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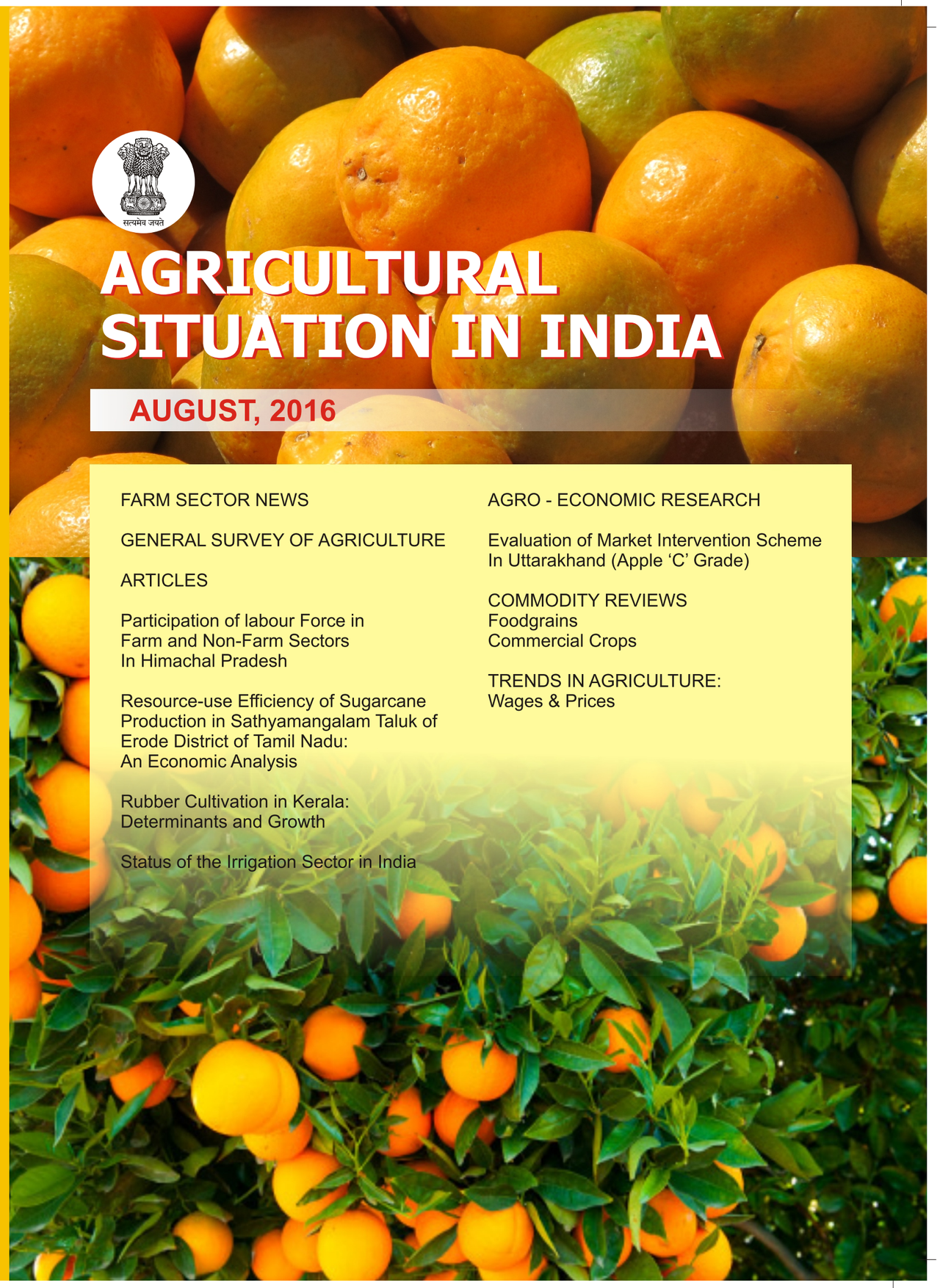

AGRICULTURAL SITUATION IN INDIA

AUGUST, 2016

Publication Division
Directorate of Economics and Statistics
Department of Agriculture, Cooperation & Farmers Welfare
Ministry of Agriculture & Farmers Welfare
Government of India
C-1, Hutments, Dalhousie Road,
New Delhi-110 011
Phone : 23012669
(Email: agri.situation@gmail.com)

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Contents

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Note to Contributors

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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 2.76 out of 6. The score is effective from January, 2016 onwards. The score may be seen in the following website: www.naasindia.org

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

Farm Sector News

Interest Subvention to Public Sector Banks, Private Sector Banks, Cooperative Banks, Regional Rural Banks and NABARD for Providing Short Term Crop Loan to Farmers

The Union Cabinet chaired by the Prime Minister Shri Narendra Modi has approved the Interest Subvention Scheme for farmers for the year 2016-17. The Government has earmarked a sum of Rs. 18,276 Crore for this purpose. This will help farmers getting short term crop loan payable within one year up to Rs. 3 lakhs at only 4% per annum.

The salient features of the scheme are as follows:

a) The Central Government will provide interest subvention of 5 per cent per annum to all farmers for short term crop loan upto one year for loan upto Rs. 3 lakhs borrowed by them during the year 2016-17. Farmers will thus have to effectively pay only 4% as interest. In case farmers do not repay the short term crop loan in time, they would be eligible for interest subvention of 2% as against 5% mentioned above.

b) The Central Government will give approximately Rs 18,276 crores as interest subvention for 2016-17.

c) In order to give relief to small and marginal farmers who would have to borrow at 9% for the post harvest storage of their produce, the Central Government has approved an interest subvention of 2% i.e, an effective interest rate of 7% for loans upto 6 months.

d) To provide relief to the farmers affected by Natural Calamities, the interest subvention of 2% will be provided to Banks for the first year on the restructured amount.

e) In case farmers do not repay the short term crop loan, in time they would be eligible for interest subvention of 2% as against 5% mentioned above.

Shri Radha Mohan Singh Inaugurates Two-Day Conference on "Innovations in Agricultural Mechanization - Development of linkage among R&D Institutes, Industry and Farmers"

The Union Minister of Agriculture & Farmers Welfare, Shri Radha Mohan Singh inaugurated two-day Conference on "Innovations in Agricultural Mechanization - Development of linkage among R&D Institutes - Industry - Farmers" on 7th July, 2016 at Vigyan Bhawan, New Delhi.

Speaking on the occasion, Shri Radha Mohan Singh congratulated Agricultural Engineers/ Scientists of the country who have contributed greatly in increasing the productivity of farm produce through mechanization. In his inaugural address the Union Minister emphasized that agricultural mechanization is essential for agricultural modernization and accordingly its benefits need to be extended to all categories of farmers in each agro-climatic zones of the country. He has informed that the Hon'ble Prime Minister, Shri Narendra Modi has cleared the road map and vision for agricultural development and welfare of farmers and alwaysact as a guiding force in the adoption of appropriate plans and programs towards this. Shri Singh also stressed upon the need to transfer the latest technology to the farmers so that their income may be doubled by way of reducing the cost of cultivation and increasing production.

Shri Radha Mohan Singh has requested to all the manufacturers to come forward for the commercialization of technology so that the appropriate technology may reach to the farmers to benefit them. The Union Minister has stressed upon the need for saving the water and the mantra "per drop, more crop".

During the inaugural address, Shri Singh emphasized on the establishment of four new Farm Machinery Training & Testing Institutes in the Bihar, Gujarat, Maharashtra and Uttar Pradesh. The Union Minister has also informed about the initiatives taken by his Government by which the farmers of the country have been benefited such as Pradhan Mantri Gram Sinchayee Yojana; Solar Pumping Set System; Soil Health Cards etc. The farmers were also advised to adopt the technologies in agriculture which can save the water and thereby increase the profitability. However in farm, business, due to small land holdings, the use of compatible equipment is not economically advantageous. Enabling custom hiring centers for agricultural machinery is a good effort. A book, named "Farm Mechanization in India - The Custom Hiring Perspective" was released on this occasion.

During the plenary session, the eminent personalities in the field of agricultural mechanization presented the latest innovations and technological development in the agricultural machinery and equipments. The national innovation foundation has stressed upon the need for standardization of grass root technologies developed by the rural innovators / artisans. The technology developed in the R&D systems of ICAR and private sectors have been shown to the farmers and the Government officials for their promotion and popularization. Some of the innovations have also been offered for commercialization such as

Source : www.pib.nic.in

- Variable rate fertilizer applicator
- Check basin former
- Turmeric rhizomes planter
- Ultrasonic sensor based sprayer
- Unmanned autonomous vehicle for agriculture

KVK Portal will Help in Monitoring at the National Level and in Providing Timely Information and Advisory to the Farmers: Shri Radha Mohan Singh

The Union Minister of Agriculture and Farmers Welfare, Shri Radha Mohan Singh formally launched Krishi Vigyan Kendra (KVK) portal (http://kvk.icar.gov.in) on 8th July, 2016 in New Delhi. The Minister of State for Agriculture and Farmers Welfare, Shri S.S Ahluwalia, the Minister of State for Agriculture and Farmers Welfare, Shri Parshottam Rupala, the Minister of State for Agriculture and Farmers Welfare, Shri Sudarshan Bhagat and Secretary, ADF, Shri Devendra Chaudhary also graced the occasion.

Speaking on the occasion the Union Minister of Agriculture & Farmers Welfare said that there are 645 Krishi Vigyan Kendra's (KVKs) in the country. These centres are established in the Rural Districts of the country. Each KVK has direct interface with at least 1000 farmers. As the information related to KVK was not available at one place at the National Level, the farmers and other stake-holders had difficulty in accessing the information and also there was no online monitoring system at the National level to review and monitor the functioning of KVKs against the mandates and objectives. This portal will provide a platform to provide the information and advisory to the farmers and facilitate online monitoring of the KVK activities.

Shri Singh said that the KVKs are the main center of knowledge and resource in the field of agriculture at the district level and this portal will help in monitoring at the National level and in providing timely information and advisory to the farmers.

Features of the Portal:

1. The portal provides provisions for online monitoring of KVKs which will include reporting of major events on regular basis and submission of monthly reports online.
2. The portal will also provide information on different services being provided by different KVKs.
3. Weather and Market related informations can also be accessed by the farmers and others.
4. The forthcoming programmes will also be available on the website which will benefit farmers and youth in joining different training programmes being organized by KVKs.
5. Question and answer facility will also be available for the farmers.
6. Agriculture related information of the districts will also be available on the portal.
7. The farmers and the Agricultural Officers may register themselves and seek different informations related to KVKs.

Rural Entrepreneurship Development Scheme will be effective from 2016-17: Shri Radha Mohan Singh

Union Agriculture and Farmers Welfare Minister Shri Radha Mohan Singh has said that recommendations to rectify the curriculum as well as its contents by 5th Dean Committee has been approved so as to improve the quality of agricultural education in the country. Shri Singh further said that it would help students as it would provide quality education in agriculture. The Minister said this on 11th July, 2016 at Mahatma Phule Agriculture Vidyapeeth, Rahuri, Ahamednagar, Maharahstra. The Union Agriculture and Farmers Welfare Minister reiterated that all agricultural universities across the country are expected to enforce it at the earliest.

Shri Singh added that for the first time the degrees imparted by Agriculture University in Maharashtra have been given professional status. Now, the strength of emeritus scientists and emeritus professors has been increased. The duration of these schemes has been increased from 2 to 3 years. In addition to this, the amount of remuneration has been increased from Rs. 25,000 to Rs. 50,000.

The Minister further added that Hon'ble Prime Minister Shri Narendra Modi had launched Rural Entrepreneurship Development Scheme in 2015 and it will be effective from 2016-17. It is a new programme to impart opportunities for attaining experience as well as entrepreneurship skills on part of agriculture graduates. Under this scheme, the agriculture graduate students will be granted scholarship at the rate of Rs. 3000 per month.

Shri Singh said that the objective of pilot studies is to augment knowledge as well as skill as per the requirements of private sector. It also aims at to create belief and competency amongst undergraduate students so as to initiate their own enterprise. The Minister observed that it will trigger helping the students for practicable knowledge as well as skill orientation which will be very much conducive to provide quality entrepreneurship for augmenting strength of agriculture graduates.

Union Agriculture and Farmers Welfare Minister reiterated that the amount related to National Talent Scholarship has been earmarked for post graduate students for the year 2016-17 every month. Apart from this, the sum of scholarship meant for graduation students has been shot

up from Rs. 1000 to Rs. 2000 per month which is an innovative approach to motivate the students concerned.

Loan Applying Process might be Conducted Online and Agriculture Loan should be Provided within Scheduled Timeframe: Shri Radha Mohan Singh

The Union Minister of Agriculture and Farmers Welfare, Shri Radha Mohan Singh has asked NABARD to make its agriculture loan process easier along with its banking facilities so that they can grant the required loan on time. The Minister urged this on the valedictory function of one day National Seminar on "Doubling of Farmers' Income by 2022" organized by NABARD on its 35th Foundation Day on 12th July, 2016. Shri Singh further said that they should also work on to standardize the documents concerned for the sanction of loan. He added that we should ensure that loan applying process might be conducted online and agriculture loan should be provided within scheduled timeframe.

The Minister said that a long term irrigation fund has been set up with a cluster fund of Rs. 20,000 crore with the cooperation of NABARD so as to complete some of the larger irrigation projects. Shri Radha Mohan Singh further added that to provide bank loan to landless farmers, Modi Government has provided financial help of Rs. 10,225 crore to 10.49 lakh joint liability groups during the span of 2 years. Whereas previous government had provided financial help of Rs. 6630 crore only to 6.7 lakh such clusters during the span of 7 years. To fulfil the loan needs of farmers, a target of Rs. 9 lakh crore has been earmarked for the year 2016-17 and we hope that this will be achieved.

The Minister observed that digitalization process related to land records in most of the states has been completed so as to sanction loan expeditiously to the farmers. Apart from this, online mortgage is also being facilitated. Simultaneously the schemes related to interest subvention and relaxations on timely repayment of the loan are also continued this year so that farmers might obtain agriculture loan at the rate of 4% interest. Recently, a sum of Rs. 18,000 crore has been approved for interest subventions.

The Union Minister of Agriculture and Farmers Welfare said that every possible efforts are being made to make the farmers income double. To chalk out strategy for this purpose, a committee has been constituted in Ministry of Agriculture and farmers welfare under the Chairmanship of Dr. Ashok Dalwai, Additional Secretary. NCAER, along with this committee is being associated as a knowledge organization. He while expressing his views, said NABARD will develop the programmes and products concerned so as to double the income of the farmers.

Shri Singh briefed that West Bengal, Tamil Nadu, Odisha, Punjab, Jharkhand, Bihar as well as Kerala have been invited for this purpose and they have been stressed that they should participate in E-Mandi process in the interest of the farmers in their states. On this eve, the Agriculture Minister briefed that Modi Government has set up a National Climate Adaptation Fund to face the challenges created by the impact of climate change. The Union Minister opined that the outputs received from the states in respect of Pradhan Mantri Fasal Bima Yojana are encouraging.

Steps taken to increase Pulses Production

Central Government is taking several measures to control the price rise of pulses. On one hand Government is trying to give relief to citizens by importing pulses from foreign countries or taking action against hoarders, on the other hand Govt has taken several steps to increase pulses production and to incentivise pulses growing farmers. Recently, Govt has given a step hike in MSP for pulse crops to encourage farmers Central govt has decided to form a committee under the Chief economic advisor, Govt of India to make a long term plan to encourage pulse growing among farmers and to review MSP and bonus for farmers.

Agriculture and Farmer Welfare Ministry has taken several steps to increase pulse production. In the year 2013-14, under the National Food security mission, only 482 districts of 16 states were included. Now, all 638 districts of 29 states have been included in this plan. Goa, Kerala and 8 north eastern states and 3 hilly states have now been included in this mission.

Total 17 hundred crores is being allocated under National food security mission. For pulses, total allocation is Rs. 1630 crores. Central govt has allocated Rs. 1100 crores and 430 crores have been allocated by state govt.

Of this amount allocated for NFSM, 15% goes for production of new varieties of pulses. During UPA tenure, grant being given through state governments for distribution of new seeds varieties was Rs.12/- per kg till 2013-14, which has now been increased to Rs.25/- per kg. from the year 2014-15. For expansion of cultivation of new kinds of seeds of min-kit rice Rs.7.85 lakhs are being distributed to farmers free of cost in the year 2016-17, through State Governments.

In the year 2016-17, demonstration of new techniques for pulse production is being carried out in 31,000 hectares by 534 KVKs through ICAR & State Agriculture Universities and Rs.25.29 crores have been allocated for this purpose.

Recently, the extent of buffer stocks of pulses has been increased from 8 to 20 MTs. The Central Government agencies like Central procurement agencies like (NAFED, FCI, S.F.A.C.) against the target of procurement of chana and masur to the tune of 1.00 lakh tones for the year 2016-17, have procured 69 thousand tonnes of chana and masur

till 10th July,2016.. chana and masoor were procured at the rate of Rs.4900-7000 and Rs.5400-8500 per quintal respectively. The purchase of pulses is still in progress.

Central Government has made a committee under the supervision of chief economic advisor, the gout of India to make long term plan to review MSP and bonus as well as to encourage pulse production in the country.

Vast Scope of Development of Bee Keeping in Bihar: Shri Radha Mohan Singh

The scope of agriculture is very vast. Our farmers not only grow foodgrains in the field but they are contributing very much in the development of the country by doing other work associated with farming and getting employment. Bee keeping is one of them. It is a very attractive rural agriculture/horticulture based activities. It neither requires technology nor capital investment or comprehensive infrastructure. Our farmers, agriculture workers can increase their income alone and by forming groups also. Union Agriculture and Farmers Welfare Minister, Shri Radha Mohan Singh said this on the occasion of inauguration of two days seminar of 'Integrated Bee Keeping Development' in Piprakothi, Motihari in Bihar on 17th July, 2016 on awareness, promotion and technology transfer in bee keeping.

The seminar was organized by National Bee Keeping Board (NBB), Department of Agriculture Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India. Union Minister has said that we have learnt bee keeping from our tradition. It is a traditional industry of forest areas and many tribal and other persons know the original art of honey collection. We have to help them by scientific management. We have to link it with employment. He said that bee keeping has so many benefits: (a) To provide self employment to rural and forest based population (b) Production of honey, pollen, wax, venom and royal jelly; (c) To provide employment to rural educated youths in collection, processing and marketing of bee products; (d) To increase the yield by cross pollination of several agriculture and horticulture crops and to improve their quality. The Government is trying its best for this.

Shri Radha Mohan Singh said that we not only get honey from honey bees but there are so many species of honey bees in India which are very helpful in giving pollination support for increasing yield of agriculture and horticulture corps. In many developed countries honey bees are used for pollination in agriculture and horticulture crops in a very large number for increasing per acre productivity for the last three four decades. The agriculture scientists of America and Europe have estimated that the yield of crops has increased manifold due to bee pollination. In many of the crops, yield has increased manifold by cross pollination of honey bees e.g. 159.8% in Mustard, 20 to 3400% in Sunflower, 24-33150% in Burseme, 180 to 6950% in Apple, 10,000% in Lichi, 471 to more than 900% in Orange, 70 to more than 140% in Guava, upto 30% in Pulses like Arhar etc. According to National Bee Board, 12 main crops are unfertile themselves and they require bee pollination and for this atleast 2000 lakh bee colonies are required. Recently about 25 lakh bee colonies are reared by more than 2.00 lakh bee keepers and the estimated annual production of honey is about 90,000 metric tonne.

Thus we see that bee keeping has double benefits. On the one hand our agriculture yield is increasing and we are getting bee products on the other hand. Besides honey, we get wax, venom, royal jelly, propolis etc. from bee keeping which are used in medicine and cosmetics. These products are in great demand in national and international markets.

Steps undertaken for Protection and Conservation of Native Breeds of Cattle

In order to complement and supplement the efforts made by the States for protection and conservation of indigenous breeds of cattle, Government of India has undertaken following measures:

(i) Rashtriya Gokul Mission is a new initiative initiated as a part of National Programme for Bovine Breeding and Dairy Development exclusively for development and conservation of indigenous bovine breeds including indigenous breeds of cattle.

(ii) National Dairy Plan-I is a World Bank assisted project being implemented in 18 major dairy States covering development and conservation of 12 indigenous breeds of cattle and buffaloes namely (i) Gir; (ii) Kankrej; (iii) Tharparkar; (iv) Sahiwal; (v) Rathi; and (vi) Hariana cattle breeds and (i) Marrah; (ii) Mehsana; (iii) Pandharpuri; (iv) Jaffarabadi; (v) Banni and (vi) Nili Ravi buffalo breeds.

(iii) Government has also established three subordinate organizations, namely, (i) Central Cattle Breeding Farms (CCBFs) (ii) Central Herd Registration Scheme and (iii) Central Frozen Semen Production & Training Institute. These organization are also undertaking development and conservation of indigenous breeds, namely, (i) Tharparkar; (ii) Red Sindhi; (iii) Gir; (iv) Kankrej; (v) Ongole; (vi) Hariana and (vii) Rathi breed of cattle and (i) Surti; (ii) Murrah; (iii) Meshsana and (iv) Jaffarabadi breeds of buffaloes.

Drone Based Agricultural Technology

The Indian Council of Agricultural Research (ICAR) through the Indian Agricultural Research Institute (IARI) has formulated a collaborative research project titled "SENSAGRI: SENsor based Smart AGRIculture" involving six partner Institutes (Agriculture & IT) to be funded by Information Technology Research Academy (ITRA), Department of Electronics and Information

Technology (DEITY), Ministry of Communication and Information Technology (MCIT), Govt. of India and ICAR. The major objective is to develop indigenous prototype for drone based crop and soil health monitoring system using hyperspectral remote sensing (HRS) sensors. This technology could also be integrated with satellite-based technologies for large scale applications.

Drone technology based unmanned aerial vehicle (UAV) has ability for smooth scouting over farm fields, gathering precise information and transmitting the data on real time basis. This capability could be used for the benefit of farming sector at regional/local scale for assessing land and crop health; extent, type and severity of damage besides issuing forewarning, post-event management and settlement of compensation under crop insurance schemes.

Impact of Agro-Chemicals

Ministry of Agriculture and Farmers Welfare has started a central sector scheme,namely, "Monitoring of Pesticide Residues at National level" under which samples of food commodities are collected and analysed for the presence of pesticide residues. The detail of samples analysed during the year 2015-16 is given below.

Details of the samples analysed during the year 2015-16

S. No.	Commodity	Samples Analyzed	Samples found above FSSAI MRL
1.	Foodgrains (Rice and Wheat)	1955	157 (8%)
2.	Vegetables	11551	339 (2.9%)
3.	Fruits	2358	30 (1.27%)

The Government is implementing "Strengthening and Modernization of Pest Management Approach in India" through 35 Central Integrated Pest Management Centres (CIPMCs) of Directorate of Plant Protection Quarantine and Storage established across the country with an aim to promote Integrated Pest Management (IPM) approach . CIPMCs inter alia, produce biological agents for release in the fields, conserve natural bio-control agents, promote bio-pesticides as an alternative to chemical pesticides and advocate judicious and safe use of chemical pesticides as a last resort. These activities are implemented through Farmers Field Schools (FFSs), 2 days and 5 days training programmes and season long training program for State Agriculture Extension officers and NGOs/Private Bodies. A 'Grow Safe Food' campaign has been initiated to carry the message of safe and judicious use of pesticides to farmers and other stakeholders. A simple message related to five essential principles of judicious pesticide use - application of pesticides on the right crop, against pests for which the pesticide has been approved, at the right time, in approved doses, and as per approved method of application - is sought to be disseminated in regional languages in Gram Panchayats and rural areas. Package of practices for control of pests and diseases in 79 crops have been revised to include techniques to reduce dependence on chemical pesticides and encourage use of bio-pesticides and other alternative plant protection measures.

Steps undertaken to Tackle Banned Pesticides

The Government registers pesticides after a detailed evaluation of efficacy of the product and safety to human, animal and environmental health. Technical reviews are carried out from time to time to assess the safety of pesticides. An expert committee was constituted under Dr. AnupamVerma, Former Professor, Indian Agriculture Research Institute (IARI), to carry out technical review of 66 pesticides that are banned, restricted, withdrawn in one or more countries but continued to be registered in India. The Expert Committee, inter alia, recommended 13 pesticides to be banned, 27 pesticides to be reviewed in 2018 after completion of certain technical studies and 6 pesticides to be phased out by 2020. The Committee further recommended continuation of ban on 1 pesticide and did not offer any assessment of a pesticide which is currently sub judice. The VermaCommittte recommended continued use of 18 pesticides which are given below in table.

Further, the Ministry of Agriculture and Farmers Welfare is implementing a program for "Monitoring of Pesticide Residues at National Level" (MPRNL) under which samples of agriculture commodities are collected and analyzed for the presence of pesticide residues. In the previous year , 2.9 % of all samples of commodities contained pesticide residues above the Maximum Residues Limits (MRLs) fixed by the Food Safety and Standards Authority of India. No residues of banned pesticides have been detected in commodities monitored under this program.

Central Integrated Pest Management Centres (CIPMCs) under the Department of Agriculture, Cooperation and Farmers Welfare conduct Farmers Field Schools to sensitize farmers regarding safe and judicious use of pesticides, use of bio-pesticides etc. A 'Grow Safe Food' campaign has also been initiated carrying the message of safe and judicious use of pesticides to farmers and other stakeholders. Package of practices for control of pests and diseases in 79 crops have been revised to include techniques to reduce dependence on chemical pesticides and encourage use of bio-pesticides and other alternative plant protection measures. Under Soil Health Management Scheme, financial assistance is provided to States for imparting training and demonstration to farmers on balanced use of fertilizers.

Further, the Government is encouraging establishment of Bio-fertilizer units by providing financial assistance to State Government up to a maximum limit of Rs 160.00 lakh per unit. Financial assistance is also

provided to farmers/Individual/Private agencies @ 25% of total financial outlay or Rs. 40 lakh, whichever is less under Capital Investment Subsidy Scheme (CISS) through National Bank for Agriculture and Rural Development.

Development of Eco-Friendly Flood Tolerant Seeds

National Agricultural Research System comprising ICAR, central agricultural universities and SAUs are taking adequate steps continuously for developing eco-friendly flood tolerant seeds for protecting the crops in flood prone regions of the various States of the country. The concerted research efforts led to release of 49 different crop varieties tolerant to flood/water logging stresses comprising 22 of rice, 4 of maize, 10 of sugarcane, 10 of jute and 3 of soybean.

During 2013-14, 2014-15, 2015-16 and kharif 2016, 30.2 lakh ton, 30.4 lakh ton, 31.6 lakh ton and 12.0 lakh ton, respectively, of certified/quality seeds of improved varieties of different crops tolerant to flood/drought were made available to the farmers.

The Government of India has launched several central sector crop development schemes viz. National Food Security Mission (NFSM), Bringing Green Revolution in Eastern India (BGREI), National Mission on Oil Seeds and Oil Palm (NMOOP), Rashtriya Krishi Vikas Yojana (RKVY), Sub-mission on Seeds & Planting Material under National Mission on Agricultural Extension & Technology and these schemes are under operation in all the states including flood prone states as well.

Setting up of Ripening Chambers for the Benefit of Farmers and Entrepreneurs

Department of Agriculture, Cooperation and Farmers Welfare (DAC&FW) is implementing Mission for Integrated Development of Horticulture (MIDH) for holistic development of horticulture in the country including creation of post harvest management infrastructure to reduce losses of perishable horticulture produce. Post harvest management component includes establishment of setting up of pack house, pre-cooling, primary processing, cold chain, refrigerated transport, ripening chambers etc.

These components are demand & entrepreneur driven for which credit linked back ended subsidy is available through respective State Horticulture Missions. An entrepreneur can avail assistance for establishment of ripening chamber @ 35% of admissible project cost in general areas and @ 50% in hilly and schedule area as credit linked and back ended subsidy. The admissible cost for ripening chamber is Rs. 1.00 lakh per MT limited to maximum of 300 MT capacity.

Capacity building of field staff and farmers is one of the major components of MIDH. State Horticulture Missions are organizing regular training programmes and workshops on Post-harvest Management (PHM) including ripening chambers for the benefit of farmers and entrepreneurs. Further, National Centre for Cold-chain Development (NCCD), an autonomous organization under Department of Agriculture, Cooperation & Farmers Welfare is holding workshops and training programmes in various parts of the country for ripening chamber operators and farmers for awareness and technical information for establishment and running of ripening chambers.

Steps Taken to Increase Production of Fruits and Vegetables

Various steps taken by the Government to increase the Country's production and exports of fruits and vegetables are as under:

Mission for Integrated Development of Horticulture (MIDH), a Centrally Sponsored Scheme, is being 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.

To boost exports, recently a new scheme has been launched namely "Merchandize Exports from India (MEIS)" under Foreign Trade Policy 2015-20, wherein the exporters/farmers are incentivized for export of their goods/ products including fruits and vegetables to specified markets.

Milk Production and Per Capita Availability of Milk in the County

The total quantum of milk produced in the county during 2015-16 is 155.5 million tonnes and the per-capita availability of milk is 337 grams per day. The State/UTs-wise per capita availability of milk during 2015-16 is given below.

The Department of Animal Husbandry, Dairying and Fisheries (DADF) is implementing the following Dairy Development Schemes to increase the production of milk:

(i) National Dairy Plan (Phase-I): The Government of India has approved National Dairy Plan Phase- I (NDP-I) with an outlay of Rs. 2,242 Crore for implementation during 2011-12 to 2018-19 as a Central Sector Scheme in 18 major milk producing states.

(ii) National Programme for Dairy Development (NPDD) under the Central Sector Scheme "National Programme for Bovine Breeding and Dairy Development".

(iii) Dairy Entrepreneurship Development Scheme: "Dairy Entrepreneurship Development Scheme (DEDS)" is implemented through National Bank for Agriculture and Rural Development (NABARD) across the country.

The Government does not have any special scheme for setting up of high-tech dairies to boost milk production. However, the Department is implementing "Dairy Entrepreneurship Development Scheme" (DEDS) from 1.09.2010 through National Bank for Agriculture and Rural Development (NABARD) in which back ended capital subsidy (25% of the project cost for General Category and 33.33% for SC & ST beneficiaries) is provided under bankable projects through eligible financial institutions, subject to the norms of the scheme for establishment of small dairy unit from 2 to 10 crossbred cows or indigenous cows/ buffaloes.

The mechanism for ensuring availability of quality milk in the country is governed under Food Safety & Standards (FSS) Act, 2006 which is implemented by the Food Safety & Standards Authority of India through the State/Union Territories' Food Safety Commissioners.

Steps to Make Barren Land Fertile

Indian Council of Forestry Research and Education (ICFRE) have not conducted study to assess the barren and desert land in the country. However, Indian Council of Agricultural Research (lCAR) conducts survey from time to time for assessing the extent of soil erosion and land degradation. As per available estimates (ICAR-2010), out of a total geographical area of 328.73 million ha. about 120.40 million ha. (37%) is subjected to various kinds of land degradation which includes 94.87 million ha. of area affected by water and wind erosion in the country.

As per available estimates, about 1.73 million ha.of areas in the States of Haryana, Punjab & Uttar Pradesh are affected by alkalinity and salinity. Main reason of such problem is excess use of irrigation water, Imbalance use of chemical fertilizers and non adoption of recommended crop rotation. According to the definition of land uses, barren land includes all lands covered by mountains, deserts, etc. which cannot be brought under cultivation except at an exorbitant cost. As such, there is no comprehensive programme for development of barren land into fertile land. However, Government of India is implementing various watershed development programmes for development of degraded land in the country and parts of such developed land are put to cultivation for various crops including food crops.

Policy to Improve Agriculture Sector

The Blue Revolution, with its multi-dimensional activities, focuses mainly on increasing production from aquaculture and fisheries resources, both inland and marine. Blue Revolution visualizes "Creating an enabling environment for an integrated and holistic development and management of fisheries keeping in view the sustainability, bio-security and environmental concerns".

The main objectives of the scheme are:-

i) To increase the overall fish production in a responsible and sustainable manner for economic prosperity;

ii) To modernize fisheries with special focus on new technologies;

iii) To ensure food and nutritional security;

iv) To generate employment and export earnings;

v) To ensure inclusive development and empower fishermen and aquaculture farmers.

The Administrative approval of the restructured scheme was issued on 22.12.2015 with revised funding norms. The guidelines of the scheme has been revamped and issued on 30.06.2016 with revised cost norms for the entire gamut of activities in the fisheries sector.

Under the revised scheme, unit cost of Fishermen houses has been increased to Rs. 120,000/- in plain areas and Rs.130,000/- in North-East Himalayan states from existing Rs.75,000/-. Similarly, for saving-cum-relief, financial assistance to be provided to each Fishermen has been increased to Rs.3,000/- from existing Rs.1,800/-.

Government of India is implementing National Horticulture Mission (NHM) scheme for development of post harvest management and market infrastructure.

India-US Launch Innovative Agriculture Programme to Address Global Challenges

Launched of Feed the Future- India Triangular Training Programme

The Ministry of Agriculture and Farmers Welfare and the U.S Agency for International Development (USAID) launched the second phase of the Feed the Future India Triangular Training Programmeon 24th July, 2016, bringing specialized agriculture training to 1,500 agricultural professional across Africa and Asia. The Secretary of Agriculture and Farmers Welfare, Shri S.K Pattanayak and U.S Ambassador to India Shri Richard R. Verna launched the programme together at the National Agriculture Science Complex in New Delhi.

Speaking on the occasion, Secretary of Agriculture and Farmers Welfare said that in order to continue our successful partnership programme covering more countries

in Africa and Asia, MANAGE as lead institution representing Govt. of India and USAID representing US Government signed a Limited Scope Cooperation Agreement (LSCA) on 7th November, 2005. The new programme will be called as "Feed The Future: India Triangular Training Programme", in which 32 Training programme of 15 days duration will be conducted in India and 12 Training programs of 10 days duration will be conducted in selected African and Asian Countries during 2016-20 i.e., for 4 years. The entire expenditure including participants travel, insurance, lodging, boarding, local travel and programme fee will be met by USAID and MANAGE. The training areas will be identified based on demand analysis conducted in participating countries.

Shri S.K Pattanayak informed that 17 countries covered under the programme are Kenya, Malawi, Liberia, Ghana, Uganda, Rwanda, Democratic Republic of Congo, Mozambique, Tanzania, Sudan, Botswana, Ethiopia in Africa and Afghanistan, Cambodia, Lao PDR, Myanmar, Mongolia, and Vietnam in Asia. Also faculty of MANAGE visited Cambodia and Vietnam in Asia and Tanzania and Mozambique in Africa as part of Demand analysis.

The U.S Ambassador Shri Richard R. Verma said that by harnessing the expertise and innovation of two great countries, we are unlocking new opportunities to address global development challenges, bringing us closure to our shared objective of eliminating global poverty and hunger.

Shri Richard R. Verma emphasized that the United States and India remain committed to their partnership of working, together to break the vicious cycle of poverty and hunger. Through sharing agriculture innovations worldwide, the U.S and India will help other countries develop their agriculture sectors, helping promote global prosperity and stability.

Web and App Services for Farmers

Government has launched number of web and mobile based applications for dissemination of information on agricultural related activities, free of cost, for the benefit of farmers and other stakeholders.

Some major mobile applications developed by Government are as under:

(i) Kisan Suvidha: This app has a simple interface and provides information on five critical parameters- weather, input dealers, market price, plant protection and expert advisories.

(ii) Pusha Krishi: This app provides information on latest technologies to farmers.

(iii) Crop Insurance: - Famer can learn of insurance premium, notified area etc. on the mobile.

(iv) Agri Market: - Farmer can learn of the prices of various crops in the mandis near him.

(v) India Weather:- This app provides current weather and 4 days weather forecast across the country for more than 300 cities.

The major Web portals developed by Government are as under:-

(i) Farmers'Portal: Farmers' Portal is a one stop shop for farmers where a farmer can get information on a range of topics including seeds, fertilizer, pesticides, credit, good practices, dealer network, and availability of inputs, beneficiary list and Agromet advisories.

(ii) Kisan Portal: This is a unified platform from where officials and scientists can send targeted text and voice based advisories to the farmers on a host of issues related to agriculture and allied sectors.

(iii) Crop Insurance Portal: To provide complete information related to Crop Insurance scheme being implemented in the country.

(iv) Participatory Guarantee System of India (PGS) Portal. This is a portal for encouraging participatory approach to certification of organic farming in the country.

These mobile apps and portal are available in the public domain. The web portal and the mobile apps are centrally developed by Government, through the services of NIC and in-house team.

The Government has conducted a number of workshops and Krishi Mela's involving the State and UT officials as well as farmers for educating/demonstrating these initiatives.

The Mobile Applications and the Web based Applications are given due prominence on the official websites and also through print and electronic media. Detailed advertisements have been issued in English and regional publications. Discussion-cum-demonstration sessions have also been held on Kisan TV Channel which has been telecasted throughout the country.

Subsidies to Farmers under Various Schemes

The Government is providing subsidies to farmers under various schemes for improving the infrastructure, marketing facilities and promotional services.

Under Agricultural Marketing Infrastructure (AMI) sub-scheme of Integrated Scheme for Agricultural Marketing (ISAM), subsidy is being provided @ 25% to 33.33% to eligible beneficiaries for creation of storage infrastructure. Currently the scheme is temporarily stopped w.e.f. 05.08.2014 for general category promoters due to exhaustion of funds. However, the scheme is open for SC/ ST promoters and for promoters in North-Eastern Region.

Under Rashtriya Krishi Viskas Yojana (RKVY) scheme, funds are released to the State Governments as 100% grant on the basis of projects approved in the State Level Sanctioning Committee (SLSC) meeting headed by the Chief Secretary of the State. No subsidy is provided by the Government of India directly to the individuals/farmers under the scheme. Subsidy under RKVY scheme is provided to farmers by the States as per norms of other existing Government of India schemes.

Under National Horticulture Mission (NHM) scheme for development of Horticulture, assistance is being provided for development of Post-H+arvest Management (PHM) and Marketing infrastructure. The component of market Infrastructure includes rural primary markets, wholesale markets and terminal market complexes.

Under National Food Security Mission (NFSM), financial assistance is being provided to the farmers for farm machineries for improving the infrastructure.

Under Bringing Green Revolution to Eastern India scheme (BGREI), assistance is being provided for activities that help in enhanced procurement, creation of storage facilities, marketing and value addition. Assistance is being provided 50% of the project cost for individual beneficiary and 100% for community assets.

Centre Approves 93 Seed Hubs Under National Food Security Mission With an Outlay of Rs. 13981.08 Lakh

93 seed hubs against a target of 150 at Indian Council of Agriculture Research Institutes (ICAR), State Agriculture Universities (SAUs), Krishi Vigyan Kendras (KVKs) have been approved under National Food Security Mission (NFSM) with an outlay of Rs.13981.08 lakh.

15% of the allocation for pulses component of NFSM is earmarked for production of quality seed of pulses seeds through states. An incentive of Rs.25/- per kg is being provided for pulses seed production. 7.85 lakhs seed minikits of newer varieties of pulses have been targeted for distribution to the farmers free of cost during 2016-17. For enhancing the production of breeder seed of pulses, an amount of Rs.2039 lakh has been approved for 12 ICAR institutes and SAUs. Cluster frontline demonstrations of pulses in 31000 ha have been allocated to 534 KVKs for the year 2016-17. The strengthening of production units of bio-fertilizers and bio-control agents has been planned.

Initiatives taken to encourage Crop Diversification

Indian Council of Agricultural Research (ICAR) advocates crop diversification with low water consuming crops in place of high water consuming crops like rice, sugarcane and banana for rain dependent areas and areas having lack of assured irrigation.

Department of Agriculture, Cooperation and Farmers Welfare is promoting cultivation of pulses and coarse cereals under National Food Security Mission (NFSM) and oilseeds under National Mission on Oilseeds and Oil Palm (NMOOP) in the country, as these crops need less water. Crop Diversification Programme is also being implemented in Original Green Revolution States of Punjab Haryana and Western Uttar Pradesh to diversify cropping pattern from water guzzling paddy to pulses, oilseeds, maize, and agro-forestry with the objective of tackling the problem of declining soil fertility and depleting water table in these States. To reduce utilization of water in paddy, water conservation techniques like Direct Seeded Rice (DSR), System of Rice Intensification (SRI), alternate wetting & drying method, laser land levelling, adoption of short duration and drought tolerant varieties, etc are promoted through various crop development programmes like National Food Security Mission (NFSM), Bringing Green Revolution to Eastern India (BGREI), etc.

In order to enhance water use efficiency in water intensive crops, assistance is given for promotion of water saving tools/technologies like sprinkler and drip irrigation, creation of farm ponds, efficient delivery and distribution systems and adoption of agronomic practices like alternate row/furrow irrigation, mulching, etc. Pradhan Mantri Krishi Sinchai Yojana also focuses on creating sources for assured irrigation, creating protective irrigation by harnessing rain water at micro level through 'JalSanchay' and 'JalSinchan' to ensure 'Per drop-More crop'.

Steps to Increase Farmers' Income

Government believes, that farmers welfare will improve if there is increase in net income from the farms. With this end in view, the approach is to reduce cost of cultivation, enable higher yield per unit and realize remunerative prices of farm produce. Some of the important new initiatives in this context and the targets achieved are as follows:

Scheme to Rationalize Input Management:-

(i) Soil Health Card (SHC) scheme by which the farmers can know the major and minor nutrients available in their soils which will ensure judicious use of fertiliser application and thus save money of farmers. The balanced use of fertiliser will also enhance productivity and ensure higher returns to the farmers. Against a target of 253 lakh samples, 184.75 lakh soil samples collected, 87.90 lakh soil samples tested and against target of 1400 lakh Soil Health Cards, 226.99 lac Soil Health Cards distributed as on 28.06.2016.

(ii) Neem Coated Urea is also being promoted to regulate urea use, enhance its availability to the crop and reduce cost of fertilizer application. The entire quantity of domestically manufactured urea is now neem coated. From the current year (i.e. 2016), the urea that is imported would also be neem coated.

(iii) Paramparagat Krishi Vikas Yojana (PKVY) is being implemented with a view to promoting

organic farming in the country. This will improve soil health and organic matter content and increase net income of the farmer so as to realise premium prices. The target is to cover 2 lakh ha in 3 years. Each cluster will be 20 ha each and total clusters 10,000. In 2015-16, 7186 clusters were sanctioned and Rs. 226.19 crore released to State Governments out of approved outlay of Rs. 511.67 crore. (GOI share is 335.05 crore). In 2016-17, remaining 2814 clusters have been sanctioned.

(iv) ThePradhanMantriKrishiSinchaiYojana (PMKSY) is being implemented to expand cultivated area with assured irrigation, reduce wastage of water and improve water use efficiency. In 2015-16, against a target of 5 lac ha., 5.6 lac ha has been brought under micro irrigation.

Scheme to Cover Nature Related Risks:-

(v) Government has also recently approved a new crop Insurance scheme, namely, Pradhan Mantri Fasal Bima Yojana (PMFBY) to replace National Agricultural Insurance Scheme (NAIS) and Modified NAIS (MNAIS) from Kharif 2016 season. PMFBY has addressed all the shortcomings in the earlier schemes and would be available to the farmers at very low rates of premium. The farmers will get full insurance cover as there will be no capping of sum insured and consequently the claim amount will not be cut or reduced. This scheme would provide insurance cover for all stages of the crop cycle including post-harvest risks in specified instances. The area coverage would be increased from 23% presently to 50% in two years.

Scheme to Transfer Remunerative Prices to Farmers:-

(vi) A Market Intervention Scheme, namely, e-NAM was approved on 1-7-2015 with a budget allocation of Rs. 200 crore to be implemented during 2015-16 to 2017-18. The releases of grants under the scheme are made on the basis of completion of 3 reform pre-requisites i.e., Single Trading License, Single License Fee and Creation of e-Platform for Trading. The scheme was launched on 14.04.2016 in 8 States viz. Gujarat, Telangana, Rajasthan, Madhya Pradesh, Uttar Pradesh, Haryana, Himachal Pradesh and Jharkhand covering 21 markets. As of now, 23 markets are integrated.

Scheme to Increase Productivity:-

(vii) National Food Security Mission (NFSM) pulses: Out of a total allocation Rs. 1700 crore, an amount of Rs. 1100 crore is allocated for pulses as centre share. The target set for pulses production during the year 2016-17 is 20.75 million tons and the area coverage target is 26 million hectares during this year.

In addition, the Government is implementing several Centrally Sponsored Schemes viz. Mission for Integrated Development of Horticulture (MIDH); National Mission on Oilseeds &Oilpalm (NMOOP); National Mission for Sustainable Agriculture (NMSA); National Mission on Agricultural Extension & Technology (NMAET); and Rashtriya Krishi Vikas Yojana (RKVY).

Further, the Government undertakes procurement of wheat and paddy under its 'MSP operations'. In addition, Government implements Market Intervention Scheme (MIS) for procurement of agricultural and horticultural commodities not covered under the Minimum Price Support Scheme on the request of State/ UT Government. The MIS is implemented in order to protect the growers of these commodities from making distress sale in the event of bumper crop when the prices tend to fall below the economic level/cost of production.

Kharif Crop Sowing Crosses 799 Lakh Hectare Areas

The total sown area as on 29th July, 2016 as per reports received from States, stands at 799.51 lakh hectare as compared to 752.29 lakh hectares at this time last year.

It is reported that rice has been sown/transplanted in 231.92 lakh ha, pulses in 110.35 lakh ha, coarse cereals in 150.76 lakh ha, oilseeds in 159.78 lakh ha, sugarcane in 46.83 lakh hectare and cotton in 92.33 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 2016-17	Area sown in 2015-16
Rice	231.92	225.68
Pulses	110.35	78.25
Coarse Cereals	150.76	144.84
Oilseeds	159.78	147.98
Sugarcane	46.83	45.91
Jute & Mesta	7.54	7.72
Cotton	92.33	101.91
Total	799.51	752.29

General Survey of Agriculture

Trends in Foodgrain Prices

During the month of June, 2016, the All India index number of wholesale price (2004-05=100) of foodgrains increased by 2.36 percent from 266.4 in May, 2016 to 272.7 in June, 2016.

The Wholesale Price Index (WPI) number of cereals increased by 1.87 percent from 241.1 to 245.6 and WPI of pulses increased by 3.73 percent from 385.8 to 400.2 during the same period.

The wholesale price index number of wheat increased by 1.76 percent from 221.3 to 225.2 while that of rice increased by 2.34 percent from 239.6 to 245.2 during the same period.

Rainfall Situation

Cumulative Monsoon Season (June to September) rainfall for the country as a whole during the period 01st June to 27th July, 2016 has been equal to Long Period Average (LPA). Rainfall in the four broad geographical divisions of the country during the above period has been higher than LPA by 9% in Central India, by 2% in South Peninsula and at the same level of normal in North-West India but lower than LPA by 12% in East & North East India.

Out of a total of 36 meteorological Sub-divisions, 28 subdivisions received excess/normal rainfall and 8 Sub-divisions received deficient/scanty rainfall.

Out of 608 districts for which rainfall data available, 165(27%) districts received excess rainfall, 256(42%) received normal rainfall, 158(26%) districts received deficient rainfall and 29(5%) received scanty 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 28th July, 2016) is 59.37 BCM as against 68.45 BCM on 28.07.2015 (last year) and 63.13 BCM of normal storage (average storage of last 10 years). Current year's storage is 13% of the last year's storage and 6% of the normal storage.

Sowing Position during Kharif 2016

As per latest information available on sowing of crops, around 75% of the normal area under Kharif crops has been sown up to 29.07.2016. Total area sown under Kharif crops in the country as on 29.07.2016 has been reported to be 799.51 lakh hectares as compared to 752.29 lakh hectares in the corresponding period of last year. This year's area coverage so far is higher by 47.2 lakh ha. than the last year and 40.6 lakh ha. than normal as on date.

As compared to normal area as on date, total area coverage this year is higher by 5.8 lakh ha. under rice, 33.6 lakh ha. under pulses, 3.7 lakh under coarse cereals, 9.3 lakh ha. under oilseeds and 0.6 lakh ha. under sugarcane but lower by 11.9 lakh ha. under cotton and 0.6 lakh ha. under jute & mesta.

Economic Growth

As per the provisional estimates of national income released by Central Statistics Office on 31st May, 2016, the growth rate of Gross Domestic Product (GDP) at constant (2011-12) prices for the year 2015-16 is estimated at 7.6 per cent as compared to the growth of 7.2 per cent in 2014-15 (Table 1).

The growth in Gross Value Added (GVA) at constant (2011-12) basic prices for the year 2015-16 is estimated at 7.2 per cent as compared to the growth of 7.1 per cent in 2014-15. At the sectoral level, the growth rate of GVA at constant (2011-12) basic prices for agriculture & allied sectors, industry and services sectors for the year 2015-16 are estimated at 1.2 per cent, 7.4 per cent, and 8.9 per cent respectively (Table 1).

The Share of total final consumption in GDP at current prices in 2015-16 is estimated at 70.1 per cent as compared to 68.5 per cent in 2014-15. The fixed investment rate (gross fixed capital formation to GDP) is declined from 30.8 per cent in 2014-15 to 29.3 per cent in 2015-16.

The growth in GDP in Q4 of 2015-16 (January-March) is estimated at 7.9 per cent as compared to the growth of 6.7 per cent in the corresponding quarter of 2014-15. GDP Growth during the first three quarters of 2015-16 was 7.5 per cent, 7.6 per cent and 7.2 per cent respectively (Table 2).

The saving rate (gross saving to GDP) for the years 2014-15 and 2013-14 remained at 33.0 per cent as compared to 33.8 per cent in 2012-13. The investment rate (gross capital formation to GDP) in 2014-15 was 34.2 per cent, as compared to 34.7 per cent and 38.6 per cent in 2013-14 and 2012-13 respectively.

Agriculture and Food Management

Rainfall : The cumulative rainfall received for the country as a whole, during the period 1st June-15th June 2016, has been 1 per cent above normal. The actual rainfall received during this period has been 352.6 mm as against the normal at 348.0 mm. Out of the total 36 meteorological subdivisions, 8 subdivisions received excess season rainfall, 22 subdivisions received normal season rainfall and the remaining 6 subdivisions received deficient/scanty/ no season rainfall.

All India production of foodgrains: As per the 3rd Advance released by Ministry of Agriculture & Farmers Welfare on 9th May 2016, production of foodgrains during 2015-16 is estimated at 252.2 million tonnes as compared to 252.0 million tonnes in 2014-15 (Table 3).

Procurement: Procurement of rice as on 30th June 2016 was 34.0 million tonnes during Kharif Marketing Season 2015-16 (KMS is under progress) whereas procurement of wheat as on 30th June 2016 was 22.9 million tonnes during Rabi Marketing Season 2016-17 (Table 4).

Off-take: Off take of rice during the month of April, 2016 was 24.2 lakh tonnes. This comprises 22.8 lakh tonnes under TPDS/NFSA (offtake against the allocation for the month of May, 2016) and 1.5 lakh tonnes under other schemes. In respect of wheat, the total off-take was 21.2 lakh tonnes comprising 19.4 lakh tonnes under TPDS/ NFSA (offtake against the allocation for the month of May, 2016) and 1.8 lakh tonnes under other schemes. Cumulative off-take of food grains during 2016-17 (till April, 2016) is 8.5 million tonnes (Table 5).

Stocks: Stocks of food-grains (rice and wheat) held by FCI as on July 1, 2016 was 54.9 million tones as compared to 60.4 million tonnes as on July 1, 2015 (Table 6).

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

Sector	Growth			Share in GVA		
	2013-14	2014-15	2015-16 (AE)	2013-14	2014-15	2015-16 (AE)
Agriculture, forestry & fishing	4.2	-0.2	1.2	17.5	16.3	15.3
Industry	5.0	5.9	7.4	31.6	31.2	31.3
Mining & quarrying	3.0	10.8	7.4	2.9	3.0	3.1
Manufacturing	5.6	5.5	9.3	17.4	17.1	17.5
Electricity, gas, water supply & other utility services	4.7	8.0	6.6	2.2	2.2	2.2
Construction	4.6	4.4	3.9	9.0	8.8	8.5
Services	7.8	10.3	10.3	51.0	52.5	53.4
Trade, hotels, transport, Communication and services related to broadcasting	7.8	9.8	9.0	18.4	18.9	19.2
Financial, real estate & professional services	10.1	10.6	10.3	20.3	21.0	21.6
Public administration, defence and other Services	4.5	10.7	6.6	12.3	12.7	12.6
GVA at basic prices	6.3	7.1	7.2	100.0	100.0	100.0
GDP at market prices	6.6	7.2	7.6	—	—	—

Source: Central Statistics Office (CSO). AE: Advance Estimates.

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

Sectors	2013-14				2014-15				2015-16			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Agriculture, forestry & fishing	2.7	4.0	5.0	4.6	2.3	2.8	-2.4	-1.7	2.6	2.0	-1.0	2.3
Industry	5.9	5.2	5.2	3.9	8.0	5.9	3.8	5.7	6.7	6.3	8.6	7.9
Mining & quarrying	-1.5	3.0	2.1	8.1	16.5	7.0	9.1	10.1	8.5	5.0	7.1	8.6
Manufacturing	7.4	4.4	6.4	4.5	7.9	5.8	1.7	6.6	7.3	9.2	11.5	9.3
Electricity, gas, water supply & other utility services	2.7	6.4	3.8	5.8	10.2	8.8	8.8	4.4	4.0	7.5	5.6	9.2
Construction	6.6	7.2	4.4	0.8	5.0	5.3	4.9	2.6	5.6	0.8	4.6	4.5
Services	8.4	9.6	7.8	5.6	8.6	10.7	12.9	9.3	8.8	9.0	9.12	8.7
Trade, hotels, transport, communication and services related to braodcasting	5.0	7.6	10.5	7.8	11.6	8.4	6.2	13.1	10.0	6.7	9.2	9.9
Financial, real estate & professional services	10.8	14.8	7.1	6.7	8.5	12.7	12.1	9.0	9.3	11.9	10.5	9.1
Public administration, defence and Other Services	9.1	3.9	4.7	0.9	4.2	10.3	25.3	4.1	5.9	6.9	7.2	6.4
GVA at Basic Price	6.7	7.4	6.3	4.9	7.4	8.1	6.7	6.2	7.2	7.3	6.9	7.4
GDP at maket prices	6.7	7.8	6.4	5.8	7.5	8.3	6.6	6.7	7.5	7.6	7.2	7.9

Source: Central Statistics Officer (CSO).

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

Crops	Production (in Million Tonnes)			
	2012-13	2013-14	2014-15	2015-16 (3rd AE)
Total Foodgrains	257.1	265.0	252.0	252.2
Rice	105.2	106.7	105.5	103.4
Wheat	93.5	95.9	86.5	94.0
Total Coarse Cereals	40.0	43.3	42.9	37.8
Total Pulses	18.3	19.3	17.2	17.1
Total Oilseeds	30.9	32.8	27.5	25.9
Sugarcane	341.2	352.1	362.3	346.7
Cotton#	34.2	35.9	34.8	30.5

Source: DES, DAC&FW, M/o Agriculture & Farmers Welfare, 2nd AE: Second Advance Estimates,. #Million bales of 170 kgs. each.

TABLE 4: PROCUREMENT OF CROPS IN MILLION TONNES

Crops	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Rice#	35.0	34.0	31.8	32.2	33.8*	—
Wheat@	28.3	38.2	25.1	28.0	28.1	22.9*
Total	63.4	72.2	56.9	60.2	61.9	—

Source: DEPD, M/o Consumer Affairs and Public Distribution;
#Kharif Marketing Season (October-September),
@Rabi Marketing Season (April-March),
*Position as on 30.06.2016.

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

Crops	2012-13	2013-14	2014-15	2015-16	2016-17 (Till April)
Rice	32.6	29.2	30.7	31.8	4.6
Wheat	33.2	30.6	25.2	31.8	3.9
Total (Rice & Wheat)	65.8	59.8	55.9	63.6	8.5

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

TABLE 6: STOCKS OF FOODGRAINS (MILLION TONNES)

Crops	July 1, 2015	July 1, 2016
1. Rice	15.9	19.4
2. Unmilled Paddy#	8.6	7.8
3. Converted Unmiled Paddy in terms of Rice	5.8	5.3
4. Wheat	38.7	30.2
Total Rice & Wheat) (1+3+4)	60.4	54.9

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

Articles

Participation of Labour Force in Farm and Non-Farm Sectors in Himachal Pradesh

S.P. Saraswat*

It is universally recognized that women are the majority of the world's agricultural producers, with decisive roles in the management of fishery, forestry and farming resources. World-wide, women produce more than 50 percent of the food that is grown. Moreover, in many places, women are responsible for providing most of the food required by their families, if not by producing it then by earning the income to purchase it. Finally, women are almost universally responsible for food processing and preparation. They do all this in the face of constraints and attitudes that conspire to increase their daily workload disproportionately, the economic contribution of their labours and hinder their participation in decision and policy making (Carsalade, 1998) are still under estimated. In this context, it has been emphasized that a significant proportion of women's work remains unaccounted because much of their work takes place outside formal markets and the valuation of the productive work is surmounted by conceptual and measurement problems (Duraisamy&Duraisamy, 1995; Papola, 1993). According to the FAO, women produce over 50 per cent of all the world's food items. Unfortunately women's participation in farming, forestry and fishing is often underestimated as censuses and other studies only take remunerative work into account (Anonymous, 1999).

Keywords : Gender Issues and Policy Implications for Rural Development Strategies

Women studies focusing on gender equity and development have struck deep roots over the last three decades in the country, as it were. As a result,empowerment of women and their effective participation in national development activities have occupied centre stage today. Women development issues can be appreciated appropriately in the right perspective for formulation of appropriate strategies when we take into account the ground realities brought out in bold relief by district and state level studies which focus on their participation in multifarious activities and the development processes. In Himachal Pradesh, the proportion of rural female workers engaged in non-farm sector increased from 4.5 per cent during 1993-94 to 4.9 per cent during 1999-2000. It is important to identify factors operating behind the process of structural shift of workers from farm to non-farm sector to assess the viability and long-term welfare effects of this transformation (Chadha and Sahu, 2002).

The primary sector such as agriculture, animal husbandry, fisheries and forestry employed 200 million (52.06 percent) of the total 384.91 million workforce (2004-05), reorganized non-farm sector employes184.91 million (47.94 percent) and organized sector employes 22 million (5.6 percent) in the country. Employment in the organized sector decreased slowly from 24 million in 1983 to 21 million in 2004-05. Evidently, unless some spectacular changes occur; the organized sector's share in the absorption of additional labour force will remain small in the near future. As a result, a major portion of the additions to the labour force will have to be absorbed in the unorganized non-farm sector as agriculture is already overcrowded (Radha Krishnan, 2002). In this context, Islam (1997) has put forth four arguments in favour of promotion of the rural non-farm sector (i) it provides employment for a growing labour force (ii) it contributes to growth (iii) it shows rural-urban migration and helps control urban congestion and pollution and (iv) it promotes an equitable distribution of income and contributes to the alleviation of poverty. In this backdrop, the study on participation of labour force in farm and non-farm sectors in Himachal Pradesh with special reference to the women was conducted.

Methodology

Himachal Pradesh is a hilly state and it is situated in the lap of Himalayas. Its elevation ranges from 1000 to 20000 ft. above mean sea level. Temperature varies from minus 22° c in winter to 40° c in summer. These conditions make the situations of agriculture in different parts of the state some-what varied. Therefore, the state has been categorized into three zones on the basis of elevation (height above mean sea level)i.e. (a) low hill elevation up to 3000 ft. (b) mid hill elevation from 3000 ft. to 5000 ft. (c) high hill elevation above 5000 ft.

In the present study, twelve villages were selected in the state i.e. four villages each from low-hills, mid hills and high hills. All the farmers were classified into two categories according to the size of their holdings: (i) small farmers (below 2 hectares) and (ii) large farmers (above 2 hectares). A proportional sample of 10 households was drawn randomly from each village. Hence, a sample of 120 households was taken i.e. 40 households each from low, mid and high hills i.e. 26 and 14, 24 and 16 and 26

*Ex-Research Investigator in A.E.R.C., H.P. University, Flat No.1 Block B,Everest Society Complex Summer Hill Shimla-171005.

and 14 households respectively from small and large categories of farmers in low, mid and high hills. It may be explicitly noted that the sample consists of farming households only and rural households like landless laboureres and others have not been considered at all. The information about men and women labour utilization etc. were collected by cost accounting method for the crop year 2013-14. The various activities have been classified broadly into farm work and non-farm work. Farm work covers (i) crop production, (ii) animal husbandry and (iii) other farm work, while, non-farm work includes (a) all types of subsidiary work under non-farm work and (b) household work. Simple tabular analytical technique has been adopted for drawing meaningful inferences. The study focuses critically on the participation of women in various farm and non-farm activities vis-à-vis such participation by men in labour force in rural areas of the three hill zones of Himachal Pradesh.

Salient Results

Agriculture constitutes the mainstay of Himachal Pradesh's economy since it provides direct employment to about 69 per cent of total workers of the state. Distribution of population by main workers, marginal workers and non-workers (dependents), showed that only 32.31 per cent of total population are the workers, 19.22 per cent are marginal workers and dependency ration is quite high viz. 50.77 per cent (Govt. of H.P.), in 2007-08.

The participation of a worker in different farm and nonfarm activities in rural areas depends on various factors such as skill level, composition of family, numbers of animals reared, cropping pattern and cropping intensity , openings in secondary sector and tertiary sector, opportunities for non-farm subsidiary activities, requirements for fulfillment of household work and so on.

The participation of women and men in crop production, animal husbandry and other farm work in the farm sector and non-farm sector are presented in Table 1. It indicates that the participation of women is consistently higher in the farm sector in all the three hill zones. This could be attributed to three factors. Firstly, men have increasingly shifted their occupations in secondary sector and tertiary sector. Secondly, women are constrained to continue in the basic agricultural activities because of low literacy level and lack of skills needed for exploiting the emerging opportunities in industrial and services sector. Last but not the least it also engage in subsidiary occupations in rural areas which women can not do either because of social factors or their preoccupation with household work. This is very much vindicated by the fact that women participation was totally nil in low and high hills and almost negligible in mid hills so far as subsidiary non-farm works are concerned.

It has been reported that a farm worker should normally and optimally work for 300 days (2400 hrs) in a year (Raj, 1959; Pandey, Shah and Singh 1975; Saraswat, 1982). A study of manpower utilization undertaken by Singh and Bhati (1985) in Himachal Pradesh revealed that a male worker was without work for 151 days on marginal farms, for 128 days on small farms and 129 days on medium farms annually. The female labour unemployment was 157 days, 130 days and 160 days per annum on corresponding farm sizes, respectively. The results of the study indicate that the degree of women unemployment was more than that for men in low hills since, on average, a woman participated in productive economic activity for 155 days as against 182 days for man per year. But, in mid hills, women participation was much higher (225 days/ year) than man participation (176 days) as discussed above. In the high hills, their participation in income earning activities was almost at par.

A critical look at table 1 also shows that animal husbandry rearing is mainly the domain of womenfolk because men are engaged in other non-farm work or other household activities outside. Women also outperformed men so far as household work in totality is concerned but household work is still treated as an unpaid economic activity in the country. However, paradigm shift in accounting household work as economic activity is reported in the 2011 census enumeration. Month wise and daily participation by women and men in farm and non-farm activities are given in Table 2 and 3 for the overall farms basis and for female and male respectively. It is observed that the labour force participation was below 2 hours per day for crop production in all the three zones for both types of workers except during October and November on large farms. The participation level of women workers and men workers for paid economic work ranged between 4 to 5 hours per day but considering the unpaid household work, the total average working hours were computed to be 8 to 10 hours. In view of the fact that a full day work is treated to be for 8 hours for a paid economic activity, the degree of disguised unemployment is quite high in all zones and for both men and women.

Key Issues for Women Participation and Development

India has the large number of illiterate women. In 2011, female literacy rate was 65.5 per cent and the dropout rate for girls in the primary school was as high as 50 per cent. About 96 per cent of the women workers are concentrated in the vast rural and urban unorganized sector characterized by long hours of work, low wages, low productivity, lack of job security, inadequate legislative protection, lack of enforcement of minimum wages and other safeguards regulating their working conditions (Arya, 1988). In Himachal Pradesh,female literacy rates was 75.93 per cent as against male literacy rate of 89.5 per cent and total literacy is 82.80 per cent in 2011 census. According to Bal

Krishnan (1988), the central issues are (i) achieving gender equity gains for women in agriculture and rural communities parallel to urban gender gains (ii) creating opportunities for rural women to be the principal agents in poverty eradication and (iii) achieving household food security with gender equity. According to Pattanaik (1998), the status of women in India is very low, 86.5 per cent women are employed in rural areas. The health status is low and they are not sufficiently involved in decision making process.

Conclusion and Policy Implications

The role of women in agriculture is widely recognized now. In Himachal Pradesh's undulating topography, small and narrow terraces on hill slopes limit the choice of machines in agriculture. Women play important role in agriculture and centrally sponsored project "Women in Agriculture" is being implemented in the state since 1995-96 and BetiHaiAnmolYojana in 2010, and self-employment scheme for women and 50 percent reservation in Panchayati Raj Institution. But still the view persists that men are the primary clientele for technology adoption and are thus the technology consumers. (Bal Krishnan, 1998). This is also indicated by the poor track record on the implementation of the scheme "Development of women and children in rural Areas" in the state.

First and foremost, the literacy level of women in the state has to be increased for giving a fillip to socio-economic transformation in order to accelerate the development process. It is rightly said that if you educate a boy, you educate an individual and it you educate a girl, you educate a family. Secondly, extensive training programmes in agriculture sector and for non-farm subsidiary occupations should be launched for skill upgradation and new skill formation of productive women work force. It is gratifying to note that the project "Women in Agriculture" was extended to whole of Himachal Pradesh during 9th Five Year Plan. Women should be imparted training in horticulture, floriculture, animal rearing, crop husbandry, tailoring, knitting, weaving, carpet making, embroidery, mushroom cultivation, bee keeping and other agro-processing ventures. Thirdly, the training programmes have to be tailored according to the peculiarity of different hill zones. Fourthly, income from the farm sector may not be sufficient for the farming families because of declining farm holdings and high risk and uncertainty in hill agriculture. In order to reduce the scourge of disguised unemployment, non-farm activities need a big boost. Last but not the least, gender equity and justice should be ensured through strict enforcement of laws and radical transformation of the social mindset for higher contribution by the women in development in Himachal Pradesh.

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TABLE 1: Hill Zone-wise Employment Pattern of Women and Men Workers in Farm and Non-Farm Activities in Himachal Pradesh during 2013-14

(Labours days per Worker per annum)

Farm size & category of Workers	Agriculture Work				Non-Agriculture			Total labour days	Total labour days excluding houshold work
	Crop Prod.	Animal Rearing	Other farm work	Total farm work	Non-agri. work	Household work	Total nonfarm work		
				Low Hill Zone					
Small Farms									
Men	27.84	58.60	25.83	112.27	74.27	208.53	282.80	395.07	186.54
Women	23.83	85.27	48.87	157.97	-	267.00	267.00	424.97	157.97
Large Farms									
Men	45.90	63.54	31.02	140.46	33.83	218.54	252.37	352.83	174.29
Women	38.95	71.11	40.18	150.24	-	278.64	278.64	428.88	150.24
All Farms									
Men	34.56	60.44	27.76	122.76	59.22	212.25	271.47	394.23	181.98
Women	29.72	79.75	45.48	154.95	-	272.03	272.03	426.98	154.95
				Mid Hill Zone					
Small Farms									
Men	23.66	36.65	58.97	119.28	30.66	150.09	180.75	300.03	149.94
Women	24.68	74.73	112.76	212.17	1.68	201.36	203.04	415.21	213.85
Large Farms									
Men	32.95	38.26	56.64	127.85	78.09	154.91	233.00	360.85	205.94
Women	34.10	77.07	131.67	242.84	0.41	210.13	210.54	453.38	243.25
All Farms									
Men	27.90	37.38	57.91	123.19	52.31	152.29	204.60	327.79	175.50
Women	28.13	75.58	119.67	223.38	1.21	204.57	205.78	429.16	224.59
				High Hill Zone					
Small Farms									
Men	27.70	72.23	14.84	114.77	29.44	108.08	137.52	252.29	144.21
Women	24.03	94.66	42.15	160.84	-	148.95	148.95	309.79	160.84
Large Farms									
Men	44.00	90.46	26.96	161.42	5.58	99.54	105.12	266.54	167.00
Women	37.47	76.02	48.00	161.49	-	151.95	151.95	313.44	161.49
All Farms									
Men	34.58	79.90	19.94	134.42	19.40	104.49	123.89	258.31	153.82
Women	29.34	87.29	44.6	161.09	-	150.14	150.14	311.23	161.09

TABLE 2: Month-wise and Hill Zone-wise pattern of Participation of Women in Labour Force in Various and Non-Farm Activities Overall farms Basis in Himachal Pradesh During 2013-2014

(Hours per day per worker)

Particulars	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan	Feb.	March	April	May	June
Low Hill Zone												
Crop Production	1.33	0.17	1.35	1.53	0.94	0.08	0.03	0.01	0.03	1.12	1.47	1.45
Animal Husbandry	1.82	2.22	2.24	2.04	2.26	2.49	2.17	2.06	2.25	1.74	2.01	2.18
Other farm work	1.45	1.82	2.21	3.05	1.31	0.91	0.87	0.57	0.91	1.01	0.27	0.26
Non-agri. Work	-	-	-	-	-	-	-	-	-	-	Neg.	-
Total hours	4.60	4.21	5.80	6.62	4.51	3.48	3.07	2.64	3.19	3.87	3.75	3.89
Household Work	7.14	7.25	8.03	7.53	6.99	7.22	6.65	7.11	7.64	7.04	7.56	6.82
Mid Hill Zone												
Crop Production	1.09	0.57	0.44	1.20	0.53	0.43	0.20	0.17	0.46	1.16	1.46	1.24
Animal Husbandry	1.59	1.89	1.95	1.94	2.07	2.02	1.90	2.02	2.04	2.06	2.40	2.25
Other farm work	3.16	3.65	3.84	4.01	3.82	3.15	2.47	2.21	2.48	3.00	3.23	3.21
Non-agri. Work	0.02	0.14	-	-	-	-	0.07	Neg.	0.13	-	-	-
Total hours	5.86	6.25	6.23	7.15	6.42	5.60	4.64	4.40	5.11	6.22	7.09	6.70
Household Work	5.30	5.53	5.56	5.75	4.61	5.63	5.76	5.12	5.48	5.46	5.75	5.46
High Hill Zone												
Crop Production	0.84	1.08	0.48	0.82	0.66	0.36	0.19	0.11	1.27	0.39	1.58	1.53
Animal Husbandry	3.35	3.22	3.00	2.44	2.30	2.23	1.27	1.73	2.26	2.06	2.04	1.90
Other farm work	0.82	1.74	1.82	3.48	1.56	0.84	0.14	0.35	0.44	0.71	1.13	0.65
Non-agri. Work	-	-	-	-	-	-	-	-	-	-	-	-
Total hours	5.01	6.04	5.30	6.74	4.52	3.42	1.60	2.19	3.97	3.16	4.75	4.08
Household Work	4.18	4.00	3.93	4.07	4.03	3.84	3.74	4.03	4.27	3.93	3.98	3.89

TABLE 3: Month - wise and Hill Zone - wise pattern of Participation of Men in Labour Force in Various and Non - Farm Activities Overall Farms Basis in Himachal Pradesh During 2013-2014

(Hours per day per worker)

Particulars	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan	Feb.	March	April	May	June
Low Hill Zone												
Crop Production	1.11	0.14	1.28	1.77	1.64	0.07	0.08	Neg.	0.02	0.78	2.21	1.89
Animal Husbandry	2.68	2.13	1.74	1.49	1.30	1.49	1.52	1.42	1.54	1.16	1.40	1.37
Other farm work	0.86	1.04	1.28	1.55	0.72	0.64	0,69	0.40	0.52	0.60	0.13	0.19
Non-agri. Work	1.55	1.29	1.10	0.85	1.37	1.52	1.41	1.70	2.37	2.03	1.74	1.93
Total hours	6.20	4.60	5.40	5.66	5.03	3.72	3.70	3.52	4.45	4.57	5.48	5.38
Household Work	5.88	5.63	6.33	6.09	5.37	5.65	5.17	5.38	5.69	5.29	5.96	5.21
Mid Hill Zone												
Crop Production	0.97	0.68	0.57	1.03	0.58	0.40	0.22	0.22	0.58	0.96	1.50	1.23
Animal Husbandry	0.75	0.89	0.99	1.01	1.04	0.83	1.06	1.05	1.03	1.07	1.22	1.07
Other farm work	1.41	1.60	1.74	2.37	2.08	1.40	1.21	1.14	1.22	1.26	1.50	1.34
Non-agri. Work	0.87	1.20	1.20	1.32	1.40	1.45	1.49	1.34	1.64	1.77	1.78	1.45
Total hours	4.00	4.37	4.50	5.73	5.10	4.08	3.98	3.75	4.47	5.06	6.00	5.09
Household Work	4.33	4.32	4.18	4.50	4.11	4.42	4.42	3.88	4.41	4.12	4.40	4.31
High Hill Zone												
Crop Production	0.69	1.30	0.43	1.30	0.74	0.39	0.69	0.12	1.57	0.47	1.56	1.76
Animal Husbandry	2.41	2.02	2.09	2.02	2.38	1.68	1.40	1.76	1.87	2.36	2.73	2.79
Other farm work	0.36	0.83	1.36	1.81	0.81	0.47	0.06	0.12	0.13	0.05	0.05	0.30
Non-agri. Work	0.82	1.11	0.59	0.97	0.40	0.39	0.29	0.66	0.58	0.41	0.38	0.40
Total hours	4.28	5.26	4.47	6.10	4.33	2.93	2.44	2.66	4.15	3.29	4.72	5.25
Household Work	3.12	2.92	2.81	2.89	2.67	2.73	2.64	2.75	3.01	2.74	2.55	2.54

Resource-use Efficiency of Sugarcane Production in Sathyamangalam Taluk of Erode District of Tamil Nadu: An Economic Analysis

Dr. A. Saravanan*

Abstract

The aim of this study is to estimate the cost and returns and resource use efficiency in sugarcane production per acre on different size of farms in Sathyamangalam taluk of Erode District in Tamil Nadu. The study is confined to a sample of 150 sugarcane farmer households selected from ten villages of Sathyamangalam taluk of Erode District. A simple percentage analysis is employed to identify the socio-economic characteristics and cost and returns of sugarcane cultivation for the selected sample farmers. The stochastic production frontier function model of the Cobb-Douglas type is used to incorporate the technical inefficiency effects. The study concluded that this technical inefficiency in production of sugarcane may be as a result of high cost of hired labour, fertilizer, seeds and machine hours used. This means that in the sugarcane production, technical efficiency (TE) can be increased by using such inputs more efficiently. To ensure the efficient use of resources in the production, sugar cane in the region, a concerted effort on the part of individual farmers, government and research institutes is very important.

Keywords: Sugarcane, Cost & Returns, TE, OLS, Stochastic Frontier Function

1. Introduction

Sugarcane is an important commercial crop of the world and is cultivated in more than 100 countries, the leading countries are being Brazil, India, China, Thailand, Pakistan, Mexico and Colombia. The botanical name of sugarcane is *Saccharum officinarum* and for sugar beet, it is Beat *Vulgare*. Sugarcane is produced in tropical and temperate zones. It is the second important commercial crop in India and is grown in about 5 million hectares, production of about 27 million tonnes of sugar, contributing direct and indirect employment to 40 million farmers, besides providing employment to 3-5 lakhs skilled and unskilled workers in the manufacturing of Sugar, Gur and Khandasari. Even though, sugarcane cultivation occupies only 2 percent of the total cultivable area of the country; it contributes 7 percent of the total value of the agricultural crop in the country. Moreover, the area under sugarcane cultivation in the country has gone up from 1.18 million hectares (1930-1931) to 5 million hectares (2010-2011); while cane production has gone from 37 million tonnes to 340 million tones with an average productivity of 628.10 quintals per hectare in the corresponding period.

Tamil Nadu is one of the major sugarcane growing states in India, contributing 6.41 percent of national sugarcane and produced 8.32 percent of national sugarcane production in 2011-12. Tamil Nadu is also leading producers of sugar in the country and its contribution is about 7 percent of country's total sugar production. As on 31.5.2011, there are 46 sugar mills in Tamil Nadu, of which 16 sugar mills are in cooperative sector, 3 in public sector and 27 in private sector. At present 44 sugar mills are functioning and the remaining 2 mills viz., Madura Sugars and Arunachalam Sugar Mills Ltd., are not functioning. This implies that the economy of the farmers as well as prosperity of the state is highly influenced by the earnings from this crop enterprise. Now-a-days, sugarcane farming is becoming gradually commercialized in Tamil Nadu. The commercial farmer's chief concern is to secure a satisfactory margin between the cost and selling price of his produce. Thus, in order to justify continuance a farm enterprise, generation of a net profit over the total cost is necessary. It is, therefore, crucially important for the farmers to know their production costs. The cost of production and returns from sugarcane varies from region to region and from one category of farmers to another.

2. Objectives

The specific objectives of the study are;

1. To identify the socio-economic characteristics of sugarcane farmers in the study area.

2. To analyse of Cost and Returns of Sugarcane Production in Sathyamangalam taluk of Erode District of Tamil Nadu,

3. To examine the resource use pattern of sugarcane cultivating farmers of varying farm size groups in the study area,

4. To evaluate the farm level technical efficiencies in the production of sugarcane in Sathyamangalam taluk of Erode District in Tamil Nadu, and

5. To suggest suitable recommendation and policy measures to improve the sugarcane production in Erode district of Tamil Nadu.

*Assistant Professor in Economics, J.K.K .Nataraja College of Arts & Science, arapalayam-638 183,Namakkal District, Tamil Nadu, India. Email:saravananchamp@gmail.com

3. Data and Methodology

3.1. Selection of Sample Households

For the purpose of the study, three stage stratified random sampling technique was adopted. In the first stage, Sathyamangalam taluk in Erode district was purposively selected on account of its commendable position in sugarcane cultivation in Erode District. Sathyamangalam taluk has 66 revenue villages, out of which 10 villages were selected at random in the second stage. In the third stage, 150 farmers from ten villages were selected at random, giving equal representation to all sample villages. The primary data on various aspects were collected through personal survey method with the help of structured interview schedule. The data pertained to the agriculture year December 2015 - February 2016. Post stratification was made to classify the farmers into four farm size groups viz., less than 2.5, 2.5-5.0, 5.0-7.5 and more than 7.5 acres respectively. Thus, the study was confined to a sample of 150 sugarcane farmer households selected from ten villages of Sathyamangalam taluk of Erode district in the state of Tamil Nadu.

3.2. Analytical Methodology

A simple percentage analysis was employed to identify the socio-economic characteristics and cost and returns of sugarcane cultivation for the selected sample farmers. In order to do the estimation of technical efficiency, the Stochastic Frontier Production Function (Aigner *et al*., 1977) is the most popular approach considered in recent years. The stochastic frontier (Bhende and Kalirajan,2007) has been modeled with a composite error term, comprising two components. A symmetric component permits random variation of the frontier across firms and captures the effects of measurement error, other statistical noise and random shocks outside the farms control. A one sided component captures firm-specific effects such as slackness in production due to labour shirking, which are under the control of the firms and influence their level of achievement of technical efficiency. For the present analysis, the empirical model used for analysis consists of two stages. In the first stage, farm specific technical efficiency scores are estimated using stochastic production function, of the following type;

$$\ln (Yi) = Xi\ á + Vi - Ui \qquad (1)$$

Where Y is the dependent variable (output) and Xi are the independent variables viz., area under crop, seed, family labour, hired labour, machine hours, chemical fertilizer and pesticide cost. In this model, the dependent variable is bounded by the stochastic variable, Vi – Ui. The random error, Vi can be positive or negative and so the stochastic outputs vary about the deterministic part of the frontier model.

Vi is the symmetric random error term distributed independently and identically [IID n~ $(o, ó_v^2)$] and captures errors beyond the farmers control. Ui is the one sided random component, distributed independently and identically with non-negative truncation of the normal distribution [N $(o, ó_v^2)$]. If the farm is inefficient (efficient), the actual output produced is less than (or equal to) the potential output. Therefore, the ratios of actual output and potential ouput can be treated as a measure of technical efficiency. Using the above equation I, the technical efficiency (TE) of the i^{th} farm is derived as: $TE_i = \exp(-Ui)$

The technical efficiency of the i-th farmer ($TE_i = \mu_i$) is derived from the density function of u and v which can be written as :

$$F_u(u) = 1/\sqrt{½*ð}).\ 1/ó_u .\ \exp.[-u^2/2\ ó_u^2] \text{ for } u \le 0 \qquad (2)$$

$$= 0 \text{ otherwise}$$

$$F_v(v) = 1/\sqrt{½*ð}).\ 1/ó_v .\ \exp.[-v^2/2\ ó_v^2] \text{ for } -\infty \le u \le \infty \qquad (2a)$$

The density function of y is the joint density function of (u+v) and is given by

$$F_v(y) = ð .1/\sqrt{½*ð}) .\ 1/ó .\ \exp.\{(u+v)^2 / 2\ ó^2\}.$$

$$1- f\{((u+v) / ó)\ (ã/ 1+ ã))] \qquad (3)$$

Where,

$$ó^2 = ó_u^2 + ó_v^2 \qquad (4)$$

$$ã = ó_u^2 / ó^2,\ 0 \le ã \le 1 \qquad (4a)$$

Finally, ã is given by

$$ó^{ui} = - ó_u ó_v / ó\ [\{ö(.)/1-ö(.)\}-\{((u+v)/ó)\ \sqrt{}\ (ã /1- ã)))] \qquad (5)$$

where ö (.) and ö (.) are standard density and distribution functions, respectively. The variables specified for estimation of Technical Efficiency for the individual farms and crops based on Cobb-Douglas type was;

y = output of crops (sugarcane / in quintal / acre)

X_1 = seed rate in kg/acre

X_2 = Area under crop (in acres)

X_3 = Family labour (male + female) man-days/acre.

X_4 = Hired labour used in man-days/acre

X_5 = Cost on machine hours used in Rs. / acre

X_6 = Quantity of chemical fertilizer used in kg/acre

X_7 = Cost on pesticide components (in Rs./acre)

3.3. Determinants of Technical Efficiency

As crop output is conditioned by the factors like rainfall, incidence of disease & pest infestation, soil fertility and other socio-economic factors, a simple linear regression technique of the following type was used to identify the factors that influence the technical efficiency of the selected farmer households. The technical efficiency scores

generated by the frontier are regressed on the independent variables as follows;

$$TE_{ij} = \alpha + \alpha_1 (X_1) + \alpha_2 (X_2) + \alpha_3 (X_3) + \alpha_4 (X_4) + e_i$$

Where,

TE_{ij} = level of technical efficiency estimated through MLE

X_1 = Age

X_2 = Educational status

X_3 = Farm size

X_4 = Family Size

α_1……α_4 = regression co-efficients

e_i = error term

α = constant

4. Results and Discussion

The results of the study are presented in three main parts viz., (i) socio-economic characteristics of the sample sugarcane farmers, (ii) Estimated Cost and Returns of Sugarcane Cultivation and (iii) Resource Use Efficiency of Sugarcane Production in Sathyamangalam taluk of Erode District.

4.1. Socio-Economic Characteristics of the Sample Farmer Households

This part is mainly devoted for the study of the socio-economic characteristics of the selected sample of sugarcane farmer households in Sathyamangalam taluk of Erode District. The important socio-economic characteristics chosen for analysis in the study are type of family, family size, age, educational status and monthly income of the family among sample sugarcane farmer households of different farm size groups classified through post stratification method.

TABLE-4.1: Socio-Economic Characteristics of the Sample Farmer Households

Socio-Economic Characteristics	Farm Size Group (in acres)				Total
	Below 2.5	2.5 - 5.0	5.0-7.5	Above 7.5	
Nuclear	31 (70.45)	25 (67.57)	25 (67.57)	19 (59.38)	100 (66.67)
Joint	13 (29.55)	12 (32.43)	12 (32.43)	13 (40.62)	50 (33.33)
Total	44 (100.00)	37 (100.00)	37 (100.00)	32 (100.00)	150 (100.00)
Below 2	8 (18.18)	6 (16.22)	6 (16.22)	5 (15.62)	25 (16.67)
2 – 4	27 (61.36)	18 (48.65)	17 (45.95)	15 (46.88)	77 (51.33)
Above 4	9 (20.45)	13 (35.14)	14 (37.84)	12 (37.50)	48 (32.00)
Total	44 (100.00)	37 (100.00)	37 (100.00)	32 (100.00)	150 (100.00)
Below 40	9 (20.45)	11 (29.73)	10 (27.03)	10 (31.25)	40 (26.67)
40 – 60	27 (61.36)	14 (37.84)	15 (40.54)	12 (37.50)	68 (45.33)
Above 60	8 (18.18)	12 (32.43)	12 (32.43)	10 (31.25)	42 (28.00)
Total	44 (100.00)	37 (100.00)	37 (100.00)	32 (100.00)	150 (100.00)
Below Rs.25000	15 (34.09)	7 (18.92)	13 (35.14)	19 (59.38)	54 (36.00)
Rs.25000 – Rs.50000	23 (52.27)	15 (40.54)	16 (43.24)	9 (28.12)	63 (42.00)
Above Rs.50000	6 (13.64)	15 (40.54)	8 (21.62)	4 (12.50)	33 (22.00)
Total	44 (100.00)	37 (100.00)	37 (100.00)	32 (100.00)	150 (100.00)

TABLE-4.1: Socio-Economic Characteristics of the Sample Farmer Households—*Contd.*

Socio-Economic Characteristics	Farm Size Group (in acres)				Total
	Below 2.5	2.5 - 5.0	5.0-7.5	Above 7.5	
Illiterate	11 (25.00)	11 (29.73)	10 (27.03)	8 (25.00)	40 (26.67)
Primary Level	7 (15.91)	9 (24.32)	12 (32.43)	8 (25.00)	36 (24.00)
Secondary Level	21 (47.73)	15 (40.54)	10 (27.03)	13 (40.62)	59 (39.33)
Higher Secondary & above level	5 (11.36)	2 (5.41)	5 (13.51)	3 (9.38)	15 (10.00)
Total	44 (100.00)	37 (100.00)	37 (100.00)	32 (100.00)	150 (100.00)

Source: Survey data , Figures in parentheses indicate percentage.

From table-4.1, it is observed that out of the 150 sample sugarcane farmer households selected for the study, the majority of them belonged to nuclear family; their family consist of 2-4 members; their age were between 40–60 years and had a small family monthly income of Rs.25,000 to Rs.50,000. The educational status of the farmers was secondary level.

4.2. Estimated Cost and Returns of Sugarcane Cultivation

The estimated cost and returns of sugarcane cultivation pertaining to the different farms level data collected from the sample farmers of ten villages in Sathyamangalam taluk of Erode District is furnished from table-4.2.

TABLE-4.2 : Estimated Cost and Return of Sugarcane Cultivation (Per Acre) in Sathyamangalam taluk of Erode District

Variables	Farm Size Groups (in acre)				All Farms
	Below 2.5	2.5-5.0	5.0-7.5	Above 7.5	
N	44	37	37	32	150
Average area under Sugarcane crop in acre	1.72	3.68	5.58	7.56	4.40
Cost on Seed	6058.94 (14.75)	6140.99 (16.03)	6184.99 (15.75)	6153.2 (16.25)	6149.85 (15.86)
Imputed Cost on Family Labour	8091.83 (19.69)	6141.82 (16.03)	5852.55 (14.91)	2608.48 (6.89)	4978.83 (12.84)
Cost on Hired Labour	15200.93 (37.00)	15024.93 (39.22)	15520.77 (39.53)	16904.77 (44.64)	15889.48 (40.99)
Cost on Machine hours	5597.35 (13.62)	5604.41 (14.63)	5672.76 (14.45)	5630.89 (14.87)	5634.7 (14.54)
Cost on Chemical Fertilizer	5650.66 (13.75)	4833.09 (12.62)	5541.28 (14.11)	6093.33 (16.09)	5610.28 (14.47)
Cost on Pesticide	487.68 (1.19)	565.77 (1.48)	486.2 (1.24)	480.66 (1.27)	500.73 (1.29)
Total Variable Cost (TVC)	41087.39 (100.00)	38311.01 (100.00)	39258.56 (100.00)	37871.33 (100.00)	38763.86 (100.00)
DIRTI-5	1930.73	1279.23	878.17	746.74	1033.03
Total Cost (TC)	43018.12	39590.24	40136.73	38618.07	39796.89
Total Return (TR)	68473.51	87532.72	71184.02	72888.64	74867.8
Net Return (TR-TC)	25455.39	47942.49	31047.29	34270.57	35070.91
Return over Variable Cost (TR-TVC)	27386.12	49221.71	31925.46	35017.3	36103.94

Source: Survey Data, Figures in parentheses indicate percentages

The Table-4.2 shows that the cost and return particulars of the selected sample sugarcane cultivating farmers of Sathyamangalam taluk in Erode District. The mean size farms for <2.5 acres, 2.5-5.0 acres, 5.0-7.5 acres and >7.5 acres of land group were worked out to 1.72 acres, 3.68 acres, 5.58 acres and 7.56 acres respectively. Taking into account all size groups of farms, the average size was worked out to 4.40 acres. The area under sugarcane, cost of seed, imputed cost of family labour, cost of hired labour, cost of machine hours used, cost of chemical fertilizer and cost of pesticide were the important constituents determining the economics of sugarcane production in the area. Of which, the average sugarcane cultivating farmer in the area ought to spent an average of about more than 40 percent of the total cost towards cost of hired labour followed by Cost on seed (15.86 percent), 14.54 percent of the total cost on machine hours used, 14.47 percent of the total cost on chemical fertilizer, 12.84 percent (appropriate cost) on family labour and only 1.29 percent on pesticide, realised a total return of Rs.74867.80 per acre. In other words, sugarcane cultivation, being a labour intensive occupation, depends much on hired labour. Higher proportion of hired labour might be due to their moderate dependency in farm activities in the region. The cost on machine hours used for cultivation has showed an average of 14.54 percent of the total cost, indicating the use of modern agricultural implements in crop production. Chemical fertilizer and cost of pesticide are the other important factor inputs which have direct effect on crop production. In other words, an average farmer in the category of less than 2.5 acres of sugarcane cultivation spent 13.75 percent of his total cost on chemical fertilizer, while 16.09 percent was recorded for the farms of more than 7.5 acres, indicating the fact that due to the poor economic background, the small farmers were constrained to spend more on fertilizer, this is not so for the bigger sized farms. From the point of view of pesticide use, higher proportion of cost was accounted for farms of the below 5 acres; while it was on the reverse for farms of above 5 acres. In other words, the proportion of fertilizer cost tended to increase with farm size, while the proportion of pesticide cost tended to diminish with farm size. The net return worked out for different size group of farms cultivating sugarcane in the area tended to increase with farm size upto 7.5 acres; showed a marginal decline for farms of above 7.5 acres. However, from the point of view of the return over variable cost, all farms group were witnessed with positive odds. Thus, to conclude, an average sugarcane cultivating farmer in the area spent 15.86 percent, 12.84 percent, 40.99 percent, 14.54 percent, 14.47 percent and 1.29 percent, respectively on cost of seed, family labour, hired labour, machine hours used, chemical fertilizer and pest management; and received a net revenue of Rs.36,103.94/- per acre.

4.3. Resource Use Efficiency of Sugarcane Production

4.3.1. Average Levels of Input Use and Output per Acre

Prior to the discussion on the technical efficiency of farm groups, an overview of the input and output characteristics of the selected farmer households of varying size groups in Sathyamangalam taluk is furnished in table-4.3.

TABLE–4.3: Average Levels of Input Use and Output per Acre by Sample Farm Size Group

Particulars	Farm Size Group				
	Less than 2.5	2.5-5.0	5.0-7.5	More than 7.5	All
Average area under Sugarcane	1.72	3.68	5.58	7.56	4.4
Seed Cane in Pieces (No's)	22866.09	24180.59	27210.34	29665.83	22633.38
Family labour (man-days)	27.44	30.66	30.51	29.11	22.28
Hired labour (man-days)	172.63	186.45	199.56	228.12	172.83
Machine hours	2.46	2.44	2.50	3.70	2.95
Chemicals fertilizer (in Rs.)	4975.90	5346.68	5951.50	6470.71	4823.02
Pesticide components (in Rs.)	151.11	161.66	176.06	190.68	146.95
Cane Output (tonnes)	38.15	40.51	45.55	49.17	39.25
Capital Cost (DIRTI-5) (in Rs.)	1238.94	1229.78	1239.03	1379.85	1072.15
Farm specific variables					
Age	50.74	54.98	60.21	70.89	50.66
Education Status	5.42	6.20	6.86	7.27	5.54
Farm size	1.66	4.05	7.36	11.76	4.07
Family Size	3.69	4.37	4.63	5.75	3.89

Source: Survey data.

From the data furnished in table-4.3, it is observed that the average size of farms cultivating sugarcane in the Sathyamangalam taluk were worked out to 1.72 acres, 3.68 acres, 5.58 acres and 7.56 acres, respectively for the farms of less than 2.5 acres, 2.5-5.0 acres, 5.0-7.5 acres and more than 7.5 acres. Taking into account all farm groups together, the average size of farm cultivating sugarcane in the Sathyamangalam taluk was worked out to 4.40 acres. In other words, based on the mean level data, it is observed that the area under the reference sugarcane was positively associated with the size of land holdings. As hired labour seemed to be an important constituent in agricultural production, especially for the small and medium size group of farms, the proportion of hired labour utilized by each group of farms was worked out separately. Observation clearly showed that hired labour seemed to be an important source of crop production for all size group of farms and each farm in Sathyamangalam taluk utilized 173 days, 186 days, 200 days and 228 days, respectively. By taking all farm size groups together; an average sugarcane cultivating farmer in the Sathyamangalam taluk has utilized 173 man-days per acre through hired labour sources. In the case of farms with more than 7.5 acres of sugarcane cultivation, the hired labour force participation was found to be higher than the farms of less than 2.5 acres of sugarcane cultivation. This might be due to the fact that their dependence on hired labour was relatively high as evident from table 4.3.. In other words, the family labour use per acre for sugarcane cultivation in Sathyamangalam taluk was found to be decrease with farm size, while an increasing trend was witnessed in the case of hired labour. The machine hours used per acre of sugarcane cultivation was worked out to an average of 3 hours, starting from ploughing to harvest in the taluk, inspite of the fact that marginal differences had been witnessed between groups. The quantity of plant nutrients in the form of NPK compounded fertilizer used per acre was found increase with farm size in the taluk. In other words, on an average, a farmer in the Sathyamangalam taluk in Erode District had used 4823.02 of NPK compounded fertilizer (per acre) on sugarcane. The proportion of cost incurred for pesticide components was worked out to be more in farms with below 5 acres, while increasing trend was observed with increasing farm size in the taluk.

4.3.2. Average Production Function

Prior to the examination of the levels of technical efficiency between sample farms, an attempt has been made in the study to estimate the average output response to the changes in inputs at the existing state of technology. The Cobb-Douglas Production Function, using Ordinary Least Square (OLS) technique, was considered to estimate the output elasticities with respect to the key inputs in the production of sugarcane in Sathyamangalam taluk of Erode District in Tamil Nadu. The output elasticities based on the OLS estimates of the Cobb-Douglas production function for sugarcane is presented in table-4.4.

TABLE–4.4: OLS Estimates of the Production Function for Sugarcane Cultivation

Variables	Co-efficient	t	Sig.
Intercept	5.436	2.819	0.012
Area under crop	0.651*	3.145	0.001
Seed	0.364**	2.31	0.034
Family Labour	0.193***	1.603	0.057
Hired Labour	0.177	1.222	0.137
Machine Hours used	0.615*	2.858	0.004
Chemical Fertilizer	0.135	0.322	0.675
Cost on Pesticide Components	-0.022	-0.605	0.265
R	0.751		
R^2	0.714		
Adjusted R^2	0.706		
F	102.21		0
N	150		

Source: Survey Data. *,**,*** Indicate significant at 1%, 5% and 10% level.

The estimated regression co-efficients of the variables pertaining to the data on Sathyamangalam taluk are furnished in table-4.4. It reveals that the goodness of fit as explained by R^2 shows almost 71.4% of the variability in the yield of sugarcane was explained by these independent variables. The estimated output elasticities with respect to area under crop, seed, family labour, and machine hours used were estimated to 0.651, 0.364, 0.193 and 0.615, respectively and statistically significant at 1 percent, 5 percent, 10 percent and 1 percent level, respectively.

4.3.3. Technical Efficiency

The Technical Efficiency of selected farms involved in sugarcane production from the Sathyamangalam taluk of Erode District in Tamil Nadu was estimated for sugarcane production by fitting a Stochastic Frontier Production Function. The MLE estimates obtained for sugarcane with respect to Sathyamangalam taluk of Erode District is furnished in Table-4.5.

TABLE–4.5: Estimated Parameters of the Stochastic Frontier Production Function for Sugarcane Cultivation

Variables	â	t	Sig.
Intercept	9.008	3.346	0.009
Area under crop	0.2813**	2.58	0.025
Seed	0.2465*	5.212	0.005
Family Labour	0.2047*	4.293	0.006
Hired Labour	0.1611	1.455	0.325

TABLE–4.5: ESTIMATED PARAMETERS OF THE STOCHASTIC FRONTIER PRODUCTION FUNCTION FOR SUGARCANE CULTIVATION—*Contd.*

Variables	â	t	Sig.
Machine Hours used	0.0822***	1.901	0.083
Chemical Fertilizer	0.0322	0.576	0.517
Cost on Pesticide Components	0.0636	1.375	0.645
σ_v	0.1597		
σ_u	0.2995		
σ^2	0.1152		
σ_v^2	0.0255		
σ_u^2	0.0897		
γ	0.7786		
Log Likelihood	73.8751		
N	150		

Source: Survey Data*,**,*** Indicate significant at 1%, 5% and 10% level.

The maximum likelihood estimates of the stochastic frontier production based on the sample farm level data pertaining to Sathyamangalam taluk indicates the fact that four input variables viz., area under sugarcane crop, seed, family labour and machine hours used were registered with a priori signs and statistically significant at 5 percent, 1 percent and 1 percent level respectively. In other words, the output elasticities of sugarcane with respect to area under crop, seed, family labour and machine hours were worked out to 0.2813, 0.2465, 0.2047 and 0.0822, respectively. Though, use of hired labour, chemical fertilizer and cost of pesticide have positive impacts on sugarcane output, the estimates were not statistically significant. The estimated value of $ó_u^2$ and $ó_v^2$ were 0.0897 and 0.0255, respectively. A high value registered for ã (0.7786) indicated the presence of significant inefficiencies in the production of sugarcane among the farmers of the Sathyamangalam taluk. In other words, 78 percent of the difference between the observed and frontier output among farms was mainly due to the inefficient use of resources which are under the control of the sample farmers in the area.

4.3.4. Efficiency Scores

In order to find out the extent of farm level inefficiencies witnessed for sugarcane cultivating farmers of Sathyamangalam taluk of Erode District, technical efficiency scores were worked out through the maximum likelihood estimates of the frontier production function. The frequency distribution of the estimated technical efficiencies for sugarcane cultivating sample households by farm size group as well as for the farm as a whole for Sathyamangalam taluk in Erode District is presented in table-4.6.

TABLE–4.6: TECHNICAL EFFICIENCY BY FARM SIZE GROUPS FOR SUGARCANE CULTIVATION

Levels of Technical Efficiency (Per cent)	Farm size group <2.5	2.5-5.0	5.0-7.5	Above7.5	All
<70	7	5	3	2	17
	(15.91)	(13.51)	(8.11)	(6.25)	(11.33)
70-80	23	23	16	12	74
	(52.27)	(62.16)	(43.24)	(37.50)	(49.33)
>80	14	9	18	18	59
	(31.82)	(24.32)	(48.65)	(56.25)	(39.33)
Mean TE	.7525	.7599	.7373	.7659	.7534
N	44	37	37	32	150

Source: Primary data Figures in parentheses indicate percentages

From the table-4.6, it is observed that the average level of technical efficiency was estimated to 76 percent for the Sathyamangalam taluk farms, indicating the fact that the sugarcane output can be raised by 11 percent by following better crop management practices without increasing the level of inputs. It was also observed that 11.33 percent of the farmers in the area operated at the efficiency levels of <70 percent; while 49.33 percent were between 70-80 percent and 39.33 percent were >80 percent. The mean technical efficiency for farms of less than 2.5 acres, 2.5-5.0, 5.0-7.5 and more than 7.5 acres had been worked out to 0.7525, 0.7599, 0.7373 and 0.7659, respectively, of which the farmers in the size group of less than 2.5 acres of sugarcane cultivation in the area were termed as more efficient than the other groups. This might be due to the fact that the authors observation of optimum size of farm falls on these categories.

4.3.5. Determinants of Technical Efficiency

The efficiency scores generated by the frontier model were regressed on the variables viz., Education, Farm Size, Age, and Family Size, as furnished in table-4.7.

TABLE–4.7: DETERMINANTS OF TECHNICAL EFFICIENCY

Variables	â	t	Sig.
Intercept	0.747	12.910	0.000
Age	0.229*	3.199	0.005
Educational status	0.123**	2.534	0.044
Farm size	0.195**	3.465	0.027
Family Size	0.206*	2.570	0.000
R^2	0.691		
Adj R^2	0.675		
N	150		

Source: Survey Data*,**,*** Indicate significant at 1%, 5% and 10% level.

The model explained the variation in technical efficiency on the sample farms interms of R^2 which is 69 percent for sugarcane cultivating farmer households. As expected, all of the variables have positive signs. Age, Education, farm size and family size to sugarcane cultivation in the taluk were positively related with the technical efficiency and all of the coefficients were statistically significant at 1 and 5 percent level. It can be inferred that the technical efficiency was influenced by education, as the presence of educated adult in the family adds to the efficiency in sugarcane output.

5. Conclusion and Recommendations

Emergent from the findings of this study, it can be concluded that sugarcane farmers in Sathyamangalam taluk of Erode District were technically inefficient in the use of farm resources. This may be as a result of high cost of hired labour, fertilizer, seeds and machine hours used. This means that technical efficiency in sugarcane production the study area can be increased by using these inputs more efficiently. To ensure the efficient use of resources in the production of sugar cane in the region, a concerted and collective effort on the part of individual farmers, government and research institutes is very important. The Individual farmers must make an effort to reach an improved version of the production of sugarcane while the government should ensure t the delivery of participatory extension services for sugarcane farmers. In addition, the government should ensure that the farm inputs are available to farmers at the right time and at reduced prices. Finally, research institutes should intensify research work on sugarcane to improve varieties that give higher farm productivity in a short time.

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Rubber Cultivation in Kerala: Determinants and Growth

Dr. N. Karunakaran*

Abstract

The development experience of Kerala agriculture since the last few decades has been characterised by sharp decline in the area under food crops and the substantial expansion in the area under non-food crops. From the analysis of the growth trends of area of principal crops in Kerala, it is clearly established that the cropping pattern in the state made a significant change from food crops to non-food crops, and recently towards rubber. This change in cropping pattern is mainly due to farmers' decisions. There must be certain determinants that motivated the farmers to make such a shift in the cropping pattern. Area response and yield response models were used to analyse the determinants. The determinants estimated are lagged area, expected price of the crop, expected price of the competing crop, lagged yield, expected yield risk and price risk, average annual rainfall, tappable area, etc. Knowledge about the decision behaviour is crucial and the analysis about rubber revealed that price is the most dominant governing determinant, that is, farmers' decision behaviour is more sensitive in the case of rubber.

Keywords: Rubber; determinants; growth, supply response; area response; yield response.

Introduction

Due to differences in soil and climatic conditions, a wide variety of food and non-food crops are grown throughout Kerala which include, rice, coconut, rubber, tapioca, pepper, cashewnut, arecanut, banana, coffee, tea, ginger, cardamom, etc. Agricultural development experience of the state since the last seventies has been characterised by sharp decline in the area under food crops and the substantial expansion in the area under non-food crops. Area under food crops decreased from 66.63 percent of the total cropped area during 1960-61 to 12.05 percent of the total cropped area during 2009-10. But the situation is just the reverse in the case of non-food crops, which went up from 33.37 percent of the total cropped area in 1960-61 to 87.95 percent of the total cropped area in 2009-10.

The agriculture scenario of Kerala thus demonstrates a heavy concentration of non-food crops. The two main characteristics of the cropping pattern of agriculture in Kerala are the predominance of crops, which are dependent on world market conditions, and the dominance of perennial crops as against annual or seasonal crops. The emergence of cash crops as a dominant sector over the last four decades is the most notable feature of Kerala's agricultural development. The main feature of the cropping pattern trend at present is shifting cultivation, that is, shift in the cultivated area under food grain crops to non-food grain crops and shift in the cultivated area under one non-food grain crop to another non-food grain crops. Data on the area under major crops in Kerala depicts this shift in cultivation. The area under paddy cultivation decreased from 347.46 thousand hectare in 2000-01 to 234.01 thousand hectare in 2009-10, the area under coconut cultivation decreased from 925.78 thousand hectare in 2000-01 to 778.62 thousand hectare in 2009-10, the area under cashewnut cultivation decreased from 92.12 thousand hectare in 2000-01 to 48.97 thousand hectare in 2009-10, the area under pepper cultivation decreased from 202.13 thousand hectare in 2000-01 to 171.49 thousand hectare in 2009-10; whereas the area under rubber cultivation increased from 474.36 thousand hectare in 2000-01 to 525.41 thousand hectare in 2009-10 (Govt. of Kerala, 2010).

This change in cropping pattern mainly towards rubber is due to farmers decisions. Based up on price expectations, labour availability, impact of government strategies, agro-climatic conditions, irrigation facilities, expected yield, cost of cultivation, soil fertility and so on, farmers decide whether to allocate their land for agricultural purposes, viz, which of the crops to cultivate, how much area to allocate, etc, or for non-agricultural purposes (Mythili G, 2006). The most important decisions therefore are what crops to grow and on how much land. These decisions are taken in an uncertain future environment (Parikh KS and Narayana NSS, 1980).

In Kerala, changes in cropping pattern thus takes place due to different reasons. It may be due to expected price of the crop, price of the competing crop, expected yield, variations in the climatic conditions, soil fertility, irrigation facilities, labour availability, cost of cultivation, etc. Various studies pointed out that the popular methodology to discuss the determinants is the supply response models, where the farmer's decisions are

* Head of the PG Department of Economics, EKNM Government College Elerithattu, Elerithattu – Post, Nilishwar – Via, Kasaragod – Dist, Kerala, India, 671314, E mail: narankarun@gmail.com

discussed from two angles, area response and yield response (Mani KP, 2009).

The agricultural statistics of Kerala since 1960-61, clearly depicted that the cropping pattern in the state has made a significant shift towards rubber. Naturally, there must be certain determinants which motivated the farmers to make such a change in the cropping pattern. Hence, in this study an attempt has been made (i) to examine the growth trends in area, production and productivity of rubber in Kerala during 1960-61 to 2009-10 and (ii) to identify the major determinants of rubber in Kerala in area response and yield response angles during 1960-61 to 2009-10.

Methodology and Materials

The study used secondary data and was collected from various publications of the Government of Kerala like Economic Review, Statistics for Planning and Agricultural Statistics. The universe of the study is the state as a whole and the study period is 1960-61 to 2009-10 and is split up into different sub- periods.

Herfindahl Index (HI) is used in this study to measure the extent of crop diversification in Kerala and is calculated by taking sum of squares of acreage proportion of each crop to the total cropped area.

$$HI = \sum_{i=1}^{N} p_i^2$$

Where, N is the total number of crops and P_i represents acreage proportion of the i^{th} crops to total cropped area.

With the increase in diversification, the Herfindahl Index would decrease. The index takes a value one when there is a complete specialisation and approaches zero at N gets large, that is, if diversification is perfect. Thus the HI is a measure of concentration; it was transformed by subtracting it from one, that is,

Diversification Index (DI) = 1 – HI

Compound Growth Rates (CGR) of area, production and productivity of rubber for the period were estimated with the following exponential model.

$$Y = ab^t$$

The growth rate (GR) has been computed using the formula:

$$GR = (Antilog\ b\text{-}1)\ x100$$

The F test has been applied to test the significance of b.

The popular methodology which the agricultural economists used to discuss the determinants is the supply response models (Usha Tuteja, 2006). This model has been used in this study and the farmers decisions are discussed in terms of area response and yield response and the following models were developed and estimated for the rubber crop on the basis of Nerlovian lagged adjustment model.

(i) Area Response Model for Rubber:

$$At = a_0+a_1Pt^e+a_2Ptc^e+a_3Yt^e+a_4TAt+a_5PRt^e+a_6RFt+vt$$

(ii) Yield Response Model for Rubber:

$$Yt = b_0+b_1Yt\text{-}1+b_2Pt^e+b_3Ptc^e+b_4PRt^e+b_5RFt+ut$$

Where,

At = Area under the crop in the current year,

Yt = Yield per hectare of the crop in the current year,

Pt^e = Expected price of the crop (The expected price of the crop in period t was calculated as the average prices prevailing in the preceding three years),

PRt^e = Expected price risk in the current year (The price risk in period t was represented by the standard deviation of price in the past three years from period t),

RFt = Average annual rainfall in mm,

Ptc^e = Expected price of the competing crop (that is, coconut),

Yt^e = Expected yield of the crop (The expected yield of the crop in period t was calculated as the average yield prevailing in the preceding three years),

TAt = Tappable area in the current year,

Yt-1 = Yield of the crop in period t-1.

The regression coefficients were estimated by the method of OLS. The regression coefficients were tested for their significance using t test. Durbin-Watson statistic was also computed for testing the incidence of auto-correlation.

Cropping Pattern in Kerala towards Rubber

During 1960-61 the order of the first five crops (rice, coconut, tapioca, rubber and pepper) were in the descending order of shares to the total cropped area. Table.1 reveals that in 2009-10, the first five crops were coconut, rubber, rice, pepper and arecanut. Rubber occupied fourth position in area during 1960-61 went to second position during 2009-10. The main crops losing area between 1960-61 and 2009-10 were rice and tapioca. This change in cropping pattern clearly established a shift from the traditional subsistence cropping to the recent commercial cropping like rubber. From Table.1 it is very clear that, among the four plantation crops, rubber emerged as the most significant crop with largest area in the state next only to coconut.

TABLE.1. Cropping Pattern In Kerala According to Land Use Statistics (Percentage to Total Cropped Area (TCA))

Sl. No.	Crops	1960-61	1970-71	1980-81	1990-91	2000-01	2009-10
1	Rice	33.16 (1)	29.83 (1)	27.79 (1)	18.53 (2)	11.50 (3)	8.77 (3)
2	Coconut	21.32 (2)	24.52 (2)	22.56 (2)	26.72 (1)	30.63 (1)	29.18 (1)
3	Arecanut	2.31 (6)	2.93 (7)	2.12 (7)	2.15 (10)	2.89 (8)	3.72 (5)
4	Rubber	5.23 (4)	6.11 (4)	8.24 (4)	13.63 (3)	15.70 (2)	19.65 (2)
5	Pepper	4.25 (5)	4.03 (5)	3.75 (6)	5.58 (4)	6.69 (4)	6.43 (4)
6	Cashewnut	2.31 (6)	3.50 (6)	4.90 (5)	3.83 (6)	3.05 (7)	1.84 (9)
7	Tapioca	10.31 (3)	10.01 (3)	8.49 (3)	4.85 (5)	3.79 (5)	2.80 (7)
8	Coffee	0.72 (10)	1.08 (11)	2.02 (8)	2.49 (7)	2.80 (9)	3.18 (8)
9	Tea	1.60 (8)	1.28 (10)	1.25 (11)	1.15 (11)	1.22 (11)	1.35 (11)
10	Cardamom	1.22 (9)	1.62 (9)	1.87 (9)	2.21 (8)	1.37 (10)	1.56 (10)
11	Ginger	0.51 (11)	0.41 (12)	0.44 (12)	0.47 (12)	0.38 (12)	0.20 (12)
12	Banana and other plantains	1.89 (7)	1.66 (8)	1.72 (10)	2.17 (9)	3.29 (6)	3.71 (6)
13	Other crops	15.17	13.02	14.87	16.22	16.69	17.27
14	T C A	100.00	100.00	100.00	100.00	100.00	100.00

Figures in bracket shows rank

Source : — Computed from (i) Statistics for planning (various issues), Department of Economics and Statistics, Govt. of Kerala, Thiruvananthapuram. (ii) Economic Review (various issues), State Planning Board, Govt. of Kerala, Thiruvananthapuram.

The percentage increase in the area under rubber was 327.61 in 2009-10 over the year 1960-61 (Table.2). Among the districts, Thiruvananthapuram district recorded highest percentage increase in area under rubber cultivation (697.85 percentages).

TABLE.2. Percentage Change in the Cultivation of Rubber in Kerala in Different Decades

Sl. No.	Districts	1970-71 over 1960-61	1980-81 over 1970-71	1990-91 over 1980-81	2000-01 over 1990-91	2009-10 over 2000-01	2009-10 over 1960-61
1	Thiruvananthapuram	83.61	28.06	159.38	24.45	5.12	697.85
2	Kollam	42.35	26.87	-22.66	22.26	2.69	75.35
3	Pathanamthitta	-	-	-	9.50	4.16	14.06
4	Kottayam	25.84	16.49	70.69	3.02	0.75	159.73
5	Alappuzha	75.82	23.99	-32.11	31.02	10.76	114.19
6	Ernakulam	64.52	-10.73	161.05	-7.01	2.27	264.59
7	Idukki	-	-	98.26	10.06	3.31	125.43
8	Trissur	31.21	14.27	-26.90	94.91	10.59	136.26
9	Palakkad	70.56	28.33	116.93	20.33	18.49	577.03
10	Malappuram	-	-	6.09	42.79	28.91	8.34
11	Kozhikkode	48.99	-18.29	-37.58	44.26	10.79	31.31
12	Wayanad	-	-	-	36.46	38.26	88.67
13	Kannur	42.07	62.26	-3.49	46.96	22.49	300.50
14	Kasaragod	-	-	-	21.43	26.98	54.19
15	State	45.89	32.64	73.11	15.25	10.76	327.61

Source: - Computed from (i) Statistics for planning (various issues), Department of Economics and Statistics, Govt. of Kerala, Thiruvananthapuram. (ii) Economic Review (various issues), State Planning Board, Govt. of Kerala, Thiruvananthapuram.

Table.3 clearly supported this shift from food crops, mainly rice and tapioca, in favour of tree crops such as rubber and coconut in Kerala, which was shown in the form of diversification index. The approach followed is to utilise Herfindahl Index (HI) to measure crop diversification. Herfindahl Index (HI) is a measure of concentration and

so it has to transform by subtracting from one (that is, 1 – HI) to get Diversification Index. It may be observed that the transformed values of Herfindahl Index were lower in the initial years of study. This implies less diversification in the initial years, viz, 1960-61 and 1970-71. The higher values in the later years, viz, 1980-81, 1990-91, 2000-01 and 2009-10 indicates more diversification.

Considering the value of crop diversification indices for Kerala from 1960-61 to 2009-10, relatively less diversification in initial years of study compared to recent years could be attributed mainly to the farmers' preference for growing more number of commercial crops and less number of subsistence crops. The diversification in cropping pattern mainly towards rubber was noticed during the recent years (Srikumar Chattopadhyay, et.al, 2006).

TABLE.3. Crop Diversification Indices for Kerala (1960-61 To 2009-10)

Sl. No.	Year	Crop Diversification Index
1	1960-61	0.821 (0.179)
2	1970-71	0.833 (0.167)
3	1980-81	0.852 (0.148)
4	1990-91	0.867 (0.133)
5	2000-01	0.858 (0.142)
6	2009-10	0.863 (0.137)

Figures in bracket shows Herfindahl Index

Determinants of Rubber Cultivation in Kerala

Originally rubber was introduced into areas with degraded forests. From there it spread all over. It replaced natural vegetation, tapioca, cashewnut, fruit trees and coconut (Srikumar Chattopadhyay, et.al, 2006). The area, production and productivity of rubber cultivation had tremendously increased during 1960-61 to 2009-10 (Table.4 and Figure.1).

Factors like expected price and yield of the crop, price of the competing crops (like coconut), average annual rainfall, tappable area, lagged yield of the crop, etc, are conceived to be great importance in determining the area allocation and yield response of rubber in Kerala.

(a) Area Response of Rubber

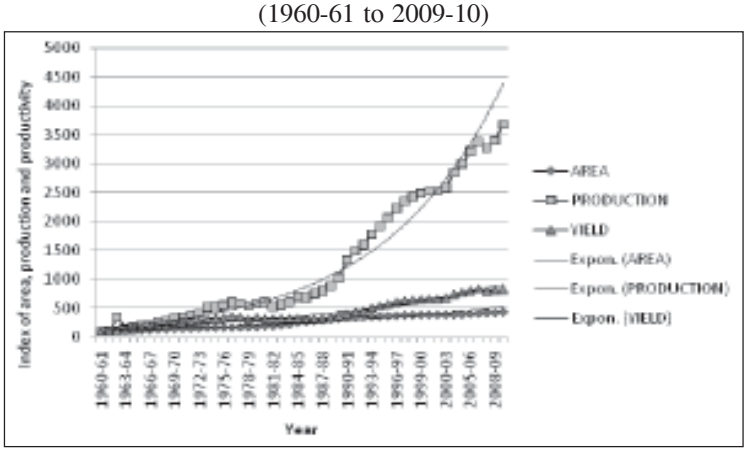
The estimated results of the area response of rubber in Kerala in three periods are given in Table.5. The expected price of the crop, expected price of the competing crop (coconut), tappable area of rubber and rainfall are the most significant factors which influenced the area response of rubber in Kerala during the sub-period one. Among these four factors expected price of coconut is the strong determinant (0.405) in the area expansion of rubber in the initial period. This revealed the fact that the low expected price of coconut is the main determinant of planted area decision of rubber in Kerala up to the year 1989-90. Expected yield and expected price risk of rubber were shown negative influence in area adjustments.

TABLE.4. Compound Growth Rates of Area, Production And Productivity Of Rubber In Kerala In Different Periods.

Sl. No.	Districts	1960-61 over 1969-70	1970-71 to 1979-80	1980-81 to 1989-90	1990-90 to 1999-10	2000-01 to 2009-10	1960-61 to 2009-10
1	Area	3.647	1.989	6.485	1.407	1.196	3.292
2	Production	*11.311	6.107	7.640	7.345	4.514	7.065
3	Productivity	10.729	3.819	1.087	5.853	3.281	3.903

* - Significant at probability level 0.01

Figure.1 Growth in area, Production and Productivity of Rubber Cultivation in Kerala (1960-61 to 2009-10)



In the second period, the tappable area of rubber is the major governing factor of farmer's decisions. In addition to that the expected price of rubber and coconut are the next two factors working behind the farmer's area adjustment decisions on rubber. All other variables were found to have negative significant influence.

From the estimation results of the area response of rubber in Table.5 during 1960-61 to 2009-10, it is revealed that price variables (expected price of rubber, 0.1383 and expected price of competing crop, 0.2158) turns out to be an important factor in determining the area response in addition to tappable area of rubber (0.4756). The expected yield and expected price risk seems to have negative influence on area.

TABLE.5. Regression Coefficients of the Determinants of Area of Rubber in Kerala in Different Periods.

Sl. No.	Variables	1960-61to1989-90	1990-91 to 2009-10	1960-61 to 2009-10
1	a_0	3.3996	3.7358	2.1703
2	Pt^e	0.0119 (0.081)	0.0957 (0.026)	0.1383 (0.025)
3	Ptc^e	0.405 (0.099)	**0.0254 (0.023)	0.2158 (0.036)
4	Yt^e	-0.1747 (0.050)	***-0.0407 (0.074)	-0.2183 (0.041)
5	Tat	**0.1648 (0.112)	0.3623 (0.718)	0.4756 (0.073)
6	PRt^e	*-0.020 (0.008)	*-0.012 (0.004)	-0.0237 (0.006)
7	RFt	**0.0606 (0.036)	**-0.0366 (0.034)	**0.0527 (0.034)
8	R Square	0.9901	0.9842	0.9942
9	Durbin-Watson statistic	2.290	1.4631	1.4479

Figures in bracket shows standard error
*- Significant at 1% level of significance
**- Significant at 5% level of significance
***- Significant at 10% level of significance

(b)Yield response of Rubber

The regression coefficients of the determinants of the yield of rubber are given in Table.6. Price risk as well as expected price of rubber had negative influence on yield in the first period. The lagged yield, expected price of the competing crop and rainfall were the main determinants of yield response of rubber in the period. The lagged yield of rubber turns out to be the important factor among this in determining the crop yields (0.8406).

During the second period also lagged yield value is the most important factor (1.0873), in addition to average rainfall and expected price risk in determining variations in yield over time. The price variables seem to be negative during the period.

TABLE.6. Regression Coefficients of the Determinants of Yield of Rubber in Kerala in Different Periods.

Sl. No.	Variables	1960-61 to 1989-90	1990-91 to 2009-10	1960-61 to 2009-10
1	b_0	1.226	-0.0226	-0.4139
2	Yt-1	0.8406 (0.104)	1.0873 (0.156)	0.9559 (0.048)
3	Pt^e	**-0.2079 (0.150)	**-0.146 (0.077)	0.0047 (0.039)
4	Ptc^e	**0.1918 (0.142)	***-0.0336 (0.084)	0.0079 (0.039)
5	PRt^e	***-0.010 (0.016)	**0.0239 (0.014)	***-0.0083 (0.010)
6	RFt	***0.0466 (0.064)	***0.0881 (0.107)	*0.0896 (0.048)
7	R Square	0.9758	0.9765	0.9905
8	Durbin-Watson statistic	2.521	2.8199	2.181

Figures in bracket shows standard error
*- Significant at 1% level of significance
**- Significant at 5% level of significance
***- Significant at 10% level of significance

With regard to the overall period, the estimated results shows that lagged yield and rainfall were the significant factors influencing the yield of rubber. The price variable seems to be insignificant in the case of yield response of rubber.

The area response and yield response of rubber show that area under rubber was found to be price responsive. Future expectations about prices are one of the major determinants governing the area expansion of rubber in Kerala. The price of coconut and tappable area of rubber are the next two factors working behind the farmer's area expansion decisions on rubber.

Conclusion

From the analysis of the change in cropping pattern and the growth trends of area of principal crops in Kerala, it is clearly established that the cropping pattern in the state made a significant change from food crops to non-food crops and recently towards rubber. This change in cropping pattern is mainly due to farmers' decisions. There must be certain determinants that motivated the farmers to make such a shift in the cropping pattern. Area response and yield response models were used to analyse the determinants. The determinants estimated are lagged area, lagged yield, expected price of the crop, expected price of the competing crop, expected yield risk and price risk, average annual rainfall, tappable area, etc.

The results of the study revealed that, in the case of rubber, the price variable (expected price and expected price of competing crop) is the major determining factor in addition to tapped area for area decision. In the yield response decision, past years yield and rainfall were the significant variables for rubber. The area response and yield response of rubber shows that area under rubber was price responsive. Future expectations about price are the dominating factor governing the acreage decision of rubber in Kerala.

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Status of the Irrigation Sector in India

MONDIRA BHATTACHARYA*

Indian agriculture is said to be a 'gamble of the monsoons' as it is still dependent on monsoon rainfall that is uncertain, irregular and unevenly distributed. India, being an agricultural economy, the importance of irrigation water is crucial. Further, topography and soil type also necessitate dependency on different sources of irrigation. Irrigation is necessary to boost agricultural production to meet the requirements of an ever increasing population. India, which accounts for one-sixth of the world's population, already faces water stress that is likely to aggravate further in future. The main cause for this water stress is growing population and rising food demand. In India irrigation is provided to just 44.91 per cent arable land. Moreover, 62 per cent of geographical area i.e., 200 million hectares is under rainfed farming that have most poverty and the contribution of rainfed agriculture is high. The potential water resources in India is 140 mha, out of which the potential created is 112 mha and that utilized so far is 89 mha. According to the National Commission on Integrated Water Resources Development (NCIWRD), the sectoral demand for water in the year 2010 was the highest for the irrigation sector (557 BCM) followed by drinking water (43 BCM), industry (37 BCM) and energy sectors (19 BCM). The demand for irrigation water would increase to 1093 billion cubic meters) by 2025. Understanding the crucial need of irrigation for agriculture, this paper highlights some critical issues associated with irrigation water use for agriculture in India and also provides an analysis of the macro trends and patterns of irrigation and its relationship with crop productivity.

Key words : Rainfall, irrigaton, crop productivity, rain fed agriculture. Critical Issues Related to Irrigation in India

Expenditure on Irrigation

Table 1 shows the Plan wise share of expenditure on irrigation sector in India. Although Plan expenditure on irrigation has increased from Rs.441.8 crore in the Ist Plan to Rs. 2,11,700 crore (outlay) in the XIth Plan, the share in total Plan expenditure has decreased from 22.54 per cent to 5.81 per cent. Plan wise expenditure on flood control has increased from Rs.13.2 crores in the Ist Plan to Rs. 20100 crores in the XIth Plan. Expenditure on Major & Medium Irrigation (MMI) projects has been higher than Minor irrigation (MI) and Command Area Development (CAD) programmes. However, the share of expenditure on MMI projects in total irrigation expenditure has declined from 85 per cent in the Ist Plan period to 78 per cent in the XIth Plan period, while that on MI&CAD projects has increased from 15 to 22 per cent in the same time frame.

TABLE 1: PLAN-WISE EXPENDITURE ON IRRIGATION & FLOOD CONTROL SECTORS (RS.CRORES)

Plan Periods	MMI	MI/MI & CAD	Total Irrigation	Flood Control	Total Plan Expenditure All Sectors	Expenditure on Irrigation (%)
First Plan(1951-56)	376.2	65.6	441.8	13.2	1960	22.54
Second Plan(1956-61)	380	161.6	541.6	48.1	4672	11.59
Third Plan(1961-66)	576	443.1	1019.1	82.1	8577	11.88
Annual Plans(1966-69)	429.8	560.9	990.7	42	6625	14.95
Fourth Plan (1969-74)	1242.3	1173.4	2415.7	162	15779	15.31
Fifth Plan(1974-78)	2516.2	1409.6	3925.8	298.6	28653	13.70
Annual Plans(1978-80)	2078.6	1344.9	3423.5	330	22950	14.92
Sixth Plan(1980-85)	7368.8	4159.9	11528.7	787	109292	10.55
Seventh Plan (1985-90)	11107.3	7626.8	18734.1	941.6	218730	8.56
Annual Plans (1990-92)	5459.2	3649.5	9108.7	460.6	123120	7.40
Eighth Plan(1992-97)	21071.9	13885.3	34957.2	1691.7	483060	7.24
Ninth Plan(1997-02)	49289	13760	63049	3038	941041	6.70
X Plan (2002-07)	83647	16458.9	100105.9	4344.18	1618460	6.19
XI Plan (2007-2012) Outlay Projection	165350	46350	211700	20100	3644718	5.81
Total	350892.3	111049.5	461941.8	32339.08	7227637	6.37

Source: Planning Commission Reports, Govt. of India

*Sr. Associate, Council for Social Development, New Delhi.

The Central sector outlay for XIIth Plan is Rs.18,118 crores, which envisages schemes like Irrigation Management Programme, Development of Water Resources Information System, Ground Water Management and Regulation (including aquifer mapping) etc. The indicative outlays for the XIIth Plan under the Water Resources Sector (irrigation, flood management and command area development) would be about Rs.4,22,012 crores. The realisation of this outlay is dependent upon the resource position of the states and their priority to the sector.

Plan wise Proliferation of Schemes

The numbers of major & medium projects taken up and completed in different Plan periods are given in Table 2. It is seen that so far, over the Plan periods, only 73 per cent of the projects have been completed. Among the different types of projects, the share of completed projects in the medium projects sector is the highest (82 per cent) followed by major projects (58 per cent) and Extension, Renovation and Modernisation (ERM) projects (59 per cent).

For speedy completion of ongoing projects in advance stage of construction, Accelerated Irrigation Benefit Programme (AIBP) was launched in 1996-1997. During VIIIth Plan period, irrigation potential of 2.22 mha was created under the MMI sector. This increased to 4.10 mha in the IXth Plan out of which 1.65 mha (nearly 40%) was through AIBP. This further rose to 5.30 mha in the Xth and 4.28 mha in the XIth Plan period. Renovation, Modernization and Rehabilitation of old irrigation schemes gained momentum. User's participation in MMI schemes received greater attention. Repairs and improvement to the minor irrigation projects, as a part of integrated micro-development, also received encouragement. Similarly, sprinkler and drip irrigation programmes and the conjunctive use of surface and ground water gained momentum. The projects completed, along with minor irrigation and ground water development had created an estimated potential of about 103 mha by the end of the Xth Plan.

TABLE 2: PLAN WISE PROLIFERATION OF SCHEMES IN THE MMI SECTOR

Plan Periods	Major Projects		Medium Projects		ERM Proejcts		Total Projects	
	Take Up	Completed	Taken Up	Completed	Taken Up	Completed	Taken Up	Completed
Pre Plan	74	74	143	143	0	0	217	217
First Plan (1951-56)	44	5	165	34	12	3	221	42
Second Plan (1956-61)	33	20	102	85	5	5	140	110
Third Plan (1961-66)	32	11	44	61	7	7	83	79
Annual Plans (1966-69)	11	5	27	43	1	3	39	51
Fourth Plan (1969-74)	33	15	74	62	7	4	114	81
Fifth Plan (1974-78)	68	6	303	70	20	1	391	77
Annual Plans (1978-80)	11	2	55	18	3	2	69	22
Sixth Plan (1980-85)	31	30	89	138	37	4	157	172
Serventh Plan (1985-90)	11	14	36	137	24	15	71	166
Annual Plans (1990-92)	2	7	0	12	0	8	2	27
Eighth Plan (1992-97)	19	9	72	48	30	22	121	79
Ninth Plan (1997-02)	32	30	38	66	27	13	97	109
Tenth Plan (2002-07)	49	32	84	40	46	30	179	102
Eleventh Plan (2007-2012)	38	45	50	68	42	5	130	116
Total	488	276	1230	1008	215	126	1933	1410

Source: Planning Commission Reports, Govt. of India

However, in spite of rationalizing completion schedule of projects under AIBP, several projects are lying behind schedule. Gestation period of major projects is 15-20 years and for minor projects it is 5-10 years. A large number of projects are going on for 30-40 years. Many MMI projects remain under execution forever as they slip from one Plan to the other with enormous cost and time overruns. There are 337 spill over projects (154 major, 148 medium and 35 ERM) into the XIIth Plan from previous plan periods. Most of these are state government projects without Planning Commission approval and hence not eligible for central assistance. Several projects have inter-state disputes.

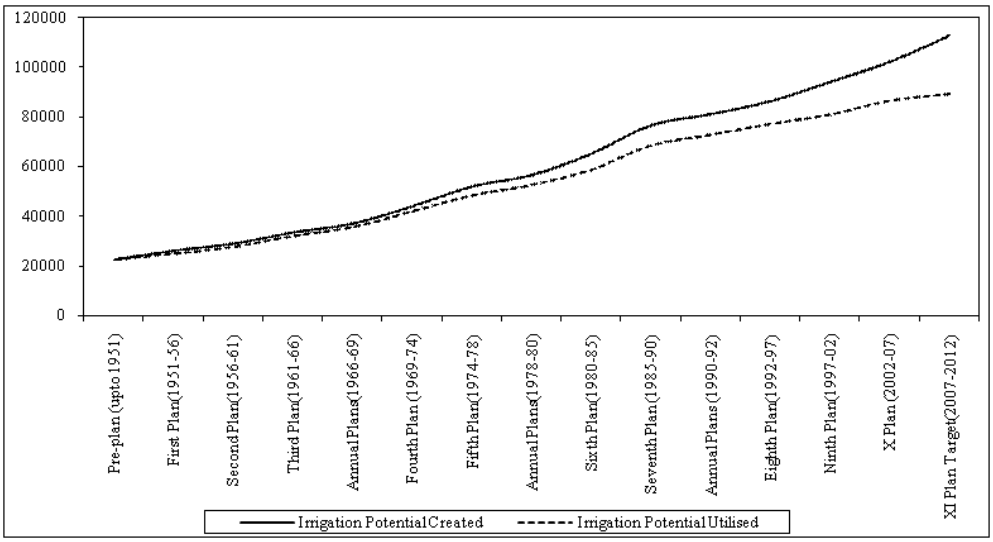
Irrigation Potential Created and Utilised

The ultimate irrigation potential of India was estimated at 140 mha and by the end of Xth Plan, the development of irrigation reached 75-80 per cent of the available potential, which means irrigation sector is heading towards saturation. Although, some irrigation potential is available for development but, it may be difficult to develop the available potential on account of non-availability of suitable sites, submergence of fertile lands, environmental problems, etc. Over the years, huge amount of investment have been made in the irrigation sector with contributions from State and Central Governments with the main objective of making

the country self-sufficient in foodgrains. One of the main problems of Indian irrigation sector is under utilisation of the created potential. The executing/implementing agencies of irrigation projects are mainly concerned with the creation of the structures while management of the created structure is not given due priority. The populist measures of the government like low water rates/waiving off of water charges compounds the problem. Low irrigation water rates results in poor revenue generation, which in turn results in poor allocation of funds for maintenance of the projects. Again, poor maintenance leads to poor system efficiency, shrinkage of irrigated command and under utilisation of created potential. This is a vicious circle and a large number of projects have fallen in to this circle.

According to the Ministry of Water Resources (MoWR), Irrigation Potential Created (IPC) upto the end of XIth Plan stood at 112.53 mha against which Irrigation Potential Utilized (IPU) was 89.26 mha. The gap between actual irrigation potential created (IPC) and irrigation potential utilized (IPU) has been increasing over different Plan periods (Figure 1 & Table 3). The issue of widening gap between IPC and IPU is important because of its implied inefficiency connotations.

FIGURE 1: GAP BETWEEN IRRIGATION POTENTIAL CREATED AND UTILISED ('000 HA)



Source: Ministry of Water Resources, Govt of India

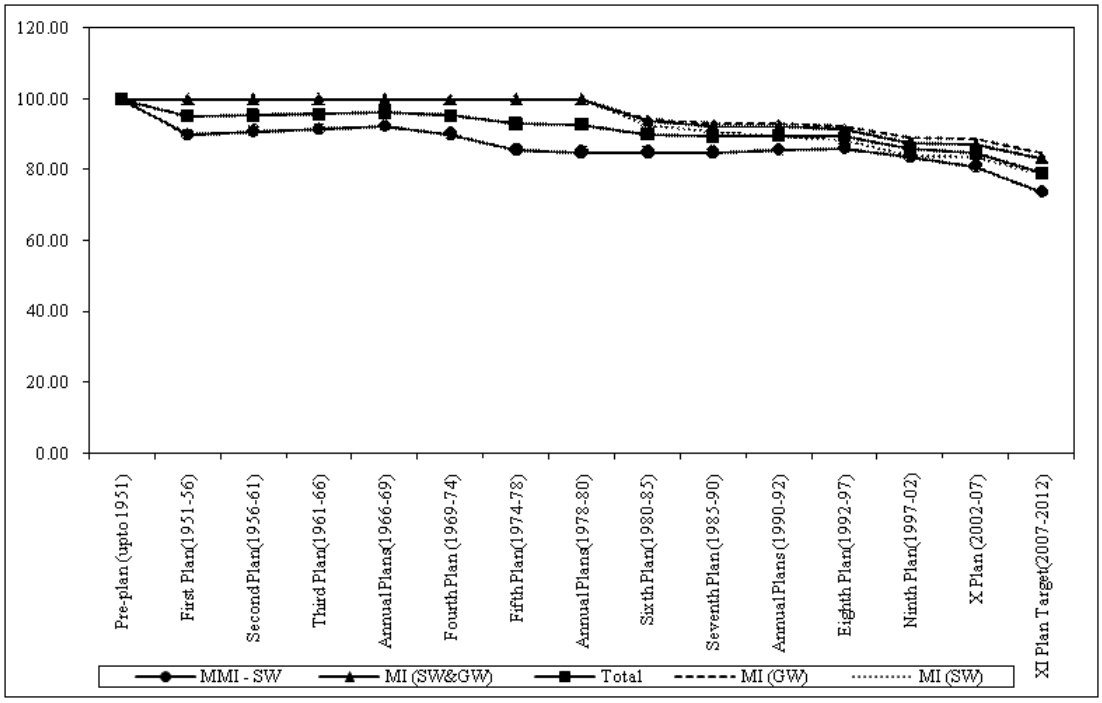
TABLE 3: PLAN-WISE IRRIGATION AND POTENTIAL CREATED AND UTILISED IN INDIA ('000 HA)

Period	Major and Medium Irrigation Surface Water			Minor Irrigation Surface Water			Minor Irrigation Ground Water			Total (Major Medum and Minor Irrigation) Surface & Ground Water					
	IPC	IPU	IPUPC%	IPC	IPU	IPUPC%	IPC	IPU	IPUPC%	IPC	IPU	IPUPC%	IPC	IPU	IPUPC%
Pre-plan (upto 1951)	9705	9705	100.00	6401	6401	100.00	6500	6500	100.00	12901	12901	100.00	22606	22606	100.00
First Plan (1951-56)	12191	10985	90.11	6430	6430	100.00	7630	7630	100.00	14060	14060	100.00	26251	25045	95.41
Second Plan (1956-61)	14334	13052	91.06	6454	6454	100.00	8277	8277	100.00	14731	14731	100.00	29065	27783	95.59
Third Plan (1961-66)	16565	15175	91.61	6480	6480	100.00	10520	10520	100.00	1700	1700	100.00	3365	32175	95.86
Annual Plan (1966-69)	18095	16751	92.57	6512	6512	100.00	12508	12508	100.00	19030	19020	100.00	37115	35771	96.38
Fourth Plan (1969-74)	20703	18688	90.27	6962	6962	100.00	16438	16438	100.00	23400	23400	100.00	44103	42088	95.43
Fifth Plan (1974-78)	24717	21163	85.62	7500	7500	100.00	19800	19800	100.00	27300	27300	100.00	52017	48463	93.17
Annual Plan (1978-80)	26612	22645	85.09	8000	8000	100.00	22000	22000	100.00	3000	3000	100.00	56612	52645	92.99
Sixth Plan (1980-85)	27695	23574	82.12	9698	9011	92.92	27820	26238	9431	37518	35249	93.95	65213	58823	90.20
Seventh Plan (1985-90)	29920	25467	85.12	10987	9968	90.73	35620	33152	93.07	46607	43120	92.52	76527	68587	89.62
Annual Plans (1990-92)	30741	26315	85.60	11457	10289	89.81	38890	36249	93.21	50347	46538	92.43	81088	72853	89.84
Eighth Plan (1992-97)	32957	28441	86.30	12510	11070	88.49	40800	37700	92.40	53310	48770	91.48	86267	77211	89.50
Ninth Plan (1997-02)	37054	31010	83.69	13600	11440	84.12	43300	38550	89.03	56900	49990	87.86	93945	81000	86.21
X Plan (2002-07)	41640	33740	81.03	14310	12000	83.86	46110	40810	88.51	60420	52810	87.40	102060	86550	84.80
XI Plan Target (2007-2012)	47410	35010	73.85	15720	12430	79.07	49400	4820	84.66	65120	54250	83.31	112530	89260	79.32

Source: Ministry of Water Resource & Planning Commission Reports, Govt. of India.

From Figure 2, it is seen that the trends in irrigation potential utilized as a proportion of irrigation potential created have been declining ever since the annual plans (1978-1980), thereby showing increasing gap between the potential created and utilised. Irrigation potentials were utilized more in case of minor irrigation (MI) projects compared to major and medium irrigation (MMI) projects. Further, in case of minor irrigation projects, potentials created both for ground as well as surface water had been utilized fully till the annual plans, but ever since then irrigation potential utilized is declining, more so for surface compared to groundwater, showing high dependence and thereby resulting in strains on ground water resources in India.

FIGURE 2: IRRIGATION POTENTIAL UTILIZED AS PERCENTAGE OF IRRIGATION POTENTIAL CREATED



Source : Calculated from Table 3

The main reasons identified for this increasing gap are poor operation and maintenance of already created irrigation potential, low water discharge, and insufficient water distribution mechanism, loss of water in distribution, diversion of cultivable land to other purposes within command area and also incorrect recording of irrigated area[1] . Although, individually each factor may contribute to a small gap, but their cumulative impact is very high and all these factors are supposed to be tackled in a coordinated manner for solving the problem of non-utilization of IPC.

Irrigation Sources

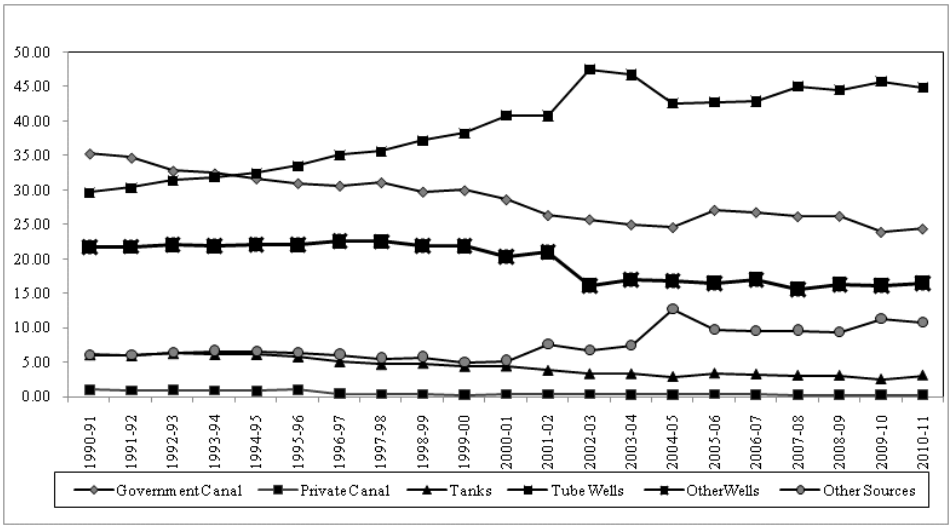
The water resources potential in India has been assessed as 1869 BCM (Central Water Commission). The utilizable water resources of the country has been assessed as 1133 BCM, out of which 690 BCM is from surface water and 433 BCM is from ground water resources. Surface water and ground water resources utilized so far is 225 and 339 BCM, respectively. Thus, there is more use of ground water compared to surface water in the country and it accounts for nearly two thirds of India's irrigation.

Among different sources of irrigation, it is seen that share of area irrigated by tubewells is the highest (approximately 45 per cent) followed by government canals (25 per cent) (Figure 3). The share of area irrigated by tanks and private canals is very less. Further, the shares of area irrigated by government canals and other wells are also on the decline. Tubewell irrigation has been increasing at a rapid rate of 3.72 per cent per annum from 1990-91 while private canal and tank irrigation is declining rapidly. The increase in area under tubewell irrigation indicate heavy dependency on ground water resources in the country.

Over the years, increase in irrigated area mainly from groundwater source is because of two reasons. Firstly, there has been a slowdown in the growth of public investments in large-scale surface irrigation infrastructure. Owing to incompletion of ongoing projects, the surface irrigated area has not increased in the 1990's. Neglected maintenance of canal irrigation systems has led to poor capacity utilization, rising incidence of water logging and salinity and lower water use efficiency (WUE). Secondly, in the absence of

[1]http://wrmin.nic.in/writereaddata/linkimages/IIM_Lucknow99657331.pdf & Finance Commission Reports

FIGURE 3: SOURCE WISE SHARE OF IRRIGATED AREA (%)



Source: Directorate of Economics and Statistics, Ministry of Agriculture, Govt of India

new large-scale surface irrigation schemes, and the availability of low cost electric and diesel pumps coupled with little or no electricity charges, ground water has been a major driver in the irrigated area expansion.

At the state level, it was observed that the share of area irrigated by tubewells in 2010-11 was highest in Uttar Pradesh (41.08 per cent) followed by Punjab (16.47 per cent) (Table 1). In case of government canals the shares were highest in Uttar Pradesh (20.67 per cent) followed by Andhra Pradesh (13.78 per cent), Rajasthan (13.57 per cent) and Punjab (11.81 per cent).

TABLE 4: STATEWISE SHARE OF IRRIGATED AREA BY TUBEWELLS AND GOVERNMENT CANALS (2010-11)

Tubewells		Govt Canals	
States	%	States	%
Uttar Pradesh	41.08	Uttar Pradesh	20.67
Punjab	16.47	Andhra Pradesh	13.78
Rajasthan	9.91	Rajasthan	13.57
Bihar	8.64	Punjab	11.81
Andhra Pradesh	8.18	Karnataka	8.38

Source: Directorate of Economics and Statistics, Ministry of Agriculture, Govt of India

Table 5 shows the share of annual ground water withdrawal for irrigation purposes in India in the year 2009-10. It is seen that 91 per cent of ground water was withdrawn for irrigation purposes in India. The rest 9 per cent was withdrawn for domestic and industrial uses. Most states of India withdrew ground water for irrigation, highest among them being Punjab (98.01 per cent) followed by Uttarakhand (96.19 per cent), Haryana (94.21 per cent), Maharashtra (93.86 per cent), Uttar Pradesh (92.97 per cent) and West Bengal (92.67 per cent).

TABLE 5: STATEWISE SHARE OF ANNUAL GROUND WATER WITHDRAWAL FOR IRRIGATION PURPOSES IN INDIA IN 2009-10 (%)

States	GW Withdrawal (%)	States	GW Withdrawal (%)
Punjab	98.01	Puducherry	80.67
Uttarakhand	96.19	Odisha	79.59
Haryana	94.21	Himachal Pradesh	74.19
Maharashtra	93.86	Daman and Diu	72.73
Uttar Pradesh	92.97	Jharkhand	72.67
West Bengal	92.67	Arunachal Pradesh	66.67
Madhya Pradesh	92.61	Tripura	56.25
Gujarat	91.84	Kerala	46.26
Karnataka	90.01	Delhi	35.00
Andhra Pradesh	89.12	Goa	31.82
Tamil Nadu	88.83	Sikkim	30.00
Rajasthan	88.57	Jammu and Kashmir	20.55
Assam	88.50	Dadra and Nagar Haveli	11.11
Meghalaya	88.24	Andaman and Nicobar Islands	5.45
Bihar	86.18	Mizoram	0.00
Chhattisgarh	85.56	Lakshadweep	0.00
Manipur	82.50	India	91.00

Source: www.indiastat.com

Heavy dependence on ground water for irrigation has resulted in a decline in ground water tables. According to National Aeronautics and Space Administration (NASA), during 2002 to 2008, India lost about 109 cu.km. water leading to a decline in water table to the extent of 0.33 metres per annum (XIIth Plan). The Approach Paper of the XIIth Plan, mentions that 'Slipped back' habitations have increased every year as the same aquifer is also being tapped for irrigation. The availability and utilization of ground water resources in the country have been uneven. From Table 6 it is seen that highest ground water development has taken place in north-western region, followed by the western arid region, southern region. In the north-western part of the country in the states of Punjab, Haryana, Western Uttar Pradesh, there is abundant ground water resources. However, the withdrawal of ground water is also excessive in these areas resulting in over-exploitation and continuous

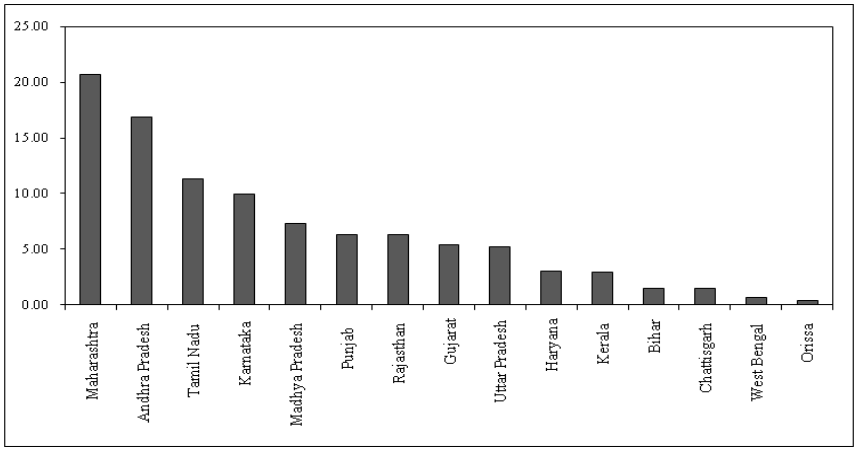
decline in water level. In the western part of the country in Rajasthan due to arid climate, recharge is less and the meagre ground water resources are being utilized resulting in over-exploitation. Similarly, in the southern peninsular India due to comparatively poor aquifer characteristics, the ground water recharge is less while stress on ground water resources is high, thereby resulting in over-exploitation. On the other hand, in the eastern part of the country in Ganga basin including eastern Uttar Pradesh, Bihar, West Bengal and Brahmaputra valley of Assam, ground water resources are yet to be tapped to its optimum level (CGWB, 2009).

TABLE 6: Ground Water - Availability and Utilisation (2009)

Regions	Net Annual GW Available (BCM)	Annual GW Draft (BCM)	Stage of GW Develop-ment (%)
Northern Himalayan States	4.92	1.84	37
North Eastern Hilly States	30.98	5.63	18
Eastern Plain States	102.5	43.97	43
North Western Plain States	73.85	72.17	98
Western Arid Region	25.4	24.48	96
Central Plateau States	85.53	36.11	42
Southern Peninsular States	75.65	46.4	61
Islands	0.32	0.01	4
Country Total	399.26	230.63	58

Source: Jha & Sinha, CGWB, Govt. of India

FIGURE 4: PERCENTAGE OF PUMPSET ENERGISATION AS ON 31-12-2013 (%)



Sources of Energy for Irrigation

Studies have shown that, between 1970 and 2005, the share of animal power in agricultural operations fell from 44 per cent to just 6 per cent and that of manual power from 37 per cent to 8 per cent. Much of this has been substituted with electricity and petroleum products, notably diesel (Business Standard, 2010). Electricity consumption in agriculture sector has been increasing over time mainly because of greater irrigation demand for new crop varieties and subsidized electricity to this sector. Electricity consumption for agriculture in India increased from 10.22 per cent (4,470 Gwh) of the total electricity consumed in all sectors in 1970-71 to 19.62 per cent (1,20,209 Gwh) in 2009-10 growing at rate of 9 per cent between 1970 and 2009. This rate of growth was second to the growth rate of electricity usage in the domestic sector (9.52 per cent). In 2009-10, highest share of electricity consumption for agricultural purposes was seen in the southern region (25.66 per cent, 43,501 million kWH) followed closely by the northern region (24.40 per cent, 39, 653 million kWH), western region (20.11 per cent, 33,932 million kWH), eastern region (3.68 per cent, 2,333 million KWH) and finally the north-eastern region (1.31 per cent, 74 million kWH) .

Given that rains are not always timely and evenly distributed, farmers prefer pump sets as a more reliable and assured source of irrigation; as a result, energization of pump sets have been increasing rapidly. By 2001, 13 million pumpsets were energized. The figure rose to 15 million by 2007 and as on 31.12.2013, it was 19 million pumpsets. Figure 4 shows the proportion of pumpsets energized by the end of 2013. Maharashtra has the largest share of energized pump sets (20.73 per cent, 4 million), followed by Andhra Pradesh (16.85 per cent, 3 million) and Tamil Nadu (11.33 per cent, 2 million).

Most irrigation pump sets in operation in India use electric motors. According to the Agricultural Census of India, over the years the number of electric pumpsets was much greater than diesel pumpsets (Table 7). Largest number of electric pumpsets was seen in the states of Tamil Nadu, Andhra Pradesh and Maharashtra. However, owing to insufficient and erratic timings of electricity supplies, some farmers have also procured diesel pump sets as a standby. The use of diesel pumpsets is also increasing over time, with states like Uttar Pradesh, West Bengal and Punjab having largest numbers of these. However, it is to be noted that there are wide discrepancies in appropriate data on electric and diesel pumpsets, with the Agricultural Census, Input Survey, Minor Irrigation Census and State Electricity Boards providing divergent figures (Rawat and Mukherji, IWMI). This is a cause for serious concern and calls for immediate action and coordination among different government data collection agencies.

[2]IASRI Databook 2012 and 2013, Govt. of India

TABLE 7: NUMBER OF AGRICULTURAL AND ELECTRIC DIESEL PUMPSETSREPORTED BY AGRICULTURAL CENSUS (LAKHS)

Diesel Pumpsets					Electric Pumpsets				
States	1985-86	1995-95	2000-01	2005-06	States	1985-86	1995-95	2000-01	2005-06
Andhra Pradesh	1.76	1.09	0.41	0.44	Andhra Pradesh	4.75	12.71	13.08	17.2
Assam		0.1	0.18	0.08	Assam			0.18	0.17
Bihar	4.34	5.06			Bihar	0.72	0.86		
Gujarat	3.07	2.66	1.42	2.19	Gujarat	2.08	4.32	6.07	5.87
Haryana	1.12	2.13	0.39	1.71	Haryana	2.77	3.17	3.83	5.97
Karnataka	0.14	0.61	0.11	0.42	Karnataka	3.42	7.08	7.96	7.35
Kerala	0.42	0.31	0.51	0.23	Kerala	2.17	6.32	12.18	15.53
Madhya Pradesh	1.12	2.05	0.91	0.72	Madhya Pradesh	4.15	8	8.29	6.41
Maharashtra	0.46	0.41	0.18		Maharashtra	5.69	13.89	13.58	
Orissa	0.02	0.35	0.44	0.37	Orissa	0.04	0.39	0.5	0.54
Punjab	4.69	6.82	5.35	5.11	Punjab	4.58	8.4	8.74	10.01
Rajasthan	2.82	5.03	3.03	3.92	Rajasthan	2.33	4.04	3.23	5.12
Tamil Nadu	0.38	1.01	1.35	4.71	Tamil Nadu	1.69	4.18	17.1	20.57
Uttar Pradesh	7.79	11.11	17.13	18.4	Uttar Pradesh	2.51	4.32	2.34	2.73
West Bengal	4.24	8.45	10.34	6.79	West Bengal	0.99	2.53	3.68	3.08
India	32.41	47.14	42.16	45.37	India	38.2	80.44	101.68	101.72

Source: Rawat and Mukherjee (2012)

Todays concern is also about how to meet the growing demand for energy as well as how to remove inefficiencies in energy use, which are resulting in a substantial waste of this precious and scarce resource. Most irrigation pump sets in operation in India use electric motors of poor efficiency, which results in higher consumption of electricity for delivering the same or lower output. Though tractors consume a lot of energy, they are emerging as a significant means of delivering power for farm operations such as running irrigation pumps and grain threshers as well as for transportation. There is scope for saving fuel consumed by tractors. This can be done by avoiding the use of heavier tractors for relatively lighter farm operations. There are numerous instances in which farmers use tractors of as much as 35 horsepower (HP) to perform minor operations like running a grain thresher, which requires only a 7.5 to 15 HP diesel engine to operate, or for energising a 5 to 10 HP electric motors. However, much of this wasteful use of tractors can be attributed to the non-availability of electric power in rural areas in adequate measure, at the time when it is required for agricultural work. If this aspect can be taken care of, the indiscriminate use of tractors can be curtailed.

Renewable energy sources, such as sun, wind and biomass, which are plentiful in India, have huge potential in meeting the increased energy demand of the farm sector in an efficient manner. In the recent past, concerted efforts of the government have led to an introduction of Solar Photovoltaic based pumping systems (India Energy Portal). Field studies carried out by IWMI in Rajasthan during October-November 2012 suggested that solar irrigation pumps had a bright future. Although the number of farmers using them were found to be small, they were more likely to grow quickly.The Government ofRajasthan's aggressive policy of subsidizing solar pumps was helping to increase the numbers (Tewari, 2012).

Food-Irrigation-Energy Relationship

It is a fact that India's irrigation sector is dependent on groundwater. Much of this is pumped using electricity, which in turn is subsidized in most states. Further, growth in agricultural electricity consumption is quite high. However, farmers receive poor quality service and the requirement for subsidies keeps rising. Moreover, over-exploitation, depletion and scarcity of ground water resources have emerged as serious problems in several regions of India. This creates a nexus where the agricultural sector is dependent on the unsustainable trends of groundwater and irrigation sectors. Recently analyses of minor irrigation censuses show that the rate of growth of India's groundwater structures is slowing down (Mukherji, Rawat and Shah 2013). This could be because many places may have run out of water due to over-exploitation. However, more than the physical scarcity of groundwater, the energy crisis may have also played a role in this slow down. Since most states use electricity for pumping ground water, the deep crisis in the electricity sector led to severe rationing of electricity to farmers. Earlier farmers on an average used to receive 16-20 hours of electricity per day but now with rationing they receive on an average 6-8 hrs of water per day. Hence many farmers are now switching to higher capacity pumps.

The food-irrigation-energy relationship is different in different states and states manage the nexus differently. The situation in West Bengal, Punjab and Karnataka is discussed here. The groundwater situation in West Bengal is quite good. Farmers across the country, excepting West Bengal, usually pay for electricity on a flat rate basis. In the state of West Bengal, farmers pay metered tariff equivalent to the cost of supply of electricity, thereby doing away with electricity subsidy. Thus, a strong price signal is sent to the farmers to make efficient use of electricity and groundwater and break the nexus. But with this type of metering pump owners are winners while water buyers are losers. There are restrictions imposed by electricity utilities on new connections due to which most farmers in West Bengal depend mainly on diesel pumpsets, while the rest of India uses electric pumpsets. Secondly, the cost of pumping is also high due to the dependence on diesel pumps. Rising diesel prices and stagnant output prices resulted in slow growth of ground water structures (Mukherji 2012). Based on these findings the policy decision taken by the West Bengal government was two-fold, one to remove a restrictive permit requirement for operating low-power irrigation pumps and the other was to reduce the electrification cost to run the pumps by means of application of a fixed connection fee for an electricity connection to farmers. These decisions are expected to facilitate easier extraction of ground water by farmers as a result of which they would be able to intensify their cropping systems, earn better livelihoods and emerge out of poverty (Mukherji, Shah and Banerjee, 2012).

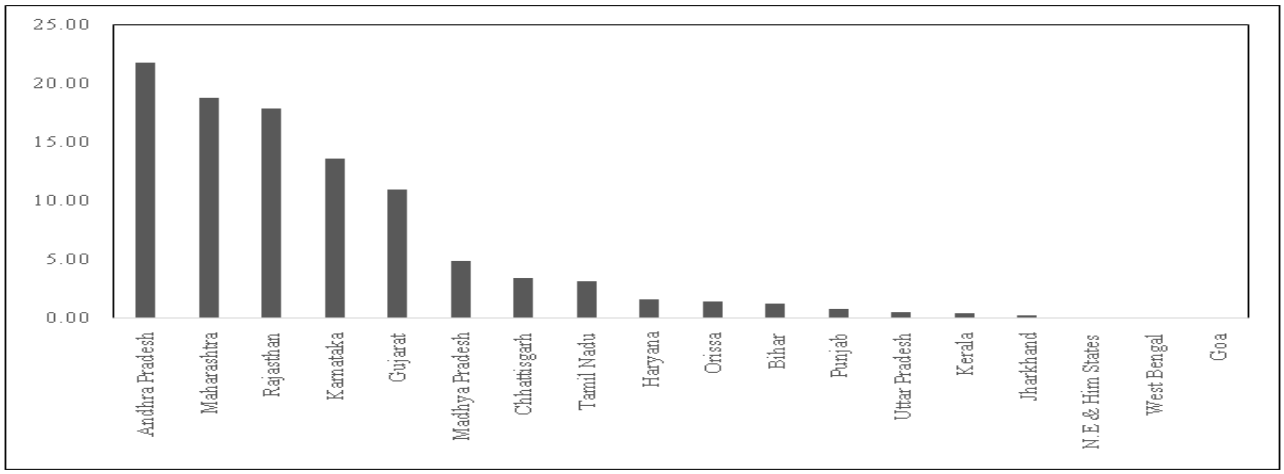
In Punjab, the system of rice-wheat crop rotation on the one hand is helping India's food security but on the other it has over-exploited groundwater resources. Punjab farmers get free electricity but it is rationed strictly. Rationing came up as a result of strong political resistance to metering. Some steps taken to manage the nexus were feeder segregation, high voltage distributors and energy audits. Farmers invested in efficiency enhancing measures such as energy efficient pumps and laser levelers. The farmers are managing this rationed electricity as best as they can as they feel that water is a scarce resource hence making optimal use of it. However, the flip side is that severe rationing is also pushing farmers to use diesel. Further the subsidy burden for agricultural consumption keeps rising.

The state of Karnataka, is precariously dependent on groundwater which is again severely depleted. Here too, like Punjab, the government has taken upon a scheme to separate agricultural and non-agricultural feeders and ration electricity to agriculture, but the design of this scheme is such that it has defeated the very purpose of rationing. For instance, in segregated agricultural feeders, three-phase electricity is provided for 6 hours, but single phase electricity is provided for another 10-12 hours. This enables farmers to withdraw groundwater using a single phase electric pump. Further, mismanagement, cases of power theft and illegal tube wells are rampant.

New Technologies in Irrigation - A Case for Micro-Irrigation

Micro Irrigation is a resource conservation technology and involves the use of drip and sprinkler system of irrigation. This is a modern method of irrigation and is also being recognized as an alternative for efficient use of surface as well as ground water resources. The National Mission on Micro Irrigation (NMMI) was launched as a Mission from June 2010. Prior to this it was implemented as the centrally sponsored scheme since 2005.The technology involves irrigating crops at the root zone as per the crop requirement comprising drip and sprinkler systems. This technology greatly enhances water use efficiency and can also be used for fertilizer application. The XIIth Plan has accorded micro irrigation coverage to be given priorityboth in irrigated and rainfed areas, as part of comprehensive local planning.

Figure 5: Statewise Share of Area Covered under NMMI in India (2005-2006 to July 2012)



Source: www.indiastat.com

Figure 5 shows that the largest share of area under micro irrigation system was in Andhra Pradesh (21.69 per cent) followed by Maharashtra (18.70 percent), Rajasthan (17.79 percent), Karnataka (13.53 per cent) and Gujarat (10.91 per cent).

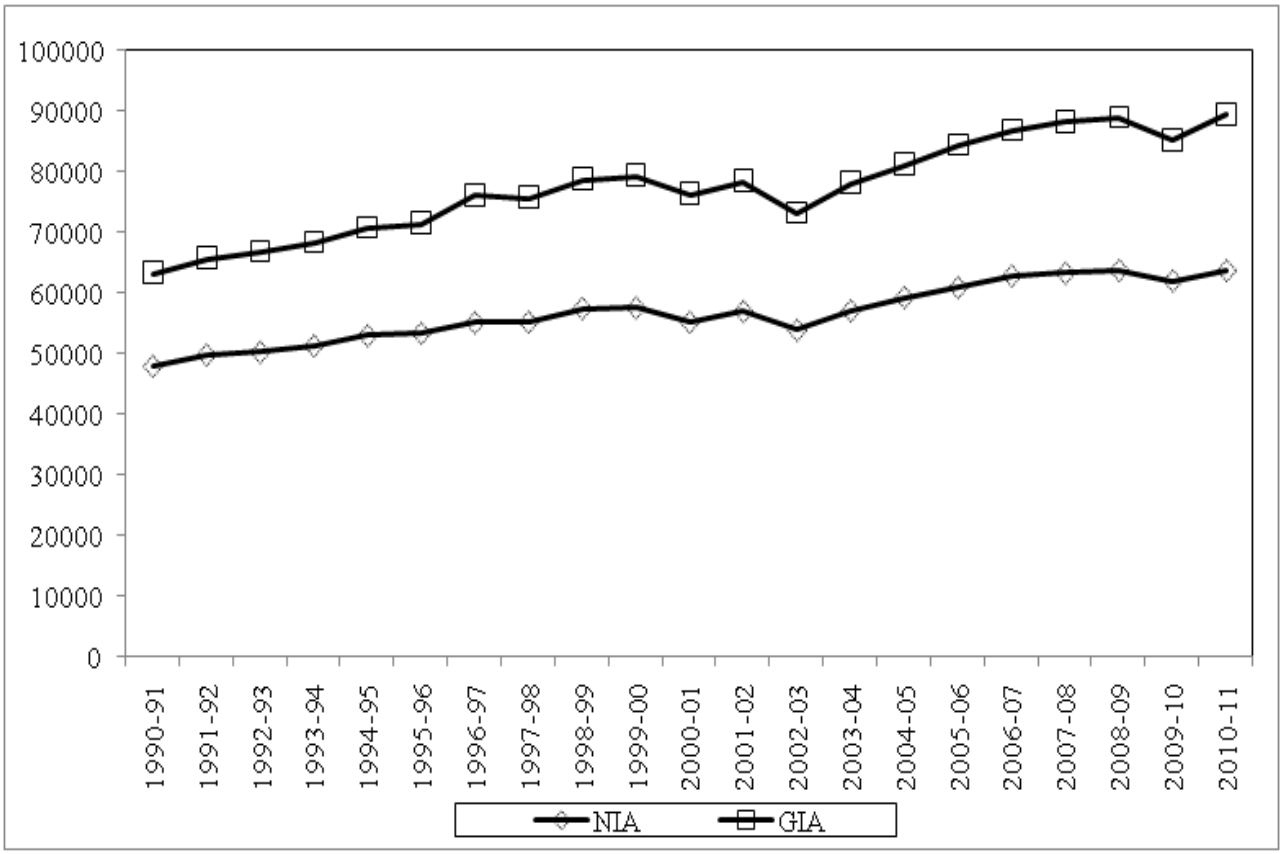
A recent study undertaken by IWMI in 2011on the spread and economics of micro irrigation in India, based on both secondary data and evidence from nine states indicated that there is a potential of bringing around 42million hectares under drip and sprinkler in the country, of which only about 9 per cent potential was covered. This included 12.2 per cent of potential drip irrigation area and 7.8 per cent of potential sprinkler area with large variations across states. Thus, the rate of adoption of this technology was very low compared to the potential. Only a few states like Andhra Pradesh, Maharashtra and Tamil Nadu had expanded the area under micro irrigation. The poor adoption was attributed to factors such as high cost, complexity of the technology and socio-economic issues such as a lack of access to credit facilities,fragmented landholdings, localised cropping pattern, etc. Though the adoption of this technology had a positive impact in terms of water saving, yield and income enhancement at farm level, the overall impression among the farmers was that it was capital intensive and suited only to large farmers who had access to capital and technical knowhow. Majority of the adopters sampled in Andhra Pradesh, Karnataka, Orissa and Punjab were small farmers. In contrast, in Maharashtra and Tamil Nadu, majority of adopters were found to be large farmers. Analysis of the rate of return on investment indicated no significant difference in incremental net income attributed to micro irrigation across farm categories; however, there were significant differences in incremental net income of adopters across states (Palanisami et al, 2011).

Macro Patterns and Trends of Irrigation in India

Trends in Gross and Net Irrigated Area

Figure 6 shows trends in gross and net irrigated area in India 1990 onwards. Both are seen to be increasing with dips in the drought years of 2002-03 and 2009-10. Net irrigated area (NIA) has grown at a trend rate of 1.31 per cent per annum while gross irrigated area (GIA) grew at the rate of 1.59 per cent per annum between 1990-91 and 2010-11.

Figure 6: Trends of GIA & NIA in India



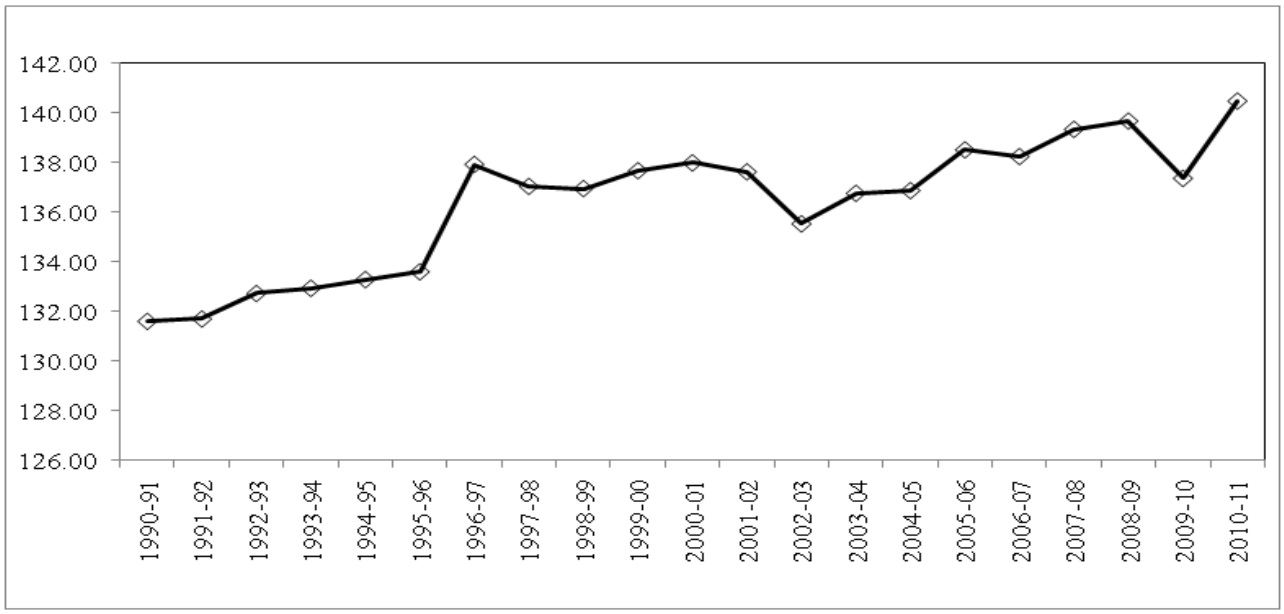
Source: Directorate of Economics and Statistics, Ministry of Agriculture, Govt of India

The share of GIA in the year 2010-11 was highest in Uttar Pradesh (21.68 per cent) followed by Rajasthan (9.31 per cent), Punjab (8.64 per cent), Andhra Pradesh (8 per cent) and Madhya Pradesh (7.99 per cent).The share of NIA in the same year was highest in Uttar Pradesh (21.05 per cent) followed by Madhya Pradesh (11.23 per cent) and Rajasthan (10.47 per cent).

Irrigation Intensity

The irrigation intensity described as the ratio between gross and net irrigated area has been increasing from 131.61 per cent in 1990-91 to 140.50 per cent in 2010-11 (Figure 7). There were major slumps in the drought years of 2002-03 and 2009-10.

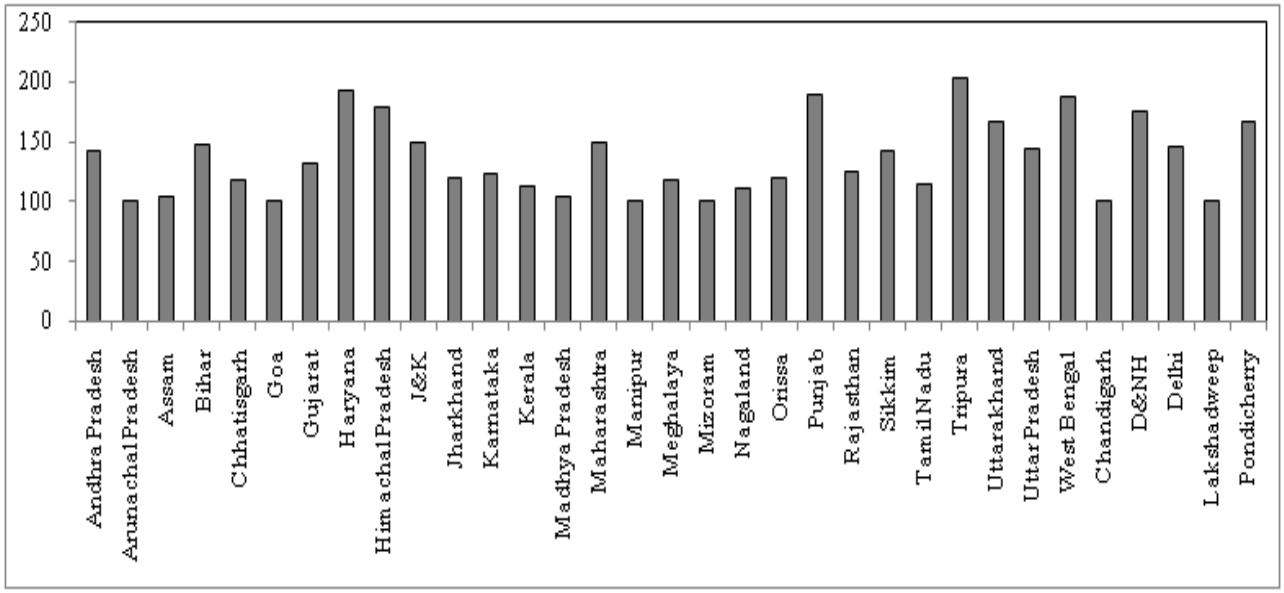
Figure 7: Irrigation Intensity



Source: Directorate of Economics and Statistics, Ministry of Agriculture, Govt of India

From Figure 8, it is observed that in the year 2010-11, irrigation intensity was highest in the state of Tripura (203.33 per cent) followed by Haryana (192 per cent), Punjab (190 per cent) and West Bengal (188.22 per cent).

Figure8: Statewise Irrigation Intensity in 2010-11 (%)

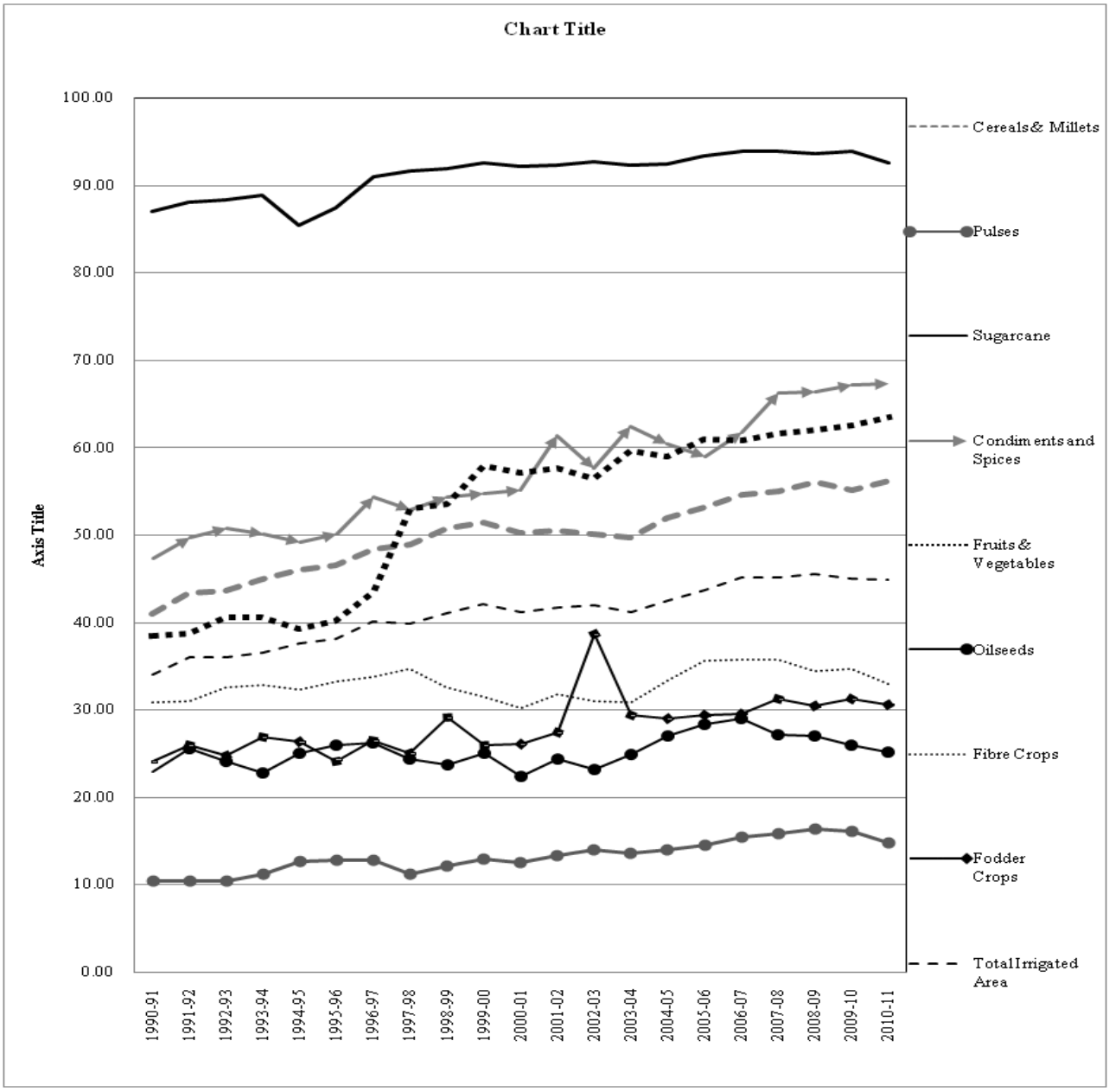


Source: Directorate of Economics and Statistics, Ministry of Agriculture, Govt of India

Share of Irrigated Area in Cropped Area

Irrigation allows for better and more diversified choices in cropping patterns and the cultivation of high-value crops.Figure 9 shows the share of crop irrigated area to the gross cropped area. It is seen that the share of total irrigated area that had started to rise 2003-04 onwards showed a slight decline in 2009-10 and 2010-11. In 2010-11 the total irrigated area was only 44.91% of the gross cropped are of the country. The shares of irrigated area to gross cropped are seen to be rising for condiments & spices, fruits and vegetables and cereals and millets. The shares were highest for sugarcane (above 90 per cent), meaning that more than 90 per cent of sugarcane area is irrigated. But it registered a decline in 2010-11. Other crops that showed a slight decline in their irrigation shares were fibre crops, fodder crops, oilseeds and pulses.

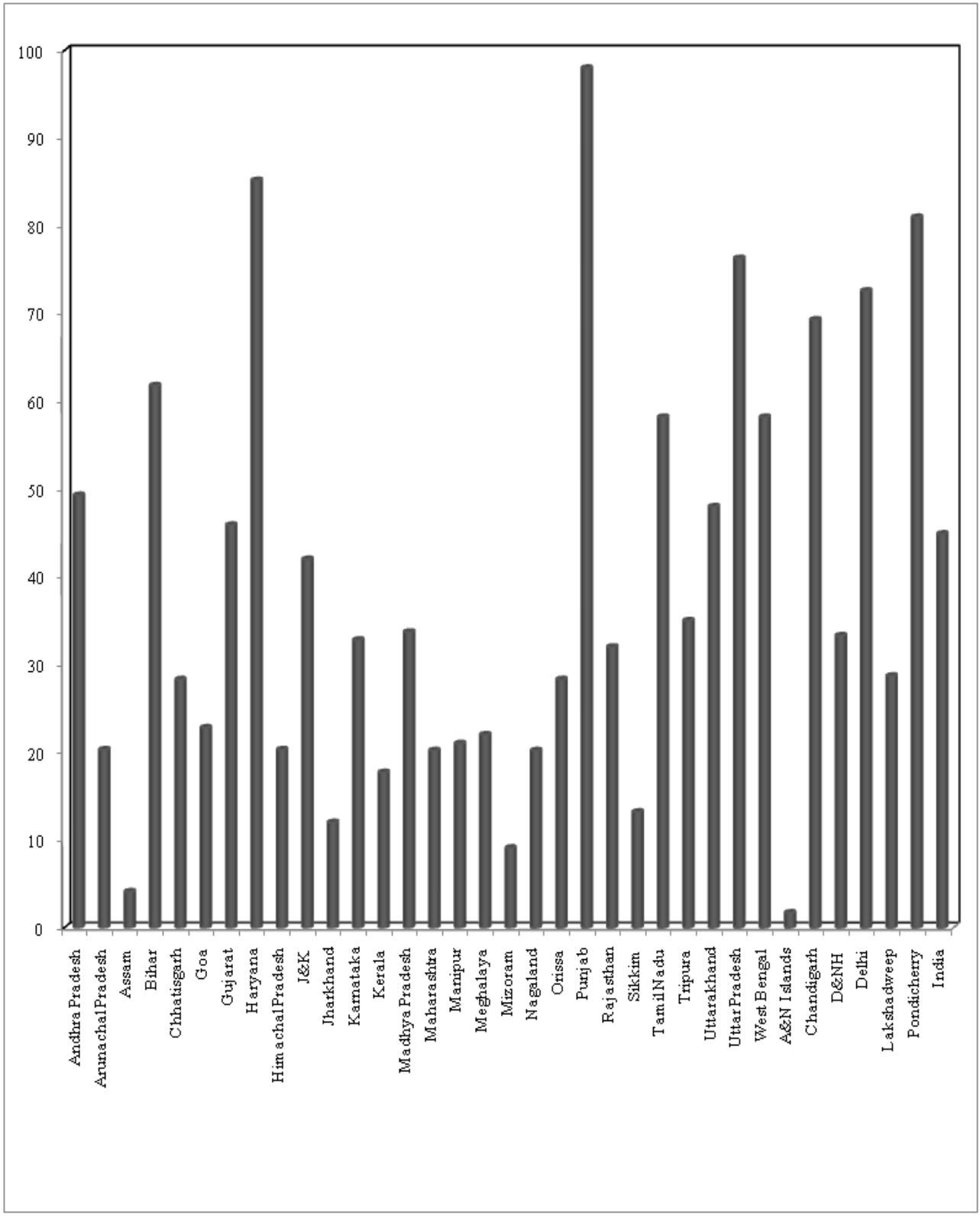
Figure 9: Share of Irrigated Area to Sown Area (%)



Source: Directorate of Economics and Statistics, Ministry of Agriculture, Govt of India

At the state level it is seen that in 2010-11 in state of Punjab 98 per cent of the gross cropped area was irrigated (Figure 10). Punjab was followed by Haryana (85 per cent), Pondicherry (81 per cent) and Uttar Pradesh (76.3 per cent).

Figure 10: Statewise Share of Gross Irrigated Area to Gross Cropped Area in 2010-11 (%)



Source: Directorate of Economics and Statistics, Ministry of Agriculture, Govt of India

Table 8 shows crops which had over 90 per cent of their area under irrigation in 2010-11 in various states. It is seen that amongst all states, most of the crops in Punjab and Haryana are irrigated

TABLE 8: HIGHLY IRRIGATED CROPS (2010-11)

States	Crops
Andhra Pradesh	Rice, Sugarcane, Wheat
Bihar	Tobacco, Wheat
Chattisgarh	Sugarcane, Tobacco
Goa	Sugarcane
Gujarat	Rapeseed & Mustard, Sugarcane, Fruits & Vegetables, Wheat
Haryana	Sunflower, Condiments & Spices, Cotton, Rice, Sugarcane, Wheat, Fodder crops, Fruits & Vegetables, Barley, Groundnut
Himachal Pradesh	Linseed
Jammu & Kashmir	Arhar (Tur), Ragi, Rice
Jharkhand	Condiments & Spices, Wheat
Karnataka	Sugarcane
Kerala	Cotton
Madhya Pradesh	Sugarcane, Condiments & Spices
Maharashtra	Sugarcane, Condiments & Spices
Orissa	Sugarcane, Wheat, Fruits & Vegetables
Pondicherry	Cotton, Ragi, Rice, Sugarcane, Sunflower, Fruits & Vegetables, Groundnut, Sesamum,
Punjab	Jowar, Sunflower, Condiments & Spices, Cotton, Rice, Barley, Fruits & Vegetables, Wheat, Arhar (Tur), Sugarcane, Linseed, Fodder crops, Bajra, Rapeseed & Mustard
Rajasthan	Fruits & Vegetables, Condiments & Spices, Cotton
Tamil Nadu	Sugarcane, Rice
Uttarakhand	Sugarcane
Uttar Pradesh	Sunflower, Wheat, Sugarcane
West Bengal	Cotton, Wheat
D&N Haveli	Sugarcane, Fruits & Vegetables
Delhi	Rice, Wheat, Fodder Crops
India	Sugarcane, Wheat

Source: Directorate of Economics and Statistics, Ministry of Agriculture, Govt of India.

Share of Crop Irrigated Area to Total Irrigated Area

Trends in percentage of irrigated area of major crops show that cereal and millet crops have the largest share in the total irrigated area in India (approximately 65 per cent). The share of other crops is very low when compared to cereals and millets. The share of oilseeds in the total irrigated area is around 9 per cent followed by fruits & vegetables (6 per cent), sugarcane (5 per cent), fibre crops and pulses (4 per cent), fodder crops (3 per cent) and condiments and spices (2 per cent).Within cereals the share of wheat and rice is the highest (approximately 30 per cent). Within oilseeds the share of rapeseed & mustard (5 per cent) is the highest. Within fibre crops the share of cotton (4 per cent) is the highest. Within pulses the share of gram (3 per cent) is the highest.

Out of the total area under irrigation the share of rice crop was the largest (between 50-100 per cent) in the states of Andhra Pradesh, Tamil Nadu, Karnataka, all North Eastern states, West Bengal, Orissa, Chattisgarh and Jammu and Kashmir. The share of wheat crop was the largest in Punjab, Haryana, Uttar Pradesh, Bihar, Himachal Pradesh, Madhya Pradesh, Maharashtra, Rajasthan and Delhi (35-45 per cent).The shares of fruits &vegetables were high in Jharkhand, Goa, Kerala, Maharashtra, Meghalaya, Sikkim, Tripura and West Bengal. Among oilseeds, Rajasthan showed a high proportion of irrigated area under rapeseed and mustard (23.65 per cent). The share of irrigated area in cotton was highest in Gujarat (27.52 per cent).

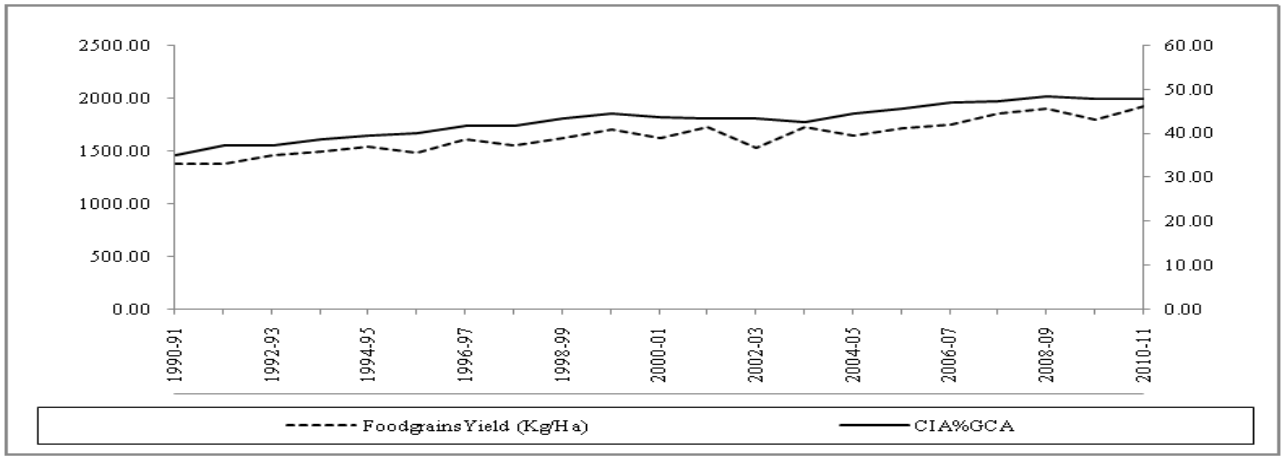
Relationship between Crop Yields and Irrigation

Agriculture in India has a high dependence on irrigation and there is a high correlation (R=0.9) between cropping intensity and irrigation intensity.As pointed earlier, most of the irrigation is from ground water source and it is found that crop yields in areas irrigated by groundwater are often substantially higher than the yield from surface water sources. FAO research indicates that yields in groundwater irrigated areas are higher by one third to one half than in areas irrigated from surface sources. Higher yields from groundwater-irrigated areas are in large part due to increase in the reliability of water supply (Bhaduri, Amarasinghe and Shah, 2006).The relationship between yields and irrigation show that foodgrain yields in the country are heavily dependent on irrigation. Irrigation dependency is relatively lesser for pulses and cotton followed by oilseeds (Figure 11). The proportion of irrigated area under sugarcane is the highest in the country i.e., nearly above 90% but sugarcane yields have shown huge fluctuations despite high irrigation indicating that its yields are more dependent on other factors rather than irrigation.

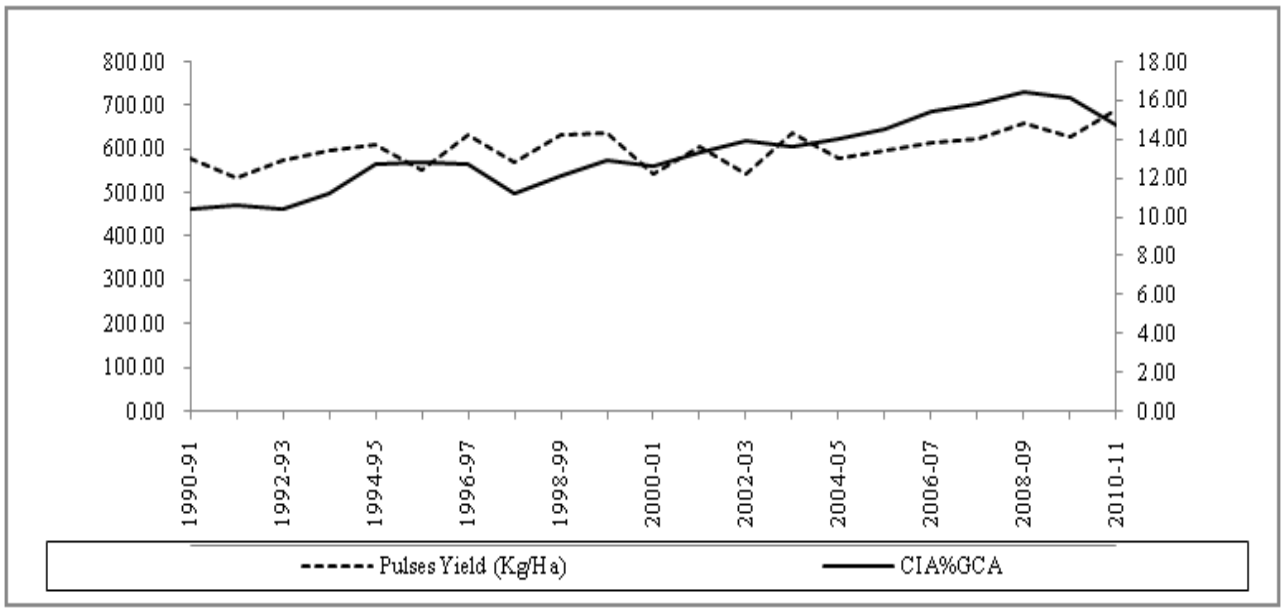
It is estimated that India's population would be around 1600 million by the year 2050 requiring a total food-grain production of around 420 million tonnes (MoWR). By the end of the XIth Plan, foodgrain production has been 260 million tonnes. The Planning Commission estimates foodgrain demand to be around 257 million tonnes by the end of the XIIth Plan and 277 million tonnes by 2020. These figures suggest that present levels of food grain production already exceed the likely demand by the end of the XIIthPlan. However food grain production has been fluctuating within 190 to 230 million tonnes band and in some years there has been decline in the growth of agriculture production. Thus, concerted efforts are required to manage irrigation water for ensuring food security in India.

Figure 11: Relationship between Crop Yields and Percentage of Crop Irrigated Area

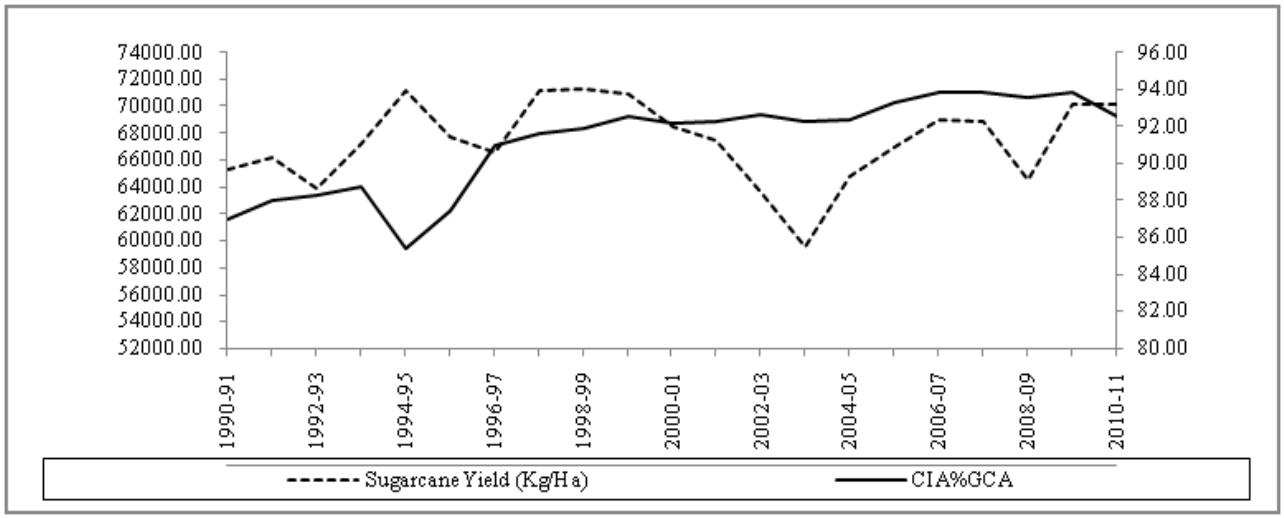
Foodgrains (R^2 = 0.93)



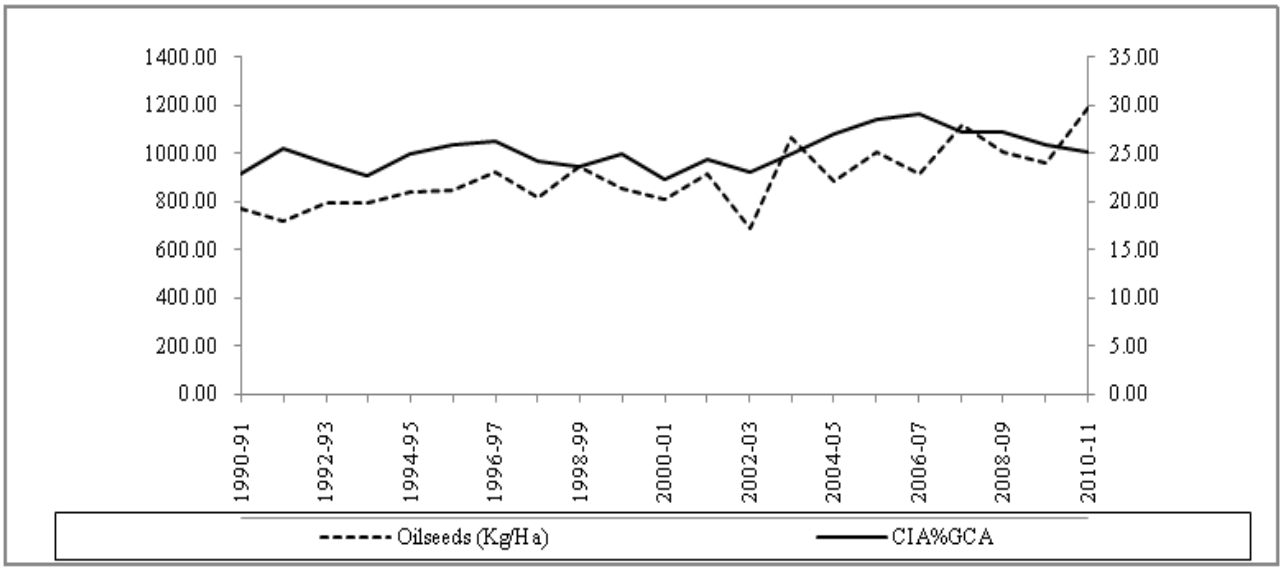
Pulses (R^2 = 0.54)



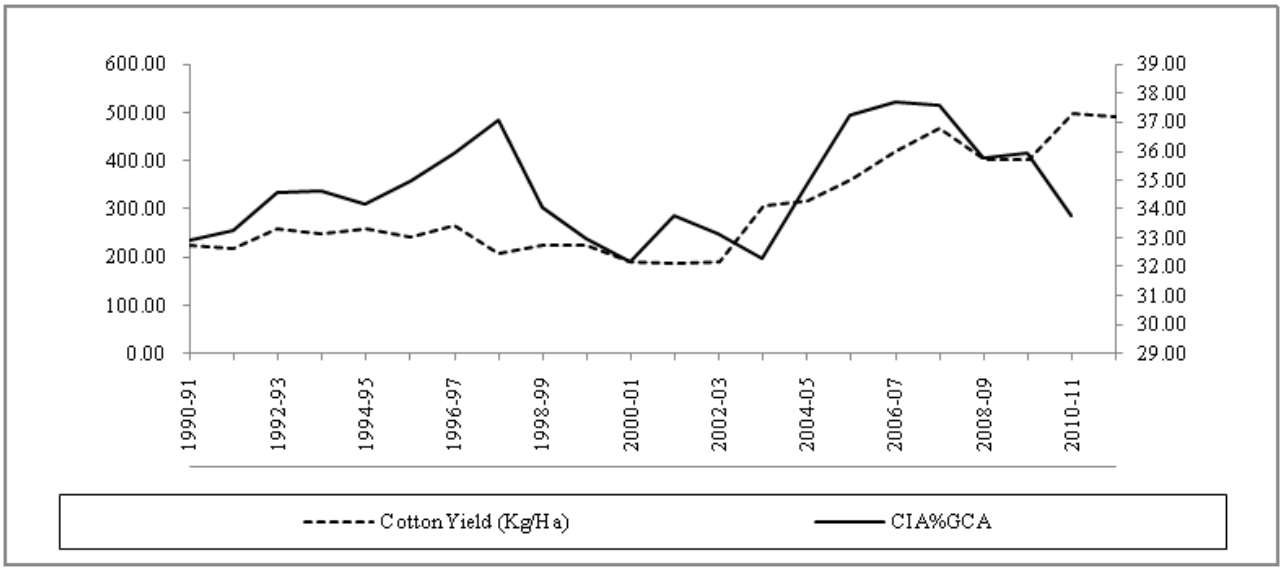
Sugarcane (R^2 = 0.03)



Oilseeds ($R^2 = 0.49$)



Cotton ($R^2 = 0.54$)



Conclusions and Policy Recommendations

Apart from understanding macro trends and patterns of irrigation in India as well as its relation with crop productivity, this paper highlights some critical issues related to irrigation for agriculture in India. These issues range from high expenditure incurred on irrigation and proliferation of schemes, rising gaps between irrigation potential created and utilized, dependence and over-exploitation of ground water as well as the irrigation-energy nexus. Looking at the increasing food demands of the country, it is imperative to evolve policies, which essentially focus on proper management of created irrigation potential and productivity per unit of volume of irrigation water used / per unit area of cultivated land. Some recommendations suggested by experts are as follows:

- The focus of irrigation development projects needs to shift from large canal based surface irrigation projects to greater conjunctive use of surface and groundwater resources.
- More important than investment, there needs to be an emphasis towards a performance-based system. The need is of an Accelerated Power Development and Reform Programme, which encourages and supports states to undertake management reform, promote accountability,

restructure incentives and improve all round performance of power utilities. This will accelerate irrigation benefits more than simply funding more dams and canals as the AIBP has done all along.

- Suitable policy decisions need to be taken to break the food-irrigation-energy nexus.
- Overexploitation of groundwater is a serious issue and needs to be controlled. It may be more effective to introduce participatory processes in groundwater management through water users associations, if democratically elected. The government has started the concept of 'Participatory Irrigation Management' (PIM), where 'Water Users Associations'(WUA) would be involved in the maintenance of the project and a part of revenue collected would be allocated to the WUA. The reforms package anticipated a turnover in the management of irrigation systems by way of contraction of government's role in irrigation system with corresponding expansion of farmers' participation.
- Appropriate pricing of electricity and water can help to improve efficiency in water use and groundwater management. So, distortions such as subsidized electricity tariffs for agriculture and other forms of subsidy should be phased out to promote efficient utilization of water in agriculture.
- Harnessing renewable energy sources such as sun, wind and biomass which are plentiful in India, is the need of the hour in meeting the increased energy demand of the farm sector.
- Micro Irrigation adoption in the country needs to be accelerated. Some recommendations for that include reduction in capital cost of the system, provision of technical support for regular operation and maintenance and creation of a single state level agency or a Special Purpose Vehicle (SPV) for speedy implementation of the micro irrigation programmes.
- At the local level, major efforts are needed for harnessing, retaining, and reusing water. Small, decentralized rainwater harvesting structures, and innovative watershed management programmes involving community participation need greater thrust. Waste water recycling offers immense potential particularly since the costs of recycling have reduced dramatically. This makes reuse of wastewater for non-potable purposes a viable option.

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Agro-Economic Research

Evaluation of Market Intervention Scheme in Uttarakhand (Apple 'C' Grade)

D.S. Bhupal*

Introduction:

After liberalization many development have taken place in the agricultural economy of the country. Four major changes have been effected to boost private investment and production of the sector. After 1993-94, external trade in agriculture has been liberalized, Agricultural Produce Market Committee (APMC) Acts have been proposed for major amendments, and in some states have been changed also. Contract farming has to boost captive supply and for export of agricultural produce, Special Economic Zones (SEZs) have been granted. But the expected results have not been achieved. Half-hearted economic reforms did not bring in much needed investment from the private sector and public investment in agriculture could not maintain its earlier tempo. Consequently, there is no stability in agricultural production. Large scale disparity in distribution of income and imbalance in demand and supply of basic agricultural commodities has become a common phenomenon. Horticultural crops are gaining importance but their short supply is at times blamed for high food inflation.

There is need to change the cropping pattern from low value crops to high value crops like fruit and vegetables to meet these challenges as well as to increase rural income.

In view of least control over input and output markets, farmers' main emphasis has been on increasing production, resulting many times in crash in output prices, thus necessitating government intervention in the form of procurement at Minimum Support Price (MSP) under Price Support Scheme (PSS) and Market Intervention Scheme (MIS).

The reforms agenda in agricultural sector, in fact, focused on food processing, change in cropping pattern, development of rural infrastructure in the form of roads, storage and better availability of modern transport for transportation of delicate/perishable crops.

In developing economies like India, where 2/3 rd population is largely dependent upon agriculture, land holdings are tiny and economically unviable, and alternative sources of rural livelihood are yet to develop so consequences of market failure can be disastrous. Government therefore intervenes in agricultural marketing for the sake of protection of producers and consumers and to maintain food security for public distribution system. Role of government has become more important after making Right to Food statutory.

In the PSS government besides announcing MSP for 25 major agricultural commodities defends the said price by procurement. Whereas in the case of MIS particularly apple 'C' grade, no MSP is announced. State Governments announce the procurement price and ask its agency/s to buy at that price.

The present study, as a part of All India project to evaluate direct role of the government, is planned to evaluate MIS in the marketing of Apple 'C' grade in Uttarakhand with reference to maintenance of price stability, particularly during the peak of arrivals because due to obvious reasons a huge percentage of farmers cannot withhold the produce for the prices to move up. Moreover, apple 'c' grade gets lowest preference of the buyers. And the farmers in remote areas like district Uttarkashi cannot bring the commodity to distant markets and risk even the recovery of transport costs, leave apart the cost of production and opportunity cost of their labour. But for the purchases made by some processing units like Patanjli Yogpeeth, Mother Dairy, Shree Jagdamba Samiti (SJS) etc. for murabba, sauces, jams juices farmers in cases have to throw away the produce as waste. Therefore, the market intervention scheme and price support system play crucial role. In the light of the above, evaluation of the MIS was planned with the following objectives.

Objectives:

The specific objectives were as follows:

- The analyze the extent of coverage of MIS with respect to farmers of apple 'c' grade in Uttarakhand.
- To ascertain the socio-economic factors that influence coverage of villags and farmers in MIS.

* A.E.R.C. University of Delhi.

- To understand problems of different stakeholders in operation of MIS.
- To study the effect of MIS on the market price of commodity in Uttarakhand, and,
- To suggest policy measures to improve operations of MIS.

Data and Methodology

It was noticed from the information that though apple is grown in almost all hill districts like pithoragarh, Champawat, Nainital etc. of the state, MIS for apple 'c' grade was operationalized only in one district, Uttarkashi. Therefore, district Uttarkashi where MIS was operational was selected. Not only in one district, in fact the MIS was operational in one block, Mori, so block Mori has to chosen. From block Mori * villages and 'Toks' (small hamlets) namely Thunara, Kiranu, Arakot, Bhutanu, Gokool, Jhatodee, Kaleech, and Makuri were selected. In fact, in the entire state, as major part of procurement of apple 'c' grade took place in these villages. As would be seen from the sample data, that more than 45% procurement was from the sample households. Further for purpose of analysis a sample of non-beneficiary farmers was also taken.

Sampling Framework

The details of sample are as given in table 1

TABLE 1: SAMPLE SIZE

Item	Uttarakhand	Total
Selected Distt.	Uttarkashi	1
Tehsil/block	Mori	1
Crops	Apple 'c' grade	
Beneficiary farmers	30 (8)	30 (8)
Non-beneficiaries	1	1
District schedules	1	1
Village schedules	8	8

Note: ( ) no. of villages

After going through literature and data on the subject, it was noticed that so far, only in three years, a small quantity of apple 'c' grade was procured under. MIS. As the MIS in the state is implemented in a very limited way, the sampling design as proposed by the coordinator, for example, two districts and then two blocks from each district etc., could not be strictly applied.

In India, apples are graded into three categories viz. 'A', 'B' 'C'. Along with other specifications like colour, maturity, freshness, un-punctured skin, brands, varieties etc, diameter of the fruit is most important criterion. 'A' grade apples have more than 80 mm diameter, 'B' grade apples have between 65 and 80 mm and all those with less than 65mm diameter are graded as 'C', 'C' grade apple is most suitable for Murabbla[1] making and for processing into jams, sauces and even juice preparation, because it is cheap.

In Himachal Pradesh, Horticulture Produce, Marketing it and Processing Corporation (HPMC) buys apple 'c' grade at the stipulated price, processes then sells. But in Uttarakhand, the horticulture department through Horticulture Mobile Team (HMT) along with Kumaun Mandal Vikas Nigam and Garhwal Mandal Vikas Nigam (as the case may be) is entrusted by the government to buy 'c' grade apples from the farmers at the stipulated price. However, in Uttarakhand, both these corporations are not at all involved in food processing or procurement. The exercise is performed by the HMT alone.

Main observations:

Coverage of Apple in the Selected District and Block:

Uttarakhand plays a minor role in area and production of apple in the country. During 3 years from 2008-09 to 2010-11, share of Uttarakhand in area under apples has been between 5-6% while in production only between 2-3%. Naturally in yield it is behind other states.

However, the state share of Uttarkashi has been about 23% in area under apples and about 32% in production during the three years.

Further, in Block Mori, about 83% of the of the other area under fruits is under apple cultivation. It produces about 87% of apples and 13% are rest fruits. Moreover, in the district Uttarkashi, Mori block covers about 42% area under apple and about 44% of production. Thus, Mori block contributes about 14% of total apple produced in Uttarakhand.

Although the hill areas are most favoured for production of horticultural crops due to weather and moisture content, there are hurdles in transportation, storage, processing and good marketing facilities. Uttarakhand in general and Uttarkashi in particular, suffer from the absence of good marketing infrastructure.

The agricultural markets in Uttarakhand are regulated under UP regulated Markets Act, 1964 adopted by the state in 2000. There are 66 wholesale markets in total in the state. But number of regulated markets is further less, with 25 principal regulated markets yards and 33 submarket yards. Out of 25 markets only 20 are functional in the state as of now. In district Uttarkashi only one market is regulated and that also is un-functional. Therefore, most of the fruit and vegetables are sold in Dehradun and

[1]An aaurvedic processed product of apple. Small size apples are boiled in sugar mixed water till the liquid becomes thick, then packed and marketed. The current market price of one kg murabba (containing 1/2 to 1/3 apple) is Rs. 150.

Kanpur. Some are bought by private traders through the contractors. Block Mori is a part of district Uttarkashi, no regulated market exists there too. Hence, the produce is collected and transported largely to Dehradun and a small portion to Kanpur. Though roads per square km of area are slightly more in district Uttarkashi than any other hill district of the state, but there was no processing facility for horticultural crops in the district.

Marketing Practices:

Before liberalization, and before intervention of the Mother Dairy and some private players, like Shri Jagdamba Samiti, almost the entire horticultural produce of the area was either consumed locally or was collected by some contractors on behalf of the wholesale purchasers in Dehradun, Kanpur and Delhi or was wasted. But after the intervention of Mother Dairy and other private players like Reliance, Birla, Chirag, SJS etc., the marketing scenario has changed. The access to distant markets has increased.

So far as 'C' grade apple is concerned, if not bought by private processing units, it is generally sold in the neraby market and mostly at throw away prices. Many times farmers are not sure of even recovery of transport costs hence do not bring thein produce to the market. In such a situation, when there is no local market for the produce and in the regulated market producers are not sure whether apple 'c' grade will be sold or not, MIS becomes important. The scheme takes shape when the state government orders procurement which is effected at the MIS purchase/collection centres, established particularly for the purpose. In district Uttarkashi, 5 such centres have been established. For the farmers of Mori block, apple 'C' grade is generally purchased at the Arakot centre.

MIS Coverage:

It is obvious that during the entire history of MIS for apple 'c' grade in Uttarakhand, only in 3 years apple 'c' grade was purchased under MIS and that too not on regular basis and also not in substantial quantity. In other words, MIS so far has not played any effective role in coverage of the sale of apple 'C' grade. On the other hand , in the neighbouring state Himachal Pradesh, not only MIS has been more or less regular but HPMC plays a major role in processing of apples.

Based upon the information provided by the respondents, about 18% to 20% of apple turns into 'C' grade, depending upon the snowfall, rainfall, setting of the fruit, pollination etc. If we roughly take 15% average, we can say that during the two years 2008-09 and 2010-11, when only 86.46 and 33.25 metric tonnes of apple 'C' grade was procured out of production of 4-5 000 metric tonnes and 6-8 000 metric tonnes of apple 'c' grade in these years respectively, it works out 2.1% to 1.7% of production in 2008-09 and between 0.55% to 0.41% in the year 2010-11. Therefore, much more is required to be done. As stated earlier, due to lack of local market and processing, if not purchased under MIS, it turns into nothing but waste.

Moreover, 15% to 18% of production remains unutilized which is not a small proportion of harvested crop which on the one hand involves all costs of production, harvesting and sorting and on the other, causes unnecessary shortage of supply consequently, shooting up of prices in the consumption centres.

Table 2 gives details of MIS procurement during the years.

TABLE 2: APPLE MARKETING UNDER MARKET INTERVENTION SCHEME

Year	Rate, Rs./kg	Quantity (MT)	Amt. Lakh Rs.	Agency
2007-08	4.5	114.95	5.17	HMT/KGMVN*
2008-09	4.5	86.46 (4-5k)@	3.89	HMT
2009-10	0	0	0	Na
2010-11	6	33.25 (6-8k) @	1.99	HMT
2011-12	0	0	0	Na

*HTM: Horticulture Mobile Team, KGMVN: Kumaun Garhwal Mandal Vikas Nigam, Nk: not known; Na: not applicable (@) rough estimates of apple 'c' grade as 15% - 18% of total apple production during the years, k-1000

Pattern of Disposal and Coverage of Farmers and Villages

About the pattern of disposal by the respondents under the MIS, following points need to be made. First, as per the requirement of the coordinated study, data for the last two years were to be collected. But we had to stop at one year because there was no MIS for apple 'c' grade during the year 2009-10. Secondly and importantly, during the year 2010-11 when the apple 'c' grade was purchased under MIS, total 33.25 MT or 332.5 quintals of apple 'c' grade was purchased. And out of that 152 qunitals or abount 46% were sold by our respondents. Therefore, sample covers about 50% of the targeted crop hence, the results *viz.,* opinions, difficulties, perceptions etc. can be treated with confidence. Largest share of produce sold under MIS comes from marginal farmers, followed by small farmers (table 3). Thirdly, the price paid under MIS is meager neither related will cost of production, nor with price of A and B grade apples (There is 6 times difference in price received through MIS and that received for other category of the produce that is for 'A' and 'B' category fruits) and nor with the price of final processed product of 'c' grade apples.

Another important issue is tht the respondents sold about 50% of the total procurement made under the MIS, however, that covers only 5.4% of their total production. If 15-18% of the produce turns out to be 'c' grade then

even the fespondents were left with 2/3rd of the produce still to be marketed. One can consider the poosition of other farmers of the Mori block who were not our respondents, other blocks in the district and other districts in the state, in other words, what happends to their 'c' grade produce. Overall thus at current level of procurement, MIS covers almost nothing and fails to make any effect.

Last, the trend of MIS shows continuous decline in procurement from 115 Metric Tonnes in 2007-08 to 86MT in 2008-09 and finally 33 MT in 2010-11 contrary to increasing production.

The argument that in absence of MIS even this much returns will not be possible, may be true, but the price should be considered in terms of utility and value of processed category 'c' grade apples. For example, we know for murrabba, only small size apples, and that too of any quality are much better, they are mixed with sugar paste and sold at Rs. 140-150/- kg. Then if Patajali Yogpeeth has agreed to buy 'c' grade apples at higher price than MIS could be easily understood.

In underlines the need of processing of 'c' grade apples into jams, jellies, squashes, juices, murabba rtc. Though there is nothing wrong in buying by private processors at higher price but looking at the profit margins (for example, in Delhi one kg. apple Murrabba is being sold for Rs. 150 kg. which contains hardly 300 grams of apple rest is sugar and water. Thus, with 1 kg apple 'C' grade turns into 2.5 to 3 kg murrabba worth Rs. 400-450 is prepared.

TABLE 3: Apple Produced by Farmers and its Disposal Pattern Uttarkashi, Beneficiary

Crops	Production (qtls)	Kept for home consumption (qtls)			Marketed (qts) under		Price (Rs./kg) through	
	2010-11	2010-11	% of prod.	Other	MIS	% sold under MIS	MIS	Other
Marginal	1127	28	2.48	1027	73	7.11	6.5	36.4
Small	1067	8	0.75	999	61	6.11	6.5	37.5
Medium	816	7	0.86	790	19	2.41	6.5	36.3
Large	0	0	0	0	0	0	0	0
All Sizes	3010	43	1.43	2816	152	5.40	6.5	36.75

Problems and Perceptions:

In addition to limited procurement, an important issue which needs to be underlined from the household data is limited availability of credit. Rupees 26 lakhs loan was made available to total 69 sample households (beneficiary and non-beneficiary) and with that they were running their economies, agriculture, horticulture, animal husbandry all put together, an annual economy of 1115 persons. After deducting number of children and senior citizens, they were providing employment to about 800 persons. Thus, per household amount of loan in both the beneficiary and non-beneficiary households works less than Rs. 33 thousand in the case of non-beneficiary households and about Rs. 44 thousand in the case of beneficiary households. Hence, time, quantity and cost of availability of loan are important issues.

Another important point is that this loan was for production and not for marketing of the produce. Virtually, for marketing of apple, no loan to the farmers is available.

Efficiency of the Nodal Agency:

As far as evaluation of efficiency of the procurement agency is concerned, we could not take up because the total procurement of apple 'c' grade under MIS was effected by Horticulture Mobile Team (HMT), a section of the Horticulture Department of the government of Uttarakhand. The other agency supposed to be entrusted with this task was Garhwal Mandal Vikas Nigam (GMVN) for Garhwal division and Kumaun Mandal Vikas Nigam (KMVN) for Kumaun Division, Because Uttarkashi is in Garhwal, hence only GMVN was to procure, which was not at all involved in any procurement or food processing. In fact its main functions so far are to promote tourism, Pilgrimage adventure sports and yoga. The main function of HMT is to provide extension services (mostly agronomical) through the mobile vans. The MIS operation was neither their mandate, nor their

expertise and nor were the having training or staff for this purpose. Obviously a section of a government department cannot be evaluated for its efficiency by looking into any small any time ad hoc task like MIS.

Effect on Price:

After apple is produced in the districts and blocks and graded thereafter, under the MIS programme with very limited accessability in few villages, such limited operations under the scheme are going to have only a negligible impact on the market price of the commodity. In the case of similar miniscule operation under PSS and sunflower in Haryana, it was observed that the procurement at MSP could lead to market price to reach at the MSP level, and that could happen because there were private processors of sunflower who needed the produce to run their mills and also sunflower could be stored for coming months. Neither of these is possible in the case of apple 'c' grade. Neither there is processing and nor private traders to complete for purchases, and also the produce cannot be stored. Therefore, almost negligible operation under the MIS could make any impact on prices.

Clearly the discussion will lead to suggest that a lot of efforts are needed for improvement in production, marketing, storage, transportation and processing of the produce. However, arranging loans from production as well as for marketing cannot be overemphasized. In absence of availability of credit in reasonable quantity and at reasonable rates of interest and at proper times, there is very possibility that MIS per se will not serve the purpose.

Policy Options:

In the light of the above, following points will be helpful in improving the production and marketing of apple in the region.

1. Production of apple, particularly through yield enhancement needs to be improved. For that agronomical efforts along with provision of easy and adequate credit need to be made.

2. High quality seeds and extension services for the proper care of the plants need to be emphasized, so that ratio of 'C' grade apple to that of 'A' and 'B' is reduced.

3. The state lacks in marketing infrastructure, particularly in number of required regulated markets, which need attention. In districts like Uttarkashi not a single regulated merket in functional.

4. Along with markets, proper storage, transportation and packing etc. need to be improved.

5. As production, howsoever may be in quantity and quality, per se cannot improve the income and living standard of the producers unless it is efficiently marketed, therefore, processing, in the area need to be taken up urgently.

6. If 'C' grade apple is not bought by private processing units it is either sold in the market at throw away prices or it turns into waste. Therefore, processing facility under private public partnership along with one like HPMC needs to be considered. There is no dearth of demand of processed apple with handsome margins, hence, it would be beneficial to the state economy as well.

7. As far as MIS is concerned, with this negligible, intervention in the market, the role of MIS in influencing, cropping pattern, farmers' income, market price etc. cannot be significant. But that cannot be construed that it might not have affect the farmers' returns. Hence, the concept of MIS needs to be emphasized keeping in mind the total production of 'C' grade apples and its purchase by private agencies. It would be worthwhile that after the purchases made by the private agencies, entire left over produce is procured and processed by the government under MIS at a resonable rate.

8. It would be worthwhile if the minimum price of apple 'c' grade is determined by keeping in mind not only the cost of cultivation but also the market value of its processed products.

In sum, lot of efforts are needed for regular intervention through MIS and to a larger extent. Also, by financial institutions like public sector banks for providing capital, fixed as well as working capital to the farmers for production as well as for marketing. Processing of fruits in the pattern of HPMC along with providing basic infrastructure for marketing, storage, transportation etc., probably will be the best effort for productively solving the problems of marketing of apple in the region. MIS alone without processing facilities may not be of much use.

Commodity Reviews

Foodgrains

During the month of June, 2016 the Wholesale Price Index (Base 2004-05=100) of pulses increased by 3.73%, cereals increased by 1.87% & foodgrains increased by 2.36% respectively over the previous month.

ALL INDIA INDEX NUMBER OF WHOLESALE PRICES

(Base: 2004-2005=100)

Commodity	Weight (%)	WPI for the Month of June 2016	WPI for the Month of May 2016	WPI A Year ago	Percentage change during	
					A month	A year
1	2	3	4	5	6	7
Rice	1.793	245.2	239.6	237.2	2.34	3.37
Wheat	1.116	225.2	221.3	210.8	1.76	6.83
Jowar	0.096	290.8	290.4	283.9	0.14	2.43
Bajra	0.115	314.2	318.2	244.7	-1.26	28.40
Maize	0.217	287.1	279.4	246.1	2.76	16.66
Barley	0.017	272.8	269.5	217.3	1.22	25.54
Ragi	0.019	349.7	356.6	327.1	-1.93	6.91
Cereals	3.373	245.6	241.1	231.0	1.87	6.32
Pulses	0.717	400.2	385.8	316.1	3.73	26.61
Foodgrains	4.09	272.7	266.4	245.9	2.36	10.90

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 the month of June, 2016.

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

Procurement of Rice

0.88 million tonnes of Rice(including paddy converted into rice) was procured during June 2016 as against 1.23 million tonnes of rice(including paddy converted into rice)procured during June 2015. The total procurement of Rice in the current marketing season i.e 2015-2016, up to 30.06.2016 stood at 34.05 million tonnes, as against 30.48 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 2015-16 (upto 30.06.2016)		Corresponding Period of last Year 2014-15		Marketing Year (October-September) 2014-15		2013-14	
	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	4299	12.63	3476	11.40	3591	11.17	3722	11.76
Chhatisgarh	3442	10.11	3355	11.00	3423	10.64	4290	13.56
Haryana	2861	8.40	2015	6.61	2015	6.27	2406	7.60
Maharashtra	222	0.65	178	0.58	199	0.62	161	0.51
Punjab	9350	27.46	7786	25.54	7786	24.21	8106	25.62
Tamil Nadu	1097	3.22	948	3.11	1049	3.26	684	2.16
Uttar Pradesh	2910	8.55	1682	5.52	1698	5.28	1127	3.56
Uttarakhand	597	1.75	465	1.53	465	1.45	463	1.46
Others	9272	27.23	10581	34.71	11936	37.11	10678	33.75
Total	34050	100.00	30486	100.00	32162	100.00	31637	100.00

Source: Department of Food & Public Distribution.

Procurement of Wheat

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

PROCUREMENT OF WHEAT

(In Thousand Tonnes)

State	Marketing Season 2016-17 (upto 30.06.2016)		Corresponding Period of last Year 2015-16		Marketing Year (April-March) 2015-16		2014-15	
	Procurement	Percentage to Total	Procurement	Percentage to Total	Procurement	Percentage to Total	Procurement	Percentage to Total
1	2	3	4	5	6	7	8	9
Haryana	6722	29.32	6692	24.00	6778	24.13	6495	23.20
Madhya Pradesh	3990	17.40	7195	25.80	7309	26.02	7094	25.34
Punjab	10645	46.42	10346	37.10	10344	36.83	11641	41.58
Rajasthan	762	3.32	1300	4.66	1300	4.63	2159	7.71
Uttar Pradesh	802	3.50	2267	8.13	2267	8.07	599	2.14
Others	9	0.04	85	0.30	90	0.32	6	0.02
Total	22930	100.00	27885	100.00	28088	100.00	27994	100.00

Source: Department of Food & Public Distribution.

Commercial Crops

Oil Seeds & Edible Oils

The wholesale Price Index (WPI) of nine major oilseeds as a group stood at 224.1 in June, 2016 showing an increase of 0.9% and 2.5% over the previous month and year respectively. The WPI of cotton seed increased by 2.5%, rape & mustard seed by 1.9%, groundnut seed by 1.6% and sunflower by 1.2% over the previous month. The WPI of safflower (kardi seed) decreased by 4.7%, copra (coconut) by 3.7%, gingelly seed by 2.1% and niger seed by 2.0% over the previous month.

Edible Oils

The WPI of edible oils as a group stood at 154.3 in June, 2016 showing an increase of 1.2% and 3.4% over the previous month and year respectively. The WPI of cotton seed oil increased by 2.1%, groundnut oil by 1.8%, mustard& rapeseed oil by 0.6%, soyabean oil by 0.4% and sunflower oil by 0.2% over the previous month.The WPI of gingelly oil decreased by 1.6% and copra oil by 1.4% over the previous month.

Fruits & Vegetable

The WPI of fruits & vegetable as a group stood at 277.4 in June, 2016 showing an increase of 7.9% and 11.0% over the previous month and year respectively.

Potato

The WPI of potato stood at 248.7 in June, 2016 showing an increase of 11.6% and 64.5% over the previous month and year respectively.

Onion

The WPI of onion stood at 255.4 in June, 2016 showing an increase of 3.0% over the previous month. However, it shows a decrease of 28.6% over the previous year.

Condiments & Spices

The WPI of condiments & spices (Group) stood at 352.3 in June, 2016 which is lower by 0.4% over the previous month. However, it shows an increase of 8.0% over the previous year. The WPI of chillies (dry), black pepper and turmeric decreased by 3.3%, 2.6% and 1.5% respectively over the previous month.

Raw Cotton

The WPI of raw cotton stood at 214.9 in June, 2016 showing an increase of 11.0% and 9.0% over the previous month and year respectively.

Raw Jute

The WPI of raw jute stood at 538.3 in June, 2016 showing an increase of 3.5% and 51.0% over the previous month and year respectively.

WHOLESALE PRICE INDEX OF COMMERCIAL CROPS

(Base Year : 2004-05 = 100)

COMMODITY	LATEST	MONTH	YEAR	% VARIATION OVER	
	June,2016	May,2016	June,2016	MONTH	YEAR
1	2	3	4	5	6
OIL SEEDS	224.1	222.1	218.6	0.9	2.5
Groundnut Seed	283.8	279.2	257.9	1.6	10.0
Rape & Mustard Seed	230.4	226.0	214.7	1.9	7.3
Cotton Seed	219.3	213.9	181.4	2.5	20.9
Copra (Coconut)	109.3	113.5	160.9	-3.7	-32.1
Gingelly Seed (Sesamum)	316.3	323.1	347.4	-2.1	-9.0
Niger Seed	330.0	336.6	261.5	-2.0	26.2
Safflower (Kardi Seed)	153.2	160.8	153.4	-4.7	-0.1
Sunflower	187.3	185.1	192.7	1.2	-2.8
Soyabean	224.1	223.1	217.6	0.4	3.0
EDIBLE OILS	154.3	152.4	149.2	1.2	3.4
Groundnut Oil	212.1	208.4	192.9	1.8	10.0
Cotton Seed Oil	191.8	187.8	179.2	2.1	7.0
Mustard & Rapeseed Oil	180.7	179.6	177.2	0.6	2.0
Soyabean Oil	154.3	153.7	149.4	0.4	3.3
Copra Oil	138.8	140.8	153.8	-1.4	-9.8
Sunflower Oil	134.6	134.3	128.4	0.2	4.8
Gingelly Oil	183.5	186.4	171.7	-1.6	6.9
FRUITS & VEGETABLES	277.4	257.1	249.9	7.9	11.0
Potato	248.7	222.9	151.2	11.6	64.5
Onion	255.4	247.9	357.7	3.0	-28.6
CONDIMENTS & SPICES	352.3	353.8	326.3	-0.4	8.0
Black Pepper	764.3	785.0	713.6	-2.6	7.1
Chillies(Dry)	407.3	421.3	322.3	-3.3	26.4
Turmeric	250.4	254.1	250.6	-1.5	-0.1
Raw Cotton	214.9	193.6	197.1	11.0	9.0
Raw Jute	538.3	520.3	356.5	3.5	51.0

Statistical Tables

Wages

TABLE 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.,15	8	200	200	300	NA	250	NA	300	NA	NA
	Guntur	Tadikonda	Dec.,15	8	270	218	275	NA	225	NA	NA	NA	NA
Telangana	Ranga Reddy	Arutala	Feb.,15	8	350	269	NA	NA	NA	NA	350	300	NA
Karnataka	Bangalore	Harisandra	Nov., 15	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Tumkur	Gidlahali	Nov., 15	8	170	170	180	180	180	180	200	190	NA
Maharashtra	Nagpur	Mauda	Sep., 14	8	100	80	NA	NA	NA	NA	NA	NA	NA
	Ahmednagar	Akole	Sep., 14	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
Jharkhand	Ranchi	Gaitalsood	March, 14	8	120	120	100	100	75	75	200	200	NA

TABLE 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	Herds-man	Skilled Labour		
							Labour					Carpenter	Black Smith	Cobbler
Assam	Barpeta	Laharapara	March,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,14	M	8	310	210	210	260	250	210	350	360	310
				W	8	NA	NA	NA	250	210	NA	NA	NA	NA
	Shekhpura	Kutaut	June,14	M	8	220	NA	NA	NA	220	NA	280	NA	NA
				W	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chhattisgarh	Dhamtari	Sihava	Feb.,16	M	8	400	150	150	NA	150	100	300	200	120
				W	8	NA	120	125	NA	100	80	NA	80	100
Gujarat*	Rajkot	Rajkot	Sep, 15	M	8	215	205	163	180	150	188	450	450	360
				W	8	NA	175	150	175	135	117	NA	NA	NA
	Dahod	Dahod	Sep,15	M	8	180	160	160	160	130	NA	260	210	210
				W	8	NA	160	160	160	130	NA	NA	NA	NA
Haryana	Panipat	Ugarakheri	Mach, 16	M	8	400	400	400	400	400	NA	NA	NA	NA
				W	8	NA	300	300	300	300	NA	NA	NA	NA
Himachal Pradesh	Mandi	Mandi	Jun,15	M	8	NA	200	200	200	200	200	350	350	NA
				W	8	NA	200	200	200	200	200	NA	NA	NA
Kerala	Kozhikode	Koduvally	Dec,15	M	4-8	1290	675	NA	675	983	NA	825	NA	NA
				W	4-8	NA	NA	475	575	550	NA	NA	NA	NA
	Palakkad	Elappally	Dec,15	M	4-8	500	500	NA	500	467	NA	600	NA	NA
				W	4-8	NA	NA	300	300	300	NA	NA	NA	NA

TABLE 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	Herds-man	Skilled Labour		
												Carpenter	Black Smith	Cobbler
Madhya Pradesh	Hoshangabad	Sangarkhera	March,16	M	8	200	200	200	200	200	150	400	400	NA
				W	8	NA	200	200	200	150	150	NA	NA	NA
	Satna	Kotar	March,16	M	8	200	200	200	200	200	200	300	300	300
				W	8	NA	200	200	200	200	200	NA	NA	NA
	Shyopurkala	Vijaypur	March,16	M	8	NA	300	300	300	NA	250	300	300	NA
				W	8	NA	300	NA	300	NA	NA	NA	NA	NA
Odisha	Bhadrak	Chandbali	March, 16	M	8	250	NA	250	300	250	250	350	300	300
				W	8	NA	NA	200	200	200	200	NA	NA	NA
	Ganjam	Aska	March, 16	M	8	300	200	200	250	300	NA	400	400	200
				W	8	NA	100	100	200	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	Aug,15	M	8	NA	NA	300	NA	NA	300	700	500	NA
				W	8	NA	NA	200	NA	NA	200	NA	NA	NA
	Jalore	Sarnau	Aug,15	M	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
				W	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tamil Nadu*	Thanjavur	Pulvarnatham	Apr, 16	M	8	NA	340	NA	342	335	NA	NA	NA	NA
				W	8	NA	NA	120	130	125	NA	NA	NA	NA
	Tirunelveli	Malayakulam	Apr, 16	M	8	NA	500	NA	400	496	NA	NA	NA	NA
				W	8	NA	175	176	195	358	NA	NA	NA	NA
Tripura	State Average		June, 15	M	8	299	280	280	281	279	295	328	291	297
				W	8	NA	216	218	216	215	225	NA	NA	NA
Uttar Pradesh*	Meerut	Ganeshpur	Feb,16	M	8	275	258	256	250	256	NA	370	NA	NA
				W	8	NA	200	207	200	207	NA	NA	NA	NA
	Aurraiya	Aurraiya	Feb, 16	M	8	NA	NA	NA	NA	160	NA	375	NA	.NA
				W	8	NA	NA	NA	NA	160	NA	NA	NA	NA
	Chandauli	Chandauli	Feb,16	M	8	NA	NA	200	NA	200	NA	350	NA	NA
				W	8	NA	NA	200	NA	200	NA	NA	NA	NA

M-Man

W-Woman

NA- Not Available

* States reported district average daily wages

PRICES

TABLE 2 : WHOLESALE PRICES OF CERTAIN AGRICULTURAL COMMODITIES AND ANIMAL HUSBANDRY PRODUCTS AT SELECTED CENTRES IN INDIA

(Month end Prices in Rupees)

Commodity	Variety	Unit	State	Centre	Jul-16	May-16	Jul-15
Wheat	PBW 343	Quintal	Punjab	Amritsar	1600	1600	1600
Wheat	Dara	Quintal	Uttar Pradesh	Chandausi	1640	1535	1460
Wheat	Lokvan	Quintal	Madhya Pradesh	Bhopal	1722	1680	1434
Jowar	-	Quintal	Maharashtra	Mumbai	2200	2300	2350
Gram	No III	Quintal	Madhya Pradesh	Sehore	6231	5810	3890
Maize	Yellow	Quintal	Uttar Pradesh	Kanpur	1325	1415	1370
Gram Split	-	Quintal	Bihar	Patna	6200	5950	4970
Gram Split	-	Quintal	Maharashtra	Mumbai	8300	7600	5600
Arhar Split	-	Quintal	Bihar	Patna	15000	14270	8390
Arhar Split	-	Quintal	Maharashtra	Mumbai	11450	11550	9500
Arhar Split	-	Quintal	NCT of Delhi	Delhi	13200	12900	10200
Arhar Split	Sort II	Quintal	Tamil Nadu	Chennai	12500	12700	9900
Gur	-	Quintal	Maharashtra	Mumbai	4000	3700	3200
Gur	Sort II	Quintal	Tamil Nadu	Coimbatore	3800	3800	4000
Gur	Balti	Quintal	Uttar Pradesh	Hapur	2900	2840	2375
Mustard Seed	Black (S)	Quintal	Uttar Pradesh	Kanpur	4280	4150	3550
Mustard Seed	Black	Quintal	West Bengal	Raniganj	4750	4600	4250
Mustard Seed	-	Quintal	West Bengal	Kolkata	4700	4525	4750
Linseed	Bada Dana	Quintal	Uttar Pradesh	Kanpur	5450	4850	4240
Linseed	Small	Quintal	Uttar Pradesh	Varanasi	4420	4425	3915
Cotton Seed	Mixed	Quintal	Tamil Nadu	Virudhunagar	2300	2300	1700
Cotton Seed	MCU 5	Quintal	Tamil Nadu	Coimbatore	2500	2500	2000
Castor Seed	-	Quintal	Telangana	Hyderabad	3300	3375	3800
Sesamum Seed	White	Quintal	Uttar Pradesh	Varanasi	11825	11800	13400
Copra	FAQ	Quintal	Kerala	Alleppey	5250	5200	8100
Groundnut	Pods	Quintal	Tamil Nadu	Coimbatore	5500	5500	4500
Groundnut	-	Quintal	Maharashtra	Mumbai	6600	6400	6000
Mustard Oil	-	15 Kg.	Uttar Pradesh	Kanpur	1474	1481	1290
Mustard Oil	Ordinary	15 Kg.	West Bengal	Kolkata	1638	1610	1530
Groundnut Oil	-	15 Kg.	Maharashtra	Mumbai	1900	1650	1440
Groundnut Oil	Ordinary	15 Kg.	Tamil Nadu	Chennai	1995	1995	1635
Linseed Oil	-	15 Kg.	Uttar Pradesh	Kanpur	1560	1489	1425
Castor Oil	-	15 Kg.	Telangana	Hyderabad	1050	1065	1238
Sesamum Oil	-	15 Kg.	NCT of Delhi	Delhi	1450	1455	1855
Sesamum Oil	Ordinary	15 Kg.	Tamil Nadu	Chennai	2100	2010	2070
Coconut Oil	-	15 Kg.	Kerala	Cochin	1155	1140	1755
Mustard Cake	-	Quintal	Uttar Pradesh	Kanpur	2160	2150	1900
Groundnut Cake	-	Quintal	Telangana	Hyderabad	4000	3500	3386
Cotton/Kapas	NH 44	Quintal	Andhra Pradesh	Nandyal	5100	4750	4000
Cotton/Kapas	LRA	Quintal	Tamil Nadu	Virudhunagar	NT	4400	3400

TABLE 2 : MONTH END WHOLESALE PRICES OF CERTAIN AGRICULTURAL COMMODITIES AND ANIMAL HUSBANDRY PRODUCTS AT SELECTED CENTRES IN INDIA — *Contd.*

Commodity	Variety	Unit	State	Centre	Jul-16	May-16	Jul-15
Jute Raw	TD 5	Quintal	West Bengal	Kolkata	5765	5880	4210
Jute Raw	W 5	Quintal	West Bengal	Kolkata	5705	5820	4160
Oranges	-	100 No	NCT of Delhi	Delhi	NA	600	NA
Oranges	Big	100 No	Tamil Nadu	Chennai	800	750	490
Banana	-	100 No.	NCT of Delhi	Delhi	333	292	333
Banana	Medium	100 No.	Tamil Nadu	Kodaikkanal	498	498	495
Cashewnuts	Raw	Quintal	Maharashtra	Mumbai	86000	80000	62000
Almonds	-	Quintal	Maharashtra	Mumbai	50000	52000	74000
Walnuts	-	Quintal	Maharashtra	Mumbai	55000	55000	68000
Kishmish	-	Quintal	Maharashtra	Mumbai	11000	11000	24000
Peas Green	-	Quintal	Maharashtra	Mumbai	6500	6300	4000
Tomato	Ripe	Quintal	Uttar Pradesh	Kanpur	3200	875	1800
Ladyfinger	-	Quintal	Tamil Nadu	Chennai	2500	3000	3300
Cauliflower	-	100 No.	Tamil Nadu	Chennai	1200	1800	2800
Potato	Red	Quintal	Bihar	Patna	1350	1200	810
Potato	Desi	Quintal	West Bengal	Kolkata	1620	1580	700
Potato	Sort I	Quintal	Tamil Nadu	Mettuppalayam	3487	2800	1633
Onion	Pole	Quintal	Maharashtra	Nashik	550	600	1550
Turmeric	Nadan	Quintal	Kerala	Cochin	15500	16000	12000
Turmeric	Salam	Quintal	Tamil Nadu	Chennai	9000	8800	7900
Chillies	-	Quintal	Bihar	Patna	9800	9900	8900
Black Pepper	Nadan	Quintal	Kerala	Kozhikode	68000	68000	61000
Ginger	Dry	Quintal	Kerala	Cochin	16500	16000	22500
Cardamom	Major	Quintal	NCT of Delhi	Delhi	130000	130500	125000
Cardamom	Small	Quintal	West Bengal	Kolkata	95000	NT	110000
Milk	Buffalo	100 Liters	West Bengal	Kolkata	3800	3600	3600
Ghee Deshi	Deshi No 1	Quintal	NCT of Delhi	Delhi	35000	35685	29181
Ghee Deshi	-	Quintal	Maharashtra	Mumbai	46000	46000	46000
Ghee Deshi	Desi	Quintal	Uttar Pradesh	Kanpur	36700	36500	34750
Fish	Rohu	Quintal	NCT of Delhi	Delhi	10000	12000	8300
Fish	Pomphrets	Quintal	Tamil Nadu	Chennai	35500	35000	38500
Eggs	Madras	1000 No.	West Bengal	Kolkata	4350	4500	4200
Tea	-	Quintal	Bihar	Patna	21200	21150	21050
Tea	Atti Kunna	Quintal	Tamil Nadu	Coimbatore	34000	33000	33000
Coffee	Plant-A	Quintal	Tamil Nadu	Coimbatore	29500	28500	29500
Coffee	Rubusta	Quintal	Tamil Nadu	Coimbatore	13000	14500	13000
Tobacco	Kampila	Quintal	Uttar Pradesh	Farukhabad	4500	4420	4400
Tobacco	Raisa	Quintal	Uttar Pradesh	Farukhabad	3350	3350	3400
Tobacco	Bidi Tobacco	Quintal	West Bengal	Kolkata	12500	12000	3900
Rubber	-	Quintal	Kerala	Kottayam	11400	10600	11800
Arecanut	Pheton	Quintal	Tamil Nadu	Chennai	32500	32500	31400

3 Month end Wholesale Prices of Some Important Agricultural Commodities in International Markets during Year 2016

Commodity	Variety	Country Centre	Unit		Jan	Feb	March	April	May	June
CARDAMOM	Guatmala Bold Green	U.K.	-	Dollar/MT	9000.00	9000.00	9000.00	9000.00	9000.00	9000.00
				Rs./Qtl	61281.00	61542.00	60210.00	59796.00	60255.00	60516.00
CASHEW KERNELS	Spot U.K. 320s	U.K.	-	Dollar/MT	8350.09	8143.20	8333.00	9184.69	9568.85	9560.20
				Rs./Qtl	56855.76	55683.20	55747.77	61023.08	64063.45	64282.78
CASTOR OIL	Any Origin ex tank Rotterdam	Netherlands	-	Dollar/MT	1374.00	1244.70	1244.70	1244.70	1274.70	1249.90
				Rs./Qtl	9355.57	8511.26	8327.04	8269.79	8534.12	8404.33
CHILLIES	Birds eye 2005 crop	Africa	-	Dollar/MT	4100.00	4100.00	4100.00	4100.00	4100.00	4100.00
				Rs./Qtl	27916.90	28035.80	27429.00	27240.40	27449.50	27568.40
CLOVES	Singapore	Madagascar	-	Dollar/MT	8650.00	8650.00	8650.00	8700.00	8750.00	8750.00
				Rs./Qtl	58897.85	59148.70	57868.50	57802.80	58581.25	58835.00
COCONUT OIL	Crude Phillipine/ Indonesia, cif Rotterdam	Netherlands	-	Dollar/MT	1155.00	1255.00	1545.00	1535.00	1430.00	1600.00
				Rs./Qtl	7864.40	8581.69	10336.05	10198.54	9573.85	10758.40
COPRA	Phillipines cif Rotterdam	Phillipine	-	Dollar/MT	687.50	714.50	811.00	813.00	767.00	798.50
				Rs./Qtl	4681.19	4885.75	5425.59	5401.57	5135.07	5369.11
CORRIANDER		India	-	Dollar/MT	2000.00	2000.00	2000.00	2000.00	2000.00	2000.00
				Rs./Qtl	13618.00	13676.00	13380.00	13288.00	13390.00	13448.00
CUMMIN SEED		India	-	Dollar/MT	2200.00	2200.00	2500.00	2500.00	2500.00	2500.00
				Rs./Qtl	14979.80	15043.60	16725.00	16610.00	16737.50	16810.00
GROUNDNUT OIL	Crude Any Origin cif Rotterdam	U.K.	-	Dollar/MT	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00
				Rs./Qtl	8170.80	8205.60	8028.00	7972.80	8034.00	8068.80
MAIZE		U.S.A.	Chicago	C/56 lbs	369.25	359.75	368.50	380.75	404.75	393.00
				Rs./Qtl	988.09	966.77	968.85	994.17	1064.95	1038.52
OATS		CANADA	Winnipeg	Dollar/MT	283.14	250.42	250.99	247.92	244.91	263.38
				Rs./Qtl	1927.90	1712.37	1679.12	1647.18	1639.67	1770.97
PALM KERNAL OIL	Crude Malaysia/Indonesia, cif Rotterdam	Netherlands	-	Dollar/MT	890.00	1030.00	1320.00	1285.00	1200.00	1410.00
				Rs./Qtl	6060.01	7043.14	8830.80	8537.54	8034.00	9480.84
PALM OIL	Crude Malaysian/Sumatra, cif Rotterdam	Netherlands	-	Dollar/MT	575.00	637.50	705.00	710.00	717.50	710.00
				Rs./Qtl	3915.18	4359.23	4716.45	4717.24	4803.66	4774.04
PEPPER (Black)	Sarawak Black lable	Malaysia	-	Dollar/MT	10000.00	10000.00	10000.00	10000.00	10200.00	10200.00
				Rs./Qtl	68090.00	68380.00	66900.00	66440.00	68289.00	68584.80
RAPESEED	Canola	CANADA	Winnipeg	Can Dollar/MT	481.20	460.70	469.50	499.50	524.80	480.00
				Rs./Qtl	2334.78	2298.89	2378.02	2643.85	2707.97	2515.20
	UK delivered rapeseed, delivered Erith(buyer)	U.K.	-	Pound/MT	247.00	247.00	245.00	245.00	245.00	232.00
				Rs./Qtl	2415.66	2352.43	2314.03	2378.22	2405.66	2271.05
RAPESEED OIL	Refined bleached and deodorised ex-tanks, broker price	U.K.	-	Pound/MT	660.00	614.00	615.00	658.00	602.00	602.00
				Rs./Qtl	6454.80	5847.74	5808.68	6387.21	5911.04	5892.98
SOYABEAN MEAL	UK produced 49% oil & protein ('hi-pro') ex-mill seaforth UK bulk	U.K.	-	Pound/MT	248.00	255.00	249.00	291.00	342.00	325.00
				Rs./Qtl	2425.44	2428.62	2351.81	2824.74	3358.10	3181.43
SOYABEAN OIL	Refined bleached and deodorised ex-tanks, broker price	U.S.A.	-	C/lbs	30.87	30.92	33.36	33.62	31.34	31.55
				Rs./Qtl	4632.67	4659.94	4918.85	4923.10	4624.46	4675.61
		U.K.	-	Pound/MT	618.00	639.00	650.00	616.00	590.00	596.00
				Rs./Qtl	6044.04	6085.84	6139.25	5979.51	5793.21	5834.24

3 Month end Wholesale Prices of Some Important Agricultural Commodities in International Markets during Year 2016 — *Contd.*

Commodity	Variety	Country	Unit		Jan	Feb	March	April	May	June July
SOYABEANS		U.S.A.	-	C/60 lbs	883.00	867.50	905.25	1019.00	1085.50	1137.50
				Rs./Qtl	2206.53	2177.03	2222.60	2484.68	2667.14	2807.02
	US NO.2 yellow	Netherlands	Chicago	Dollar/MT	377.20	372.90	385.60	409.20	426.00	456.40
				Rs./Qtl	2568.35	2549.89	2579.66	2718.72	2852.07	3068.83
SUNFLOWER SEED OIL	Refined bleached and deodorised ex-tanks, broker price	U.K.	-	Pound/MT	674.00	720.00	720.00	720.00	720.00	720.00
				Rs./Qtl	6591.72	6857.28	6800.40	6989.04	7069.68	7048.08
Wheat		U.S.A.	Chicago	C/60 lbs	476.50	442.75	463.00	474.25	466.00	458.75
				Rs./Qtl	1190.73	1111.10	1136.77	1156.39	1144.99	1132.06

Source: Pubic Ledger.

Foreign Exchange Rates

Currency	Jan	Feb	Mar	Apr	May	Jun
Can Dollar	48.52	49.90	50.65	52.93	51.60	52.40
UK Pound	97.80	95.24	94.45	97.07	98.19	97.89
US Dollar	68.09	68.38	66.90	66.44	66.95	67.24

Crops Production

4. Sowing and Harvesting Operations Normally in Progress During the Month of September, 2016.

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, Rapseseed & 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

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