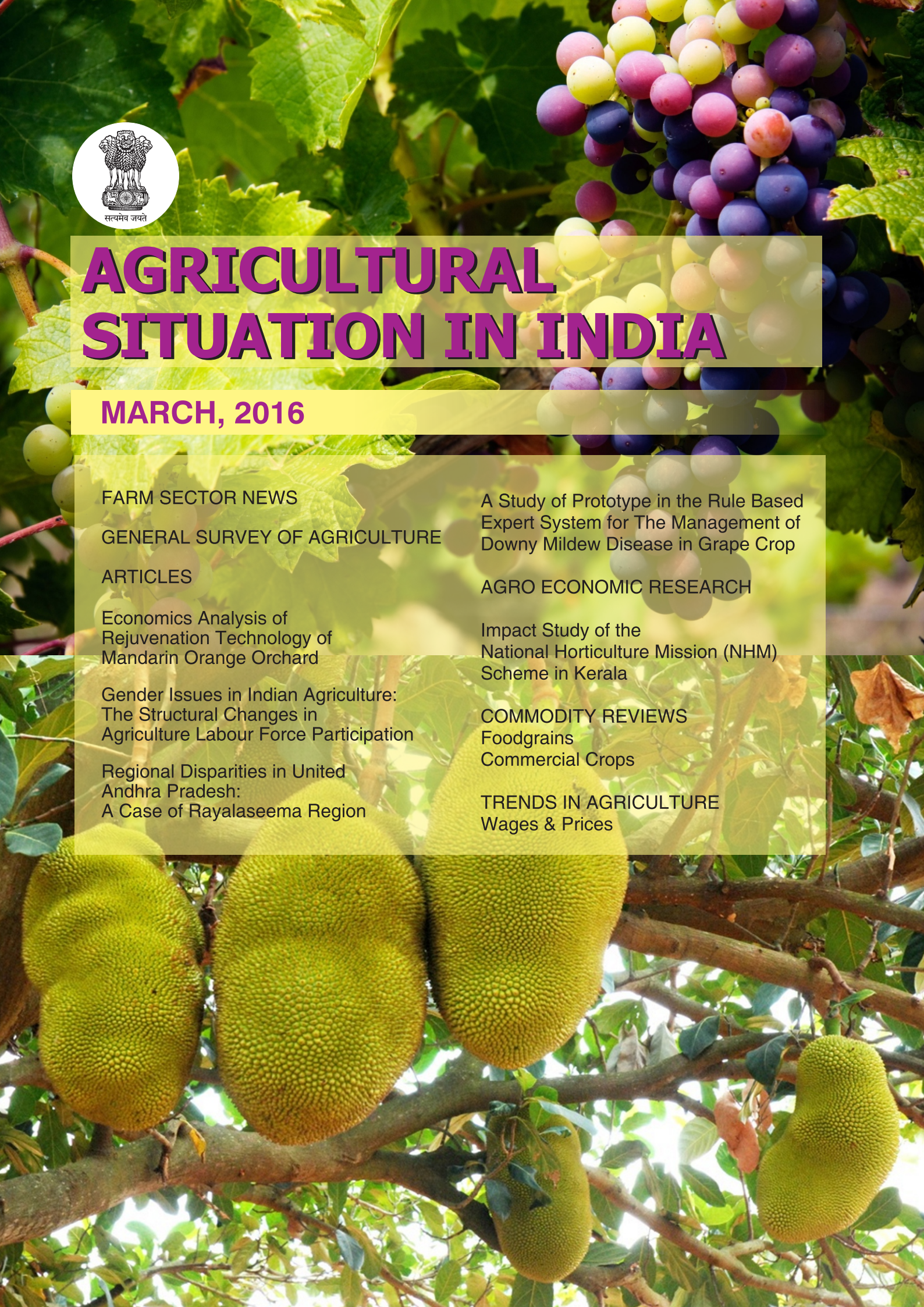

# AGRICULTURAL SITUATION IN INDIA

## MARCH, 2016


FARM SECTOR NEWS

GENERAL SURVEY OF AGRICULTURE

ARTICLES

Economics Analysis of Rejuvenation Technology of Mandarin Orange Orchard

Gender Issues in Indian Agriculture: The Structural Changes in Agriculture Labour Force Participation

Regional Disparities in United Andhra Pradesh: A Case of Rayalaseema Region

A Study of Prototype in the Rule Based Expert System for The Management of Downy Mildew Disease in Grape Crop

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

### NOTE TO CONTRIBUTORS

Articles on the State of Indian Agriculture and allied sectors are accepted for publication in the Directorate of Economics & Statistics, Department of Agriculture, Cooperation & Farmers Welfare's monthly Journal "Agricultural Situation in India". The Journal intends to provide a forum for scholarly work and also to promote technical competence for research in agricultural and allied subjects. Good articles in Hard Copy as well as Soft Copy (agri.situation@gmail.com) in MS Word, not exceeding five thounsand words, may be sent in duplicate, typed in double space on one side of foolscap paper in Times New Roman font size 12, addressed to the Editor, Publication Division, Directorate of Economics and Statistics, M/o Agriculture & Farmers Welfare, C-1, Hutments 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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An honorarium of Rs. 2000/- per article of atleast 2000 words for the regular issue and Rs. 2500/- per article of at least 2500 words for the Special/Annual issue is paid by the Directorate of Economics & Statistics to the authors of the articles accepted for the Journal.

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

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| | | |
|---|---|---|
| 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. |

We are pleased to inform that our monthly journal Agricultural Situation in India has been accredited by National Acedemy of Agricultural Sciences (NAAS) and it has given a score of 2.76 out of 6. The score is effective from January 1, 2016 onwards. The score may be seen in PDF at the following website: *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

**MSP for Copra for 2016 Season**

The Cabinet Committee on Economic Affairs, chaired by the Prime Minister Shri Narendra Modi, has given its approval for the Minimum Support Prices (MSPs) for Copra for 2016 season. The decision is based on recommendations of Commission for Agricultural Costs and Prices (CACP). CACP, which is an expert body, takes into account the cost of production, overall demand-supply, domestic and international prices, cost of conversion of copra into coconut oil, the likely effect of the Price Policy on the rest of economy, besides ensuring rational utilization of production resources like land and water, while recommending MSPs.

The Minimum Support Price (MSP) for Fair Average Quality (FAQ) of "Milling Copra" has been increased to Rs.5950/- per quintal for 2016 season from Rs. 5550/- per quintal in 2015. Also, the MSP for FAQ of "Ball Copra" has been increased to Rs.6240/- per quintal for 2016 season from Rs. 5830/- per quintal in 2015. The MSP of Copra is expected to ensure appropriate minimum prices to the farmers and step up investment in Coconut cultivation and thereby production and productivity in the country.

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

Besides increase in Minimum Support Prices (MSP) for Copra, Government has taken several other farmer friendly initiatives over the last one year. These, inter-alia, include the following:

A new crop Insurance scheme for farmers' welfare, namely, the 'Pradhan Mantri Fasal Bima Yojana' has been introduced under the scheme, there will be a uniform premium of only 2% to be paid by farmers for all Kharif crops and 1.5% for all Rabi crops. In case of annual commercial and horticultural crops, the premium to be paid by farmers will be only 5%.There is no upper limit on Government subsidy.

A Scheme to issue Soil Health Card to every farmer has been introduced. Apart from soil health Government has also created portal on crops insurance in order to keep farmers better informed. Management in the country is being promoted through setting up of soil & fertilizer testing laboratories and implementation of organic farming. Government has also framed guidelines under Paramparagat Krishi Vikas Yojna (PKVY) to promote organic farming and develop potential market for organic products.

An initiative is being taken to set up a National Agriculture Market (NAM). This would enable farmers to overcome the impediments in marketing of agricultural produce and get better price discovery. A common e-market platform is being created and would be provided free of cost to the States/UTs that undertake to introduce a single license for trading in the whole state, a single point levy of market fee and permit e-trading Government is also encouraging formation of Farmer Producer Organisations.

**Area Coverage Under Summer Crops**

As per preliminary reports received from the States, the total area sown under summer crops as on 05th February, 2016, stands at 7.16 lakh hectares.

Summer Rice in 5.91 lakh hectares, summer Pulses in 0.00 lakh hectares and summer oilseeds sown in 1.25 lakh hectares.

The area sown so far and that sown during last year this time is as follows:

(In Lakh hectare)

| Crop | Area sown in 2015-16 | Area sown in 2014-15 |
|---|---|---|
| Summer Rice | 5.91 | 8.09 |
| Summer Pulses | 0.00 | 0.00 |
| Summer Oilseeds | 1.25 | 1.65 |
| Total | 7.16 | 9.74 |

**Vietnam Lifts Ban on Import of Indian Groundnut-Major Step Forward in Securing Market Access**

Vietnam has formally lifted the ban on import of Indian Groundnut, thereby providing market access after nine months. The Vietnam Ministry of Agriculture & Rural Development (MARD) has formally communicated the decision to the Indian Government stating that Plant Protection Department of Vietnam (PPD) issued import permits for groundnuts for January 18th 2016.

The lifting of ban has come in the wake of visit of Vietnam delegation to India in December 2015. The delegation was satisfied after seeing fumigation facilities,

Source:www.pib.nic.in

export procedures and export certification system for export of groundnuts export from India, as per the Standard Operating Procedure developed by Directorate of plant Protection, Quarantine and Storage, Faridabad.

**Agricultural Growth is also Necessary Along with Industrial Development-says Sri Radha Mohan Singh**

Union Agriculture and Farmers Welfare Minister, ShriRadha Mohan Singh said that "until the farmers of the country will be prosperous, the development of the country will not pave its way in the right direction. Therefore, agricultural growth is also necessary alongwith industrial development. A better developed future market meant for agricultural commodities will be significant for the farmers. It will facilitate them to obtain fair price of their products. With this system, they will face lesser perils related to the ups and downs of prices. In this series, such farmers,Who cannot participate directly in future markets will also benefit as the variations due to the timely price fluctuations in the market will be reduced".

Union Agriculture and Farmers Welfare Minister was addressing at the eve of inauguration of 14th Commodity Future Summit organized by ASSOCHAM. Shri Singh said that "this is good indication for the agriculture arena of the country that ASSOCHAM is taking interest to revitalize agricultural sector by adopting sophisticated techniques so as to improve production in agricultural sector. This conference is meant for exchanging views on the topic that how commodity futures market can be conducive for price related balance and perils. At present there are 22 registered markets in India. As you are aware, that India has granted recognizition to three national level multi commodity exchanges. Out of them 1st multi commodity exchange of India (MCX), 2ndNational Commodity, Derivatives Exchange Limited (NCDEX) in Mumbai and 3rd named as National Multi Commodity Exchange India Limited (NMCE) are located in Ahmedabad. There are excellent international leveled methodologies regarding trading, clearing, settlement and governance structure in these markets. In addition to this, erstwhile Forward Market Commission (FMC) has recently been merged with SEBI. All commodity exchanges have been placed on regulatory monitoring with the condition applicable for security exchange".

Agriculture and farmers Welfare Minister added that "the tremendous problem related to agricultural field is that most of Indian farmers are small and marginal and they do not enjoy specific capacity to transect the deals concerned. They deal with their business in low benefitting markets and are victimised of exploitation owing to limited awareness about marketing. A better developed future markets for farmer meant for agricultural commodities attribute to great importance. National Agriculture Market (NAM), a Pan India Electronic Trade Portal is an important measure taken by Central Government in this direction. There will be a single window service for all information and services related to NAM portal. There will also be a provision for the availability of commodities, their price, sale and purchase, related trade offers, to respond to the offers pertaining to trade along with other services. Whereas the inflow of commodities related to agriculture will be unabated in the markets. Due to online market, the cost pertaining to transactions will be lesser and transparency will be enhanced. The Cabinet Committee on Economic Affairs (CCEA) has granted a budget of Rs. 200 crore on 1st July 2015 for formulating a NAM portal. Department of Agriculture, Cooperation and Farmers Welfare will be imparting a grant of Rs. 175 crore for 585 markets during 2015 to 2018".

Shri Singh further added that they have "formulated an interactive farmer portal to provide information to the farmers. It will provide all related information to the farmer in their own language. During this process, the farmers can put up their queries and also retort to them. A well developed storage methodology is also important for the success of commodity exchange. Government of India is supporting a plan formulated by Storage Development and Regulatory Authority (WDRA) at existing scenario. There are 949 storages registered with WDRA. Indian farmers are the real face of India". He inspires all approaches being carried out for interest of the farmers.

**ICAR is Committed to overcome Farm Constraints to make Indian Agriculture truly Sustainable and Profitable-says Sri Radha Mohan Singh**

Union Agriculture and Farmers Welfare Minister, ShriRadha Mohan Singh addressed the 87thAGM of the ICAR Society. Shri Singh said that "the Indian Council of Agricultural Research (ICAR) has completed over eighty six years, overcoming challenges in growth and development of agriculture through generation of appropriate technologies that resulted in improving farm productivity, farm incomes, and building institutions, human resources, diversifying agriculture, creating new opportunities and opening up new frontiers of knowledge. The infusion of modern technologies in agriculture has undoubtedly rescued several innocent lives from claws of hunger. The ICAR is committed to overcome various farm constraints to make Indian agriculture truly sustainable and profitable".

Shri Singh, while highlighting the achievements of ICAR and its educational and research institutes, said that "a new fish species;Clarias serratobrachium sp. nov.was discovered from the wetlands along Indo-Burma border. Development of improved varieties and hybrids and availability of their quality seed is the most vital and critical input for increasing the productivity of crops. During the year, 80 new improved varieties/hybrids of different field and horticultural crops were released for cultivation in diverse agro-ecological regions of the country and

produced and distributed over 98,000 quintals of breeder seeds of major food crops, as well. Biofortified rice variety, like CR Dhan 310 was commercialized successfully in the Indo-Gangetic Plains belt and SwarnaShreya, a new rice variety for drought-prone conditions was released."

**Union Agriculture & Farmers Welfare Minister Announced Establishment of National Organic Farming Research Institute (NOFRI) at Gangtok, Sikkim**

Union Agriculture & Farmers Welfare Minister, ShriRadha Mohan Singh announced the establishment of National Organic Farming Research Institute (NOFRI) at Gangtok, Sikkim. Shri Singh, during 87th Annual General Meeting of Indian Council of Agricultural Research, announced establishment of National Organic Farming Research Institute (NOFRI) at Gangtok, Sikkim. Sikkim has recently been declared as the first organic state in the country. In view of above, Union Agriculture and Farmers Welfare Minister has given approval to execute NOFRI.

Shri Singh informed that the Institute would provide research and technological backstopping to Organic Production System in the country in general and North East Hills Region in particular. The institute will undertake basic, strategic and adaptive research on efficient, economically viable and environmentally sustainable organic farming systems for improving productivity, resource use efficiencies and quality of produce. Besides, it will impart vocational and advanced training to stakeholders for promotion of organic farming in the country. Required financial resources, manpower and infrastructure facilities will be made available accordingly.

**Shri Radha Mohan Singh Addresses the National Convention on Challenges in Indian Agriculture: Future Strategies for Sustainability, in Jabalpur**

The Union Agriculture & Farmers Welfare Minister, Shri Radha Mohan Singh addressed the National Convention on Challenges in Indian agriculture, Future Strategies for Sustainability, in Jabalpur. The convention was being organised by VidyarthiKalyanNyas at JNKVV, Jabalpur during 13-14 February, 2016.

Speaking on the occasion, Shri Radha Mohan Singh said that Indian Agriculture has come a long way since the independence, overcoming an era of acute food shortages and import dependence to the present level of being self-reliant in terms of food security. He said that during the year 2015, our institutions initiated several new programmes. These include MeraGaonMeraGaurav and farmers FIRST, to improve scientist-farmer interaction for an effective technology dissemination, new initiatives such as attracting and Retaining Youth in Agriculture (ARYA), Consortia research Platform, extra Mural Funding, national agricultural science fund, National agricultural education Project (NAEP) and agricultural education in schools. He also said that for a sustainable agriculture in the country, the Agriculture and farmers welfare ministry of the current Government has initiated several schemes, such as PradhanMantri Crop Insurance Scheme,Revision of standards for relief in event of natural calamity, Deen Dayal Grameen Jyoti Yojna and Kisan TV channel. The Deen Dayal Upadhyaya Grameen Koushalya Yojana (DDU-GKY) is a placement-linked skill development scheme for poor rural youth. A total of 51,956 candidates have been skilled under the DDU-GKY, of which 28,995 have been placed till November during 2014-15, he added.

The text of the Union Agriculture & Farmers Welfare Minister, Shri Radha Mohan Singh's address on the occasion is as follows:

"It is a pleasure for me to be present here on the occasion of National Convention on Challenges in Indian agriculture, Future Strategies for Sustainability being organized by Vidyarthi Kalyan Nyas on the campus of JNKVV, Jabalpur. I appreciate the organisers for identifying a theme of extreme relevance for the present and future of agriculture in our country.

Indian Agriculture has come a long way since the independence, overcoming an era of acute food shortages and import dependence to the present level of being self reliant in terms of food security. The realization to build a robust and self reliant food security programme took shape in form of a concerted national effort integrating agricultural research and development that resulted in transforming agricultural scenario, termed as Green Revolution. The success instilled a sense of confidence of the national R&D systems.

In the following years, concerns of malnutrition and hidden hunger are to be addressed. In this endeavor, R&D priority was accorded to diversify the food basket by including non-cereal food items consequently, the productivity, production and availability of fruits, vegetables, milk, meat, eggs and fish started increasing as a result the diet became more nutritionally balanced but lot remains to be done.

The agriculture sector is and will remain central to India's economic security in the foreseeable future. As the largest private enterprise (~138 million farm families) in India, agriculture contributes nearly 18% of the national GDP and engages about 50% of the workforce. Therefore, almost half of the workforce in India still remains dependent on agriculture. Given the low share of this workforce in the GDP, on average, it earns much lower income poorer than its counterpart in industry and services. Hence growth in agriculture and allied sectors remains a 'necessary condition' for inclusive growth.

India is predominated by small farm agriculture. According to Agriculture Census, the total number of operational holdings in India numbered 138.35 million with an average size of 1.15 ha. Of the total holdings, 85

per cent are in marginal and small farm categories of less than 2 ha (Agriculture Census, GOI, 2014). These small farms, though operating only on 44 per cent of land under cultivation, are the main providers of food and nutritional security to the nation, but have limited access to technology, inputs, credit, capital and markets. Technologies that cater to the needs of landless, small and marginal farmers are need of the hour to free the rural households from poverty.

As per the Agricultural Census-2014, the number of landholdings in the country was 138.35 million with an average of 1,15 ha. The farm holdings of less than 2 ha.account for 85%. Even though the small and marginal farmers cultivate 44% of the area but their contribution towards national food security is immense. Today, we have technologies and other infrastructure facilities and financial institutions and markets that will enable to bring the small farmers out of poverty.

**'Country's Farmers can be Benefitted only when the new Agricultural Technologies are Utilized by them at the Field Level', says Shri Radha Mohan Singh**

Union Agriculture & Farmers Welfare Minister, Shri Radha Mohan Singh attended the National Seminar and "Assam Krishi Unnayan Mela", 2016, at Guwahati.

During the occasion, Shri Radha Mohan Singh said that Assam and rest of the North Eastern states have abundant natural resources, congenial climatic conditions and large population of educated youth which makes the region suitable to trigger India's second Green Revolution. He also said that comparative advantages of the region in producing fruits, vegetables and other horticulture products can be tapped by setting up small-scale processing units for the local market which will also boost rural employment.

Shri Radha Mohan Singh said that the country's farmers can be benefitted only when the new agricultural technologies are utilized by them at the field level. Our Prime Minister clearly told that the country's development is not possible until our village and farmers are not developed.

The text of the Union Agriculture & Farmers Welfare Minister, Shri Radha Mohan Singh's address on the occasion is as follows:

The north-eastern region occupies eight percent of India's land area and is home for four percent of its population. Agriculture provides livelihood to 70% of the region's population. In Mizoram, around 51% of population lives in rural areas and is dependent on agriculture. The figure in Sikkim is as high as 89%. However, the pattern of agricultural growth has remained uneven across the region. The states continue to be net importers of food grains for their own consumption. However, over the last decade, the demand-supply gap of food grains in the north-eastern region had narrowed down. The region has low proportion of irrigated area and investment in building irrigation capacity has been insufficient. The Farmer brothers and sisters it is clear that Assam and rest of the North Eastern states have abundant natural resources, congenial climatic conditions, large population of educated youth makes the region suitable to trigger India's second Green Revolution. Comparative advantages of the region in producing fruits, vegetables and other horticulture products can be tapped by setting up small-scale processing units for the local market which will also boost rural employment. As stated by the Prime Minister of India, ShriNarendraBhaiModi, the North-East should focus on a second green revolution through organic farming.

Assam is predominantly an agricultural state and over 75% of the population is dependent on agriculture. Paddy is the most important food crop grown in the state. Cash crops like tea, jute, cotton, oilseeds, sugarcane, potato etc. contribute considerable acreage. Among the horticultural crops produced in the state, orange, banana, pineapple, arecanut, coconut, guava, mango, jackfruit, and citrus are the important ones. The state has an estimated 39.44 lakh hectares of gross cropped area, of which net sown area is about 27.01 lakh hectares.

Area under pulses and Oilseeds are 1.05 and 2.26 lakh hectare respectively, rice area covered by HYV are 63% of total rice area. Consumption of chemical fertilizers and Organic Manure are 63.2 and 73 kg per hectare. Similarly, Consumption of Chemical Pesticides and Bio-Pesticides are 39 and 6 g per hectare. But it is surprising that, our Prime Minister has started the Traditional Agricultural development Scheme for the promotion of organic farming and given Rs. 5.76 crore to the Assam state. That money is also not utilized by the state government, whereas, previously no money were allotted for such a scheme. In addition, for the promotion of organic farming in the North Eastern states Central Government has sanctioned Rs. 100 crore, unfortunately the state government is not able to utilize it.

**2nd Advance Production Estimates of Major Kharif Crops During 2015-16**

The 2nd Advance Estimates of production of major crops for 2015-16 have been released by the Department of Agriculture, Cooperation and Farmers Welfare.

The estimated production of major crops during 2015-16 is as under:

- **Foodgrains** - 253.16 million tonnes
  - Rice - 103.61 million tonnes
  - Wheat - 93.82 million tonnes
  - Coarse Cereals - 38.40 million tonnes

- Maize - 21.00 million tonnes
- Pulses - 17.33 million tonnes
- Tur - 2.55 million tonnes
- Gram - 8.09 million tonnes

➢ Oilseeds - 26.34 million tonnes
- Soyabean - 9.13 million tonnes
- Groundnut - 7.18 million tonnes
- Rapeseed & Mustard - 6.84 million tonnes

➢ Cotton - 30.69 million bales (of 170 kg each)

➢ Sugarcane - 346.39 million tonnes

Despite setback in Kharif crops due to deficient monsoon rainfall and Rabi crops due to shortage of water in reservoirs and relatively warmer winter, as per the 2nd Advance Estimates for 2015-16, total foodgrains production in the country has been higher than that in the last year. Total foodgrains production during 2015-16, estimated at 253.16 million tonnes, has been higher by 1.14 million tonnes over the production of 252.02 million tonnes during 2014-15.

Total production of rice during 2015-16 is estimated at 103.61 million tonnes, which is lower by 1.87 million tonnes than its production of 105.48 million tonnes during 2014-15. Production of wheat estimated at 93.82 million tonnes is higher by 7.29 million tonnes than the production of 86.53 million tonnes of wheat during 2014-15. Wheat production in 2015-16 is also higher by 2.29 million tonnes than its 5 years' average production.

Total production of coarse cereals is estimated at 38.40 million tonnes which is lower by 4.47 million tonnes as compared to their production of 42.86 million tonnes during 2014-15. Total pulses production of 17.33 million tonnes during 2015-16 is marginally higher than the previous year's production of 17.15 million tonnes. With a decline of 1.17 million tonnes over the previous year's production's total oilseeds production in the country during 2015-16 is estimated at 26.34 million tonnes.

Production of sugarcane estimated at 346.39 million tones, is lower by 15.95 million tonnes than its production during 2014-15. Production of Cotton estimated at 30.69 million bales (of 170 kg each) is also lower by 4.11 million bales than its production of 34.81 million bales during 2014-15. Production of jute is estimated at 9.89 million bales (of 180 kg each) which is marginally lower than its production of 10.62 million bales during 2014-15.

**Cultivation of Oilseeds and Pulses is Important for Food and Nutritional Security of the North Eastern States- Says Sri Radha Mohan Singh**

For the food and nutritional security of the North Eastern States, it is important to promote the cultivation of oilseeds and pulses. This was stated by Union Agriculture & Farmers Welfare Minister, ShriRadha Mohan Singh, after inaugurating the academic block of College of Post-Graduate Studies, CAU, Imphal and also laying the foundation stone for the new College of Agriculture, Kyrdemkulai, Meghalaya. He said that the scientists of CAU and ICAR should develop technologies and resources for organic agriculture in the North Eastern Region.

Full text of Union Agriculture and Farmers Welfare Minister is as follows:

"Central Agricultural University is a unique agricultural university in the country, which takes care of the agricultural education, research and extension needs of six of the North Eastern Hill States. The University has played a pivotal role in the overall development of the states under its jurisdiction.

It is a matter of pleasure for me to know that the students of this university are doing exceedingly well in the national level competitive examinations. I am told that in 2014 the university obtained 2nd position in India with respect to ICAR-JRF scholarships awarded to its students. This year 17 students of this college have cleared ICAR-NET examination. For this good performance, I congratulate all the students and hope that they will give their University, their region and their country a good name.

This region has a lot of potential for agriculture and human resource development. Keeping this in mind 6 new colleges under the jurisdiction of the Central Agricultural University have been planned. I am happy to share with you that out of these - 4 new colleges have already started their fist academic session. I hope that, the other 2 colleges in Nagaland and Mizoram will be started soon.

To empower the unemployed rural youths, the university has planned 6 vocational training centres and six multi-technology testing centers, and I hope that these centers for making rural youth employment generators rather than employment seekers, would be implemented soon.

I am happy to know that scientists of CAU are whole heartedly participating in the Government's "MeraGaonMeraGaurav" scheme. The effort by CAU to develop and distribute 2500 soil health cards to the farmers is appreciable. I hope that these efforts will continue and be beneficial for the farmers in future.

For the food and nutritional security of the North Eastern States, it is important to promote the cultivation of oilseeds and pulses. The effort by Central Agricultural University to promote Rabi mustard under zero tillage is commendable. I hope that the university will play an important role in increasing the cropping area of different pulses like lentil and lathyrus.

I also would like to advise the scientists of CAU and ICAR to develop technologies and resources for organic agriculture in the North Eastern Region. Emphasis should be given on production of farm manure from all organic waste.

To make agriculture monetarily remunerative is a challenge in front of all of us. It is my expectation from all the teachers, scientists and students to accept this challenge and work towards fulfilling the interest of the Indian farmers."

**Tremendous Potential in NE States for Development of the Horticulture Sector- says Shri Radha Mohan Singh**

Union Minister for Agriculture & Farmers Welfare,ShriRadha Mohan Singh has said that there exists tremendous potential in NE states for development of the horticulture sector and we need to ensure focused attention for harnessing available potential through scaling up ongoing interventions under various schemes. Addressing the meeting of the Parliamentary Consultative Committee of Ministry of Agriculture and Farmers Welfare on Horticulture Development in India held in Shillong, he said the challenge is to complement the sector with food processing, agro logistics, agri-business, input related services and agricultural lending. Referring to the challenges faced by horticulture crops the Minister suggested that grower associations and farmer producer organisations should also be taken on board,from planting material to post harvest management and issues of logistics and price discovery.

The Minister said setting up of market infrastructure has been linked with reforms in APMC act for permitting direct marketing of horticulture produce. Shri Singh said," Although we have achieved a substantial breakthrough in production, the challenge lies in converting this into gains for farmer. We still have a long way to go in establishing a robust cold chain system from farm to fork. Creation of infrastructure for post harvest management and value addition therefore are a high priority area with focus on creating cold chain networks". He said horticulture mechanization is being promoted to bring in efficiency in horticulture production and harvesting operations.

The meeting was also attended by Dr. Sanjeev Kumar Balyan, Union Minister of State for Agriculture and Farmers Welfare and Shri Mohanbhai Kundariya, Union Minister of State for Agriculture and Farmers Welfare and six Members of Parliament besides the Director of ICAR NEH Region Dr.SV Ngachan.

Earlier the Minister visited the ICAR Research Complex for NEH Region and inaugurated the FATE (Facility for Air Temperature Enhancement) and CTGC (Carbon dioxide Thermal Growth Chamber) at the Complex and also interacted with 250 farmers on the occasion.

**Memoranda of Understanding Signed with Various Countries for Cooperation in the Field of Agriculture & Allied Sectors**

The Union Cabinet chaired by the Prime Minister Shri Narendra Modi gave its ex-post facto approval for Memoranda of understanding (MoU) signed between India and various countries for cooperation in the field of agriculture and allied sectors.

The MoU will help in the nature of capacity building, knowledge exchange through visits of scientists and technicians, exchange of genetic resources that aid in development of appropriate technologies and farm practices for enhancing agriculture productivity at farmers' field. Expertise and technology so developed is applied all over the country as per felt needs.

Expenditure incurred on implementation of such MoU is managed within the "financial allocation made for the Department.

**India and Armenia Sign MoU on Agriculture Cooperation**

A meeting was held between Shri Radha Mohan Singh, Union Agriculture Minister and Mr. Sergo Karapetyan, Armenian Agriculture Minister in New Delhi. The two Ministers recalled the partnership, the two countries have shared, and discussed several areas of interest for cooperation between the two countries, and emphasized on furthering relationships not only for catalyzing trade and investment prospects but also sharing the knowledge that the two countries have accumulated over the years.

The two Ministers signed an agreement for cooperation in the field of agriculture sectors. The MoU envisaged various priority sectors such as plant-breeding, including agricultural crop seed-breeding and plant protection; buffalo-breeding and poultry, including pedigree; exchange of experience on agricultural organization in dry lands; milk production and processing; development of new forms of farming in agrifood complex; agrarian education, training for agricultural specialists; exchange of experience in irrigation and water management (rain water) progressive technology systems exchange of fruit-trees, germplasm (apricot, grapes, apples, pears etc.); exchange of technical expertise and research in fruit-tree disease management; exchange of information on technologies in mechanization of agricultural farming (including research, design, production, installation of agricultural machinery/ equipments); hi-tech horticulture including irrigation and water management technology; exchange of information on technologies in processing sector; phytosanitary measures during export and import of plant and plant materials; Animal husbandry including cattle identification; cooperation in the field of Agricultural Census.

The MoU provides for establishment of Joint Working Group and preparation of Work Plans, and will be valid, initially for a period of five years, and would be extendable beyond five The two Ministers further identified sectors such as cattle identification, cooperatives, agriculture machinery, plant breeding and exchange of agri scientist and students, as the priority areas and resolved to constitute the JWG at the earliest to move the agreement

**Agriculture and Farmers Welfare Minister Stressed upon Building Network of Soil Testing Laboratories Across Country**

Union Agriculture & Farmers Welfare Minister, ShriRadha Mohan Singh reviewed Soil Health Card Scheme with Secretaries (Agriculture) / Directors (Agriculture) of States on 23.02.2016. In his opening remarks Minister mentioned that Soil Health Card (SHC) Scheme is an important scheme of the Government. It aims at promoting soil test based and balanced use of fertilizers, so that the farmer can realize higher yields at lower cost.

The target for the year 2015-16 is to collect 100 lakh soil samples and test these for issue of Soil Health Cards to farmers. During discussion with states, it was observed that States like Andhra Pradesh, Arunachal Pradesh, Nagaland, Sikkim, Gujarat, Bihar, Tripura, Tamil Nadu, Meghalaya, Maharashtra, Punjab, Himachal Pradesh, Kerala, Telangana, Rajasthan, and Jharkhand have shown good performance in soil sample collection. Gujarat, Andhra Pradesh, Tamil Nadu, Maharashtra, Goa and Sikkim shown good performance in distribution of Soil Health Card and they are expected to achieve the target by March, 2016. Agriculture & Farmers Welfare Minister asked the other States to expedite on their performance so as to complete the target as per time scheduled.

States and Union Territories attended the review meeting. Against the target of 104 lakh soil samples, the States have reported collection of 81 lakh soil samples and tested 52 lakh soil samples. By now the States have distributed 1.12 crore soil health cards and 2 core cards are under printing, which will also be distributed before March, 2016. Samples are testing for one crore cards. States assured that 20 lakhs samples will be taken by March 2016.

Shri Singh stressed upon building network of soil testing laboratories. The guidelines of the scheme have been amended to set up soil testing labs as well as mini labs through Capital Investment Subsidy Scheme (CISS) implemented through NABARD. The guidelines have been modified to involve science students of Agriculture and other science colleges in soil health card programme.

Agriculture and Farmers Welfare Minister also reviewed setting up of soil testing labs. Most of the States are under the process of tender for purchase of equipment for the labs. Shri Singh advised the States to use the funds released by the Government and set up more laboratories with facility for micronutrient testing. He also advised them to promote portable mini labs and position them at Block/ Panchayat level so that target is achieved in time.

National Portal on Soil Health Card was reviewed and found that some States have not come on board; they are Arunachal Pradesh, Assam, Bihar, Goa, Manipur, Meghalaya, Mizoram, Nagaland, Telangana and Tripura. Against 80 lakh samples collected, only 6.5 lakh samples have been registered on the Portal. These States were advised to train their staff through e-learning programme being conducted by NIC and to start use of the National Portal. The NIC Officers made a presentation on Mobile Phone Application at village level to capture soil health card data using Android Phone.

**Government of Bihar must give Debt to the Farmers Without Interest - says Shri Radha Mohan Singh**

Union Agriculture Minister Shri Radha Mohan Singh in Patna said that Central Government has started a number of schemes for the welfare of farmers and agricultural sector. The Government of Bihar should avail this scheme. It may be Prime Minister Crop Insurance Scheme or Pradhan Mantri Krishi Sinchai Yojana - all of these schemes will pave the way of growth for the agricultural sector as well as farmers. Mr. Radha Mohan Singh said that Government of Bihar is supposed to impart relief regarding the agricultural debt on the farmers. The farmers of Bihar are bestowed debt with the 7 % interest out of this 3 % interest relief is extended by Government of India. If Government of Bihar desires the farmers thereof may enjoy interest free debt, the Government of Bihar is expected to provide debt to the farmers on 4 % debt relief interest like those of Madhya Pradesh, Chhattisgarh, Gujarat and Maharashtra, etc. so as to be set free farmers from the clutches of interest as a whole in agricultural sector.

Shri Singh was addressing a one day conference being conducted on the subject titled as "role of cooperatives in the composite formation and growth of Bihar" by Bihar Cooperative Development Coordination Committee. Shri Singh said that Modi Government has requested to the States to have their respective rules and regulations framed regarding agricultural sector. They are supposed to enforce these rules and regulations with the assistance of Ministry of Agriculture and other central institutions concerned. Agriculture is a subject of State therefore without the assistance of the State the development of agriculture sector cannot be paved. Therefore I request the Government of Bihar that they should work altogether while making a blue print for agriculture related scheme so that new innovation may be find out for sorting out the difficulty coming in the way of agricultural growth. Consequent upon the pace of the development may be accelerated. There was coined a term

in the country named as "Bimaru - implied the Sick one" which was attributed to the State of Bihar, Chhattisgarh, Rajasthan as well as Uttar Pradesh. However, Madhya Pradesh and Chhattisgarh are not the sick ones and Minister is confident that while benefiting them with the various agriculture related scheme Bihar will not be a sick one anymore.

Shri Singh said that the sense of indifference has been manifested by the purchase, center of State Food Grain Cooperation on the purchase of paddy upto the scheduled date by all of the packs and trade unions in Bihar State. Moreover, these packs have been paid lesser amount wherever the purchase of paddy had been carried through from the Farmers by packs / unions in various districts. The packs are of the saying that through this purchase they are supposed to make the payment within the span of one-two days. Due to none availability of the funds, the interest abundance has been increased on this society. Therefore, State Government is supposed to take action to impart interest free debt to them so that they could make payment to the farmers on time bound programme and farmers could get fair price for their yield on right time.

Agriculture and Farmers welfare Minister said that the Central Government has extended financial assistance to the cooperatives of Bihar through NABARD. It is determined to empower all these institutes in future. According to the survey of National Sample Survey Organization, 46% farmers households are groaning under the huge pressure of debt which have been sought from various organizations and its percentage in the context of Bihar is 49.99%. There is pretty enough imbalance regarding the availability of agricultural debt to the various regions of Bihar and all eastern states. There is also imparity regarding the agricultural debt to be given to the marginal and big farmers.

Shri Singh said that Bihar is being given Rs. 149 crore for Dairy Cooperatives, Rs. 51.05 crore for ICDP, 12.5 crore rupees for Cold Storage Cooperatives and 28.10 crore rupees for the societies related to marketing and as a whole, a sum of 240.80 crore rupees has been granted to the state of Bihar during the year 2015-16 through National Cooperative Development Cooperation for the development of agricultural sector and livestock. There are very limited training centres in Bihar who impart this sort of training and I am of the view that they are very much inadequate to meet the needs for the growth of human resources regarding cooperative personnel as well as sophisticated technical needs for cooperative campaign in state of Bihar. So, I am desirous that a cooperative management institute might be opened on national level in Eastern Champaran, Bihar. Therefore, State Government is requested to allot a piece of 5 acre land on the eve of a century of Champaran Movement launched by Mahatama Gandhi so that it might be set up. Central Government will extend whole financial assistance for the construction of this institute.

Shri Singh said that there are a number of schemes to inspire bio farming in the state like soil health card and PradhanMantriSinchaiYojana. In this context, recently our government has launched PradhanMantri Crop Insurance Scheme, KHARIF 2016 for the protection of crops. Under this scheme, the farmers will have to pay minimum premium. It has been decided that 2% premium in Kharif and 1.5% premium in Rabi will have to be paid by the farmers and rest of the premium will be afforded by the Central Government. ShriRadha Mohan Singh said that today,Indian cooperative Campaign has encompassed the global scenario. It is the largest cooperative campaign in the world. In India, the cooperative access stretches to the national level. The cooperative societies have facilitated farmers while providing inputs like debt, fertilizers seeds etc. to the cooperative societies. Now, the dairy related cooperative has made a landmark in the country and abroad with an exclusive feature. Therefore, if you want to take the country ahead, you are supposed to take villages, poor and farmers ahead. You will have to increase income of the farmers and for this purpose, a second time revolution is required in agricultural sector. Cooperative societies strengthen the farmers in economic and financial prospective.

# General Survey of Agriculture

**Release of Second Advance Estimates of Production for 2015-16**

The Second Advance Estimates of production of major crops for 2015-16 have been released by the Department of Agriculture, Cooperation and Farmers Welfare on 15th February, 2016. The estimated production of various crops as per the Second Advance Estimates for 2015-16 is annexed.

Despite setback in Kharif crops due to deficient monsoon rainfall and Rabi crops due to shortage of water in reservoirs and relatively warmer winter, the total foodgrains production during 2015-16 estimated at 253.16 million tonnes has been higher by 1.14 million tonnes over the production of 252.02 million tonnes during 2014-15.

**Trends in Foodgrain Prices**

During the month of January, 2016 the All India Index Number of Wholesale Price (2004-05=100) of Food grains decreased by 0.65 percent from 261.8 in December, 2015 to 260.1 in January, 2016.

The Wholesale Price Index (WPI) Number of Cereals decreased by 0.17 percent from 237.1to 236.7 and WPI of Pulses decreased by 2.14 percent from 378.2 to 370.1 during the same period.

The Wholesale Price Index Number of Wheat increased by 0.36 percent from 222.7to 223.5 while that of Rice increased by 0.59 percent from 237.3to 235.9 during the same period.

**Weather, Rainfall and Reservoir Situation during February, 2016**

**Rainfall Situation**

Cumulative Rainfall for the country as a whole during 1st January to 24th February, 2016 was 59% lower than Long Period Average (LPA). Rainfall in the four broad geographical divisions of the country during the above period was lower by 65% in North West India, 69% in Central India, 68% in South Peninsula and 34% in East & North East India.

Out of 36 met sub-divisions, 05 met sub-divisions have received excess/normal rainfall, 26 met sub-divisions received deficient rainfall and 05 met sub-divisions received no rain.

**Water Storage in Major Reservoirs**

Central Water Commission monitors 91 major reservoirs in the country which have a total live capacity of 157.80 BCM at Full Reservoir Level (FRL). Live storage in these reservoirs as on 25th February, 2016 has been 51.20 BCM as against 66.35 BCM on 25.02.2015 (last year) and 67.80 BCM of normal storage (average storage of the last 10 years). Current year's storage as on 25.02.2016 has been 23% lower than last year's and 24% lower than the normal storage.

**Sowing Position during Rabi 2016**

As per 2nd Advance estimates for 2015-16, area coverage under all Rabi crops taken together has been 597.82 lakh hectares at All India level as compared to 629.31 lakh hectares during the last year. Area coverage under Wheat is lower by 23.8 lakh ha. than its area coverage of 314.66 lakh ha. during 2014-15. Area coverage under pulses is higher by 1.35 lakh ha. than their last year's area of 135.62 lakh ha. Area coverage under Rabi coarse cereals has been lower by 5.35 lakh ha as compared to their area coverage of 62.22 lakh ha. during Rabi 2014-15. Area coverage under Rabi Oilseeds is lower by 0.33 lakh ha. than their last year's area of 73.99 lakh ha.

A statement indicating comparative position of area coverage under major Rabi crops as per 2nd advance estimates for 2015-16 vis-a-vis the coverage during the last year is given in the Annexure.

ALL INDIA RABI CROP SITUATION - 2ND ADVANCE ESTIMATES 2015-16

(Area in lakh hectares)

| Crop Name | Normal Area | Area sown | | | |
|---|---|---|---|---|---|
| | | 2nd Adv. Estimates 2015-16 | % of Normal of Whole Season | Final Estimates 2014-15 | Absolute Change |
| Wheat | 301.75 | 290.89 | 96.4 | 314.66 | -23.8 |
| Rice | 43.01 | 39.44 | 91.7 | 42.82 | -3.4 |
| Jowar | 38.26 | 36.57 | 95.6 | 38.93 | -2.4 |
| Maize | 15.02 | 13.30 | 88.6 | 16.22 | -2.9 |
| Barley | 6.85 | 6.98 | 101.9 | 7.08 | -0.1 |
| Total Coarse Cereals | 60.13 | 56.85 | 94.6 | 62.22 | -5.4 |
| Total Cereals | 404.89 | 387.18 | 95.6 | 419.69 | -32.5 |
| Gram | 88.37 | 84.74 | 95.9 | 82.51 | 2.2 |
| Urad | 7.54 | 9.18 | 121.8 | 7.61 | 1.6 |
| Moong | 8.65 | 10.49 | 121.3 | 9.94 | 0.5 |
| Others | 33.65 | 32.57 | 96.8 | 35.55 | -3.0 |
| Total Pulses | 138.21 | 136.98 | 99.1 | 135.62 | 1.4 |
| Total Foodgrains | 543.09 | 524.16 | 96.5 | 555.31 | -31.2 |
| Rapeseed & Mustard | 63.20 | 58.14 | 92.0 | 57.99 | 0.2 |
| Groundnut | 8.46 | 7.41 | 87.5 | 7.55 | -0.1 |
| Safflower | 2.06 | 1.69 | 82.1 | 1.75 | -0.1 |
| Sunflower | 4.85 | 3.73 | 77.0 | 3.85 | -0.1 |
| Linseed | 3.11 | 2.69 | 86.3 | 2.86 | -0.2 |
| Total Oilseeds (Nine) | 81.69 | 73.66 | 90.2 | 73.99 | -0.3 |
| All-Crops | 624.78 | 597.82 | 95.7 | 629.31 | -31.5 |

Normal Area - Average of 5 years area (2010-11 to 2014-15).
Source: DES, DAC&FW

**Economic Growth***

As per the Advance Estimates of National Income released by Central Statistics Office on 8th February 2016, the growth rate of Gross Domestic Product (GDP) at constant (2011-12) prices for the year 2015-16 is estimated to be 7.6 per cent as compared to the growth of 7.2 per cent, 6.6 per cent, and 5.6 per cent for 2014-15, 2013-14, and 2012-13 respectively (Table 1).

The growth in Gross Value Added (GVA) at constant (2011-12) basic prices for the year 2015-16 is estimated to be 7.3 per cent as compared to the growth of 7.1 per cent, 6.3 per cent, and 5.4 per cent respectively for 2014-15, 2013-14, and 2012-13. 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 to be 1.1 per cent, 7.3 per cent, and 9.2 per cent respectively (Table 1).

Accordingly to the quarterly estimates, the growth in GDP in Q3 of 2015-16 (October-December) was 7.3 per cent, compared to the corresponding growth of 6.6 per cent in 2014-15. Growth during the first three quarters of 2015-16 (April-December) works out to be 7.5 per cent as compared to the corresponding growth of 7.4 per cent in 2014-15 (Table 2).

The share of total final consumption in GDP at current prices in 2015-16 is estimated to be improved to 70.5 per cent from 68.5 per cent in 2014-15. Though the share of fixed investment rate (Gross Fixed Capital formation to GDP) is expected to maintain its downward trend in 2015-16 also; the growth rate is estimated to be

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strengthened to 5.3 per cent in 2015-16 as compared to 4.9 per cent in 2014-15.

The saving rate (gross saving to GDP) for both 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, compared to 34.7 per cent and 38.6 per cent in 2013-14 and 2012-13 respectively.

**Agriculture**

**Rainfall:** The cumulative rainfall received for the country as a whole, during the period 1st January—17th February 2016, has been 63 per cent below normal. The actual rainfall received during this period has been 11.7 mm as against the normal of 31.3 mm. Out of the total 36 meteorological subdivisions, 3 subdivisions received excess season rainfall, 1 subdivision received normal season rainfall and the remaining 32 subdivisions received deficient/scantry/no season rainfall.

**All India Production of Foodgrains:** As per the 2nd advance estimates released by Ministry of Agriculture on 15th February 2015, production of foodgrains during 2015-16 is estimated at 253.2 million tonnes compared to 252.0 million tonnes in 2014-15 (Table 3).

**Procurement:** Procurement of rice as on 15th February, 2016 was 26.4 million tonnes during kharif marketing season 2015-16 and procurement of wheat as on 15th February, 2016 was 28.1 million tonnes during rabi marketing season 2015-16 (Table 4).

**Off-take:** Off-take of rice during the month of December 2015 was 28.2 lakh tonnes, This comprises 22.5 lakh tonnes under TPDS/NFSA (offtake against the allocation for the month of January, 2016) and 5.7 lakh tonnes under other schemes. In respect of wheat, the total off-take was 32.7 lakh tonnes comprising of 19.7 lakh tonnes under TPDS/NFSA (offtake against the allocation for the month of January 2016) and 13.0 lakh tonnes under other schemes. Cumulative off-take of foodgrains during 2015-16 (till December 2015) is 497.9 lakh tonnes (Table 5).

**Stocks:** Stocks of food-grains (rice and wheat) held by FCI as on February 1, 2016 were 49.3 million tonnes, compared to 47.2 million tonnes as on February 1, 2015 (table 6).

TABLE 1: GROWTH OF GVA AT BASIC PRICES BY ECONOMIC ACTIVITY (AT 2011-12 PRICES)
(IN PER CENT)

| Sector | Growth | | | Share in GVA | | |
|---|---|---|---|---|---|---|
| | 2013-14 | 2014-15 | 2015-16 (AE) | 2013-14 | 2014-15 | 2015-16 (AE) |
| Agriculture, forestry & fishing | 4.2 | -0.2 | 1.1 | 17.5 | 16.3 | 15.3 |
| Industry | 5.0 | 5.9 | 7.3 | 31.6 | 31.2 | 31.2 |
| Mining & quarrying | 3.0 | 10.8 | 6.9 | 2.9 | 3.0 | 3.0 |
| Manufacturing | 5.6 | 5.5 | 9.5 | 17.4 | 17.1 | 17.5 |
| Electricity, gas, water supply & other utility services | 4.7 | 8.0 | 5.9 | 2.2 | 2.2 | 2.2 |
| Construction | 4.6 | 4.4 | 3.7 | 9.0 | 8.8 | 8.5 |
| Services | 7.8 | 10.3 | 9.2 | 51.0 | 52.5 | 53.4 |
| Trade, hotels, transport, communication and services related to broadcasting | 7.8 | 9.8 | 9.5 | 18.4 | 18.9 | 19.2 |
| Financial, real estate & professional services | 10.1 | 10.6 | 10.3 | 20.3 | 21.0 | 21.5 |
| Public administration, defence and Other Services | 4.5 | 10.7 | 6.9 | 12.3 | 12.7 | 12.7 |
| GVA at basic prices | 6.3 | 7.1 | 7.3 | 100.0 | 100.0 | 100.0 |
| GDP at market prices | 6.6 | 7.2 | 7.6 | — | — | — |

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

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

| | 2013-14 | | | | 2014-15 | | | | 2015-16 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sectors | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 |
| Agriculture, forestry & fishing | 2.8 | 3.3 | 5.7 | 4.3 | 2.3 | 2.8 | -2.4 | -1.7 | 1.6 | 2.0 | -1.0 |
| Industry | 3.1 | 3.9 | 4.0 | 1.7 | 8.0 | 5.9 | 3.8 | 5.7 | 6.8 | 6.4 | 9.0 |
| Mining & quarrying | 2.2 | -3.0 | 0.5 | 7.2 | 16.5 | 7.0 | 9.1 | 10.1 | 8.6 | 5.0 | 6.5 |
| Manufacturing | -0.8 | 0.5 | 2.4 | -0.7 | 7.9 | 5.8 | 1.7 | 6.6 | 7.3 | 9.0 | 12.6 |
| Electricity, gas, water supply & other utility services | -2.6 | 1.0 | -1.5 | 0.4 | 10.2 | 8.8 | 8.8 | 4.4 | 4.0 | 7.5 | 6.0 |
| Construction | 13.3 | 14.6 | 9.9 | 5.2 | 5.0 | 5.3 | 4.9 | 2.6 | 6.0 | 1.2 | 4.0 |
| Services | 8.7 | 9.3 | 7.7 | 5.4 | 8.6 | 10.7 | 12.9 | 9.3 | 9.0 | 9.4 | 9.4 |
| Trade, hotels, transport, communication and services related to broadcasting | 6.8 | 8.4 | 9.2 | 6.9 | 11.6 | 8.4 | 6.2 | 13.1 | 10.5 | 8.1 | 10.1 |
| Financial, real estate & professional services | 9.8 | 14.0 | 9.1 | 6.9 | 8.5 | 12.7 | 12.1 | 9.0 | 9.3 | 11.6 | 9.9 |
| Public administration, defence and Other Services | 9.6 | 2.9 | 3.2 | 1.2 | 4.2 | 10.3 | 25.3 | 4.1 | 6.1 | 7.1 | 7.5 |
| GVA at Basic Price | 5.9 | 6.7 | 6.1 | 4.0 | 7.4 | 8.1 | 6.7 | 6.2 | 7.2 | 7,5 | 7.1 |
| GDP at market prices | 6.2 | 7.7 | 6.0 | 4.4 | 7.5 | 8.3 | 6.6 | 6.7 | 7.6 | 7.7 | 7.3 |

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

| Crops | Production (in Million Tonnes) | | | |
|---|---|---|---|---|
| | 2012-13 | 2013-14 | 2014-15 | 2015-16 (2nd AE) |
| Total Foodgrains | 257.1 | 265.0 | 252.0 | 253.2 |
| Rice | 105.2 | 106.7 | 105.5 | 103.6 |
| Wheat | 93.5 | 95.9 | 86.5 | 93.8 |
| Total Coarse Cereals | 40.0 | 43.3 | 42.9 | 38.4 |
| Total Pulses | 18.3 | 19.3 | 17.2 | 17.3 |
| Total Oilseeds | 30.9 | 32.8 | 27.5 | 26.3 |
| Sugarcane | 341.2 | 352.1 | 362.3 | 346.4 |
| Cotton | 34.2 | 35.9 | 34.8 | 30.7 |

*Source:* DES, DAC&FW, M/o Agriculture & Farmers Welfare, 2nd AE: Second Advance Estimates

TABLE 4: PROCUREMENT OF CROPS IN MILLION TONNES

| Crop | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 |
|---|---|---|---|---|---|---|
| Rice# | 34.2 | 35.0 | 34.0 | 31.8 | 32.2 | 26.4B |
| Wheat@ | 22.5 | 28.3 | 38.2 | 25.1 | 28.0 | 28.1B |
| Total | 56.7 | 63.4 | 72.2 | 56.9 | 60.2 | 54.5 |

*Source*: DFPD, M/o Consumer Affairs and Public Distribution;#Kharif Marketing Season (October-September), @ Rabi Marketing Season (April-March), B Position as on 15.02.2016.

TABLE 5: OFF-TAKE OF FOODGRAINS (MILLIONTONNES)

| Crops | 2012-13 | 2013-14 | 2014-15 | 2015-16 (Till December) |
|---|---|---|---|---|
| Rice | 32.6 | 29.2 | 30.7 | 26.3 |
| Wheat | 33.2 | 30.6 | 25.2 | 23.5 |
| Total (Rice & Wheat) | 65.9 | 59.8 | 55.9 | 48.8 |

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

TABLE 6: STOCKS OF FOODGRAINS (MILLION TONNES)

| Crops | February 1, 2015 | February 1,2016 |
|---|---|---|
| 1. Rice | 13.5 | 16.3 |
| 2. Unmilled paddy# | 17.4 | 18.9 |
| 3. Converted Unmilled Paddy in terms of Rice | 11.7 | 12.7 |
| 4. Wheat | 22.0 | 20.3 |
| Total (Rice & Wheat) (1+3+4) | 47.2 | 49.3 |

*Source:* FCI; # Since Septermber, 2013, FCI gives separate figures for rice and unmilled paddy lying with FCI & state agencies in terms of rice.

## Articles

# Economic Analysis of Rejuvenation Technology of Mandarin Orange Orchard

DR. NISHANT V. SHENDE*

**Executive Summary**

In recent years fruits and vegetables have gained prominence due to their potential rates in ensuring nutritional security to the population and their role in diversification of agriculture. It is under this background that adoption of disease management in horticultural crops in general and rejuvenation of mandarin orange orchard in particular has become important. The present study is undertaken in Nagpur district of Maharashtra State of India. In total 100 farmers were selected from four Tahsil of Nagpur district for the year 2010-11. The data was collected from the orange growers by personal interview. The study of extent of adoption indicates that hundred percent of farmers were adopted the two component of technology of rejuvenation i.e. pruning and application of Bordeaux paste. However, may be due to non availability of well decomposed FYM with sample farmers, overall only Eleven percent farmer shown under high level of adoption. It ia a very popular practice of application of Nitrogen amongst cultivator. On an average 63 per cent farmers were adopted the recommended level of technology. On the other hand only 15 per cent farmers were the high level of adoption of application of phosphorus. An examination of total adoption index revealed that 82 per cent farmer had either low or medium adoption of the technology. Therefore, it provides an opportunity for increasing their level of adoption of the through extension support and input subsidization. The average adoption index was found to be 39.70 this reveals that most of the farmers adopted the technology only at partial level and there was a need to promote the adoption of technology including all its components. There was absolutely no fruiting or in few areas very negligible amount of fruiting was observed before rejuvenation. It is observed from the study that 25.19 and 53.97 percent increased in yield over low adopter for medium and high group of farmers respectively. The fruit yield was increased from low level of adopter to high level of adopter in the range of 45.80 qt/ha to 70.52 qt/ha. The average price received by the high level of adopter was 3407.71/qt i.e. 27.83 per cent higher than low level of adopter due to the quality of production. The cost of rejuvenation were increased as there was an in level of its adoption. Use of human labour accommodated more than 50 per cent share in total expenditure. However the net income was increased from 84935 to 195713/ha for low to high level of adopter respectively. As perceived by farmers, scarcity of electricity during irrigation, absence of proper extension services, non availability of well decomposed FYM and Neem Cake and lack of labour availability were found to be the four most important constraints which limit wider adoption of rejuvenation technology. Therefore, making available of electricity for irrigation and better access to extension services would lead to wider adoption.

**Key Word**s: Rejuvenation, Orange, Impact assessment.

**Introduction and Objectives:** Increasing income and the changes in the life style of people have shifted the dietary pattern in favour of nutritious foods like fruits and vegetables. After rice, wheat and milk products, based on gross value, orange is considered to be the fourth most important food crop in the world. It is closely inter woven in our national heritage.

The area and production under citrus cultivation over last 30 years has increased, which shows that expansion of citrus industry was quite sustainable in India. The average yield of citrus fruits in India compared to other developed countries like USA, Brazil and Japan etc is alarmingly low despite the fact that production wise India contributes 4.8 per cent of total basket of citrus.

Citrus fruits have been under cultivation in Indo-China and sub-Himalayan parts of India. Today they are grown extensive in subtropical region of the world and even sub parts of the temperate region of the world. Citrus is grown at 40o C either side of equator having predominantly tropical and subtropical climate in 49 countries of the world. India is one of the important citrus growing country. Citrus is the third largest fruit industry in India after Mango and Banana in terms of area under cultivation, covering 4.82 lakh ha. with an annual production of 44.87 lakh tones. In central India Nagpur mandarin is cultivated on about 1.25 lakh ha.

Citrus decline or dieback of citrus was first reported in Madhya Pradesh as early as eihteenth century. Later its occurrence was reported in 1912 in western India. During the 20th century it has spread alarmingly, especially, since in 1940's and by early 1960's it was recorded in all the citrus growing areas of the country. The problem of citrus decline in India is complex in natures

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and concrete no remedial measure are available for this problem of citrus as yet. However Dr. PDKV, Akola, Maharashtra State of India has recommended the technology for rejuvenation of such citrus orchard, specially mandarin orange orchard which gives at least five to six years fruiting and helps to increase the production and income of the farmers.

Though citrus decline is a worldwide phenomenon in India it is quite different in India. It is a syndrome of various symptoms caused by a number of biotic and abiotic factors such as general neglect of orchard coupled with unsuitable site selection, non-availability of disease free planting materials, inadequate observance nursery and orchard management practices, nutritional deficiencies, non-efficient use of water, lack of drainage and inadequate plant protection measures against insect pest, nematodes and disease. All these factors individually or collectively responsible for citrus decline are the result of nothing but neglectosis.

The syndrome of citrus decline can be effectively tackled even by the ordinary growers, provided and requisite technological support is made available to them through on farm demonstration and convince them about the efficacy of such technologies.

Diagnostics criteria to distinguish decline or blight affected trees from healthy trees comprise reduced water uptake in the trunk by water injection, presence of amorphous plug in xylem vessels, rate of canopy decline by visual aspects of trees, high zinc and water soluble nutrients accumulation in the trunk wood and phloem and low or no water flow through secondary roots of affected trees.

Adoption of modern technology in production of cereals crops has long been attracting attention of researchers and policy makers due to food security concerns. In recent years fruits and vegetables have gained prominence due to their potential rate in ensuring nutritional security to the population and their role in diversification of agriculture. A multi-proned strategy has been implemented, including launching of the National Horticultural Mission, in order to double the horticulture production. It is under this background that adoption of disease management in horticultural crops in general and rejuvenation of mandarin orange orchard in particular has become important.

**Methodology**

The main objective of any scientific investigation is to draw useful conclusion in light of objective of study. In order to get the meaningful conclusion, it is essential for investigator to adopt appropriate method and procedure, keeping this in view, to explain the methodology adopted, and to fulfill the objective of study. It also deals with selection of area, selection of farmers, type of data, collection of data, and analytical tools used.

**(1) Selection of Area**

The present study was undertaken in Nagpur district of Maharashtra State of India. The villages and the number of farmers selected are as follows.

TABLE 1: TAHSIL-WISE DISTRIBUTION OF FARMERS SN

| Sl.No. | Name of District | Name of Tehsil | Name of Villages | Sample size | Total Farmers |
|---|---|---|---|---|---|
| 1 | Nagpur | Savner | Badegaon | 4 | 24 |
| | | | Gosewadi | 4 | |
| | | | Khapa | 2 | |
| | | | Pimpal | 4 | |
| | | | Savner | 1 | |
| | | | Nanda | 3 | |
| | | | Salai | 3 | |
| | | | Kelwad | 3 | |
| | | Katol | Dhawlapur | 10 | 17 |
| | | | Masode | 7 | |
| | | Kalmeshwar | Kalmeshwar | 7 | 33 |
| | | | Uparwahi | 7 | |
| | | | Telkamathi | 11 | |
| | | | Telgaon | 8 | |
| | | Narkhed | Narkhed | 14 | 26 |
| | | | Sawargaon | 12 | |
| | | | Total | 100 | 100 |

In total 100 farmers were selected from four Tahsil of Nagpur district for the year 2010- 11. The data was collected from the orange growers by personal interview.

**(2) Data Source:**

a) Primary data: For this research, both primary and secondary data was used. Primary data were collected for the year 2010-11 from Nagpur district. The data was collected from the Orange growers by personal interview. The primary data was pertaining to the year 2010-11.

The data on following aspects were collected, tabulated and subjected to various tools of statistical analysis.

- General information about farmers.
- Details of farm size.
- Details of land utilization pattern.
- Details of various input used along with their quantities and prices for rejuvenation of Mandarin Orange Orchard.
- Constraints faced by farmers for adopting recommended technologies.
- Yield obtained.
- Cost and returns.

b) Secondary data: The secondary data on area and production of Orange in Nagpur district as well as Vidarbha & Maharashtra state as a whole were collected from various issue of Govt. publications such as epitome of Agriculture and District socio economic review, NHB Data book etc. The data pertained to the period of 24 years from 1985-86 to 2008-09.

**(3) Adoption of Technology:**

In the present study "Adoption of technology"refers to actual practices adopted by the farmer for rejuvenation of mandarin orange orchard. The information on practices adopted by the selected farmers was collected.

**(3.1) Recommended Technology**

The term recommended technology refers to the rejuvenation practices recommended by Dr. PDKV akola for mandarin ornage orchard. The university has made recommendation of following practices.

TABLE 2: RECOMMENDED TECHNOLOGY FOR REJUVENATION OF MANDARIN ORANGE ORCHAD

| Sr. No. | Technology Componant | Description |
|---|---|---|
| 1. | Pruning | Removal of infected, dried shoots along with 5 cm healthy portion and prunng of shoot 30-45 cm from top in the month of June |
| 2. | Plant Protection | After the judicious pruning fungicides and insecticides spraying should be undertaken. |
| 3. | Bordeaux paste application | Application of Bordeaux paste (1:1:10) to tree trunk and on pruned portion |
| 4. | FYM application | Apply 50 kg well decomposed FYM |
| 5. | Neem cake application | 7.5 kg Neem cake per plant |
| 6. | N & P application | Application of 500 gm N + 500 gm P in the month of October |

(3.2) Extent of adoption of technology

Actual level of adoption of each item of technology on farmers field was identified. Using the recommended technologies developed by Dr. PDKV, Akola and efficiency of each technology were calculated by using following formula.

$$\text{Adoption of particular practices} = \frac{\text{Practices actually adopted}}{\text{Practices recommended}} \times 100$$

A technology adoption Index (TAI) was constructed to categories the sample farmers as low, medium and high adoption of technology, by incorporating the different sub components of rejuvenation of mandarine organce orchard technology (RMOT) given in table.

Technology adoption index was calculated using the following formula

Where,

I = Farmer, i=1, 2, .....100.

j = Management measures, j= 1, 2, ....., n.

TAIi = Technology Adoption Index of ith farmer

OSij = Observed score of ith farmer for jth management measure.

TSj = Total score obtainable for jth management measure.

(No adoption = O, Partial adoption = 1, Full adoption = 2)

Aij = Area under jth management measure in hectares of ith farmer.

TAi = Total area under orange cultivation of ith farmers in hectares.

The technology adoption index so calculated can very from 1 to 100 depending upon the farmer's degree of adoption of improved package of practices for rejuvenation of mandarine orange orchard. On the basis of adoption index all the 100 farmers were classified into three equal categories, low adoption (TAI between 0<33), Medium adoption (TAI between >34 to <66) and high adoption (TAI >66). The extent of adoption level was examined across the above categories.

**(4) Determinant of Adoption of Rejuvenation Technology in Mandarine Orange Orchard**

For identifying the factors affecting the adoption of modern technology for all the farmers together, Tobit model was used, considering technology adoption index (TAI) as dependent variable and some important independent variables, which may be expected to have an effect on adoption technology.

**Tobit Model**

It is critical to precisely measure the degree of influence of variables, which determine the adoption. In this study, Tobit model was used to estimate the coefficients of regression analysis of adoption, which not only measures the probality of adoption of technology but also takes care of the intensity of its adoption.

The functional form of Tobit model is given below in equation

$Yi = Yi^*$, $Yi^* = BX_i + Ui > O$ for those who have adopted the technology

Or $Yi = O$, $Yi < O$ for those who have not adopted the technology

Where,

Yi = probability and extent of adoption

Yi* = Non-observable latest variable that indexes adoption.

β = Socio-economic characteristic of adoption, which it is hypothesized effect the adoption decision

Xi = vector of independent variables

i = ith sample farmer.

Ui = Independently normally distributed error term, N (O, σ2)

The above equation is a simultaneous stochastic decision model. If the non observed latest variable Yi is greater than 0, then observed variable Y, that indexes adoption, become a continuous function of the explanatory variables and zero otherwise (i.e., Non-adoption of rejuvenation management technology). The maximum likelihood approach is used to estimate the coefficient in equation for Tobit model.

Empirical Model

$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9,)$

Where,

Y - Technology Adoption Index

$X_1$ - Farmers education (0-illiterate, 1-primary, 2-High School, 3-Secondary, 4-Graduation, 5-Higher)

$X_2$ - Non farm Income earned annually as binary variables (1-earned, O-else)

$X_3$ - Total area under orange (ha.)

$X_4$ - Age of the farmer (years)

$X_5$ - Experience of the farmers in orange cultivation (years)

$X_6$ - Training received from Government or Private Sources (1-recieved 0-else)

$X_7$ - Extension contact of farmer (1-recieved 0-else)

$X_8$ - Awareness about the benefits of rejuvenation (0-Poor, 1-Moderate, 2-Good)

$X_9$ - Number of members in the family

The exponential form of Tobit model was used in the study.

**(5) Yield Realization, Resource use Pattern and Returns**

The resource use pattern was examined and compared between low, medium and high adoption levels using tabular analysis. The gap between actual use of inputs and the recommended use has been found by comparing the two. This was used to compare the input use pattern levels, whether optimal or suboptimal, among the different adoption levels.

To examine incremental returns due to adoption of rejuvenation technology, tabular analysis was used with data on cost required for rejuvenation, loss of production due to decline in orchard and yield from the farm. Data was compared among different adoption levels to find out the impact of technology on farmers income.

**(6) Constraints Analysis**

Simple tabular analysis was use to identify the different constraints for non adoption of hundred per cent technology of rejuvenation of mandarin orange orchard. The identified constraints were presented on the basis of level of adoption.

**Results and Discussion**

Keeping in view the objectives of the study, the data were analyzed using suitable analytical techniques. The results obtained from this study have been presented and discuss critically.

**(A) Profile of Sample Farm**

A total of sixteen (16) villages spread across four talukas of Nagpur district of Maharashtra were surveyed for the study. The demographic characteristics of the Nagpur district sample farm's families are profiled in table 5. Age and education play vital role in farmers disposition towards technology and their comprehension and adoption. Family size is a major factor in determining the economic well being of the farmers. Only 3 percent of the respondents fell under young category while 53 percent belonged to middle age category and rest 44 percent to old age category. The educational profile showed that 50 percent farmers had high school level, followed by 30 percent Diploma/College level, 12 percent secondary level and 7 percent primary level. While illiteracy was confined to small holding *i.e.* only one farmer of total sample was found to be illiterate.

The family size distribution showed that 40.91, 30 and 43.75 percent had small family under small, medium and large size of holding respectively. Whereas on an average 62 percent came under medium family size *i.e.* 5 to 10 member in one family. The bigger families observed under large size of holding only.

TABLE 3: FAMILY PROFILE OF THE SAMPLE FARM HOUSEHOLD

| Sr. No. | Particular | Small | Medium | Large | Overall |
|---|---|---|---|---|---|
| **A** | **Age groups** | | | | |
| 1 | Young (<30) | 2 (04.55) | 1 (02.50) | 0 (0.00) | 3 |
| 2 | Middle (30-50) | 26 (59.09) | 22 (55.00) | 5 (31.25) | 53 |
| 3 | Old (>50) | 16 (36.36) | 17 (42.50) | 11 (68.75) | 44 |
| **B** | **Education status** | | | | |
| 1 | Illiterate | 1 (02.27) | 0 (0.00) | 0 (0.00) | 1 |
| 2 | Primary level | 2 (04.55) | 5 (12.50) | 0 (0.00) | 7 |
| 3 | Secondary level | 5 (11.36) | 7 (17.50) | 0 (0.00) | 12 |
| 4 | High School level | 24 (54.55) | 18 (45.00) | 8 (50.00) | 50 |
| 5 | Diploma/College level | 12 (27.27) | 10 (25.00) | 8 (50.00) | 30 |
| **C** | **Family size (member)** | | | | |
| 1 | Small (<5) | 18 (40.91) | 12 (30.00) | 7 (43.75) | 37 |
| 2 | Medium (5-10) | 26 (59.09) | 28 (70.00) | 8 (50.00) | 62 |
| 3 | Large (>10) | 0 (0.00) | 0 (0.00) | 1 (6.25) | 1 |

(Figures in parenthesis indicate the percentage over number of farmer in respective size of holding)

**(B) Land use Pattern**

The average size of holding for sample farmers was 6.00 acre of which 0.36 acre were fallow land. The size of holding ranged between 3.13 acre in small and 12.97 acre in large farms. The proportion of irrigated lands to total land was more than 90 percent for all farmers under sample. The average net cropped and gross cropped area was 5.64 acre and 10.30 acre respectively. The cropping intensity was highest in small size of holding *i.e.* 222.75 per cent. As the area was under irrigation, the farmers were cultivated intercrop in orange orchard during kharif, rabi and summer season. The average cropping intensity was 180.62 per cent in the sample farm (Table 6).

TABLE No. 4: Land Use Pattern of Selected Orange Farmers

(Area in Acre)

| S.N. | Particular | Small | Medium | Large | Overall |
|---|---|---|---|---|---|
| 1 | No. of farmers | 44 | 40 | 16 | 100 |
| 2 | Total land holding | 137.8 | 242 | 220.5 | 600.3 |
| 3 | Size of holding | 3.13 | 6.2 | 12.97 | 6.00 |
| 4 | Dry land area | 0 | 0.13 | 0 | 0.05 |
| | | (0.00) | (1.42) | (0.00) | (0.49) |
| 5 | Fallow land | 0.03 | 0.32 | 1.29 | 0.36 |
| | | (0.44) | (3.50) | (6.04) | (3.50) |
| 6 | Irrigated area | 3.10 | 5.88 | 11.67 | 5.64 |
| | | (44.99) | (64.40) | (54.69) | (54.76) |
| 7 | Net sown area | 3.10 | 5.88 | 11.67 | 5.64 |
| | | (44.99) | (64.40) | (54.69) | (54.76) |
| 8 | Area sown more than once | 3.79 | 3.25 | 9.67 | 4.66 |
| | | (55.01) | (35.93) | (45.31) | (45.24) |
| 9 | Gross cropped area | 6.89 | 9.13 | 21.34 | 10.30 |
| | | (100.00) | (100.00) | (100.00) | (100.00) |
| 10 | Cropping intensity (%) | 222.75 | 180.92 | 182.86 | 182.62 |

(Figures in parenthesis indicate the percentage over CGA)

**(C) Cropping Pattern**

Cropping pattern of the region is influenced by the agro climatic condition and market condition in the locality, the farmers has to plan his cropping pattern every year. Besides the agro climatic condition while exercise limitation in respect of choice of crops to be grown, demand for agriculture produce and traditions in vogue in the locality act as guiding factor in allocation of the area under cash crops and food grains and subsistence crops. The cropping pattern of selected farmers is presented in table 5.

The table 5 revealed that the percent area under orange cultivation was highest in medium size of holding (27.38 percent) followed by small size group (23.22 percent) and large farmers (16.54 percent). It could be revealed from the table 5 that Cotton + Tur intercrops and soybean were dominating the cropping pattern during kharif season is all size group. However, Wheat was the important crop during rabi season.

TABLE 5: Cropping Pattern of Selected Orange Farmers

| S.N. | Particular | Small | Medium | Large | Overall |
|---|---|---|---|---|---|
| **A.** | **Kharif** | | | | |
| 1 | Orange | 1.6 | 2.5 | 3.53 | 2.27 |
| | | (23.22) | (27.38) | (16.54) | (22.03) |
| 2 | Cotton+Tur | 1.2 | 2.42 | 4.66 | 2.23 |
| | | (17.41) | (26.50) | (21.83) | (21.67) |
| 3 | Soybean | 0.82 | 1.58 | 4.67 | 1.92 |
| | | (11.90) | (17.30) | (21.88) | (18.64) |
| 4 | Cotton | 0.6 | 0.78 | 2.16 | 0.99 |
| | | (8.70) | (8.54) | (10.12) | (9.61) |
| 5 | Black gram | 0.14 | 0.06 | 0.2 | 0.1 |
| | | (2.03) | (0.65) | (0.93) | (0.97) |
| 6 | Mosambi | 0 | 0 | 1.38 | 0.26 |
| | | (0.00) | (0.00) | (6.46) | (2.52) |
| 7 | Flower and Vegetables | 0.4 | 0.015 | 0.54 | 0.23 |
| | | (5.80) | (0.16) | (2.53) | (2.23) |

| S.N. | Particular | Small | Medium | Large | Overall |
|---|---|---|---|---|---|
| **B** | **Rabi** | | | | |
| 1 | Wheat | 1.14 | 0.98 | 2.32 | 1.27 |
| | | (16.54) | (10.70) | (10.87) | (12.33) |
| 2 | Gram | 0.63 | 0.73 | 1.68 | 0.88 |
| | | (9.14) | (8.00) | (7.87) | (8.54) |
| **C** | **Summer** | | | | |
| 1 | Others | 0.36 | 0.06 | 0.2 | 0.15 |
| | | (5.22) | (0.65) | (0.93) | (1.45) |
| | **Total area** | **6.89** | **9.13** | **21.34** | **10.3** |

(Figures in parenthesis indicate the percentage over total area)

**(D) Extent of Adoption**

Actually level of adoption of each item of technology of farmers field was identified using the recommended technologies developed by Dr. PDKV, Akola. All extent of adoption score were scale down to 1 to 100 and all groups of farmers were classified on the basis of efficiency as presented from table 6 to 10.

An investigation was done for assessing the extent and nature of adoption of rejuvenation technology of mandarine orange orchard and its components among the orange growers of Nagpur district. A adoption pattern of different compounds was analyzed and classified based on intensity or level of adoption. The intensity of adoption is define as the level of adoption of a given technology which reference to the extent of use of recommended package of practices for rejuvenation of orange orchard.

Hundred percent of farmers had adopted the two component of the technology of rejuvenation *i.e.* pruning and application of Bordeaux paste. However, the other different components of the rejuvenation technology is presented and discussed critically.

**(i) Spraying of Insecticides and Fungicides**

Table 8 reveals that, the adoption of spraying of insecticides and fungicides, 97.72 percent of small farmers were found to be medium level of adopter and the percentage decreased of holding increase for medium level of adopter. However 31.25 per cent of large holding farmers were high level of adopter.

TABLE 6: EXTENT OF ADOPTION OF RECOMMENDED TECHNOLOGY: SPRAYING OF INSECTICIDES AND FUNGICIDES

| Adoption level | Small | Medium | Large | Overall |
|---|---|---|---|---|
| Low level | 1 | 3 | 1 | 5 |
| (Upto 33) | (2.27) | (7.50) | (6.25) | |
| Medium Level | 43 | 375 | 1 | 95 |
| (34-66) | (97.72) | (87.50) | (62.50) | |
| High Level | 0 | 3 | 5 | 0 |
| (> 66) | (0.00) | (7.50) | (31.25) | |
| Total | 44 | 40 | 16 | 100 |

(Figures in parenthesis indicate the percentage over total no. of farmers)

**(ii.) Application of well Decomposed FYM**

As per the recommendation of Dr. PDKV Akola, 50 Kg of well decomposed FYM per plant is required for rejuvenation technology. However, it may be due to non availability of well decomposed FYM with sample farmers, overall only Eleven percent of the showed under high level of adoption. Whereas, 47.72 per cent of small category of farmers were classified under medium level of adopters and the percentage increased as there was an in size of holding i.e. 57.50 and 62.50 per cent for medium and large size of holding respectively (Table 7).

TABLE 7: EXTENT OF ADOPTION OF RECOMMENDED TECHNOLOGY: APPLICATION OF WELL DECOMPOSED FYM

| Adoption Level | Small | Medium | Large | Overall |
|---|---|---|---|---|
| Low level | 20 | 13 | 2 | 35 |
| (Upto 33) | (45.45) | (32.50) | (12.50) | |
| Medium Level | 21 | 23 | 10 | 54 |
| (34-66) | (47.72) | (57.50) | (62.50) | |
| High Level | 3 | 4 | 4 | 11 |
| (> 66) | (6.82) | (10.00) | (25.00) | |
| Total | 44 | 40 | 16 | 100 |

(Figures in parenthesis indicate the percentage over total no. of farmers)

**(iii) Application of Neem Cake**

As per the recommendation, 7.5 Kg of Neem cake per plant is required for rejuvenation of mandrain orange orchard technology. Whereas 97 percent farmers were classified under low level of adoption. It indicates that either there was lack of availability of neem cake or farmers were not interested to apply recommended does of Neem cake (Table 8).

TABLE NO. 8: EXTENT OF ADOPTION OF RECOMMENDATION TECHNOLOGY: APPLICATION OF NEEM CAKE

| Adoption Level | Small | Medium | Large | Overall |
|---|---|---|---|---|
| Low level | 43 | 39 | 15 | 97 |
| (Upto 33) | (97.72) | (97.50) | (93.75) | |
| Medium Level | 1 | 1 | 1 | 3 |
| (34-66) | (2.27) | (2.50) | (6.25) | |
| High Level | 0 | 0 | 0 | 0 |
| (> 66) | (0.00) | (0.00) | (0.00) | |
| Total | 44 | 40 | 16 | 100 |

(Figures in parenthesis indicate the percentage over total no. of farmers)

**(iv) Nitrogen Application**

It is a very popular practice amongst cultivator. As per the recommendation, 500 gm of Nitrogen is required to apply per plant. Table 10 revealed that 70.45 percent farmers from small size of holding applied nitrogen above 66 percent efficiency level of adoption of technology. Whereas 60 and 50 percent level of adoption were found in medium and large size group respectively. On an average 63 per cent farmers had adopted the recommended level of technology.

TABLE NO. 9: EXTENT OF ADOPTION OF RECOMMENDED TECHNOLOGY APPLICATION OF N

| Adoption Level | Small | Medium | Large | Overall |
|---|---|---|---|---|
| Low level | 5 | 8 | 2 | 15 |
| (Upto 33) | (11.36) | (20.00) | (12.50) | |
| Medium Level | 8 | 8 | 6 | 22 |
| (34-66) | (18.18) | (20.00) | (37.50) | |
| High Level | 31 | 24 | 8 | 63 |
| (> 66) | (70.45) | (60.00) | (50.00) | |
| Total | 44 | 40 | 16 | 100 |

(Figures in parenthesis indicate the percentage over total no. of farmers)

**(v) Phosphorus Application**

As per the recommendation, 500 gm of phosphorus per plant is recommended. It is observed from the table that 43.18 percent farmers from low level of adopter in small size of holding. On the other hand 50 percent farmers from large size group were medium level of adopter of this technology. On an average 15 percent farmers were high level of adopter, 37 percent medium level and rest of farmers i.e. 48 percent were recorded low level of adoption of technology.

TABLE 10: EXTENT OF ADOPTION OF RECOMMENDED TECHNOLOGY APPLICATION OF P

| Adoption Level | Small | Medium | Large | Overall |
|---|---|---|---|---|
| Low level | 19 | 23 | 06 | 48 |
| (Upto 33) | (43.18) | (57.50) | (37.50) | |
| Medium Level | 15 | 14 | 08 | 37 |
| (34-66) | (34.09) | (35.00) | (50.00) | |
| High level | 10 | 03 | 02 | 15 |
| (> 66) | (22.73) | (7.50) | (12.50) | |
| Total | 44 | 40 | 16 | 100 |

(Figures in parenthesis indicate the percentage over total no. of farmers)

**(E) Estimation of Total Adoption Index**

The Total Adoption Index (TAI) was estimated as per the discussed in methodology for each farmers based on extent of adoption of each technology. A distribution of farmers according to the Total Adoption Index (TAI) is presented in Table 11.

It is apparent from the table that most of the farmers (70 percent) were found to have medium level of rejuvenation technology adoption and about 12 percent of total farmers under low adopter category and 18 percent under high level of adoption. The average adoption index was found to be 39.70. This reveals that most of the farmers adopted the technology only at partial level and there was a need to promote the adoption of technology including all its components.

TABLE NO. 11: CLASSIFICATION OF ORANGE GROWERS AS PER DIFFERENT LEVELS OF ADOPTION

| Adoption level | Score | Sample growers |
|---|---|---|
| Low (Mean-SD) | Up to 30.86 | 12 |
| Moderate | 30.87 to 48.54 | 70 |
| High (Mean + SD) | Above 48.55 | 18 |
| Total Sample | | 100 |
| Mean of Adoption | | 39.70 |
| Standard deviation of Adoption | | 08.84 |

**(F) Determinats of Rejuvenation Technology in Mandrain Orange Orchard**

The interpretation of any fitted model requiries it being able to draw practical inferences from the coeffifcients estimated in the model. For linear models, in which the link funciton is the identity function, coefficients express a corresponding change in the dependent variable for a unit change in the independent variable.

In order to study the factor influencing adoption of rejuvenation technology in mandrain orange orchard, a Tobit model was used which estimates the likelihood of adoption and its extent (i.e. intensity) of adoption. However, in the Tobit model these coefficients do not have a straight forward interpretation. The slope coefficients represent a change in the link function for a change of one unit in the independent variable. Proper interpretation of coefficients depends on being able to give meaning to the difference between two values of the link function. One of the main problems encountered in cross sectional analysis is heteroscedasticity. Both heteroscedasticity and autocorrelation were checked in this model and data were found free from these problems.

Table 12 present the different variables used in this model with their mean.

TABLE 12: MEAN VALUE OF REGRESSION VARIABLES USED IN TOBIT-MODEL

| Variable | Description | Mean |
|---|---|---|
| X1 | Education of farmer | 2.25 |
| X2 | Non farm income | 0.66 |
| X3 | Total area under orange in ha | 0.93 |
| X4 | Age of farmers (year) | 49.73 |
| X5 | Experience of farmers in orange cultivation in year | 24.88 |
| X6 | Training received from Govt. or Private sources | 0.58 |
| X7 | Extension contact of farmer | 0.54 |
| X8 | Awareness about the benefits of Rejuvenation | 0.98 |
| X9 | No. of members in the family | 4.8 |
| Dependent Variable (TAI) | Technology adoption index | 39.70 |

TABLE NO. 13: MAXIMUM LIKELIHOOD ESTIMATES (MLE) OF COEFFICIENTS OF THE TOBIT MODEL FOR THE ADOPTION OF REJUVENATION TECHNOLOGY.

| So.No. | Variable | Maximum Likelihood Estimate | Standard error (SE) | Asymtotict ratio | P value |
|---|---|---|---|---|---|
| 1 | Intercept | 24.65 | 7.463 | 3.561 | 0.000 |
| 2 | X1 | 6.112 | 1.092 | 5.29 | 0.000 |
| 3 | X2 | 2.613 | 2.082 | 1.121 | 0.312 |
| 4 | X3 | 0.437 | 0.143 | 0.423 | 0.801 |
| 5 | X4 | -0.712 | 0.196 | -1.822 | 0.200 |
| 6 | X5 | 0.247 | 0.180 | 1.365 | 0.172 |
| 7 | X6 | 4.811 | 2.872 | 3.901 | 0.003 |
| 8 | X7 | 0.151 | 1.610 | 3.792 | 0.000 |
| 9 | X8 | 7.556 | 2.745 | 2.765 | 0.006 |
| 10 | X9 | -0.352 | 0.412 | -1.205 | 0.425 |

Maximum likelihood estimates of the coefficients with their significance level are given in table 13.

In conformity with the maintained hypothesis four variables were found to be significant at one per cent significance level and were also positively related to the adoption of the technology. These variables were educational status of the farmers, farmer's contact with extension personal, participation in training programmer organized by Government or private agencies and farmers awareness about the benefits of adoption.

The significant influence of awareness may probably be due to better perceptions about rejuvenation technology by the farmers who are having good awareness about the benefits of technology. Education had a positive and significant influence on adoption of technology may be attributed to the ability of the farmer to understand the importance of adoption.

The other variables namely, family size, age of the farmer, non farm income, area under orange and experience in orange cultivation were found non significant but retained their expected sign in the model except total area under orange cultivation. This variable has positive sign in the model, which was expected to have a negative sign.

**(G) Yield Realization**

There was absolutely no fruiting or in few areas very negligible amount of fruiting was observed before rejuvenation. It is observed from the table 14 that average

fruit weight was increase from 93 gm to 121 gm as the level of adoption increased. It is interestingly noted that, 25.19 and 53.97 percent increased in yield over low adopter were observed for medium and high group of farmers respectively. The fruit yield was increased from low level of adopter to high level of adopter in the range of 45.80 qt/ha 70.52 qt/ha. The average price received by the high level of adopter was 3407.71/qt i.e. 27.83 per cent higher than low level of adopter due to the quality of fruits.

TABLE 14: FRUIT YIELD REALIZATION AFTER REJUVENATION

| Particular | Adoption level | | |
|---|---|---|---|
| | Low | Medium | High |
| Average fruit weight (gm) | 93 | 103 | 121 |
| Average fruit/trees | 250 | 293 | 315 |
| Fruits/tree (Kg) | 23.25 | 30.18 | 38.12 |
| Fruit yield (qt/ha) | 45.80 | 57.34 | 70.52 |
| Per cent increase in yield (over low adopter) | - | 25.19 | 53.97 |
| Average price received (/qt.) | 2665.23 | 3122.17 | 3407.01 |
| Per cent increase in average price (over low adopter) | - | 17.14 | 27.83 |

**(H) Resource use Pattern**

Inputs are critical in determining the cost incurred and returns received in farming. Farmers use inputs according to its availability their awareness about the optimum level of input use and its importance and their ability to purchase these inputs. Decision to adopt a new technology also involves the decision to use more inputs. Therefore, a tabular analysis was carried out to compare resource use pattern at different adoption levels. The results are presented in table 15.

TABLE 15: COMPONENT-WISE RESOURCE USE PATTERN FOR REJUVENATION OF MANDARIN ORANGE ORCHARD

| Sl. No. | Resources | Low | Medium | High |
|---|---|---|---|---|
| 1. | Human labour (Days/ha) | 167.17 | 178.62 | 206.30 |
| | a. Pruning | 75.00 | 79.04 | 88.89 |
| | b. Application of Plant protection & Bordeaux paste | 33.76 | 35.80 | 39.20 |
| | c. Application of Manures & Fertilizers | 58.41 | 63.78 | 78.21 |
| 2. | FYM (qt / ha) | 76.70 | 79.10 | 98.13 |
| 3. | Nitrogen (Kg / ha) | 60.25 | 78.71 | 120.91 |
| 4. | Phosphorus (Kg / ha) | 25.99 | 37.90 | 55.01 |
| 5. | Neem cake (Kg / ha) | 14.92 | 44.77 | 69.09 |
| 6. | Plant protection chemical (Kg / ha) | 3.15 | 4.45 | 5.88 |

A perusal of table 15 shows that the use of human labour in the case of high adopter was high with an average value of 206.30 man days. It was found to be significantly different from the input use pattern of low level adopter which was about 167.17 man days. The application of FYM was found to be high among high adopter of rejuvenation technology when compared with low adopters with an average of 98.13 and 76.70 qt/ha. respectively. The similar significantly higher application of all resources was observed in high level of adopter category.

**(I) Cost of Rejuvenation and Incremental Returns due to Adoption**

The adoption of a technology in beneficial when it either increases the yield per hectare of net income. Here the adoption of rejuvenation technology helped the farmers to increase the net income and yield per hectare from complete decline of mandarine organge orchard.

The table 16 revealed that the cost of rejuvenation increased as there was an increase in the level of adoption.

Use of human labour accommodation more than 50 per cent share in total expenditure. However the net income increased from 84935 to 195713/ ha. for low to high level of adopter respectively.

TABLE No. 16: Cost and Incremental Returns due to Adoption

| Sl. No. | Resources | Low | Medium | High |
|---|---|---|---|---|
| 1. | Human labour (Rs/ha) | | | |
| | a. Pruning | 10350 | 11065.6 | 12889.05 |
| | b. Plant protection chemical & Application of Bordeaux paste | 4220 | 4654 | 5174.4 |
| | c. FYM + Neem cake + Nitrogen + Phosphorus | 5841 | 7015.8 | 8759.52 |
| | Total | 20411 (54.97) | 22735.4 (55.39) | 26822.97 (60.21) |
| 2. | FYM+Neem cake ('/ha.) | 10644.84 (28.67) | 9056.93 (22.06) | 9566.00 (21.47) |
| 3. | Nitrogen ('/ha.) | 916.84 (2.47) | 1197.76 (2.91) | 1839.93 (4.13) |
| 4. | Phosphorus ('/ha.) | 635.62 (1071) | 926.90 (2.25) | 1345.35 (3.02) |
| 5. | Plant protection chemical ('/ha.) | 1671.39 (4.50) | 3894.47 (9.48) | 1518.54 (3.41) |
| 6. | Other cost | 2852.34 (7.68) | 3236.25 (7.88) | 3456.54 (7.76) |
| | Total cost of rejuvenation | 37132.03 | 41047.71 | 44549.33 |
| | Total Return ('/ha.) | 122067.53 | 179025.23 | 240262.35 |
| | Net income ('/ha.) | 84935.5 | 137977.5 | 195713.02 |
| | Per cent increase in net income (over low level of adoption) | | 62.44 | 130.42 |

(Figures in parenthesis indicate the percentage over total cost of rejuvenation)

**(J) Constraints in Adoption**

In the economy of Nagpur district, citrus occupies a very significant place as it contributes a lion's share in the ropping pattern of this district. One of the major problems in citrus production is considered to be the declining of orchards and the consequent losses farmers are incurring due to the decline. Even then, it receives low priority in the allocation of resources to control their threatening problem. In order to examine the constraints inhibiting the adoption of rejuvenation technology, farmer's perception was elicited through interviewing them. The result obtained from the analysis are presented in Table 17.

TABLE No. 17: Farmers Perception about Different Constrains in Adoption of Technology

| Sr. No. | Type of constraints | Prioritization for the constraints | | | |
|---|---|---|---|---|---|
| | | Major | Moderate | Minor | Total |
| 1 | 2 | 3 | 4 | 5 | 6 |
| 1. | Lack of Labour availability | 30 (58.82) | 12 (23.53) | 9 (17.65) | 51 |
| 2. | Attack of birds | 19 (29.69) | 17 (26.56) | 28 (43.75) | 64 |

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| 3. | Unfavorable climatic condition | 52 (69.33) | 13 (17.33) | 10 (13.33) | 75 |
| 4. | Scarcity of good quality of fertilizer/insecticide | 38 (48.72) | 24 (30.77 | 16 (20.51) | 78 |
| 5. | Lack of know how | - | 02 (25.00) | 06 (75.00) | 08 |
| 6. | Scarcity of electricity during irrigation | 57 (57.00) | 36 (36.00) | 07 (07.00) | 100 |
| 7. | Non availability of well decomposed FYM | 39 (39.00) | 46 (46.00) | 15 (15.00) | 100 |
| 8. | Non availability of well Neem Cake | 43 (43.00) | 45 (45.00) | 12 (12.00) | 100 |
| 9. | Absence of proper extension services | 46 (46.00) | 42 (42.00) | 12 (12.00) | 100 |

(Figures in parenthesis indicate the percentagte over total no. of farmers)

The table 17 shows the per cent of farmers who ranked constrains in adoption of rejuvenation technology. Based on the intensity of the problems faced by the farmers it was classified as major, moderate and as minor constrains. The major constrains, which emerged from the study were scarcity of electricity during irrigation, absence of proper extension services and non availability of FYM and neem cake.

It was found that 78 per cent farmers felt the scarcity of good quality of fertilizer and insecticides. About 48.72 and 30.77 farmers felt this as major and moderated constrains respectively. The farmers who felt lack of labour availability as a major constrains were observed to be 58.82 per cent.

**Conclusion & Policy Implications**

- A examination of total adoption index revealed that 82 per cent farmer had either low or medium adoption of the technology therefore, it provides and opportunity for increasing their level of adoption through extension support and input subsidization.
- The average adoption index was found to be 39.70
- There was absolutely no fruiting or in few areas very negligible amount of fruiting was observed before rejuvenation. It is observed from the study that 25.19 and 53.97 percent increased in yield over low adopter for medium and high group of farmers respectively.
- The fruit yield had increased from low level of adopter to highlevel of adopter in the range of 45.80 qt/ha. to 70.52 qt/ha. The average price received by the high level of adopter was 3407.71'/qt *i.e.* 27.83 per cent higher than low level of adopter due to the quality of fruits.
- The cost of rejuvenation had increased as time increase was in an the level of adoption. Use of labour accommodated more than 50 per cent share in total expenditure. However the net income had increased from 84935 to 195713'/ha. for low to high level of adopter, respectively.
- The major constrains, which emerged from the study were scarcity of electricity during irrigation, absence of proper extension services, and non availability of FYM and neem cake.

The finding of this study provide some implication of rejuvenation technology in orange production in Maharashtra.

It was found in the study that a large number of farmers were not using all the components of rejuvenation of mandarin orange orchard technology scienfifically, in the total orange area. Therefore, it is suggested that awareness compaigns and training programmes should be arranged for making farmers aware about the technology. Strong extension support should be there, for proper dissemination of the technology.

As perceived by the farmers, scarcity of electricity during irrigation, absence of proper extension services, non availabilityof well decomposed FYM and Neem Cake and lack of labour availability were found to be the four most important constraints which limit wider adoption of rejuvenation technology. Therefore, making available of electricity for irrigtion and better access to extension services would lead to wider adoption.

# Gender Issues in Indian Agriculture: The Structural Changes in Agriculture Labour Force Participation

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**Abstract**

In India, there are distinct male and female roles in the rural economy. Women and girls engage in a number of agro-oriented activities ranging from seedbed preparation, weeding, and horticulture and fruit cultivation to a series of post-harvest crop processing activities like cleaning and drying vegetable, fruits and nuts for domestic use and for market. A disproportionate number of those dependent on land are women: 58% of all male workers and 78% of all female workers, and 86% of all rural female workers are in agriculture. Female headed households range from 20% to 35% of rural households (widows, deserted women as well as women who manage farming when their men migrate). Although the time devoted by both women and men in agricultural activities may, in several communities and agricultural situations, be taken to be almost equal, women are dominant within the domestic tasks. Rural Indian women are extensively involved in agricultural activities, but the nature and extent of their involvement differs with variations in agro-production systems. This paper re-affirms that women make essential contributions to agriculture and rural enterprises. But there is much diversity in women's roles and over-generalization undermines policy relevance and planning. The context is important and policies must be based on sound data and gender analysis.

**Key words:** Women, Agriculture, Gender, Labour force, Impacts and Discrimination.

## Introduction

Agriculture can be an important engine of growth and poverty reduction. But the sector is Underperforming in many countries in part because women, who are often a crucial resource in agriculture and the rural economy, face constraints that reduce their productivity. In this paper we draw on the available empirical evidence to study in which areas and to what degree women participate in agriculture. Aggregate data shows that women comprise about 43 per cent of the agricultural labour force globally and in developing countries. But this figure marks considerable variation across regions and within countries according to age and social class. The contribution of women to agricultural and food production is significant but it is impossible to verify empirically the share produced by women. Women's participation in rural labour markets varies considerably across regions, but invariably women are over represented in unpaid, seasonal and part-time work, and the available evidence suggests that women are often paid less than men, for the same work.

Regardless of the level of development achieved by the respective economies, women play a pivotal role in agricultural and in rural development in most countries of the Asia-pacific region. Evidently there are serious constraints which militate against the promotion of an effective role for women in development in those societies which were bound by age-old traditions and beliefs. Patriarchal modes and practices motivated by cultures and/ or interpretations of religious sanctions and illiteracy hinder women's freedom to opt for various choices to assert greater mobility in social interactions. Resulting from these situations. women's contribution to agriculture and other sectors in the economy remain concealed and unaccounted for in monitoring economic performance measurement. Consequently, they are generally invisible in plans and programmes. They were, in fact, discriminated against by stereotypes which restrict them to a reproductive role, and denied access to resources which could eventually enhance their social and economic contribution to the society.

In terms of the ratio of membership of women in agricultural cooperative. The percentage is rather low, but they have a strong influence on them—through the heads of the households. Certain obvious barriers restrict their direct and formal entry in agricultural cooperatives. Even in countries like Japan, the ratio of women membership in agricultural cooperative is extremely low. Only very few women serve on the Boards of Directors. Their simple and clear perception is that the administrative and decision-making domain rests with the men and women do not wish to overburden themselves with financial responsibilities in case something goes wrong with the cooperative. They, of course contribute significantly in farm operations. However, the women are very active in Women's Associations of Agricultural Cooperatives which organise their activities around the life and style of farm household members.

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Despite their important to agricultural production, women face severe handicaps. They are in fact, the largest group of landless with little real security in case of break-up of the family owing to death or divorce; inheritance laws and customs discriminate against them land reform and settlement programmes usually give sole title and hence the security needed for obtaining production credits to the husband. Agricultural development programme are usually planned by men and aimed at men. Mechanization, for example alleviates the burden of tasks that are traditionally men's responsibility, leaving women's burdens unrelieved or even increased. It may not be out of place to mention here that considering their dual responsibilities within and outside the home, it would be in the fitness of things that more and more in the village training is organized for rural farm women to suit their convenience with the due realization that institutional training is imporant in its own place.

In order that farm women get a fair deal at the hands of change agents, one of the remedial measures that needs to be undertaken is to induct a sizeable number of well trained women personnel in training and extension programmes of agricultural development agencies at all levels and more so at the grass-root level.

**Literature Review:**

**Leela Gulati (1978)** examined working women in India and value of their labour. She found that the children of the agricultural labour too continuing the same occupation despite whatever education they had been able to receive. She also found that hunger, disease and indebtedness are an integral part of the life of the women labour. There is little prospect of anyone in the family breaking out of viscous circle.

**Sawant and Diwan (1979)** in their study of 150 villages in two taluks of Maharasthra observed a fall in female work participation and decline in self employment opportunities in developed villages.

According to **Krishna Ahooja Patel** (1979) 5 and **Ela, Bhatt** (1985), technoloical progress has the dual effect of widening women's employment opportunities and at the same time pushing them into less skilled and less mechanized occupations.

**Ashok Mitra (1980)** opined that female who works in household, cultivation, household industry, livestock, fishery or in dairying etc., are subjected to wide fluctuations in registering female work participation in census survey. Thus, such fluctuations cannot be entirely due to the differences in concepts and definitions employed in census or surveys but must be due to substantial difference in perception of the respondent as to what constitutes economic contribution by way of female work participation in these subsistence sectors. He gives an economic explanation for the census undercounting of women's contribution is seen as equal to or more than the subsistence requirements of the family, they are 'seen' as economically active.

**Agarwal (1984)** pointed out that following introduction of new technologies in agricultural, actualisation of work is increased for both men and women, while it is more enhanced in the operations such as transplanting, weeding and harvesting where female labour is primarily employed.

**Sisodia (1985)** 14 study the magnitude of the female labour participation rate in the specific field operations as well as in other preparatory or supportive activities to agricultural production process, the family female labour participate in the decision-making process and the association between the extent and nature of female participation in agriculture and economic-demographic characteristics of Bhind and Morena districts of Madhya Pradesh. The study revealed that the rate of female participations is very low. The pattern of division of labour between men and women varies from region to region according to social customs. In the Chambal region, the preparatory tillage operations are not performed by the farm women. On animal based tasks like cake making, ghee making, milking animals, removing of cow dung from the cattle shed and feeding of animals are mostly done by the farm women. There is no hired labour and female labour is employed for these animal-based tasks. Only a few per cent of total family labour is engaged in preparatory or supportive activities to agricultural production process and the rest is done by men.

**Joshi and Alshi (1985)** have attempted the impact of HYVs on female labour employment by size-groups of holdings and the employment effect of HYVs separately for family and hired female labour in Akola district of Maharashtra state. The study revealed that per hectare female labour use on HYV cotton and jowar farms is more as compared to the local variety farm. In cotton HYV cotton farms used about 157 per cent more female labour per hectare over local variety, while in jowar crop, the HYV used 26 per cent more female labour over local variety. The adoption of HYV of cotton and jowar increased the requirement of casually hired female labour to a large extent, implying thereby an increase in the employment opportunities for female labour seeking agriculture wage employment.

**Availability of Women for Work in Household Premises:**

It may be noted that a large section of women, even if they are not working, do not report themselves as unemployed as many of them may not be willing to come out of the household premises for work. But some of them may be willing to accept certain types of work if the work is made available to them at the household premises. The special probing enquiry carried out in the survey, therefore,

included questions on willingness of women, engaged in domestic duties, to accept work at their household premises along with the nature and type of work acceptable to them. The relevant information was tabulated only for women aged 15 years and above.

TABLE: 1 Number of Females (per 1000 Females of Age 15 Years and above Usually Engaged in Domestic Duties in Principal Status) Who were Willing to Accept Work at the Household Premises for the Different Types of Work Acceptable

| Type of Work Accepted | Rural | Urban |
|---|---|---|
| Dairy | 70 | 13 |
| Poultry | 20 | 6 |
| Other Animal Husbandry | 27 | 5 |
| Food Processing | 27 | 27 |
| Spinning & Weaving | 27 | 21 |
| Manufacturing of wood and Cane products | 7 | 3 |
| Tailoring | 97 | 114 |
| Leather goods manufacturing | 2 | 2 |
| Others | 51 | 79 |

*Source: NSSO Report No. 550: Participation of Women in Specified Activities along with Domestic Duties, 2009.*

**Gender Division of Labour in Agriculture**

The particular tasks done on farms by men and women have certain common patterns. In general, men undertake the heavy physical labour of land preparation and jobs which are specific to distant locations, such as livestock herding, while women carry out the repetitious, time-consuming tasks like weeking and those which are located close to home, such as care of the kitchen garden. In most cultures the application of pesticides is considered a male task, as women are aware of the danger to their unborn children of exposure to chemicals. Women do a major part of the planting and weeding of crops. Care of livestock is shared, with men looking after the larner animals and women and smaller ones. Marketing is often seen as a female task, although men are most likely to negotiate the sale of crops. Some jobs are gender neutral. The introduction of a new tool may cause a particular job to be reassigned to the opposite sex and men tend to assume tasks that become mechanised.

TABLE: 2 Work Force Participation Rate 2001

| Total Workers | Number | Rate(%) |
|---|---|---|
| 1 | 2 | 3 |
| Persons | 402,234,724 | 39.1 |
| Males | 275,014,476 | 51.7 |
| Females | 127,220,248 | 25.6 |
| **Main Workers** | | |
| Persons | 313,004,983 | 30.4 |
| Males | 240,147,813 | 45.1 |
| Females | 72,857,170 | 14.7 |
| **Marginal Workers** | | |
| Persons | 89,229,741 | 8.7 |
| Males | 34,866,663 | 6.6 |
| Females | 54,363,078 | 11 |

*Source: Census of India 2001, Registrar General of India, New Delhi.*

The impact on women of the modernisation of agriculture is both complex and contradictory. Women have often been excluded from agrarian reform and training programmes in new agricultural methods. Where both men and women have equal access to modern methods and inputs there is no evidence that either sex is more efficient than the other. Technological changes in post-harvest processing may even deprive women of a traditional income-earning task.

TABLE: 3 No. of Agricultural Workers in India 2011

| S. No. | Country | TRU | Persons | Males | Females |
|---|---|---|---|---|---|
| 1. | India | Total | 106,775,330 | 57,329,100 | 49,446,230 |
| 2. | India | Rural | 102,431,218 | 54,706,211 | 47,725,007 |
| 3. | India | Urban | 4,344,112 | 2,622,889 | 1,721,223 |

*Source: Census of India 2011, Registrar General of India, New Delhi.*

*TRU: Total, Rural Urban.*

TABLE: 4 Work participation Rate of India 2011

| S. No. | Country | TRU | Persons | Males | Females |
|---|---|---|---|---|---|
| 1. | India | Total | 39.1 | 51.7 | 25.6 |
| 2. | India | Rural | 41.7 | 52.1 | 30.8 |
| 3. | India | Urban | 32.3 | 50.6 | 11.9 |

*Source: Census of India 2011, Registrar General of India, New Delhi.*
*TRU: Total, Rural, Urban*

TABLE: 5 No. of Cultivators in India 2011

| S. No. | Country | TRU | Persons | Males | Females |
|---|---|---|---|---|---|
| 1. | India | Total | 127,312,851 | 85,416,498 | 41,896,353 |
| 2. | India | Rural | 124,719,747 | 83,475,851 | 41,243,896 |
| 3. | India | Urban | 2,593,104 | 1,940,647 | 652,457 |

*Source: Census of India 2011, Registrar General of India, New Delhi.*
*TRU: Total, Rural, Urban*

**The Role of Women in Agriculture and its Allied Fields:**

Rural women performs numerous labor intensive jobs such as weeding, hoeing, grass cutting, picking, cotton stick collections, separation of seeds from fibre. Women are also expected to collect wood from fields. This wood is being used as a major fuel source for cooking. Because of the increasing population pressure, over grazing and desertification, women face difficulties is searching of fire wood. Clean drinking water is another major problem in rural areas. Like collection of wood, fetching water from remote areas is also the duty of women. Because a rural woman is responsible for farm activities, keeping of livestock and its other associated activities like milking, milk processing, and preparation of ghee are also carried out by the women. Livestock is the primary subsistent activity used to meet household food needs as well as supplement farm incomes. The majority of farms own some livestock. The pattern of livestock strength is mainly influenced by various factors such as farm size, cropping pattern, availability of range-lands including fodder and pasture. It is common practice in the rural areas to give an animal as part of a women's dowry. Studies have revealed rural women earn extra income from the sale of milk and animals. Mostly women are engaged in cleaning of animal, sheds, watering and milking the animals.

Rural women are also responsible for collection, preparing dung cakes an activity that also brings additional income to poor families. Evidently, rural women are involved in almost all livestock related activities. Except grazing, all other livestock management activities are predominantly performed by females. Majority of women are involved in shed cleaning and collection of farm and manure. Males, however, share the responsibility of taking care of sick animals, It is evident that the women are playing a dominant role in the livestock production and management activities. Poultry farming is one of the major sources of rural economy. The rate of women in poultry farming at household level is the central in poultry industry. Even though rural women are not using modern management techniques, such as vaccination and improved feed, but their poultry enterprise is impressive. Every year, income from poultry farming has been rising. In order to generate more and more income, rural women often sell all eggs and poultry meat and leave nothing for personal use. Due to poverty and lack of required level of proteins most of women have got a very poor health. Most of women suffer from malnutrition.

TABLE 6: NUMBER OF FEMALES (PER 1000 FEMALES OF AGE 5 YEARS AND ABOVE USUALLY ENGAGED IN DOMESTIC DUTIES IN THE USUAL PRINCIPAL STATUS) WHO CARRIED OUT SPECIFIED ACTIVITIES

| Specific activities | Rural | Urban |
|---|---|---|
| 1 | 2 | 3 |
| Maintenance of kitchen garden | 241 | 112 |
| Work in House hold poultry | 254 | 33 |
| Free collection of fish | 188 | 21 |
| Free collection of fire wood | 423 | 67 |
| Husking of paddy (own produced) | 74 | 5 |
| Grinding of food grain (own produced) | 65 | 19 |
| Preparation of meat (own produces) | 12 | 5 |
| Making Baskets, etc. (own produced) | 28 | 5 |
| Husking paddy (acquired) | 63 | 34 |
| Grinding food grain (acquired) | 72 | 58 |
| Preparation of meat (acquired) | 51 | 34 |
| Making Baskets, etc. (acquired) | 47 | 29 |
| Preparing cow dung cake | 424 | 56 |
| Sewing, tailoring | 287 | 229 |
| Free tuition of own/others children | 67 | 137 |
| Bringing water from House hold premises | 366 | 125 |
| Bringing water from outside village | 12 | - |
| Number of females engaged in domestic duties per 1000 female | 443 | 522 |

*Source: NSS Report No. 550: Participation of Women in Specified Activities along with Domestic Duties, 2009-10.*

**More Work, Less Pay:**

The estimates for changes in the last 5-7 years show declines in employment ranging from 20 per cent to as much as 77 per cent. Employment in agriculture is thus available for fewer days per year. It is therefore becoming essential for men to migrate in search of better-paid work. Women are filling this vacuum. Women are forced to accept work in agriculture in their own village under very bad conditions because they cannot migrate as easily as men. The dependence of women labour on family farms, especially during the peak periods of sowing and harvesting has become very common. About 15 years ago, agricultural work was considered acceptable for poor tribal women, Muslim women today even, who were traditionally bound by rules of purdah, go out to work for wages in the fields in certain areas. Farmers, on the other hand, also seem to prefer women as agricultural workers. The farmer is faced with the increasing costs of production required for modern agriculture. He finds that he can squeeze his labour costs by using lower-paid women workers. Similarly, the work of women within family-based agriculture is preferred because it is cheaper than hiring labour. Women agricultural workers, although they represent a big proportion of all women workers, continue to receive lower wages than men. The Ministry of labour puts the difference at 60 per cent of mens wages, while the Indian Labour journal showed that women received 75 per cent of men earnings.

OCCUPATION-WISE AVERAGE DAILY WAGE RATES IN AGRICULTURAL OCCUPATIONS IN INDIA

(2002-2003, 2004-2005 AND 2006-2007 TO 2012-2013)

(In Rs.)

| Year | Ploughing | Sowing | Weeding | Transplanting | Harvesting | Winnowing | Threshing | Picking* | Herdsman | Well-Digging | Cane Crushing |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2002-03 | | | | | | | | | | | |
| Men | 71.53 | 62.62 | 53.9 | 57.33 | 58.03 | 52.88 | 57.22 | 54.76 | 40.36 | 83.38 | 57.83 |
| Women | 40.46 | 44.2 | 44.9 | 48.24 | 47.86 | 44.11 | 46.84 | 43.63 | 31.6 | 43.74 | 42.95 |
| 2004-05 | | | | | | | | | | | |
| Men | 72.28 | 66.09 | 57.79 | 62.06 | 61.95 | 54.93 | 59.15 | 54.6 | 41.51 | 84.17 | 60.62 |
| Women | 41.58 | 46.17 | 46.73 | 50.8 | 50.99 | 42.69 | 46.63 | 41.49 | 31.68 | 47.09 | 42.73 |
| 2006-07 | | | | | | | | | | | |
| Men | 81.79 | 73.29 | 64.97 | 69.47 | 68.45 | 66.18 | 67.4 | 67.45 | 43.46 | 99.48 | 72.46 |
| Women | 42.37 | 51.41 | 52.82 | 56.44 | 55.69 | 51.04 | 54.41 | 51.06 | 34.43 | 53.37 | 47.05 |
| 2007-08 | | | | | | | | | | | |
| Men | 91.38 | 79.28 | 70.07 | 73.79 | 75.24 | 71.06 | 73.5 | 72.46 | 47.64 | 106.96 | 77.92 |
| Women | 49.96 | 57.18 | 58.27 | 61.93 | 62.31 | 56.09 | 59.41 | 58.15 | 37.78 | 58.33 | 54.93 |
| 2008-09 | | | | | | | | | | | |
| Men | 102.9 | 90 | 80.15 | 83.28 | 87.05 | 81.23 | 85.06 | 81.1 | 53.48 | 116.28 | 87.27 |
| Women | 55.43 | 65 | 68.02 | 71.43 | 71.58 | 65.08 | 67.66 | 66.37 | 41.32 | 63.47 | 61.23 |
| 2009-10 | | | | | | | | | | | |
| Men | 120.85 | 104.52 | 92.78 | 98.29 | 102.82 | 96.32 | 100.23 | 96.98 | 62.23 | 140.81 | 98.43 |
| Women | 70.43 | 79.47 | 78.94 | 86.71 | 84.95 | 79.02 | 82.12 | 78.94 | 46.66 | 75.44 | 75.49 |
| 2010-11 | | | | | | | | | | | |
| Men | 145.51 | 125.75 | 111.22 | 120.19 | 122.53 | 112.82 | 117.78 | 121.1 | 77.17 | 170.32 | 120.33 |
| Women | 87.23 | 98.17 | 95.79 | 104.17 | 102.36 | 94.83 | 97.08 | 101.19 | 60.43 | 93.81 | 89.09 |
| 2011-12 | | | | | | | | | | | |
| Men | 170.47 | 152.07 | 134.01 | 140.14 | 148.49 | 136.9 | 141.46 | 145 | 92 | 208.22 | 147.79 |
| Women | 99.09 | 120.14 | 117.67 | 124.79 | 123.29 | 114.07 | 115.75 | 116.8 | 72.45 | 119.3 | 119.21 |
| 2012-13 | | | | | | | | | | | |
| Men | 204.11 | 177.36 | 158.87 | 165.17 | 176.17 | 160.03 | 171 | 154.89 | 111.3 | 255 | 175.19 |
| Women | 121.25 | 141.17 | 139.31 | 146.84 | 144.83 | 132.34 | 137.86 | 130.25 | 86.23 | 138.44 | 135.78 |

*Note:*:* picking including picking of cotton bolls and seed pods, jute stalk and tea leaves etc.

*Source:* Ministry of Labour & Employment, Govt. of India. (13690)

**Issues Involved**

In the background of the above discussion and in view of the constraints faced by women with regard to their participation in agricultural cooperatives, the following issues need to be tackled by the concerned authorities and cooperative institutions:—

- Indentification of an appropriate mechanism which could provide development opportunities to women in rural areas;
- Encouraging cooperatives to have special programmes and tasks for women to perform in the organisational and business affairs. It has been observed that in many of the countries of the Region more women are being taken in to undertake administrative and functional activities-they make very good, reliable and honest cashiers, sales girls, inventory controllers, secretaries, public relations officers and member contract persons;
- Review, revision and reformation of cooperative legislation and government policies which facilitate and encourage women to become members of cooperatives and participate in

decision-making processes.Cooperative institutions and their federations may take the lead on their own to institute programmes for the participation of women in cooperatives. Voluntary initiatives by cooperatives themselves do not necessarily to be qualified by government approvals. Cooperatives should lobby with their governments to replace or suitable amend the restrictive laws;

**Conclusions and Recommendations:**

Rural women are the major contributors in agriculture and its allied fields. Her work ranges from crop production, livestock production to cottage industry. From household and family maintenance activities, to transporting water, fuel and fodder. Despite such a huge involvement, her role and dignity has yet not been recognized. Women's status is low by all social, economic, and political indicators. Women's wage work is considered a threat to the male ego and women's engagement in multiple home-based economic activities leads to under remuneration for their work. Women spend long hours fetching water, doing laundry, preparing food, and carrying out agricultural duties. Not only are these tasks physically hard and demanding, they also rob girls of the opportunity to study. The nature and sphere of womens productivity in the labour market is largely determined by socio-cultural and economic factors. Women do not enter the labor market on equal terms when compared to men. Their occupational choices are also limited due to social and cultural constraints, gender bias in the labor market, and lack of supportive facilities such as child care, transport, and accommodation in the formal sector of the labor market. Women's labour power is considered inferior because of employers predetermined notion of women's primary role as homemakers. As a result of discrimination against female labor, women are concentrated in the secondary sector of labor market. Their work is low paid, low status, casual, and lacks potential upward mobility. The majority of women in the urban sector work in low-paying jobs.

For the recognition of women contribution in agriculture and its allied fields and reducing the gender issues, these are the following recommendations:—

- Recognition of labor work of working women in the rural economy may be accounted in monetary terms.
- More facilities should be provided to poor rural women for land, agricultural and livestock extension services.
- Priority must be given to women in accessing credit on soft terms from banks and other financial institutions for setting up their business, for buying properties, and for house building.
- Measures should be taken to enhance women's literacy rates. A separate education policy for women may serve the purpose.

Women must be involved in decision-making bodies that have the potential to introduce structural changes. This action will bring some changes in the gender relations in the society. Women must be aware regarding their existing rights, access to judicial relief and redress, removing discrimination through legal reforms, and providing legal aid, assistance and counselling.

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# Regional Disparities in United Andhra Pradesh: A Case of Rayalaseema Region

M. Srinivasa Reddy* Sanjit Kumar Rout** and T. Sudarsana Reddy***

**Abstract**

Regional disparities are inherent in any development process and India, like many of the developing countries of the world, confronting the same issue over the years. For a huge country like India, it is very important to look at the disparity at the disaggregate level. This paper is based on the evidence from undivided Andhra Pradesh (AP) which is recently bifurcated. Issues of regional disparities across the three regions of AP which had become the main driving force behind the demand for the separation of the state is examined in this paper. The variation in development across three regions of the State with respect to agricultural development is examined with the help of secondary data. Moreover, the role of Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) is also examined in connection with the reduction in regional disparity. The evidence presented in the paper shows existence of high and persistent inter-regional disparity in agriculture in the state over the years and contrary to the perceived backwardness of the Telangana region which had become the major basis for the separation of the AP, this study indicates the relative backwardness of the Rayalaseema region when compared to the other two regions. Access to sufficient water for irrigation may lead to reduction in regional disparities. State interventions in promoting irrigation can help to reduce these disparities. Moreover, allocation of more funds under MGNREGA to backward regions like Rayalaseema with proper implementation, would play a critical role in the development process and help in reduction of regional disparities.

**Keywords :** Regional Disparities, MGNREGA, Irrigation.

## Introduction

India, like many of the developing countries of the world, is confronting the challenges of disparities in economic and social development across the regions and intra-regional disparities among different segment of the society. This has been one major area of concern and it has influenced planning in India since independence. Studies concerning Indian economy observed mild increase in income inequalities across Indian states till mid eighties and thereafter it increased rapidly (Subramanayam and Raj Gopal Rao, 2000 and Govinda Rao et. Al, 1999). The widening gaps between advanced and backward regions within a state make those living in backward regions disgruntled and generate demands for separation of the state.

One important factor causing limited success to achieve balanced developments has been the neglect of variations within states and exclusive dependence on information relating to disparity at the state level. For a huge country like India, it is very important to look at the disparity at the disaggregate level. Moreover, a study at the disaggregated level, especially regional level is essential for identification of the factors that are fundamental in controlling regional disparity and framing appropriate policy mix to achieve the same. Though, there exists voluminous literature corresponding to the issue of regional disparity, most studies have focussed on state as unit for measuring disparity and have examined the impact of development policy on the state. Therefore, policies aiming at balanced regional development based on the findings of such studies have met with limited success. Moreover, thrust on regional disparity in agricultural development has been rather lacking, though a strong linkage of agriculture within agricultural sector and with non-agricultural sector for higher economic growth has been argued and supported by empirical analysis (Johnston and Mellor, 1961). Though, the studies relating to backwardness of agriculture have pointed out some major problems of the agricultural sector, yet they have failed to compare the variations in performance of different regions.

This paper is based on the evidence from undivided/ united Andhra Pradesh (AP) which is recently bifurcated[1]. Issues of regional disparities across the three regions of Andhra Pradesh which had become the main driving force behind the demand for the separation of the state is examined in this paper.

## Study Area

The state of Andhra Pradesh, which came in to existence on November1, 1956 under the State Re-organization Act

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[1]United AP (comprises of 23 districts, 10 in Telangana, nine in Coastal Andhra and four in Rayalaseema). The United AP was bifurcated into two states - the new state Telangana (29th State of Indian Union) and A P on June 2nd 2014. However, this Paper has looked at the issues of backwardness in the both states and not separately.

was the fourth largest state in India, both in terms of area and population, before its partition. It consisted of 23 districts distributed over three distinct geographical regions namely, Coastal Andhra (9 Districts), Rayalaseema (4 Districts) and Telangana (10 Districts) with widely different endowments, historical legacies and institutional arrangements. Historically the Coastal Andhra and Rayalaseema regions were a part of the former Madras presidency, whereas the Telangana region comprised the districts which were under the control of Nizam of Hyderabad. The differential administrative control led to the differential access to irrigation across these regions. The relative area under irrigation was less in the Rayalaseema region, which compared to other two regions of the state. Thus, these three constituent regions of Andhra Pradesh, Viz., Coastal Andhra, Rayalaseem and Telangana typifies unequal economic development ever since the formation of Andhra Pradesh. At the time of the formation of the AP, it was expected that the newly formed state will integrate these diverse units into a single economic entity and to accelerate the growth of its productive sectors along with reduction in regional disparities among the three regions. However, the difference in the level of development among these regions that existed even at the time of formation of the AP has widened over the years and significantly intensified during the period of reforms. In spite of higher growth in the last two decades at the last two decades at the aggregate level, inclusive growth or equitable development among the regions was observed to be missing (Dev, 2007).

**Objective of the Study**

The purpose of the present paper is to offer analytical description of the manner in which these three regions of undivided A P have behaved *vis-a-vis* one another over the period 1956-57 to 2012-13. The variation in development across ifferent regions of the State is examined in the present paper through different indicators relating to the performance of the agricultural sector. Moreover, the role of Mahatma Gandhi National Rural Employment Guarntee Act (MGNREGA) is also examined in connection with the reduction in regional disparity.

**Date Base and Methodology**

The present paper is based on secondary data collected from various sources of Government of Andhra Pradesh (GoAP), i.e., Directorate of Economics and Statistics (DE&S), Satistical Abstracts, Season and Crop Reports, Socio Economic Surveys, Minor Irrigation Census of Andhra Pradesh. Apart from these sources, the data has been taken from research Journals, News Papers, books, article reference books, web sources and survey organizations etc., Moreover, discussions with relevant officials and eminent scholars in the field were also held so as to get an overview of the situation. Trend lines along with Compound Annual Growth Rates[2] (CAGR) and percentage points are used to compare the performance of the three regions with respect to a particular indicator.

The paper is divided into three sections, Section-I presents the introduction which include a brief discussion about the background of the study, study area, objective of the study and data base and methodology. Section-II analyses agricultural development related trend across regions in AP in terms of the indicators chosen and measures the inter-region disparity. Moreover, the role of MGNREGA in connection with the reduction in regional disparity is also examined in this section. Finally, the last section (Section-III) provides conclusions and makes suggestions in order to reduce the regional disparity.

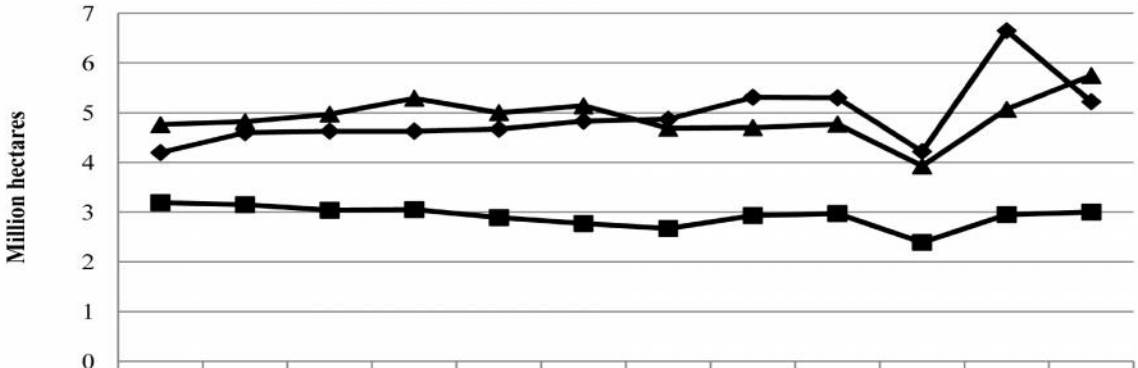
**Trends Across Regions in Andhra Pradesh (Section II)**

Being an agrarian state, the growth of agriculture hold the key for the overall development of any region as performance of this sectors through forward and backward linkages. Agriculture, not only contributes significantly to the states' New State Domestic Product (NSDP) but, at the same time, is a major source of employment in rural areas, Hence, the neglect of agriculture could be detrimental to economic growth and welfare of the people.

Agricultural development of a region can be assessed in terms of the changes in Gross Cropped Area (GCA) and Net Cropped Area (NCA). The following Figure (Figure-1) indicates changes in GCA across regions of Andhra Pradesh during the period 1956 to 2013. While Coastal Andhra and Telangana regions had witnessed around 10 per cent increase in their GCA, Rayalaseema had experienced a decline of about 2 per cent in its GCA during this period (Appendix Table-1). The GCA in Coastal Andhra and Telangana regions were in the average of 5.2 and 5.8 million hectares respectively during 2011-13 compared with 4.2 and 4.8 million hectors in 1956-60. On the other hand, the GCA of Rayalaseema region had declined from 3.2 million hectares to 3.0 Million hectares during this period (Figure-1 and Appendix Table-1). While Coastal Andhra (CA) region experiences a positive compound annual growth rate (CAGR) of 0.1387, the other two regions Telangana (TG) and Rayalaseema (RS) experienced negative growth rates (-0.0794 and-0.1850 respectively) during the same period and Rayalaseema's growth rate is found to be minimal. For a better understanding of the growth in as agriculture, we have also considered the pattern of growth in irrigation.

2CAGR arrived through log linear function.

**Figure-1: GCA across Regions of AP (in million Ha.)**



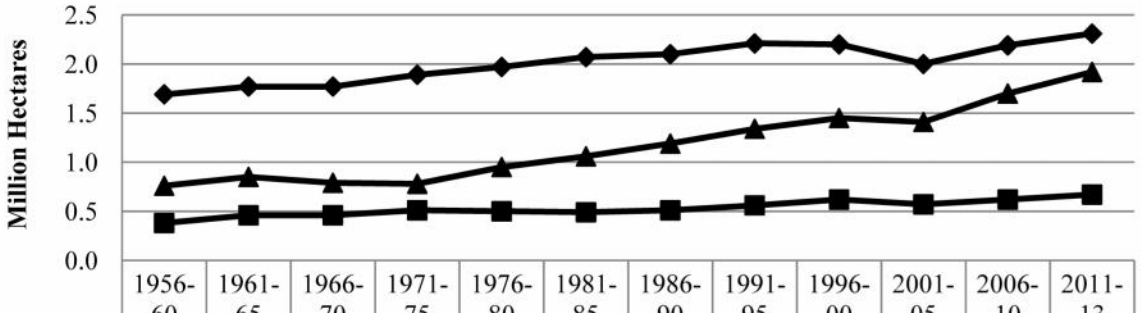

| | 1956-60 | 1961-65 | 1966-70 | 1971-75 | 1976-80 | 1981-85 | 1986-90 | 1991-95 | 1996-00 | 2001-05 | 2006-10 | 2011-13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CA | 4.2 | 4.6 | 4.63 | 4.63 | 4.67 | 4.83 | 4.87 | 5.31 | 5.3 | 4.22 | 6.65 | 5.22 |
| RS | 3.19 | 3.15 | 3.04 | 3.05 | 2.89 | 2.77 | 2.67 | 2.93 | 2.97 | 2.39 | 2.95 | 3 |
| TG | 4.76 | 4.82 | 4.97 | 5.29 | 5 | 5.14 | 4.69 | 4.7 | 4.77 | 3.93 | 5.07 | 5.75 |

*Source*: Data Compiled from GoAP, Season and Crop Reports and Statistical Absrtracts, different years, Directorate of Economics and Statistics, Hyderabad.

**Growth in Irrigation**

Net Irrigation Area (NIA) in all the three regions of AP has undoubtedly increased over the years. However, it is the Telangana region which has experienced more increase (12 percent points) when compared to the other two regions (Appendix Table-2). In fact the NIA in Telangana has increased more than doubled (from 0.8 million hectares in 1956-60 to 1.9 million hectares by 2011-13; Figure-2) On the other hand, the increase in Rayalaseema was the least, meagre 3 percent only, among the three regions (Appendix Table-2).

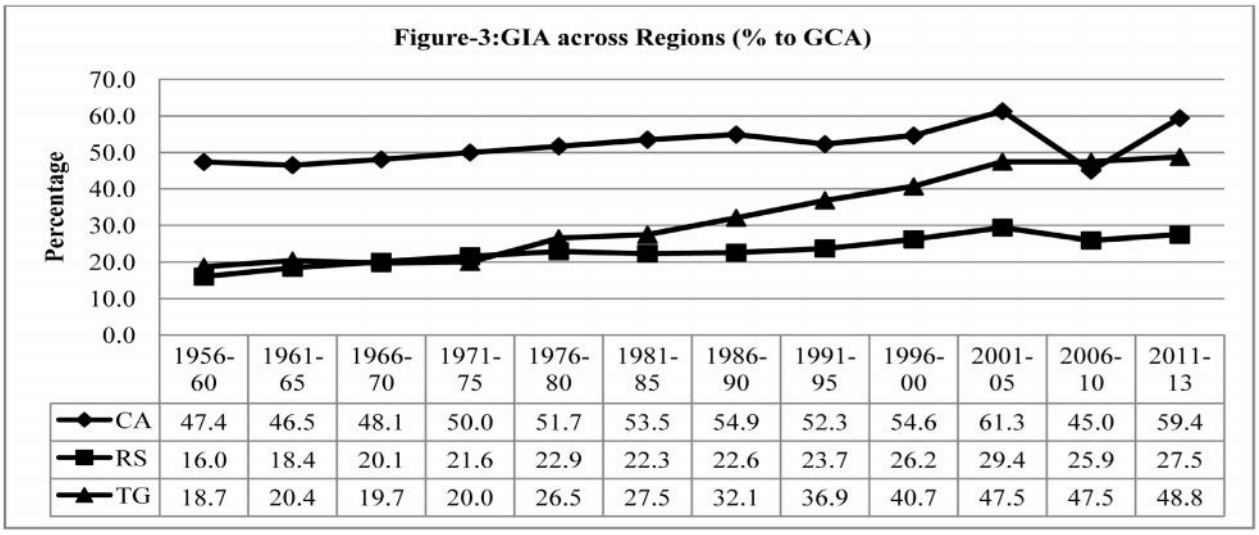
**Figure-2: NIA across Regions of AP (in million Ha.)**




| | 1956-60 | 1961-65 | 1966-70 | 1971-75 | 1976-80 | 1981-85 | 1986-90 | 1991-95 | 1996-00 | 2001-05 | 2006-10 | 2011-13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CA | 1.7 | 1.8 | 1.8 | 1.9 | 2.0 | 2.1 | 2.1 | 2.2 | 2.2 | 2.0 | 2.2 | 2.3 |
| RS | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.6 | 0.6 | 0.6 | 0.6 | 0.7 |
| TG | 0.8 | 0.9 | 0.8 | 0.8 | 1.0 | 1.1 | 1.2 | 1.3 | 1.5 | 1.4 | 1.7 | 1.9 |

*Source :* Data Compiled from GoAP, Season and Crop Reports and Statistical Abstracts, different years, Directorate of Economics and Statistics, Hyderabad.

Moreover, when access to irrigation facilities (% GIA to GCA) is concerned, it is the Rayalaseema region which was again lagging behind the other two regions over this time period, the only exception observed during 1966-75, when access to irrigation in Rayalaseema was marginally higher than the Telangana region. Coastal Andhra region had a relative advantage over other two regions with respect to access to irrigation facilities owing to the presence of Godavari and Krishna rivers in its area.



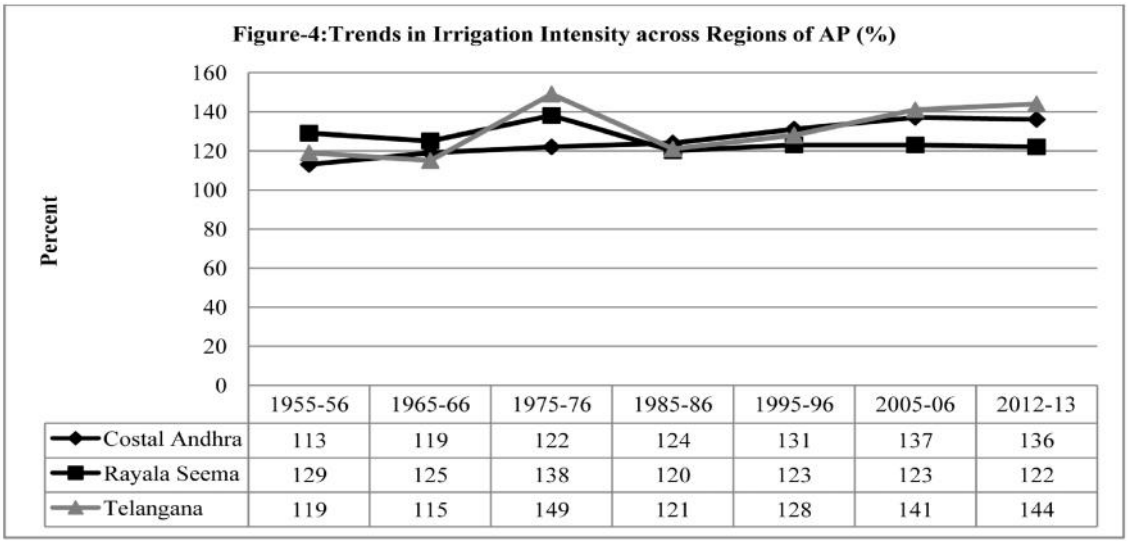

| | 1956-60 | 1961-65 | 1966-70 | 1971-75 | 1976-80 | 1981-85 | 1986-90 | 1991-95 | 1996-00 | 2001-05 | 2006-10 | 2011-13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CA | 47.4 | 46.5 | 48.1 | 50.0 | 51.7 | 53.5 | 54.9 | 52.3 | 54.6 | 61.3 | 45.0 | 59.4 |
| RS | 16.0 | 18.4 | 20.1 | 21.6 | 22.9 | 22.3 | 22.6 | 23.7 | 26.2 | 29.4 | 25.9 | 27.5 |
| TG | 18.7 | 20.4 | 19.7 | 20.0 | 26.5 | 27.5 | 32.1 | 36.9 | 40.7 | 47.5 | 47.5 | 48.8 |

*Source:* Data Compiled from GoAP, Season and Crop Reports and Statistical Absrtracts, different years, Directorate of Economics and Statistics, Hyderabad.

From the formation of the state in 1956 to till date, the scenario with respect to better irrigation facilities in Coasl Andhra region compared to other two regions remain unchanged, the only exception was observed during 2006-10 when Telangana had surpassed Coastal Andhra region. The poor irrigation facility in the Rayalaseema region is adversely affecting the agricultural development in the region and therefore, contributing towards the enhancement of the regional disparities (Figure 3 and Appendix Table-1).

**Irrigation Intensity (II)**

Status of irrigation across regions is also analysed with the help of 'irrigation intensity' which is the ratio of GIA to NIA. About the time of reorganization of AP in 1956, Rayalaseema region had the highest irrigation intensity of 129% compared to 119% in Telangana and 113% Coastal Andhra regions.




| | 1955-56 | 1965-66 | 1975-76 | 1985-86 | 1995-96 | 2005-06 | 2012-13 |
|---|---|---|---|---|---|---|---|
| Costal Andhra | 113 | 119 | 122 | 124 | 131 | 137 | 136 |
| Rayala Seema | 129 | 125 | 138 | 120 | 123 | 123 | 122 |
| Telangana | 119 | 115 | 149 | 121 | 128 | 141 | 144 |

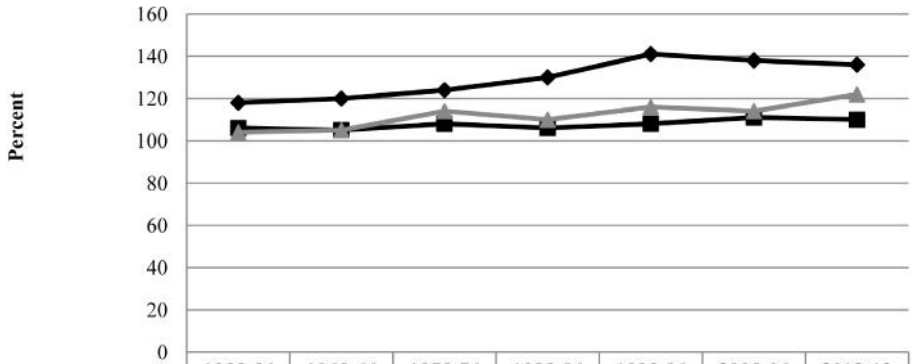
Source: Data compiled from GoAP, Season and Crop Reports and Statistical Abstracts, different years, Directorate of Economics and Statistics, Hyderabad.

Howerver, Rayalaseema was able to retain its relative advantage over the other two regions only for a decade (up to 1965-66) and after 1985-86, and after 1985-86, the irrigation intensity of Rayalaseema started lagging behind the other two regions (Figure-4 and Appendix Table-3). While CAGR related to II corresponding to these period was found to be more for Telangana region (0.1266), it was not only lowest but even negative in case of Rayalaseema region (-0.0618).

Cropping intensity (CI) of a region reflects the ability of the area to utilise the land, labour capital and technology efficiently to raise more number of crops per unit area per unit time to obtain higher productivity and income. At the time of the formation of the state, Coastal Andhra (118%)

was ahead of the other two regions in the matter of CI followed by Rayalaseema (106%) and Telangana (104%). During 1965-66, CI of Rayalaseema was similar to that of Teleangana, but 1975-76 onwards, CI of Rayalaseema region lagged behind the other two regions. CI of Coastal Andhra region remained to be higher when compared to the other two regions over all these years (Figure-5 and Appendix Table-3). The superiority of Coastal Andhra region when compared to the other two regions and relative backwardness of Rayalaseema are also reflected in the CAGR (while it is turned out to be 0.1150for Coastal Andhra, Rayalaseema experienced a native growth rate of 0.0737 during the same period) calculated for the 1955-56 to 2012-13 time periods.

**Figure-5:Trends in Cropping Intensity across Regions of AP (%)**

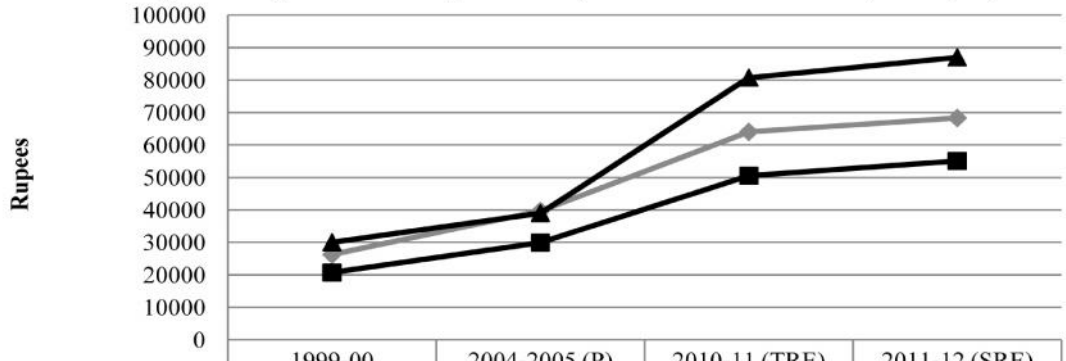



| | 1955-56 | 1965-66 | 1975-76 | 1985-86 | 1995-96 | 2005-06 | 2012-13 |
|---|---|---|---|---|---|---|---|
| Costal Andhra | 118 | 120 | 124 | 130 | 141 | 138 | 136 |
| Rayala Seema | 106 | 105 | 108 | 106 | 108 | 111 | 110 |
| Telangana | 104 | 105 | 114 | 110 | 116 | 114 | 122 |

*Source:* Data Compiled from GoAp, Season and Crop Reports and Statistical Abstracts, different years, Directorate of Eonomics and Statistics, Hyderabad.

GDP per capita is generally used to compare the economic development and average income between different countries. In the following analysis, Gross District Level Domestic Product (GDDP) data corresponding to different regions of Andhra Pradesh were aggregated at the regional level to undertake regional level comparisons over time. Rayalaseema region always remained behind the other two regions with respect to the per capita GDDP calculated at constant 2004-05 prices indicating a low growth rate in Rayalaseema compared to Telangana and Costal Andhra regions. This trend was observed in all the period (1999-2000, 2004-05, 2010-11 and 2011-12). Telangana because of Hyderabad was ahead of the other two regions in all the time period, the only exception was observed during 2004-05 when Coastal Andhra region had slightly higher per capital GDP than Telengana region (Figure-6 and Appendix Table-4).

**Figure-6: Region-wise Per capita GDDP (at Constant 2004-05 Prices) in AP (Rs.)**

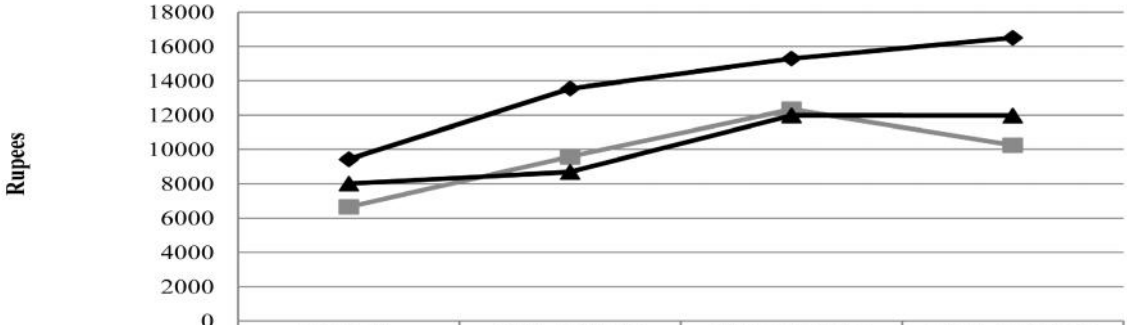



| | 1999-00 | 2004-2005 (P) | 2010-11 (TRE) | 2011-12 (SRE) |
|---|---|---|---|---|
| Costal Andhra | 26218 | 39657 | 64036 | 68335 |
| Rayala Seema | 20709 | 29878 | 50541 | 55065 |
| Telangana | 29992 | 38993 | 80696 | 86966 |

*Source:* Data Compiled from GoAp, Socio Economic Survey, different years, Directorate of Economics and Statistics, Hyderabad.

As far as capita GDDP originating in the primary sector at constant 2004-05 prices was concerned, it was the Rayalaseema region whose share was lowest among the three regions during 1999-2000 and also in 2011-12 indicating this region's relative backwardness when compared to the other two regions of the state (Figure-7 and Appendix Table-4).

**Figure-7: Region-wise Per capita GDDP (at Constant 2004-05 Prices) originating in the Primary Sector in AP (in Rs.)**



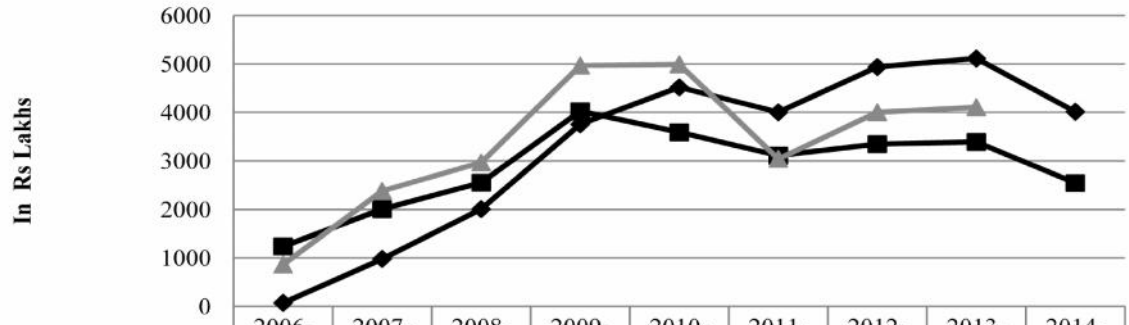

| | 1999-00 | 2004-2005 (P) | 2010-11 (TRE) | 2011-12 (SRE) |
|---|---|---|---|---|
| Costal Andhra | 9416 | 13548 | 15292 | 16504 |
| Rayala Seema | 6647 | 9566 | 12334 | 10238 |
| Telangana | 8001 | 8678 | 11979 | 11968 |

*Source:* Data Compiled from GoAP, Season and Crop Reports, different years, Directorate of Economics and Statistics, Hyderabad.

**MGNREGA and Regional Disparity**

Mahatma Gandhi National Rural Employment Gurantee Act (MGNREGA ) has emerged as one of the largest flagship schemes of Government of India (largest job creation programme of its kind in the world) provide assured employment for rural poor. One of the main objectives of MGNREGA is to eardicate rural poverty and unemployment by way of generating productive employment in villages. It encompasses inclusive growth strategy to reduce chronicle poverty and regional imbalances in the country. Considering the Government of India's efforts to scale-up MGNREGA, It was expected that being relatively backward[3], Rayalaseema region will attract more funds related to MGNREGA expenditure than the other two regions. however, it had happened only during 2006-07, the first year of its inception.

**Figure-8: Region-wise Expenditure on MGNREGA per acre of Net Cropped Area**




| | 2006-07 | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 |
|---|---|---|---|---|---|---|---|---|---|
| Costal Andhra | 69.8 | 977.5 | 2006.3 | 3755.4 | 4518.1 | 4004 | 4938.2 | 5113.3 | 4013.6 |
| Rayala Seema | 1233.8 | 2004.9 | 2549.5 | 4021.9 | 3590.7 | 3110.9 | 3347.3 | 3391.6 | 2544.4 |
| Telangana | 860.7 | 2381.9 | 2968.3 | 4967.4 | 4991.8 | 3042.8 | 4002.6 | 4108.4 | |

*Source:* 1. Data Compiled from GoPA, Season and Crop Reports, different years, Directorate of Economics and Statistics, Hyderabad
2. Data compelled from Gol, MGNREGA Public data Portal, different years.

while expenditure on MGNREGA per acre of net cropped area was found to be more in Telangana when compared to the other two region during 2007-08 to 2010-11, it was coastal Andhra, which extracted more funds after 2011-12 onwards (Figure-8 and Appendix Table. 5).

[3]The analysis has proved the relative backwardness of the Rayalaseema region when compared to the other two regions.

Thus, Government by not spending more amount of money under MGNREGA in Rayalaseema when compared to the other two regions has failed to utilise MGNREGA appropriately to reduce the regional disparity.

**Conclusions (Section III)**

Overall development of any region is largely influenced by the growth of its agricultural sector. Evidence shows existence of high and persistent inter-regional disparity in agriculture in the State over the years and contrary to the perceived backwardness of the Telangana region which had become the major basis for the separation of the Andhra Pradesh, this study indicates the relative backwardness of the Rayalaseema region when compared to the other two regions. The study has found that GIA, NIA and II are low in Rayalaseema region when compared to the other two regions.

Considering the importance of the agricultural sector to the lives of the rural population, the immediate task of the Government is to reduce this unevenness and disparity, otherwise it will put bulk of the populaiton of the state under duress. There is an urgent need to re think strategies of development for regions like Rayalaseema with a greater focus on sustainable and equitable natural resource management, within a framework of greater devolution of powers and participatory development planning. Formulations of area/region specific plans with emphasis on backward regions are going to be the key in this regard.

Water scarcity is one of the main reasons resulting in regional disparities. Some regions like Coastal Andhra have sufficient assured irrigation facilities due to its geographical/natural conditions. Access to sufficient water for irrigation may lead to reduction in regional disparties. However, public investments in major and medium irrigation schemes have declined over the years; state has not taken any major steps for improving the water resources. State interven ions in promoting irrigation can help to reduce these disparties.

Proper implementation of MGNREGA would play a critical role in the development process particularly activities related to the development of the Agricultural sector under MGNREGA should be increased. Priority should be given to backward regions like Rayalaseema and low rainfall regions. This calls for more allocation of resources under MGNREGA to backward regions like Rayalaseema.

**Appendix Tables**

TABLE 1 GROSS CROPPED AREA (GCA) ACROSS REGIONS (5 YEAR AVERAGES/AREA IN LAKH HECTARES)

| Region | 1956-60 | 1961-65 | 1966-70 | 1971-75 | 1976-80 | 1981 85 | 1986-90 | 1991-95 | 1996-00 | 2001-05 | 2006-10 | 2011-13 | Increase in% points | CAGR from 1955 to 2012-13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Coastal Andhra | 42.0 (47.4) | 46.0 (46.5) | 46.3 (48.1) | 46.3 (50) | 46.7 (51.7) | 48.3 (53.5) | 48.7 (54.9) | 53.1 (52.3) | 53.0 (54.6) | 42.2 (61.3) | 66.5 (45) | 52.2 (59.4) | 10.2 | 0.1387 |
| Rayala Seema | 31..9 (16) | 31.5 (18.4) | 30.4 (20.1) | 30.5 (21.6) | 28.9 (22.9) | 27.7 (22.3) | 26.7 (22.6) | 29.3 (23.7) | 29.7 (26.2) | 23.9 (29.4) | 29.5 (25.9) | 30.0 (27.5) | -1.9 | -0.1850 |
| Telengana | 47.6 (18.7) | 48.2 (20.4) | 49.7 (19.7) | 52.9 (20) | 50.0 (26.5) | 51.4 (27.5) | 46.9 (32.1) | 47.0 (36.9) | 47.7 (40.7) | 39.3 (47.5) | 50.7 (47.5) | 57.5 (48.8) | 9.9 | -0.0794 |

CAGR: Compound annual growth rate
CA- Costal Andhra, RS- Rayala Seema, TG- Telengana
Source: Data Compiled from GoPA, Season and Crop Reports, different years, Directorate of Economics and Statistics, Hyderabad
Note: 1. Figures in the parenthesis indicate the % GIA to GCA; 2. CAGR arrived through log liner function

TABLE 2 NET IRRIGATED AREA (GCA) ACROSS REGIONS (5 YEAR AVERAGES/AREA IN LAKH HECTARES)

| Region | 1956-60 | 1961-65 | 1966-70 | 1971-75 | 1976-80 | 1981 85 | 1986-90 | 1991-95 | 1996-00 | 2001-05 | 2006-10 | 2011-13 | Increase in% points | CAGR from 1955-56 to 2012-13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Coastal Andhra | 16.9 (47.4) | 17.7 (47) | 17.7 (47.2) | 18.9 (50.2) | 19.7 (52.5) | 20.7 (54.7) | 21.0 (56.7) | 22.1 (57.4) | 22.0 (57.5) | 20.0 (54.5) | 21.0 (58) | 23.1 (60.4) | 6.2 | 0.2222 |
| Rayala Seema | 3.8 (12.9) | 4.6 (15.4) | 4.6 (16.1) | 5.1 (17.8) | 5.0 (18.4) | 4.9 (18.9) | 5.1 (19.5) | 5.6 (20.5) | 6.2 (22.8) | 5.7 (21.2) | 6.2 (24.5) | 6.7 (25.1) | 2.9 | 0.3530 |
| Telengana | 7.6 (16.5) | 8.5 (18.4) | 7.9 (16.9) | 7.8 (16.2) | 9.5 (21.3) | 10.6 (22.9) | 11.9 (27.6) | 13.4 (32.9) | 14.5 (36) | 14.1 (35.4) | 17.0 (40.8) | 19.2 (41.9) | 11.6 | 0.2494 |

CAGR: Compound annual growth rate
CA- Costal Andhra, RS- Rayala Seema, TG- Telanaga
*Source:* Data Compiled from GoPA, Season and Crop Reports, different years, Directorate of Economics and Statistics, Hyderabad
Note: 1. Figures in the parenthesis indicate the % NIA to NCA; 2. CAGR arrived through log liner function

TABLE 3 IRRIGATION INTENSITY AND CROP INTENSITY CROSS REGIONS (%)

| Region | 1955-56 | 1965-66 | 1975-76 | 1985-86 | 1995-96 | 2005-06 | 2012-13 | CAGR from 1955-56 to 2012-13 |
|---|---|---|---|---|---|---|---|---|
| 1. Irrigation Intensity (II) | | | | | | | | |
| Costal Andhra | 113 | 119 | 122 | 124 | 131 | 137 | 136 | 0.0983 |
| Rayala Seema | 129 | 125 | 138 | 120 | 123 | 123 | 122 | -0.0618 |
| Telangana | 119 | 115 | 149 | 121 | 128 | 141 | 144 | 0.1266 |
| 2. Cropping Intensity (CI) | | | | | | | | |
| Costal Andhra | 118 | 120 | 124 | 130 | 141 | 138 | 136 | 0.1150 |
| Rayala Seema | 106 | 105 | 108 | 106 | 108 | 111 | 110 | -0.0737 |
| Telangana | 104 | 105 | 114 | 110 | 116 | 114 | 122 | 0.0355 |

*Source:* Data Complied from GoAP, Season and Crop Reports, different years, Directorate of Economics and Statistics, Hyderabad

*CAGR:* Compound annual growth rate; Note: CAGR arrived through log linear function

TABLE 4 REGION-WISE PER CAPITA GDDP AND PER CAPITA GDDP ORIGINATING IN THE PRIMARY SECTOR AT CONSTANT (2004-05) PRICES (IN RS.)

| Region | 1990-00 | | 2004-05 (P) | | 2010-11 (TRE) | | 2011-12(SRE) | |
|---|---|---|---|---|---|---|---|---|
| | Primary Sector | Overall GDDP | Primary Sector | Overall GDDP | Primary Sector | Overall GDDP | Primary Sector | Overall GDDP |
| Costal Andhra | 9416 | 26218 | 13548 | 39657 | 15292 | 64036 | 16504 | 68335 |
| Rayala Seema | 6647 | 20709 | 9566 | 29878 | 12334 | 50541 | 10238 | 55065 |
| Telangana | 8001 | 29992 | 8678 | 38993 | 11979 | 80696 | 11968 | 86966 |

TRE: Third Revised Estimates, SRE: Second Revised Estimates

*Source:* 1 Go AP, Directorate of Economics and Statistics, Hyderabad; 2. Go T, Directorate of Economics and Statistics, Hyderabad.

TABLE: 5 REGION-WISE EXPENDITURE ON MGNREGA PER ACRE OF NET CROPPED AREA

| Region | 2006-07 | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 |
|---|---|---|---|---|---|---|---|---|---|
| Costal Andhra | 69.8 | 977.5 | 2006.3 | 3755.4 | 4518.1 | 4004.0 | 4938.2 | 5113.3 | 4013.6 |
| Rayala Seema | 1233.8 | 2004.9 | 2549.5 | 4021.9 | 3590.7 | 3110.9 | 3347.3 | 3391.3 | 2544.4 |
| Telangana | 860.7 | 2381.9 | 2698.3 | 4967.4 | 4991.8 | 3042.8 | 4002.6 | 4108.4 | NA |

*Note:* MGNREGA Expenditure (in Rs. Lakhs) and Net Cropped Area (in Lakh Ha.)

**Source:** 1. Data compelled from GoI, MGNREGA Public Data Portal; and

2. Data Compiled from GoAP, Season and Crop Reports and Statistical Abstracts, different years, Directorate of Economics and Statistics, Hyderabad

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# A Study of Prototype in the Rule Based Expert System for the Management of Downy Mildew Disease in Grape Crop

Mr. S.K. Jadhav* and Dr. R.D. Kumbhar**

**Abstract:—**In recent years, expert system technology is used by professionals in different fields. Development of an expert system on agricultural crops will guide the farmers to take decisions into different aspects of crop management. Downey mildew disease caused by fungus Plasmopara Viticola. During monsoon, this disease noticed on leaves of grape crop. If the fruit pruning taken before 15th October, then there is a greater risk of downy mildew because there are more chances of rains and also temperature is warmer. On the basis of information like crop period, whether pruning is foundation or forward pruning and appearance of infection of downy mildew etc, this system suggests various preventive measures and different pesticide treatments. This paper presents the development of a prototype of a rule based expert system for the management of Downy Mildew disease in grape crop.

**Keywords:—**Expert System, Downy Mildew, Pesticide Treatment, Forward Chaining.

## 1. Introduction

An Expert System is computer program that emulates the behavior of human expert to solve problems which are real word problems associated with a particular domain of knowledge [3]. The most commonly known type of knowledge based system is the rule based expert system in which the experience and knowledge of human experts is captured in the form of IF-THEN rules and facts which are used to solve the problems. It contains the knowledge and analytical skills of one or more human experts.

Downy mildew of grapes is caused by the obligate parasitic fungus, Plasmopara viticola. All varieties of grapes in the species Vitis vinifera are highly susceptible, V. aestivalis and V. labrusca are less susceptible, while V. Cordifolia, V rupestris and V. rotundifolia are relatively resistant [4]. Infection of downy mildew takes place when leaf, cane or bunch remains wet during day time at least for 2.5 to 3.00 hours. These conditions are observed when it rains and dew or fog remains for long time in the morning. Heavy losses due to downy mildew are observed when it rains during November and December.

Grape cultivation in one of the most remunerative farming enterprises in India. It faces serious threat from several insect pests and diseases. Diseases like downy mildew, powdery mildew, anthracnose etc. causes enormous economic losses to grape sector every year. Downy mildew is a highly destrictive disease of grapevines in all grape-growing areas causing up to 100% losses if the disease is not controlled during favorable weather. To avoid such losses, it is necessary to make use of appropriate pesticides in right does (i.e. proper combination and ratio) at right time. It is also important to note that, indiscriminate use of pesticides not only adds to the cost of production significantly, but also results in pesticide (chemical substance) residues in the final produce (i.e. grape) and also in soil.

Author has developed a prototype of expert system for the use of various pesticides at different stages of grape crop to control the attack of downy mildew. The paper inlcudes

## 2. Grape Crop in Maharashtra (India)

Grape (Vitis vinifera) is growth under a variety of socil and climatic conditions in three distinct zone namely, sub-tropical, hot tropical and mild tropical climatic regions in India. Nashik, Sangali, Solapur, Pune, Satara, Lature and Osmanabad districts of Maharashtra state comes under hot tropical climatic region. Vines do not undergo dormancy and double pruning and single harvesting is the general practice in this region. Maximum and minimum temperature is 42°C and 8°C respectively, The major problems in this region are soil and water salinity and drought. Berry growth is impaired and in certain locations pink blush sometimes develops on green berries due to temperature that drop to a low of 8°C. Thompson seedless & its clones (i.e. Tas-A-Ganesh, Sonaka), Anab-E shahi, Sharad seedless and Flame seedless are the varieties grown in this region.

In India, Maharashtra is a leading state in production of grapes. With regard to agricultural land under grape cultivation and production, Nashik and Sangali districts are at forefront in the state. Area under grapes in Maharashtra is 86.0 thousand ha and production is around 774.0 thousand MT annually. (source: National Horticulture Board, Govt. of India).

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**3. Inforamtion About Various Disease Observed In Grape**

The major diseases observed in the grapes are

a) Powdery Mildew: Powdery mildew is observed in all the grape growing regions. It is devastating disease like downy mildew. Diseases are characterized by the presence of white powdery (ash like) coating in patches on both sides of the leaves, young shoots and immature berries. The disease develops under warm and dry conditions. Shade or diffused light also helps in the development of this disease. Affected shoots remain weak and immature. The buds affected during growing season, fail to sprout after October pruning. Thus the productivity of the cane and the number of productive canes are reduced. If blossoms are affected they fail to set fruit.

(b) Downy Mildew: Downy mildew is the most devastating disease of grapes in the tropical region of the country. The disease mainly appears on the leaves, but also attacks the flower clusters and young fruits Diseases are characterized by the presence of oil spots. The losses are very high when it attacks the clusters before fruit set. Entire clusters decay, dry and drop down. [5] It comes naturally in the rainy season when humidity of environment is high. After the cutting or plants for grape production, in the first 40 to 65 days, the leaves of grapes are delicate & immature. At that time this disease comes. [6]

(c) Rust: This disease is caused by fungal pathogen Phakopsora euvitis, Symptoms of the disease initially are brown spots on the upper side of leaves. Corresponding to the spots on the underside of leaves. yellowish-orange mass of powdery spores are formed profusely. Infection spreads rapidly on the leaves cuasing them to dry and wither. It can infect the vines all year round but becomes noticeable during the dry season. The disease in spread through air. Heavy infection during havest time, which often occurs in warm temperature, causes considerable reduction in yield.

(d) Anthracnose: The disease is characterized by small lights brown or grayish black lesions on tender shoots, young leaves, flowers and young berries. It found in warm, humid and rainy regions.

(e) Bacterial Leaf Spot or Stem Canker (Xanthomonas campestris):

The disease is more prevalent during June-August and again in February-March. Termperature range of 25-30°C and relative humidity of 80-90% is favorable for the development of the disease. The young growing shoots are affected first. Disease infects leaves, shoots and berries. The symptoms appear as minute water soaked spots on the lower surface of the leaves along the main and lateral veins. Later on these spots coalesce and form larger patches. Brownish black lesions are formed on the berries, which later became small and shriveled. (Source: National Horticulture Board, Govt. of India).

**4. Effect or Damage due to Attack of Downy Mildew in Grape:—**

Downy mildew has become an increasing threat to grapevine causing heavy loss in the field.

(1) Downy mildew primarily attacks grape leaves.

(2) It may also attacks and cause severe malformation of shoots, tendrils or berries early.

(3) The attacked leaves eventually turn brown, become dry and fall.

(4) Once it is affected it will diminish the quantity & quality of grapes, it reduce the Photosynthesis process.

(5) Downey mildew causes deformed shoot, cluster growth reduction, premature defoliation causes delayed ripening of fruit, young berries will turn light brown, becomes soft then fall off the cluster easily.[6]

**5. Control or Management of Downy Mildew Attack in Grape Crop:—**

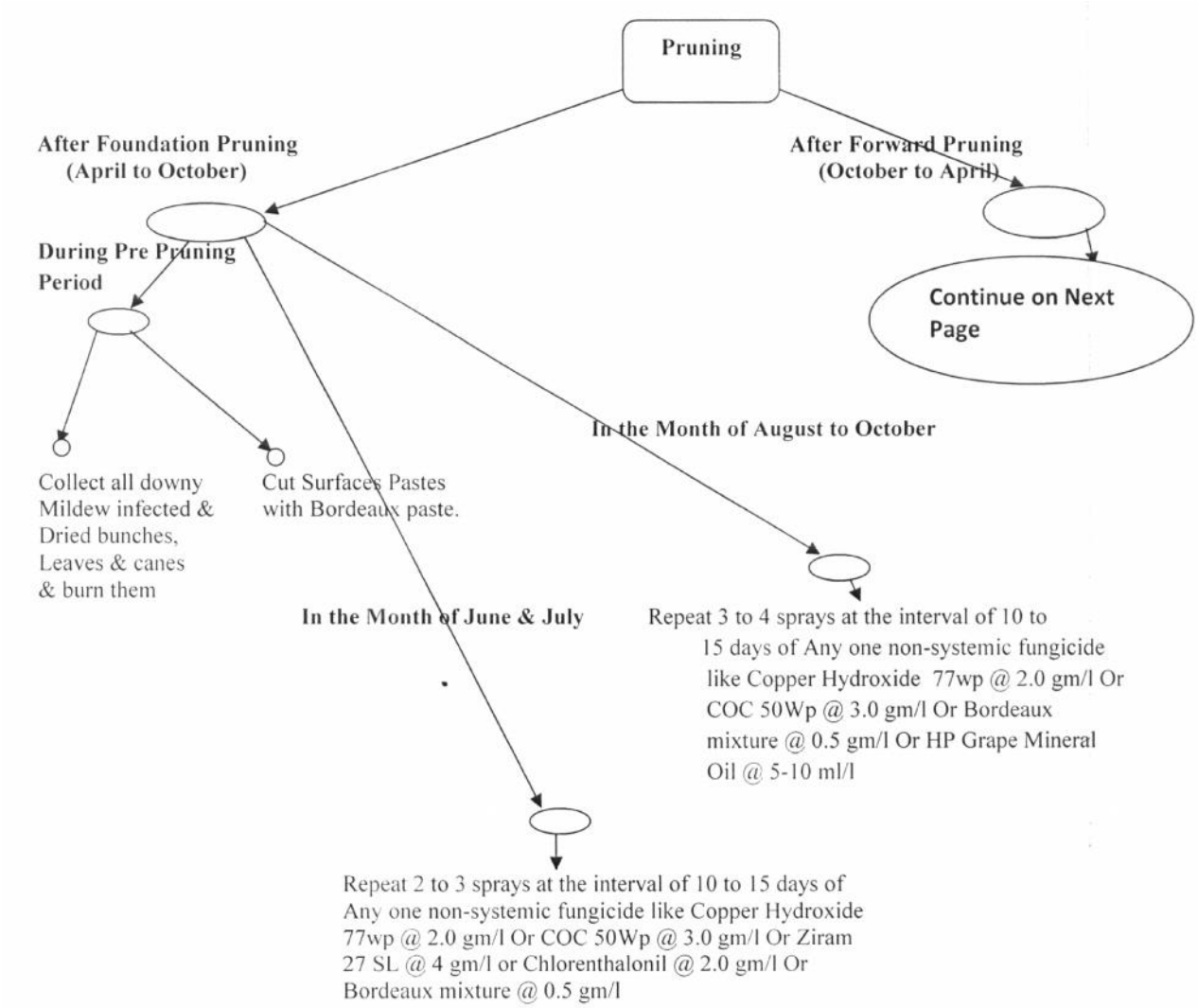
Management of downy mildew can be planned well in advance especially immediately after both April and October Pruning.

**Pruning:** In Maharashtra, the vines are forced to undergo for about a month immediately after harvesting. This helps in storing the food material in the mature parts of the vine. The canes are cut back in April by keeping 1-2 buds which develops into canes in 4-5 months. The dried canes are also removed. Here it is called "Back pruning" or"

Foundation" or "Growth Pruning".

In the month of September-October, these canes are pruned for fruiting. This pruning is called "Forward pruning" or "Winter Pruning". Vines, which have attained the age of one year, can be subjected to this pruning. The level of forward pruning depends upon the region, variety and vine vigour. Normally the vines start yielding in about 5 months from forward pruning.

Here after foundation as well as forward pruning,



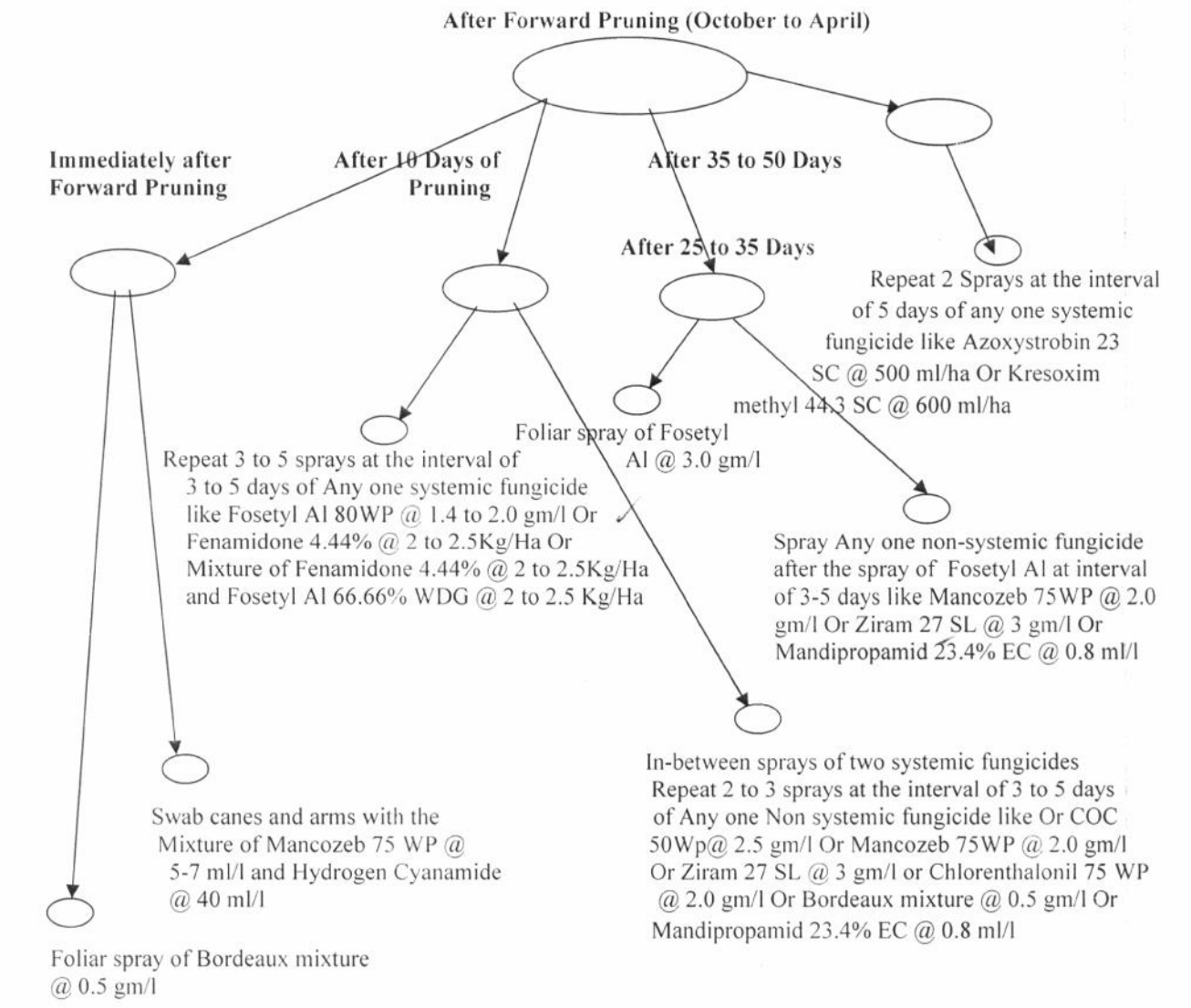



**Figure-1: Tree Structure of Representation of the Primary, Secondary and Tertiary Nodes.**

several downy mildew controlling steps are suggested and shown in following figure as below.

**6. Rule Base Development:**

The human mental process is internal and it is too complex. However most experts are capable of expressing their knowledge in the form of rules for problem solving.

For ex. IF the 'traffic light' is Green
THEN the action is 'GO'
IF the 'traffic light' is Red
THEN the action is 'STOP'

The term rule is AI is the most commonly used type of knowledge representation can be defined as an IF-THEN structure. A rule provides some description of how to solve a problem. They are relatively easy to create and understood. A rule can have multiple antecedents joined by keyword AND (conjunction), OR (disjunction or combination of both.

IF < antecedent>
AND <antecedent>
.....
AND <antecedent>
THEN <consequent>

The rule based system uses rules in the form of IF-THEN. The IF part needs to be satisfied by the facts for the goal *i.e.* to fire the THEN part. The knowledge base is a collection of knowledge in the domain area. Here domain is to study the pest named downy mildew and to suggest

various pest control treatments against it. In this paper, expert knowledge is acquired in the form of If-Then rules to suggest disease control treatment on the basis of input given by the user. End user enters information like type of pruning, number of days after pruning etc. The prototype model will accept this information and suggest different disease control treatments.

There are two inference techniques, forward chaning and backward chaining. Forward chaining is the data-driven reasoning. It starts with the available data and uses inference rules to extract more data (from an end user) until a goal is reached. An inference engine using forward chaining searches the inference rules until it finds one where the antecedent (IF clause) is known to be true. When such a rule is found, the engine can conclude, or infer, the consequent (THEN clause), resulting in the addition of new information to its data. [3] The reasoning starts from the known data and proceeds forward with that data. Each time only topmost rule is executed. Any rule can be executed only on. However, in forward chaining; many rules may be executed that have nothing to do with the established goals. Therefore, if our goal is to infer only one particular fact, the forward chaining inference technique would not be efficient.

Backward chaining is the goal-driven reasoning. In this technique, an expert system has the goa (*i.e.* a hypothetical solution) and the inference engine attempts to find the evidence to prove it. First the knowledge base is searched to find rules that might have the desired solution. Such rules must have the goals in their THEN (action) parts. If such rule is found and it's IF (condition) part matches data in the database, then the rule is fired and the goal is proved. Thus the inference engine puts aside the rule it is working with and sets up new goal or sub-goal, to prove the IF part of this rule. Then the knowledge base is searched again for rules that can prove the sub-goal. [18]

Rule based systems differ from standard procedural or object-oriented programs in that there is no clear order in which code executes. Instead, the knowledge of the expert is captured in a set of rules, each of which encodes a small piece of the expert's knowledge. Each rule has a left hand side and a right had side. The left hand contains information about certain facts and objects which must be true in order for the rule to potentially fire *i.e.* execute. Any rules whose left hand sides match in this manner at a given time are placed on an agenda. Then right hand \\192.168.3.1\e\Agriculture 2016\5150Agri\76-77

side is executed and family it is removed from the agenda. The agenda is then updated and new rule is picked to execute. This continues until there are no more rules on the agenda.

Following rules illustrates how the knowledge base has been represented in the form of 'IF-THEN' rules.

**7. Rule Base System for the Management of Downy Mildew**

For the data driven forward chaining expert system, it starts with the available data and uses inference rules to extract more data. Here the available data is stage of crop life cycle (*i.e.* forward or foundation pruning), age of crop (*i.e.* days after pruning) etc. and the final aim is: suggesting proper ratio of Pesticides and other preventing actions. Anyone can have 9 resulting combinations (If-then rules in Rule base), based on which he/she decide which Pesticide should be used against attacked pest at which stage. The system ultimately has to reach one of these goals after processing all the paramaters under each rule to complete the evaluation process and provide the final decision about the management of downy mildew. On which system suggest appropriate ratio of pesticides.

Following rules represents the expert's knowledge in the form of IF-THEN rules.

Rule #1

If Pruning is Foundation Pruning and Crop Period is Pre-pruning Period and Vine is Infested by Downy Mildew Then Collect all Downy Mildew Infected & Dried Bunches, Leaves & Canes and Burn them. Also Cut Surfaces Pastes with Bordeaux Paste.

Rule #2

If Pruning is Foundation Pruning and Crop Period is the Month of June and July and Vine is Infested by Downy Mildew Then Repeat 2 to 3 Sprays at the Interval of 10 to 15 days of Any One Non-Systemic Fungicide like Copper Hydroxide 77WP @ 2.0 GM/L

Or COC 50WP @ 3.0 GM/L

Or Ziram 27 SL @ 4 GM/L

Or Chlorenthalonil @ 2.0 GM/L

Or Bordeaux Mixture @ 0.5 GM/L

Rule #3

If Pruning is Foundation Pruning and Crop Period is the Month between August to October and Vine is Infested by Downy Mildew Then Repeat 3 to 4 Sprays at the Interval of 10 to 15 days of Any One Non-Systemic Fungicide like Copper Hydroxide 77WP @ 2.0 GM/L

Or COC 50WP @ 3.0 GM/L

Or Bordeaux Mixture @ 0.5 GM/L

Or HP Grape Mineral Oil @ 5-10 ML/L

Rule #4

If Pruning is Forward/Fruit Pruning and Crop Period is the Immediately after Fruit Pruning and Vine is Infested by Downy Mildew Then Foliar Spray of Bordeaux Mixture @ 0.5 GM/L Also, Swab Canes and Arms with the Mixture of Mancozeb 75WP @ 5-7 ML/L and Hydrogen Cyanamide @ 40 ML/L

Rule #5

If Pruning is Forward/Fruit Pruning and Crop Period is 10 days of Fruit Pruning and Vine is Infested by Downy Mildew Then Repeat 3 to 5 Sprays at the Interval of 3 to 5 days of Any One Systemic Fungicide like Fosetyl AL 80WP @ 1.4 to 2.0 GM/L Or Fenamidone 4.44%@2 to 2.5Kg/HaOr Mixture of Fenamidone 4.44% @ 2 to 2.5 Kg/Ha and Fosetyl AL 66.66% WDG @ 2 to 2.5 Kg/Ha

Rule #6

If Pruning is Forward/Fruit Pruning and Crop Period is 10 days fo Fruit Pruning and Vine is Infested by Downy Mildew And Spray of Systemic Fungicide has taken Then In-between Sprays of Two Systemic Fugicides Repeat 2 to 3 Sprays at the Interval of 3 to 5 days of Any One Non-Systemic Fungicide like COC 50WP @ 2.5 GM/L

Or Mancozeb 75WP @ 2.0 GM/L

Or Ziram 27 SL @ 3 GM/L

Or Chlorenthalonil 75WP @ 2.0 GM/L

Or Bordeaux Mixture @ 0.5 GM/L

Rule #7

If Pruning is Forward/Fruit Pruning and Crop Period is 25 to 35 days of Fruit Pruning and Vine is Infested by Downy Mildew Then Foliar Spray of Fosetyl AL @ 3.0 GM/L

Rule #8

If Pruning is for Ward/Fruit Pruning And Crop period is 25 to 35 days of fruit pruning And vine is infested by downy mildew And foliar spray of fosetyl Al has taken Then Spray any one non-systemic fungicide at the interval of 3-5 days like mancozeb 75WP @ 2.0gm/l or ziram 27 SL @ 3 gm/l or mandipropamid 23.4% EC @ 0.8 ml/l

Rule #9

If Pruning is for ward/fruit pruning And crop period is 35 to 50 days of fruit pruning And vine is infested by downy Mildew Then Repeat 2 Sprays at the interval of 5 days of any one Systemic Fungicide like Azoxystyrobin 23 SC @ 500 ML/HA

Or Kersoxim Methyl 44.3 SC @ 600 ML/HA

Or Fenamidone 4.44% @ 2.0 to 2.5 KG/HA

Or Fosetyl Al 80WP @ 1.4 to 2.0 GM

**Sample Rule**

Consider following rule from above rule base.

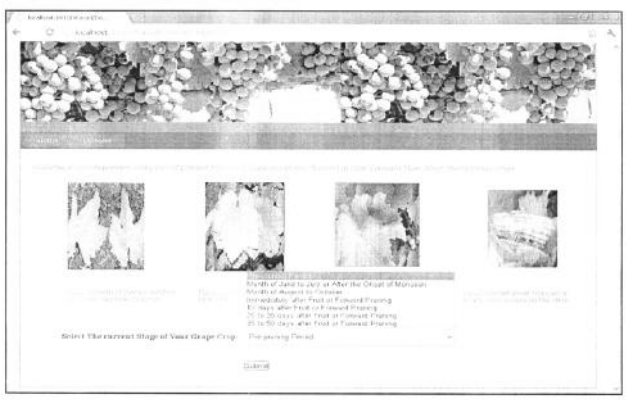
Rule #8

If Pruning is forward/Fruit Pruning And Crop period is 25 to 35 days of fruit pruning And vine is infested by downy mildew And foliar spray of fosetyl Al has taken Then Spray any one non-systemic fungicide at the interval of 3-5 days like mancozeb 75WP @ 2.0gm/l or ziram 27 SL @ 3 gm/l or mandipropamid 23.4% EC @ 0.8 ml/l

Here forward chaining method is used to reach to the result. The available data is stage of crop life cycle (i.e. forward pruning), age of crop (i.e. 25-35 days after pruning), and application of systemic fungicide like Fosetyl Al has taken before 3-5 days. Hence Rule # 8 is selected, because its antecedent matches the available data. Now the consequent is added to data. Nothing more can be inferred from this information, but we have now accomplished our goal of suggesting pesticide treatment for "Downy mildew" disease. Thus forward chaining is implemented here. In this way remaining rules are prepared.

**8. Implementation**

Many expert systems are built with products called expert system shells. The shell is software which contains the user interface, knowledge base and inference engine. The knowledge engineer uses the shell to build a system for a particular problem domain. For the proposed study,



author developed a prototype using ASP .net and Ms-Access.

**9. Conclusion**

This Knowledge Based System is helpful to grape growers, agricultural professional, research scholars and academicians to take decision related to the management of Downy mildew disease in grape crop. *i.e.* the system suggests a preventive action with use of pesticides to control disease which attack on grapes. As a pesticide treatment, this system suggests different pesticide to control single disease. So here grape growers get choice of selecting pesticide by considering different companies and their prices. This expert system is checked by grape growers as well as agricultural expert and initial feedback collected which is positive. With further work, the scope of the expert system can be widened. Also the author is quite interested to develop an expert system in grape crop management, which will be useful as a virtual expert for grape growers.

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# Agro-Economic Research

## (Impact Study of the National Horticulture Mission (NHM) Scheme in Kerala*

K. JOTHI SIVAGNANAM

**Introduction**

Agriculture continues to be crucial for the growth of the Indian economy. This was proved in 2009 when the rural economy supported the industry and service sectors in India thereby insulating them from the global economic downturn. It acquires greater importance in our policy of inclusive growth. Though its contribution to GDP has come down to 17 per cent, it still employs about 56 per cent of the population. With less than 3 per cent of world's arable area and less than 4 per cent water available for irrigation, it produces enough food for 17 per cent of the world's population.

However, in the year 2006, the country was heading towards a possible food shortage. The year 2007 witnessed a global food crisis exacerbated by a financial crisis. There were times when there was no food available in the global market even if one had enough money. This was a wake-up call for the Indian policymakers. They decided to increase government's investment in agriculture substantially from the previous levels.

Agriculture and allied activities have been given adequate thrust and horticulture is one of the key thrust areas as it makes a substantial contribution to the share of agriculture in GDP. Horticulture in India includes fruits, vegetables, spices, medicinal and aromatic plants, flowers, mushroom and a variety of plantation crops such as coconut, areca nut, cashew and cocoa which have been contributing significantly to the share of agriculture in GDP.

In order to have a planned development of horticultural crops, the National Horticultural Mission (NHM) was launched on July 8, 2004. The scheme has been implemented in 18 States with effect from 2005-06. Since the programme entered in the fourth year it was proposed to carry out crop based impact evaluation study in different States in order to analyse the impact of the flagship programme *vis-a-vis* objectives of the NHM scheme especially for the major focused crops in terms of area expansion, increase in production and productivity.

The objectives of the National Horticulture Mission are as follows:

Doubling horticultural production; that is to achieve a production of 300 million tonnes by 2011-12.

Establishing convergence and synergy among various on-going and planned programmes in the field of horticultural development.

Promoting development and dissemination of technologies by blending traditional wisdom and frontier knowledge.

The National Horticulture Mission (NHM) focuses on horticultural research, development, post-harvest management, processing and marketing.

The programme under horticultural development aims at increasing the production and productivity of all horticultural crops through adoption of improved technologies in crop production. Under this programme, special emphasis is given for regionally differentiated crops, which are most suitable for the state/region. This programme is implemented by the horticultural departments of the State governments, which also include cooperative organizations, self-help groups, NGOs commodity organizations for achieving the targeted production and productivity of identified crops. Risk management in the form of crop insurance has also been included.

Post-harvest management would include creating suitable infrastructure for efficient post-harvest management and marketing of horticultural produce (handling, transport, storage and marketing) besides taking up market promotional activities such as dissemination of market information to the farmers, processors, traders, and consumers. Special thrust has been provided to promote export of horticultural produce through establishment of AEZs, for which there is a potential global market.

The Mission also focuses on promoting processing of horticultural produce and value addition by providing incentives for setting up horticultural processing industries and food parks in potential areas and to encourage linkages between the market for the horticultural produce and processing industry. This activity is supported by the Ministry of Food Processing Industry (MFPI) and implemented through agencies under the administrative control of MFPI and other organizations and the concerned departments of the State government. These programmes would be credit-linked through NABARD/IDBI/State Financial Corporations. The estimated requirements of

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funds for the Mission during the X Plan was Rs. 65,000 million. Research was given Rs 4,700 million, horticultural development Rs. 3,200 million, post-harvest management and marketing Rs. 18,600 million, processing and value addition Rs. 8,700 million and the National Horticulture Mission headquarters Rs. 1,000 million. The funds were allocated for the years 2004-07 of the Tenth Five Year Plan.

**Guiding Principles under NHM:** The Mission has adopted an end-to-end approach covering production, post-harvest managements, processing and marketing to:

Assure appropriate returns to growers/producers;

Promote Research and Development (R and D) of technologies for production, post-harvest management and processing in potential belts/ clusters;

Enhance acreage, coverage and productivity in potential belts/clusters.

Adopt a coordinated approach and promote partnership, convergence and synergy among R&D, processing and marketing agencies in public as well as private sectors, at all levels;

Promote, where appropriate, National Dairy Development Board model of cooperatives to ensure support and adequate returns to farmers; and

Facilitate capacity-building and human resource development

The State and sub-State level structures have been evolved, keeping in view the need for getting adequate returns for the produce of the farmers and eliminating middlemen to the extent possible.

**Kerala-An Overview**

Kerala is situated in the south west region of India and it covers a mere 1.3 per cent of the country's total land area, lying between the Lakshadweep sea and the forested Western Ghats that define its border with Tamil Nadu in the east and south, Karnataka to the north and north east and Arabian sea to the west. The land area of Kerala is about 38,863 sq km, with a total population of 31,838,619. It is about 3 per cent of the country's population. Kerela is the twelfth largest state by population and is divided into 14 districts.

Nearly half of the state's population has agriculture as its primary source of livelihood. Major foodgrains produced in the state are rice and tapioca apart from pulse crops that are produced in smaller pockets of the state.

Kerala has the natural endowments conducive for a wide variety of horticultural crops. The opportunity for raising a variety of fruits and vegetables by taking advantage of the varying climate and other favourable features remain largely untapped. Kerala has a rich diversity of horticulture crops.

Horticulture sector has been a promising sector in the state with good production of an array of cash crops. Kerala is a major producer of cash crops such as coconut, rubber, pepper, cardamom, ginger, banana, cocoa, cashew, arecanut, coffee and tea.

Kerala is a land of spices considering the large variety of spices grown in the state. India is the single largest source of spices in the world. Kerala, accounts for 96 per cent of the total production in the country.

**Major Highlights of the State**

Ranked 2nd in India in investment climate index (World Bank study 2009)

Operationals costs and rentals much lower in comparison with other Indian states

Power and water tariff among the lowest in the country

Human development Index at par with the developed countries

Three international airports (Thiruvananthapuram, Kochi and Kozhikode) and an international seaport at Kochi

Highest density of science and technology personnel in India. Lowest employee attrition rate in the country-less than 5 per cent

Man-days lost in labour strike-one of the lowest in India

Major Industries: Agriculture, IT Products, Software, Tourism, Textile, Marine, Food Processing, Bio Technology, Textiles, Herbal Products, Petrochemicals and Spices and Spice Extracts

**State Horticulture Mission-Kerala-Introduction**

The State Horticulture Mission (SHM) was launched in October 2005 for implementation of the National Horticulture Mission programme introduced by Government of India (GOI) during 2005-06. The schemes of the SHM envisaged overall development of the horticulture sector including areas of production, post-harvest management, processing and marketing of horticultural produce. Initially, the programme was implemented in 10 districts but it was subsequently extended to four more districts (Kollam, Kottayam, Pathanamthitta and Thiruvananthapuram).

**Organisational Set up**

The SHM, registered under the Travancore-Cochin Literary, Scientific and Charitable Societies Registeration

Act 1955, started functioning from October 2005. The control, administration and management of the affairs of the SHM are vested in a Governing Body with the Minister for Agriculture as the Chairman and the Agriculture Production Commissioner as the Vice Chairman. A State level Executive Committee (SLEC), constituted under the Chairmanship of the Agriculture Production Commissioner is responsible for project formulation and monitoring. The SHM is headed by a Director while the District Missions are headed by Deputy Directors of Agriculture (Horticulture). The programmes are mainly implemented by the State Agriculture Department through Krishi Bhavans. The Kerala Agriculture University (KAU), the Kerala State Horticultural Product Development Corporation Limited (Horticorp), the Vegetable and Fruit Promotion Council, Keralam (VFPCK), are also involved in the implementation of the SHM schemes.

**Highlights**

The State Horticulture Mission was launched in 2005-06 to give new momentum to the development of horticulture, generate employment and enhance farm income. Out of the various interventions under the State Horticulture Mission, organic cultivation practised in Wayanad district showed significant improvement. Rural marketing facilities and infrastructure for seed production established by the Vegetable and Fruit Promotion Council, Kerala enabled farmers to sell their products directly to the customers and achieve substantial progress in production of vegetable seeds.

**Primacy of Horticulture Crops in Kerala**

Horticulture has always been the thrust area of Kerala's agricultural scenario. Kerala's predominance of commercial horticulture is of national importance in terms of valuable foreign exchange earned through exports and foreign exchange saved through import substitution. The state has virtual monopoly in pepper production (81 percent), rubber (92 per cent) cardamom (74 per cent), coconut (44 per cent) besides coffee (22 per cent), cashew (15 per cent) and tea (8 per cent). Kerala contributing 88 per cent of export earmings from pepper, 72 percent from cardamom, 54 per cent from cashew kernels, 56 per cent from ginger and 21 per from turmeric. Out of a total cropped area of about 39 lakh hectares, as high as 89.59 per cent of the area has been occupied by horticultural crops. The important horticultural crops of the state include pepper, coconut, cashew, ginger, turmeric, arecanut, cocoa, cardamom, tapioca, sweet potato and other tubers, fruits covering banana and plantains, mango, jack, pineapple and papaya besides vegetables such as cowpea, pumpkin, snake-gourd, bitter-gourd, cucumber, bhendi, amaranthus, brinjal, tomato, chillies, floriculture etc.

**Production and Productivity of Horticulture Crops**

Productivity of horticulture crops in Kerala is trailing behind the National averages except in the case of pepper and cashew. The scope for improvement lies more on productivity improvements than area expansion in a land-hungry State like Kerala. Accordingly, the Department of acriculture, Kerala in its ongoing programmes has given priority for productivity enhancement. By NHM support, the growth rate in horticulture moved up from 6 percent to 10 percent at the terminal year of the Eleventh Five year Plan (2011-2012). Accordingly the horticultural crop prodcution had been projected to go up from 60.47 lakhs tonnes in 2003 to 109.45 MT in 2012, almost accomplishing the goal of doubling of production by 2012.

When compared to exports of horticultural crops at the All India level, good potential exists for Kerala in the years ahead, as exports of these products were much below one per cent of global exports.

**Main Objectives of the Study**

The study aims to understand the impact of the NHM scheme in Kerala.

The main objectives of the study are:

To assess the impact in terms of increase in area, production and productivity of identified horticultural crop covered under NHM, keeping 2004-4005 as the base year in the State in general and for the identified crops/districts in particular.

To assess the extent to which the scheme has helped in creating employment opportunities and enhancement of income of the farmers and

To suggest measures for improving the implementation strategy of NHM in Kerala.

**Data and Methodology**

The study area under evaluation consists of two districts of the State of Kerala, namely, Wayanad and Ernakulam which are located in north-eastern and central parts of the State. Totally 4 villages in the 2 districts were covered for the study. Main thrust was given to Pineapple for Ernakulam district, and pepper for Wayanad district.

The sources of data were both primary and secondary. As regards the primary data, a survey of 98 farmers from the two selected districts, by using the household schedule for studying the impact of the National Horticulture Mission in Kerala, was made and the data so collected were analyzed and interpreted.

The secondary sources were obtained only through the library and documentary sources apart from the online sources. It is regretful to report that no support was received from the State Horticulture Mission, Government of Kerala with regard to the secondary data. The secondary data provided by the State Horticulture Mission,

Government of Kerala were the data that are completely irrelevant to the required inputs of current study. Had there been proper responses to the numerous requests from this office to the State Horticulture Mission, Kerala, State's relevant departments/agencies, for providing relevant data a precise analysis could have been ensured. However, the report has been prepared with best efforts having been put for analysis with the available data.

**Major Findings of the Study**

**Area, Production and Productivity of Horticultural Crops in Kerala**

The area of horticultural crops in Kerala was discussed in detail. It must be noted at the outset that the analysis has been severely constrained by extremely poor and scattered availability of data on horticultural production in the state. The total geographical area of the State accounted for 3886287 ha. Of this, cultivable area which was 2132483 ha. during TE 2004-05 declined to 2088955 ha. during TE 2008-09. Though there was a general decline in the total cultivable area during 2008-09, the area under horticultural crops on the other hand registered a higher decreasing trend from 917527 ha during TE 2004-05 to 723484 ha. during TE 2008-2009.

The study reveals that NHM made a favourable impact on the growth of horticultural crops in Kerala.

A considerable increase could be noticed in area of selected horticultural crops, pepper and pineapple from the period TE 1980-81 to TE 2008-2009 in Kerala. All the two selected crops pepper and pineapple registered a substantial growth in terms of area during the period under study.

**Household Characteristics, Cropping Pattern and Production Structure**

Characteristics of operational holdings, nature of tenancy, sources of irrigation, sources and purpose of credit, cropping pattern, production cost and returns were analysed. The total number of sample respondents for the study was 98 comprising 13 marginal, 30 small, 53 medium and 2 large farmers. The aversge household size was 2.77 persons. The average number of earners was found to be 1.38. As regards the sex of sample respondents, it was 51.8 per cent male and 48.2 per cent female. About 66 per cent of the members of the sample household belonged to the productive age group of 16-60 years. As regards education, about 83 per cent of the sample respondents had education ranging from primary to graduation level. About 17 per cent of the sample respondents were illiterates. As far as community of the sample respondents was concerned, BC was found to be the dominant community claiming more than 50 per cent whereas SC community constituted just 3 per cent only. Farming was found to be the main occupation for about 86 per cent of the working members of the sample households.

As regards operational holdings, average net opertated net operated area and net sown area of the sample households accounted for 11.78 acres and again 11.78 acres respectively. The average gross cropped area worked out to 16.66 acres and cropping intensity was 141 per cent. The leased-in area was found to be 3.75 acres on an average and fixed rent in cash was the nature of tenancy prevailing among the sample households.

Tank, Canal and well were the sources of irrigation for the sample households and among them wells were found to the major source, irrigating 65.09 per cent of the land of the sample households. A little more than one tenth of the net operated area depended upon tanks and rain.

The average amount of loan borrowed from different sources accounted for Rs. 71612 per household. About 97 per cent of the loan taken from all sources was for agricultural purposes. With regard to asset holding, it accounted for Rs. 166054 per household and Rs. 14096 per acre of NSA on an average.

The sample respondents raised paddy, arecanut, cardamom, coconut and ginger during kharif season and paddy, banana, tapico and cashew during rabi season. As regards horticultural crops, pepper, pineapple, other fruits, vegetables, plantations crops, spices & condiments and medicinal crops were cultivated by the sample respondents. The total area under kharif crop accounted for 3.81 acres per hosehold whereas it was 3.89 acres per household for rabi crop. In case of horticultural crops, the total area worked out to 8.96 acres per household. The area under pepper on an average accounted for 2.03 acres per household. The average area under pineapple worked out to 1.81 acre per household. The study reveals that a little more than 81 per cent of the area per household was irrigaged during kharif season and 77.78 per cent of the area per household was irrigated during the rabi season. In the case of horticultural crops, about 93 per cent of the area was irrigated per household.

The total value of output on an average was Rs. 764177 per household. The total cost of production worked out to Rs. 290958 per household while the realized net returns on an average of Rs. 473219 per household. The total income including non-farm income earned by the sample respondents was of Rs. 526711 per household. The total value of output per acre of net sown area and per acre of gross corpped area worked out to Rs. 64871 and Rs. 45869 respectively. The total cost of production calculated in terms of per acre of net sown area and per acre of gross cropped area accounted for Rs. 24699 and Rs. 17464 respectively. In the case of net returns from agriculture, the average per acre net returns of net sown area and per acre net returns of gross cropped area were Rs. 40171 and Rs. 28405 respectively.

Kerala is gradually turning to organically grown pepper, turmeric, coffee, tea, peneapple and other horticultural produce to help marginal farmers earn more money through the highly priced chemical fertilizer-free produce. Initiated in 2005-06 with Rs. 750 million funding from National Horticulture Mission, the Kerala State Horticulture Mission used around 75 per cent funds in developing and rejuvenating horticulture and cash crops in some areas like Wayanad. And such schemes are being implemented through the horticulture mission that is receiving funds from both the central and state governments.

**Production Structure and Resource Use under Horticulture Crops**

Cost of cultivation, output and net returns of selected crops pepper and pineapple and use of human labour in the cultivation of these crops were studied.

The average area of pepper planted by the sample farmers was three acress per household. The total cost of cultivation of pepper including variable cost and fixed cost on an average was Rs. 60903 per acre, whereas the average revenue earned by a farmer was Rs. 165000 per acre. The average output produced by a sample farmers was calculated to be 13.75 quintals of pepper per acre. The average area of pineapple cultivated by the sample farmers was 5.35 acres per household.

The total cost of cultivation of pineapple was put at Rs. 21015 per acre. Against this cost the total net returns generated by the sample farmers on an average were Rs. 64233 per acre.

A comparison of net returns obtained from horticultural crops and non-horticultural crops was made in this chapter. The study reveals that the average net returns generated by a sample household from kharif crop was to the tune of Rs. 20980 per acre whereas the average net returns obtained from rabi crop were put at Rs. 39586 per acre. But at the same time, the average net returns generated from horticultural crops were much higher compared to kharif and rabi crops. The average net returns from horticultural crops stood at Rs. 7768 per acre. Of the two selected horticultural crops the average net returns obtained from pepper were found to be high at Rs. 13995 per acre followed by pineapple (Rs. 11975).

Human labourer is employed in different activities of agriculture. The study shows that human labour used for all the kharif crops by the sample households on an average worked out to 23.65 man-days per acre and it was little higher at 30.31 man-days per acre in case of rabi crop. When compared to kharif and rabi crops, the human labour used in horticultural cultivation was found to be normal which worked out to 22-25 days on an average for all horticultural crops. The study reveals that human labour required for all recurring activities in horticulture on an average worked out to 18.37 man days per acre whereas for fixed activities the figure was found to be 13.66 man-days per acre.

As regards the marketing channels, the selected horticultural crops pepper and pineapple produced by the sample households were sold through wholesale markets and intermediaries at farm gate. In the case of pepper, only 12 per cent of the produce was marketed through intermediaries at farm gate. Similarly, only 11 per cent of the pineapple produced was also sold through the same channel. That shows in general 90 percent of that pepper and pineapple produce were sold directly by the farmer households in the sample.

**Impact of NHM on the Expansion of Horticultural Crops**

While analyzing the impact of NHM on area. the study found that, there was no change in the area under pepper crop cultivated by the sample respondents and it remained the same during the period from 2004-2005 to 2009-10. The average area under pepper crop per household worked out to 0.61 acre.

In the case of pineapple crop, area expansion could be witnessed over the period. The average area under pineapple crop was 1.21 acres during 2004-05 which marginally rose to 2.69 acres during 2008-09 and further increased to 2.92 acres during 2009-10. Impact of NHM on yield was visible as the average yield of pineapple obtained by the sample respondents marginally increased from 31.6 quintals per acre in 2004-05 to 33.4 quintals per acre in 2008-09 and further rose to 32.3 quintals per acre during 2009-10. In the case of pepper, the yield decreased from 1.26 quintals per acre in 2004-05 to 0.90 quintals per acre in 2008-09 and increased marginally to 1.00 quintals during 2009-10.

The average area for which certified inputs were procured under rejuvenation and protection through NHM resource provision accounted for 1.81 acres and 1.80 acres per household respectively in case of pepper and pineapple crops during 2008-09. It is found from the study that rejuvenation support was given to nearly 10 per cent and 9 per cent of the sample respondents growing pepper and pineapple respectively under NHM. Area under pepper and pineapple expanded due to rejuvenation under NHM. The average area expanded under pepper and pineapple accounted for 0.41 acre and 0.36 acre respectively.

Majority of the sample respondents availed the promotional activities such as availability of good quality planting materials like nursery, rejuvenation with improved cultivators, integrated nutrient management or integrated pest management and so on.

As regards subsidy, it was provided for planting materials, fertilizers, pesticides, other inputs drip/sprinkler irrigation, in respect of all the selected crops pepper and

pineapple. In the case of pepper, all the 49 sample respondents received subsidy for fertilizer, pesticies, other inputs and vermi compost, while all the 49 sample households growing pieapple availed subsidy for planting material, fertilizer, pesticides, other inputs and vermi compost.

The average amount of subsidy under NHM for pepper crop ranges from Rs. 762 to Rs. 11,127 per household. In the case of pineapple, the average subsidy amount provided for fertilizer, pesticide, other inputs and vermi compost, was Rs. 1051 per household respectively. Training was imparted to the farmers under NHM. As regards frequency of training, it was 1.87 times per household per yer through all sources. The average number of days of training provided through all sources was 2.75 per household per year.

As regards perception of sample households about NHM, over 74 per cent of them reported that the scheme helped them by providing seedlings/nursery. According to 60 per cent of the sample respondents, subsidy provision was a great benefit, in the policy towards NHM. About 83 per cent of the sample respondents expressed the that NHM increased employment opportunities for the farmers and agricultural labourers by increasing area under horticultural crops.

Out of various suggestions put forth by the sample households, providing single phase electricity connection so as to enable them to improve their horticultural operations was considered important by 68 per cent of the sample respondents. Nearly 72 per cent of the sample respondents suggested that there was need for providing subsidy for fencing their horticultural crops.

**Regional Agricultural Research Station, Ambalavayal**

A Regional Agricultural Research Station functions at Ambalavayal as a part of Kerala Agricultural University. The station mainly concentrates on the research on spices, tropical and subtropical fruits, vegetables, especially cool season vegetables and hill paddy. A Krishi Vigan Kendra, with the objective of dissemination of latest technologies to the farmers, is also attached to this station. Recently, a plant Biotechnology Centre started functioning here for the large-scale production of tissue culture plants of high value crops.

**Spices Board**

The Spices Board has a filed office at Kalpetta. The main functions of the Spices Board are the formulation and implementation of better production and quality improvement programs, systematic research and development, educating and training growers, processors, packers and exporters, selective registration and licensing. It also acts as a data bank and communication channel for importers and exporters of Indian spices.

The Board helps exporters in establishing contact with overseas buyers of spices. The Board also forwards trade enquiries received from abroad to competent registered Indian exporters and helps the International buyer procure good quality spices from India.

**Vazhakulam Agro and Fruit Processing Company**

Under the Kerala Horticulture Development Programme, Nadukkara Agro-Processing Company Limited (NAPCL), a modern fruit processing factory, for the commercial processing of pineapple, mango and other fruits was established in the heart of Kerala's Pineapple growing area Naddukkara. Avoly panchayat near Muvattupuzha. NAPCL was established as a public limited company with 582 farmers holding 70 per cent share and the Government of Kerala 30% share. NAPCL has ISO 9002/HACCP certifications and its own brand of pineapple juice called "JIVE" and can process 70 tonnes of pineapple per day. The company initially produced 200 ml Jive tetra-pack, 256 kg dump bag juice concentrate, besides ginger candy. Today, company markets seven different types of natural cool drinks under Jive brand without using any preservatives. They have become very popular as, *the drinks of nature'.*

NAPCL organizes training and seminars and farmers for the popularisation of pineapple and promotes MD2 pineapple variety for cultivation to meet the challenges of global competition in the WTO regime. The company has also taken intiative for getting GI indicating registered for Vazhakulam Pineapple. NAPCL has recently commissioned an "*integrated pack home for export of fresh pineapple"* with facility for pre-cooling, packing, branding and certificate labelling having a capacity of 700 t/day at a cost of Rs. 3.7 crores fully funded by APEDA. It has recorded a growth rate of 500% during the last 5 years.

NAPCL was taken over by state government and functions in the name of Nadukkara Agro Processing Factory (NAPF) for some time. It is being renamed as Vazhakulam Agro and Fruit Processing Company with a proposed share holding of 51% by Government of Kerala, 30% by farmers and 19% by VFPCK, out of 10,000 shares in total.

**Pineapple Farmers's Association (PFA)**

Farmers face many problems in the cultivation and marketing of pineapple. So a group of farmers decided to form an association of Pineapple farmers in 1990 and registerd the Pineapple Farmer's Association, Vazhakulam under the Charitable Societies Act. The main objectives of PFA are to unite and strengthen the pineapple farmers, make awareness about farming, marketing and other related subjects, promote marketing and processing facilities and help farmers to avail financial and technical assistance from government and non-government organizations and banks. The service area of PFA is Kerala

State. The PFA is distributing good quality planting materials, fertilizers. pesticides, herbicides, growth regulators etc. at subsidised rates to the members. Every year the PFA conducts a three day Agriculture Fair at Vezhakulam. This is a festival of Pineapple farmers. The association presents the 'Pineapple Sree' Award to the best Pineapple Farmer. Agricultural Unviersity and the Department of Agriculture. PFA strived very much for getting GI indication registered for boosting the export of Vazhakulam pineapple.

**Pineapple Research Station (PRS)**

The Pineapple Research Station at Vazhakulam was establihsed on 2nd January 1995 to give research and development support to pineapple farmers. Sicne the, this research centre of the Kerala Agricultural University has been steadily growing and serving as a subvention to the pineapple growers of the state and the country as well. The research centre strives to become the ultimate authority and provider of excellent quality technology, products and services in the pineapple sector through concerted research and development efforts sustained by best human resource and infrastructure development.

The centre had a humble beginning on 2.1.1995 as "Pineapple Research Station & Pest and disease Surveillance Unit" under Kerala Horticulture Development Programme (KHDP). For the construction of the office-cum-laboratory building of the station, 15 cents of land was transferred from the Revenue Department to Kerala Agricultural University on 24.6.1996. It was delinked from KHDP and became a constituent research centre of Kerala Agricultural University under central zone on 1.7.1997. The present building was occupied on 27.6.1998. The centre is located close to the pineapple market at Vazhakulam.

The mandate of the research centre is to give research and development support to the pineapple growers, provide quality technology, products and services to the pineapple sector and undertake basic and applied research in pineapple and other fruit crops of Kerala. The station has taken up research in pineapple on various aspects like intercropping in rubber and coconut, plant spacing and density,organic and chemical fertilizer requirement besides experiments on development of new varieties. Based on continuous surveillance and laboratory studies, the station has identified the presence of PMWA virus in pineapple in Vazhakulam area. Based on all the findings this station has formulated the Package of Practices Recommendations for the popular variety Mauritius and included in the DOP and all the technology developed are being transferred to the pineapple growers extensively. Vazhakulam pineapple has been registered in the Geographical Indication Registry to boost the export of pineapple.

The centre has established good laboratory facilities. The Plant Tissue culture, biochemistry and pathology labs are equipped with Gel documentation, ELISA Reader and washer, PCR, Colourimeter, UV-Transilluminator, Flame photometer, Centrifuge, Microscopes, Electrophoresis, Shakers, ovens, Precision Weighing balances, Deep freezer, BOD, Laminar Air Flow, still, etc. It has a leased farm of two hectares at NAPCL. The centre undertakes basic and applied research and development activities in pineapple and other fruit crops of Kerala. The research and development projects are mainly in Participatory Technology Development (PTD) mode and funded by various agencies as KAU, State and central governments, ICAR, SHM, NHM, etc.

The centre has developed scientific technology for the commercial cultivation of Kew and Mauritius varieties of pineapple, including pure cropping, intercropping in rubber and coconut plantations and in reclaimed paddy lands. Technology is developed for organic production. Tissue culture protocols for various varieties of pineapple are available. Performance evaluation of MD2 pineapple is in progress at the centre. Participatory technology process and product development in association with sister institutions, Nadukkara Agro Processing Co. Ltd. and Pineapple Farmers' Association for the stakeholders is a steady and continuing process at the centre. Technology transfer is effectively carried out through personal discussions, field visits, phones emails, website, posts, radio, TVs, news papers, periodicals, publications, pineapple fests, seminars. Trainings, etc. At present pineapple cultivation in Kerala is generating employment of about 60 lakh mandays among farmers, agricultural workers, people involved in loading, unloading, transporting, traders, retailers etc. By doubling the area under pineapple cultivation, and additional 50 lakh man-days per year can be created.

Earnest efforts are also being made to acquire free government land nearby as a permanent farm for raising various fruit plants, conserving germplasm and conducting field research, besides establishing adequate infrastructure for further development and diversification, renaming the station as Tropical Fruit Crops Research Station (TFCRS). It is also proposed to establish a fruit processing laboratory with FPO registration at the centre for the efficient conversion of leftover fruits to value added products like squash, jam, syrup, etc.

Concerted research and development efforts coupled with excellent human resource and infrastructure development will ensure the way to ultimate success and supremacy in the sector.

**Policy Suggestions**

**The State is Ideally Suited for Exports given the Strategic Location of Airports and Sea Ports.**

Trade and marketing arrangements in place, both spatially and economically, are able to support horticultural crop exports, particularly pineapple. Both pepper and pineapple are a much preferred and demanded products not only locally and regionally but also nationally and internationally. There are indeed varieties of pineapple which are all the time favourites of people in India and abroad that the demand for them is never low. In the recent years, the export of pineapple has been on an increase which should be nurtured and promoted to reach greater heights. It would be appropriate to create policy support facilitating the export of pineapple, in the international arena. Promotional efforts would be in order for making horticultural crops in constant demand and use.

**Presence of Leading Institutions like Kerala Pineapple Mission, Spice Board, Agricultural University and other Research Institutions.**

Institutions such as the Kerala Pineapple Mission, Spice Board and other research centres are an advantage to the State as they will be involved in furthering the cause of horticulture and also improve the status of the farmers in the State.

**State Government Policies Facilitate Growth of the Sector**

Continued support of the Government in facilitating the growth of the horticultural sector must be appreciated. New areas of development must be encouraged so as to improve the GDP and the per capita agricultural income.

**Awareness on Hi-tech Horticulture/Quality Consciousness among Growers**

Despite enormous growth in hi-tech in the country and in the State, the lack of awareness of hi-tech horticulture has been an impediment in the growth and development of horticulture. Much needs to be done by way of bringing awareness among the farmers, especially small and marginal farmers. Also important are the efforts at improving the quality of products and spreading quality consciousness among the growers. Newer strategies involving non-governmental organizations may be sought to be developed for this purpose.

**The Presence of Small Land Holdings Hampers Adoption of Best Practices**

This is a greater problem and is difficult to resolve unless consolidation of land holdings takes place in tune with the needs of the sector. Unless consolidation occurs spontaneously in response to the needs of the horticultural sector, adoption of best practices may continue to be hampered.

**There is Low Focus on Post-harvest Management and Facilities like Cold Storage, Pre-cooling and Waxing Centres and Processing Units.**

This is true as of now, but efforts are underway to improve the situation. But what has been done so far is not adequate for the purpose. Further, efforts on providing facilities like cold storage, pre-cooling and waxing centres at the local level at low, affordable prices and also processing units may be encouraged. Local farmers may be encouraged to set up their own facilities, either individually or in a cooperative spirit with government assistance for doing so in response to the local needs.

**Non-availability of Work Force for Agriculture during Season**

This is indeed an insurmountable problem for a variety of reasons. The most important of them are: (a) the increasing unavailability of local agricultural labour, which is largely being catered to by Mahatma Gandhi National Rural Employment Guarantee Scheme and (b) the increasing bargaining power of the local and specialized labour. The MNREGS has now attracted most of the local agricultural labourers who prefer to work for the program related activities. The labour in the last few years has become increasingly powerful because of the increasing demand for them on the one hand and the bargaining power on the other. This may escalate into a crisis in the future, unless some drastic attempts are made by the government and labour associations to resolve the crisis.

**Strategies for Further Improvement of Horticulture**

As for Kerala is concerned, the important things to do to improve the prospects and consequences of the National Horticulture Mission are to:

Organize farmers' groups, cooperatives on the national/state models, self-help groups, producer companies and other associations;

Provide for collection centres and transportation to local markets; and

Provide for a network of cold chain storage van all over the country in cooperative/private/public sector.

**Development of a New Variety in Pepper—Hope for Farmers due to Improved Traits**

Researchers at the Spice Board, Kerala have developed and released sixteen improved varieties of black pepper for cultivation Panniyur-1 and Panniyur-3 are hybrids evolved at the Pepper Research Station, Panniyur (Kerala) and have Uthirankotta and Cheriyakaniakadan as their female and male parents respectively.

**Need for a sustainable Development Strategy**

In NHM, it has to be seen as to how much of its benefits are percolating to farmers across geographical regions and

income levels. It is cautioned that any unplanned major shift towards horticulture should not happen at the cost of wheat and rice cultivation as this would lead to a shortage of food grains. Hence, very careful sustainable development strategies are to be planned so that food shortage will not occur due to the development of horticulture.

**Need for Strengthening Supply Chain Management**

The enormous losses of fruits produced in the country are mainly because of the lack of proper infrastructure for storage and transportation under controlled conditions. Of late, Supply Chain Management (SCM) is gaining importance due to globalization.

Several factors are driving emphasis on supply chain management and the following three are identified as most important, 1. The cost and availability of information resources between entities in the supply chain allow easy linkages that eliminate time delays in the network. 2. The level of competition in both domestic and international markets requires organizations to be agile and flexible. 3. Customer expectations and requirements are becoming much more stringent so as to satisfy the consumers. The supply chain management system should operate with the two main objectives namely timeliness and quality.

**Cold Chain Development**

The focus needs to be on areas of reducing post-harvest losses, building supply chains, and developing linkages of farming to the processing industries. India should augment cold chain facilities and container handing facilities at major ports as also at air cargo complexes for targeting global markets.

**Export from the State and Suggestion for Increased Export**

(a) Information of production estimates is required at a district level and at quarterly level.

(b) Price discovery mechanism has to be improved

This should be encouraged at National and State level with adequate support and incentives.

**Lack of Adequate Post-harvest Infrastructure**

There is a clear need to increase the focus on post-harvest infrastructure, especially pack houses, cold stores, refrigerated vans and market infrastructure. They have to be provided at the project site considering the special nature of exportable fruits.

**The Marketing Channels are not Well D+eveloped.**

This has to be done by the local, regional and national governments on a wider scale throughout the country. Newer, modern marketing practices may be ushered in, with the encouragement and support of the government and even international funding organizations.

**Strategies for Improving Marketing**

It is understood from the study that the farmers must have support in marketing their horticultural products and the strategies for improving marketing could be the following:

The substantial gap between farmers' share in consumers' prices has to be narrowed;

A number of marketing practices can be encouraged but with focus on regulated marketing; Farmer-Consolidator - Trader - Commission Agent - Wholesaler - Retailer - Consumer; Markets regulated by marketing committees;

A model of transparency cold chains and linkage with farmers may well be adopted;

There is need to provide infrastructure for local markets and help set up NDDB type markets; and

Different markets in one location may continue to provide competition.

## Commodity Reviews

## Foodgrains

During the month of January, 2016 the Wholesale Price Index (Base 2004-05=100) of pulses increased by 2.14%, cereals decreased by 0.17% & foodgrains decreased by 0.65% 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, 2015 | WPI A year ago | Percentage Change during | |
|---|---|---|---|---|---|---|
| | | | | | A month | A year |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Rice | 1.793 | 235.9 | 237.3 | 239.2 | -0.59 | -1.38 |
| Wheat | 1.116 | 223.5 | 222.7 | 216.6 | 0.36 | 3.19 |
| Jowar | 0.096 | 277.9 | 289.1 | 284.4 | -3.87 | -2.29 |
| Bajra | 0.115 | 278.9 | 270.3 | 242.4 | 3.18 | 15.06 |
| Maize | 0.217 | 261.6 | 260.6 | 241.5 | 0.38 | 8.32 |
| Barley | 0.017 | 243.8 | 240.3 | 242.6 | 1.46 | 0.49 |
| Ragi | 0.019 | 335.6 | 328.3 | 328.7 | 2.22 | 2.10 |
| Cereals | 3.373 | 236.7 | 237.1 | 233.8 | -0.17 | 1.24 |
| Pulses | 0.717 | 370.1 | 378.2 | 255.4 | -2.54 | 44.91 |
| Foodgrains | 4.09 | 260.1 | 261.8 | 237.6 | -0.65 | 9.47 |

*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 January, 2016.

| Commodity | Main Trend | Rising | Falling | Mixed | Steady |
|---|---|---|---|---|---|
| Rice | Falling | Haryana | A.P.<br>Jharkhand<br>U.P. | Karnataka | Gujarat<br>Kerala |
| Wheat | Rising<br>Falling<br>Mixed | Rajasthan<br>U.P. | M.P.<br>Maharashtra | Gujarat<br>Haryana | Karnataka |
| Jowar | Rising & Falling | Gujarat<br>Karnataka | A.P.<br>Maharashtra | Rajasthan | |
| Bajra | Rising | Gujarat<br>Maharashtra | | | Rajasthan |
| Maize | Rising | Rajasthan<br>U.P. | Karnataka | | |

**Procurement of Rice**

4.96 million tonnes of rice (including paddy converted into rice) was procured during January 2016, as against 3.83 million tonnes of rice(including paddy converted into rice)procured during January 2015. The total procurement of rice in the current marketing season i.e 2015-2016, up to 29.01.2016 stood at 23.85 million tonnes, as against 18.59 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 29.01.2016) | | 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 | 1849 | 7.75 | 968 | 5.21 | 35.91 | 11.17 | 3721 | 11.76 |
| Chhatisgarh | 2722 | 15.61 | 2861 | 15.40 | 3423 | 10.64 | 4290 | 13.56 |
| Haryana | 2854 | 11.97 | 2015 | 10.84 | 2015 | 6.27 | 2406 | 7.60 |
| Maharashtra | 102 | 0.43 | 90 | 0.48 | 199 | 0.62 | 161 | 0.51 |
| Punjab | 9349 | 39.20 | 7781 | 41.89 | 7786 | 24.21 | 106 | 25.62 |
| Tamil Nadu | 118 | 0.49 | 117 | 0.63 | 1049 | 7.26 | 684 | 2.61 |
| Uttar Pradesh | 1930 | 8.09 | 1067 | 5.74 | 1698 | 5.98 | 1129 | 3.56 |
| Uttarakhand | 561 | 2.35 | 377 | 2.03 | 465 | 1.45 | 463 | 1.46 |
| Others | 3364 | 14.11 | 3306 | 17.79 | 11936 | 39.11 | 10678 | 33.75 |
| Total | 23849 | 100.00 | 18583 | 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 2015-2016 up to July, 2015, is 28.09 million tonnes against a total of 27.17 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 2015-16 (upto 13.07.2015) | | Corresponding Period of last Year 2014-15 | | Marketing Year (April-March) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 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) |
| Haryana | 6778 | 24.13 | 6414 | 23.61 | 6495 | 23.20 | 5873 | 23.41 |
| Madhya Pradesh | 7309 | 26.02 | 7188 | 26.46 | 7094 | 25.34 | 6355 | 25.33 |
| Punjab | 10344 | 36.83 | 10775 | 39.66 | 11641 | 41.58 | 10897 | 43.43 |
| Rajasthan | 1300 | 4.63 | 2155 | 7.93 | 2159 | 7.71 | 1268 | 5.06 |
| Uttar Pradesh | 2267 | 8.07 | 628 | 2.31 | 599 | 2.14 | 683 | 2.72 |
| Others | 90 | 0.32 | 6 | 0.02 | 6 | 0.02 | 16 | 0.06 |
| Total | 28088 | 100.00 | 27166 | 100.00 | 27994 | 100.00 | 25092 | 100.00 |

*Source*: Department of Food & Public Distribution.

## Commercial Crops

### Oilseeds and Edible Oils

The Wholesale Price Index (WPI) of nine major oilseeds as a group stood at 215.3 in January, 2016 showing a decrease of 1.2% over the previous month. However, it is higher by 5.9 % over the previous year. The WPI of cotton seed increased by 4.1% and gingelly seed by 1.2% over the previous month. The WPI of copra decreased by 8%, niger seed by 5.9%, soyabean by 1.9%, rape & mustard seed by 1.6 % and sunflower seed by 1.1 % over the previous month. The WPI of safflower seed and groundnut seed remained unchanged over the month.The Wholesale Price Index (WPI) of edible oils as a group stood at 149.6 in January, 2016 showing a decrease of 1.3% over the previous month. However, it is higher by 2.1 % over the previous year. The WPI of cotton seed oil increased by 1.9 %, sunflower oil by 0.9 % and gingelly oil by 0.8 % over the previous month. The WPI of mustard & rapeseed oil decreased by 2.2 %, copra oil by 2.2 % and groundnut oil by 0.8 % over the previous month. The WPI of soyabean oil remained unchanged over the month.

### Fruits &Vegetable

The Wholesale Price Index (WPI) of fruits & vegetable as a group stood at 257.5 in January, 2016 showing a decrease of 6 % over the previous month. However, it shows an increase of 4.7 % over the previous year.

### Potato

The Wholesale Price Index (WPI) of potato stood at 151.5 in January, 2016 showing a decrease of 13.3% and 17.1% over the previous month and year, respectively.

### Onion

The Wholesale Price Index (WPI) of onion stood at 348.4 in January, 2016 showing a decrease of 20 % over the previous month. However, it shows an increase of 5.5 % over the previous year.

### Condiments & Spices

The Wholesale Price Index (WPI) of condiments & spices (group) stood at 363.3 in January, 2016 showing a decrease of 2.4 % over the previous month. However, it shows an increase of 17.1% over the previous year.The WPI of black pepper (4.1 %), chillies (dry) (0.5 %) and turmeric (0.2 %) decreased over the previous month.

### Raw Cotton

The Wholesale Price Index (WPI) of raw cotton stood at 190.5 in January, 2016 showing an increase of 1.5% and 2.8% over the previous month and year, respectively.

### Raw Jute

The Wholesale Price Index (WPI) of raw jute stood at 483.2 in January, 2016 showing an increase of 6.6% and 62% over the previous month and year, respectively.

WHOLESALE PRICE INDEX OF COMMERCIAL CROPS

| Commodity | Latest | Month | Year | % Variation Over | |
|---|---|---|---|---|---|
| | January, 2016 | December, 2015 | January, 2014 | Month | Year |
| OIL SEEDS | 215.3 | 217.9 | 203.3 | -1.2 | 5.9 |
| Groundnut Seed | 242.2 | 242.2 | 207.1 | 0.0 | 16.9 |
| Rape & Mustard Seed | 242.9 | 246.9 | 202.2 | -1.6 | 20.1 |
| Cotton Seed | 211.4 | 203.1 | 155.7 | 4.1 | 35.8 |
| Copra (Coconut) | 128.0 | 139.1 | 180.0 | -8.0 | -28.9 |
| Gingelly Seed (Sesamum) | 294.9 | 291.4 | 404.1 | 1.2 | -27.0 |
| Niger Seed | 378.8 | 402.4 | 214.1 | -5.9 | 76.9 |
| Safflower (Kardi Seed) | 148.4 | 148.4 | 125.6 | 0.0 | 18.2 |
| Sunflower | 197.9 | 200.0 | 177.4 | -1.1 | 11.6 |
| Soyabean | 208.7 | 212.7 | 203.2 | -1.9 | 2.7 |
| EDIBLE OILS | 149.6 | 151.5 | 146.5 | -1.3 | 2.1 |
| Groundnut Oil | 192.2 | 193.8 | 179.7 | -0.8 | 7.0 |
| Cotton Seed Oil | 197.8 | 194.2 | 173.3 | 1.9 | 14.1 |
| Mustard & Rapeseed Oil | 188.7 | 193.0 | 165.2 | -2.2 | 14.2 |
| Soyabean Oil | 150.4 | 150.4 | 153.9 | 0.0 | -2.3 |
| Copra Oil | 144.5 | 147.8 | 149.0 | -2.2 | -3.0 |
| Sunflower Oil | 133.6 | 132.4 | 124.8 | 0.9 | 7.1 |
| Gingelly Oil | 160.0 | 158.8 | 173.5 | 0.8 | -7.8 |
| FRUITS & VEGETABLES | 257.5 | 273.8 | 246.0 | -6.0 | 4.7 |
| Potato | 151.5 | 174.8 | 182.7 | -13.3 | -17.1 |
| Onion | 348.4 | 435.4 | 330.2 | -20.0 | 5.5 |
| CONDIMENTS & SPICES | 363.3 | 372.3 | 310.2 | -2.4 | 17.1 |
| Black Pepper | 710.0 | 740.7 | 747.4 | -4.1 | -5.0 |
| Chillies(Dry) | 394.7 | 396.7 | 319.3 | -0.5 | 23.6 |
| Turmeric | 266.6 | 267.1 | 249.4 | -0.2 | 6.9 |
| Raw Cotton | 190.5 | 187.7 | 185.4 | 1.5 | 2.8 |
| Raw Jute | 483.2 | 453.4 | 298.3 | 6.6 | 62.0 |

## WAGES

1. AVERAGE 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 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Carpen-ter | Black Smith | Cobbler |
| | | | | | M | W | M | W | M | W | M | M | M |
| Andhra Pradesh | Krishna | Ghantasala | Aug,15 | 8 | 267 | 175 | 300 | NA | 250 | 200 | NA | NA | NA |
| | Guntur | Tadikonda | Aug,15 | 8 | 275 | 200 | 275 | NA | 225 | NA | NA | NA | NA |
| Telangana | Ranga Reddy | Arutala | March,15 | 8 | 260 | 190 | 300 | NA | NA | NA | NA | NA | NA |
| Karnataka | Bangalore | Harisandra | Aug,15 | 8 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | Tumkur | Gidlahali | Aug,15 | 8 | 168 | 160 | 180 | 180 | 180 | 180 | 180 | 180 | 180 |
| 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 : AVERAGE DAILY AGRICULTURAL WAGES IN SOME STATES (OPERATION-WISE)

(In Rs.)

| State | District | Centre | Month & Year | Type of Labour | Normal Daily working Hours | Ploughing | Sowing | Weeding | Harvest-ing | Other Agri Labour | Herds-man | Skilled Labour | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Carpenter | Black Smith | Cobbler |
| Assam | Barpeta | Laharapara | June,15 | M | 8 | 250 | 250 | 250 | 250 | 250 | 200 | 300 | 300 | 250 |
| | | | | W | 8 | NA | NA | NA | NA | NA | 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 | Oct,15 | M | 8 | NA | NA | NA | 120 | 150 | 100 | 250 | 150 | 100 |
| | | | | W | 8 | NA | NA | NA | 100 | 100 | 100 | 200 | 100 | 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 | Oct,15 | M | 8 | 400 | 400 | 400 | 400 | 400 | NA | NA | NA | NA |
| | | | | W | 8 | NA | NA | 300 | 300 | 300 | NA | NA | NA | NA |
| Himachal | Mandi | Mandi | Dec,13 | M | 8 | NA | 162 | 162 | 162 | 162 | NA | 260 | 240 | 240 |
| Pradesh | | | | W | 8 | NA | 162 | 162 | 162 | 162 | NA | 650 | NA | NA |
| Kerala | Kozhikode | Koduvally | July,15 | M | 4-8 | 1230 | 660 | NA | 660 | 957 | NA | 760 | NA | NA |
| | | | | W | 4-8 | NA | NA | 460 | 510 | 510 | NA | NA | NA | NA |
| | Palakkad | Elappally | July,15 | M | 4-8 | 500 | 500 | NA | NA | 467 | NA | 600 | NA | NA |
| | | | | W | 4-8 | NA | NA | 300 | NA | 300 | NA | NA | NA | NA |
| Madhya | Hoshangabad | Sangarkhera | Sep,15 | M | 8 | 100 | 130 | 130 | NA | 100 | 100 | 500 | 500 | NA |
| Pradesh | | | | W | 8 | NA | 130 | 130 | NA | 100 | NA | NA | NA | NA |
| | Satna | Kotar | Sep,15 | M | 8 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | W | 8 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | Shyopurkala | Vijaypur | Sep,15 | M | 8 | NA | 300 | NA | 300 | NA | 250 | 300 | NA | NA |
| | | | | W | 8 | NA | NA | NA | NA | NA | NA | NA | NA | NA |

1.1 : Average Daily Agricultural Wages in Some States (Operation-wise) - *Contd.*

(In Rs.)

| State | District | Centre | Month & Year | Type of Labour | Normal Daily working Hours | Ploughing | Sowing | Weeding | Harvest-ing | Other Agri. Labour | Herds-man | Skilled Labour | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Carpenter | Black Smith | Cobbler |
| Odisha | Bhadrak | Chandbali | Sep,15 | M | 8 | 250 | 150 | 250 | 200 | 250 | 250 | 350 | 200 | 200 |
| | | | | W | 8 | NA | NA | 200 | 150 | 200 | 200 | NA | NA | NA |
| | Ganjam | Aska | Sep,15 | M | 8 | 300 | 200 | 200 | 250 | 200 | 200 | 400 | 400 | 300 |
| | | | | W | 8 | NA | 100 | 100 | 150 | 100 | 100 | NA | NA | NA |
| Punjab | Ludhiyana | Pakhowal | July,14 | M | 8 | 300 | 300 | 300 | NA | 365 | NA | 395 | 395 | NA |
| | | | | 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 | Oct,15 | M | 8 | NA | 339 | 120 | 257 | 342 | NA | NA | NA | NA |
| | | | | W | 8 | NA | NA | NA | 120 | 121 | NA | NA | NA | NA |
| | Tirunelveli | Malayakulam | Oct, 15 | M | 8 | NA | 362 | NA | 375 | 490 | NA | NA | NA | NA |
| | | | | W | 8 | NA | 200 | 160 | 175 | 358 | NA | NA | NA | NA |
| Tripura | State Average | | Apr, 14 | M | 8 | 287 | 262 | 264 | 277 | 261 | 270 | 305 | 212 | 285 |
| | | | | W | 8 | NA | 197 | 201 | 209 | 197 | 200 | NA | NA | NA |
| Uttar Pradesh* | Meerut | Ganeshpur | Aug,15 | M | 8 | 280 | 267 | 269 | NA | 267 | NA | 381 | NA | NA |
| | | | | W | 8 | NA | 204 | 208 | NA | 250 | NA | NA | NA | NA |
| | Aurraiya | Aurraiya | Aug,15 | M | 8 | NA | 150 | 150 | NA | 160 | NA | 336 | NA | .NA |
| | | | | W | 8 | NA | NA | NA | NA | 162 | NA | NA | NA | NA |
| | Chandauli | Chandauli | Aug,15 | M | 8 | 200 | 200 | 200 | NA | 200 | NA | 350 | NA | NA |
| | | | | W | 8 | NA | NA | NA | NA | NA | NA | NA | NA | NA |

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

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

| Commodity | Variety | Unit | State | Centre | Jan.-16 | Dec.-15 | Jan.-15 |
|---|---|---|---|---|---|---|---|
| Wheat | PBW 343 | Quintal | Punjab | Amritsar | NA | 1600 | 1500 |
| Wheat | Dara | Quintal | Uttar Pradesh | Chandausi | 1600 | 1590 | 1590 |
| Wheat | Lokvan | Quintal | Madhya Pradesh | Bhopal | 1670 | 1580 | 1698 |
| Jowar | - | Quintal | Maharashtra | Mumbai | 2300 | 2300 | 2300 |
| Gram | No III | Quintal | Madhya Pradesh | Sehore | 3960 | 4286 | 2850 |
| Maize | Yellow | Quintal | Uttar Pradesh | Kanpur | 1350 | 1355 | 1420 |
| Gram Split | - | Quintal | Bihar | Patna | 5750 | 6040 | 4500 |
| Gram Split | - | Quintal | Maharashtra | Mumbai | 6000 | 6150 | 4000 |
| Arhar Split | - | Quintal | Bihar | Patna | 14880 | 14800 | 7010 |
| Arhar Split | - | Quintal | Maharashtra | Mumbai | 11650 | 13250 | 7000 |
| Arhar Split | - | Quintal | NCT of Delhi | Delhi | 13290 | 13350 | 6350 |
| Arhar Split | Sort II | Quintal | Tamil Nadu | Chennai | 12400 | 12800 | 8200 |
| Gur | - | Quintal | Maharashtra | Mumbai | 3100 | 3100 | 3300 |
| Gur | Sort II | Quintal | Tamil Nadu | Coimbatore | 4000 | 4000 | 4650 |
| Gur | Balti | Quintal | Uttar Pradesh | Hapur | 2350 | 2350 | 2300 |
| Mustard Seed | Black (S) | Quintal | Uttar Pradesh | Kanpur | 4500 | 4385 | 3350 |
| Mustard Seed | Black | Quintal | West Bengal | Raniganj | 4800 | 5000 | 3900 |
| Mustard Seed | - | Quintal | West Bengal | Kolkata | 5050 | 5300 | 4300 |
| Linseed | Bada Dana | Quintal | Uttar Pradesh | Kanpur | 4450 | 4425 | 4200 |
| Linseed | Small | Quintal | Uttar Pradesh | Varanasi | 4250 | 4250 | |
| Cotton Seed | Mixed | Quintal | Tamil Nadu | Virudhunagar | 2100 | 1900 | 1100 |
| Cotton Seed | MCU 5 | Quintal | Tamil Nadu | Coimbatore | 2300 | 2300 | 2000 |
| Castor Seed | - | Quintal | Telangana | Hyderabad | 3300 | 3500 | 3775 |
| Sesamum Seed | White | Quintal | Uttar Pradesh | Varanasi | 11000 | 13550 | |
| Copra | FAQ | Quintal | Kerala | Alleppey | 6000 | 6650 | 9650 |
| Groundnut | Pods | Quintal | Tamil Nadu | Coimbatore | 4500 | 4500 | 4500 |
| Groundnut | - | Quintal | Maharashtra | Mumbai | 5600 | 5900 | 5500 |
| Mustard Oil | - | 15 Kg. | Uttar Pradesh | Kanpur | 1530 | 1515 | 1223 |
| Mustard Oil | Ordinary | 15 Kg. | West Bengal | Kolkata | 1500 | 1710 | 1380 |
| Groundnut Oil | - | 15 Kg. | Maharashtra | Mumbai | 1335 | 1335 | 1470 |
| Groundnut Oil | Ordinary | 15 Kg. | Tamil Nadu | Chennai | 1695 | 1725 | 1320 |
| Linseed Oil | - | 15 Kg. | Uttar Pradesh | Kanpur | 1455 | 1455 | 1457 |
| Castor Oil | - | 15 Kg. | Telangana | Hyderabad | 1065 | 1125 | 1298 |
| Sesamum Oil | - | 15 Kg. | NCT of Delhi | Delhi | 1410 | 1385 | 1900 |
| Sesamum Oil | Ordinary | 15 Kg. | Tamil Nadu | Chennai | 1763 | 1725 | 2775 |
| Coconut Oil | - | 15 Kg. | Kerala | Cochin | 1260 | 1350 | 2085 |
| Mustard Cake | - | Quintal | Uttar Pradesh | Kanpur | 2500 | 2450 | 1840 |
| Groundnut Cake | - | Quintal | Telangana | Hyderabad | 3571 | 3429 | 3143 |
| Cotton/Kapas | NH 44 | Quintal | Andhra Pradesh | Nandyal | 4200 | 4100 | 3750 |
| Cotton/Kapas | LRA | Quintal | Tamil Nadu | Virudhunagar | 4226 | 3000 | 2906 |
| Jute Raw | TD 5 | Quintal | West Bengal | Kolkata | 5090 | 5290 | 3200 |

WHOLESALE PRICES OF CERTAIN AGRICULTURAL COMMODITIES AND ANIMAL HUSBANDRY PRODUCTS AT SELECTED CENTRES IN INDIA - *Contd....*

| Commodity | Variety | Unit | State | Centre | Jan.-16 | Dec.-15 | Jan.-15 |
|---|---|---|---|---|---|---|---|
| Jute Raw | W 5 | Quintal | West Bengal | Kolkata | 5030 | 5230 | 3150 |
| Oranges | - | 100 No | NCT of Delhi | Delhi | 600 | 650 | 417 |
| Oranges | Big | 100 No | Tamil Nadu | Chennai | 400 | 480 | 355 |
| Oranges | Nagpuri | 100 No | West Bengal | Kolkata | 500 | | 700 |
| Banana | - | 100 No. | NCT of Delhi | Delhi | 292 | 267 | 333 |
| Banana | Medium | 100 No. | Tamil Nadu | Kodaikkanal | 498 | 495 | 501 |
| Cashewnuts | Raw | Quintal | Maharashtra | Mumbai | 82000 | 82000 | 63000 |
| Almonds | - | Quintal | Maharashtra | Mumbai | 95000 | 95000 | 72000 |
| Walnuts | - | Quintal | Maharashtra | Mumbai | 82000 | 82000 | 68000 |
| Kishmish | - | Quintal | Maharashtra | Mumbai | 23000 | 23000 | 24000 |
| Peas Green | - | Quintal | Maharashtra | Mumbai | 4200 | 4200 | 4500 |
| Tomato | Ripe | Quintal | Uttar Pradesh | Kanpur | 1385 | 1400 | 1350 |
| Ladyfinger | - | Quintal | Tamil Nadu | Chennai | 2500 | 4000 | 2500 |
| Cauliflower | - | 100 No. | Tamil Nadu | Chennai | 2000 | 2000 | 1500 |
| Potato | Red | Quintal | Bihar | Patna | 800 | 820 | 800 |
| Potato | Desi | Quintal | West Bengal | Kolkata | 750 | 860 | 600 |
| Potato | Sort I | Quintal | Tamil Nadu | Mettuppalayam | 1870 | 2303 | 2348 |
| Onion | Pole | Quintal | Maharashtra | Nashik | 1000 | 1250 | 1300 |
| Turmeric | Nadan | Quintal | Kerala | Cochin | 14000 | 13000 | 11500 |
| Turmeric | Salam | Quintal | Tamil Nadu | Chennai | 9200 | 9000 | 8200 |
| Chillies | - | Quintal | Bihar | Patna | 10550 | 10250 | 9200 |
| Black Pepper | Nadan | Quintal | Kerala | Kozhikode | 60000 | 64000 | 60000 |
| Ginger | Dry | Quintal | Kerala | Cochin | 18000 | 19500 | 20000 |
| Cardamom | Major | Quintal | NCT of Delhi | Delhi | 131000 | 131500 | 105000 |
| Cardamom | Small | Quintal | West Bengal | Kolkata | 100000 | 100000 | 120000 |
| Milk | Cow | 100 Liters | NCT of Delhi | Delhi | | | NA |
| Milk | Buffalo | 100 Liters | West Bengal | Kolkata | 3600 | 3600 | 3600 |
| Ghee Deshi | Deshi No 1 | Quintal | NCT of Delhi | Delhi | 34351 | 34017 | 26680 |
| Ghee Deshi | - | Quintal | Maharashtra | Mumbai | 46000 | 46000 | 40000 |
| Ghee Deshi | Desi | Quintal | Uttar Pradesh | Kanpur | 35700 | 35650 | 35600 |
| Fish | Rohu | Quintal | NCT of Delhi | Delhi | 10500 | 10000 | 7600 |
| Fish | Pomphrets | Quintal | Tamil Nadu | Chennai | 34500 | 32000 | 31700 |
| Eggs | Madras | 1000 No. | West Bengal | Kolkata | 4950 | 4250 | 4300 |
| Tea | - | Quintal | Bihar | Patna | 21150 | 21100 | 21000 |
| Tea | Atti Kunna | Quintal | Tamil Nadu | Coimbatore | 33000 | 33000 | 34000 |
| Coffee | Plant-A | Quintal | Tamil Nadu | Coimbatore | 28000 | 28000 | 30200 |
| Coffee | Rubusta | Quintal | Tamil Nadu | Coimbatore | 14500 | 14500 | 15600 |
| Tobacco | Kampila | Quintal | Uttar Pradesh | Farukhabad | 4650 | 4650 | 4870 |
| Tobacco | Raisa | Quintal | Uttar Pradesh | Farukhabad | 3425 | 3500 | 3600 |
| Tobacco | Bidi Tobacco | Quintal | West Bengal | Kolkata | | | 3900 |
| Rubber | - | Quintal | Kerala | Kottayam | 8300 | 9100 | 10000 |
| Arecanut | Pheton | Quintal | Tamil Nadu | Chennai | 31600 | 31500 | 29800 |

3. Monthly Wholesale Prices of Some Important Agricultural Commodities in International Markets during Year 2016

| Commodity | Variety | Country | Centre | Unit | JAN |
|---|---|---|---|---|---|
| CARDAMOM | Guatmala Bold Green | U.K. | - | Dollar/MT | 9000.00 |
| | | | - | Rs./Qtl | 61281.00 |
| CASHEW KERNELS | Spot U.K. 320s | U.K | - | Dollar/MT | 8350.09 |
| | | | | Rs./Qtl | 56855.76 |
| CASTOR OIL | Any Origin ex tank Rotterdam | Netherlands | - | Dollar/MT | 1374.00 |
| | | | | Rs./Qtl | 9355.57 |
| CHILLIES | Birds eye 2005 crop | Africa | - | Dollar/MT | 4100.00 |
| | | | | Rs./Qtl | 27916.90 |
| CLOVES | Singapore | Madagascar | - | Dollar/MT | 8650.00 |
| | | | | Rs./Qtl | 58897.85 |
| COCONUT OIL | Crude Phillipine/ | Netherlands | - | Dollar/MT | 1155.00 |
| | Indonesia,cifRotterdam | | | Rs./Qtl | 7864.40 |
| COPRA | Phillipines cif Rotterdam | Phillipine | - | Dollar/MT | 687.50 |
| | | | | Rs./Qtl | 4681.19 |
| CORRIANDER | | India | - | Dollar/MT | 2000.00 |
| | | | | Rs./Qtl | 13618.00 |
| CUMMIN SEED | | India | - | Dollar/MT | 2200.00 |
| | | | | Rs./Qtl | 14979.80 |
| GROUNDNUT OIL | Crude Any Origin cif Rotterdam | U.K. | - | Dollar/MT | 1200.00 |
| | | | | Rs./Qtl | 8170.80 |
| MAIZE | | U.S.A. | Chicago | C/56 lbs | 369.25 |
| | | | | Rs./Qtl | 988.09 |
| OATS | | CANADA | Winnipeg | Dollar/MT | 283.14 |
| | | | | Rs./Qtl | 1927.90 |
| PALM KERNAL OIL | Crude Malaysia/Indonesia, cif Rotterdam | Netherlands | - | Dollar/MT | 890.00 |
| | | | | Rs./Qtl | 6060.01 |
| PALM OIL | Crude Malaysian/Sumatra, cif Rotterdam | Netherlands | - | Dollar/MT | 575.00 |
| | | | | Rs./Qtl | 3915.18 |
| PEPPER (Black) | Sarawak Black lable | Malaysia | - | Dollar/MT | 10000.00 |
| | | | | Rs./Qtl | 68090.00 |
| RAPESEED | Canola | CANADA | Winnipeg | Can Dollar/MT | 481.20 |
| | | | | Rs./Qtl | 2334.78 |
| | UK delivered rapeseed, delivered Erith(buyer) | U.K. | - | Pound/MT | 247.00 |
| | | | | Rs./Qtl | 2415.66 |
| RAPESEED OIL | Refined bleached and deodorised ex-tanks, broker price | U.K. | - | Pound/MT | 660.00 |
| | | | | Rs./Qtl | 6454.80 |
| SOYABEAN MEAL | UK produced 49% oil & protein ('hi-pro') ex-mill seaforth UK bulk | U.K. | - | Pound/MT | 248.00 |
| | | | | Rs./Qtl | 2425.44 |
| SOYABEAN OIL | | U.S.A. | - | C/lbs | 30.87 |
| | | | | Rs./Qtl | 4632.67 |
| | Refined bleached and deodorised ex-tanks, broker price | U.K. | - | Pound/MT | 618.00 |
| | | | | Rs./Qtl | 6044.04 |

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

| Commodity | Variety | Country | Centre | Unit | JAN |
|---|---|---|---|---|---|
| SOYABEANS | | U.S.A. | - | C/60 lbs | 883.00 |
| | | | | Rs./Qtl | 2206.53 |
| | US NO.2 yellow | Netherlands | Chicago | Dollar/MT | 377.20 |
| | | | | Rs./Qtl | 2568.35 |
| SUNFLOWER SEED OIL | Refined bleached and deodorised ex-tanks, broker price | U.K. | - | Pound/MT | 674.00 |
| | | | | Rs./Qtl | 6591.72 |
| Wheat | | U.S.A. | Chicago | C/60 lbs | 476.50 |
| | | | | Rs./Qtl | 1190.73 |

Source - Public Ledger

| | Currency | JAN |
|---|---|---|
| Foreign Exchange Rates | CanDollar | 48.52 |
| | UKPound | 97.8 |
| | USDollar | 68.09 |

## Crop Production

4. Sowing and Harvesting Operations Normally in Progress during April, 2016

| State | Sowing | Harvesting |
|---|---|---|
| 1 | 2 | 3 |
| Andhra Pradesh | Autumn Rice, Sugarcane. | Summer rice, Jowar (R), Ragi (R), Small Millets (R), Other Rabi Pulses, Sugarcane, Cotton. |
| Assam | Autumn Rice, Maize, Small Millets (R), Tur (R), Sugarcane, Cotton, Mesta. | Wheat, Tur (R), Sown during previous year. |
| Bihar | Jowar (K), Bajra, Jute. | Wheat, Barley, Gram, Tur (K), Castorseed, Linseed. |
| Gujarat | Sugarcane. | Castorseed, Onion. |
| Himachal Pradesh | Maize, Summer Potato (Hills), Sugarcane, Ginger Chillies (Dry), Sesamum, Cotton, Turmeric. | Wheat, Barley, Gram, Other Rabi Pulses, Rapeseed and Mustard, Linseed. |
| Jammu & Kashmir | Autumn Rice, Jowar (R), Maize, Ragi, Small Millets (K), Summer Potato, chillies (Dry), Tobacco, Sannhemp, Onion. | Wheat, Barley, Small Millets (R), Gram, Sesamum, Linseed, Onion. |
| Karnataka (Plains) | Maize, Urad (K) Mung (K), Summer Potato (Hills) Tobacco, Castorseed, Seasamu, Sweet Potato (Hills), Sannhemp, Onion (2nd Crop). | Summer Rice, Gram, Urad (R), Summer Potato, Cotton, Turmeric, Onion (1st Crop). Tapioca. |
| Kerala | Autumn Rice, Ragi, Ginger, Turmeric, Tapioca. | Summer Rice, Tur (R), Other Rabi Pulses, Sesamum, |
| Madhya Pradesh | Sugarcane, Onion | Wheat, Barley, Tur (K), Winter Potato (Plains), Castorseed, Linseed, Onion. |
| Maharashtra | Sugarcane. | Maize (R), Wheat Gram, Other Rabi Pulses, Cotton, Onion. |
| Manipur | Maize, Turmeric | Gram. |
| Orissa | Sugarcane, Chillies (Dry) | Wheat, Barley, Urad (R), Mung (R), Chillies (Dry). |
| Punjab and Haryana | Tur (K), Potato, Sugarcane, Ginger, Chillies (Dry), Sweet Potato, Turmeric. | Wheat, Barley, Small Millets (R), Gram, Tur (K), Other Rabi Pulses, Potato, Castorseed, Rapeseed and Mustard, Linseed, Onion. |
| Rajasthan | Sugarcane. | Wheat, Barley, Urad (R), Mung (R), Other Rabi Pulses, Tobacco, Castorseed, Rapeseed and Mustard, Linseed. |
| Tamil Nadu | Summer Rice, Jowar (R), Summer Potato, Sugarcane, Pepper (Black), Chillies (Dry), Groundnut (Late), Sesamum Cotton, Onion Sannhemp. | Winter Rice, Jowar (R), Tur (R), Mung (K), Winter Potato (Hills), Sugarcane, Chillies, (Dry), Tobacco, Groundnut (Early), Cotton, Onion. |
| Tripura | Autumn Rice, Maize, Sugarcane, Ginger, Chillies, (Dry), Sesamum, Cotton, Jute. | Summer Rice, Chillies (Dry), Tobacco. |
| Uttar Pradesh | Sugarcane, Chillies (Dry), Cotton, Jute, Mesta. | Summer Rice, Wheat, Barley, Gram, Tur (K), Tobacco, Castorseed, Rapeseed and Mustard, Linseed, Onion, Sugarcane. |
| West Bengal | Autumn Rice, Maize, Tur (K), Sugarcane, Ginger Chillies (Dry), Sesamum, Jute, Mesta. | Summer Rice, Wheat, Barley, Gram, Tur (K), Urad (R), Other Rabi Pulses, Winter Potato (Plains), Chillies (Dry). |
| Delhi | Jowar (K), Sugarcane, Tobacco, Onion. | Wheat, Gram, Tur (K) Rapeseed and Mustard, Linseed. |

(K)-Kharif (R)-Rabi.:



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