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Contents

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

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Enhancing Rice Productivity and Food Security through System of Rice Intensification (SRI) in India

For further details contact:

Poornima Varma
Centre for Management in Agriculture (CMA),
IIM Ahmedabad
poornimav@iima.ac.in; Phone: +91-79-6632-4818

Introduction

- As the second largest producer and consumer, India plays an important role in the global rice economy. However, rice cultivation in India in the recent times has suffered due to several inter-related problems. Increased yields achieved during the green revolution period through input-intensive methods of high water and fertilizer use in well-endowed regions are showing signs of stagnation and concomitant environmental problems due to salinization and waterlogging of fields. Water resources are also limited and water for irrigation must contend with increasing industrial and urban needs. As a consequence of all these, rice farmers experienced a downturn in productivity growth. The average productivity of rice in India at present, is 2.2 tons/ha, which is far below the global average of 2.7 tons/ha. Since there is not much scope of increasing the area of rice cultivation, the additional production has to come from less land, less water and less of other inputs. The new intensification methods for rice cultivation are known as low-external input sustainable agriculture, organic farming, ecological farming, intermittent irrigation, alternate wetting and drying, aerobic rice cultivation etc. The System of Rice Intensification (SRI) shares one or more of the aspects of these methods of rice cultivation. The major objectives of the study are as follows:

  - To understand the need for sustainable rice farming practices in general and the SRI in particular.
  - To make a detailed analysis of the factors affecting the adoption of SRI among the selected rice-producing states of India.
  - To analyze the impact of SRI adoption on rice yield and the household income.
  - To understand the impact of government's National Food Security Mission (NFSM) on the promotion of SRI.
  - SRI is expected to be environment friendly, yield enhancing and reducing water and other input requirements substantially by changing the management of plants, soil, water and nutrients. The technical components of SRI are typically summarized as follows:
    1. Transplanting of young seedlings
    2. Shallow planting of seedlings
    3. Single seedling at wider spacing
    4. Weeding by mechanical weeder
    5. Use of organics
    6. Efficient water management: Alternate wetting and drying

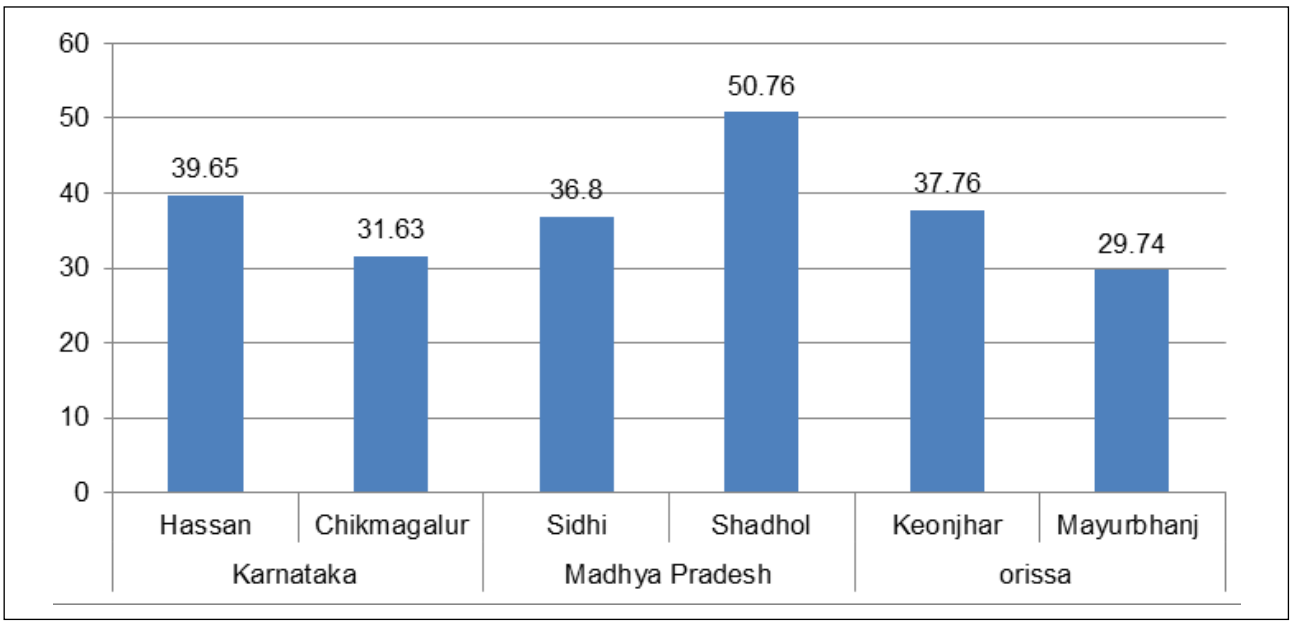
Methods and Coverage

- Three major rice-producing states – Karnataka, Madhya Pradesh and Orissa were identified for the purpose of analysis. For the purpose of further identification of the districts, the study made use of three criteria, viz., agro-climatic zones, SRI districts and SRI-NFSM districts. Thus, 2 districts from each state that belong to the same agro-climatic zones were identified. Selection of the districts in each state belonging to same agro-climatic zones was done after ensuring that one is with SRI practice and the other is with SRI incorporated under NFSM. For Karnataka, Hassan (SRI-NFSM) and Chikmagalur (SRI) districts were identified. Similarly for Orissa, Keonjhar (SRI-NFSM) and Mayurbhanj (SRI) districts were identified and for Madhya Pradesh, Sidhi (SRI) and Shahdol (SRI-NFSM) districts were selected.
- The study was based on primary data collected through a comprehensive household survey in the year 2015. The farmers were selected through a stratified random sampling technique. The sample ensured the representation of almost all the available SRI farmers from the study region and equal number of non-adopters of SRI. The survey was conducted through questionnaire, covering details of household characteristics, wealth and farm characteristics, institutional and access related variables, risk and economic factors. The total number of farm households interviewed was 386, of which 193 households were SRI adopters. Appropriate econometric techniques were employed to analyze the research questions.

Findings

- The intensity of SRI adoption was the highest in Shahdol district of Madhya Pradesh which shows that 50.76 percentage share of total land under rice has been allocated to SRI. This was followed by Hassan district of Karnataka which devoted around 40 percent of the total land under rice for SRI. The huge disparities in the level of adoption were observed in Madhya Pradesh: Shahdol had 50.76 percent while Sidhi had only 36.8 percent. The lowest adoption was noted in Mayurbhanj district of Orissa. In Mayurbhanj, the acres devoted for SRI in total land was only 30 percent. Therefore, the percentage share of area under SRI in total land under rice is the highest in Madhya Pradesh and the lowest in Orissa. The disparities in the level of adoption were the lowest in Karnataka (Figure 1).

Figure 1: Intensity of SRI adoption (% share of area under SRI in total rice)



Source: Survey data

- Planting young seedlings was the highest in Chikmagalur followed by Mayurbhanj and Hassan. Shallow planting was the highest in Shahdol followed by Keonjhar, Sidhi and Mayurbhanj. Single seedling practices were the highest in Keonjhar, followed by Shahdol and Mayurbhanj. Practices of wider spacing were the highest in Hassan, followed by Chikmagalur. Use of organics was the highest in Hassan. Use of cono-weeder was the highest in Chikmagalur, followed by Hassan. Use of cono-weeder was the lowest in Sidhi. Alternate wetting and drying was the highest in Shahdol and the lowest in Sidhi (Table 1).

Table 1: Adoption of SRI practices by farmers (in %)

Package	Hassan	Chikmagalur	Sidhi	Shahdol	Keonjhar	Mayurbhanj
Young seedling	95	100	37.5	83.33	79.59	97.56
Shallow planting	80	76.19	96.88	100	97.96	95.12
Seedling	20	23.81	75	83.33	85.71	70.73
Wider spacing	100	90.48	65.63	66.67	81.63	65.85
Use of organics	100	57.14	65.63	23.33	6.12	7.32
Use of cono-weeder	95	100	6.25	63.33	67.35	46.34
Alternate wetting and drying	55	38.1	28.13	93.33	67.35	48.78

Source: *Survey data*

- The descriptive analysis showed that adopters of SRI received higher average yield as compared to non-adopters. The average rice yield for adopters of SRI was 3.43 quintal per acre whereas for non-adopters the average yield was only 2.7 quintal per acre (Table 2). Similarly, the average income for adopters was 80 thousand whereas for non-adopters the average income was only 75 thousand. The data further shows that the average cost of cultivation was lower for adopters than non-adopters. The average cost of cultivation for adopters was only Rs.4257 per acre whereas for non-adopters it was around Rs.7697 per acre (Table 2).

Table 2: Descriptive statistics for economics of SRI adoption

Variable	Adopters	Non-Adopters
Average Yield (Quintal per Acre)	3.43 (1.09)	2.7 (0.89)
Average Income (in Lakhs Rupees)	0.80 (0.29)	0.75 (0.28)
Average Cost of Cultivation (in Rupees per acre)	4257.04 (3723.6)	7696.95 (9079.8)
Total Observations	193	193

Note: Standard deviation is given in parentheses.

Source: Survey data.

- While the average yield among adopters was the highest in Karnataka–4.14 quintal per acre, it was the lowest in Madhya Pradesh–2.99 quintal per hectare (Table 3).
- The average income among the adopters was higher than non-adopters in all the states. In Karnataka, the average income among the adopters was around Rs.1.11 lakhs–the highest, whereas among the non-adopters the average income was around Rs. 1.07 lakhs. (Table 3).
- Average cost of rice cultivation was lower for adopters of SRI in all states. The average cost of cultivation among the adopters of SRI in Karnataka, Madhya Pradesh and Orissa was Rs. 4390 per acre, Rs. 4285 per acre and Rs. 4177 per acre respectively. Among the non-adopters the cost was the highest in Madhya Pradesh. In Madhya Pradesh per acre cost of cultivation for rice was Rs. 9091. Therefore, the difference in cost of cultivation between the adopters and non-adopters were also the highest in Madhya Pradesh. The difference was the lowest in Karnataka (Table 3).

Table 3: Descriptive statistics for economics of SRI adoption (State-wise)

Districts	SRI Adoption Status	Average Yield (Quintal per acre)	Average Income (In Lakhs Rupees)	Average Cost of Cultivation (in Rupees per acre)
Karnataka	Adopters	4.14(.72)	1.11(.37)	4390.8(2991.03)
	Non Adopters	3.60(.74)	1.07(.39)	6709.3(5937.3)
Madhya Pradesh	Adopters	2.99(1.05)	.76(.19)	4284.9(3486.5)
	Non Adopters	2.00(.56)	.68(.15)	9090.7(8534.5)
Orissa	Adopters	3.40(1.10)	.68(.18)	4176.8(4188.5)
	Non Adopters	2.77(.73)	.66(.18)	7186.8(10489.2)

Note: Standard deviation is given in parentheses.

Source: Survey data.

Conclusions and Recommendations:

Importance of effective information and extension services

- Even when around 90 percent of the sample farmers knew about SRI, the adoption of SRI took place only among the farmers who had received information and proper guidance from sources such as agricultural departments and NGOs. The analysis showed that the attempts to enhance SRI practices through Government of India's National Food Security Mission (NFSM) did not yield desired results as the variable for NFSM was statistically insignificant. The results pointed out the lacuna in government intervention in disseminating the awareness and the merits of SRI among farmers. SRI adoption seemed to always require direct contact with extension personnel (either government or NGO field officers), which means that wider adoption through farmer-to-farmer exchange of information/learning is unlikely to happen. This is one reason why many of these technologies are not widely adopted in the small farm sector.

Importance of irrigation and Government support to reduce the cost of cultivation

- Certain components of SRI such as intermittent irrigation, although perceived to be water saving, require proper crop management and irrigation availability. Therefore, investments in upgrading of irrigation scheme could encourage wider adoption of SRI.
- Greater government support to reduce cost of certain SRI components and skill oriented training to agricultural laborers.
- The adoption of SRI had a positive impact on yield. The impact on farm income was mixed due to high cost of some of the components of SRI. Therefore, government intervention can help in reducing the cost. For example, supply of mechanical weeders can ensure more efficient weeding and thereby full realization of the benefits. Similarly, skill oriented training to agricultural laborers can also help in reducing the transaction costs involved in the adoption of SRI practices.

Importance of strengthening local collective institutions

- The positive impact of membership in farmer organizations, input supply cooperatives etc., indicate that there should be higher focus on establishing and strengthening local collective institutions.

Protected Cultivation of Horticulture Crops in Himachal Pradesh

For further details contact:

Meenakshi Sharma
N. K. Sharma
Agro-Economic Research Centre, Himachal Pradesh University, Shimla
aerchpushimla@gmail.com; Phone: 0177-2830457

Introduction

- A shift towards modern technologies of crop production like protected cultivation (such as poly-houses) has become necessary in the wake of climate change, decreasing land holdings, increasing population, increasing pressure on natural resources and a high demand of quality horticultural fresh produce.
- Protected cultivation is a unique and specialized form of agriculture which protects plants from the adverse climatic conditions by providing optimum conditions of light, temperature, humidity, CO_2 and air circulation for the best growth of plants to achieve maximum yield and best quality. Protected cultivation improves the productivity, profitability and sustainability of crops. With the coordinated efforts of the central and state governments, this cultivation is gaining popularity in India. At present, area of around twenty-five thousand hectares is under this cultivation in the country. In the present day context, a good number of different type of structures are built for protected cultivation such as; polythene covered green-houses (poly-houses), shade-net houses, plastic tunnels, plastic mulching etc. Among these protective cultivation techniques, green house/poly house is useful for the hill zones.
- Agriculture is the main occupation of the people in Himachal Pradesh. At present, 89.96 percent population lives in rural areas. However, most of the farmers have small landholding on hill slopes, and need to augment their income. The average holding size is about 1 hectare. Out of total land holdings, 87.95 percent area is of small and marginal farmers. Moreover, it is difficult to grow anything outdoors in the harsh Himalayan winter. Therefore, the government is now promoting protected cultivation which makes small holdings more viable by producing more high value crops like vegetables and flowers from limited land with the adoption of all-weather technology. The Government is motivating farmers to adopt poly-house farming by offering subsidies for the construction of poly-houses and also promoting the centrally sponsored schemes, like MIDH (Mission for Integrated Development of Horticulture) which was launched for the holistic development of horticulture in the country during the 12th Plan.

Findings

- The area under poly-houses has been increasing continuously in the state. As per latest figures provided by the Directorate of Horticulture, the area under green/poly-houses was 140 hectares with a total financial outlay of Rs. 5271.94 lakhs under HMNEH (Horticulture Mission for North East & Himalayan States)/MIDH. An area of 6.71 hectares was brought under poly-houses under Macro Management Scheme. As such, the total area of poly-houses in the state stands at 154.62 hectares.
- Overall, average net return from cultivation of **carnation** was Rs. 1,467,278 per poly-house, whereas category-wise net returns were Rs. 323,830, Rs. 1,124,394 and Rs. 2,602,367 for small (about 250 sq. mtr.), medium (about 500 sq. mtr.) and large (about 1000 sq. mtr.) poly-houses respectively.
- On an average total production of carnations was 460 boxes per poly-house in a year. The cost per box was Rs. 2210 and its value in the market was Rs. 5400 resulting in net returns of Rs. 3190 per box at overall level. The net returns per box were Rs. 2865 for small, Rs. 3176 for medium and Rs. 3229 of large poly-house farmers.
- In case of **rose**, average net return was Rs. 1,612,012 per poly-house. However, net returns were Rs. 363,307, Rs. 1,254,842 and Rs. 2,871,538 for small, medium and large poly-houses respectively.
- On an average total production of rose was 464 boxes per poly-house in a year. The cost per box was Rs. 2346 and its value in the market was Rs. 5850 resulting in net return of Rs. 3474 per box at overall level. The net returns per box were Rs. 3186 for small, Rs. 3495 for medium and Rs. 3540 for large poly-house farmers.
- In carnation, on an average, marketing cost per 100 spikes, incurred by producers was Rs. 212.85 which was 19.5 percent of the consumer's price of Rs. 1090 per 100 spikes. The net price received by the producer in marketing of carnation, in Delhi market, was Rs. 387 per 100 spikes which was 35.50 percent of consumer price.
- The costs paid in marketing of carnation by the farmers, wholesalers, *mashakhors* (sub-wholesalers) and retailers were 19.53 percent, 1.65 percent, 1.28 percent and 8.8 percent respectively and thus total marketing cost of intermediaries was Rs. 128 i.e., 11.74 percent of the consumer paid price. The total margins were 33.21 percent of the consumer price.
- In case of rose, on an average, marketing cost per 100 spikes, incurred by producers was Rs. 298 which was 19.26 percent of the consumer price of Rs. 1184 per 100 spikes. The share of producer in consumers' rupee was 35.64 percent and net price received by the producer in marketing of rose, in Delhi market, was Rs. 422 per 100 spikes.

- For rose, the costs paid by the farmers, wholesalers, *mashakhors* (sub-wholesaler) and retailers were 19.25 percent, 1.77 percent, 1.26 percent and 8.95 percent respectively and thus total marketing cost of intermediaries was Rs. 142 i.e., about 12 percent of consumer paid price. The total margins were 33.10 percent of the consumer price.
- On an average, the net return from **capsicum** cultivation was Rs. 149,686 per poly-house, whereas category wise net returns were Rs. 69,205, Rs. 117,623 and Rs. 235,839 for small, medium and large poly-house farmers respectively.
- In the case of **tomato** cultivation, net returns were Rs. 101,196, Rs. 194,072 and Rs. 347,928 for small, medium and large poly-house farmers respectively. At overall level, net return from cultivation of tomato was Rs. 227,142 per poly-house.
- On an average, the total production of capsicum and tomato was 402 and 566 boxes per poly-house in a year having cost per box Rs. 194 and Rs. 185 respectively. Their value in the market was Rs. 574 and Rs. 592 per box resulting in net returns of Rs. 260 and Rs. 407 per box. Out of total marketed surplus of 389 boxes of capsicum, 345 boxes i.e., 88.69 percent were marketed in Chandigarh market and rest 44 boxes i.e. 11.31 percent in the local markets. In the case of tomato, out of total marketed produce of 552 boxes, 496 boxes i.e., 90 percent were marketed in Chandigarh market and rest 56 boxes i.e., 10 percent in the local market.
- On an average the cost of marketing borne by the growers for selling capsicum worked out to be Rs. 333 per quintal which was 8.46 percent of the consumer's price of Rs. 3935 per quintal. For tomato, on an average, marketing cost per quintal borne by the growers was Rs. 320 which was 9.12 percent of consumers' price of Rs. 3508 per quintal.
- The net price received by capsicum producers was Rs. 2545 per quintal which was about 65 percent of consumer price in Chandigarh market whereas in the marketing of tomato the share of producer in consumers' rupee was 58.44 percent and the net price received by tomato producers was Rs. 2050 per quintal
- The gross price received by the grower was Rs. 28.73 per quintal in case of capsicum which was 73 percent of consumer's price. The costs paid by the farmers, wholesalers, *mashakhors* and retailers were 8.46 percent, 1.27 percent, 0.64 percent and 6.20 percent respectively and thus the total cost of marketing of intermediaries was Rs. 2319 i.e., 8.11 percent of the consumer paid price. The total margins were 18.9 percent of the consumer price.
- In the case of tomato, the costs paid by the farmers, wholesalers, *mashakhors* and retailers were 9.12 percent, 1.36 percent, 0.71 percent and 8.75 percent respectively and thus total marketing cost of intermediaries was Rs. 387 i.e., 11.03 percent of the consumer price. The total margins were 21.41 percent of the consumer price.
- The pre-harvest losses in carnation range from 0.36 percent on large poly-houses to 3.33 percent on small ones. Similarly in rose, these losses were the maximum–4.09 percent on small farms and minimum on large farms–0.48 percent. Overall these losses were 0.42 percent and 0.84 percent in carnation and rose respectively. In case of capsicum and tomato pre-harvest losses were the highest i.e., 1.76 percent and 1.25 percent respectively on small farms and lowest 0.62 percent and 0.56 percent on large farms. Overall, these losses were 0.72 percent and 0.34 percent in capsicum and tomato respectively.
- At post-harvest stages, the highest losses were during transportation in all the selected crops and farms except on large farms where these were highest at the time of grading and packing. Overall, at post-harvest stages, transportation losses were 0.42 percent, 0.21 percent, 0.48 percent and 0.34 percent in carnation, rose, capsicum and tomato respectively.
- Although the poly-house farming was found to be profitable regarding income and employment generation, the activity is not free from problems. In most of the cases construction of the poly-house was delayed due to the long and cumbersome clearance procedure adopted by various departments for sanctioning poly-house and clearance of loan & subsidy. The construction was further delayed by the contractor. Delay in technology transfer was another reason due to which the poly-house could not become operational well in time.
- Once a poly-house became operational, unavailability of inputs, higher prices or poor quality of inputs were the problems faced by farmers. Lack of knowledge of most appropriate sowing time and cultural practices i.e., raising nursery and crops was another major problem. The poly-house growers also faced the problems related to harvesting, packing/processing, storage, marketing etc.
- It can be concluded that overall in poly-house cultivation, the input-output ratio was 1:2.44, 1:2.48, 1:3.11 and 1:2.85 in case of carnation, rose, tomato and capsicum respectively making the venture profitable as most of the farmers have already recovered the cost of construction of a poly-house. Cultivation of these crops in a poly-house of large category was found to be highly feasible as reflected in higher values of NPV (Net Present Value) (Rs. 3,040,661), BCR (Benefit-Cost Ratio) (1.86) and IRR (Internal Rate of Return) (71 percent) with payback period of two years. The investment in other two categories of poly-houses was also found to be economically sound and quite remunerative.
- Though the horticulture department was the main source of authentic and detailed information about the poly-houses, the friends & relatives, awareness camps and mass media also inspired the farmers to set up poly-houses. There were not many deviations from the approved design of the poly-houses.

Conclusions and Recommendations

- The growing of flowers and vegetables inside a poly-house in Himachal Pradesh has improved the quality of life of the growers by improving income and employment. However, the profitability of these crops still can be improved by taking the following steps:
- Low cost technologies, required on small holdings, should be developed. There is a strong need for developing the required minimum infrastructure in major production zones to be used by growers on community/cooperative basis.
- Keeping in view the perishable nature of vegetables, and variations in market prices, adequate storage facilities should be developed. Emphasis should be given to expand the market and develop infrastructure by improving packing and transportation facilities.
- Arrangements should be made to provide latest information regarding prices and arrivals of the vegetables in the markets.
- In the present marketing system of flowers and vegetables, most of the benefits are reaped by the middlemen. An attempt should be made to strengthen the marketing system by organizing cooperative societies, particularly for small growers. This will help in minimizing the margin of the intermediaries and will ultimately ensure better producers' share in consumer's rupee.
- The cropping practices are significantly different in poly-houses than that of in growing crops or vegetables outside the poly-house. Poly-house farming requires skill monitoring and care. Before poly-houses become operational, the growers should be given proper training related to cultural practices i.e., raising nursery and crops, intensity of irrigation, most appropriate sowing and harvesting time.
- The poly-houses in Himachal Pradesh are prone to damage by heavy rain and storms. As such, farmers found difficult to reconstruct these poly-houses due to the lack of funds. Hence, poly-houses should be insured at the time of construction.

Figure 2: Protected cultivation of Rose and Tomato.

Source: *www.agrifarming.in/rose-farming-information, www.agrifarming.in/tomato-cultivation*

Revival of Fallow Land in Madhya Pradesh

For further details contact:

H. O. Sharma
Deepak Rathi
Ravi Singh Chouhan
Agro-Economic Research Centre - JNKVV, Jabalpur, Madhya Pradesh
aerc_jbp@yahoo.co.in; Phone: 0761-2680315

Introduction

- Land occupies a pre-dominant position among all the resources required for development of the agricultural sector. Like any other resource, land has two dimensions – quality and quantity and both of these crucial aspects are under serious threat due to the intensive and extensive use of land, both for agricultural and non-agricultural purposes. The competition between agricultural and non-agricultural sectors for land is resulting in an increasing pressure on land for food production on one hand and housing, industrial expansion, creation of infrastructural facilities etc., on the other.
- Lands without utilization for productive agricultural activities could be categorized as fallow lands. It is imperative to understand the dynamics of fallow land in land use parameters of Madhya Pradesh and its revival. This would help us in understanding the ways in which fallow land can be utilized for cultivation and thereby, leading to an increase in the level of income of the farmers.
- This would further guarantee food security at household level which can help doubling income of the farmers. Fallow land area can be allocated to the crops where the demand is high and import dependency is relatively higher. Further, more employment opportunities are likely to be created in the rural areas.

Findings and Conclusions

- District wise time series secondary data for the period 2001-2015 were considered for the study. The state of Madhya Pradesh was subdivided into two heads i.e., major and other fallow land districts for the study. Balaghat, Shahdol, Mandla, Dindori, Umariya, Rewa, Satna, Seoni, Katni, Sidhi, Chhattarpur, Tikamgarh, Betul and Chhindwara were considered under major fallow land districts.

- In the first stage, districts were selected on the basis of percentage share of fallow land in recent five years (2010-15) in the districts, to the total geographical area.
- One district with the highest (Mandla) and the other with the lowest percentage of fallow land (Bhopal) were identified.
- A list of all the farmers who had left land fallow during the reference year was prepared and 15 farmers were selected for the study, considering the total land left fallow by these farmers should at least become 15 hectares. Thus, the study comprises of 120 sample households of 8 villages, 4 blocks and two districts (Mandla and Bhopal) of Madhya Pradesh.
- Area under barren land, uncultivated land, permanent pastures, land under miscellaneous tree crops, groves and cultivable waste, recorded significant negative growth but there was a substantial growth in the current fallow, which was the consequence of year to year rainfall variations. There was an inverse relationship between rainfall and current fallow. It was also found that there was a sharp increase in the land put into non-agricultural uses due to increasing rate of urbanization and industrialization.
- With the result of significant reduction of area under barren and uncultivated land, permanent pastures (-12.61 thousand ha/year), cultivated waste land (-14.61 thousand ha/year), fallow lands other than current fallow (-8.97 thousand ha/year) and current fallow lands (-27.55 thousand ha/year), the area under forest, non-agricultural uses, and net area sown was found to be increased at highly significant rate with the magnitude of 1.51, 21.16, 45.34 thousand ha/year respectively.
- In the other districts of Madhya Pradesh the area under non-agricultural uses was found to have been increased at a highly significant rate.
- It was found that not even in a single district, the area under forest had significantly fallen. At the same time, there was a significant increase in area under non-agricultural uses in almost all the districts of the state. The area under barren and uncultivated land was also found to be increased.
- A significant increase in area under permanent pasture and other grazing land was found only in Betul district, while the same was found to be decreased significantly in Balaghat, Dindori, Umaria, Seoni, Katni and other fallow land districts.
- The area under miscellaneous tree crops & groves (not included in net area sown) was found to be increased significantly in Balaghat, Shahdol and Dindori, while decreased significantly in Umaria, Rewa, Satna, Katni and Tikamgarh districts. The area under cultivable waste land was found to be increased significantly in Dindori, Umaria and Chhindwara districts, while significant decrease was observed in Balaghat, Seoni, Chhatarpur, Betul along with major and other fallow land districts of MP.
- Area under fallow land other than current fallow and current fallow was not found to have been increased even in a single district of the state, but was found to have been decreased significantly in Mandla, Seoni, Chhatarpur and Chhindwara including major and other fallow land districts.
- The Net Area Sown (NAS) and area under non-agricultural uses was found to be increased significantly in Mandla, Balaghat, Seoni, Katni, and Chhatarpur. Apart from this the NAS was found to be increased significantly in Tikamgarh, Betul and Chhindwara districts, while significant increase in area under non-agricultural uses was noticed in Shahdol, Dindori, Umaria, Rewa and Satna districts of MP.
- Net irrigated area played a significant role to reduce fallow land as the study revealed that with 1 percent increase in net area irrigated to net area sown resulted in a decrease in share of total fallow land to total net sown area by 0.27 percent.
- Mandla district, where proportionate area under fallow land was more as compared to Bhopal differs with respect to average size of holdings. Annual income per household and caste composition, show that Mandla was dominated by ST (76.6 percent) while OBC (64.70 percent) were more in Bhopal. The average size of holding per household was found to be more in Mandla (10.49 acres) as compared to Bhopal (7.32 acres), while the income was found to be low in Mandla (Rs. 66,658/year) as compared to Bhopal (Rs. 114,095/ year).
- An average farmer earned more income where the share of fallow land was found to be lower in the total land viz., Bhopal (Rs. 114,095/Farm) as compared to where the share of fallow land was found to be higher in the total land viz. Mandla (Rs. 66,658/Farm).
- As the size of farm increased, the area under leased in, leased out, irrigation, fallow land, food grains, fruits and vegetables was found to have been increased. However, the size of operational holding was found to be more in Mandla (7.22 acres) as compared to Bhopal (6.66 acres), while area under irrigation and food grains was found to be more in Bhopal (4.29 and 5.19 acres) as compared to Mandla (1.16 and 3.62 acres).
- At over-all level, the area under current fallow land (2.33 acres) was found to be more as compared to permanent fallow land (0.06 acres), which accounts to be 28.62 percent and 0.52 percent of the total operation holding. As the size of holding increases the area under fallow land also increases.
- On the basis of ranking by the respondents and coefficient of variance the reasons of land kept fallow were divided into most important, important and least important – The most important reason for leaving land fallow was lack of assured irrigation and uncertainty in rainfall.
- The important reasons were found to be land left for crop rotation, lack of expertise/experience in cultivation, low fertility of soil & lack of interest in

cultivation in unfavorable season, to conserve moisture & prepared land for next crops, not able to recover costs in farming/low profit, lack of plough/tractor/ Farm Yard Manure (FYM), high production cost/lack of resources, providing grazing lands for the cattle, weed infected, shocks in personal life (like accident or death of a member), lack of assured market for the produce, land being unsuitable for cultivation, high price volatility in the previous years, no access to credit, lack of watershed or similar efforts which could recharge ground water.

- The least important reasons were land set apart for conversion into non-agricultural purposes, issues related to land entitlement, shifts into other occupations which were more profitable, lack of agricultural extension, unavailability of labour for cultivation, surface run-off and water logging. At the farm level, increase in farm size; non-agricultural income and labour shortage have a positive impact on fallow land. The technological factors led to the under-utilization of land due to the resource crunch faced by the farmers on account of the capital intensive nature of modern inputs. The climatic and institutional factors were also affecting the land.

Recommendations

- Utmost care should be taken so that land suitable for cultivation will not be converted for the purpose of non-agricultural uses. Efforts should be made to divert barren & uncultivable lands which fall under the land capabilities classes V to VIII for industrial and real estate purposes. These calls for government attention to frame effective and feasible land use policy to protect cultivable land from its diversion to non-agricultural purposes.
- As increase in net irrigated area significantly reduces the area under fallow land, hence, emphasis should be given to bring more and more area under irrigation. Apart from this, systems of irrigation should be popularized amongst the farming community such as in situ moisture conservation, water management technologies, use of location-specific suitable crop varieties that require less water, must be used to increase the water use efficiency in a significant manner.
- Efforts should be made not only to introduce an effective, efficient local-specific integrated land use pattern but, its effective implementation should also be ensured. This is due to the fact that the land use pattern, cropping pattern, irrigation intensity, method and system of irrigation and features of various districts differed remarkably and reasons of leaving land fallow were not same across the selected districts.
- Finally, there is a need for scientific, creative and orderly management of land resources, facility and services with a view to securing the physical, economic and social efficiency, health and well-being of communities. There is need for an effective, efficient and integrated land use planning which inter-alia includes agriculture, industry, commerce, forests, mining, housing infrastructure, urban settlement and transportation facilities to resolve claims/counter-claims of these sectors.

Pressurized Irrigation Network Systems (PINS) in Gujarat

For further details contact:

Shrikant Kalamkar
Agro-Economic Research Center (AERC), Vallabh Vidyanagar, Gujarat
directoraercgujarat@gmail.com; Phone: 02692-230106

Introduction

- Water scarcity for agriculture has been growing year after year due to various reasons, for which the Government has been very keen to increase the water use efficiency, especially with its new slogan 'More Crop Per Drop'. Government envisaged promoting Micro Irrigation Systems (MIS) for increasing the area under water saving technologies. The Pressurized Irrigation Network System (PINS) is one such concept which was initiated in Gujarat during the period of developing the command area of Narmada by Sardar Sarovar Narmada Nigam Ltd (SSNNL). PINS is an innovative concept which facilitates all the basic requirements of MIS. It comprises of pipe network with controls, pumping installations, power supply, filtration, intake well/diggy. It is a common and shared infrastructure (by group of farmers) facilitating individual beneficiary for installing and operating MIS. The present study has assessed the extent of adoption and performance of PINS in Gujarat. The functioning of WUAs (Water User Associations) in PINS command area and the experiences of beneficiary farmers in the command area has also been examined. Data was collected from three selected districts, viz., Mehsana, Patan and Gandhinagar, covering 200 beneficiary and non-beneficiary households from canal and tubewell command areas.

Findings

- Gujarat has been one of the front runners in India in the promotion of PINS. On canal command, total 25 pilot projects were initiated in the state through SSNNL. In tubewell command areas, PINS were introduced by Gujarat Water Resources Development Corporation (GWRDC) in 10 districts of the state.
- Even though the state government followed a pro-active approach to increase the adoption of PINS by water users, the existing practices of farmers did not change much. The farmers did not want to change the cropping pattern which was highly water-sensitive. They did not want to spend anything on MIS since canal water was available to them at a very low rate. The rules and regulations which were enforced to check the illegal use of canal water/water theft were not strict. Unavailability of necessary power network, insufficient power availability and higher MIS cost estimates were some of the reasons.
- Looking at the unsatisfactory experience of Canal

PINS in the state, Under Ground Pipe Line (UGPL) was promoted. The major benefits of UGPL system are land saving and water saving, less implementation period, feasibility even in flood zone/undulating area, avoidance of land fragmentation, integration of field channels with the sub-minors and less operation and maintenance expenditure. Moreover, there are some issues in implementation of UGPL in sub-minors. Farmers were not willing to pay 10 percent of total installation cost as their contribution, which was later on reduced to 2.5 percent.

- The tubewell PINS has a wider coverage. About 95.3 percent of sample beneficiary farmers adopted drip whereas 10 percent of them adopted sprinkler in the state. Since sprinkler is less water saving MIS compared to drip system, it was not very popular in the state.
- Both water and energy savings are estimated to be higher in case of tubewell PINS with drip compared to tubewell with flood irrigation or surface with flood irrigation. Water savings by use of MIS with PINS is realized to the tune of 50-75 percent, whereas the energy savings by the same is realized to the tune of 25-76 percent. The percentage change in yield under drip over flood and change in yield under sprinkler over flood has been spectacular with respect to some crops like castor and cotton. From the study, it was found that the higher maintenance costs and energy costs have discouraged the farmers in its adoption to a further extent.
- Though, there were 25 Canal PINS implemented in Gujarat, none of them were found functional. The major benefits provided by the WUAs to its members were arrival of water in time, proper distribution of water among farmers, more information on how to use water judiciously, saving of water, electricity and labour cost, improved maintenance of the system and less conflicts around water. WUAs/TUAs (Tubewell Water Users Associations) also faced some constraints such as insufficient funds, unavailability of required quantity of water, unavailability of proper maintenance and repairing services and electricity problems etc.

Recommendations

- There was less adoption of canal PINS because the projects were located very close to minors and sub-minors from where farmers were able to get water at a very low cost. Thus, it is suggested to re-launch the canal PINS programme with required amendments by locating these projects at far off places where farmers are struggling to get irrigation water.
- There is a need for the revision of water rates, which currently are very low. Strict rules and regulations should be enforced to check the illegal use of canal water and theft of water.
- There is a need to discourage water-intensive cropping pattern, by encouraging suitable cropping patterns through some incentive structures.
- Majority of sample farmers were marginal with small land holdings that faced difficulties in securing bank loans. Measures should be taken to provide affordable credit facilities to small and marginal farmers.
- There is a need to regulate agencies supplying MIS to the farmers and adhering to standard norms on maintaining quality and providing proper and regular services for the repair of the PINS-MIS within reasonable time limits.
- Better quality drip systems should be provided and fencing subsidy should be provided to individual farmers, so that the irrigation systems are not damaged in case of an animal attack.
- Since UGPL infrastructure is used as PINS as well as for conventional irrigation, the new scheme has been well adopted by some farmers in Gujarat. However, due to poor maintenance of field channels, the nearby lands are affected by water-logging. Thus, it is suggested to arrange regular repairing and maintenance of minors and field channels, which are used by UGPL.
- Proper training and awareness programmes should be conducted to impart training to farmers on the need, importance and use of MIS with PINS and also to promote fertigation and chemigation.

Farmer Suicides in Telangana

For further details contact:

G. Gangadhara Rao
Agro-Economic Research Centre (AERC), Andhra University, Visakhapatnam, Andhra Pradesh
ggrao333@gmail.com; Phone: 0891-2755873

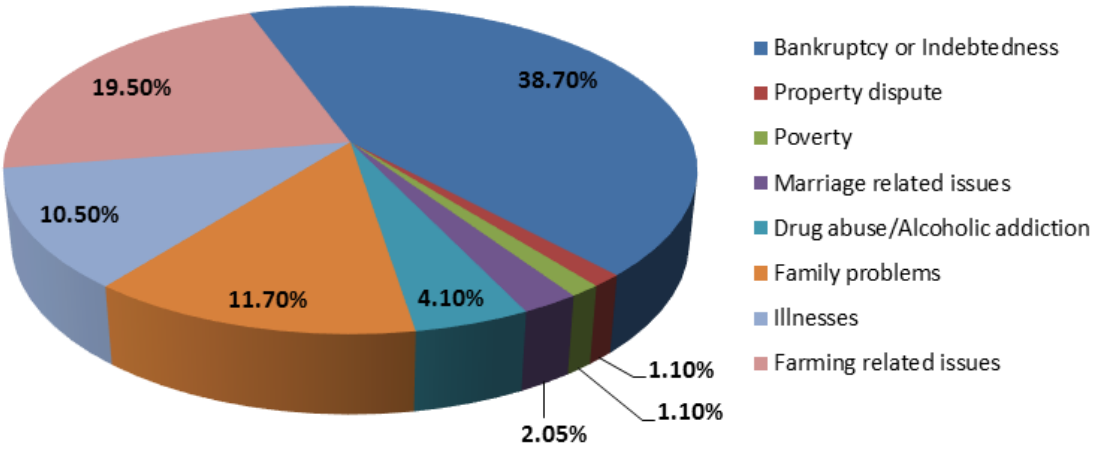
Introduction

- In the recent past, farmers have been facing many problems in farming like lack of investment, inability to secure decent prices for the produce, lack of funds for the purchase of proper inputs, lack of irrigation facilities and monsoon failure. Due to these reasons, more than 70 percent of the total farmers in the country (mostly marginal and small farmers) are in a debt trap, which has led to an increase in the number of farmers' suicides in the country.
- Telangana ranks second in the number of farmers' suicides. As per the report of 'Accidental Deaths and Suicides in India (ADSI), 2015, the number of farmers' suicides that took place in Telangana was 1358 in 2015 as against 898 in 2014, an increase of 51 percent, which was relatively higher than the all-India rise of 42 percent. In spite of a number of schemes and programmes implemented by the central and state governments to address the issue of farmers' suicides, the number has been rising at an alarming rate.

Findings

- According to the report of ADSI, 2015, the main reason behind farmers' suicide was bankruptcy or indebtedness of the farmers, followed by farming-related issues and family problems (Figure 3).

Figure 3: Percentage share of major causes of suicides among farmers in India during 2015



Source: National Crime Records Bureau

- Standing at the second position among the states, Telangana has the highest number of farmers' suicides in Warangal district followed by Nalgonda and Karimnagar. The higher incidence of suicides occurred in the months of September to December in a year across Telangana (2015).
- The sample households were found to have lower incomes with the sharing of income per household from agriculture, wage income and 'pensions and salaries' at 35 percent, 32 percent and 27 percent, respectively.
- The dependency on a borewell had led to a higher indebtedness of the farmers due to its failures. A dominance of cash crop, cotton in the cropping pattern of the sample households (majority of the OBCs) was noticed. Further, all the households were from marginal and small farmer landholding groups with more than 60 percent illiterates and with a planned family (3.28 members) in the study areas in Telangana.
- Non-institutional credit was found to be the dominant source of credit for the victim families. The outstanding amount on credit taken by farmers with marginal and small landholding sizes (2.24 acres per household) was 89 percent for non-institutional sources and 11 percent for institutional sources.
- The installment remittance took place at 18 percent of households, and out of these households, 16 percent of households remitted the installments as per the schedule to the non-institutional sources.
- Over 96 percent of the suicides in the present study area were due to farming related causes such as failure of crops & lack of access to irrigation.
- The 'natural calamities', and the 'failure of rainfall/ drought' were viewed 100 percent causative ones, and the failure of finding a borewell on the farm had led to heavy indebtedness of the marginal and small farmers. The 'Higher output' and the 'Higher prices' report 88 percent of the causative influence over the incidence of suicides.
- There was a higher influence of the 'family problems' followed by 'no earning member' and 'agricultural activities stopped' and the 'schooling of children stopped' reported at the lower level. The factors 'family member's depression' and family member's illness have appeared.
- The lifestyle of the peasants has changed due to several factors - financial conditions, availability of labour, prices and quality of inputs, volatile and exploitative markets against the backdrop of the augmented cost of cultivation.

Conclusions and Recommendations

- 'Commodity Supply Credit System' should be introduced, and it could be done based on the selling of commodity by the farmer to the purchasing body of the government. Number of commodities sold by a producer may be recorded, and payment of the amount of sold merchandise may be deposited in the farmer's bank account, where he could take a crop loan or a land development loan. To realize the level of cultivated area of a farmer, this would facilitate and authorize the bank to give loans to farmers including tenants, based on the cultivated area in the village.
- Extension of institutional credit could be done through the conversion of present Business Agents/ Correspondents to the Village Single Window Banking Employee to do all the institutional banking work of a village. There needs to be an extension of institutional credit without the consideration of collateral property of tenants and marginal and small farmers, rather with the examination of the extent of cultivated area under the farmer. The quantum of allotted credit to the marginal and small farmers could be fixed or sanctioned by the banks, based on the area cultivated in the village concerned.

- Mandal/block level Farm and Non-Farm Employment Development Cell should be started to extend employment in the allied activities of agriculture as well as non-agriculture. The Cell should finance and guide small and tiny ventures in the villages. It should be integrated with all the employment generating departments and agencies across the state and nation.
- Proper marketing system should be in place, especially for small and marginal farmers in every village. For example; currently cotton is purchased at the few agricultural market centers rather than at the village level by the Cotton Corporation of India (CCI). The harvesting season should be supported through the purchases of agricultural marketing committees. Otherwise, some other governmental body should be assigned this activity to make purchases at village level during the harvest season.
- Groundwater storage and the other environmental precautions should be taken care of by the government. For this purpose, a committee should be formed in Telangana for job creation for weaker sections of society at the village level with a proper allotment of funds from both state and central governments, as in the case of watersheds.
- Village Level Personal Counseling Centers could be very helpful to the villagers in general, and in particular for the farmers. With the support of some Non-Governmental Organisations (NGOs) like the Ramakrishna Mission, Mata Amruthananda Mai, Isha Foundation, etc., the 'Secular Personality Counselling Centres' may be started in rural Telangana.
- Other Measures: a) In the districts of a high incidence of suicides, a pilot programme of single window system for institutional loans, inputs and marketing could be made on trial/temporary basis. It would facilitate and relieve the farmers from all the delayed procedures and malpractices of the market for input purchase and farmer's output selling. b) In the post-suicide redressal operations, the panchayat's role is to be enhanced. The ex-gratia payment may be accounted for in the bank immediately. There is an urgent need for the better role of extension services for the better relief either in cultivation or in other allied activities of the victim families.

Soybean Production in Maharashtra: The Double-edged Sword

For further details contact:

Jayanti Kajale
Agro-Economic Research Centre (AERC), Gokhale Institute of Politics and Economics, Pune, Maharashtra
Phone: 020-25650287, 25654288

Introduction

- An overview of the cropping pattern of the state of Maharashtra shows that oilseed is often the second most important crop category after food grains occupying around 18 percent of the gross cropped area. Soybean is the most important oilseed crop with around 90 percent of the total oilseed state area and occupying highest area in 2016-17 among all the crops in the cropping pattern. The area under the crop has steadily increased from 3 million hectares to 3.9 million hectares thus, registering an increase of around 30 percent during 2011-12 and 2016-17.

Findings

- The real problem in case of soybean is, however, steadily increasing area and fluctuating production, leading to wide year to year fluctuations in the yield. The data shows that the production declined by 55 percent from 3.9 MMT to 1.79 MMT, even though the area has registered an increase during 2011-12 and 2015-16. As a result, yield declined by 63 percent during the same period.
- It is observed that while the yield was 1.2 MMT in 2013-14, due to severe drought conditions in the two succeeding years, it sharply declined to 0.5 MMT and 0.48 MMT respectively. The third advance estimate for the year 2016-17 shows that the area, production and yield of soybean have increased.
- The available data shows that while the all India average prices of soybean did not soar sharply in view of a 50 percent decline in the production in the years 2014-15 and 2015-16 as compared to the earlier year of 2013-14, they reached an all-time low in 2016-17 due to normal rains. The farmers therefore, seem to have suffered on account of moderate prices in spite of lower production as well as lower prices in times of a bumper crop.
- Moderate level of prices in times of lower production could be explained by increasing imports of oil which increased from around 10 MMT to 15 MMT during 2013-14 and 2015-16.

Recommendations

- Farmers can be incentivized to grow soybean in future so that they are able to take advantage of growing demand for edible oil in the country. Some of the medium and long term ways are:
  - A strong procurement network should be put in place, especially in times of a bumper crop.
  - Processing of soybean should be encouraged.
  - The extent of irrigation should be increased for protecting and increasing the yield.