	8	254	254	241	229	211	208	500	475	488
				W	8	NA	200	241	229	211	198	NA	NA	NA
	Dahod	Dahod	Oct, 16	M	8	300	300	150	150	150	NA	400	350	300
				W	8	NA	250	150	150	150	NA	NA	NA	NA
Haryana	Panipat	Ugarakheri	Jan, 17	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	Nov,16	M	4-8	945	785	NA	785	735	NA	885	NA	NA
				W	4-8	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Palakkad	Elappally	Nov,16	M	4-8	NA	500	NA	500	500	NA	600	NA	NA
				W	4-8	NA	NA	NA	NA	NA	NA	NA	NA	NA
Madhya Pradesh	Hoshangabad	Sangarkhera	March, 17	M	8	250	NA	250	250	250	150	400	400	NA
				W	8	NA	NA	250	250	200	150	NA	NA	NA
	Satna	Kotar	March, 17	M	8	NA	200	200	200	200	200	300	300	300
				W	8	NA	200	200	200	200	200	NA	NA	NA
	Shyopurkala	Vijaypur	March, 17	M	8	NA	300	300	300	NA	300	400	400	NA
				W	8	NA	300	300	300	NA	300	NA	NA	NA

1.1 Average 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	March, 17	M	8	350	250	350	300	300	350	400	350	300
				W	8	NA	250	220	220	220	220	NA	NA	NA
	Ganjam	Aska	March, 17	M	8	300	250	250	250	250	250	500	500	500
				W	8	NA	200	200	250	200	200	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	Jan, 17	M	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
				W	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Jalore	Sarnau	Jan, 17	M	8	NA	NA	300	400	NA	NA	500	200	NA
				W	8	NA	NA	300	300	NA	NA	NA	100	NA
Tamil Nadu*	Thanjavur	Pulvarnatham	Feb, 17	M	8	800	368	NA	365	250	NA	NA	NA	NA
				W	8	NA	138	139	136	NA	NA	NA	NA	NA
	Tirunelveli	Malayakulam	Feb, 17	M	8	NA	263	NA	NA	387	NA	NA	NA	NA
				W	8	NA	166	200	158	NA	NA	NA	NA	NA
Tripura		State Average	July, 16	M	8	290	255	267	270	268	290	307	283	283
				W	8	NA	203	198	199	203	220	NA	NA	NA
Uttar Pradesh*	Meerut	Ganeshpur	May, 17	M	8	275	265	264	280	264	NA	398	NA	NA
				W	8	NA	205	211	208	211	NA	NA	NA	NA
	Aurraiya	Aurraiya	May,17	M	8	170	175	150	235	171	NA	400	NA	.NA
				W	8	NA	NA	150	235	171	NA	NA	NA	NA
	Chandauli	Chandauli	Feb,17	M	8	NA	200	NA	250	200	NA	400	NA	NA
				W	8	NA	200	NA	250	200	NA	NA	NA	NA

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

Prices

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

Commodity	Variety	Unit	State	Centre	June-17	May-17	June-16
Wheat	PBW 343	Quintal	Punjab	Amritsar	1615	1625	1600
Wheat	Dara	Quintal	Uttar Pradesh	Chandausi	1640	1625	1640
Wheat	Lokvan	Quintal	Madhya Pradesh	Bhopal	1586	1602	1722
Jowar	-	Quintal	Maharashtra	Mumbai	2300	2100	2200
Gram	No III	Quintal	Madhya Pradesh	Sehore	4700	5350	6231
Maize	Yellow	Quintal	Uttar Pradesh	Kanpur	1420	1340	1425
Gram Split	-	Quintal	Bihar	Patna	6600	7000	6200
Gram Split	-	Quintal	Maharashtra	Mumbai	7000	7500	8300
Arhar Split	-	Quintal	Bihar	Patna	7160	7500	15000
Arhar Split	-	Quintal	Maharashtra	Mumbai	5250	5700	11450
Arhar Split	-	Quintal	NCT of Delhi	Delhi	5250	5725	13200
Arhar Split	Sort II	Quintal	Tamil Nadu	Chennai	5300	5600	12500
Gur	-	Quintal	Maharashtra	Mumbai	3750	3900	4000
Gur	Sort II	Quintal	Tamil Nadu	Coimbatore	4200	4200	3800
Gur	Balti	Quintal	Uttar Pradesh	Hapur	2980	3150	2900
Mustard Seed	Black (S)	Quintal	Uttar Pradesh	Kanpur	3370	3425	4280
Mustard Seed	Black	Quintal	West Bengal	Raniganj	4200	4300	4750
Mustard Seed	-	Quintal	West Bengal	Kolkata	4000	3900	4700
Linseed	Bada Dana	Quintal	Uttar Pradesh	Kanpur	5400	4850	5450
Linseed	Small	Quintal	Uttar Pradesh	Varanasi	4600	4730	4420
Cotton Seed	Mixed	Quintal	Tamil Nadu	Virudhunagar	1950	2100	2300
Cotton Seed	MCU 5	Quintal	Tamil Nadu	Coimbatore	2750	2750	2500
Castor Seed	-	Quintal	Telangana	Hyderabad	4100	4150	3300
Sesamum Seed	White	Quintal	Uttar Pradesh	Varanasi	6050	6270	11825
Copra	FAQ	Quintal	Kerala	Alleppey	8800	9000	5250
Groundnut	Pods	Quintal	Tamil Nadu	Coimbatore	5000	5000	5500
Groundnut	-	Quintal	Maharashtra	Mumbai	5500	5800	6600
Mustard Oil	-	15 Kg.	Uttar Pradesh	Kanpur	1338	1330	1474
Mustard Oil	Ordinary	15 Kg.	West Bengal	Kolkata	1390	1400	1638
Groundnut Oil	-	15 Kg.	Maharashtra	Mumbai	1400	1550	1900
Groundnut Oil	Ordinary	15 Kg.	Tamil Nadu	Chennai	1890	1950	1995
Linseed Oil	-	15 Kg.	Uttar Pradesh	Kanpur	1365	1315	1560
Castor Oil	-	15 Kg.	Telangana	Hyderabad	1395	1425	1050
Sesamum Oil	-	15 Kg.	NCT of Delhi	Delhi	1510	1520	1450
Sesamum Oil	Ordinary	15 Kg.	Tamil Nadu	Chennai	2400	2415	2100
Coconut Oil	-	15 Kg.	Kerala	Cochin	1905	1935	1155
Mustard Cake	-	Quintal	Uttar Pradesh	Kanpur	1825	1830	2160
Groundnut Cake	-	Quintal	Telangana	Hyderabad	2857	2786	4000
Cotton/Kapas	NH 44	Quintal	Andhra Pradesh	Nandyal	5000	5000	5100
Cotton/Kapas	LRA	Quintal	Tamil Nadu	Virudhunagar	4500	4300	NT
Jute Raw	TD 5	Quintal	West Bengal	Kolkata	3540	3450	5765
Jute Raw	W 5	Quintal	West Bengal	Kolkata	3590	3500	5705
Oranges	-	100 No	NCT of Delhi	Delhi	667	583	NA
Oranges	Big	100 No	Tamil Nadu	Chennai	NT	500	800
Banana	-	100 No.	NCT of Delhi	Delhi	333	350	333

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

Commodity	Variety	Unit	State	Centre	June-17	May-17	June-16
Banana	Medium	100 No.	Tamil Nadu	Kodaikkanal	570	615	498
Cashewnuts	Raw	Quintal	Maharashtra	Mumbai	90000	95000	86000
Almonds	-	Quintal	Maharashtra	Mumbai	60000	70000	50000
Walnuts	-	Quintal	Maharashtra	Mumbai	90000	95000	55000
Kishmish	-	Quintal	Maharashtra	Mumbai	11000	11000	11000
Peas Green	-	Quintal	Maharashtra	Mumbai	4000	3200	6500
Tomato	Ripe	Quintal	Uttar Pradesh	Kanpur	2450	610	3200
Ladyfinger	-	Quintal	Tamil Nadu	Chennai	2500	1800	2500
Cauliflower	-	100 No.	Tamil Nadu	Chennai	1900	1700	1200
Potato	Red	Quintal	Bihar	Patna	860	750	1350
Potato	Desi	Quintal	West Bengal	Kolkata	760	780	1620
Potato	Sort I	Quintal	Tamil Nadu	Mettuppalayam	2210	2827	3487
Onion	Pole	Quintal	Maharashtra	Nashik	600	400	550
Turmeric	Nadan	Quintal	Kerala	Cochin	14000	14000	15500
Turmeric	Salam	Quintal	Tamil Nadu	Chennai	7700	7800	9000
Chillies	-	Quintal	Bihar	Patna	12000	11500	9800
Black Pepper	Nadan	Quintal	Kerala	Kozhikode	46000	47000	68000
Ginger	Dry	Quintal	Kerala	Cochin	11000	11000	16500
Cardamom	Major	Quintal	NCT of Delhi	Delhi	122000	124000	130000
Cardamom	Small	Quintal	West Bengal	Kolkata	110000	110000	95000
Milk	Buffalo	100 Liters	West Bengal	Kolkata	3800	3800	3800
Ghee Deshi	Deshi No 1	Quintal	NCT of Delhi	Delhi	40020	40020	35000
Ghee Deshi	-	Quintal	Maharashtra	Mumbai	46000	50000	46000
Ghee Deshi	Desi	Quintal	Uttar Pradesh	Kanpur	37700	37750	36700
Fish	Rohu	Quintal	NCT of Delhi	Delhi	13000	13000	10000
Fish	Pomphrets	Quintal	Tamil Nadu	Chennai	34000	34500	35500
Eggs	Madras	1000 No.	West Bengal	Kolkata	4000	4150	4350
Tea	-	Quintal	Bihar	Patna	21250	21250	21200
Tea	Atti Kunna	Quintal	Tamil Nadu	Coimbatore	36000	36000	34000
Coffee	Plant-A	Quintal	Tamil Nadu	Coimbatore	35000	35000	29500
Coffee	Rubusta	Quintal	Tamil Nadu	Coimbatore	30000	30000	13000
Tobacco	Kampila	Quintal	Uttar Pradesh	Farukhabad	3400	4200	4500
Tobacco	Raisa	Quintal	Uttar Pradesh	Farukhabad	2500	3100	3400
Tobacco	Bidi Tobacco	Quintal	West Bengal	Kolkata	12800	13200	12500
Rubber	-	Quintal	Kerala	Kottayam	11500	12200	11400
Arecanut	Pheton	Quintal	Tamil Nadu	Chennai	32700	32700	32500

Crops Production

3. Sowing and Harvesting Operations Normally in Progress During the Month of September, 2017.

State	Sowing	Harvesting
Andhra Pradesh	Paddy, Jowar, Maize, Tobacco, Groundnut, Mesta And Linseed.	Paddy, Bajra, Ragi, Ground, Sesamum and Ginger.
Assam	Paddy, Gram, Pulses, Potato and Linseed.	Paddy and Mesta.
Bihar	Wheat, Barley, Gram,Rapeseed & Mustard, Linseed and Potato.	Paddy, Jowar, Bajra,Maize, Ragi and Sesamum.
Gujarat	Paddy, Gram, Pulses and Potato.	Paddy, Jowar, Groundnut, Bajra and Cotton.
Himachal Pradesh	Wheat, Barley, Gram, Rapeseed & Mustard.	Paddy, Bajra, Maize, Small Millets, Pulses, Potato and chillies.
Jammu & Kashmir	Wheat, Barley, Rapeseed & Mustard and Onion.	Paddy, Bajra, Maize, Small Millets, Pulses Potato and Chillies.
Karnataka	Jowar, Potato, Tobacco, Linseed, Sweet Potato and Onion.	Kharif Jowar, Ragi, Small Milets, Chillies and Groundnut.
Kerala	Paddy, Pulses and Sesamum.	Paddy, Sweet Potato and lemongrass
Madhya Pradesh	Wheat, Barley, Gram, Jowar, Rabi Pulses, Potato, Chillies, Rapeseed & Mustard and Onion.	Paddy, Ragi, Kharif Pulses, Potato, Ginger Chillies and Groundnut.
Maharashtra	Wheat, Gram, Jowar, Barley and Pulses.	Kharif Paddy, Jowar, Bajra, Maize, Groundnut and Seasamum.
Manipur	Wheat, Potato and Rapeseed & Mustard.	Surgacane and late Paddy.
Orissa	Wheat, Jowar, Gram, Rapeseed & Mustard and Linseed.	Paddy, Kharif, Jowar and Sesamum.
Punjab	Wheat and Gram.	Paddy, Cotton, Pulses and Early Sugarcane.
Rajasthan	Wheat, Barley, Rapeseed & Mustard and Linseed.	Jowar,Bajra, Maize, Cotton and Sannhemp.
Tamil Nadu	Paddy, Jowar, Groundnut, Smal Millets, Tobacco And Cotton.	Kharif Paddy, Jowar,Maize, Cotton, Tapioca, Mesta and Ginger.
Tripura	Pulses and Potato.	Til.
Uttar Pradesh	Wheat, Barely, Gram, Linseed and Rapeseed & Mustard.	Paddy, Jowar, Bajra,Sesamum and Groundnut.
West Bengal	Wheat,Barley, Rapeseed & Mustard, Tobacco, Chillies, Til, Potato and pulses.	Paddy, Jute and Red Chillies.
Delhi	Wheat, Barley and Pulses.	Paddy, Jowar, Bajra, Maize and Sugarcane.

(K) Kharif (R)-Rabi

GIPMRND—2354AGRI—13.11.2017.