

Agro-Economic Policy Briefs

Aiding the Future of India's Farmers and Agriculture



On critical policy issues in India's Agricultural Economy

Issue 6, August 2018

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Compiled and Edited by
Center for Management in
Agriculture (CMA),
Indian Institute of Management
Ahmedabad

Contact:

Prof. Poornima Varma, or
Prof. Vasant P. Gandhi
Chairperson CMA
cma@iima.ac.in

Phone: +91-79-6632-4651

Acknowledgements: Nikita Pandey,
Dipali Chauhan, Nicky Johnson



For kind attention of:

The Hon'ble Prime Minister's Office,
the Ministry of Agriculture and Farmers Welfare,
and all others interested

Based on Research &
Contributions of: 15 Agro-
Economic Research Centers
and Units, supported by
Ministry of Agriculture &
Farmers Welfare

Maize in Bihar: Supply Chain, Marketing and Value-Addition

For further details contact:

Ranjan Kumar Sinha

Agro-Economic Research Centre, Bhagalpur University, Bihar.
ranjan@aercbhagalpur.org; Phone: 9430815567

Introduction

- Maize is a very important crop in Bihar. On a national basis, Maize is the third largest crop in India. It is cultivated in an area of about 9 million hectares, has an annual production of 23 million metric tonnes and an average productivity of 2.57 metric tonnes per hectare. It is grown across wide range of environments, extending from extreme semi-arid to sub-humid and humid regions. In recent years, significant changes have occurred in maize utilization in Bihar, due to increasing commercial orientation and rising demand for diversified end-users. Past strategy did not explicitly recognize the role of this in raising farmers' income.
- To examine this, the primary survey data was collected from two sample districts viz., Samastipur and Katihar with an overall sample of 200 farmers. Besides this, the growth of area, production and yield of maize is analysed using the secondary data. The reference period of the study was 2016-17.
- In Bihar, maize production is gradually shifting from rainy season to winter season (Rabi). Besides production, demand has also been increasing more rapidly as compared to other major commodities. It is estimated that by 2025, India would require 50 million metric tons of maize grain, of which 64 percent would be required in the feed sector, 30 percent in the industrial sector, 4 percent as food and 2 percent for seed and miscellaneous purposes. Thus, in the next 7-8 years there is a necessity and an opportunity for increasing India's maize production by about 40 percent from the current level (2016-17) of production of approximately 38 million metric tonnes. To meet such target, some strong policy interventions will be required in the area of production, marketing and processing of maize in general and particularly in Bihar.

Findings

- Bihar's agriculture department has recognised 11 districts in north Bihar and Seemanchal region as the 'Maize Road'. In the year 2016-17, the maize road occupied nearly 75.3 percent of the state's total maize area and produced 79.5 percent of the state's total maize production.
- During 2000-01 to 2016-17 the area under maize expanded from 620.5 thousand hectares to 720.9

thousand hectares in the state, indicating 16.18 percent increase with Annual Average Growth Rate (AAGR) of 0.98 percent and Compound Annual Growth Rate (CAGR) of 0.94 percent. The production touched 3845.7 thousand metric tonnes from 1497.3 thousand metric tonnes, registering significant increase of 156.8 percent during the same period. The AAGR and CAGR were 7.47 percent and 5.71 percent respectively. The yield increased from 2413 kg per hectare to 5335 kg per hectare indicating 121 percent increase over the two years. AAGR and CAGR of yield rates were 6.39 percent and 4.78 percent respectively during the period under study.

- The season-wise CAGR of maize production was 6.86 percent for Kharif, 9.52 percent for Rabi, 4.87 percent for summer and for annual 7.55 percent during 2007-08 to 2016-17. Similarly, the season-wise CAGR of maize yield was 7.79 percent for Kharif, 6.46 percent for Rabi, 4.06 percent for summer and 6.57 percent for annual during the same period.
- The analysis further revealed that the area under maize was gradually increasing to new areas and to some extent was replacing wheat, banana and a few millet crops. Moreover, with rich water resources, the production and yield rates touched a new high particularly in maize-road districts which has led to a structural change in maize ecosystem in the State.
- Till August 2016, there were 407 food processing units in Bihar and out of it nearly 278 (68.3 percent) were operational. These industries have created 48,404 employment in the sector. Maize gives a unique position to the state in national maize market as most of the maize processing units, particularly in north India, depended highly on maize from the state for a significant period of time. With the state productivity (5335 kg per hectare) much higher than national productivity (2509 kg per hectare) level, the area under cultivation is expected to rise further. There are, thus, large opportunities for the maize processing units which can be set up for making wide range of products such as starch, corn oil, corn flakes, corn flour, poultry feed etc.
- At present, there are 93 micro, medium and large maize processing units in the state. Out of them, 23 units have been benefitted under the financial assistance program of the department of food processing in the state. The Bihar Industrial Policy, 2016 has placed high importance on agro-based industries. Under the policy, food processing sector has been included as one of the ten priority sectors.

Figure 1: Maize Processing Unit in Bihar.



Source: AERC, Bhagalpur.

- The study is formed from a sample of 200 farm households with an average age of 45.7 years and average family size of 6.5 members. The average net operational area in the study is 6.20 acres. Most of the farmers were dependent upon bore-wells (98.5 percent) as the source of irrigation.
- The higher proportion of irrigated land was found among medium farmers, followed by large, small and marginal farmers, as they were not ready to take any risk in the process of crop cultivation. The leased-in irrigated lands and its rental values were the highest in case of medium farmers (Rs. 18333 per acre), followed by large (Rs. 18000 per acre), small (Rs. 6272 per acre) and marginal (Rs. 12800 per acre) farmers. The common crops grown by the sample farmers included paddy, maize, wheat, pulses, soybean and vegetables. The cropping intensity was higher at 175 percent for marginal & small farmers followed by medium farmers (157 percent) and large farmers (140 percent).
- At overall farmer level, the total paid out costs and net returns realized by the sample maize farmers during Rabi season were estimated at Rs. 20,125 per acre and Rs. 28,009 per acre respectively. The cost-benefit ratio was 1:2.39. Similarly, in case of summer maize, the total paid out costs and net returns were estimated at Rs. 18,662 per acre and Rs. 21,078 per acre respectively. The cost benefit ratio was 1:2.13.
- Majority of farmers were found to have availed of loans from institutional sources (94.8 percent). Among the institutional sources, commercial banks and Regional Rural Banks (RRBs) formed the major sources of finance, whereas among non-institutional sources, moneylenders, traders and commission agents were the major sources of credit to the sample farmers. At the aggregate level, seasonal crop cultivation is the main purpose behind borrowing of loans, which amounts to 66.15 percent of the total borrowing amount.
- The volume of net marketed surplus of maize was 106.05 quintal (90.22 percent) against the production of 117.54 quintals on an overall average farm size of 2.84 acres. Among the farms, the net marketed surplus on average large farms (4.90 acres) was the highest at 190.52 quintals (94.82 percent) followed by medium (91.54 percent), small (85.54 percent) and marginal (85.20 percent) farms. It is revealed that unlike other agricultural produce the net marketed surplus of maize is quite high mainly due to low family consumption and other needs of the produce at the farmers' level.
- Among the production constraints, it was found that the maize seeds were costlier than any other crop's seeds by nearly 38.5 percent. Other problems faced were drying of Rabi maize (36.5 percent), shortage of labour due to migration, lack of proper irrigation facilities by nearly 30.5 percent and destruction of the crop by blue bulls and boars by nearly 27.5 percent.
- Among marketing constraints, it was found that there was a lack of storage facilities at the villages or nearby areas (58 percent), there were frequent road snatchings while coming back to home after selling the produce in big mandis or markets, there was harassment by traffic police, lack of confidence on outside traders and absence of formal marketing agencies.

Recommendations

- Production (sowing to harvesting) should be strengthened by ensuring the availability of quality seeds at reasonable prices, balanced use of nutrients and transplantation of maize under late sown conditions.
- To address the issue of poor quality, there is a need to establish a chain of community based dryers at producer level, construction of threshing floors (10,000 square feet) at village level and providing tarpaulin (40' x 40') to maize farmers for protecting grains from pre-monsoon rains.
- Aflatoxins and storage pests problems are developed due to high moisture at harvesting, hence, the installation of affordable community/metal silos at producer level should be made to save maize grains from pest infestation. This will simultaneously prevent the distress sale of crops.
- Destruction of the crop by blue bulls and boars should be checked with the cooperation of the Forest, Environment and Wildlife Management Department.
- To address the supply chain issues, market linkage model should be promoted or strengthened through farmers' producer organizations. It would minimize the number of market functionaries or intermediaries and increase the producer's share in consumer's rupee. Further, complete production-to-end user value chain needs to be strengthened.
- To overcome the marketing constraints, procurement of maize must be done by formal agencies; there should be a check on harassment by traffic police, extending storage facilities at village or panchayat level and check on unfair means adopted by the traders by licensing them.
- The logistics for bulk handling system of maize from farm to processing industries need to be strengthened through development of good roads and proper railway connections. Further, there should be improvement in market information system and there should be transparency in the prices.
- The level of processing of maize in the state is presently quite low. Hence, there is a need to incentivize maize based processing industries in the state. Further, the State Government should gear-up the process of establishment of at least one mega food park in each of the agro-climatic zones or potentially identified geographical areas.

(Cover Photo: Ray Witlin / World Bank)

Economic Losses in the Fisheries Sector in Gujarat due to Inadequate Post-Harvest Infrastructure Facilities

For further details contact:

H. Sharma, M. Swain, S.S. Kalamkar

Agro-Economic Research Center, Vallabh Vidyanagar, Anand, Gujarat.

directoraercgujarat@gmail.com; Phone: 02692-230106

Introduction

- Fisheries sector is very important in Gujarat and nationally this sector provides livelihood to approximately 14.49 million people. It has been recognized as a powerful income and employment generator as it stimulates growth of a number of subsidiary industries and is a source of cheap and nutritious food besides being a source of foreign exchange.
- Marine fisheries have progressively increased by nearly six times during the last five-decade period. The country has a long coastline of 8,118 kilometres and equally large areas under estuaries, backwaters and lagoons that are conducive for developing capture as well as culture fisheries. Gujarat accounts for about one-fifth of the total length of coastline in the country.
- Even though the fisheries sector has been transformed in terms of its nature and significance, the sector still faces a lot of challenges such as elimination of economic losses due to inadequate Post-Harvest Infrastructure (PHI) facilities. Since fish is a highly perishable commodity, it requires proper facilities such as processing, storage, transport and distribution running through the entire supply chain from capture to consumer. Absence of such infrastructure results in considerable wastage and losses.
- The present study is based on both primary and secondary data. The primary data were collected during October 2015 from three fishing harbours i.e., Veraval, Porbandar and Mangrol of Gujarat.
- Coastal Gujarat has one of the richest fishing resources in India and the most important commercial varieties of fish such as - Pomfret, Hilsa, Bombay duck, Ribbonfish, Catfish, Rays, Cuttlefish and Shrimps. Along the coastline of Gujarat, 851 fishing villages/towns and 286 marine landing centers are located. About 55,062 fishermen families and 3,16,972 fisher-folk population are located in these fishing villages. Out of the total production of 7.93 lakh metric tonnes in 2013-14, about 88 percent was marine fish while remaining 12 percent was inland fish production. There are 5 fish harbours existing in the state with total fish production capacity of 3,88,000 metric tonnes.

- The state level fisheries management is undertaken mainly through licensing, prohibitions on certain fishing gear, regulations on mesh size and establishment of closed seasons and areas, under the Marine Fishing Regulation Act (MFRA).
- The closed season or 'monsoon fishing ban' is another important 'temporal-spatial' management measure implemented on both the east and west coasts of India for a period of 47 days and 65 days respectively, which is considered to be the spawning and breeding season.

Findings

- Among different fishing crafts and fishing gears

Figure 2: Port in Gujarat; A woman selling fish in the market.



Source: AERC, Gujarat.

- On an average, around 14 tonnes fish per trip were caught in selected harbours. Out of total fish landed at harbours, about 85 percent fish were of Grade I and the remaining were categorized as low grade, i.e., Grade II.
- It was observed that not only the fish landed per trip was higher in case of motorised boat owners than other fishermen but also the percentage of Grade I quality fish was higher. Motorised boat owners had 15 percent Grade I fish higher than other fishermen.
- The sale pattern of fish landed indicates that, about 94 percent of total fish was sold, of which around 37 percent was sold to exporter, around 29 percent to wholesaler and contractor and the remaining were sold to retailer.
- Across seasons, in case of boat owner, average price per kg of Grade I fish ranges from as high as Rs. 800 per kg for Pomfret to as low as Rs. 50 per kg for prawn, while Grade II fish ranges between Rs. 730 per kg for Pomfret and Rs. 40 per kg for redfish.
- In case of fishermen, Grade I fish ranges from Rs. 800 per kg for Pomfret to Rs. 40 per kg for redfish while for Grade II fish rate ranges from Rs. 600 per kg for Pomfret to Rs. 40 per kg for prawn.
- There were appreciable losses during both harvest and post-harvest stages in fisheries. The economic loss in terms of low market value of fish due to poor post-harvest infrastructure was estimated at Rs. 18.10 per kg. The major reasons for losses at this stage were physical damage during fishing and spoilage due to improper icing, whereas very minimal share was lost due to fish being eaten away by birds. Further, motorized trawlers and gill netters are major causes for fish losses.
- The condition of washing and cleaning facilities available at Porbandar and Mangrol was unsatisfactory while the same facilities were very poor at the harbour in Veraval.

- On an average, the facilities like chill plants, cold storage, ice plants and insulated vans were available about three kilometres away from the sea shore. These facilities were available relatively closer to Veraval and Mangrol harbour than Porbandar harbour.
- The major problems cited by the fishing households were storm, cyclone, tsunami, high waves, rains, poor hygienic facilities and incidence of skin diseases. The non-availability of cold storages was another major problem. Non-availability of additional subsidy on fuel and inadequate supply of fuel were the other problems cited.
- During the survey, it was found that there were no proper shops or buildings for marketing of fish in retail. The fish were sold on the roadside without facility of proper roof, electricity, water, drainage, storage room and proper flooring. At some places, small platforms were constructed in the market. Fish were piled up on the floor and sold. Majority of retail fish markets were found to be ill-managed and unhygienic. There was no proper handling, washing, cleaning, icing or re-icing of the fish in the market places.
- It was found that 90 percent of the fish retailers were women. The average age of retailers was about 48 years. Only about 33 percent of them were literate. The literacy rate of female retailers was better in Porbandar harbour compared to other places.
- About 70 percent of total fish were purchased by retailers through the brokers or middlemen. Entire fish in the retail market were sold to the consumers coming from the nearby areas.
- About 93 percent of selected sample retailers got ice in adequate quantity and about 90 percent of them could get ice in time and uninterruptedly. On the whole, only about 33 percent retailers expressed that the price of ice was more or less stable throughout the year. The average price of ice in the retail market was around Rs. 1.25 per kg.
- The harbour wise details on value addition by processors indicate that about 75 percent of total quantities of fish were used for export as frozen fish and the remaining 25 percent as whole fish plus frozen. Overall 80-90 percent of total processed quantity of fish were exported to Europe, Japan, US, China, Vietnam, Dubai, Italy and South Korea and 10-20 percent of total quantity of processed fish products were sold in Delhi, Ahmedabad, Jodhpur, Mumbai, Surat, Vadodara, Anand, Pune and other

domestic markets. Overall about 75 percent processed products were ready to cook and eat.

Recommendations

- The post-harvest infrastructure in marine sector in Gujarat seems to have been neglected. The industry has been pre-occupied majorly with the exports, no major initiatives have been taken for the development of the domestic market. Fish is by and large sold in the most unhygienic conditions and this area needs considerable intervention in the coming period.
- The fishermen and boat owners should be provided training on proper handling, transport and processing of fish by the government and cooperative organizations.
- Fishing harbours are being developed at both major and minor ports. However, the condition of washing and cleaning facilities available is unsatisfactory. Hence, the facilities like clear landing platform and cold storage or chill plants within the fishing harbour premises and availability of insulated storage boxes on board the fishing vessel need to be ensured.
- The marketing and processing activities need to be strengthened. There is a need of expansion of harbour regions as well as construction of more number of jetting/landing platforms.
- The fish breeding places need to be protected from encroachment as well as fishing activity should be strictly prohibited during the ban period.
- The dumping of hazardous chemical waste from industries located near the sea shore (particularly at Veraval and Porbandar) not only affect the fish quality due to polluted water but also results in dying and moving away of good species of fish from the harbour area. Therefore, dumping of industrial waste should be prohibited effectively.
- The level of administrative and financial autonomy at harbours should be increased with sufficient fund availability so that infrastructure and developmental activities at harbour regions can be stepped up.
- Though it is prohibited by the law, the catching of young fish is still prevalent on a larger scale which affects the future growth of fish volume and thus fish management in region. Therefore, strict monitoring of catching of young fish at harbour level needs to be undertaken. Vertical intensification through integration of different farm-based enterprises and post-harvest loss reductions could help to meet expected increase in production demand and quality.

Impact of Agri-Clinics & Agri-Business Centers (ACABC) Scheme in Assam

For further details contact:

Moromi Gogoi, Runjun Savapandit

Agro-Economic Research Center, Assam Agricultural University,
Jorhat, Assam.

ms.moromi@rediffmail.com; Phone: 0376-2340096

Introduction

- Agri-Clinics & Agri-Business Centers (ACABC) Scheme is a central government scheme launched on 9th April, 2002 in order to strengthen the transfer of technology and agricultural extension services and to provide self-employment opportunities to the technically trained people. The scheme also meant to encourage each and every farmer across the country through enhanced extension services.
- In Assam, ACABC scheme was initiated in 2002 with the prime objective to supplement the efforts of public extension by facilitating qualified agricultural professionals to set-up Agri-ventures that can deliver value-added extension advisory services to the farmers at their door step, besides providing self-employment opportunities to Agripreneurs.
- Under this programme, the Government provides training to graduates in agriculture and allied activities like horticulture, sericulture, veterinary science, forestry, dairy, and fisheries etc. After the completion of the programme, the trainees are supported by special start-up loans for specialized ventures. The agri-clinics are envisaged to provide expert advice and services to the farmers on technology, cropping practices, protection from pests and diseases, market trends, prices of various crops in the markets and clinical services for animal health which would enhance the productivity of crops and animals and ultimately, the farmers' income.
- The main objectives of the present study are to identify the benefits accrued to farmers through

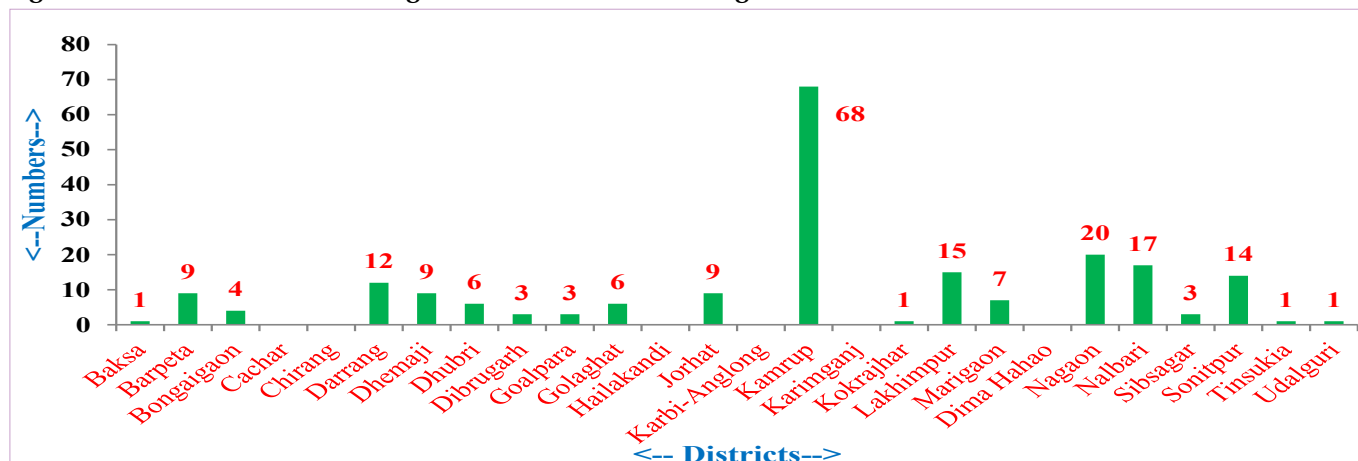
extension services by ACABCs, to assess the extent of effects on income of beneficiary farmers through extension services by ACABCs and the income of non-beneficiary farmers, to examine the problems or factors hampering the effects of extension services by ACABCs, to explore measures and suggestions for strengthening extension services by ACABCs and to suggest desirable changes in imparting extension services to farmers under the ACABC Scheme.

- The study was based on primary data collected in the year 2016 in two districts of Assam, viz., Kamrup and Nagaon. From each district, five agri-ventures were selected. Those ventures were further categorized according to proper agriculture services, allied agriculture services and other services. From each of the agri-venture, 10 of the beneficiary and 5 of the non-beneficiary sample farmers of the adjacent area were selected randomly. Further, farmers were divided into marginal, small and medium, and large farmers. Thus, a total of 100 beneficiary farmers and 50 non-beneficiary farmers were taken into consideration to study the impact of agriculture extension services through ACABC scheme in the state of Assam.

Findings

- The number of agri-ventures established in Assam during the period 2003-04 to 2016-17 was 209. Out of the total agri-ventures established so far, Kamrup district (68) had the highest number of ventures followed by Nagaon (20), Nalbari (17) and Lakhimpur (15) district. Not even a single agri-venture was established in the districts of Cachar, Chirang, Karimganj, Hailakandi, Karbi Anglong and Dima Hasao (Figure 3) even though there were a limited number of agri-graduates trained under the ACABC scheme from these districts.

Figure 3: District-wise number of agri-venture established during 2003-17 in Assam



Source: AERC, Assam.

- Out of 100 beneficiary farmers, 56 reported that the production of cereals had increased. Also, 38 sample farmers told that the production of other horticultural crops had increased satisfactorily. Out of the total sample farmers, 28 farmers reported that the number of milch animals had increased, 15 farmers reported that the production of poultry and fish also increased considerably after the establishment of agri-ventures in their areas.
- The ACABC scheme was successful in imparting

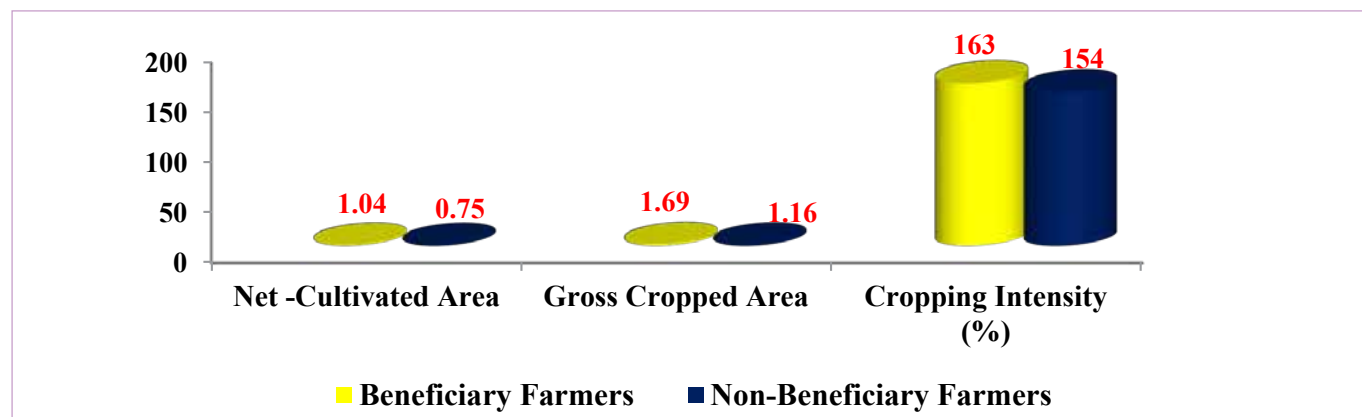
knowledge through the agri-ventures to the farmers on new and scientific methods of farming, which had led to an increase in the net cultivated area, gross cultivated area and enhanced cropping intensity, finally resulting in a boost in agricultural production (Table 1). It was found that net-cropped area and gross cropped area were found to be higher in the category of proper agricultural services and cropping intensity was found higher in all the categories of services of beneficiary farms as compared to the farms of non-beneficiary farmers (Figure 4).

Table 1: Comparative advantage of ACABC Scheme in the sample area (Area in Hectares Per farm, Cropping Intensity in %)

Category	Number of Samples		Net-Cropped Area		Gross Cropped Area		Cropping Intensity (%)	
	Beneficiary Farmers	Non-Beneficiary Farmers	Beneficiary Farmers	Non-Beneficiary Farmers	Beneficiary Farmers	Non-Beneficiary Farmers	Beneficiary Farmers	Non-Beneficiary Farmers
Proper Agricultural Services	45	17	1.89	1.20	3.08	1.87	163	155
Allied Agricultural Services	40	20	0	0	0	0	0	0
Both Agricultural & Other Services	15	13	1.24	1.32	2.01	2.02	162	153
Total	100	50	1.04	0.75	1.69	1.16	163	154

Note 1: Net Cultivated area includes area under agricultural crops, dairy, fishery, poultry etc. **Note 2:** Other Services include Dairy, Poultry and Fishery
Source: AERC, Assam.

Figure 4: Comparison of Net Cropped Gross Cropped Area and Cropping Intensity of Beneficiary and Non-beneficiary Farmers

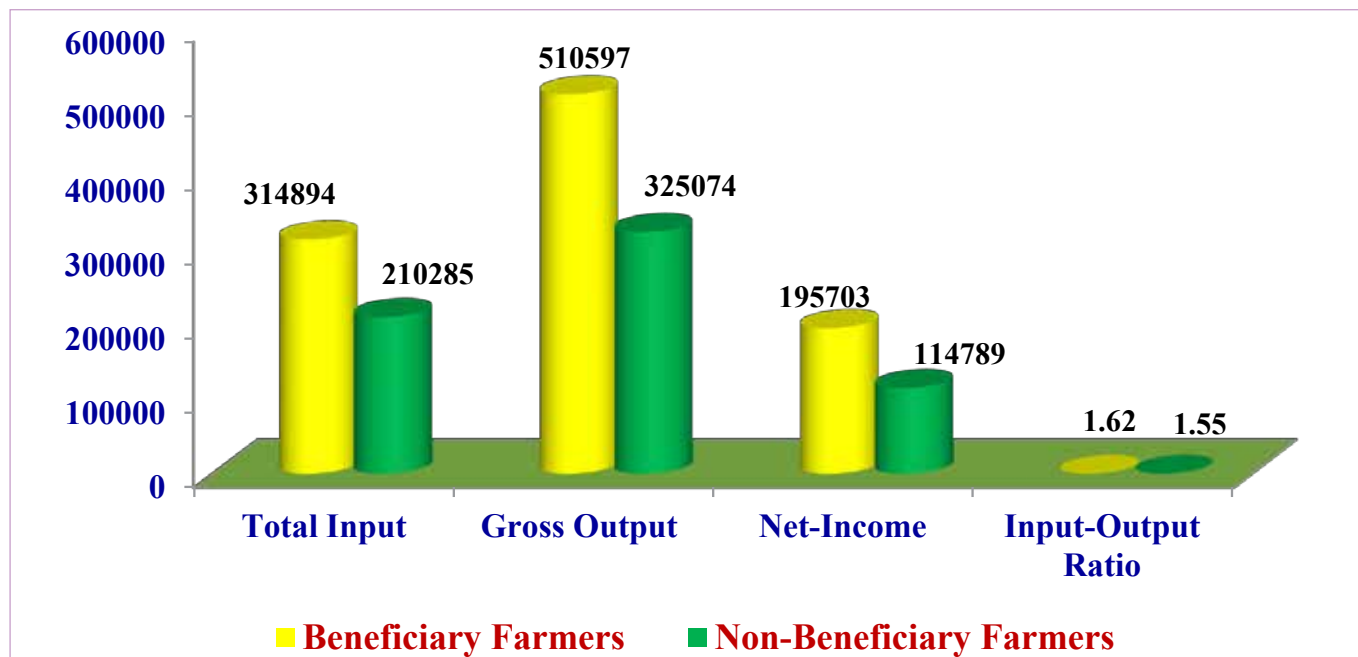


Source: AERC, Assam.

- ACABC scheme had positive impact on different activities for all the categories of services, viz., proper agriculture and allied agriculture. The overall average total input costs per farm in case of beneficiary farmers was found at Rs. 3,14,894 against Rs. 2,10,285 per farm in case of non-beneficiary farmers. Accordingly, the gross output per farm was also higher, Rs. 5,10,597 in case of beneficiaries against Rs. 3,25,074 per farm for non-beneficiary

farmers. The net income per farm was estimated at Rs. 1,95,703 in case of beneficiary farmers and Rs. 1,14,789 per farm in case of non-beneficiaries. Thus, the overall average input-output ratio was estimated at 1:1.62 in case of beneficiaries and 1:1.55 in case of non-beneficiary farmers. Category-wise input-output ratio were also found higher in case of beneficiaries for all the three categories (Figure 5).

Figure 5: Comparison of Input, Output, Net Income and BCR of Beneficiary and Non-beneficiary Farmers (Rupees Per Farm)



Source: AERC, Assam.

- Although the ACABC Scheme has become popular in many parts of the country, it is yet to make significant headway in the state of Assam. It was found that the farmers in the remote areas were not fully aware of the ACABC scheme, there was a lack of proper extension network to educate the farmers

on different components such as dairy, poultry, fishery enterprise, there was a lack of own money to start business, fear of business failure was prevalent, there was inadequate mechanism to ascertain the exact needs of farmers in the field.

Figure 6: Poultry and dairy activities of agripreneurs.



Source: AERC, Assam.

- Further, it was found that the Primary Agricultural Credit Societies (PACS) hesitated to issue No Objection Certificate (NOC) to the agripreneurs for obtaining license for selling fertilizers, banks were unwilling to extend credit facilities, recurring expenditure in some activities such as poultry, agri-business and dairy were quite high and were considered as limiting factors in managing the business units, the profit margins were low and vulnerable to fluctuations in prices.

Recommendations

- Long-term viability and sustainability of the agri-enterprises should be ensured. Banks should engage Business Facilitators (BF) and provide technical or advisory services for the identification of potential enterprises and prospective borrowers. Farmers should have easy access to credit at an affordable rate of interest, whenever necessary.
- Comprehensive livestock development policy

- should be adopted to encourage the farmers to go for livestock enterprises including dairy.
- Training programs should be conducted by the agripreneurs to educate and assist the farmers to avail the benefits of ACABC viz., advisory services, input support & custom hiring services etc.
- Since majority of farmers were not covered under the ACABC scheme, there should be adequate promotional measures taken to drive away the elements of dissatisfaction or disinterest, if any, from among the non-participating farmers.
- There is an urgent necessity of developing infrastructural facilities in the remote areas so that the agripreneurs can build up their ventures to reach the ones who have not been reached.
- The entire marketing system is required to be revamped so that each and every farmer can be an active player in the market for getting remunerative price for their produces.
- ACABC is an innovative scheme which gives an opportunity to the agricultural graduates to become agripreneurs through entrepreneurship development training with matching financial support in order to supplement agricultural growth & extend broad-based extension services to the peasant community. The performance of the scheme in the State of Assam, is not up to the mark, but there is ample scope of strengthening the same through vigorous campaign, continuous monitoring, fund-support and a robust networking with state extension machineries.

Scenario of Hill Agriculture: A Study of Malana Village in Kullu District of Himachal Pradesh

For further details contact:

Arvind Kalia, Anil Kumar, Sujan Singh, Nisha Devi, Vamika Darhel

Agro-Economic Research Center, Himachal Pradesh University, Shimla.

aerchpushimla@gmail.com; Phone: 0177-2830457

Introduction

- Agriculture in the Himalayan regions is based upon the traditional knowledge, but the linkages between traditional knowledge and development have not yet received significant recognition. The study area (i.e., village Malana) is concentrated at an elevation of nearly 260m, above the mean sea level in the remote mountainous region of northwest part of Kullu district of western Indian Himalayas.
- The landscape has undulating terrain, high peaks, steep slopes, narrow gorges, route and dense vegetation cover. Most of the mountain peaks and slopes are surrounded by ice. The landscape is characterized by the low density of population, small landholdings, poor infrastructure, traditional farming practices and dependency on natural resources and the rich diversity of biological and cultural heritage. The landscape is dominated by coniferous species, and herbaceous plants, including medicinal plants and other wild edibles. Farming and animal rearing are the main livelihood occupations. The agricultural

support land contributes a major share in the household economy. This support system mainly includes; pasture and forest lands, which are not cultivated for social and legal reasons.

- Present study examines the factors responsible for the changing agricultural scenario and subsequently attempts at finding out possible solutions for sustainable development of the village Malana. Both the primary and secondary data have been used for two agricultural years viz; 1990-91 and 2016-17. During 1990-91, there were 170 households and in 2016-17, the number has increased to 317 households.

Findings

- In Malana village, the average size of holdings during 1990-91 and 2016-17 was 0.85 hectares and 0.25 hectares respectively, which shows a decreasing tendency. The main reason for the same is fragmentation of land due to an increase in population. The entire land owned by the inhabitants of Malana was under self-cultivation during the study period. There has been no report of crop sharing.
- The entire agricultural land is monsoon-dependent. The area has plenty of natural perennial water channels but it was found that the farmers did not use the natural resources for crop cultivation.

Figure 7: Status of traditional crops in Malana; Cultivation of cannabis on arable land



Source: AERC, Shimla.

- In 1990-91, pulses, vegetables and medicinal crops were introduced for cultivation. During 2016-17 Rabi season, the area under traditional crops such as small millets declined and was shifted towards wheat and barley, and in Kharif season towards maize, pulses and vegetables.
- There has been an increase in crop diversification from traditional crops to a number of new crops and as a result an increase in area under cultivation. The supply of staple food grains through Public Distribution System (PDS), increase in per capita income, availability of superior grains in open market and low productivity of traditional crops were the reasons for this shift in cropping pattern away from traditional crops. Therefore, the cultivation of traditional crops was limited to self-consumption.
- The value of Herfindahl-Hirschman Index (Diversification Index) in 1990-91 was 0.3464, which slightly increased to 0.3694 in 2016-17. It means that the extent of crop diversification was comparatively high in 1990-91 as compared to 2016-17.
- During the period 1990-91 to 2016-17, a tremendous growth (nearly 86 percent) in livestock wealth has been observed. This major growth is attributed to sheep and goats which increased from 5,231 to 24,886 during 1990-91 and 2016-17 respectively. Number of horses and ponies increased from 13 to 72 for transportation purposes.
- It is interesting to note that production of meat and mutton has increased from 28 kgs in 1990-91 to 74 kgs in 2016-17. This is due to the increase in the number of sheep and goats. Further, wool production and simultaneously quantity of dung has also increased from 26 kgs and 20 quintals to 48 kgs and 120 quintals respectively during 1990-91 to 2016-17.
- The major returns from livestock include sales mainly of sheep and goats, which gives an annual income of Rs. 22,143 on an average farm. The gross returns from livestock tending during the last decades have shown a tremendous growth from Rs. 7,457 in 1990-91 to Rs. 71,419 in 2016-17. The imputed value of milk has shown an increase of Rs. 2,671 during the given time frame. The value of wool produced has also increased from Rs. 910 to Rs. 18,269 during the same period. Out of total gross income, meat and mutton products accounted for the largest share (37.74 percent) followed by the animal sales, wool, milk and milk products.
- In 2016-17 an average family was reported to be getting 36.33 quintals of wild grass, 21.45 quintals of tree leaves, 63.81 quintals of fuel wood and 18.72 quintals of timber, per annum. On an average 22.93 kgs of low cost wild vegetables were also received by the village inhabitants in addition to the 2.15 kgs of honey (a high value food item per annum). An average family is estimated to be getting 78.02 kgs of different kinds of medicinal herbs annually.
- Almost all the inhabitants are getting a lot of money by collecting the banned herb cannabis (*bhang*) from public support lands annually. It was not possible to collect quantitative information on cannabis (*bhang*) grown extensively in Malana territory. In addition to the above, the village inhabitants are also cultivating cannabis on their arable land. In 2016-17 on an average farm, the annual net returns were estimated to be Rs. 3,35,764 and in 1990-91 these were Rs. 2,124.

Recommendations

- Economic viability and sustainability of crop production, animal husbandry and support land should be maintained.
- New and improved high value crops and varieties of pulses and vegetables, disease free high quality seeds of traditional vegetables must be introduced. Further, fruit crops like almond, walnut, cherry, hop, wild grape and other high hills wet zone fruits must also be introduced.
- Provisions should be made for the dissemination of appropriate technical know-how about the

improvement in productivity of the existing crops.

- New and improved breeds of sheep, goats and particularly local cows must be introduced. There should be a provision for veterinary services at the village level and adoption of better feeding management should be taken care of.
- Cultivation of herbs and other high value low volume

crops on commercial scale, like *Dori ghash*, *Kooth* and *Kalazira (Black Cumin)* should be promoted. Further, use of various minor forest products on the sustainable basis should be promoted as well.

- Improvement in productivity of private support land and there should be provisions of legalization of extraction of banned support land products on scientific terms.



CENTRE FOR MANAGEMENT IN AGRICULTURE (CMA)
Indian Institute of Management Ahmedabad (IIMA)
Vastrapur, Ahmedabad, Gujarat 380015

e-mail: cma@iima.ac.in | **Phone:** +91-79-6632-4650, 6632-4651 | **Fax:** +91-79-6632-4652
Web: www.iima.ac.in