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Agricultural Situation in India

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Contents

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Note to Contributors

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

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

STATISTICAL TABLES

Abbreviations used

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

Plus (+) indicates surplus or increase.

Minus (–) indicates deficit or decrease.

We are pleased to inform that our monthly journal *Agricultural Situation in India* has been accredited by the National Academy of Agricultural Sciences (NAAS) and it has been given a score of 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

1,12,487 Farmer's Friend (FF) Identified during 2015-16 under the ATMA Scheme

The Government had launched 'Agricultural Technology Management Agency' (ATMA) scheme to support extension reforms in the States during 2005-06.

Presently, the Scheme is under implementation in 652 districts of 29 States and 3 UTs in the country. Under the scheme, grants-in-aid is released to State Governments with an objective to support their efforts of revitalization of the extension system and making available the latest agricultural technologies in different thematic areas to increase agricultural production through extension activities viz. Farmers Training, Demonstration, Exposure Visits, KisanMela, Mobilization of Farmers Groups and Setting up of Farm Schools. In order to percolate the benefits of ATMA Scheme down to the farmers for adoption of good agricultural practices, an innovative support is being provided under the Scheme w.e.f. 2010-11 through Farmer Friend (FF) at village level @ one FF per two villages. The FF is serving as a vital link between extension workers and farmers at village level.

Under the Scheme, Grants-in-aid is released to State Governments through their respective State Treasuries based on their approved State Extension Work Plan (SEWP). No component-wise funds are released to the States by the Government of India. State Governments allocate funds (component/activity-wise) based on their priority areas and approved Work Plans. Government of Uttar Pradesh has not yet identified FF under ATMA Scheme.

ATMA Guidelines, 2014 provide instructions for identifying one FF per two villages. Further, as per Guidelines, Farmer Friends are provided with special opportunity for up-gradation of their skills through Trainings, Study Tours and Visits to State Agricultural Universities/other institutes, by utilizing support available under ATMA. For assisting FF, a provision of contingency amount of Rs.6000/- per annum has been made under the Scheme which is shared between the Centre and the State Government on 50:50 basis.

Nam Trade Report between 14th April-23rd July 2016

No State has indicated that they are not interested in participation in National Agriculture Market (e-NAM). Proposals from 13 States, namely, Gujarat, Maharashtra, Telangana, Jharkhand, Chhattisgarh, Madhya Pradesh, Rajasthan, UT of Chandigarh, Haryana, Himachal Pradesh, Uttar Pradesh, Andhra Pradesh and Odisha have been received for integration of their mandis with e-NAM. 23 mandis of 8 States across the country have already been integrated with e-NAM. In addition to above mentioned States, many other States/UTs like Karnataka, Uttarakhand, Punjab, Tamil Nadu, UT of Puducherry, Administration of Andaman & Nicobar Islands, Assam, Manipur, Arunachal Pradesh, Nagaland and Mizoram have expressed their willingness to join the e-NAM.

The Government has taken up with the States through issue of advisories, holding interactive sessions/ meetings, etc. to undertake amendments in their Agricultural Produce Market Committees (APMCs) Acts in respect of (i) a single trading license to be valid across the State; (ii) single point levy of market fee across the State; and (iii) provision for electronic auction as a mode for price discovery. So far, 13 States (Andhra Pradesh, Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Karnataka, Rajasthan, Sikkim, Goa, Madhya Pradesh, Mizoram, Telangana and Uttar Pradesh) have amended their Acts to be eligible under the e-NAM scheme.

Farm Machinery Training and Testing Institutes

The Government has established four Farm Machinery Training & Testing Institutes in the country as under:

1) Central Farm Machinery Training & Testing Institute, Budni, District - Sehore (Madhya Pradesh)
2) Northern Region Farm Machinery Training & Testing Institute, Hisar (Haryana)
3) Southern Region Farm Machinery Training & Testing Institute, Garladinne, District - Anantapur (Andhra Pradesh)
4) North Eastern Region Farm Machinery Training & Testing Institute, BiswanathChariali, District -Sonitpur (Assam).

The proposals received from the Government of Gujarat, Maharashtra and Uttar Pradesh for establishment of Farm Machinery Training & Testing Institutes are under consideration in the Department of Agriculture, Cooperation & Farmers Welfare and the action would be completed within next six months.

Source : pib.nic.in

Development of farm technologies is an ongoing activity. Central Institute of Agricultural Engineering, Bhopal & its regional centres under Indian Council of Agricultural Research (ICAR) are working for development of agricultural machines and equipment to cater the requirement of various crops, commodities, agro-climatic regions and socio economic conditions of farmers.

Financial assistance to the farmers for purchase of such equipments and machinery including the latest imported tools and equipment is provided under various schemes of the Department of Agriculture, Cooperation & Farmers Welfare viz. Sub-Mission on Agricultural Mechanization (SMAM), National Food Security Mission (NFSM), Mission for Integrated Development of Horticulture (MIDH), RashtriyaKrishiVikasYojana (RKVY) and National Mission on Oilseeds and Oil Palm (NMOOP).

Farmers' awareness programmes like KisanVani&KrishiDarshan are being broadcasted through All India Radio/Doordarshán& also from all public & prominent Private TV channels. In addition to this, various print advertisements for the same purpose are published from time to time for the awareness of farmers. Farmer's awareness campaigns are done by various agencies mostly at the State level through diversified sources. Therefore, the exact countrywide data on the number of awareness campaigns, funds allocated/utilized and number of farmers benefitted from such campaigns is not maintained in the Department of Agriculture, Cooperation & Farmers Welfare.

India Produces 2.158 Million Tones of Flowers During 2015-16

Due to favourable agro-climatic conditions prevailing in the country, India produces 2.158 million tones of flowers during 2015-16. Flower crops are grown in almost all the States. The major flower growing States are Tamil Nadu, Karnataka, West Bengal, Madhya Pradesh, Mizoram, Gujarat, Andhra Pradesh, Odisha, Jharkhand, Haryana, Assam, Chattisgarh, Himachal Pradesh and Maharashtra. Flowers are being exported from India to about 150 countries in the world and India's share in the world floriculture trade and exports is less than 1%.

The Mission for Integrated Development of Horticulture (MIDH) provides assistance for development of horticultural crops including flowers. Floriculture farmers are provided assistance @ 40% of the cost ranging from Rs.40,000 per ha. to Rs.1.50 lakh per ha. limited to 2 ha per beneficiary. Besides, the technological support is provided by the Indian Council of Agricultural Research, which has established a full-fledged Directorate of Floricultural Research at Pune to address the issues specific to floriculture research.

NDDB to Implement "Giftmilk" Scheme to Improve Child Nutrition

The duty and functions of National Dairy Development Board (NDDB) are to promote, plan and organize programmers for the purpose of development of dairy and other agriculture based and allied industries and biological on an intensive and nation-wide basis and to render assistance in the implementation of such programs.

Government has approved a proposal for setting up an Institution for promotion of nutrition through milk/milk products (especially for children) utilizing Corporate Social Responsibility funds of NDDB's subsidiaries and other voluntary donation. Subsequently , NDDB registered a trust/ society known as 'NDDB Foundation for Nutrition'(NFN) to implement this initiative known as "Giftmilk" to improve child nutrition thought consumption of milk & milk products by providing milk free of cost. The supply of milk / milk product would be facilitated through dairy cooperatives only. NFN is currently implementing the "Giftmilk" initiative in 3 schools -2 in Delhi & 1 in Telangana, which have a total enrolment of about 3100 students. Till now, about 1,20,000 packets of flavored milk have been distributed . The "Giftmilk" is presently supported by NDDB's subsidiaries who have contributed through their CSR commitment.

The NFN has been registered on 9 October 2015 in Gujarat under the Societies Registration Act, 1860 and Bombay Public Trust Act,1950. Further, NFN has been granted approval u/s 80G (5) of the Income Tax Act 1961.

NDDB is extending financial and technical support to dairy cooperatives. NDDB is implementing National Dairy Plan phase-1(NDP-1), a central sector scheme of Ministry of Agriculture&farmers welfare, Government of India to increase milk production in the country.

Drip and Sprinkler Irrigation Being Promoted Under "Per Drop More Crop" Component of Pradhan Mantri Krishi Sinchayee Yojana

Drip and sprinkler irrigation systems are being promoted under "Per Drop More Crop" component of Pradhan Mantri Krishi SinchayeeYojana (PMKSY) {erstwhile scheme on Micro Irrigation has been subsumed under PMKSY since 1st July, 2015}. Under the scheme, 15% additional assistance is provided to small and marginal farmers for installation of micro irrigation systems compared to other farmers for area covered under Drought Prone Area Programme (DPAP), Desert Development Programme (DDP) and North Eastern and Himalayan States and 10% for other areas.

As per available information, during the last three years (2013-14 to 2015-16), 14.3 lakh hectare area have been covered under drip and sprinkler irrigation systems (Drip Irrigation- 9.04 lakh hectare, Sprinkler Irrigation-

5.26 lakh hectare) in the country including Punjab and Haryana.

Krishi Vigyan Kendras Portal

The Government has recently launched Krishi Vigyan Kendras (KVKs) Portal which will help in monitoring the functioning of KVKs at the National level and in providing timely information and advisory to the farmers.

The aim of the portal is to transfer the technologies developed by the agricultural scientists to the farmers in a fast and effective manner using web and mobile technology as well as to monitor the activities of Krishi Vigyan Kendras (KVKs). The objectives of the portal are to create a platform to monitor the various activities as well as resource utilization by various KVKs; to create a database of the various programmes organized by the KVKs along with their detailed information and learning resources; to help the farmers in resolving their queries using web and mobile technologies; to provide information about various facilities and activities performed by the KVKs and to provide linkage to other important information such as weather and market information.

The portal provides provisions for online monitoring of KVKs which include reporting of major events on regular basis and submission of monthly reports online. The portal also provides information on different services being provided by different KVKs. The portal also has links for accessing Weather and Market related information by the farmers; forthcoming programmes are also being be available on the website which will benefit farmers and youth in joining different training programmes being organized by KVKs. The portal also maintains the database of past programmes along with related information such as technologies covered, photo and videos; Question and answer facility is available for the farmers and Agriculture related information of the districts is available on the portal. The farmers and the Agricultural Officers may register themselves and seek different information related to KVKs.

Increase in Sugar Recovery From 10.01% in 2012-13 to 10.62% in 2015-16

A number of sugarcane varieties, higher in cane yield and sugar content have been developed and are being cultivated in the country which is evident by increase in sugar recovery from 10.01% in sugar season of 2012-13 to 10.62% in 2015-16.

Indian Council of Agricultural Research (ICAR) through Sugarcane Breeding Institute (SBI), Coimbatore, Indian Institute of Sugarcane Research, Lucknow and All India Coordinated Research Project (AICRP) on Sugarcane are already conducting research to improve the quality of sugarcane by increasing cane yield and sucrose content.

Measures Taken by the Government for Upliftment of Women in Agriculture Sector

As per Census 2011, Sixty five percent (65%) of the total female workers in India are engaged in agriculture. Of the total cultivators (118.7 million), 30.3% are female. Out of 144.3 million agricultural labourers, 42.6 % are Women. In 2001, female agricultural labourers were 21% which increased to 23% in 2011.

The Department of Agriculture, Cooperation & Farmers Welfare implements various programmes of farmers including women in agriculture sector. As per directives for the Women Component Plan, the State Governments have been asked to ensure flow of funds to the tune of 30% for the benefit of women farmers.

The guidelines of Centrally Sponsored Scheme/ Missions such as Support to State Extension Programmes for Extension Reforms under Sub-Mission on Agricultural Extension(SMAE), National Food Security Mission, National Mission on Oil Seed and Oil Palm and National Mission on Sustainable Agriculture, Sub-Mission for Seed & Planting Material, Sub-Mission on Agricultural Mechanization and Mission for Integrated Development of Horticulture (MIDH) stipulate that States and other Implementing Agencies are required to earmark at least 30 % expenditure on Women Farmers.

The primary objective of "Mahila Kisan Sashaktikaran Pariyojana (MKSP)" implemented by Ministry of Rural Development is to empower women in agriculture by making systematic investments to enhance their participation and productivity, as also to create and sustain agriculture based livelihoods of rural women. Under the Pariyojana, projects are conceived in such a manner that the skill base of the women in agriculture is enhanced to enable them to pursue their livelihoods on a sustainable basis.

Government to give all possible help for `mithun' conservation: Shri Radha Mohan Singh

The Government will give all possible help for conservation of mithun, the only animal that is recognized as the State Animal of Arunachal Pradesh and Nagaland. Stating this, the Union Minister of Agriculture and Farmers Welfare ShriRadha Mohan Singh said that the mithun has a very significant role to play in the lives of the tribal communities of the North East. It's image is also present in the official seal of the state of Nagaland. Realizing the requirements for technology transfer for conservation of mithun, a new KrishiVigyan Kendra has been put in place at Peren only on 6th August, 2016. In Research &Development, ICAR's NRC mithun is the only Institute in the world dedicated purely to the research on conservation and improvement of this precious animal species.

The Minister said that this Institute is to work towards technology development for scientific rearing of mithuns

that has not only helped in the conservation of the biodiversity and the rich cultural heritage of the region, but also contributed to the economic development and ecological stability of the NE states.

He further stated that the tribal community in Arunachal Pradesh, Nagaland, Mizoram and Manipur is closely involved in rearing of this bovine species, called `mithun'. Even though, the mithun may be genetically different from other bovine species, it has a genetic resemblance with its ancestor `gaur'.

The total population of mithun in the country is about 3 lakh, of which, Nagaland accounts for 12%. Looking into this meagre population, there is a great need for putting in breeding and conservation efforts in this direction.

ShriRadha Mohan Singh also said that 'in order to bring stability in the horticulture-based farming system, animal integration is essential'. Though Índia possesses the largest number of milch animals in the world, yet their productivity is one of the lowest, which calls for efforts to enhance the productivity. Keeping these points in views, the Government has initiated schemes like RashtriyaGokul Mission, Pasudhan Mission and PasuChikitsaYojna under which efforts are being made to conserve and further develop the indigenous breeds of cattle, he said.

FMD vaccination in non-covered (FMD-CP) States under Rashtriya Krishi Vikas Yojana (RKVY) during 2016-17

Foot & Mouth Disease (FMD) is one of the most economically devastating contagious viral animal diseases affecting all susceptible cloven-footed animals. As per the estimates by the Indian Council of Agricultural Research (ICAR), direct loss due to milk and meat is to the tune of RS. 20,000 crores per annum. It can be much more if indirect losses due to reduced work capacity; abortions, subsequent infertility and sterility (that account for the reduced milk production subsequently) are taken into account.

In order to prevent economic losses due to Foot and Mouth Disease, a location specific programme called 'Foot and Mouth Disease Control Programme (FMD-CP)' is under implementation since 10th Plan Period. Gradually FMD-CP was expanded during 11th &12th Plan Period. Thus, as of now, it covers 351 Districts in 13 States and 6 UTs i.e. Andhra Pradesh, Telangana, Maharashtra, Kerala, Tamil Nadu, Gujarat, Punjab, Haryana, Uttar Pradesh, Karnataka, Goa, Rajasthan, Bihar, Puducherry, Delhi, Andaman & Nicobar, Dadar& Nagar Haveli, Daman & Diu and Lakshadweep. The scope of the programme will be extended to cover remaining States in a phased manner so as to have geographically contiguous areas to yield desired results for the creation of FMD Free Zones depending upon availability of resources. With robust implementation of FMD-CP in the States, disease occurrence has drastically been reduced particularly in FMD-CP States e.g. 879 FMD outbreaks were reported in 2012 throughout the country which have been reduced to 109 in 2015.

Looking at the economic importance of the controlling of these diseases, the Department has conceived 'FMD Mukt Bharat' in next few years. However, 16 States and one UT are yet to be covered under intensive FMD vaccination at six monthly intervals. Therefore, it has now been decided to take up FMD vaccination in these States under RashtriyaKrishiVikasYojana (RKVY) during 2016-17.

Animal Identification and Traceability System

The details of the implementation strategy suggested by the Food Safety and Standards Authority of India (FSSAI) for Animal Identification and Traceability System (AI&TS) as per the Allocation of Business Rules is Department of Animal Husbandry, Dairying and Fisheries (DADF), New Delhi, are as follows

The DADF has prepared AI&TS and EFC meeting with Ministry of Finance was on 5th August, 2016 and after approval of EFC, the proposal would be sent to Cabinet for Approval.

At first phase, the cattle and buffaloes would be covered under AI&TS list for identification; and Monitoring of Artificial Insemination and birth of calf.

The Livestock Health and Disease Control (LH&DC) scheme envisages issuance of animal health card for which the DADF is providing financial assistance as an activity under FMDCP and PPRCP to maintain record of vaccination of these animals which would tackle the problem of outbreak of livestock diseases in addition to breeding activities proposed under AI&TS.

Conservation and Promotion of Indigenous Cow Breeds

In order to compliment and supplement the efforts made by the States for promotion, development and conservation of indigenous bovine breeds including breeds of Gir and Sahiwal, Government of India has initiated following programmes (i) RashtriyaGokul Mission 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 Gir and Sahiwal breed of cattle; (ii) National Dairy Plan-I, 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 and 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.

Indigenous breeds, namely,Gir, Sahiwal, Rathi and Red Sindhi have been classified as dairy purpose breed and have potential for higher quantity of milk production.

In order to complement and supplement the efforts made by the States for promoting indigenous breeds to produce milk from indigenous cows including Gir and Sahiwal Government of India is releasing funds to the States for implementation of the scheme namely, (i) RashtriyaGokul Mission part of National Programme for Bovine Breeding & Dairy Development and (ii) National Dairy Plan.

Infrastucture Support for Livestock

According to estimates of the Central Statistics Office (CSO), the Gross Value Added from Livestock sector at current price was about Rs.7,33,054crore during 2014-15 which is about 28.7% of the Gross Value Added (GVA) from total Agriculture and allied sector at current prices and 27.8% at constant prices. As against proposed plan outlay of Rs 25,639.24 crore, the then Planning Commission approved an outlay of Rs 14,179 crore for the 12th Five Year Plan Period (i.e.2012-17). However, Planning Commission had approved an outlay of Rs.8174 crore to the Department of Animal Husbandry, Dairying & Fisheries during 11th Five Year Plan period. The allocations for different sectors are decided keeping in view the competing demands and the total resources available with the Government.

However, financial resources for the projects of Animal Husbandry, Dairying & Fisheries sectors have also been made available under state plan scheme of Rashtriya Krishi Vikas Yojana (RKVY) over and above the budgetary allocation of the Department. In addition, under Animal Science Division of Indian Council of Agricultural Research, there are 19 Institutes pertaining to animals, two Deemed Universities, Central Institutes, National Research Centers, Directorates and Species specific institutes, which looks into the issues pertaining to the particular species like cattle, buffalo, goat, sheep, Equine, poultry etc.

Veterinary Services including veterinary infrastructure and facilities for disease diagnosis, epidemiology, monitoring & surveillance for animal diseases are provided by respective State Governments. However, Department supplements the efforts of State/UT Governments by, providing financial assistance through, namely, 'Livestock Health and Disease Control (LH &DC) Scheme to develop adequate facilities and veterinary infrastructure for animal disease diagnosis, reporting, epidemiology, monitoring and early warning system of livestock diseases in the country.

1194 Crore Messages Sent to the Stakeholders/ Registered Farmers through m-Kisan Portal

The Government has devised certain mechanism to inform farmers about market information via SMS from the AGMARKNET Portal. Daily price information is collected from Agricultural Produce Markets (APMCs) on the Agmarknet portal on real-time basis. Efforts are made to disseminate desired information on commodities and mandies to farmers through SMS in their local languages.

Farmers registering on the AGMARKNET portal and m-kisan portal are provided with SMS through m-kisan portal.

Besides this, efforts are made to provide market information via SMS by other public and private agencies who have sought live data access through Advanced Programming Interface (API) route from AGMARKNET portal. IffcoKisan Sanchar Ltd (IKSL) is providing market information to farmers through voice SMS. Media Lab Asia, is providing Market Information through SMS and interactive way in three states viz. Andhra Pradesh, Telangana and Meghalaya in their local languages. Karnataka State Marketing Board is also providing market information to farmers from their Krishi Maratha Vahini in local languages.

Kharif Crop Sowing Crosses 1019 Lakh Hectare Areas

The total sown area as on 26th August, 2016 as per reports received from States, stands at 1019.10 lakh hectare as compared to 973.40 lakh hectare at this time last year.

It is reported that rice has been sown/transplanted in 363.07 lakh ha, pulses in 139.42 lakh ha, coarse cereals in 182.99 lakh ha, oilseeds in 177.74 lakh ha, sugarcane in 45.55 lakh hectare and cotton in 102.78 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	363.07	352.23
Pulses	139.42	103.85
Coarse Cereals	182.99	172.73
Oilseeds	177.74	174.58
Sugarcane	45.55	49.60
Jute & Mesta	7.56	7.73
Cotton	102.78	112.68
Total	1019.10	973.40

Centre Working Expeditiously to Provide Agriculture Loans to Farmers According to their Needs and in a Timely Manner: Shri Radha Mohan Singh

Union Minister of Agriculture and Farmers Welfare ShriRadha Mohan Singh addressed the 96th Annual Conference of Kota Co-operative Societies Ltd., Rajasthan on 28th August, 2016. Speaking on the occasion,ShriRadha Mohan Singh highlighted the following points.

- Central Government has made concerted efforts to strengthen Co-operative Societies.
- At the local level, through cooperative societies, employment opportunities are being created for farmers & youth.
- Efforts are to make women of the villages self-reliant.

Union Minister said that the Central Government is working expeditiously to provide agriculture loans to farmers according to their needs and in a timely manner.

Shri Singh said that NABARD is making groups of farmers and agriculture producers to provide them cheap agricultural loans from banks. Till January 2016 across the country 14.43 lakh joint liability groups were formed and by March 2016, NABARD has set up approximately 2424 producer groups. The Minister said that from April 2005 to March 2014, Rs. 6775 crore were spent. Whereas, the new Government has, from April 2014 until December 2015, extended Rs.7084 crore as financial assistance to joint liability groups.

Union Minister of Agriculture & Farmers Welfare said there is imbalance in the availability of credit to the agriculture sector and amongst small and big farmers. Shri Singh acknowledged that credit availability per capita in the region is much lower than in other regions. The National Sample Survey Organisation (NSSO) survey, 46 percent of farming households are burdened by debt and the loans are from different institutions.

The Minister informed that the Central Government has taken concrete steps to strengthen cooperatives so that they are economically viable and active participation of their members, to make them dynamic democratic organizations. Shri Singh said that by doing so, cooperative societies will be able to withstand the competitive global economy. The Minister said that for the development of the rural economy and to increase employment opportunities in the agricultural, cooperatives have an important role to play.

On the occasion, Shri Singh said farmers through cooperatives and youth employment at the local level being added, as well as through self-help groups of village women work towards self-sufficiency is happening. The Central and State Governments are working together in this direction rapidly. ShriRadha Mohan Singh informed that many cooperatives get NCDC funding so that they can create employment for the needy.

Doubling the Farmers' Income, Sooner the Better- Shri Devendra Chaudhry

Secretary (Department of Animal Husbandry, Dairying and Fisheries), Ministry of Agriculture & Farmers Welfare, ShriDevendraChaudhry chaired a Review Meeting with Principal Secretaries/Secretaries of Animal Husbandry, Dairying & Fisheries of State Governments here on 29th August, 2016. ShriChaudhry has underscored the ultimate goal of doubling the farmers' income, sooner the better, and has devoted the entire Agenda Points towards achieving the target in a time bound and specific result oriented manner. The entire day's deliberations addressed the issues, inter alia, of improving the breeding of high yielding indigenous breeds, infrastructure and technological support to dairy sector and livestock development through veterinary support, preparing launching pad for blue revolution, upgradation of poultry and small ruminants etc.

The interactive session benefitted the participants through sharing of successful entrepreneurship experiences and difficulties both at grass root level and State specific issues. DADF at Central Government level has been benefitted by the varied experiences and would like to incorporate suitably while formulating policy frameworks for upscaling the livestock, fisheries and poultry sectors in a big way. It is a proven method of bringing significant change in the life of common man, farmers and vulnerable sections by enhancing their financial and livelihood opportunities.

Highlights of achievement of schemes are as under:

Blue Revolution:Proposals of Rs.436.52 crore for 23 States/UTs have been approved and Rs.107.04 crore has been released as 1st installment of Central share;

National Livestock Mission: Fund of Rs.129.82 crore has been released to 9 States/UTs as Central share for implementation of National Livestock Mission;

National Programme for Bovine Breeding and RashtriyaGukulMission:Fund of Rs.17.31 crore has been released to the State Government for implementation of the project.

National Programme for Dairy Development (NPDD): Central share of Rs.239.95 crore has been released to 17 States out of total approved project cost of Rs.340.77 crore. Till date, 278.6 Thousand Liters Per Day (TLPD) of milk processing capacity and 93.5 TLPD milk chilling capacity have been created under the project and 977 Dairy Cooperative Societies have been organized.

Livestock Health & Disease Control: Central share of Rs.164.88 crore has been released to the State. About 26.8 million vaccinations have been carried out.

The Central Government (DADF) conjointly with the State Governments is striving towards the goal of doubling the farmers' income in real sense by adopting various Mission Mode approaches. State Governments and entrepreneurs have to take advantage of the available opportunities and support to excel in this endeavour.

General Survey of Agriculture

Trends in foodgrain prices

During the month of July, 2016, the All India Index Number of Wholesale Price (2004-05=100) of food grains increased by 2.82 percent from 272.7 in June, 2016 to 280.4 in July, 2016.

The Wholesale Price Index (WPI) number of cereals increased by 0.98 percent from 245.6 to 248.0 and WPI of pulses increased by 12.18 percent from 385.8 to 432.8 during the same period.

The Wholesale Price Index Number of wheat increased by 1.07 percent from 225.2 to 227.6 while that of rice increased by 0.90 percent from 245.2 to 247.4 during the same period.

Weather, Rainfall and Reservoir situation during August, 2016

Rainfall Situation

Cumulative monsoon season rainfall for the country as a whole during the period 01st June to 24th August, 2016 has been 2% lower than the Long Period Average (LPA). Rainfall in the four broad geographical divisions of the country during the above period has been higher than LPA by 7% in Central India and 5% in North-West India but lower than LPA by 16% in East & North East India and 13% in South Peninsula.

Out of total 36 meteorological sub-divisions, 26 subdivisions received excess/normal rainfall and 10 Sub-divisions received deficient rainfall.

Out of 610 districts for which rainfall data are available, 118(19%) districts received excess rainfall, 271(44%) received normal rainfall, 205(34%) districts received deficient rainfall and 16(3%) 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 24th August, 2016) is 102.15 BCM as against 91.02 BCM on 24.08.2015 (last year) and 100.19 BCM of normal storage (average storage of last 10 years). Current year's storage is higher than the last year's storage by 12% and the normal storage by 2%.

Sowing Position during Kharif 2016

As per latest information available on sowing of crops, around 96% of the normal area under kharif crops has been sown upto 26.08.2016. Total area sown under kharif crops in the country has been reported to be 1019.10 lakh hectares as compared to 973.40 lakh hectares during the same period last year. This year's area coverage so far is higher by 45.7 lakh ha. than the area coverage during the corresponding period of last year and by 48.8 lakh ha. than normal area coverage during the same period.

Area coverage under kharif rice is higher by 10.8 lakh ha. than the last year and 13.4 lakh ha. than normal as on date.

Area coverage under kharif pulses is higher by 35.6 lakh ha. than the last year and by 40.2 lakh ha. than normal as on date. this is due to higher coverage in tur, urad and moong.

area coverage under kharif coarse cereals is higher by 10.3 lakh ha. than last year and by 6.2 lakh ha. normal as on date. this is due to higher coverage in maize.

Area coverage under total kharif oilseeds is higher by 3.2 lakh ha. than the last year and by 3.0 lakh ha. than normal as on date. This is due to higher coverage in Groundnut.

Area coverage under sugarcane is lower by 4.1 lakh ha. than the last year and by 0.7 lakh ha. than normal as on date.

Area coverage under cotton is lower by 9.9 lakh ha. than the last year and by 12.8 lakh ha. than normal as on date.

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 (Tabe 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) declined from 30.8 per cent in 2014-15 to 29.3 per cent in 2015-16.

The growth in GDP in Q 4 (January-March) of 2015-16 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 was 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 South-West Monsoon rainfall received for the country as a whole, during the period 1st June-16th August 2016, has been 0.2 per cent above normal. The actual rainfall received during this period has been 599.4 mm as against the normal at 598.2 mm. Out of the total 36 meteorological subdivisions, 7 subdivisions received excess season rainfall, 23 subdivisions received normal season rainfall and the remaining 5 subdivisions received deficient/scanty/no season rainfall.

All India Production of Foodgrains: As per the 4th Advance Estimates released by Ministry of Agriculture & Farmers Welfare on 2nd August 2016, production of foodgrains during 2015-16 is estimated at 252.2 million tonnes 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. The total off-take of wheat was 21.2 lakh tonnes comprising 19.4 lakh tonnes under TPDS/NFSA (offtake against the allocation forthe 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 (Table 5).

Stocks: Stocks of food-grains (rice and wheat) held by FCI as on August 1, 2016 was 49.0 million tonnes, compared to 55.4 million tonnes as on August 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 (1st RE)	2015-16 (PE)	2013-14	2014-15 (1st RE)	2015-16 (PE)
Agriculture, forestry & fishing	4.2	-0.2	1.2	17.5	16.3	15.4
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 & 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	8.9	51.0	52.5	53.4
Trade, hotels, transport, communication and broadcasting services	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 (COS). 1st RE: First Revised Estimates, PE: Provisional Estimates.

TABLE 2: Quarter-wise Growth of GVA Constant (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	9.3
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	9.1	8.7
Trade, hotels, transport, communication and broadcasting services	5.0	7.6	10.5	7.8	11.6	8.4	6.2	13.1	10.00	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 Prices	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 market 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 Office (CSO).

Table 3: Production of Major Agricultural Crops (4 th Adv. Est.)

Crops	Production (in Million Tonnes)			
	2012-13	2013-14	2014-15	2015-16 (4th AE)
Total Foodgrains	**257.1**	**265.0**	**252.0**	**252.0**
Rice	105.2	106.7	105.5	104.3
Wheat	93.5	95.9	86.5	93.5
Total Coarse Cereals	40.0	43.3	42.9	37.9
Total Pulses	18.3	19.3	17.2	16.5
Total Oilseeds	30.9	32.8	27.5	25.3
Sugarcane	341.2	352.1	362.3	352.2
Cotton#	34.2	35.9	34.8	30.1

Source: DES, DAC&FW, M/o Agriculture & Farmers Welfare. 4th AE: Fourth 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	34.0#	—
Wheat@	28.3	38.2	25.1	28.0	28.1	22.9*
Total	63.4	72.2	56.9	60.2	62.1	—

Source: DFPD, 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 Foodgrains (Million Tonnes)

Crops	2012-13	2013-14	2014-15	2015-16	2016-17 (Till Arpil)
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	August 1, 2015	August 1,2016
1. Rice	15.3	18.0
2. Unmilled Paddy#	5.0	6.2
3. Converted Unmilled Paddy in terms of Rice	3.4	4.1
4. Wheat	36.8	26.9
Total (Rice & Wheat) (1+4)	55.4	49.0

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

Articles

A Study on Sugarcane Production and Marketing in Meerut District of Western Uttar Pradesh

Krishna Kant[1] and Subhash Chandra[2]

Abstract

The present study was an attempt to identify the important factors influencing the input use efficiency in sugarcane production. Primary data collected during 2010-12. From the total sugarcane growers, 100 respondents were selected in probability proportion to their population, for the collection of data, on costs and returns involved in the cultivation practices, Cost concepts and Cobb-Douglas production function were employed for achieving the objectives. The cost of cultivation of sugarcane planted was Rs 172679, in which share of operational cost, land rent and material costs were 38, 22 and 26 percent, respectively. The cost of cultivation of sugarcane ratoon was to be Rs 129752.65 with share of operational cost, land rent and material cost of 41, 29 and 14 percent, respectively. The value of coefficient of multiple determination (R2) is varying from0.646 to 0.988 all across categories farms. In the study area, sugar cane supply to sugar mills varies from 84.26 to 98.59 per cent and 1.41 to 5.74 percent for crashers and rest amount was utilized for home consumption.

Key words: Sugarcane, profitability, resource use efficiency and marketing.

Introduction:

Sugarcane is an important agro industry crop in India that plays a pivotal role in national economy by contributing 1.9 per cent to gross domestic product. It is an important component in cropping pattern of the sugarcane growers, which provides many essential commodities in the form of sugar and jaggery and also helps to solve the problem of green fodder for half of the year. The crop is cultivated in 5.03million ha producing more than 342 million tones with a productivity of about 70 tonnes per ha. Among different states of the country, Uttar Pradesh occupies first place in area with 2.21 million ha and production (132.43 million tonnes) of about 38.81 per cent of total sugarcane production in India, followed by area under sugarcane in Maharashtra, Karnataka,Tamilnadu,Gujarat and Andhra Pradesh, respectively.But in terms of productivity, Uttar Pradesh ranks eleventh (Agriculture Statistics at a glance 2012-13). Sugarcane is an important cash crop in the Western Uttar Pradesh. It has dominated the farming system in this region for a long time.

In Western Uttar Pradesh, Meerut district occupies an important place in terms of area and production of sugarcane cultivation. It was grown onan area of 109.12 thousand ha, with its production of 759.59 lakhs quintal and productivity65.99 tonnes per ha (2010-11). Sugarcane varies with region to region and farmer to farmer. Keeping in view the above discussion and importance of the sugarcane cultivation, the present study was an attempt to investigate economics of sugarcane production , resources use efficiency and marketing with following objectives.

1. To work out the costs and returns of sugarcane production at different size group of farms.
2. To examine the resource use efficiency in sugarcane production at different size group of farms.
3. To study the marketing pattern of sugarcane in the study area.

Methodology:

Meerut district of Western Uttar Pradesh was selected purposively of the present investigation because the district occupies an important place in area, production and productivity of the sugarcane in the zone. A multistage stratified random cum purposive sampling technique was used for the present study. Out of the total blocks in Meerut district, one block, namely,Sardhana was selected purposively. Complete list of all the villages of the selected block was prepared with the help of block headquarters and was arranged in chronological order.From the selected block, four villages were selected randomly. A list of sugarcane growing farmers was arranged in ascending according to their size of operational holding. Subsequently, these farmers were categorized into four size groups i.e., marginal (below 1ha), small (1-2 ha), medium (2-4 ha) and large (4 ha and above). Form the list of the farmers, 25 respondents from each village and a total of 100 were selected in probability proportion to the population. The information required from the farmer were collected from sowing to harvesting periods of its ratoon

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during the agricultural year 2010-2012 with the help of pre-tested schedule through personal interview method.

Analytical tools:

Tabular analysis was employed to work out socioeconomic profile and cost of cultivation. To examine the profitability, the cost of cultivation and returns were worked out on per ha basis. Cost of cultivation and returns from sugarcane cultivation were estimated using standardized CACP cost concept.

Cost A_1: All the variable costs excluding family labour cost and including depreciation and interest on working capital.

Cost A_2: Cost A_1 + Rent paid for leased- in land

Cost B_1: Cost A_1 + Interest on owned fixed capital assets (excluding land)

Cost B_2: Cost B_1 + Rental value of own land + Rent paid for leased-in land

Cost C_1: Cost B_1 + Imputed value of family labour

Cost C_2: Cost B_2+ Imputed value of family labour

Cost C_2*: Cost C_2 was estimated by taking into account statutory minimum or actual wage rate, whichever is higher.

Cost C_3: Cost C_2* +10 percent of cost C_2* on account of managerial function Performed by the farm

Returns over Various Cost Concepts:

Gross returns were calculated at the price to which the sugarcane crop was sold to the sugar factory and/or to the khandsari unit. Returns were calculated by subtracting costs as A_1, A_2, B_1, B_2, C_1, C_2, C_2* and cost C_3 from gross returns.

Estimation of Production Function, Marginal Value Product and Resource Use Efficiency:

(a) Estimation of production function

To examine the resources use efficiency in the production of sugarcane, the production function approach was employed. The Cobb-Douglas type of production function was used due to its wider applicability in the agricultural research. Production functions were fitted separately for all the four categories of farms for sugarcane planted and ratoon crops. The Cobb-Douglas production function of the following form was fitted is given as below.

$$Y= aX_1^{b1}X_2^{b2}X_3^{b3}X_4^{b4}X_5^{b5}X_6^{b6} \text{ --------- } X_n^{bn}$$

Where:

Y = Output in quintals per hectare

X_1 = Expenditure on irrigation in Rs.

X_2 = Expenditure on Seed in Rs.

X_3 = Labour under the crop in hectare

X_4 = Expenditure on plant protection materials in Rs.

X_5 = Expenditure on manure and fertilizer in Rs.

X_6 = Expenditure on machinery in Rs.

a= constant

and, b_1, b_2, b_3, b_4, b_5 and b_6 are the regression coefficients/ elasticity or production with respect to corresponding input variables.

The regression coefficients,their significance, standard error and co-efficient of multiple determination (R^2) were worked out. Marginal physical product and marginal value productivity were worked out for each significant input.

(b) Estimation of Marginal Value Production:

The marginal value product of resources was worked out with the help of following equation

$$MPPx_i= b_i*(Y/ X_i)$$

Where,

b_i=Elasticity of production ofith input

Y=Geometric mean of output per hectare

X_I =Geometric mean of the ith input per hectare

The MVP was worked out as follows:

MVPxi= MPPxi XPy

Where,

MPPxi = Marginal product;

$MVPx_i$ = Marginal value production ofith input.

Py = Price of output

Result and Discussion

The result to costs and returns of sugarcane planted and sugarcane ratoon crop has been worked out separately and are discussed as under.

5.2.1: Cost of Cultivation and Returns from Sugarcane Planted

The component wise various costs incurred in the cultivation of sugarcane planted crop are given in Table 1. A perusal of table reveals that, the overall cost of production of sugarcane planted was Rs. 172679.00. Of the total cost of cultivation, 64 per cent expenditure was incurred as operational cost, human labour constituted the most important component of operational cost with its share of more than 38 percent. The material cost accounted 26 per cent, among the material cost items, 11

percent expenses incurred on manure and fertilizer and seed, irrigation and plant protection accounted 8.77, 4.57 and 2.07 percent, respectively. The share of rental value of land accounted 21.72 per cent and the remaining was accounted by land revenue, depreciation on implements, interest on working capital and interest on fixed capital of the total cost of cultivation.

TABLE 1: Cost of Cultivation of Sugarcane Planted Crop.

(Rs./ha)

	Variable Cost				
Operational Cost	Farm size Group				
	Marginal	Small	Medium	Large	Overall
Family Labour	42188(24.80)	35345((20.66)	29324(16.23)	18837(10.68)	35580(20.60)
Hired Labour	6738(3.96)	13446(7.80)	22858(12.65)	31069(17.61)	13929(8.07)
Machinery	10567(6.22)	10321(6.03)	10826(5.99)	12170(6.90)	10755(6.23)
Transportation Expenditure	4882(2.87)	4943(2.89)	5067(2.80)	5490(3.11)	5003(2.90)
Sub Total (A)	64376(37.87)	64055(37.45)	68075(37.68)	67566(38.30)	65297(37.81)
Material Cost					
Seed	14547(8.56)	14805(8.65)	16517(9.14)	16328(9.25)	15136(8.77)
Manure & Fertilizer	18392(10.82)	19420(11.35)	19703(10.90)	13860(7.86)	18246(10.57)
Irrigation	8057(4.74)	7096(4.15)	8407(4.65)	8119(4.60)	7886(4.57)
Plant Protection Chemical	2966(1.75)	3148(1.84)	4013(2.22)	6099(3.46)	3574(2.07)
Sub Total (B)	43963(25.87)	44469(26.00)	48640(26.92)	44406(25.17)	44842(25.97)
Total of Variable Cost(A+B)	108343(63.76)	108524(63.44)	116715(64.59)	111972(63.46)	110139(63.78)
Other Cost					
Interest on Working Capital @ 7%	2602(1.53)	2821(1.65)	3257(1.80)	3592(2.04)	2881(1.67)
Depreciation	2540(1.49)	2687(1.57)	2722(1.51)	2940(1.67)	2654(1.54)
Land Revenue	0.00(0.00))	15(0.01)	25(0.01)	55(0.03)	14.50(0.01)
Interest on Own Fixed Capital	3492(2.06)	3963(2.32)	4014(2.22)	4336(2.46)	3793(2.20)
Rental value of Own Land	37500(22.07)	37500(21.92)	37500(20.75)	37500(21.25)	37500(21.72)
Sub Total (C)	46134(27.15)	46986(27.47)	47518(26.30)	48423(27.45)	46842(27.13)
Cost C2*Total (A+B+C)	154470(90.90)	155510(90.90)	164260(90.90)	160390(90.90)	156980(90.90)
10% of C2* for managerial work	15447(10.10)	15551(10.10)	16426(10.10)	16039(10.10)	15698(10.10)
Cost C3= (C2*+ C2*10%)	169917(100)	171061(100)	180686(100)	176434(100)	172679(100)

Cost Concept Wise Cost of Sugarcane Planted Crop on Various Sized Farms Groups

The results related to various categories of cost as per CACP cost concepts for the sugarcane plant of different sized farms are presented in Table 2. Per hectare cost A1 was found to be Rs 80108 at aggregate level. It was higher in large farms followed by medium, small and marginal farms.

It has been observed that as land holding size increases, the cost A1 also increases. Regarding cost A2, B1, B2was increased with the increase in size of farm. But cost C1 and cost C2 were more in case of medium size of farm than that of marginal, small, and large size groups. It was found that actual wages rate was higher than minimum statuary wage rate thus the cost C2 and cost C2* were same for all the farm size groups in the study area. Per hectare cost C3 is the total cost of cultivation of sugarcane planted crop, which includes the managerial cost of farmers also. Medium size group of farmers spend more amount on sugarcane cultivation (Rs180686/ha) than that of other category and the overall average cost of cultivation per hectare of planted sugarcane was Rs. 172679/ha.

TABLE 2: Concept wise Cost of Cultivation of Sugarcane Planted Crop

(Rs./ha)

Particulars	Farm size Group				
Cost	Marginal	Small	Medium	Large	Overall
Cost A 1	71290(41.96)	78702(46.00)	93395(51.68)	99722(56.52)	80108(46.39)
Cost A 2	71290(41.96)	78702(46.00)	93395(51.68)	99722(56.52)	80108(46.39)
Cost B 1	74782(44.01)	82665(48.32)	97436(53.92)	104058(58.97)	83901(48.58)
Cost B 2	112282(66.08)	120165(70.24)	134936(74.67)	141558(80.23)	121401(70.30)
Cost C 1	116970(68.84)	118010(68.98)	126760(70.15)	122895(69.65)	119481(69.19)
Cost C 2	154470(90.90)	155510(90.90)	164260(90.90)	160395(90.90)	156981(90.90)
Cost C2*	154470(90.90)	155510(90.90)	164260(90.90)	160395(90.90)	156981(90.90)
Cost C3	169917(100.00)	171061(100.00)	180686(100.00)	176434(100.00)	172679(100.00)

Cost of Production and Returns from Sugarcane Planted Crop

Table 3 shows the yield of main product, by-product and their prices, the yield of sugarcane plant were 587.50, 601.50, 622.50 and 611.50 quintal per hectare under marginal, small, medium and large category of farms and the yields of by-products were 72, 72.50, 73 and 72 quintals per hectare in the respective categories. The prices received by the farmers in the respective category wereRs. 251, Rs.251, Rs.253, and Rs.254/qtl received by the large farmers were higher than that of other categories farmers The gross returns per hectare were estimated at Rs. 151638.50, Rs.155181.50, Rs.161726.50 and Rs.159526/ ha for marginal, small, medium and large farm size, respectively. Per hectare cost of cultivation was found to be more than the gross return. Therefore, net returns per hectare were found to be negative i.e.,Rs. -18279, Rs.-15879.50, Rs.-18959.50/ and Rs.-16908 on marginal, small, medium, large size of farms, respectively.

TABLE 3: Returns from sugarcane planted on various farm size group

(Rs./ha.)

Particulars	Farm size ratoon				
	Marginal	Small	Medium	Large	Overall
Yields of Main product(qtl./ha)	587.50	601.50	622.50	611.50	603.50
Yields By product(qtl./ha)	72.00	72.50	73.00	72.00	72.00
Prices of Main product (Rs./qtl.)	251.00	251.00	253.00	254.00	252.00
Prices By product(Rs./qtl.)	58.00	58.00	58.00	58.00	58.00
Return of Main product(Rs./ ha)	147462.50	150976.50	157492.50	155321.00	152082.00
Return of by product(Rs./ha)	4176.00	4205.00	4234.00	4205.00	4205.00
Gross Return (Rs./ha)	151638.50	155181.50	161726.50	159526.00	158706.00
Return over various costs					
Cost A 1	80348.00	76479.50	68331.50	59804.00	78598.00
Cost A 2	80348.00	76479.50	68331.50	59804.00	78598.00
Cost B 1	76856.00	72516.50	64290.50	55468.00	74805.00
Cost B 2	39356.00	35016.50	26790.50	17968.00	37305.00
Cost C 1	34668.00	37171.50	34966.50	36631.00	39225.00
Cost C 2	-2832.00	-328.50	-2533.50	-869.00	-1725.00
Cost C2*	-2832.00	-328.50	-2533.50	-869.00	-1725.00
Cost C3	-18279.00	-15879.50	-18959.50	-16908.00	-13973.00
Cost of sugarcane production (Rs./qtl.)	289.00	284.00	290.00	288.00	286.00
Profit margin(Rs./qtl.)	-38.00	-33.00	-37.00	-34.00	-34.00

The loss per hectare incurred by the marginal farmers was more than the other categories of farmers in the study area which were due to increase in the production Cost C3 as the farm size increases.When we examine the per quintal cost of production of planted sugarcane crop, we found that the medium and large farmers were spending relatively larger amounts of money on field preparation, planting, seeds, fertilizers and on harvesting for producing one quintal of sugarcane than other categories of farmers.

The profit margin on marginal, small, medium,large and overall farm size was Rs.-38,Rs.-33,Rs.-37andRs. -34/qtl, respectively. It is clear from the study that as the size of farm increases, the cost of crop production also increases. The farm size and cost of production of planted crop has direct relation with each other and thus due to the lowest cost of production among all farm size groups the marginal farmer having highest loss of Rs.16118.50/ha in case of sugarcane planted crop and the loss was also found to be highest in case of marginal farmers. On an average, farmswere having the loss of about Rs. 13973/ha from the sugarcane planted cultivation.

Component-wise Cost of Cultivation of Sugarcane Ratoon Crop

Table 4 reveals that the overall cost of production of sugarcane ratoon was Rs. 129753 which consists of 41 percent of the operational cost and 14 percent of the material cost. In the operational cost, more than 31 percent expenses incurred on human labour alone and in case of machinery and transportation cost, it was about 5 percent of the total cost. Within the material cost; expenditure on irrigation, manure and fertilizer, and plant protection chemicals were 6.28, 4.64 and 2.75 percent, respectively. The rental value of land was28.90 percent of the total cost of cultivation and the remaining was accounted by land revenue, depreciation on implements, interest on working capital and interest on fixed capital.As we move from the marginal to large farm size; the total cost, operational cost, and material cost increase alongwith increase in the farm size. The share of rental value of own land in the total cost of sugarcane ratoon cultivation was found to be decreasing from marginal to large farm size. Interest on working and fixed capital was observed to be positively related with size of farm. The share of land revenue was the least in the total cost.

TABLE 4: COST OF CULTIVATION OF SUGARCANE RATOON CROP

(Rs/ha)

	Variable Cost				
Operational Cost	Farm size Group				
	Marginal	Small	Medium	Large	Overall
Family Labour	32872(26.11)	28158(21.76)	20030(14.87)	10070(7.28)	26850(20.69)
Hired Labour	6973(5.54)	12707(9.82)	23020(17.09)	33652(24.31)	14224(10.96)
Machinary	5662(4.50)	5804(4.49)	6262(4.65)	62964.55)	5868(4.52)
Total transportation Expenditure	6058(4.81)	6481(5.01)	6830(5.07)	7243(5.23)	6429(4.95)
Sub Total	51565(40.96)	53150(41.07)	56142(41.69)	57261(41.37)	53371(41.13)
Material Cost					
Seed	–	–	–	–	–
Manure & Fertilizers	5738(4.56)	6141(4.75)	6348(4.71)	6435(4.65)	6016(4.64)
Irrigation	8056(6.40)	8210(6.34)	8407(6.24)	8119(5.87)	8153(6.28
Plant Protection Chemical	2966(2.36)	3148(2.43)	4013(2.98)	6099(4.41)	3574(2.75)
Sub Total	16760(13.31)	17499(13.52)	18768(13.94)	20653(14.92)	17743(13.67)
Total of Variable Cost(A+B)	68325(54.26)	70649(54.59)	74910(55.62)	77514(55.99)	71114(54.80)
Other Cost					
Interest on Working Capital (7%)	2602(2.07)	2821(2.18)	3257(2.42)	3592(2.60)	2881(2.22)
Depreciation	2540(2.02)	2687(2.08)	2722(2.02)	2940(2.12)	2654(2.05)
Land Revenue	0.00(0.00)	15(0.01)	25(0.02)	55(0.04)	14.50(0.01)
Interest on owned Fixed Capital	3492(2.77)	3963(3.06)	4014(2.980	4336(3.13)	3793(2.92)
Rental value of owned land	37500(29.78)	37500(28.98)	3750027.85)	37500(27.09	37500(28.90)
Sub Total	46134(36.64)	46986(36.31)	47518(27.85)	48423(34.98)	46842(36.10)
Cost C_2* Total (A+B+C)	114459(90.90)	117635(90.90)	122428(90.90)	125836(90.90)	117956.50(90.90)
10%C_2*for managerial work	11445.90(10.10)	11763.50(10.10)	12242.80(10.10)	12583.60(10.10)	11795.65(10.10)
CostC_2(C_2*+ C_2*10%)	125905.90(100)	129398.50(100)	134670.80(100)	138419.60(100)	129752.65(100)

NOTE: Figures in the parentheses indicate the percentage to the total

Concept-wise Cost of Sugarcane Ratoon Crop

The results related to various categories of cost for the sugarcane ratoon on different farm sizes are presented in table 5, which indicates that per hectare overall cost A_1 was Rs. 49813 and on marginal, small, medium and large farm size groups it was Rs. 40595.50, 48014, 60884 and 73930,respectively, which was 32.24, 37.10, 45.20 and 53.41 per cent of "Cost C_3" in the respective category.It has also been observed from the table that as the holding size increases Cost A1 also increases. Cost A_2, B_1, B_2, C_1,C_2 and C_2* on per hectare basis also showed the increasing trends with the increase in farm sized groups. Per hectare cost C_3 is the total cost of cultivation of sugarcane ratoon crop which includes the managerial cost of farmers also. Large farmers were found to spend more amount on sugarcane cultivation i.e.,(Rs.138419.60 /ha), which is 1.09 times more than that of marginal farmers Rs.125905.90/ha, the average cost of cultivation on per hectare of sugarcane ratoon was Rs. 129752.65/ha for all the farms in the study area.

TABLE 5: Cost Concept-wise Cost of Sugarcane Ratoon Crop

(Rs/ha)

Particulars	Farm size Group				
Cost of cultivation	Marginal	Small	Medium	Large	Overall
Cost A 1	40595(32.24)	48014(37.10)	60884(45.20)	73930(53.41)	49813.50(38.39)
Cost A 2	40595(32.24)	48014(37.10)	60884(45.20)	73930(53.41)	49813.50(38.39)
Cost B 1	44087(35.02)	51977(40.16)	64898(48.19)	78266(56.54)	53606.50(41.31)
Cost B 2	81587(64.80)	89477(69.14)	102398(76.03)	115766(83.63)	91106.50(70.21)
Cost C 1	76959(61.12)	80135(6192)	84928(63.06)	88336(63.81)	80456.50(62.00)
Cost C 2	114459(90.90)	117635(90.90)	122428(90.90)	125836(90.90)	117956.50(90.90)
Cost C2*	114459(90.90)	117635(90.90)	122428(90.90)	125836(90.90)	117956.50(90.90)
Cost C3	125905.90(100.00)	129398.50(100.00)	134670.80(100.00)	138419.60(100.00)	129752.65(100.00)

Cost of Production and Returns from Sugarcane Ratoon Crop

Table 6 shows the yield of sugarcane ratoon per hectare on marginal, small, medium and large farms which were found to be 803, 842, 869 and 897qtl./ha and the yields of by-product was 94, 95.50, 96and 97quintal per hectare in the respective categories. The prices of sugarcane received by the farmers of the respective size groups were Rs. 251, Rs.251, Rs.253, and Rs.254/qtl. From table 5, it can be seen that price received by the large farmers were higher than that of marginal, small and medium farmers. The price of sugarcane crop was Rs.58 per quintal in the market for all the categories taken together. Gross return was calculated by the addition of value of main product and value of by-product. The gross return per hectare was Rs. 206995, Rs.216881, Rs.225485and Rs. 233464 in the respective categories of farms. The net return was worked out by deducting the total cost from the gross return per hectare. Per hectare net return was found to be Rs. 81090, Rs.87483, Rs.90815, and Rs.95045 with the overall average net return of Rs. 91024.

TABLE 6: Per Hectare Returns from Sugarcane Ratoon Crop

(Rs./ha)

Particulars	Farm size groups				
	Marginal	Small	Medium	Large	Overall
1	2	3	4	5	6
Yields of Main product(qtl./ha)	803.00	842.00	869.00	897.00	845.00
Yields By product(qtl./ha)	94.00	95.50	96.00	97.00	96.00
Prices of Main product (Rs./qtl.)	251.00	251.00	253.00	254.00	252.00

1	2	3	4	5	6
Prices By product(Rs./qtl.)	58.00	58.00	58.00	58.00	58.00
Return of Main product(Rs./ ha)	201553.00	211342.00	219857.00	227838.00	212940.00
Return of by product(Rs./ha)	5442.00	5539.00	5568.00	5626.00	5568.00
Gross Return	206995.00	216881.00	225485.00	233464.00	218508.00
Returns over various costs					
Cost A_1	166400.00	168867.00	164601.00	159534.00	168694.50
Cost A_2	166400.00	168867.00	164601.00	159534.00	168694.50
Cost B_1	162908.00	164904.00	160587.00	155198.00	164901.50
Cost B_2	125408.00	127404.00	123087.00	117698.00	127401.50
Cost C_1	130036.00	136746.00	140557.00	145128.00	138051.50
Cost C_2	92536.00	99246.00	103057.00	107628.00	100551.50
Cost C_3*	92536.00	99246.00	103057.00	107628.00	100551.50
Cost C_3	81090.00	87483.00	90815.00	95045.00	887560.00
Cost of sugarcane production (Rs./qtl.)	156.00	153.00	154.00	154.00	153.56
Profit margin(Rs./qtl.)	95.00	98.00	99.00	100.00	98.44

The profit margin per hectare obtained by the large farmers was more than that of the other categories of farmers in the study area. This was due to economies of scale enjoyed by the large farm.. The table also revealed that the overall per quintal cost of production of sugarcane ratoon crop was Rs. 153.56 and the profit margin of Rs. 98.44 per quintal. The cost of production per quintal for marginal, small, medium and large sized farmers were Rs. 156, Rs.153, Rs.154 and Rs.154 and profit margins Rs.95, Rs.98, Rs.99 and Rs.100 per quintal respectively.

Determination of Resource Productivity and Resource use Efficiency in Sugarcane (Planted and Ratoon) Production.

In order to identify the factors affecting the production in sugarcane (planted and ratoon), regression analysis was performed using Cobb Douglas production function for the purpose of production function analysis. Cobb-Douglas function was found to be best fit because of high R2 value.

Regression Coefficient and Coefficient of Multiple Determinations.

Sugarcane Planted

The regression coefficient of irrigation was found to be positive for all farm size groups but it was significant for small, medium and large. However, the regression coefficient of the seed turned out to be positive for marginal and medium farms and negative for small and large farms. The elasticity coefficient of human labour turned out to be positive and insignificant for marginal, small, and large farm size group and it was negative and significant for the medium farmer group. The regression coefficient of expenditure on manure and fertilizer was found to be positive for all farm sized groups and found significant for marginal, medium and large categories. As regard the coefficients of expenditure on plant protection, the coefficient was positive and insignificant for marginal, small and medium farm size groups but for large farme'r the coefficient was found to be negative. The elasticity coefficient of machine labour turned out to be positive and insignificant for marginal and large farms size group and negative and significant, for medium size group. The value of the coefficient of multiple determinations (R2)for marginal, small, medium, and large farms were 0.9288, 0.7967, 0.9886, and 0.9517, respectively. The value of R2 from the fitted production functions show that 92.88 percent, 79.67 percent, 98.86 percent and 95.17 per cent of variation in the total value of output, respectively on the all sizes of farms was explained by the variables included in the equation, while rest of the variation in the yields was explained by those factors which had not been taken into account (Table 7).

TABLE 7: Regression Coefficient and Multiple Determinations in the Fitted Production Function for Sugarcane Planted

Farms size Groups	Intercept in log	Expen on Irrigation (Rs.)	Expen on Seed (Rs.)	Expen on Human Lab. (Rs.)	Expen on Plant prot. (Rs.)	Expen on Manure & ferti. (Rs.)	Expen on Machine (Rs.)	R_2
		X_1	X_2	X_3	X_4	X_5	X_6	
Marginal	1.1909	0.0303 (0.0378)	0.8463*** (0.0390)	0.0126 (0.0242)	0.0176 (0.0116)	0.0251** (0.0115)	0.0064 (0.0093)	0.9288
Small	4.3138	0.1969** (0.0851)	-0.0015 (0.0661)	0.0031 (0.0910)	0.0078 (0.0118)	0.0064 (0.046)	-0.0095 (0.0129)	0.7967
Medium	3.7727	0.7094*** (0.2101)	0.0023 (0.0039)	-0.4030*** (0.1232)	0.0143 (0.0157)	0.1113*** (0.0290)	- 0.0237** (0.0100)	0.9886
Large	3.1617	0.2723** (0.1090)	-0.0401 (0.0876)	0.1650 (0.2066)	-0.0332 (0.0218)	0.0829*** (0.0406)	0.01007 (0.0097)	0.9517

NOTE: Figures in the parentheses are the standard errors of the coefficients.

*, ** and ***Significant at 10%, 5% and 1% level of significance, respectively.

Sugarcane (ratoon)

The regression coefficients for the fitted production function for sugarcane (ratoon) along with the coefficients of multiple determinations are given in table 8. The regression coefficient for the expenditure on irrigation was found to be positive and significant for marginal, small and medium farms size groups, respectively. But the value of regression coefficient was found negative for large farmers. The regression coefficient of the expenditure on Human labour was found to be positive and insignificant in case of small and large farms. The coefficients was found to be positive and significant m arginal and medium farms, the regression coefficient of the expenditure on plant protection measures was found to positive for all size groups but insignificant in case of medium farmers. The regression coefficient of plant protection was found significant for marginal and small farms. For large category, it was significant.. As regard the regression coefficient of the variable expenditure on manure and fertilizer, it was found to be positive for marginal, small and large farmers and negative for the medium farms. The value of coefficients for small and Largefarms were found to be significant, For medium farms, the coefficient was observed to be negative and significant. However, the coefficient of expenditure on machinery labour was observed to be positive in case of all farms size groups and in case of large farm it was found to be insignificant. The value of the coefficients of marginal, small and medium was found to be significant.

TABLE 8: Regression Coefficient and Multiple Determinations in the Fitted Production Function for Sugarcane Ratoon

Farms size Groups	Intercept in log	Expen on Irrigation (Rs.)	Expen on Seed (Rs.)	Expen on Human Lab. (Rs.)	Expen on Plant prot. (Rs.)	Expen on Manure & ferti. (Rs.)	Expen on Machine (Rs.)	R_2
		X_1	X_2	X_3	X_4	X_5	X_6	
Marginal	3.7169	0.3420*** (0.0246)	-	0.0338 ** (0.0159)	0.0045 *** (0.0092)	0.0011 (0.0013)	0.0007 *** (0.0017)	0.9258
Small	0.0688	0.5650*** (0.0795)	-	0.0840 (0.0736)	0.5906 *** (0.1126)	0.1161 *** (0.1542)	0.0929*** (0.1018)	0.9866
Medium	1.5114	0.8968*** (0.2109)	-	0.0895** (0.2829)	0.2532 (0.1645)	-0.5815* (0.7465)	0.3993** (0.5829)	0.8680
Large	3.1382	-0.3510* (0.1930)	-	0.0878 (0.333)	0.1700* (0.2477)	0.0312** (0.1721)	0.6337 (0.5826)	0.6469

NOTE: Figures in the parentheses are the standard errors of the coefficients

*, ** and ***Significant at 10%, 5 % and 1% level of significance, respectively

The coefficient of multiple determinations R2 on marginal, small, medium and large farms were 0.9258, 0.9866, 0.8680 and 0.6469, respectively. The value of R2 from the fitted production function show that 92.58 percent, 98.66 percent, 86.80 percent, and 64.69 percent variation in the total value of yield, respectively on the all sizes of farms were explained by the independent variables considered in the function, respectively. Whereas the rest of the variation in the output would be attributable to factors exogenous to the function or to error terms.

The Marginal Value Productivities of Various Resources

In order to examine the resources use efficiency in crop production, the difference between marginal value productivity (MVP) and their acquisition cost, i.e., marginal factor cost were worked out for each of the resource considered in production function. The economic interpretation of MVP has been made with respect to only those variables whose elasticity coefficients were found to be statistically significant.

Marginal Value Productivity of Resources of Sugarcane Planted

The marginal value productivities (MVPs) of different resources used in Sugarcane (planted) for all of size group are given in Table 9, The table indicates that the MVP of expenditure on irrigation, seed, human labour, plant protection, manure and fertilizer and machine labour were Rs.0.45, Rs.7.09, Rs.0.03, Rs.0.72, Rs.1.21 and Rs.0.07, respectively. In case of marginal farmers, an increase in one rupee expenditure on these items at their geometric mean level would increase the gross return by Rs.0.45, Rs.7.09, Rs.0.03, Rs.0.72, Rs.1.21 and Rs.0.07, respectively. The higher marginal value productivity of seed on marginal farms is due to low level of resources use.

Perusal of Table9 further indicates that the MVP of expenditure on irrigation, seed, human labour, plant protection, manure and fertilizer and machine labour were Rs.1.12,Rs.1.43, Rs.6.20, Rs.0.34,Rs.1.56 and Rs.0.05, respectively for small farm, these MVPsindicate that increase in one rupee expenditure on such items would increase the gross return by Rs.1.12, Rs.1.43,Rs.6.20,Rs. 0.34,Rs. 1.56 and Rs.0.05, respectively. The maximum MVP of seed on small farms shows the low level use of resources.

In case of medium farm, the MVP of expenditure on irrigation, seed, human labour, plant protection, manure and fertilizer and machine labour turned to be Rs.10.61, Rs.0.01, Rs.0.97, Rs. -0.43, Rs.0.71 andRs. -0.27, respectively. This represent that one rupee expenditure increase on these resources at their geometric mean level, would increase the gross return by Rs.10.61,Rs.0.01, Rs.0.97 and Rs.0.71 ,respectively, while a one rupee increase expenditure on Plant protection and machine labour would decrease the gross return by Rs.0.43 and 0.27. The negative marginal value productivity of plant protection and machine labour indicates the over utilization of these resources.

In case of large farmer, the MVPsof expenditure on irrigation, seed, human labour, plant protection, manure and fertilizer and machine labour were turned out to be Rs. 12.07, Rs.-0.51, Rs.0.61,Rs. -1.43, Rs.0.95and 0.17, respectively. This indicates that one rupee expenses on these items at their geometric mean level would increase the gross return by Rs.12.07, Rs.0.61, Rs.0.95, Rs.0.17 and Rs.8.28, respectively. But in case of seed and plant protection, that decrease the gross return by Rs.0.51 and Rs.1.43. It was observed that there was under utilization of irrigation resources and over utilization of seed and plant protection measures.

Moreover, the inter farm size group comparison of the MVP of these resources whose coefficient were statistically significant for more than one size groups of farm shows that the MVP of expenditure on irrigation was higher for marginal farms as compare small, medium and large categories. In case of medium and large farm size group, expenditure on plant protection measures was found to be over utilized than other categories.

TABLE 9: The Marginal Value Productivities of Various Resources and their Acquisition Cost for Sugarcane Planted Crop

SI. NO	Particulars	Resources					
		Irrigation	Seed	Human Labour	Plant Protection	Manure and fert.	Machine labour
1	2	3	4	5	6	7	8
a.	M V Ps	0.4589	7.0984	0.0315	0.7256	1.2195	0.0732
b.	Price of input	1.0350	1.0350	1.0350	1.0350	1.0350	1.0350
c.	Difference	-0.5761	6.06***	-1.0034	-0.3093	0.18**	-0.9617
d.	S E	0.0378	0.0390	0.0242	0.0116	0.0115	0.0093
e.	Calculated `t` value	0.8030	21.6770	0.5225	1.5155	2.1822	0.6856

1	2	3	4	5	6	7	8
	Small						
a.	M V Ps	1.1253	1.433	6.200	0.3451	1.56175	0.0556
b.	Price of input	1.035	1.035	1.035	1.035	1.035	1.035
c.	Difference	0.09**	0.398	5.16***	-0.6899	0.52675	-0.9793
d.	S E	0.0851	0.0661	0.0910	0.0118	0.0460	0.0129
e.	Calculated `t` value	2.3134	-0.0234	0.0343	0.6628	0.1396	-0.7394
	Medium						
a.	M V Ps	10.614	0.0175	0.9709	-0.43428	0.7105	-0.2761
b.	Price of input	1.035	1.035	1.035	1.035	1.035	1.035
c.	Difference	9.57***	-1.0175	-0.06***	-1.4692	-0.3244	-1.3111
d.	S E	0.2101	0.0039	0.1232	0.0157	0.0290	0.0100
e.	Calculated `t` value	3.3762	0.5908	-3.2704	0.911272	3.8314	-2.3594
	Large						
a.	M V Ps	12.071	-0.5116	0.6139	-1.4356	0.9520	0.1725
b.	Price of input	1.035	1.035	1.035	1.035	1.035	1.035
c.	Difference	11.03**	-1.5466	-0.4211	-2.4706	-0.083*	-0.8625
d.	S E	0.1090	0.0876	0.2066	0.0218	0.0406	0.0097
e.	Calculated `t` value	2.4976	-0.457	0.7988	-1.5208	2.040	1.0346

The Marginal Value Productivities of Various Resources of Sugarcane Ratoon

The marginal value productivities (MVPs) of different resources used in Sugarcane (ratoon) for all size group are given in Table 10. This table indicates that the MVP of expenditure on irrigation, human labour, plant protection, manure and fertilizer and machine labour were Rs.7.28, Rs.0.14, Rs.0.22, Rs.0.05, and Rs.0.05 respectively in case of marginal farmers. Marginal productivity of these resources indicate the increase in one rupee expenditure on these resources at their geometric mean level, would increase the gross return by were Rs.7.28, Rs.0.140.22, Rs.0.057, and Rs.0.051, respectively. The higher MVP of irrigation on marginal farms is due to low level use of resources.

TABLE 10:THE MARGINAL VALUE PRODUCTIVITIES OF VARIOUS RESOURCES AND THEIR ACQUISITION COST FOR SUGARCANE RATOON.

SI. NO	Particulars	Resources					
		Irrigation	Seed	Human Labour	Plant Protection	Manure and fert.	Machine lab.
	Marginal						
a.	M V Ps	7.2870	_	0.1478	0.2213	0.0573	0.0519
b.	Acquisition cost	1.035	_	1.035	1.035	1.035	1.035
c.	Difference	6.252***	_	-0.8871*	-0.8136	-0.9776	-0.9830
d.	S E	0.0246	_	0.0159	0.0092	0.0013	0.0017
e.	Calculated t` value	13.8839	_	2.1195	0.4937	0.8162	0.4030
	Small						
a.	M V Ps	26.706	_	0.4508	41.1364	4.1473	3.5123
b.	Acquisition cost	1.035	_	1.035	1.035	1.035	1.035
c.	Difference	25.67***	_	-0.584	40.10***	3.1174	2.4773**
d.	S E	0.0795	_	0.0736	0.1126	0.1542	0.1018
e.	Calculate `t` value	7.1070	_	1.1409	5.2451	0.7532	0.913
	Medium						
a.	MVPs	24.3447	_	0.474624	14.40113	-20.9053	14.5537
b.	Acquisition cost	1.035	_	1.035	1.035	1.035	1.035
c.	Difference	23.30***	_	0.560	13.3642	21.94	13.51756

1	2	3	4	5	6	7	8
d.	S E	0.2109	_	0.2829	0.1645	0.7465	0.5829
e.	Calculated `t` value	4.2520	_	0.3164	1.5389	-0.7789	0.6850
	Large						
a.	MVPs	-9.8263	_	0.4878	10.855	1.1870	24.647
b.	Acquisition cost	1.035	_	1.035	1.035	1.035	1.035
c.	Difference	10.86*	_	-0.5471	9.8207	0.1520	23.61
d.	S E	0.1930	_	0.3331	0.2477	0.1721	0.5826
e.	Calculated `t` value	-1.818	_	0.2635	0.6862	0.1817	1.0876

Perusal of Table 10 further indicates that the MVP of expenditure on irrigation, human labour plant protection, manure and fertilizer and machine labour were Rs.26.70, Rs.0.45, Rs.41.13, Rs.4.14, and Rs.3.51 for small farm, these indicates that an increase of one rupee expenditure onthese resources would increase the gross return by Rs.26.70, Rs.0.45, Rs.41.13, Rs.4.14, and Rs.3.51, respectively.

In case of medium farm the MVP of expenditure on respective items turned to be Rs.24.34, Rs.0.47, Rs.14.40, Rs.-20.90, and Rs.14.55, respectively. This represents that an increase of one rupee expenditure on these resources at their geometric mean level, would increase the gross return by Rs.24.34, Rs.0.47, Rs.14.40 and Rs.14.55, respectively, while increase one rupee expenditure on manure and fertilizers will reduce the gross return by Rs.20.90.

MVPsfor large farmer expenditure on irrigation, human labour, plant protection, manure and fertilizer and machine labour examined werefound to be Rs. -9.82, Rs.0.48, Rs.10.85, Rs.1.18 and Rs.24.64, respectively. TheseMVPs indicate that one rupee expenses on human labour, anure & fertilizer and machine labour at their geometric mean level, would increase the gross return by Rs 0.48, Rs.10.85, Rs.1.18 and Rs.24.64, respectively, but an increase of one rupee expenditure increase on irrigation would decrease the gross return by Rs.9.82.

Moreover, the inter farm size group comparison of the MVPs of these resources whose coefficients were statistically significant on more than one size groups of farm shows that the MVP of expenditure on irrigation was higher on small, medium and marginal farms as compare to large farms.This occurred due to over utilization of such resources in case of large farms. Negative MVP of expenditure on machine labour showed over utilization of the resources.

Marketing of Sugarcane

Sugarcane marketing is a very simple and transparent process in the study area. The sugarcane produces was transferred directly from producer to the sugar mills. The sugarcane producers dispose of their produce either on the weighing centers established by the sugar mills of itself either by the own transport as hired one. In this process, the sugarcane growers are required to pay only the transport charges and other charges are being paid by them.

In the study area, marketing of sugarcane by middleman and commission agent was negligible. The sugarcane growers sell their produce directly to the sugar mills or to sugarcane crushers. The marketing channels exist in the study area are given as under :

(i) Producer -village sugar industries (kolhu, crausher etc.)

(ii) Producer - sugar factory

TABLE 11: Disposal and Marketing of Sugarcane

SI. No.	Category	Total product (Per farm in qtls.)	Human cons. use	Supply to Village industry	Supply to Sugar mills
1.	Marginal	390.87	4.5(1.15)	57(14.58)	329.37(84.26)
2.	Small	984.56	6.8(0.69)	84.50(8.58)	893.26(90.72)
3.	Medium	1718.82	8.7(0.50)	52(3.02)	1657.61(96.43)
4.	Large	3634.31	12.45(0.34)	38.50(1.05)	3583.36(98.59)
5.	Over all	1154.19	6.71(0.58)	60.44(5.23)	1087.58(94.22)

Figures in parentheses indicate percentage of total.

In the study area, about 94 per cent Sugarcane produce was supplied to Sugar mills and 5 percent to the village industry i.e. crushers, and less than one percent being utilized for home consumption. The table 5.4.1 shows that category wise harvesting of sugarcane, it was observed that as the farm size increases, the proportion of sugarcane supplied to sugar mills also increases. Supply of sugar cane varies from 84 percent to 98.59 percent to the sugar mills and the rest was sold to the crushers. The share of supply to the crushers was maximum by marginal farmers followed by small, medium and large.

Summary and Conclusions

Sugarcane occupies an important place in terms of area and production in Western Uttar Pradesh. The cost of cultivation of sugarcane planted was Rs 172679, in which share of operational cost, land rent and material costs was 38, 22 and 26 percent, respectively. The cost of cultivation of sugarcane ratoon was found to be Rs 129752.65 with share of operational cost, land rent and material cost of 41, 29 and 14 percent respectively. It may be concluded that the sugarcane planted was loss-incurring as compared to activity sugarcane ratoon production which was found to be profit making, agricultural activity with low risk. It is required to increase the profit margin further. Resources are to be utilized at their optimum level, rather, than under or over utilization. Marketing facilities need to be improved to increase the productivity per unit of cultivated area.

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Agricultural Sustainability and Subsidised Power Supply: Reflections from Haryana

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Abstract

Groundwater plays a significant role in Indian agriculture particularly for irrigation. It has been extracted with electric and diesel pump sets. Most of the state governments are supplying power to agriculture sector at highly subsidised rates or free of cost, Haryana is not exception to it. As per existing tariff policy in Haryana, various categories of consumers are being charged tariff at different rates without any socio-economic rationale. This implies that tariff rates do not have any systematic relationship with the cost of supply. Charging certain consumer categories at a price which was significantly less than its cost of supply encourages wasteful consumption of electricity and loss of revenue to the power utilities on the one hand and over exploitation of the groundwater on the other. Subsidised power supply motivates peoples to utilise the resources inefficiently. It has implications for sustainability in agriculture and electricity sectors. Due to excess utilisation of ground water in some major crops, the problems of water table depletion and soil degradation has appeared in the study area. There is lack of awareness among farmers about the implications of excess utilisation of precious ground water on the one hand, water harvesting and energy savings techniques on the other. There are hardly any efforts from the state government to motivate farmers for efficient utilisation of electricity and ground water. The state government should take initiatives to motivate farmers to adopt less water intensive cropping pattern and solar pump sets to reduce the burden of power subsidies on public exchequer and ground water. There is an urgent need to ensure metered power supply at consumer ends, particularly agriculture connections, on priority basis. It will promote efficiency and viability in the power system and sustainability in agriculture.

Keywords : Groundwater depletion, subsidised power supply, sustainable agriculture, excess utilization.

Section I

Electricity has a critical influence on the performance of the agricultural sector in India. Being the most versatile source of energy, it has been used in a variety of agricultural operations, particularly for pumping groundwater. The price of electricity supplied to agriculture sector in most of the states is heavily subsidized.

Since early seventies, the state governments adopted certain policies like highly subsidised supply of electricity to the farmers for irrigation in the agricultural sector at a flat rate. The electricity was usually not metered. These two policies, the subsidised supply at a flat rate and unmetered supply, played havoc with financial management and administration of the power sector.

Due to unmetered supply to agriculture, energy accounting system became ineffective and in fact collapsed. In such a situation when more than half of the electricity supply is not metered at consumer ends, it becomes hardly possible to estimate the actual technical T&D losses and the pilferage of power. Obviously, the beneficiaries of the unmetered supply have developed a vested interest in the system to remain unaccountable. A major part of pilferage and theft of electricity has been shown as consumption in the agricultural sector.

Under reformed regime, it is not expected that the state government will interfere in day to day functioning of the power system particularly in tariff setting, but there is close nexus among power utility/ies, state government and regulatory commission in the state, which has serious implications for the financial health of power utilities as well as the state government. The power utilities in Haryana are providing electricity at highly subsidized rates particularly to agricultural consumers on the directions of the state government and consequently the financial burden of agriculture power subsidies on public exchequer of the state government has aggravated over the period, which hampered the growth of various social and economic sectors.

The study intends to highlight the implications of the subsidized power supply for sustainable agriculture in the state of Haryana. The study focuses broadly on perception of agriculture households regarding agriculture power subsidies which is very pertinent to analyse the implications for sustainability in agriculture sector.

Objectives of the study

- To seek the perception of the households regarding utilisation of electricity and ground water in agriculture sector.
- To analyse the environmental impact of agriculture power subsidies.

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Research Methodology and Data Base

The study is based on primary as well as secondary data. For primary data collection, we have adopted multi-stage random technique for selection of agriculture households on the basis of some common indicators. A sample size of 540 households was drawn selecting 180 households each from three operational circles, namely, Karnal, Bhiwani and Jind. A list of households who have electric tubewell connection was prepared. The ultimate agricultural households were selected randomly. The data from respondents was collected with the help of well designed questionnaire.

Secondary data was collected from various publications of Government of Haryana, Regulatory Commission, Power Utilities, Central Electricity Authority, Planning Commission and Power Finance Corporation.

The study has been divided into three sections. Section one deals with introduction including objectives and research methodology of the study. Section deals with the analysis of the perception of households regarding agricultural power subsidies. The Section three highlights concluding remarks.

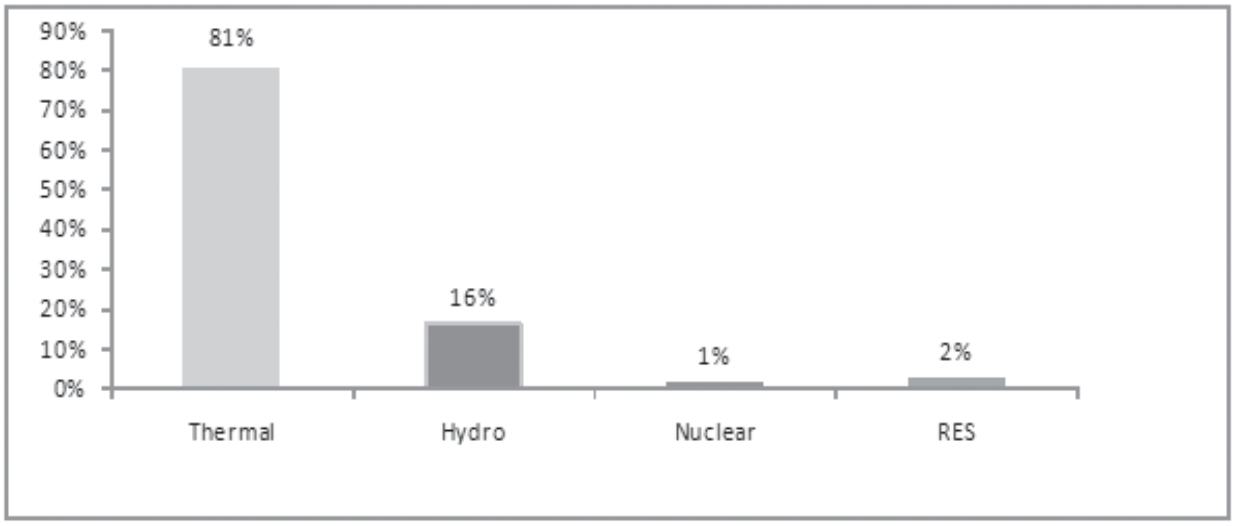
Section II

Haryana State came into existence with the reorganisation of the State of Punjab as on November 1, 1966. Haryana State Electricity Board (HSEB) was created in May 1967 by bifurcating the Punjab State Electricity Board (PSEB). HSEB was incorporated as an integrated utility to discharge the generation, transmission and distribution functions in the State. Haryana was the second state in India after Orissa to adopt and implement power sector reforms under the Haryana Electricity Reforms Act 1997 (HERA), enacted in 1997 and which came into force on 14th August, 1998.

The Haryana Electricity Regulatory Commission was established in August 1998 to regulate power sector in the State. After enforcement of HERA, the electricity generation business was handed over to Haryana Power Generation Corporation Ltd. (HPGCL). The Transmission of electricity was controlled by Vidyut Prasaran Nigam Ltd. (HVPNL). Two distribution companies i.e., Uttar Haryana Bijli Vitran Nigam Ltd (UHBVNL) and Dakshin Haryana Bijli Vitran Nigam Ltd (DHBVNL) have been engaged in distribution business. UHBVNL was vested with the distribution business in the North Zone of Haryana comprising Ambala, Yamuna Nagar, Karnal, Kurukshetra, Jind, Rohtak and Sonepat circles. The DHBVNL was vested with the Distribution business in the southern zone of Haryana comprising of Bhiwani, Faridabad, Gurgaon, Hisar, Narnaul and Sirsa circles. However, in July 2013, Jind circle has been transferred to DHBVNL.

It has been observed from the available literature that development of power sector was given a high priority during the different plans. Consequently, installed capacity has increased over the period. The Graph 1 presents the composition of total generation capacity in Haryana. The total installed generation capacity was estimated as 8589 MW as on 30.06.2014, out of which 81 per cent and 16 per cent was sourced from Thermal and Hydro power plants respectively. The share of Nuclear plant was 1 per cent and Renewable Energy Sources (RES) 2 per cent in total installed capacity.

Graph 1: Source wise Share in Total Installed Capacity (in per cent) (in per cent)



Due to quite an impressive expansion in the electricity supply system, the availability of electricity has increased significantly over the years though supply did not keep pace with electricity demand. Haryana state's own generating capacity is 5300.50 MW, out of which 98.83 per cent is coal based thermal and 1.17 per cent is hydro.

Besides the own generating capacity, it also has dedicated shares in the power plants managed and operated by Bhakra Beas Management Board (BBMB) and Central Power Undertakings (CPUs) such as NTPC, NHPC and NPC. It has also been observed that technical efficiency of various thermal power stations in Haryana was below the norms.

Electricity Consumption Pattern in Haryana

Haryana, being close to Delhi, the national capital, industrialisation and urbanization has spread at a relatively rapid pace particularly in the areas located in the National Capital Region (NCR). The accelerated rate of growth in a wide range of economic activities afforded a relatively high growth in energy consumption by various categories of consumers.

TABLE 1: Electricity Consumption Pattern in Haryana (MU)

Particulars		Domestic	Commercial	Industrial	Agricultural	Others	Total
2009-10	Utilities	4115	1520	5056	8722	2297	21710
		(18.95)	(7.00)	(23.29)	(40.18)	(10.58)	(100)
	HERC	4055	1395	5722	7474	1749	20395
		(19.88)	(6.84)	(28.06)	(36.65)	(8.58)	(100)
2010-11	Utilities	5649	1948	8485	8624	4262	28968
		(19.50)	(6.72)	(29.29)	(29.77)	(14.71)	(100)
	HERC	5338	1828	8249	7473	2519	25407
		(21.01)	(7.19)	(32.47)	(29.41)	(9.91)	(100)
2011-12	Utilities	-	-	-	-	-	-
	HERC	5950	2071	10286	6787	3044	28138
		(21.15)	(7.36)	(36.56)	(24.12)	(10.82)	(100)
2012-13	Utilities	7438	4316	9524	9769	2472	33519
		(22.19)	(12.88)	(28.41)	(29.14)	(7.37)	(100)
	HERC	6835	3716	8742	7520	2405	29218
		(23.39)	(12.72)	(29.92)	(25.74)	(8.23)	(100)
2013-14	Utilities	7550	3448	10567	9367	2427	33356
		(22.63)	(10.37)	(31.68)	(28.07)	(7.28)	(100)
	HERC	7498	3333	10058	8109	2379	31377
		(23.90)	(10.62)	(32.06)	(25.84)	(7.58)	(100)
Growth Rate of sale approved by HERC (2009-10 to 2013-14)		13.08	19.03	11.94	1.64	6.35	9.00

Source: HERC-Tariff Orders of various years.
Note: Utilities- Sale projections, HERC- Sale approved

It is pertinent to note that total electricity sale in the state has increased over the period of time. Table (1) presents that total electricity sale (approved) increased from 20395 MU in 2009-10 to 31377 MU in 2013-14 at a growth rate of 9 per cent. The domestic and agricultural consumers, which enjoyed subsidised power supply, jointly captured 49.74 per cent of total electricity sale in 2013-14 as against 56.53 per cent in 2009-10. The relative share of industrial, commercial and other sectors was 32.06 per cent, 10.62 per cent and 7.58 per cent respectively during the year 2013-14. It is also clear from the data that there was a significant difference between the projections made by the utilities and sales approved by the Regulatory Commission that needs to look into.

The demand of electricity for agriculture sector has increased at a rate of 1.64 per cent (from 7474 MU to 8109 MU) during the period 2009-10 to 2013-14. However, the actual estimation of the demand of electricity for agriculture sector was not possible due to a significant proportion of un-metered power supply to the sector. The data regarding agricultural consumption should be used with caution.

Transmission and Distribution Losses (T&D losses)

Energy losses consist of technical losses and commercial losses. Technical losses occur due to inherent characteristics of the generation, transmission and distribution system whereas the commercial losses are the result mainly of power theft & pilferage and poor recovery rates of billed sales revenue from the consumers.

The distribution losses were also observed at higher levels. It may be noted that none of the companies has

completed 100 per cent metering at consumer ends, particularly in agriculture sector. Unless all the electricity supply including supply to agricultural sector is fully metered, authentic estimates of T&D losses are difficult to make.

In the post- reforms period, the Commission has put pressure on the power distribution companies to estimate power consumption in agriculture sector on the basis of realistic average running hours of irrigation per pump-sets. The Commission highlighted that the power distribution companies neither have data on the actual energy consumption nor the correct BHP rating of the pumps as no instrument was placed to record the same at consumer ends (Tariff Order for the FY 2012-13). Therefore, it may be pointed out that the figures shown in official records were only an 'intelligent' guess and not the accurate data as more than 60 per cent electricity supply to agriculture sector was un-metered at consumer ends.

Now various stakeholders have developed a vested interest not to let full metering despite HERC's repeated directives to do the needful as early as possible. Many time dead lines have been violated. It may be noted that there is no dearth of resources to accomplish the task. There is an active nexus among the farmers, who do not want to install meters to continue being unaccountable, corrupt employees and the political patronage.

It may be argued that over the period, the state government has devoted a significant amount of funds for the growth of power sector in the state. Despite the impressive expansion of the sector, the technical performance was not satisfactory. There is an urgent need to improve technical efficiency of power utilities through ensuring transparency, accountability and public participation. The utilities must ensure 100 per cent metering at consumer ends, particularly agricultural consumers on priority basis so that precise estimation of electricity consumption and level of transmission & distribution losses may be made. In the absence of proper metering in agriculture sector, the actual electricity consumption and the amount of power subsidy cannot be precisely estimated.

Increasing amount of subsidisation on account of almost free supply of electricity to the agricultural consumers has serious implications for the state finances.

TABLE 2: Details of Total Subsidy Paid and its Ratio to TRR, OTR and GSDP in Haryana

Year	Total Subsidy Paid (Rs. in crore)	Subsidy as %age of TRR	Subsidy as %age of OTR	Subsidy as %age of GSDP
2009-10	2771	13.20	20.96	1.24
2010-11	2940	11.50	17.51	1.13
2011-12	3577	11.71	17.54	1.20
2012-13	3974	11.82	16.87	1.16
2013-14	4853 (11.86)**	11.66	18.25	1.25

Source: CAG: Annual reports for various years. RBI: State Finances: A study of Budgets for various years.

Note: TRR- Total Revenue Receipts, OTR- Own Total Receipts, GSDP- Gross State Domestic Product, **- annual compound growth rate.

The Table 2 presents the amount of total power subsidy paid by the state government and its relation with some crucial financial indicators during the period 2009-10 to 2013-14. The total amount of power subsidy to agriculture increased from Rs. 2771 crore in 2009-10 to Rs. 4853 crore in 2013-14 representing a growth rate of 11.86 per cent per annum. Subsidy as a share of Total Revenue Receipts of the state was 13.20 per cent in 2009-10 which decreased significantly to 11.66 per cent in 2013-14, however, in absolute amount, it has been continuously increasing. It may be pointed out that higher amount of subsidy leaves smaller amount of revenue with the state government for meeting developmental and other socio-economic responsibilities. The share of total own tax revenue cornered by agriculture power subsidy was more than 16 per cent during most of the period under consideration. For the year 2013-14, the share of agriculture subsidy in total own tax revenue was 18.25 per cent. Similarly, the share of subsidy in Gross State Domestic Product (GSDP) remained in range of 1.13 per cent to 1.25 per cent during the corresponding period.

It may be pointed out that the amount of power subsidy has been increasing continuously which enlarged the bill of committed expenditure at the cost of social sectors leading to widen regional disparities and leaving less resources for making quality expenditure in the hands of the government that reflected in terms of poor HDI indices on the one hand and rising levels of revenue deficit and fiscal deficit on the other. This proposition has further deteriorated the financial health of the state government as well.

To estimate wasteful consumption of electricity, we have tried to compare the optimum number of irrigations

crop-wise required (estimated by agricultural experts) with actual number of irrigations took place in the selected districts. It is pertinent to reveal that depth and number of irrigations depends on many factors such as weather conditions, especially the intensity and frequency of rainfall during the crop season, type of soil (sandy, clay, sandy loan etc.), irrigation methods to be adopted (flood, drip, sprinkler etc.) and other management practices being followed.

The Table 3 presents the comparison of crop-wise optimum number of irrigations required and actual number of irrigations with electric tube well per acre during Kharif season.

TABLE 3: Crop-wise Details of Number of Irrigations Required and Actual Number of Irrigations with Electric Tube well per acre in Kharif Season

SL. No	Crops	Area (acre)	No. of Irrigations required per acre*	No. of Actual Irrigations per acre with Electric Tube well
1	Paddy	4188.25	20-25	41.82
2	Cotton	766.50	3-4	4.60
3	Bajra	582.50	2-3	5.22
4	Fodder (Jawar)	266.25	5-7	7.39
5	Gawari	478.50	2-3	3.83
6	Pulses (Arhar)	28.00	3-4	3.25

Source: 1. Field Survey, 2014

2. Report on Efficient Management of Irrigation Water in Haryana (2009) by A.S. Dhindwal, V.K. Phogat and M.S. Dahiya, CCS Haryana Agricultural University, Hisar.

Note: *: No. of irrigations estimated by the experts are for a normal weather and soil conditions.

The data clearly shows that average actual number of irrigations is significantly higher than optimum number of irrigations required in most of the Kharif crops, except pulses. In case of paddy, being a highly water intensive crop, the estimated optimum number of irrigations required is between 20-25 per acre but actual average number of irrigations was 41.82 which amounts about double against the optimum number of irrigations. It clearly indicates over utilisation of ground water.

TABLE 4: Crop-wise Details of Number of Irrigation Requirement and Actual Number of Irrigation with Electric Tube well in Rabi Season

SL. No	Crops	Area (acre)	No. of Irrigations required per acre*	No. of Actual Irrigations per acre with Electric Tube well
1	2	3	4	5
1	Wheat	5171.00	5-6	5.80
2	Oilseeds	742.50	2-3	4.97
3	Sugarcane#	290.50	12-16	26.03
4	Fodder (barseem)	235.50	12-15	7.08
5	Pulses (gram)	123.00	1-3	4.00
6	Barley	38.00	2-3	7.20

Source: 1. Field Survey, 2014

2. Report on Efficient Management of Irrigation Water in Haryana (2009) by A.S. Dhindwal, V.K. Phogat and M.S. Dahiya, CCS Haryana Agricultural University, Hisar.

Note: *: No. of irrigations estimated by the experts are for a normal weather and soil conditions. #- Annual crop

Similar trends have also been observed in most of the Rabi crops, except wheat and fodder, from the data presented in Table (4). The average number of actual irrigations (5.80) for wheat was in the specified range of estimated number of optimum irrigations. The average actual number of irrigations for sugarcane (26.03) and barley (7.20) was perceptibly high than the respective optimum number of irrigations (12-16 and 2-3).

There were hardly any efforts from the state government to motivate farmers for efficient utilisation of electricity and ground water. There is an urgent need to ensure metered supply at consumer ends, particularly agriculture connections, on priority basis. It will promote efficiency and viability in the power system and sustainability in agriculture.

It has been observed during the survey that the extension of irrigation facilities through installation of electric tube wells has largely promoted the utilisation of High Yielding Varieties (HYVs) seeds, pesticides and chemical fertilisers, which led to a significant growth in productivity of crops in both the cropping seasons (Kharif and Rabi). However, over-utilisation of electricity/ ground water has caused the problems in terms of decline in water table, degradation of soil fertility, salinity etc.

TABLE 5: Environmental Impacts of Electric Tube well Utilisation given by respondents (multiple responses)

Particulars	Water Table Depletion	Soil Degradation
Marginal 28	10 (35.71)	26 (92.86)
Small 131	52 (39.69)	102 (77.86)
Semi Medium 166	68 (40.96)	125 (75.30)
Medium 159	63 (39.62)	122 (76.73)
Large 56	26 (46.43)	37 (66.07)
Total 540	219 (40.56)	412 (76.30)

Source: Field Survey, 2014

Note: Figures in brackets indicate percentage to respective total.

Haryana and Punjab have successfully implemented the green revolution technology in 1960s and 1970s, now these states are found to be the worst affected by excessive

ground water utilisation/ extraction and intensive farming (Joydeb Sasmal, 2014). Table 5 presents environmental impacts of electric tube well utilisation as highlighted by the respondents.

The data reveals that majority of respondents irrespective of categories highlighted soil degradation as their major problem associated with excessive utilisation of electric tube wells. They argued that to maintain and/ or increase crops' productivity during both the cropping seasons, Kharif and Rabi, higher amount/doses of chemical fertilisers and pesticides were required. Excessive utilisation of chemical fertilisers and pesticides led to deterioration in fertility of land over the period. The other major problem associated with tube well utilisation was depletion of water table in the region. About 40.56 per cent respondents highlighted water table depletion as one of the major problems after electric tube well installation.

The responses of the households regarding main reasons leading to water table depletion were presented in Table 6. The data clearly shows that the highest number of respondents (36.48 per cent) pointed out insufficient rain as a major reason for water table depletion in the region. The responses of 12.41 per cent respondents' revealed closeness of tube wells as an important reason for water table depletion.

TABLE 6: Reasons for Water Table Depletion (multiple responses)

Particulars	Insufficient rain	Over utilisation of ground water	Closeness of Tube wells
Marginal 28	9 (32.14)	5 (17.86)	4 (14.29)
Small 131	43 (32.82)	15 (11.45)	14 (10.69)
Semi Medium 166	65 (39.16)	15 (09.04)	17 (10.24)
Medium 159	58 (36.48)	6 (03.77)	24 (15.09)
Large 56	22 (39.29)	3 (05.36)	8 (14.29)
Total 540	197 (36.48)	44 (08.15)	67 (12.41)

Source: Field Survey, 2014

Note: Figures in brackets indicate percentage to respective total

It is very surprising to note that only 8.15 per cent respondents highlighted over utilisation of tube wells as a major factor responsible for water table depletion. It clearly indicates that the awareness level among farmers regarding the implications of excess utilisation of ground water is very limited. Therefore, there is an urgent need to make farmers aware about the problems associated with excess use of ground water for sustainable growth of agriculture sector in the state.

Table 7 shows main reasons responsible for soil degradation. The data reveals that a perceptible number of households (76.30 per cent) reported excess use of chemical fertilisers as a major factor leading to soil degradation. Another factor responsible for soil degradation was excess use of pesticides as 40.74 per cent respondents highlighted.

TABLE 7: Reasons for Soil Degradation (multiple responses)

Particulars	Excess use of use	Excess pesticides of chemical fertilisers	Others
Marginal 28	6 (21.43)	26 (92.86)	0
Small 131	62 (47.33)	102 (77.86)	0
Semi Medium 166	57 (34.34)	125 (75.30)	0
Medium 159	66 (41.51)	122 (76.73)	2 (1.26)
Large 56	29 (51.79)	37 (66.07)	1 (1.79)
Total 540	220 (40.74)	412 (76.30)	3 (0.56)

Source: Field Survey, 2014

Note: Figures in brackets indicate percentage to respective total

The available literature also clearly spelt out that over utilisation of ground water has caused salinity and arsenic problems in water, depletion of water table and degradation of soil fertility in many parts of the country. Haryana is not exception to it.

It may be argued that the practices of excess extraction of ground water by farmers have happened mainly due to flat rate power supply to the agriculture sector, which is also very nominal in Haryana. Flat rate tariff has also promoted the farmers to install local inefficient pump sets on their farm. It is pertinent to highlight that use of local inefficient motors led to over utilisation of ground water and excess electricity consumption, which has its implications for sustainable agricultural growth and financial viability of the power utilities.

Moreover, the respondents argued that the state government has fixed duration of 8 hours per day for power supply to agriculture sector. However, the supply remained interrupted and irregular during most of the period. The time scheduled has also been changed frequently and at some occasion the duration of 8 hours was divided in different quarters. Such type of activities may also lead to inefficiency and wastage of ground water as well as electricity and put negative impacts on agriculture production and sustainability. There should be regularity in power supply to agriculture sector.

Further, it has been noted that all the households were interested only in existing pattern of agricultural power subsidy in which they were getting power supply at highly subsidised rates. They felt that other modes of subsidy payment may force them to ensure metered supply for tube well in which they have no interest. There is an urgent need to make them aware about the benefits of other alternate modes of agriculture power subsidy payment and motivate them to install meters at their tube wells.

The Table 8 presents category-wise preferences for electricity bill payment. The data clearly highlights that more than 53 per cent of total households have their preference in flat rate billing system. It is very interesting to note that more than 2/3rd of marginal and small farm households were interested in metered supply billing system, whereas majority of big farm households (more than 60 per cent) have their vested interest in flat rate billing system.

TABLE 8: Category-wise Preferences for Electricity Bill Payment

Particulars	Metered Supply Billing	Flat Rate Supply Billing
Marginal Farmers 28	14 (50.00)	14 (50.00)
Small Farmers 131	92 (70.23)	39 (29.77)
Semi-Medium Farmers 166	64 (38.55)	102 (61.45)
Medium Farmers 159	68 (42.77)	91 (57.23)
Large Farmers 56	15 (26.79)	41 (73.21)
Total 540	253 (46.85)	287 (53.15)

Source: Field Survey

Note: Figures in brackets indicate percentage to respective total

It has also observed that big farm households extract more ground water with inefficient electric motors (local branded), which consumes relatively more electricity, to meet their irrigation requirements on large farms size. Therefore, they have developed their vested interests in flat rate billing system and avoid to install meters at their tube wells. It clearly established that big farm households captured a major chunk of benefits of agriculture power subsidy. A significant proportion of marginal and small farmers are not covered under agricultural power subsidy net due to non possession of electric tube well connections. In other words, it may be argued on the basis of available data/ information that big farm households were the major beneficiaries of power supply at subsidised rates. Therefore, there is an urgent need to ensure targeted power supply at subsidised rates. Big farmers, being in a better financial position, may be charged full cost of supply so that the burden of agriculture power subsidy can be reduced on the one hand and the environmental impacts may be controlled/ reduced to some extent on the other. It was also observed that the farmers were ready to pay higher tariffs, provided the regular and sufficient power is supplied to their tube wells.

In a power deficit scenario, solar pump sets may be an alternate source of irrigation that needs to be explored on priority basis. The state government may motivate the farmers to adopt solar pump sets for irrigation through awareness and capital incentives, which would reduce the burden of power subsidy bill on the one hand and excess extraction of ground water on the other. The state government should provide a remunerative amount of incentives on solar pump sets at initial stage and later on, it may be recovered in instalments from the beneficiaries. Moreover, awareness about energy conservation and water harvesting among the farmers needs to be enhanced on priority basis.

It is pertinent to argue that the government must take initiatives to enhance minimum support price (MSP) of less water intensive crops, so that the farmers may be motivated to shift away from more water intensive cropping pattern and consequently, the pressure on natural ground water and electricity has to be reduced in the long run.

Section III

Concluding Remarks

There is an urgent need to work out a realistic and progressive tariff structure reflecting consumer category-wise cost of supply. The amount of agriculture power subsidy has been increasing continuously which enlarged the bill of committed expenditure at the cost of social sectors. Higher amount of committed expenditure leaves fewer resources for making quality expenditure in the hands of the government that is reflected in terms of poor HDI indices on the one hand and rising levels of fiscal indicators on the other.

With the increase in size of land holdings, the farmers changed their cropping behaviour from subsistence to commercial farming. The wheat-paddy rotation is, predominantly, prevailing in the state except southern parts. Due to excess utilisation of ground water in some major crops, the problems of water table depletion and soil degradation has appeared in the study area. With the extension of irrigation facilities, the use of HYVs seeds, chemical fertilisers and pesticides was increased to enhance and /or to maintain productivity.

To extract more ground water, majority of the households were using local branded inefficient electric motors which consumed relatively more electricity. The majority of the households have very little awareness about the water harvesting and energy savings techniques. The households were also unaware about the implications of excess utilisation of precious ground water. In case of excessive dependence on ground water irrigation, rain water harvesting and crop diversification in favour of less water intensive crops, watershed development and dry land farming has been suggested as alternative policy options for sustainable growth in agriculture.

The state government should increase minimum support price (MSP) of less water intensive crops to motivate farmers to shift away from their existing, more water intensive, cropping pattern so that the burden on ground water and electricity may be reduced.

Majority of marginal and small farm households were interested in metered supply billing whereas more

than 60 per cent of big farm households favoured flat rate billing. It may also be pointed out that most of the benefits of subsidised power supply to agriculture sector had accrued to big farm households only.

The marginal and small farmers were getting a little bite of cake in the state. Moreover, most of the households were interested in existing pattern of power subsidy in which power is supplied to agricultural consumers at highly subsidised rates. They feared that alternate mode of power subsidy payment may force them to ensure metered supply at tube wells. There is an urgent need to make the farmers aware about the benefits of alternate modes of subsidy payments. The farmers, further, should be motivated to adopt solar irrigation system through awareness and remunerative capital incentives. The state government must also take initiatives to regulate excessive utilisation of ground water.

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Export Competitiveness of Chillies (Dry) in India

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Abstract

In this study, the Nominal Protection Coefficients (NPCs) were found to be below one indicating high export competitiveness of chillies. Policy Analysis Matrix (PAM) indicated that chilli cultivation enjoyed a total positive transfer of Rs 659.84 per quintal on its tradable input costs in the overall period (2008-09 to 2012-13). The estimated domestic resource cost (0.27) was less than unity indicating that chilli has long run comparative advantage in its cultivation as compared to other countries.

Key Words: Nominal Protection Coefficients, Policy Analysis Matrix, domestic resource cost, comparative advantage.

Introduction

India enjoys a pre-eminent position in spices production in the world and is famous as the "Country of Spices." The world trade in spices had commenced since the end of Second World War, recording a steady increase both in terms of quantity and value. During 2014-15, Indian spices exports have been able to continue its increasing trend both in volume and value. During the financial year 2014-15, a total of 8,93,920 tons of spices and spice products valued Rs.14899.68 crore (US$2432.85 Million) has been exported from the country as against 8,17,250 tons valued Rs.13735.39 crore (US$ 2267.67 Million) in 2013-14 registering an increase of 9% in volume and 8% in rupee terms and 7% in dollar terms of value. Among the important spices cultivated in India, chilli occupies a major position. India is one of the leading producers of chillies in the world and is the main source of red chilli in the international market. Chilli continued to be the major item of export among spices in the world in terms of quantity. According to Spices Board of India, the estimated export of chilli from India during April-September, 2015 was 1,77,000 tones which was higher than 1,64,081 tones in

April-September , 2014. India has a comparative advantage in the production of many crops in terms of diverse agro-climatic regions and the availability of labour. However, these comparative advantages could not be translated in to competitive advantages in the global market in any commodities because international markets do not operate on comparative advantages alone. It is in this context that the paper makes an attempt to evaluate the global competitiveness of Indian chilli.

Materials and Methods

For calculating NPCs, domestic price at Guntur (Andhra Pradesh), which is the Asia's largest chilli market and international price at the New York market in U.S. were collected from 2008-09 to 2012-13. For construction of Policy Analysis Matrix (PAM), the data was collected on the cost of cultivation of chillies from 2008-09 to 2012-13.

Estimation of Nominal Protection Coefficients (NPCs)

Nominal protection coefficients were computed to determine the extent of comparative advantage enjoyed by the commodity in the context of free trade. The coefficients shed light whether a country has comparative advantage in the production of that commodity in a free trade scenario or not.

The nominal protection coefficient (NPC) is defined as the ratio of the domestic price to the world reference price of the commodity under consideration. Symbolically

$$NPC = P^D / P^R$$

where,

NPC = Nominal protection coefficient

P^D = Domestic price of the commodity in question

P^R = Reference price of the commodity in question i.e. what the farmer would have received in the case of free trade.

If the Nominal Protection Coefficient (NPC) is greater (lesser) than one, then the commodity is protected (not protected or in effect, taxed), compared to the situation what would prevail in free trade.

Policy Analysis Matrix (PAM)

The measurement of impact of state policies is often done with the help of Policy Analysis Matrix. The PAM is a

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useful instrument to analyze production systems. It was introduced by Monke and Pearson (1989) and allows the measurement of policy impacts on agricultural production. The effects of policies are estimated by the observation of changes in farm incomes.

The main idea of the PAM is the comparison of private and social prices for inputs used in production and also for the produced goods. Private prices are prices observed in a current situation, while social prices, also referred to as efficiency prices (shadow prices) confirm to the situation without any intervention of the Government or market distortions. Social or efficiency prices demonstrate the opportunity costs of use.

TABLE I: POLICY ANALYSIS MATRIX

	Revenues	Costs		Profit
		Tradable -inputs	Non-tradable-inputs	
Private prices	A	B	C	D=A-B-C
Social prices	E	F	G	H=E-F-G
Effects of divergence	I=A-E	J=B-F	K=C-G	L=D-H=I-J-K

Source: Monke and Pearson (1989)

D = Private profits J = Input transfers

H = Social profits K = Factor transfers

I = Output transfers L = Net transfers

Some standard ratios reflecting the degree of price divergences, or distortions to compare profitability and efficiency of different crops can be calculated by using the elements of Policy Analysis Matrix. They include;

Profitability Coefficient (PC)

The Profitability Coefficient (PC), defined as PC=D/H, is a measure of degree to which net transfers have caused private profits to exceed social profits. It is a complete measure of incentives effects of all policies affecting production of selected products. The PC can be used as a proxy for the net policy transfer.

Effective Protection Coefficient (EPC)

The EPC is the ratio of the difference between revenues and tradable input costs in private prices to that in social prices. In PAM notion, EPC= (A-B)/ (E-F). The numerator (A-B) the value added in private prices and the denominator (E-F) is value added in world prices. EPC for a commodity is defined as:

$$EPC_i = VA_{id} / VA_{ib}$$

where, VAid is value added output i at domestic prices and VAib is value added output 'i' at border prices. EPC is an indicator of net incentive or disincentive effect of all commodity policies affecting prices of tradable outputs and inputs. An EPC greater than one means that value added at private prices is greater than it would be without commodity policies. The transfer from both output and tradable input policies taken together is positive. The EPC of less than one indicates opposite result; i.e., the net effect of policies that alter prices in product markets and tradable-input markets to reduce private value added and the combined transfer is thus negative.

Domestic Resource Cost (DRC) Ratio

Domestic Resource Cost (DRC) ratio, a measure of efficiency or comparative advantage, is calculated by dividing the factor cost in social prices (G), by the value added in social prices (E-F). A DRC greater than one indicates that the cost of domestic resources used to produce commodity is greater than the contribution of its value added at social prices, meaning a comparative disadvantage. A DRC index less than one indicates that the country has a comparative advantage in producing that commodity or that commodity is making effective use of the domestic resources.

The DRC value of less than one is taken as an indicator of long run comparative advantage.

$$DRC = \frac{G}{(E-F)}$$

When DRC ratio is lower than one, domestic production is efficient and internationally competitive because opportunity cost of domestic resources is smaller than the net foreign exchange gained in export or saved by substituting for imports. The opposite is true when DRC ratio is larger than one.

Private Cost Ratio (PCR)

The PCR explains the ratio of domestic factor costs (C) to value added in private prices (A-B). This ratio demonstrates the ability of the production system to cover the cost of domestic factors and continue to be competitive. It is almost identical to DRC ratio. The difference is that for PCR, the values in private prices are used. In PAM notion,

$$PCR = \frac{C}{(A-B)}$$

Subsidy Ratio to Producers (SRP)

The SRP is a single measure of all transfer effects. This ratio is a comparison of net transfer to the value of output in world prices.

$$SRP = \frac{L}{E}$$

The SRP indicates the extent to which the system's revenues are increased or decreased due to transfers. If the extent of market failures are minor, than the SRP shows

the net impact of distorting policy on system revenue. The smaller the SRP, the less distorted the agricultural system.

Nominal Protection Coefficient of Output (NPCO)

The NPCO is calculated as the ratio of revenue in private price (A) to the revenue in social prices (E). The objective of calculating NPCO is to measure the actual divergences or distortions between domestic prices and international or border prices. If NPCO is less than one, it confirms the presence of taxes (tariffs) on output. A NPCO greater than one shows the presence of subsidies on outputs i.e., the product is protected. A NPCO equal to one reveals the absence of intervention. A decision criterion is, if NPCO is less than one then the commodity is competitive (under importable hypothesis it is considered as a good worth to import substitution and under exportable hypothesis, it is worth to export). If NPCO is greater than one the commodity under question is not competitive i.e. neither a good is suitable for import substitution (under importable hypothesis) nor qualified as exportable commodity (exportable hypothesis).

$$NPCO = \frac{A}{E}$$

Nominal Protection Coefficient of Tradable-input (NPCI)

The NPCI is calculated as a ratio of tradable-input cost in private prices (B) to the same at social prices, F. These results are opposite from those for the NPCOs because both higher prices of output and lower prices of tradable-inputs lead to greater private profits. Hence, the larger the NPCOs and smaller the NPCIs, the greater the policy transfers to agriculture system. A NPCI equal to one indicates no transfer, NPCI less than one denotes positive transfer (since input costs are lowered by policy) and greater than one shows a negative transfer (because input costs are raised by the policy).

$$NPCI = \frac{B}{F}$$

Results and Discussion

The results of the analysis are presented as follows

(i) Nominal Protection Coefficients of Chillies under Exportable Hypothesis

As chilli being a dominant item of India's export basket, NPC was calculated under exportable hypothesis. The analytical findings of NPC's of chillies are shown in Table 2. From the results it can be inferred that the domestic prices of chillies have been consistently lower than the international prices, indicating Indian chilli's trade

TABLE 2. NOMINAL PROTECTION COEFFICIENTS (NPCS) OF CHILLI UNDER EXPORTABLE HYPOTHESIS

	2008-09	2009-10	2010-11	2011-12	2012-13
Wholesale price of red chilli in Guntur market (Rs/qtl)	3,505	3,825	6,500	6927	5583
AMC CESS 1% (Rs/ qtl)	35.05	38.25	65	56	59
Transport from cold storage/market yard(Rs/qtl)	36	36	36	81	86
Repacking in 25 kg bags(Rs)	100	100	100	23	24
New gunny bags cost(Rs)	214	214	214	36	38
Loading(Rs)	20	20	20	41	43
Lorry to Chennai(Rs/qtl)	133	140	140	154	160
Margin 5% (Rs)	175.25	191.25	325	280	295
Total (Rs/qtl)	4,218.30	4,564.50	7,400	7597	6286
Ocean freight /THC BL charges to New York (Rs/ qtl)	34.4	34.4	34.4	58	61
Wharf age charges(Rs/ qtl)	48	48	48	48	48
Fumigation/survey(Rs/ qtl)	19.2	19.2	19.2	6	7
Spices Board fee(Rs/ qtl)	12	12	12	23	24
Health certificate(Rs/ qtl)	8	8	8	10	10

	2008-09	2009-10	2010-11	2011-12	2012-13
Phyto fees(Rs/ qtl)	8	8	8	7	8
Phyto car charges(Rs/ qtl)	4	4	4	4	4
Phyto incidentals(Rs/ qtl)	8	8	8	8	8
ICD custodian charge(Rs/ qtl)	7.2	7.2	7.2	26	27
Handling/customs(Rs/ qtl)	35.2	35.2	35.2	19	20
SB processing, cargo inspection, loading mamool (Rs/ qtl)	24	24	24	24	24
MOT charges(Rs/ qtl)	5.12	5.12	5.12	5	5
GSP Certifiacte (Rs)	4	4	4	4	4
Kraft paper in container(Rs)	12	12	12	9	10
Container movement (Rs/ qtl)	252.8	252.8	252.8	232	244
Loading mamool at godown (Rs/ qtl)	12.8	12.8	12.8	8	8
DOC charges (Rs/ qtl)	2	2	2	2	2
Certifiacate of origin (Rs)	0.64	0.64	0.64	2	2
Courier&communication(Rs)	2	2	2	2	2
Handling charges (Rs/ qtl)	20	20	20	19	20
Total (Rs/qtl)	4737.66	5083.86	7919.36	8112.8	6824.12
Service tax 10.3%	487.97898	523.63758	815.6941	836	703
Landed price at New York in Rs	5,225.64	5,607.50	8,735.05	8948.4	7527
Exchange rate (Rs/dollar)	48.27	45.69	45.02	52.72	54.42
Landed price at New York in dollars	108.26	122.73	194.03	169.73	138.31
FOB at New York($/qtl)	235.87	253.05	358.51	215	250
NPC	0.46	0.49	0.54	0.79	0.55

advantageous in this regard. This is reinforced by the Nominal Protection Coefficient which is less than one ranging from 0.46 to 0.79 during 2008-09 to 2012-13, suggesting that Indian chilli is globally competitive under the exportable hypothesis. These findings are in line with that of Ajjan et al. (2012).

There has been an increasing global demand for spices and an emerging need for India to consolidate and maintain its position as the world leader in this sector. Spices account for a major share in the total farm exports of the country and a substantial jump in exports was observed in the past five years. Yet an important factor to be remembered for the export demand is the crop condition in China, a major producer of the high-colour low heat variety.

(ii) Policy Analysis Matrix without Import Duty

The inputs used for the production of chillies were disintegrated into tradable and non-tradable inputs (domestic resources). For this study, seeds, fertilizers and insecticides were considered as tradable inputs while labour, irrigation, organic manure were considered as non-tradable inputs. The findings of PAM framework constructed for chillies and the coefficients of PC, EPC, DRC, PCR, SRP, NPCO and NPCI are presented in Table 3 which indicates that chilli cultivation enjoyed a total positive transfer of Rs 659.84 per quintal on its tradable input costs in the overall period. If the government had not intervened, the chilli farmers would have had to pay 1602.47 Rs. per quintal, but the actual polices created this cost to be reduced to Rs 942.63 per quintal. This positive transfer of Rs 659.84 resulted from the policy combination of subsidies on fertilizers. Similarly, in respect of domestic factors chilli farmers had the advantage of total positive transfer of Rs. 1425.35 per quintal.

The NPCI ratio of 0.59 indicated that the policies of the government favoured farmers to reduce expenditure on tradable inputs by 41 per cent. The NPCO was 0.45.

TABLE 3 POLICY ANALYSIS MATRIX OF CHILLI WITHOUT IMPORT DUTY

Particulars	Revenue (Rs./qtl)	Costs (Rs./qtl)		Profits (Rs./qtl)
		Tradable inputs	Domestic factors (Non-tradable inputs)	
1	2	3	4	5
		Overall period		
Private prices	5800	942.63	1644.50	3212.87
Social prices	12806.67	1602.47	3069.85	8134.35
Effects of divergence	-7006.67	-659.84	-1425.35	-4921.48
PC	0.39			
EPC	0.43			
DRC	0.27			
PCR	0.34			
SRP	-0.38			
NPCO	0.45			
NPCI	0.59			
		2008-09		
Private prices	4200	744.90	1477.82	1977.28
Social prices	11385.31	1212.88	2402.83	7769.60
Effects of divergence	-7185.31	-467.98	-925.01	-5792.32
PC	0.25			
EPC	0.34			
DRC	0.24			
PCR	0.43			
SRP	-0.51			
NPCO	0.37			
NPCI	0.61			
Private prices	4500	796.92	1709.86	1993.21
Social prices	11561.63	1258.65	2681.98	7621.00
Effects of divergence	-7061.63	-461.73	-972.11	-5627.78
PC	0.26			
EPC	0.36			
DRC	0.26			
PCR	0.46			
SRP	-0.49			
NPCO	0.39			
NPCI	0.63			
		2010-11		
Private prices	7800	1000.10	2453.11	4346.79
Social prices	16140.17	1851.29	4833.24	9455.65
Effects of divergence	-8340.17	-851.19	-2380.13	-5108.86

1	2	3	4	5
PC	0.46			
EPC	0.48			
DRC	0.34			
PCR	0.36			
SRP	-0.32			
NPCO	0.48			
NPCI	0.54			
		2011-12		
Private prices	5500	994.29	1166.86	3338.86
Social prices	11341.25	1594.79	2330.83	7415.63
Effects of divergence	-5841.25	-600.51	-1163.97	-4076.77
PC	0.45			
EPC	0.46			
DRC	0.24			
PCR	0.26			
SRP	-0.36			
NPCO	0.48			
NPCI	0.62			
		2012-13		
Private prices	7000	1176.94	1414.85	4408.21
Social prices	13605	2094.72	3100.39	8409.88
Effects of divergence	-6605	-917.78	-1685.54	-4001.68
PC	0.52			
EPC	0.51			
DRC	0.27			
PCR	0.24			
SRP	-0.29			
NPCO	0.51			
NPCI	0.5 6			

inferring that existing policies have reduced the private revenue to 55 per cent less than without policy. The PC value which is less than one (0.39) indicated negative net transfers. The EPC value shows the combined impact of policies in product market (price enhancing) and input policies (cost reducing). The EPC nets out the impact of protection on inputs and outputs, and reveals the degree of protection accorded to the value added process in the production activity of the relevant commodity. EPC coefficient of 0.43 showed that cultivation of chillies was largely not protected by policies. The estimated DRC (0.27) was less than unity indicating that chilli has long run comparative advantage in its cultivation as compared to other countries. It also infers that domestic production of chilli is efficient and internationally competitive because opportunity cost of domestic resources is smaller than net foreign exchange gained in export or saved by substituting for imports. The PCR which is 0.34 demonstrates the ability of production system to cover the cost of domestic factors and continue to be competitive. The value of SRP was negative indicating that the system's revenues decreased due to distorting policies.

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Dynamics of Growth of Soybean in India: Role of Income and Risk

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Abstract

Soybean is accounting for 54% of area under kharif oilseeds and 37% of total oilseeds area in the country during 2010-12. It hascontributed to 40% of the oilseed production, nearly 25% of the total veg. oils and two-thirds of the oilcake meals supplies in the country. Area under Soybean has grown at the rate of 9.6%and production at the rate of 11.5% in the country during the period 1980-2012. Rajasthan state witnessed highest growth in production of soybean (18.3% annual) followed by Madhya Pradesh (10%) and Gujarat (7.9%) during the period 1980-2012. The instability in production of soybean in the country has been worked out to about 22-23 per cent in all the decades analysed. The decomposition analysis of output growth of soybean revealed that growth in soybean production in the country was mainly on account of changes in area and there was negligible effect of growth on yield. The net returns from cultivation of soybean in Madhya Pradesh, Maharashtra and Rajasthan were higher compared to other kharif crops except arhar and cotton. The yield risk coupled with price was found to be on lower side compared to major kharif crops, particularly during crop establishing stage.

Key Words: Soybean, Growth, Instability, Comparative Economics, Risk.

Introduction

The demand for oilseeds, edible oils and oilcake meals, has been growing rapidly in the country accelerated with thesustained growth in per capita income, increasing population and urbanisation (Birthalet. al. 2010; Gowdaet. al. 2009). During the last three decades, India's oilseed production has increased by more than three times, from 9.37million tons in 1980-81 to 32.48 million tons in2010-11. Annual per capita consumption of edibleoils increased from 4 kg in 1981 to 14.2 kgin 2010-11. India is one of the major consumersof oilseeds and their products, which accounts for approximately 10.2 per centof global consumption of edible oils as well as oilcake meals. Further, percapita consumption of edible oils has beenincreasing.This increase in demand for oilseeds and theirproducts has been accompanied by increases intheir domestic production.

Soybean (Glycine max) is one of the most important and fastest growing oil-bearing crops in the world. During 1981-2011, theworld's soybean area grew at an annual rate of 2.6 percent and production by 4percentwhich are higher than the growth in areaand production of most other food crops.Soybean accounts for 37 percent of theglobal area under oilseeds, and contributes28 percent to vegetable oil production. The crop's adaptability to varied agro-ecological environments viz the tropics, subtropics andtemperate - has been responsible for its rapidspread across the globe.Soybean is a high-value nutritive crop, henceit plays a significant role in overcomingproblems of food insecurity and nutritional deficiency,especially in developing countries (Thoenes,2004). On an average, soybean contains 40percent protein, 35 percent carbohydratesand 20 percent fat, besides several minerals (calcium and phosphorus) and vitamins (A and B). Soybean oil is highly digestible andhas almost no saturated fats. From theperspective of sustainability of agriculturalsystems, soybean's leguminous nature helpsimprove soil fertility.

Consumption of soybean-based foods hasbeen a long tradition in many Asian and African countries. Traditional soy foods like tofu, miso, tempeh, soya sauce, etc. are derived either directly from whole fresh beans or from processing beans into soymilk (Thoenes, 2004). In recent years,soy foods have expanded to include freshbeans and sprouts, grain products (soy bread, pasta and flour), dairy substitutes (soymilk and cheese) and meat substitutes. Soymeal is an excellent feedstuff for livestock and poultry. Soy meal comprises 60 percent of the global oil production.

In India, soybean has emerged from a little known crop until the early 1970s to an important oilseed crop. Soybean has come to be recognized as one of the premier agricultural crops today for various reasons. In brief, soybean is a major source of vegetable oil, protein and animal feed. Soybean, with over 40 percent protein and 20 percent oil, has now been recognized all over the world as a potential supplementary source of edible oil and nutritious food. The protein of soybean, a complete protein, as it supplies sufficient amounts of various kinds of amino acids required by the body for building and repair of tissues. Its food value in heart disease and diabetes is well known. It is established fact that Chinese infants using

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soybean milk in place of cow's milk are practically free from rickets (Bisaliah, 1986).

Soybean, however, is a more important oilseed crop than any other oil bearing crop. The crop accounted for 54 per cent of the area under *kharif* oilseeds and 37 per cent of the area under total oilseeds in the country during Triennium Ending (TE) 2010-12. It accounted for 40 percent of the oilseed production, about 25 percent of the total vegetable oils and two-thirds of the oil meals supplies during the corresponding period.Keeping these facts in mind, an attempt has been made,(a) to analyse the growth and instability of area, production and yield of soybean in major producing states as well as for India, (b) to decompose the soybean production growth, and (c) to study the comparative profitability of soybean vis-à-vis major kharif crops and their risks.

Data and Methodology

The paper is based on secondary data collected from publications of Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, Govt. of India. State-wise area production and yield data for soybean for the period 1980-81 to 2011-12 have been analysed and presented in the following sections. The soybean area, production figures for Andhra Pradesh, Karnataka and Maharashtra have been taken from 1989-90. The data of new states like Chhatisgarh (CHH) and Uttarakhand (UK) have been merged with the parent states. Comparative profitability of soybean and other major kharif crops in the selected districts was worked out from the data collected from Commission on Agricultural Costs and Prices (CACP), New Delhi.

A. Compound Growth Rates

The compound growth rates (CGR) of area, production and yield of soybean for each decade were estimated to study the growth rate. The compound growth rates are usually estimated by fitting a semi-log trend equation of the following form :

$$\ln Y = a + bt \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where, y is the time series data (response variable) of area, production and yield of soybean, t is the trend term (explanatory variable) and ais the constant coefficient. The slope coefficient b measures the relative change in y for a given absolute change in the value of the explanatory variable t. If we multiply the relative change in y by 100, we get the percentage change or growth rate in y for an absolute change in variable t. The slope coefficient b measures the instantaneous rate of growth. We calculate the compound growth rate r as follows:

$$r = [(\text{Anti ln of } b)-1] \times 100 \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Coefficient of Variation (CV in %) has been worked out to know the variability in area, production and yield of soybean in major states.

B. Decomposition of Production Growth

To measure the relative contribution of area and yield to the total output change forindividual crop, the component analysis model has been used (Narula and Vidysagar,1973; Singh and Sisodia, 1989; Bastine and Palanisami, 1994; Bhatnagar andNandal, 1994; Mundinamami et. al, 1995; Gupta and Saraswat, 1997; Singh andRanjan, 1998; Singh and Ashokan, 2000 and Siju and Kombairaju, 2001). The model is given as follows :

$$\Delta P = A_0 \Delta Y + Y_0 \Delta A + \Delta A \, \Delta Y \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Change in Production = Yield effect + Area effect + Interaction effect.

Thus, the total change in production can be decomposed into three effects viz. Yieldeffect, area effect and the interaction effect due to change in yield and area.

C. Instability (Risk) Analysis

Following Chand *et. al.*, 2011, instability in area, production and yield of soybean was worked out as

Instability index = Standard deviation of natural log of (Yt/ Yt-1)……..(4)

Where, Yt is the area / production / yield in the current year and, Y t-1 is same for the previous year. This index is unit free and very robust, and it measures deviations from the underlying trend (log linear in this case).

Growth and Instability in Area, Production and Yield of Soybean

In India, the area under soybean grew tremendously,albeit from a low base. Soybean was a littleknown crop until 1970. It was introduced inrainfed regions of Madhya Pradesh in theearly 1970s, and since then its cultivationhas expanded rapidly (Dupare et al. 2008). Initially, the crop was targeted to be produced during therainy season by utilizing the fallow lands, but subsequentlyit started replacing less profitable foodgraincrops such as sorghum, pearl millet and blackgram (Bisaliah, 1986). Gradually,the crop spread to neighbouring areas of Maharashtra and Rajasthan that have similarclimatic conditions as the soybean growingregions of Madhya Pradesh.

The little known crop until early 1970s, now has become an important oilseed crop in the country. The commercial cultivation of soybean in India has started during mid 1970s, mainly in Uttar Pradesh and Madhya Pradesh. Area under soybean cultivation in India was 5.26 lakh ha during Triennium Ending (TE) 1982, of which about 75 per cent was in Madhya Pradesh and 22 per cent in Uttar Pradesh. The area under soybean cultivation in the country has increased to 98.15 lakh ha during TE 2012, of which 57 per cent is shared by Madhya Pradesh, about 30 per cent by Maharashtra, and 8 per cent by Rajasthan.

Soybean cultivation has grown rapidly in all the major states, except in Uttar Pradesh and Gujarat where the area under soybean has decreased. During the initial period of growth and expansion in area under soybean cultivation, there was rapidity and selectivity in expansion of soybean (Bisaliah, 1986). It is interesting to note that the soybean area has decreased significantly in the traditional soybean growing state, i.e. Uttar Pradesh, and expanded in Madhya Pradesh and in nearby areas of Rajasthan and Maharashtra. These three states together currently accounts for about 95 per cent of total area under soybean cultivation in the country.

The annual compound growth rate in area under soybean in the country was 18 per cent during 1981-1991. Highest growth rate in area under soybean was found in Rajasthan (38.3%) followed by Madhya Pradesh (20.7%) and Gujarat (7.2%), while soybean area in Uttar Pradesh has declined significantly (-23.2 per cent). The growth in area under soybean cultivation in the country as well as in major soybean growing states has slowed down in subsequent decades. Overall, the soybean area has grown at the rate of 9.6 per cent in the country during the period 1980-2012 (Table1). It is interesting to note that the area under soybean is now expanding in other states like Andhra Pradesh, Karnataka, and Gujarat states, resulting high growth rate of soybean area in recent decade.

TABLE 1.Growth and Instability in Area under Soybean in Major States

States	Andhra Pradesh	Undivided Madhya Pradesh	Karnataka	Maharashtra	Rajasthan	Undivided Uttar Pradesh	Gujarat	India
Area ('000 Ha)								
TE 1982		392.0			7.5	117.7	11.0	526.3
TE 1992	0.35	2225.2	22.1	200.2	161.6	21.4	19.5	2667.3
TE 2002	15.3	4462.6	59.7	1136.7	602.5	19.3	6.3	6327.4
TE 2012	138.0	5596.6	184.0	2919.3	813.7	22.9	71.0	9814.9
Share (%)								
TE 1982		74.48			1.42	22.36	2.09	100.0
TE 1992	0.01	83.42	0.83	7.51	6.06	0.80	0.73	100.0
TE 2002	0.24	70.53	0.94	17.96	9.52	0.30	0.10	100.0
TE 2012	1.41	57.02	1.87	29.74	8.29	0.23	0.72	100.0
Compound Annual Growth Rate (%)								
1981-1991		20.7			38.3	-23.2	7.2	18.0
1991-2001	37.0	6.2	8.6	17.1	13.3	-0.4	-15.5	8.1
2001-2011	20.2	3.4	12.9	11.8	5.0	-1.4	33.5	5.9
1980-2012	30.5	8.6	11.4	16.7	15.4	-7.0	5.9	9.6
Coefficient of Variation (%)								
1981-1991		26.0			25.1	76.6		19.3
1991-2001	64.5	8.8	21.7	11.4	20.6	40.0	32.6	8.3
2001-2011	33.0	5.1	27.4	11.6	18.4	15.6	30.4	5.2
1980-2012	49.8	16.9	28.8	14.2	24.5	50.4	87.2	13.2

During 1960s, there were large fallow lands during kharif season, which was kept fallow for preserving moisture for rabi(sowing) season in Madhya Pradesh and Uttar Pradesh. The short duration of new varieties of soybeans did not affect the sowing time of the second crop after the monsoon season. Soybeans were initially introduced in Madhya Pradesh and Uttar Pradesh. Thus, rapid expansion of area under soybean crop during the initial years was from fallow lands (Bisaliah 1986, and Chand 2007). But subsequently it started replacing less profitable foodgrain crops such as sorghum, pearl millet and black gram. The crop has mainly replaced sorghum in Madhya Pradesh and in India (Birthalet. al., 2010). Better opportunities to readily sell soybean in the market, increasing domestic demand for edible oil and export demand for oilmeal led expansion in processing industries have helped in rapid area expansion of soybean in the country (Chand, 2007). The expansion in area was highest

in soybean despite low productivity, mainly on account of economic superiority of soybean over other corps and its cultivation in fallow land (Jha, et. al. 2012).

The year-to-year fluctuation is crop area and production and variability in crop yield are of major concern for researchers as well as policy makers. The instability in area under soybean cultivation was very high in major soybean growing states as well as in India during the initial phases of soybean growth and development. The area under soybean cultivation exhibited some stability in recent decades in major producing states as well as in India, as the instability in area has declined sharply. While in other states like Andhra Pradesh, Karnataka and Gujarat, the year-to-year fluctuation in soybean area was found to be higher.

TABLE 2. Growth and Instability in Production of Soybean in Major States

States	Andhra Pradesh	Undivided Madhya Pradesh	Karnataka	Maharashtra	Rajasthan	Undivided Uttar Pradesh	Gujarat	India
Production ('000 Tonnes)								
TE 1982		275.0			4.0	74.0	4.0	358.7
TE 1992	0.5	1924.3	11.4	160.1	141.8	27.4	16.3	2299.9
TE 2002	15.1	3974.9	52.8	1423.9	590.9	14.3	5.1	6106.6
TE 2012	185.7	6553.3	133.7	3494.0	1139.3	31.5	57.0	11638.1
Share (%)								
TE 1982		76.67			1.12	20.63	1.12	100.00
TE 1992	0.02	83.67	0.49	6.96	6.17	1.19	0.71	100.00
TE 2002	0.25	65.09	0.87	23.32	9.68	0.23	0.08	100.00
TE 2012	1.60	56.31	1.15	30.02	9.79	0.27	0.49	100.00
Compound Annual Growth Rate (%)								
1981-1991		23.6			47.7	-17.2	19.4	21.2
1991-2001	35.8	7.2	14.0	22.2	13.6	-9.0	-13.5	9.9
2001-2011	22.4	8.8	12.4	10.2	9.3	4.9	33.2	9.4
1980-2012	33.5	10.0	13.6	20.4	18.3	-5.8	7.9	11.5
Coefficient of Variation (%)								
1981-1991		30.0			37.9	66.3	92.5	23.7
1991-2001	55.5	21.8	36.1	33.4	38.7	37.8	24.4	21.0
2001-2011	42.3	25.2	34.5	31.4	54.3	28.1	33.7	23.9
1980-2012	48.0	25.7	50.6	33.7	46.4	46.8	58.7	22.4

Total production of soybean in the country stood at 3.58 lakh tonnes during TE 1982, of which, about 77 per cent was contributed by Madhya Pradesh, nearly 21 per cent by Uttar Pradesh, and rest by Rajasthan and Gujarat. Production of soybean has increased to about 116.38 lakh tonnes in the country during TE 2012, of which about 56 per cent was contributed by undivided Madhya Pradesh, 30 per cent by Maharashtra, nearly 10 per cent by Rajasthan (Table2). The share of Andhra Pradesh, Karnataka and Gujarat in total soybean production in the country, though miniscule, is increasing in recent years. The three major soybean producing states, viz., MP, Maharashtra and Rajasthan together accounts for more than 96 per cent of total soybean production in the country.

Soybean production in India has increased with an annual compound rate of 21.2 per cent during the period 1981-1991. The growth of soybean production was found to be highest in Rajasthan (47.7 per cent), followed by Madhya Pradesh (23.6%) and Gujarat (19.4%) while in Uttar Pradesh, production of soybean has declined by 17.2% per annum during the period 1981-1991. Overall, soybean production in the country has grown at the rate of 11.5 per cent annually during 1980-2012.Rajasthan state witnessed highest growth in production of soybean (18.3% annual) followed by Madhya Pradesh (10%) and Gujarat (7.9%) during the period 1980-2012. In other states where the soybean cultivation is gradually expanding in the recent decades,soybean production has increased at an annual

compound growth rate of 33.5% (Andhra Pradesh), 20.4% (Maharashtra) and 13.6% (Karnataka). The growth rate in production of soybean crop was highest among food crops in the country.

Though there is high growth in area and production of soybean in the country, but it is interspersed with high year-to-year fluctuations. The instability in production of soybean in the country has been worked out to about 22-23 per cent in all the decades analysed. Even in the major soybean producing states, the instability in soybean production was found to be very high and increasing in recent decades. This may be due to higher fluctuation in rainfall in major soybean producing states, as this crop is mainly grown under rain-fed conditions.

During the initial phase of commercial cultivation of soybean in the country, the productivity was 425 kg/ha (in the year 1970-71), which has increased to 681 kg/ha during TE 1982, and 1186 kg/ha during TE 2012, almost trebled from initial years (Table3). The highest productivity of soybean was found in Rajasthan at 1400 kg/ha during TE 2012, which has increased from 533 kg/ha during TE 1982. The soybean yield level shown a decline in the states like Andhra Pradesh, Uttar Pradesh and Gujarat, during TE 2002 compared to TE 1992. Overall there was increasing trend in soybean productivity, though at the slow pace. Growth in soybean yield was highest during the period 1981-1991 in all the soybean growing states as well as in India. The recent decade also witnessed higher growth in soybean yield in the country.

TABLE 3. Growth and Instability in Yield of Soybean in Major States

States	Andhra Pradesh	Undivided Madhya Pradesh	Karnataka	Maharashtra	Rajasthan	Undivided Uttar Pradesh	Gujarat	India
Yield (kg/ha)								
TE 1982		702			533	629	364	681
TE 1992	1286	865	514	800	877	1280	839	862
TE 2002	989	891	884	1253	981	740	810	965
TE 2012	1345	1171	726	1197	1400	1374	803	1186
Compound Annual Growth Rate (%)								
1981-1991		2.4			6.8	7.9	11.4	2.6
1991-2001	-0.9	1.0	5.0	4.4	0.3	-8.7	2.4	1.6
2001-2011	1.8	5.3	-0.5	-1.4	4.1	6.5	-0.3	3.3
1980-2012	2.3	1.6	1.9	3.1	2.5	1.3	1.9	1.8
Coefficient of Variation (%)								
1981-1991		22.7			28.5	16.2	62.6	19.9
1991-2001	20.5	18.1	41.1	28.3	30.5	39.4	20.4	17.5
2001-2011	35.3	25.3	34.3	35.8	49.4	24.4	32.0	24.2
1980-2012	29.5	21.3	43.4	32.4	36.0	27.8	41.7	19.7

Instability in yield of soybean was found to be higher in all major soybean growing states (ranging from 21 to 43 per cent) as well as in India (about 20 per cent). The trend in instability of soybean yield indicates an increase over the decades in all the soybean growing states. This may be due to fluctuation and changes in rainfall pattern, as the crop is mainly grown under rainfed conditions. In India, soybean is largely grown in thesemi-arid tropics, where rainfall is low anduncertain; hence its yield is also low anduncertain (Birthalet. al., 2010).

An analysis of growth in area, production and yield were discussed in the previous section, whichanalyses the general pattern of growth and thedirection of changes in area and productivity.But it does not evaluate thecontribution of area and productivity to the production growth.For that, it isnecessary to examine the sources of output growth. The growth in output ofsoybean producing states was therefore apportioned to the various sources by breaking thechange inproduction into three effects i.e., area effect, yield effect and interaction effect.

The relative contribution of area, yield and their interaction to change in productionof individual crops is presented in Table 4. The decomposition analysis of outputgrowth of soybean revealed that growth in production of soybean in the major states as well as in India was on account of change in area. About 60 to 140

per cent growth in soybean output was due to area effect, while merely 1 to 9 per cent was due to yield effect. The area yield interaction effect contributed about 28 to 166 per cent of growth in soybean output in different soybean producing states. As discussed in the previous section, the yield growth of soybean in all the soybean growing states was found to be low, and hence the yield effect was lower.

These results apparently indicated that growth in soybean production in the country was mainly on account of expansion in area and there was negligible effect of growth in yield. Although, the soybean yield level in the country has almost doubled over three decades. To further understand this phenomenon, the decomposition has been worked out for three different decades. The results of decade-wise analysis indicated that the effect of changes in soybean yield to the output growth was increasing, particularly in Madhya Pradesh, Rajasthan, Uttar Pradesh and Andhra Pradesh, as well as in India. Therefore, the scope for increasing production of soybean crop lies in increasing the yield levels.

TABLE 4. Decomposition of Production Growth of Soybean in Major States

('000 Tonnes)

Particulars	Andhra Pradesh	Undivided Madhya Pradesh	Karnataka	Maharashtra	Rajasthan	Undivided Uttar Pradesh	Gujarat	India
1992 over 1982		1649.3			137.8	-46.6	12.3	1941.2
Area effect (%)		78.0			59.7	130.0	25.0	75.2
Yield effect (%)		3.9			1.9	-164.5	42.4	4.9
Interaction (%)		18.1			38.5	134.5	32.6	19.9
2002 over 1992	14.7	2050.5	41.5	1263.8	449.1	-13.2	-11.2	3806.8
Area effect (%)	130.9	94.4	46.7	59.3	86.1	21.1	98.4	82.9
Yield effect (%)	-0.7	2.8	19.7	7.2	3.7	87.8	5.0	7.2
Interaction (%)	-30.2	2.8	33.6	33.6	10.2	-8.9	-3.4	9.9
2012 over 2002	170.5	2578.4	80.8	2070.1	548.4	17.2	51.9	5531.5
Area effect (%)	71.2	39.2	136.0	107.9	37.8	15.7	101.0	60.8
Yield effect (%)	3.2	48.5	-11.7	-3.1	46.1	70.9	-0.1	25.2
Interaction (%)	25.6	12.3	-24.3	-4.8	16.1	13.4	-0.9	13.9
2012 over 1982	185.2	6278.3	122.3	3333.9	1135.3	-42.5	53.0	11279.5
Area effect (%)	95.6	58.2	68.1	65.2	37.9	140.1	41.2	56.1
Yield effect (%)	0.0	2.9	3.8	2.4	0.6	-206.0	9.1	2.4
Interaction (%)	4.4	38.9	28.1	32.4	61.6	165.9	49.7	41.5

Soybean as an Alternative More Profitable and Less Risky Kharif Crop

With the high variability in weather and other crop production variables, risk is inherent part of farming business. In order to reduce their exposure to risk, farmers follow practices like change in production portfolio in favour of short duration and water efficient crops (Walker et al. 1986). Though, soybean was targeted to utilizing rainy season in fallow lands, but subsequently it started replacing less profitable foodgrain crops such as sorghum, pearl millet and black gram (Bisaliah, 1986). Does soybean continue to enjoy the status of less risky and more profitable alternative kharif season crop? The present study tried to answer this question by analysing profitability of soybean over competing crops and evaluating the risk in these crop enterprises.

Profitability of Soybean vis-a-vis Other Kharif Crops

Farmers allocate their land and other resources among alternative crops on the basis of their comparative advantages as sources of money income. Does soybean, a short duration kharif season crop, provide higher net returns over other competing crops in the season? To understand the higher growth in soybean area and

production in major crops, the net returns (over cost C2 and A2) from cultivation of soybean and other kharif crops in major soybean producing states have been analysed from the CACP data and presented in table5.

TABLE5. RETURNS FROM SOYBEAN AND OTHER KHARIF CROPS IN MAJOR SOYBEAN GROWING STATES

(Rs/Ha)

State	Crop	Net Returns over Cost C2			Net returns over Cost A2		
		1981-83	1995-97	2008-10	1981-83	1995-97	2008-10
MP	Soybean	753.5	1847.3	4909.6	1611.9	5725.1	13599.2
	Maize	176.4	-115.4	-3083.7	903.5	2714.9	3615.6
	Sorghum	133.9	189.4	-1193.7	728.7	3070.2	4791.2
	Arhar	810.4	3642.0	8463.0	2144.4	8156.6	17998.8
	Urad	226.6	943.7	1211.0	826.8	3690.3	7875.8
	Cotton	627.1	1326.8	9055.1	1537.1	5833.3	23752.6
	Paddy	493.7	1170.7	4789.2	1334.0	5566.7	14957.5
Maharashtra	Soybean		1651.3	2148.5		4530.4	9325.5
	Sorghum	456.7	1894.5	682.2	1074.7	4238.3	8602.6
	Bajra		158.4	-2095.6		2074.7	6831.7
	Urad		1179.5	-221.4		2861.2	5178.7
	Cotton	147.8	3218.4	3047.7	869.4	7231.5	14153.6
Rajasthan	Soybean		2702.9	3464.8		5874.3	9828.9
	Maize	361.7	-226.8	705.1	1573.6	5340.0	11625.7
	Sorghum	351.7		-197.0	922.1		5227.2
	Bajra	245.9	349.0	501.8	673.0	2501.2	7075.9
	Cotton		10180.9	18096.7		17021.9	36492.9

Note- data for Arharin MP for the year 1981-82.

The results revealed that net returns from cultivation of soybean in Madhya Pradesh, Maharashtra and Rajasthan were higher compared to other kharif crops except arhar and cotton during all three periods.This indicates that farmers in the state preferred to grow soybean than other crops in the season as the crop provides higher net returns and matures in short duration compared to arhar and cotton, which gives opportunity to cultivate other crops like potato/ garlic before planting wheat in the rabi season particularly in the Malwa region, which results higher growth in area under soybean cultivation in these states. The area share of soybeans increased from less than 0.5 percent in the early 1980s to about 5 percent of gross cropped area in the country during the period from 2008 to 2011 because of the economic superiority of soybeans.Similarly, the share of soybeans in total oilseed production increased from around 5 percent in theearly 1980s to 37percent in recent years. Furthermore, this superiority is not confined to a specialsituation prevailing in a single year. Earlier studies referring to the early 1970s (Dovringet al., 1973)and mid-1980s (Bapnaet al., 1992) and recently Chand, 2007, and Jaiswalet. al, 2011have also reported the economic superiority of soybeans overcompeting crops. Jaiswal et al., 2011 reported that net returns from soybean cultivation were higher by 868% than Jowar and by 122% compared to Maize. The added advantage from soybean cropping system is that, the crop being leguminous in nature fixes atmospheric nitrogen and improves soil health. Soybean-wheat system was found to yielding 20% higher returns compared to sorghum-wheat and maize-wheat (Badal, et. al., 2000). Soybean yields sufficiently higher per rupee net returns over operational cost in three states analysed compared to other short duration crops.

New varieties of soybeans were introduced in India during the 1960s and the crop was promoted initially with the expectation that it would meet the demand for pulses in the country. Soybean was seen as a miracle crop and was expected to repeat the success story achieved in the United States. The crop was then found to be the most profitable among all legume cropsand it was anticipated that the inclusion of soybeans in the cropping system would increase farmers' income by 88 percent (Dovringet al., 1973).The reasons for the expansion in area despite stagnant productivity (Chand, 2007)are:(a) the suitability of soybeans for cultivation in fallow land; (b) the yield

and price advantage over other crops, mainly coarse cereals and pulses.

The Risk Factor

Crop diversification towards short duration and less water intensive crops is one of the on farm strategy of farmers to averse the risk. The risks in yield, price and net income over operational cost was measured as instability index for soybean vis-a-vis other kharif crops and presented in table 6.The net income over operational cost of kharif crops was calculated from the period 1996-97 to 2010-12 from CACP data. The prices of crops were calculated from value of output of crop and the production data for the period 1980-81 to 2010-11. The net income instability index for soybean was lowest (next to Arhar) among major kharif crops in Madhya Pradesh, implying thereby that crop enjoys the status of short duration and less risky in terms of net income over operational cost. The instability index for yield of kharif crops in Madhya Pradesh was lowest for urad followed by jowar, soybean and maize. The price risk was lowest for maize followed by jowar, arhar and soybean.

In case of Maharashtra, the yield risk for soybean was found to be higher than maize, jowar, bajra and arhar. The price risk of soybean was higher than cotton and bajra, while income risk for soybean was higher than arhar and cotton. In Rajasthan, soybean stands out with other kharif crops in terms of yield risk, where jowar and bajra crops witnesses higher yield risk. Price risk was less in case of maize and jowar crops in the state. The income risk was highest in case of jowar followed by soybean.

TABLE 6. RISK IN SOYBEANVIS-A-VIS OTHER KHARIF CROPS (% INSTABILITY INDEX)

States	Crop	Yield Risk				Price Risk				Income Risk
		1981-91	1991-01	2001-11	1981-2011	1981-91	1991-01	2001-11	1981-2011	1996-2011
Madhya Pradesh	Soybean	9.5	7.8	10.3	9.1	10.5	6.8	4.1	7.4	20.3
	Maize	10.1	12.2	9.4	10.3	6.0	8.3	4.2	6.2	23.0
	Jowar	8.7	10.1	6.2	8.35	5.8	10.2	5.1	7.2	28.2
	Arhar	12.3	7.3	13.6	11.2	8.1	7.6	6.5	7.3	20.0
	Urad	7.9	8.1	6.6	7.4	5.2	13.0	7.8	8.9	45.9
	Cotton	8.3	13.5	12.1	11.7	10.6	8.6	7.7	9.0	29.9
	Paddy	9.3	11.1	17.4	12.9	2.6	18.5	7.1	11.3	40.9
Maharashtra	Soybean	-	12.3	16.0	14.14	-	5.9	9.9	7.71	23.14
	Maize	7.6	11.6	10.7	10.24	7.8	12.2	10.7	8.26	-
	Bajra	15.1	16.1	7.0	12.99	6.0	10.8	3.6	7.18	135.78
	Jowar	13.6	15.0	6.9	11.95	10.0	12.3	9.0	10.35	23.25
	Arhar	10.8	19.0	9.8	13.36	14.4	7.5	6.5	9.82	21.68
	Cotton	21.2	17.6	10.1	16.55	5.8	7.4	8.5	7.09	22.28
Rajasthan	Soybean	11.4	13.2	20.8	15.35	13.8	7.4	8.3	9.91	21.28
	Maize	24.1	10.7	20.1	18.53	8.1	8.6	9.6	8.48	16.26
	Jowar	17.8	27.4	45.6	31.53	5.7	8.8	10.1	8.11	25.33
	Cotton	23.7	9.4	23.3	19.34	11.3	11.5	11.2	10.98	15.66
	Bajra	27.2	28.0	35.0	29.29	8.4	9.5	12.7	10.02	16.89

Decade-wise analysis indicated that yield risk has decreased for kharif crops in Madhya Pradesh and Maharashtra, except for soybean and paddy. Price risk also declined in both these states. While in Rajasthan, yield risk as well as price risk has increased for all major kharif crops particularly in the recent decade with few exceptions. The yield risk coupled with price risk was found to be on lower side for soybean compared to other major kharif crops, which might also have added to the faster growth in area increase in soybean. The point of concern emerging from this analysis is that the yield risk for soybean has increased while growth in yield has decreased in major states particularly in the recent decade. This may pose an emerging challenge for crop scientists, as yield growth and its stabilization compared to competing crops decides the area allocation and in turn production levels of the

crop. Stabilizing the yield of the dominant crop would be much more effective in stabilizing revenues in the rainfed conditions (Barahet. al, 1982). Stabilizing price, on the other hand, is an effective strategy to reduce revenue risk in the irrigated districts.

Conclusions

Soybean area has grown at the rate of 9.6 per cent in the country during the period 1980-2012. The instability in area under soybean cultivation was very high in major soybean growing states as well as in India during the initial phases of soybean growth and development. The area under soybean cultivation exhibited some stability in recent decades in major producing states as well as in India, as the instability in area has declined sharply. Soybean production in the country has grown at the rate of 11.5 per cent annually during the period 1980-2012. Rajasthan state witnessed highest growth in production of soybean (18.3% annual) followed by Madhya Pradesh (10%) and Gujarat (7.9%) during the period 1980-2012. The instability in production of soybean in the country has been worked out to be about 22-23 per cent in all the decades analysed. The instability in soybean production was found to be very high and increasing in recent decades, may be due to higher fluctuation in rainfall in major soybean producing states, as a crop is mainly grown in rainfed conditions. There was increasing trend in soybean productivity, though at the slow pace. The recent decade witnessed higher growth in soybean yield in the country. Instability in yield of soybean was found to be higher in all major soybean growing states (ranging from 21 to 43 per cent) as well as in India (about 20 per cent).

The decomposition analysis of soybean output growth revealed growth in soybean production in the country is mainly on account of changes in area and there was negligible effect of growth in yield. To further understand this phenomenon, the decomposition has been worked out for three different decades. The results of decade-wise analysis indicated that the effect of changes in soybean yield to the output growth was increasing, particularly in Madhya Pradesh, Rajasthan, Uttar Pradesh and Andhra Pradesh, as well as in India. Therefore, the scope for increasing production of soybean crop lies in increasing the yield levels. The net returns from cultivation of soybean in Madhya Pradesh, Maharashtra and Rajasthan were higher compared to other kharif crops except arhar and cotton, indicating that farmers in these states preferred to grow soybean than other crops in the season as the crop provides higher net returns and matures in short duration compared to arhar and cotton, which gives opportunity to cultivate other crops like potato before planting wheat in the rabiseason, particularly in the Malwa region of MP, and thus higher growth in area under soybean cultivation in these states.Price, yield and net income risk of these crops plays a significant role in area expansion of soybean in major states. The policy and research support in this direction will provide boost to the crop area expansion and production growth.

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AGRO-ECONOMIC RESEARCH

Problems and Prospects of Oil Seeds Production in West Bengal*

DEBAJIT ROY, FAZLUL HAQUE KHAN

1. Introduction

1.1: Backdrop of the Study

On the oilseeds map of the world, India occupies a prominent position, both in regard to acreage and production. India contributes about 10 percent of the world oilseeds production, 6-7% of the global production of vegetable oil and protein meal and is the 4th largest edible oil economy in the world. This sector has also an important position in the Indian agricultural sector covering an area of about 26.8 million hectares, with total production of about 27.9 million tonnes in Triennium Ending (Te) 2010-11 (GOI, 2011). This constitutes about 14.9 percent of the gross cropped area in the country. The oilseeds accounted for about 9.7 percent (at 2004-05 prices) of the total value of output from agriculture in TE 2009-10 (CSO 2011).

1.2: Role of Agriculture in the State

West Bengal happens to be the 3rd biggest economy in India. The main contributing factor in economy and business of this Indian state is agriculture and it is the main occupation of the people of West Bengal. In the year 2009 and 2010, agriculture sector contributed a total of 18.7 percent to the state's total GDP. The cropping pattern of this state is dominated by food crops which account for about 78 per cent of the area under principal crops. Rice is cultivated in 58.48 lakh hectares (production of 161.48 lakh MT) followed by Cereals (all combined) in 63.49 lakh hectares and oilseeds in 7.14 lakh hectares, Jute in 6.09 lakh hectares and potato in 3.67 lakh hectares. The state is second largest producer of Potato and Uttar Pradesh and one of the highest producers of vegetable in the country. Traditionally, West Bengal has been the highest producer of jute. The State also accounts for 25 per cent of tea production in the country, next only to Assam. Against the ultimate irrigation potential of 67.43 lakh hectares, the gross irrigation potential created through major, medium and minor irrigation in the State till the end of March 2009 was 55.01 lakh hectares. The percentage utilization of potential created is 81.73 percent in major and medium irrigation structures and 81.64 percent in minor irrigation.

1.3: Importance of Oilseeds in the State Agriculture

In West Bengal, the share of cereals declined over the years, while those of fruits & vegetables increased from their 1980-81 levels. In particular, the share of cereals decreased from 52.76% in 1980-81 to 32.82% in 2005-06, while the share of fruits & vegetables registered a massive increase from 17.75% in 1980-81 to 44.84% in 2005-06. The share f condiments & spices showed marginal increase from 0.92% in 1980-81 to 2.07% in 2005-06, while pulses, sugarcane and fibre showed marginal decline. The share of oilseeds fluctuated over the years, and somehow succeeded to retain its relative importance more or less same over time.

1.4: Problems in Oilseeds Production

West Bengal does not occupy any significant position in terms of either acreage or production of oilseeds. In terms of both acreage and production rape and mustard are by far the most important oilseed crops both in terms of area and production. Sesame and linseeds are the other two oilseed crops raised in this state.

A brief review of literature regarding the performance of oilseeds yield and production reveals that a number of factors can be held responsible for the poor performance of the oilseeds sector in the state. These may be put as—

a) Shortage of HYV seeds,

b) Lack of use of irrigation, fertilizer and pesticide in appropriate doses,

c) High risk and uncertainty factors in production

d) Tendency to raise pulses mixed with other crops

e) Poor managerial attention, and

f) Inadequacy of extension facilities.

1.5: Objectives of the Study

The specific objectives of the study are:

1. To examine trends and pattern of growth of different edible oilseeds over time in West Bengal and identify the sources of growth in edible oilseeds output in the state;

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2. To identify major constraints in the edible oilseed cultivation and suggest policy options to increase oilseeds production and productivity in the state.

2. Coverage, Sampling Design and Methodology

The study is based on both primary and secondary data pertaining to edible oilseeds. In order to meet the first two objectives of the study, a substantial amount of collection and analysis of secondary data related to area, production and productivity of oilseeds is undertaken. In order to identify major constraints in edible oilseeds production in the country, primary data from households growing oilseeds is collected and analyzed.

A multistage, purposive sampling method is used to select the districts, blocks and farm households based on acreage & yield rate. At first stage, one district each from high acreage & highe yield (HH) districts, high acreage & low yield (HL) districts, and low acreage & highe yield (LH) districts have been selected. Since HH, HL and LH districts have potential for increasing production of oilseeds; we have selected at least one district each from these 3 categories for household survey. The 3 selected districts are Nadia, Bankura and North 24 Parganas, respectively.

At second stage, major oilseeds producing blocks is selected and an appropriate number of villages is selected for household survey. From each selected village an appropriate number of farmers representing different farm categories (Marginal 0-1 ha, Small 1-2 ha, Semi-medium 2-4 ha, and Medium 4-10 ha) based on probability proportional to size in each district, such that we get a minimum of 20 households in each category in the final sample pool. However, we finally club the semi-medium category with medium category, and treat the clubbed category as 'medium' category. In this way a total number of 250 sample households have been selected for the study distributed over different size-categories in selected districts.

The Study Area

3. Overview of Oilseeds Sector: Current Status and Growth behaviour

3.1: Cropping Pattern Changes in the Stage

After the introduction of the high yielding varieties of seeds and other land augmenting technologies, agriculture in West Bengal has witnessed remarkable changes over time. This has particularly influenced the cropping pattern of the state at large, bringing about increase in acreage of certain crops and decline in particular cases also. It is to be noted here that the impact of Green Revolution spread across West Bengal with a time-lag of one or two decades, as compared to western states like Punjab, Haryana, etc. This is reflected in a rapid increase in the acreage of certain crops in the 1970s and 1980s. During the last four decades, acreage under foodgrains hardly increased. On the part of

the oilseeds, it is quite inspring to observe that area under oilseeds (especially mustard) registered a sharp increase over time. In particular, while proportional allocation of land under rapeseed and mustard increased from 1.70 percent during TE 1973-74 to 5.80 percent during TE 2009-10, that for other oilseeds (including sesame) increased from 1.10 percent to 4.00 percent over the same period of time. As a result of these changes, proportional acreage allocation (as percent of gross cropped area) under oilseeds registered a sharp increase from 1.10 percent in TE 1973-74 to 9.80 percent in TE 2009-10. As such, it comes out that over the last few decades, while cultivation of foodgrains lost its importance to some extent, cultivation of oilseeds has gained significance in the cropping pattern in West Bengal agriculture.

3.2: Factors Underlying changes in Cropping Pattern

The changes in cropping pattern over the last few decades in the state resulted from situational advantage or disadvantage for specific crops to grow in acreage and yield rate. This was actively backed by several government schemes to promote specific crops like HYV rice or newer breeds of oilseeds over definite time periods. Though with a sufficient time-lag, the results are clearly reflected in the changes that took place in the cropping pattern of the state.

3.3: Growth Trends in Area, Production and Yield of Major Oilseeds

Among the major changes that took place in the cropping pattern of West Bengal agriculture, growth of oilseeds sector is no doubt a significant change. Data on area, production and yield rate of oilseeds in the state clearly reflects the growth trajectory of oilseeds sector over the last five decades, thanks to various government schemes and favourable condition for the growth of the sector. In fact, area, production and yield rate of oilseeds exhibited a continuous growth over the last five decades, viz. since the 1960s. There has been quantum jump, especially in the area and production of oilseeds during the 1970s. During this decade, area under oilseeds more than doubled itself, while production grew by nearly four times. This has been especially due to rapid increase in area under rapeseed and mustard in the state. In the later decades, viz., during the 1980s, oilseeds sector grew further, but at a slower rate as compared to the earlier decade. Since the 1990s, however, the growth in the oilseeds sector can largely be attributed to oilseeds like seasame, sunflower, groundnut, etc. But the fact remains that oilseeds sector in West Bengal have witnessed a consistent growth in area, production as well as yield rate throughout the last fifty years. This is especially impressive considering a corresponding slowdown in the foodgrains sector in the state, especially since the 1990s.

Trade in Average Area, Production, and Yield of Oilseeds in West Bengal

	1951-52 to 1960-61	1961-62 to 1970-71	1971-82 to 1980-81	1981-82 to 1990-91	1991-92 to 2001-01	2001-02 to 2009-10
Area ('000 hectares)	—	161.80	208.09	433.11	525.30	659.32
Production ('000 tonnes)	—	59.40	84.89	306.80	426.23	605.00
Yield (kg/ha)	—	367.50	402.99	683.33	809.32	915.32

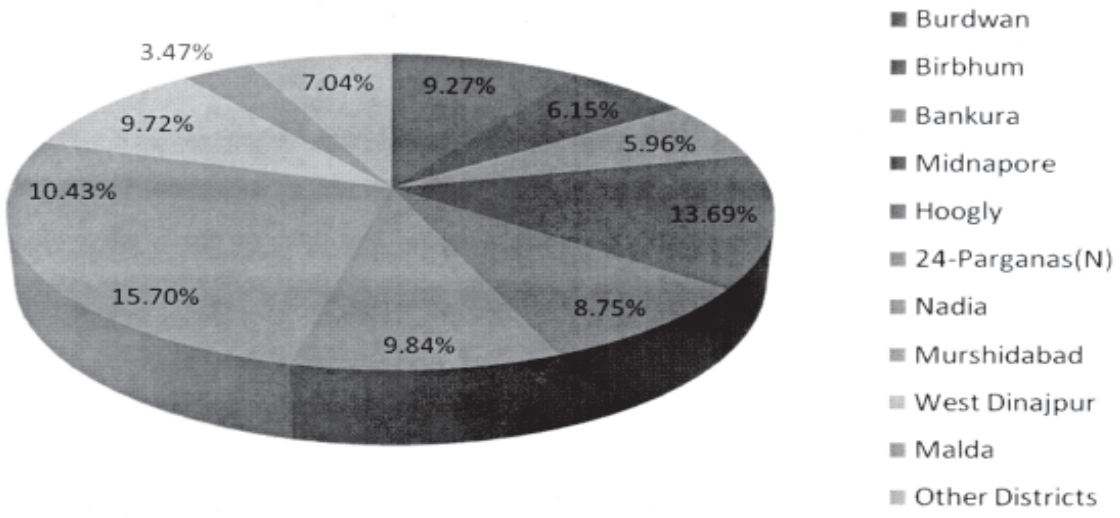
Source: Statistical Abstract (Govt. of West Bengal)-Carious Issue.

3.4 Variability in Area, Production and Yield of Sesame

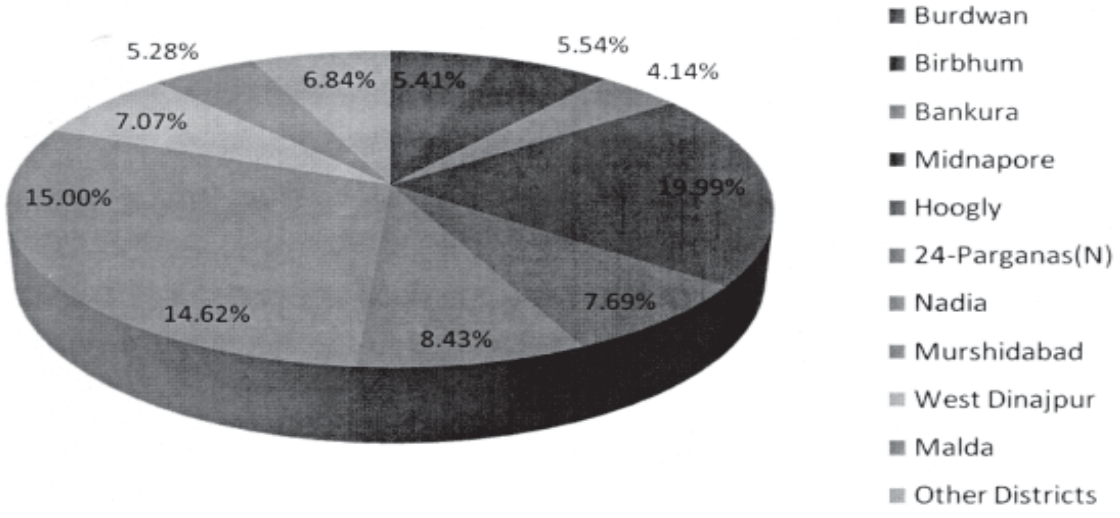
Though, in West Bengal, mustared has been major oilseeds throughout the last few decades, but very recently (especially since 1990s), there has been a slowdown in the growth of mustard while seasame is fast coming up as a major oilseeds in the state. In fact, growth in area, production and yield rate of seasame has been quite impressive throughout the decades. Over the last four decades, area under seasame grew by more than four times from 40.46 thousand hectares during the 1970s to 162.46 thousand hectares during the last decade 2002s. Production of seasame on the other hand grew even sharper from 21.82 thousand tonnes in 1970s to as high as 138.02 thousand tonnes during 2002, thanks to increasing trend in the yield rate from 554 kg/ha to 851 kg/ha over the same period to time. All over 28 per cent area under oilseeds. From our earlier analysis, it is also observed that along with the major oilseed producing districts, seasame has grow in areas which are not traditionally known as oilseed producting districts, and has come up as a situational solution to farming in summer under non-availability or poor availability of irrigation conditions.

Share of Major Districts under Oilseeds Production in the State: TE1993-94 and TE2009-10

TE 1993-94



TE 2009-10



Sources: Statistical Abstract (Govt. of West Bengal)-Various Issue.

3.5: Variability in the Growth of Area, Production and Yield of Sesame

To examine the variability in the growth of area, production and productivity of oilseeds (particularly sesame) across districts of the state, we classify districts according to the direction and magnitude (level of significance) of growth achieved during specific time periods. During the period 1981-82 to 2009-10, it can be observed that as many as 6 districts in the state have witnessed significant positive growth in area under sesame. These districts include Nadia, Midnapore (East & West), Murshidabad, 24 Parganas (North & South), Bankura and Hooghly. In contrast, a number of districts have experienced significant negative growth in area under sesame, which include districts like Malda, Dinajpur (North & South), Darjeeling, Birbhum, Howrah, Coochbehar and Purulia. At the same time, some districts have exhibited negative stagnant growth in area under sesame, which include districts like Burdwan and Jalpaiguri, while none of districts has experienced a positive stagnant growth.

4. Problems and Prospects of Oilseeds Production: An Empirical Analysis

4.1 Main Features of Sample Households: Land Ownership Pattern, Cropping Pattern, Etc.

In case of socio-economic status of the sample households, it is observed that primary occupation of an overhelming majority of respondents is agriculture. The farm families are mostly from Other Bankward Classes and male dominated in nature, where average age of the heads is about 47 years. Average level of education *12.73) and family size (about 6 persons per family) tends to increase with increase in farm-size.

The pattern of land ownership by the sample households reveals that the average size of operational holding stands at 1.23 hectares, which gets irrigation from various sources. Only parts of owned land remains un-irrigated, which is left fallow as well. On the whole, data reveals that area covered under the present survey largely remains irrigated with little fallow land to waste. The incidence of leasing-in of land is much higher for the smaller farms, especially the marginal farms (17.2 per cent) as compared to the medium farms (0.40 per cent). Furthermore, an overwhelming majority (93.75 per cent of these lease contracts/arrangements are carried out on fixed rent in cash. The major source of irrigation is found to be groundwater sources.

The principal crops of the study region are kharif paddy, follwed by summer paddy and wheat among the cereals. Among the non-cereal crops, a large area under cultivation is devoted to mustard, followed by sesame and sunflower. The principal oilseed crop comes out to be mustard. It is observed that yield rate of kharif paddy stands at 53.32 quintals per hectare, and that for boro (summer) paddy stands at 48.67 quintals per hectare. In case of kharif paddy, average yield rate shows a sharp increase with increase in size farm size, though such pattern is not observed in case of summer paddy. However, average yield of wheat stands at 26.11 quintals per hectare, which too shows a direct relationship with farm size. In case of yield rate of oilseeds, it is observed that average yield rate for mustared stands at 10.80 quintals per hectare, while for sesame stands at 11.36 quintals per hectare.

4.2: Production, Retention and Marketed Sur;plus Pattern of Oilseeds

4.2.1: Production, Retention and Sale of Rabi Oilseed I (Mustard)

In case of production of mustard, it is observed that average production of mustard steadily increases with increase in farm-size, which is quite obvious under the present circumstances. However, in case retention, it is observed that a progressively lower proportion of mustard produced is retained back, while a progressive higher proportion of mustard is marketed over increase in farm-size. This, in turn, indicates that as farm size increase, retention for family consumption also increase but at a proportionately lower rate than marketed surplus.

4.2.2: Production, Retention and Sale of Rabi Oilseeds II (Sunflower)

In case of production of sunflower, similar trends may be observed as in case of mustared, but at a lower magnitude. In particular, average production of sunflower shows an increasing trend over increase in farm-size. Retention and marketed surplus of sunflower also tends to increase with increase in farm size, but that increase is proportionate much sharper in case of marketed surplus of sunflower than its retention.

4.2.3: Production, Retention and Sale of Summer Oilseeds I (Sesame)

In case of production, retention and sale of summer oilseeds, viz. sesame, we also witness likewise pattern as mustard and sunflower. In particular, average production and average marketed surplus shows in increasing pattern with increase in farm size. However, in case of retention, such a pattern is not well established. Also, average prices per quintal of sesame remains the highest for the small farms, followed by the medium and the marginal farms.

4.3: Comparative Economics/Profitability of Oilseeds Vis-a-vis other Competing Crop(s)

4.3.1: Profitability of Major Oilseeds and Competing Crops

In case of profitability in cultivation of oilseeds (here, sesame), the results of our field investigation shows that though costs of production per unit of land is much less for sesame cultivation as compared to competing crop (summer paddy), profitability of sesame cultivation is much lower. In particular, profitability in sesame cultivation stands out to be as low as 1/3rd of that in cultivation of summer paddy. Evn though costs on account of seeds, fertilizers, insecticides & pesticides, etc. are much lower for sesame cultivation as compared to cultivation of summer paddy, lower gross value of output per unit of land in sesame cultivation in turn brings down profit.

Profitability of Major Oilseeds and Competing Crops (Rs/ha)

Cost items	Oilseeds I:Sesame				
	Merginal	Small	Medium	Large	All Farms
Total Operational Costs	22503.00	24090.00	25181.00	—	23364.00
Yield (Quintals)	11.00	12.00	12.00	—	11.00
Price	2690.00	2762.00	2762.00	—	2712.00
Value of main-product	29590.00	33144.00	32928.00	—	29832.00
Value of by product	0.00	0.00	0.00	—	0.00
Net Income (2+3)-(1)	7087.00	9054.00	7747.00	—	6468.00
Cost of production/q	2046.00	2008.00	2098.00	—	2124.00
Cost of production/ha	22503.00	24090.00	25181.00	—	23364.00
	Competing Crop I: Summer Paddy				
	Marginal	Small	Medium	Large	All Farms
Operational costs					
Total Operational Costs	32782.00	33671.00	3413.00	—	33203.00
Yield Operational Costs	50.00	50.00	51.00	—	50.00
Price	900.00	885.00	905.00	—	898.00
Value of main-product	45000.00	44250.00	46155.00	—	44900.00
Value of by-product	7233.00	7340.00	7454.00	—	7355.00
Net Income (2+3) = (1)	19451.00	17919.00	19506.00	—	19052.00
Cost of production/q	656.00	673.00	682.00	—	664.00
Cost of production/ha	32782.00	33671.00	3413.00	—	33203.00

Source: Field Survey

4.3.2: Profitability Vis-avis Risks Oilseeds Production

In terms of risks involved, cultivation of oilseeds appears much riskier as compared to cultivation of summer paddy. This has been true in respect of risks involved in yield, price of output as well as net income from cultivation of oilseeds, especially for the smaller farms. Variability in yield is also higher in case of oilseeds cultivation, which too is more pronounced for the smaller farms, though at the aggregative level yield variability in oilseeds cultivation is lower than that in cultivation of summer paddy.

Profitability vis-a-vis Risks in Oilseeds production

INdicators	Merginal	Small	Medium	Large	All Farms
Main Crop Oilseeds I (Sesame)					
Acreage variability	76.36	78.18	66.50	—	97.23
Yield Risk	52.91	45.56	41.98	—	49.89
Price Risk 42.43	44.95	41.50	33.76		42.43
Net Income Risk	144.35	88.01	116.85	—	127.52
Main Competing Crop (Summer Paddy)					
Acreage variability	47.56	41.84	64.29	—	129.87
Yield Risk	18.58	6.74	7.31	—	15.56
Price Risk	16.53	5.64	6.32	—	13.83
Net Income Risk	33.99	22.26	27.23	—	31.33

Computed values of coefficient of variation of area, yield, price and net income of main oilseeds and niain competing crops

Source: Field Survey

4.4: Access to Improved Technology and Markets for Oilseeds

With regard to access to technology in oilseeds cultivation, the survey finds that all the sample farms belonging to all size-classes use high yielding varieties of seeds. This in turn shows acceptance of modern technology among the farms in terms of use of HYV seeds. However, a majority of the farms have been found using seeds obtained from various sources, while about 38.8 percent of farms purchase seeds directly from the market, especially the larger farms.

4.5: Yield Gap Analysis

It is interestingly observed that actual farm yield is higher than both experimental yield (in demonstration plots of department of agriculture, government of West Bengal) and potential yield. This holds true consistently for all the size-classes.

4.6: Perceived Constraints in Cultivation of Oilseed Crops

There are practically numerous constraints in the cultivation of oilseeds in the study region. It is practically not feasible to address each of them, but a few of them is highlighted here. Among the technological constrained as perceived by the farmers, it is observed that the major bottlenecks are poor crop germination (96.3 percent), followed by non-availability of suitable varieties of sesame (88.5 percent). Considering various agro-climatic factors constraints in sesame cultivation, it is observed that on one extreme we have draught at critical stages of crop growth (91.2 percent) and excessive rains (91 percent) on the other extreme. Among the various economic constraints, a few important ones are low and fluctuating prices (92.5 percent), high input costs (80.1 percent) and shortage of human labour (80.6 percent). Among the institutional bottlenecks, the problem of timely availability of seeds stands out as the single major bottleneck in the cultivation of sesame, as perceived by 90.9 percent of the respondents. Lastly, among the constraints faced in the post-harvest period, the single major bottleneck appears to be exploitation by market intermediaries as perceived by as high as 98.4 percent of the respondent farmers.

4.7: Marketing Pattern of Oilseeds

Marketing of oilseeds (sesame) mostly occurs in a personalized manner where a major part of the output is sold to the processing mills (46.89 percent), followed by the local village traders (36.24 percent) and the commission agents (16.89 percent). However, there are variations in preference for particular marketing agencies among different size-class of farms. It comes out that while the smaller farms prefer to market their product to local village traders, majority of the larger farms sell their produce processing units.

4.8: Sources Of Technology And Market Information

The technical know-how about variety of seeds to be used is largely obtained from two major sources, viz. State Department of Agriculture (40.8 percent) and Retail Market (38.8 percent). Apart from farmers using (homestead seeds (14.4 percent), only about 6.0 percent of farmers obtain information about seeds from fellow farmers. While considering extension services, it has been observed that State Department of Agriculture is the only extension service provider for all the sample farms. No other agencies like state agriculture universities, krishi vigyan kendras, etc. have provided extension services to the farmers regarding sesame cultivation.

4.9: Suggestions for Improving Production and Productivity of Oilseeds

Among the suggestions forwarded by the sample farms for improving production and productivity of oilseeds (sesame), the most strongly suggested factor is the requirement of improved high yielding varieties of oilseeds, especially sesame. The other suggested measures according to their importance assigned by the farmers include suggestion on account of necessity of regulated markets (58.8 percent), soil testing and proper application of fertilizers (47.2 percent) and use of modern farm equipments (42.0 percent).

5. Concluding Observations

Based on the major findings of the present study, a number of important concluding observations can be made. However, we may highlight some of these observations as follows:

Analysis of secondary data on area, production and productivity of oilseeds over the decades reveals that while there has been a slowdown in the foodgrains sector in West Bengal agriculture, oilseeds sector in the state has experienced a remarkable development in terms of area, production as well as productivity. Though there has been a shift in the importance of specific crops in the composition of oilseeds sector, the growth trajectory has remained intact over the decades. In particular, during the 1970s and partly) in 1980s, spread of cultivation of mustard acted as the engine of growth in the oilseeds sector in West Bengal. However, over time, especially since the 1990s, situation turned in favour of cultivation of sesame. A number of districts which are not traditionally known as oilseed producing district came up as important contributors to state's oilseed map. At present, while growth of area, production and productivity of mustard has slowed down, that of sesame has picked up momentum and fast becoming a major crop in the oilseeds sector in state agriculture.

This impressive growth in the oilseeds sector led by spread of cultivation of sesame has its root planted in some of the situational and economic advantages in West Bengal agriculture, as has been observed from an empirical investigation carried out for this study. In particular, it is observed that as spread of irrigation facilities came to a halt, sesame appeared as a major crop to take advantage of the situation. It is observed that cultivation of sesame requires much less irrigation and operational cost. Though it involves many risks in terms of yield and price, cultivation of sesame complemented cultivation of summer paddy to a large extent. In particular, sesame is observed to be cultivated in plots that would have been left fallow otherwise. This is particularly why after so much risks and low yield rate, sesame is fast becoming a major crop in the oilseed map of West Bengal.

Further, it is impressive to note that cultivation of sesame has made a remarkable progress even after confronting a number of technological, economic and infrastructural constraints. It thus comes out that to further promote growth in the cultivation of oilseeds, such constraints need to be addressed in future intervention schemes, particularly relating to price risks and economic uncertainties. Such efforts are expected to place cultivation of sesame in West Bengal on a self-sustained growth path.

COMMODITY REVIEWS

Foodgrains

During the month of July, 2016 the Wholesale Price Index (Base 2004-05=100) of pulses increased by 12.18%, cereals increased by 0.98% & foodgrains increased by 2.82% respectively over the previous month.

ALL INDIA INDEX NUMBER OF WHOLESALE PRICES

(Base: 2004-2005=100)

Commodity	Weight (%)	WPI for the Month of January, 2016	WPI for the Month of December, 2016	WPI A year ago	Percentage change during	
					A month	A Year
1	2	3	4	5	6	7
Rice	1.793	247.4	245.2	237.7	0.9	4.08
Wheat	1.116	227.6	225.2	212.9	1.07	6.90
Jowar	0.096	294.1	290.8	276.6	1.13	6.33
Bajra	0.115	306.9	314.2	242.9	-2.32	26.35
Maize	0.217	296.7	287.1	245.5	3.34	20.86
Barley	0.017	278.2	272.8	219.3	1.98	26.86
Ragi	0.019	337.2	349.7	321.1	-3.55	5.05
Cereals	3.373	248.0	245.6	231.7	0.98	7.03
Pulses	0.717	432.8	400.2	318.8	12.18	35.76
Foodgrains	4.09	280.4	272.7	246.9	2.82	13.54

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 July, 2016.

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

Procurement of Rice

0.092 million tonnes of rice (including paddy converted into rice) was procured during July 2016 as against 1.13 million tonnes of rice (including paddy converted into rice) procured during July 2015. The total procurement of rice in the current marketing season i.e 2015-2016, up to 29.07.2016 stood at 34.14 million tonnes, as against 31.61 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 29.07.2016		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	4328	12.68	3522	11.14	3591	11.17	3722	11.76
Chhatisgarh	3442	10.08	3350	10.61	3423	10.64	4290	13.56
Haryana	2861	8.38	2015	6.37	2015	6.27	2406	7.60
Maharashtra	230	0.67	199	0.63	199	0.62	161	0.51
Punjab	9350	27.39	7786	24.63	7786	24.21	8106	25.62
Tamil Nadu	1128	3.30	970	3.07	1049	3.26	684	2.16
Uttar Pradesh	2910	8.52	1698	5.37	1698	5.28	1127	3.56
Uttarakhand	598	8.75	465	1.47	465	1.45	463	1.46
Others	9295	27.22	11608	36.71	11936	37.11	10678	33.75
Total	34142	100.00	31618	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 20116-17 (upto 30.06.2016)		Corresponding Period of last Year 2015-16		Marketing Year (April-March)			
					2015-16		2014-15	
	Procurement	Percentage to Total	Procurement	Percentage to Total	Procurement	Percentage to Total	Procurement	Percentage to Total
1	2	3	4	5	6	7	8	9
Haryana	6722	29.32	6692	24.00	6778	24.13	6495	23.20
Madhya Pradesh	3990	17.40	7195	25.80	7309	26.02	7094	25.34
Punjab	10645	46.42	10346	37.10	10344	36.83	11641	41.58
Rajasthan	762	3.32	1300	4.66	1300	4.63	2159	7.71
Uttar Pradesh	802	3.50	2267	8.13	2267	8.07	599	2.14
Others	9	0.04	85	0.30	90	0.32	6	0.02
Total	22930	100.00	27885	100.00	28088	100.00	27994	100.00

Source: Department of Food & Public Distribution.

Commercial Crops

Oil Seeds and Edible Oils

The wholesale Price Index (WPI) of nine major oilseeds as a group stood at 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.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

Commodity	Latest	Month	Year	% Variation Over	
	June, 2016	May, 2016	June, 2016	Month	Year
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

Commodity	Latest June, 2016	Month May, 2016	Year June, 2016	% Variation Over	
				Month	Year
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

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, 16	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

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

(In Rs.)

State	District	Centre	Month & Year	Type of Labour	Normal Daily Working Hours	Ploughing	Sowing	Weeding	Harvesting	Other Agri-Labour	Herdsman	Skilled Labours		
												Carpenter	Black Smith	Cobbler
Assam	Barpeta	Laharapara	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	BhaluiRasul	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
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

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

State	District	Centre	Month & Year	Type of Labour	Normal Daily Working Hours	Ploughing	Sowing	Weeding	Harvesting	Other Agri-Labour	Herdsman	Skilled Labours		
												Carpenter	Black Smith	Cobbler
Odisha	Bhadrak	Chandbali	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

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

Commodity	Variety	Unit	State	Centre	July 16	June 16	July 15
Wheat	PBW 343	Quintal	Punjab	Amritsar	1595	1600	1600
Wheat	Dara	Quintal	Uttar Pradesh	Chandausi	1610	1640	1460
Wheat	Lokvan	Quintal	Madhya Pradesh	Bhopal	1722	1722	1450
Jowar	-	Quintal	Maharashtra	Mumbai	2300	2200	2300
Gram	No III	Quintal	Madhya Pradesh	Sehore	7601	6231	4260
Maize	Yellow	Quintal	Uttar Pradesh	Kanpur	1350	1425	1350
Gram Split	-	Quintal	Bihar	Patna	9000	6200	5100
Gram Split	-	Quintal	Maharashtra	Mumbai	10600	8300	5600
Arhar Split	-	Quintal	Bihar	Patna	13200	15000	8780
Arhar Split	-	Quintal	Maharashtra	Mumbai	10600	11450	9250
Arhar Split	-	Quintal	NCT of Delhi	Delhi	13450	13200	9700
Arhar Split	Sort II	Quintal	Tamil Nadu	Chennai	12500	12500	10500
Gur	-	Quintal	Maharashtra	Mumbai	4000	4000	3100
Gur	Sort II	Quintal	Tamil Nadu	Coimbatore	3800	3800	4000
Gur	Balti	Quintal	Uttar Pradesh	Hapur	3280	2900	NA
Mustard Seed	Black (S)	Quintal	Uttar Pradesh	Kanpur	4370	4280	3860
Mustard Seed	Black	Quintal	West Bengal	Raniganj	4700	4750	4550
Mustard Seed	-	Quintal	West Bengal	Kolkata	5200	4700	4850
Linseed	Bada Dana	Quintal	Uttar Pradesh	Kanpur	6200	5450	4250
Linseed	Small	Quintal	Uttar Pradesh	Varanasi	4490	4420	3925
Cotton Seed	Mixed	Quintal	Tamil Nadu	Virudhunagar	2500	2300	1700
Cotton Seed	MCU 5	Quintal	Tamil Nadu	Coimbatore	2500	2500	2000
Castor Seed	-	Quintal	Telangana	Hyderabad	3700	3300	3900
Sesamum Seed	White	Quintal	Uttar Pradesh	Varanasi	11250	11825	13465
Copra	FAQ	Quintal	Kerala	Alleppey	5200	5250	8050
Groundnut	Pods	Quintal	Tamil Nadu	Coimbatore	5500	5500	4500
Groundnut	-	Quintal	Maharashtra	Mumbai	7600	6600	6500
Mustard Oil	-	15 Kg.	Uttar Pradesh	Kanpur	1490	1474	1359
Mustard Oil	Ordinary	15 Kg.	West Bengal	Kolkata	1610	1638	1530
Groundnut Oil	-	15 Kg.	Maharashtra	Mumbai	2050	1900	1515
Groundnut Oil	Ordinary	15 Kg.	Tamil Nadu	Chennai	2100	1995	1800
Linseed Oil	-	15 Kg.	Uttar Pradesh	Kanpur	1575	1560	1380
Castor Oil	-	15 Kg.	Telangana	Hyderabad	1178	1050	1253
Sesamum Oil	-	15 Kg.	NCT of Delhi	Delhi	1480	1450	1880
Sesamum Oil	Ordinary	15 Kg.	Tamil Nadu	Chennai	2145	2100	1800
Coconut Oil	-	15 Kg.	Kerala	Cochin	1155	1155	1740
Mustard Cake	-	Quintal	Uttar Pradesh	Kanpur	2140	2160	1975
Groundnut Cake	-	Quintal	Telangana	Hyderabad	3886	4000	3857
Cotton/Kapas	NH 44	Quintal	Andhra Pradesh	Nandyal	5900	5100	3950
Cotton/Kapas	LRA	Quintal	Tamil Nadu	Virudhunagar	NT	NT	3506

Commodity	Variety	Unit	State	Centre	Jul-16	Jun-16	Jul-15
Jute Raw	TD 5	Quintal	West Bengal	Kolkata	5350	5765	4270
Jute Raw	W 5	Quintal	West Bengal	Kolkata	5300	5705	4220
Oranges	Big	100 No	Tamil Nadu	Chennai	780	800	520
Banana	-	100 No.	NCT of Delhi	Delhi	333	333	332
Banana	Medium	100 No.	Tamil Nadu	Kodaikkanal	499	498	497
Cashewnuts	Raw	Quintal	Maharashtra	Mumbai	86000	86000	64000
Almonds	-	Quintal	Maharashtra	Mumbai	54000	50000	72000
Walnuts	-	Quintal	Maharashtra	Mumbai	55000	55000	70000
Kishmish	-	Quintal	Maharashtra	Mumbai	11000	11000	21000
Peas Green	-	Quintal	Maharashtra	Mumbai	6000	6500	4100
Tomato	Ripe	Quintal	Uttar Pradesh	Kanpur	2650	3200	2550
Ladyfinger	-	Quintal	Tamil Nadu	Chennai	2000	2500	1500
Cauliflower	-	100 No.	Tamil Nadu	Chennai	1300	1200	1500
Potato	Red	Quintal	Bihar	Patna	1600	1350	820
Potato	Desi	Quintal	West Bengal	Kolkata	1800	1620	680
Potato	Sort I	Quintal	Tamil Nadu	Mettuppalayam	2833	3487	2022
Onion	Pole	Quintal	Maharashtra	Nashik	600	550	3200
Turmeric	Nadan	Quintal	Kerala	Cochin	15500	15500	12000
Turmeric	Salam	Quintal	Tamil Nadu	Chennai	8900	9000	8100
Chillies	-	Quintal	Bihar	Patna	9900	9800	8900
Black Pepper	Nadan	Quintal	Kerala	Kozhikode	66500	68000	62000
Ginger	Dry	Quintal	Kerala	Cochin	16500	16500	23000
Cardamom	Major	Quintal	NCT of Delhi	Delhi	128500	130000	135000
Cardamom	Small	Quintal	West Bengal	Kolkata	105000	95000	110000
Milk	Buffalo	100 Liters	West Bengal	Kolkata	3800	3800	3600
Ghee Deshi	Deshi No 1	Quintal	NCT of Delhi	Delhi	35685	35000	29348
Ghee Deshi	-	Quintal	Maharashtra	Mumbai	46000	46000	46000
Ghee Deshi	Desi	Quintal	Uttar Pradesh	Kanpur	36650	36700	34575
Fish	Rohu	Quintal	NCT of Delhi	Delhi	10000	10000	8200
Fish	Pomphrets	Quintal	Tamil Nadu	Chennai	35000	35500	36000
Eggs	Madras	1000 No.	West Bengal	Kolkata	4500	4350	4350
Tea	-	Quintal	Bihar	Patna	21200	21200	21100
Tea	Atti Kunna	Quintal	Tamil Nadu	Coimbatore	34000	34000	33000
Coffee	Plant-A	Quintal	Tamil Nadu	Coimbatore	28500	29500	31500
Coffee	Rubusta	Quintal	Tamil Nadu	Coimbatore	14700	13000	13500
Tobacco	Kampila	Quintal	Uttar Pradesh	Farukhabad	4600	4500	4575
Tobacco	Raisa	Quintal	Uttar Pradesh	Farukhabad	3500	3400	3525
Tobacco	Bidi Tobacco	Quintal	West Bengal	Kolkata	13000	12500	3900
Rubber	-	Quintal	Kerala	Kottayam	12000	11400	11000
Arecanut	Pheton	Quintal	Tamil Nadu	Chennai	32600	32500	31500

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

Commodity	Variety	Country	Centre	Unit	Jan.	Feb.	Mar.	Apr.	May	June	Jul
1	2	3	4	5	6	7	8	9	10	11	12
CARDAMOM	Guatmala Bold Green	U.K.	-	Dollar/MT	9000.00	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	60309.00
CASHEW KERNELS	Spot U.K. 320s	U.K.	-	Dollar/MT	8350.09	8143.20	8333.00	9184.69	9568.85	9560.20	9620.02
				Rs./Qtl	56855.76	55683.20	55747.77	61023.08	64063.45	64282.78	64463.75
CASTOR OIL	Any Origin ex tank Rotterdam	Netherlands	-	Dollar/MT	1374.00	1244.70	1244.70	1244.70	1274.70	1249.90	1249.90
				Rs./Qtl	9355.57	8511.26	8327.04	8269.79	8534.12	8404.33	8375.58
CHILLIES	Birds eye 2005 crop	Africa	-	Dollar/MT	4100.00	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	27474.10
CLOVES	Singapore	Madagascar	-	Dollar/MT	8650.00	8650.00	8650.00	8700.00	8750.00	8750.00	8900.00
				Rs./Qtl	58897.85	59148.70	57868.50	57802.80	58581.25	58835.00	59638.90
COCONUT OIL	Crude Phillipine/ Indonesia, cif Rotterdam	Netherlands	-	Dollar/MT	1155.00	1255.00	1545.00	1535.00	1430.00	1600.00	1500.00
				Rs./Qtl	7864.40	8581.69	10336.05	10198.54	9573.85	10758.40	10051.50
COPRA	Phillipines cif Rotterdam	Phillipine	-	Dollar/MT	687.50	714.50	811.00	813.00	767.00	798.50	797.00
				Rs./Qtl	4681.19	4885.75	5425.59	5401.57	5135.07	5369.11	5340.70
CORRIANDER		India	-	Dollar/MT	2000.00	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	13402.00
CUMMIN SEED		India	-	Dollar/MT	2200.00	2200.00	2500.00	2500.00	2500.00	2500.00	2500.00
				Rs./Qtl	14979.80	15043.60	16725.00	16610.00	16737.50	16810.00	16752.50
GROUNDNUT OIL	Crude Any Origin cif Rotterdam	U.K.	-	Dollar/MT	1200.00	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	8041.20
MAIZE		U.S.A.	Chicago	C/56 lbs	369.25	359.75	368.50	380.75	404.75	393.00	335.75
				Rs./Qtl	988.09	966.77	968.85	994.17	1064.95	1038.52	884.20
OATS		CANADA	Winnipeg	Dollar/MT	283.14	250.42	250.99	247.92	244.91	263.38	314.33
				Rs./Qtl	1927.90	1712.37	1679.12	1647.18	1639.67	1770.97	2106.33
PALM KERNAL OIL	Crude Malaysia/ Indonesia, cif Rotterdam	Netherlands	-	Dollar/MT	890.00	1030.00	1320.00	1285.00	1200.00	1410.00	1350.00
				Rs./Qtl	6060.01	7043.14	8830.80	8537.54	8034.00	9480.84	9046.35
PALM OIL	Crude Malaysian/ Sumatra, cif Rotterdam	Netherlands	-	Dollar/MT	575.00	637.50	705.00	710.00	717.50	710.00	655.00
				Rs./Qtl	3915.18	4359.23	4716.45	4717.24	4803.66	4774.04	4389.16
PEPPER (Black)	Sarawak Black lable	Malaysia	-	Dollar/MT	10000.00	10000.00	10000.00	10000.00	10200.00	10200.00	10200.00
				Rs./Qtl	68090.00	68380.00	66900.00	66440.00	68289.00	68584.80	68350.20
RAPESEED	Canola	CANADA	Winnipeg	Can Dollar/MT	481.20	460.70	469.50	499.50	524.80	480.00	453.90
				Rs./Qtl	2334.78	2298.89	2378.02	2643.85	2707.97	2515.20	2312.62
	UK delivered rapeseed, delivered Erith(buyer)	U.K.	-	Pound/MT	247.00	247.00	245.00	245.00	245.00	232.00	252.00
				Rs./Qtl	2415.66	2352.43	2314.03	2378.22	2405.66	2271.05	2222.39
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	594.00
				Rs./Qtl	6454.80	5847.74	5808.68	6387.21	5911.04	5892.98	5238.49
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	331.00
				Rs./Qtl	2425.44	2428.62	2351.81	2824.74	3358.10	3181.43	2919.09
SOYABEAN OIL		U.S.A.	-	C/lbs	30.87	30.92	33.36	33.62	31.34	31.55	29.53
				Rs./Qtl	4632.67	4659.94	4918.85	4923.10	4624.46	4675.61	4361.29
	Refined bleached and deodorised ex-tanks, broker price	U.K.	-	Pound/MT	618.00	639.00	650.00	616.00	590.00	596.00	653.00
				Rs./Qtl	6044.04	6085.84	6139.25	5979.51	5793.21	5834.24	5758.81
SOYABEANS		U.S.A.	-	C/60 lbs	883.00	867.50	905.25	1019.00	1085.50	1137.50	1010.50
				Rs./Qtl	2206.53	2177.03	2222.60	2484.68	2667.14	2807.02	2485.09
	US NO.2 yellow	Netherlands	Chicago	Dollar/MT	377.20	372.90	385.60	409.20	426.00	456.40	412.00
				Rs./Qtl	2568.35	2549.89	2579.66	2718.72	2852.07	3068.83	2760.81

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

1	2	3	4	5	6	7	8	9	10	11	12
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	746.00
				Rs./Qtl	6591.72	6857.28	6800.40	6989.04	7069.68	7048.08	6578.97
Wheat		U.S.A.	Chicago	C/60 lbs	476.50	442.75	463.00	474.25	466.00	458.75	414.75
				Rs./Qtl	1190.73	1111.10	1136.77	1156.39	1144.99	1132.06	1019.98

Foreign Exchange Rates

Currency	JAN	FEB	MAR	APR	MAY	JUN	JUL
CanDollar	48.52	49.90	50.65	52.93	51.60	52.40	50.95
UKPound	97.80	95.24	94.45	97.07	98.19	97.89	88.19
USDollar	68.09	68.38	66.90	66.44	66.95	67.24	67.01

CROP PRODUCTION

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

State	Sowing	Harvesting
(1)	(2)	(3)
Andhra Pradesh	Paddy, Jowar, Maize, Tobacco, Groundnut, Mesta and Linseed.	Paddy, Ragi, Groundnut, Seasmum 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 and Linseed.	Paddy, Bajra, Maize, Pulses, Potato and Groundnut
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 Millets, 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 Sesamum.
Manipur	Wheat Potato and Rapeseed & Mustard.	Sugarcane and late Paddy.
Orissa	Wheat, Jowar, Gram, Rapeseed & Mustard and Linseed.	Paddy, Kharif, Jowar and Sesamum.
Punjab	Wheat and Gram.	Paddy, Cotton, Pulses and Early Sugarcane.
Rajasthan	Wheat, Barley, Rapeseed & Mustard and Linseed.	Jowar, Bajra, Maize, Cotton and Sannhemp.
Tamil Nadu	Paddy, Jowar, Groundnut, Small Millets,	Kharif Paddy, Jowar, Maize, Cotton, Tapiocam Mesta and Ginger.
Tripura	Pulses and Potato.	Til
Uttar Pradesh	Wheat, Barley, 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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