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Perceptions of Farmers about Adoption of System of Rice Intensification (SRI)

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Abstract

Rice is one of the most important ingredients of food basket and staple food for population in India. The indiscriminate use of resources particularly, water and fertilizer are creating serious challenges by degrading natural resource base. Also, the productivity of rice has started stagnating in major producing states. The System of Rice Intensification (SRI) was innovated in 1980s' and was designed to increase the productivity of rice with optimum utilization of water and other inputs and to ensure food security for the billion plus population of the country. This paper aims to analyze the perceptions of growers about biotic and abiotic stresses faced by the producers in cultivation of paddy in an agriculturally advanced state of Haryana. It also seeks to highlight the benefits of the SRI system in terms of yield, cost and net returns in some states. The primary and secondary sources of data are used to fulfill these objectives. Findings show that biotic and abiotic stresses impact yield of paddy across all farm sizes in Haryana. The SRI system is being considered as a solution to these problems. Further, we have established on the basis of secondary data that adoption of the SRI system by paddy growers in some states has increased yield and returns per unit of land. Therefore, pragmatic policy initiatives are urgent to popularize the SRI system in Haryana in order to increase the profitability from cultivating paddy and to save the precious resources.

Keywords: SRI; Yield; Net returns; Disease; Insects; Weeds

Introduction

India is among top rice growing countries in the world with an area of (43.8 million ha.) followed by China (28.67 million ha). But in terms of productivity, India is behind many countries in the world like-China, USA, Japan and Egypt. Also, depleting natural resources particularly, water is a great challenge in order to overcome these problems. The System of Rice Intensification (SRI) is an innovation which has been designed to increase the productivity of rice with optimum utilization of water and other inputs.

The improvement in productivity of rice has been one of the main objectives of agriculture development programs by the government over the past decades. The SRI was first introduced by Fr. Henri de Laulanie in Madagascar in 1980s' and spread to almost 50 countries across Asia, Africa and South America. SRI has been promoted as a system rather than a technology. There are no fixed set of practices or rules to be adopted in SRI rather, it is based on socio-economic and biophysical environment of an area and the practices may be modified accordingly.

The SRI method is based on four components - quick and healthy plant establishment, improved soil conditions, weed control and water management. It has several benefits over traditional/conventional method of rice cultivation. The yield of rice is higher in the SRI method over the traditional method but this method is not popular among cultivators. Therefore, government should adopt policy measures in order to benefit the producers.

Objectives of the Study

This paper attempts to bring out the perceptions of farmers about the constraints of conventional system of cultivation of rice and benefits of the SRI system. The specific objectives of the paper are as under-

- To highlight biotic and abiotic constraints in cultivation of rice by producers in Haryana.
- To analyze the benefits of SRI method of rice cultivation in terms of yield, cost and net returns over conventional rice cultivation.

The literary evidences on the SRI system of rice cultivation are scant. However, some scholars [1,2] carried out research in this area. Although, data on actual level of adoption of SRI methods in India are not easily available, the data available has attracted attention of many policy makers and efforts are being done by various states to promote SRI system across India.

Data and Methodology

The study is based on both primary and secondary data. The primary data were obtained from a survey of 210 rice cultivators across six districts namely, Jind, Sonipat, Palwal, Fatehabad, Panchkula and Faridabad in Haryana. The field survey was carried out by the Agricultural Economics Research Centre, University of Delhi.

The secondary data were culled out from a paper by Palanisami, Karunakaran and Amarasinghe, 2012 on "Impact of the System of Rice Intensification (SRI) for IWMI-TATA". This study was conducted in 13 rice growing states and covered 2234 farmers. The authors compared SRI and Non-SRI or conventional method of rice cultivation in order to analyze which method is more efficient in terms of yield, cost and established the superiority of SRI method in cultivation of rice in Haryana [3].

Importance and Growth of Rice in Haryana

At the outset, we have examined the status of rice in terms of acreage devoted in the gross cropped area in Haryana.

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Table 1 indicates percentage of gross cropped area devoted to different crops in a region during an agricultural year. The agro-climatic variations in Haryana are large and hence, state is bestowed with a variety of crops. In dry areas of Bhiwani, oilseeds and pulses dominate the crop pattern while in Karnal, wheat and paddy is the main crops. Wheat (27.07%) followed by bajra (15.92%), gram (12.19%) and rice (8.86%) were the principal crops of the state during 1980-81. In addition, cotton was also grown on almost 6% points of gross cropped area [4]. The fact remains that crop pattern in Haryana was dominated by food grains, which occupied 72.54% of GCA in 1980-81. The share of food grains dropped to 70.60% in 2011-12. The proportion of area under wheat and rice increased while bajra has indicated a decline of around 7%. It appeared that traditional crops like pulses lost heavily while wheat and rice gained significantly. Pulses lost area by almost 13% between 1980-81 and 2011-12. This shift could be attributed to expanding irrigation facilities in Haryana. After harvesting wheat and paddy, other crops are generally sown as pure crop or mixed crops. The land unsuitable for main crops is often devoted to other crops. Information presented in Table 1 suggests that main crops occupy major share of area and rest of GCA is devoted to other crops.

First, we have provided area, production and yield of paddy in Haryana and India. A perusal of Table 2 indicates that the area has improved from 0.48 million hectares in 1980-81 to 1.25 million hectares in 2010-11 in Haryana. This increase is found to be higher in comparison to India. This marks an increase of around 70% during the same period [5].

The area, production and yield of paddy recorded an increase in India and Haryana between 1980-81 and 2010-11. The area in India has improved from 40.15 million hectares to 42.86 million hectares by showing an increase of less than 10% (6.75%) during a period of 30 years. It appears that area under paddy has reached to saturation level in the major growing states and therefore, efforts should be made in other areas with scope of expansion. The production of paddy in the country has however, increased by 78.96% due to increase of 67.16% in productivity [6].

An analysis of area, production and yield of paddy in Haryana during the referred period indicates that area has improved by showing a commendable growth of 160.42%. Further, production has increased by 175.40% whereas yield has improved by 6.52%, which is low in view of agricultural development of the state. In brief, appreciable growth in production of paddy in Haryana was largely driven by area expansion between 1980-81 and 2010-11.

After providing an overview of area, production and yield of paddy in India and Haryana, we have examined district wise growth in area, production and yield of paddy for the entire period and two sub-periods. As a next step, we look into district wise growth of area, production and yield of rice in Haryana. Now we present compound growth rates of area, production and yield of paddy for the period 1980-81 to 2008-09. The study period is divided into two periods. Period I covers 1980-81 to 1994-95 while the II period relates to 1994-95 to 2008-09 [7].

An examination of growth in acreage of paddy presented in Table 3 indicates that area under paddy grew at the rate of 3.39% per annum between 1980-81 and 2008-09. First sub-period from 1980-81 to 1994-95 was found better than the second sub-period from 1994-95 to 2008-09. The district of Rohtak followed by Mewat, Jhajjar, Gurgaon, Palwal and Fatehabad exhibited a commendable growth of more than 10% per year in acreage during this period. It seems that expansion in irrigational facilities has made it possible. Sonipat and Ambala also indicated impressive growth of more than 5% per annum in the acreage of paddy during this period. Karnal, a major paddy growing district of Haryana has however, indicated a growth rate of around 2%.

Yield is an important factor influencing production. The scenario of growth in yield of paddy between 1980-81 and 2008-09 was not encouraging in Haryana as it grew at less than 1% per annum. Contrary to area expansion, growth in yield was found better in the second sub-period in comparison to first sub-period. The districts of Ambala, Mewat, Faridabad and Palwal indicated higher growth in yield in comparison to other districts. But, the overall scenario of yield growth of paddy in Haryana causes a serious concern for policy makers [8].

The production of paddy in Haryana grew at an impressive rate of around 4% per annum between 1980-81 and 2008-09. It was found almost uniform in both the sub-periods. The disparities across the districts were common. Rohtak, Jhajjar, Palwal, Fatehabad and Faridabad exhibited a commendable growth rate of more than 10% per annum in production of paddy. Ambala and Sonipat have also

Year	GCA* ('000 ha.)	Rice	Wheat	Bajra	Maize	Gram	Total Pulses	Other food grains	Total food grains	Mustard	Cotton	Other Crops
1980-81	5462	8.86	27.07	15.92	1.3	12.19	14.55	4.84	72.54	5.49	5.79	16.18
1990-91	5919	11.17	31.25	10.28	0.58	10.96	12.53	3.1	68.91	8	8.29	14.8
2000-01	6115	17.24	38.5	9.94	0.25	2.03	2.56	2.54	71.03	9.08	9.08	13.2
2011-12	6489	19.02	39.01	8.87	0.17	1.22	1.89	1.64	70.6	8.25	9.27	11.88

Source: Director of Land Records, Haryana. *Gross Cropped Area.

Table 1: Percentage of gross cropped area under important crops in Haryana.

Paddy	1980-81	1990-91	2000-01	2010-11
India				
Area	40.15	42.69	44.71	42.86
Production	53.63	74.29	84.98	95.98
Yield	1336	1740	1901	2239
Haryana				
Area	0.48	0.66	1.05	1.25
Production	1.26	1.83	2.70	3.47
Yield	2606	2775	2557	2776

Area: Million ha; Production: Million tonnes; Yield: Kg/ha.

Table 2: Area, production and yield of paddy in Haryana and India.

shown around 7% per annum growth. In a nutshell, improvement in production of paddy during the referred period was driven largely by area expansion.

Status of Biotic and Abiotic Constraints in Rice Cultivation

It is a common knowledge that both biotic and abiotic factors affect crop production and threaten sustainability of crop production. Under these conditions, diverse agro-systems with different traits will be better able to perform. Survey results indicate that one fourth of the sampled farmers reported that diseases are the most important problem in raising alternative crops. In addition, 20% of farmers ranked disease as important problem. The problems of infestation of insect/pests were considered most important by 22% sampled farmers. Also, around 23% respondents stated it as important. Around 14-15% farmers felt that weeds create problems in cultivating other crops in order to diversify crop pattern. Around 16% of sampled farmers informed that environmental problems such as drought, water logging and high and low temperatures are most important problems in raising these crops. Further, 13% considered these factors as important problems. In the array, non-availability of inputs such as seed, fertilizer, human labor and credit were considered most important problem by 9% farmers. A higher proportion of farmer's opined input availability as important problem, while 14% reported that storage, prices, demand, access to information and transportation create problems in raising alternative crops. Another 13% growers considered these facilities important for expanding area under alternative crops. The ranking given by different categories of the farmers to included factors varied significantly across farm size. The range of responses could be observed between 5.9% and 35% respectively. In brief, diseases followed by infestation of insect/pests, environmental problems, marketing and input availability are likely to play an important role in decision making to allocate land to alternative crops by sampled farmers in Haryana [9].

Diseases take a heavy toll of rice crop. We have presented the details of diseases in rice cultivation in Table 4. Blast continues to be a major constraint in rice cultivation around 28% farmers rated it a moderate problem while 13% opined that it is a severe constraint. The cultivators expressed that blast cause's yield loss of almost 20%. Further, root rot is rated by farmers as less severe problem which may cause yield loss of around 7%. Another disease, bacterial leaf spot also damages yield by around 7% at the overall level, around 20% farmers at the aggregate level have stated that it is a minor problem. In addition, anthracnose affects the productivity of rice. It results in considerable yield loss ranging between 9-15%. Although, severity of the problem of diseases in rice cultivation stated by different categories of farmers differs considerably but all of them opined that these are the diseases faced by the farmers in rice cultivation in Haryana.

The damaging effects caused by insect/pests to the productivity of various crops are well evidenced in literature and measures of control are also provided by the agricultural scientists. It requires crop wise understanding of different insect/pests causing the harm. During our survey, we had asked some questions regarding qualitative assessment of sampled farmers. The responses of farmers regarding problems of insect/pests in paddy cultivation are presented in Table 5.

Rice Hispa, Whitefly, Stem borer, Hairy caterpillar and Leaf folder are the major insect/pests damaging the quantity and quality of produce in case of paddy. The farmers opined that each one causes yield loss but the degree of damage varies between 8.5% and 14.9%. In particular, rice Hispa causes the maximum yield loss. The opinions of different category of farmers however, differ regarding the degree of yield loss. For instance, around 31.9% of small farmers rated it as a slight problem. On the other hand, 11.8% large farmers feel that it is a severe problem. The responses of different category farmers also vary about the severity of the problem caused by various insect/pests and their impact on the productivity of paddy but there is a general agreement

District	Area			Production			Yield		
	CGAR % 1980-81 to 1994-95	CGAR % 1994-95 to 2008-09	CGAR % 1980-81 to 2008-09	CGAR % 1980-81 to 1994-95	CGAR % 1994-95 to 2008-09	CGAR % 1980-81 to 2008-09	CGAR % 1980-81 to 1994-95	CGAR % 1994-95 to 2008-09	CGAR % 1980-81 to 2008-09
Ambala	3.7	2.93	5.08	6.36	5.22	7.06	2.57	2.23	1.89
Panchkula	4.05	-1.16	-4.19	6.72	-0.07	-2.86	2.57	1.1	1.38
Yamunanagar	4.87	2.02	3.51	-	-	-	-	-	-
Kurukshetra	3.86	0.42	2.15	5.25	3.05	3.58	1.34	2.62	1.4
Kaithal	0.95	0.71	1.85	0.68	2.13	2.11	-0.26	1.41	0.26
Karnal	3.33	0.6	2.04	2.96	3.11	2.75	-0.36	2.5	0.7
Panipat	1.46	0.99	1.27	0.13	1.67	0.86	-1.32	0.68	-0.41
Sonipat	5.69	2.46	6.4	8.73	4.17	7.07	2.88	1.67	0.63
Rohtak	3.04	8.12	13.07	12.06	6.76	14.45	8.75	-1.26	1.22
Jhajjar	3.04	8.35	11.61	12.06	6.19	12.93	8.75	-1.99	1.18
Faridabad	10.77	1.15	8.47	15.29	2.16	10.23	4.07	1	1.63
Palwal	10.77	9.07	10.98	15.29	10.18	12.79	4.07	1.02	1.63
Gurgaon	16.25	-2.8	11.02	-	-1.89	-	-	0.94	-
Mewat	13.88	6.9	12.7	21.8	6.38	14.71	6.95	-0.48	1.78
Rewari	-	-	-	-	-	-	-	-	-
Mahendragarh	-	-	-	-	-	-	-	-	-
Bhiwani	-	39.72	-	-	-	-	-	-	-
Jind	3.02	2.1	4.56	4.31	2.54	4.74	1.25	0.44	0.17
Hisar	6.34	0.86	3.76	8.28	-1.01	2.47	1.83	-1.85	-1.24
Fatehabad	6.34	8.45	10.05	8.28	10.93	11.14	1.83	2.28	0.98
Sirsa	2.57	4.6	3.8	3.32	5.48	4.69	0.74	0.85	0.86
Haryana	3.23	2.06	3.39	3.85	3.81	4.01	0.59	1.72	0.6

Table 3: District wise growth of area, production and yield of paddy in Haryana.

Particulars	Small					Medium					Large					Over al l				
	1	2	3	4	Y	1	2	3	4	Y	1	2	3	4	Y	1	2	3	4	Y
Blast	8.5	21.3	17	6.4	22.8	7.8	24	28.7	13.2	20.8	2.9	23.5	38.2	23.5	17.7	7.1	23.3	27.6	13.3	20.4
Root rot	2.1	2.1	0	2.1	5	9.3	11.6	3.1	0.8	7.1	8.8	8.8	2.9	0	5.8	7.6	9	2.4	1	6.7
Bacterial leaf spot	8.5	34	2.1	2.1	7.1	16.3	15.5	7.8	3.1	6.8	11.8	14.7	2.9	0	10.8	13.8	19.5	5.7	2.4	7.2
Anthracnose	4.3	12.8	4.3	0	12.5	7	10.9	7	1.6	7.4	5.9	5.9	2.9	0	--	6.2	10.5	5.7	1	9.1
Sooth blight	0	2.1	0	0	--	0	0	1.6	0	11	2.9	0	2.9	0	--	0.5	0.5	1.4	0	11
Pod rot	4.3	14.9	12.8	2.1	14.8	4.7	4.7	9.3	3.9	15.4	0	2.9	0	0	--	3.8	6.7	8.6	2.9	15.1
Other	0	2.1	4.3	0	8.8	1.6	1.6	0.8	0	--	0	2.9	5.9	0	15	1	1.9	2.4	0	10.8

Source: Ibid
Note: Ranks are in order of importance from 1 (No problem), 2 (Slight problem), 3 (Moderate problem) to 4 severe problem) Y means % yield loss.

Table 4: Problems of diseases faced by sampled farmers during rice production, 2012-13 (% multiple response).

Particulars	Small					Medium					Large					Overall				
	1	2	3	4	Y	1	2	3	4	Y	1	2	3	4	Y	1	2	3	4	Y
Rice hispa	6.4	31.9	10.6	0	7.8	13.2	19.4	5.4	4.7	13.8	8.8	11.8	11.8	0	29.6	11	21	7.6	2.9	14.9
Whitefly	8.5	27.7	8.5	2.1	6.9	12.4	20.2	8.5	3.1	9.5	11.8	17.6	5.9	0	11.1	11.4	21.4	8.1	2.4	9.2
Stemborer	10.6	10.6	8.5	4.3	8.6	5.4	15.5	10.9	5.4	12.2	11.8	20.6	17.6	5.9	11.7	7.6	15.2	11.4	5.2	11.1
Hairy Caterpillar	12.8	2.1	0	0	--	7	5.4	3.9	0	10.4	5.9	5.9	2.9	0	5	8.1	4.8	2.9	0	9.5
Leaf folder	6.4	14.9	19.1	10.6	8.2	12.4	10.1	13.2	2.3	8.5	2.9	23.5	20.6	0	9.2	9.5	13.3	15.7	3.8	8.5
Other	0	2.1	2.1	0	12.5	0	2.3	0.8	0	5	0	2.9	0	0	--	0	2.4	1	0	8.8

Source: Ibid
Note: Ranks are in order of importance from 1 (No problem), 2 (Slight problem), 3 (Moderate problem) to 4 (Severe problem) Y means % yield loss.

Table 5: Problems of insects/pests faced by sampled farmers during rice production, 2012-13 (% multiple response).

about the yield loss due to infestation of insect/pests in case of paddy in Haryana. Weeds affect crops by reducing productivity. Normally, crops are exposed to severe competition from self-grown weeds which grow without human efforts and not wanted. They compete with the major crop for water, soil, nutrients and sun light. Therefore, proper control of weeds is a pre-requisite for obtaining higher input efficiency. They also harbor insect/pests, diseases and other microorganisms. In addition, weeds reduce the quality of produce and make harvesting difficult.

The stage, at which, there is a maximum impact of weeds on crop growth is termed as critical period of weeds. Competition which usually varies between 15 to 60 days after sowing depends upon the crop, crop duration, soil and climatic conditions. Often, weed management is done through mechanical, cultural and chemical methods. The utilization of herbicides is an important method.

Table 6 presents responses of sampled farmers about growth of weeds in cultivation of rice. Clearly, rice is exposed to weeds such as Itsit, Mathana, Bhakhra, Motha grass and Sonfa. These weeds compete for expensive inputs. The absence of control measures reduces the productivity. The sampled farmers rated Itsit followed by Mathana as comparatively damaging weeds. These affect the productivity of rice by around 8 and 6% respectively. The Mathana, Sonfa and grass impact the yield rates negatively by 5.6%, 5.5% and 5.3% respectively. The responses of farmers across various farm sizes on the severity of these weeds vary considerably. For instance, 31.9% small farmers opined that Motha is a slight problem but in the same category, around 9% and 6% feel that it is a moderate and severe problem. The same figures for medium farmers could be observed around 27%, 21% and 4% respectively. On the other hand, 29% and 9% large farmers rated Motha as moderate and severe problem. These variations could be also noticed for other varieties of weeds. At the aggregate level, 24%, 10% and 6% of farmers stated that grass is slight, moderate and severe problem. In a nut shell, although responses of sampled farmers varied about the problems and severity of the weeds, they agreed that weeds cause losses in productivity of rice in Haryana.

Comparison of Yield, Cost and Gross Margins on SRI and Non SRI Farms

The analysis of these aspects is based on the information gathered from research paper (Impact of the System of Rice Intensification (SRI), published by International Water Management Institute (IWMI). Table 7 shows that this study of yield, cost and net returns was conducted in five regions covering 13 rice producing states. A comparison has been carried out in yield, cost and net returns between SRI and Non-SRI farms. It may be observed that the yield level of rice is higher on SRI farms as compared to non SRI farms. Gujarat indicates the highest percentage of yield between SRI and non SRI farms (53.6%), whereas, Assam has the lowest yield difference between the SRI and Non SRI farms (12%).

Overall, it can be noticed that Gujarat, Maharashtra, Orissa and Madhya Pradesh show a significant increase in the yield on SRI farms as compared to the Non-SRI farms in percentage terms (53.6%, 26.9%, 33.1% and 51.9% respectively). Assam and Rajasthan reveal the lowest percentage increase in yield when comparison is made between SRI and Non-SRI farms. At the all India level, it can be noticed that the overall increase in yield under SRI farms was 22.4%.

After the implementation of SRI method, net returns were found higher in Gujarat, Orissa and Madhya Pradesh (51.9%, 35.6% and 89.2% respectively). On the other hand, Assam, Chhattisgarh and Rajasthan show the lowest difference in net returns (10.8%, 2.3% and 12.9% respectively) even after the implementation of SRI method for rice cultivation. At the all India level, increase in net returns was calculated 18.4%. Table 7 also shows that the cost of cultivation on SRI farms is lower as compared to the Non-SRI farms except in the state of Karnataka. The state with highest decrease in cost of cultivation of rice is Assam with a decrease of almost 56.3%. Maharashtra and Tamil Nadu also had a significant decrease in the cost of cultivation after the implementation of SRI method. The lowest degree of decline in cost of cultivation could be noticed in Uttar Pradesh and West Bengal (6.2% and 2.7% respectively).

Particulars	Small				Medium				Large						
	1	2	3	4	1	2	3	Y	1	2	3	4	Y	3	Y
Itsit	14.9	23.4	12.8	0	13.2	17.1	16.3	8.1	11.8	14.7	20.6	0	8.6	16.2	7.9
Mathana	12.8	14.9	4.3	2.1	3.1	8.5	3.1	5	5.9	11.8	0	0	5.8	2.9	5.6
Bhakhra	12.8	0	0	0	7	2.3	2.3	5	17.6	5.9	0	0	7.5	1.4	4.3
Motha	12.8	31.9	8.5	6.4	16.3	27.1	20.9	5.5	20.6	29.4	8.8	0	6.7	16.2	6.3
Grass	17	25.5	12.8	6.4	16.3	25.6	10.9	5.5	17.6	17.6	0	8.8	6.7	9.5	5.3
Sonfa	10.6	17	8.5	0	8.5	7.8	4.7	4.9	5.9	2.9	2.9	0	--	5.2	5.5
Other	2.1	0	0	0	0.8	4.7	5.4	13	2.9	8.8	5.9	2.9	2.7	4.3	7.8

Source: Ibid
Note: Ranks are in order of importance from 1 (No problem), 2 (Slight problem), 3 (Moderate problem) to 4 (Severe problem)
Y means % yield loss.

Table 6: Problems of weeds faced by sampled farmers during rice production, 2012-13 (% of multiple responses).

1	**Andhra**	**69.8**	**56.8**	**22.9**	**64584**	**54490**	**18.5**	**414**	**-26**
2	Karnataka	70.8	56.7	24.8	69162	56277	22.8	426	15.1
3	Kerela	53.5	47.1	13.6	58657	51613	13.6	613	-28.4
4	Tamil Nadu	52.3	45.5	14.9	47665	41879	13.8	452	-33
	Average	60.2	51	18	57842	49552	16.7	449	-27.2
	Western Region								
5	Gujarat	28.7	18.7	53.6	26247	17274	51.9	523	-30.9
6	Maharashtra	35.4	27.9	26.9	31170	26904	15.8	274	-48
7	Rajasthan	23.6	20.9	12.9	46472	41145	12.9	1867	-9.7
	Average	32.9	25.6	28.5	34182	27597	23.8	495	-30.7
	Eastern Region								
8	Chhattisgarh	60.6	48.7	24.5	54708	53451	2.3	414	-28.7
9	Orissa	48.2	36.2	33.1	46040	33929	35.6	518	-22.5
10	Uttar Pradesh	63	54.5	15.5	61989	53655	15.5	614	-6.2
11	West Bengal	41.9	36	16.4	38285	32885	16.4	493	-2.7
	Average	49.9	40.9	22	45920	38446	19.4	513	-12.1
	Central Region								
12	Madhya Pradesh	29.3	19.3	51.9	23714	12530	89.2	374	-13
	Northeastern Region								
13	Assam	38.2	34.1	12	35692	32188	10.8	294	-56.3
	All India	46.4	37.9	22.4	44816	37845	18.4	443	-28.6

Source: Impact of the System of Rice Intensification (SRI) [1].

Table 7: Comparison of yield, net returns and cost between SRI and non-SRI farms cultivating paddy in important states.

At the all India level, it may be observed that the overall difference in cost of cultivation after the implementation of SRI method was 28.6%. In a nutshell, implementation of SRI method for rice cultivation is beneficial for the cultivators, since the yield and net returns both increased whereas, cost of cultivation of rice has decreased after implementation of SRI method.

Conclusions

Rice is staple food for majority of the population in India. With rising income and population, demand for rice is gradually increasing in the country. Hence, new innovations and techniques need to be developed in order to increase the productivity of rice to meet the increasing demand. Findings of this paper reveal that there are various biotic and abiotic constraints in rice cultivation. In the conventional method of rice cultivation, yield and the gross margins are lower due to biotic and abiotic constraints.

The adoption of SRI method of rice cultivation by farmers has increased the yield of rice as compared to the conventional method of rice cultivation. The gross margins of cultivators have also increased by almost 18% at the all India level, whereas, the cost of cultivation of rice declined by almost 29% at the all India level. Hence, it can be concluded that the SRI method for rice cultivation has increased the productivity of rice with optimum utilization of inputs like water, HYV seeds, etc. Policy measures should be initiated by the government in order to promote SRI method across the country.

Results of this paper also show that paddy growers face the biotic and abiotic stress in terms of disease, insects/pests and weeds. These constraints affect the yield level significantly and reduce the total output. On the basis of secondary data, we have established that SRI method of rice cultivation is superior to conventional method in terms of yield and net returns. In addition, it reduces cost. Therefore, there is an urgent need to popularize this method to improve the yield of rice and production. This needs pragmatic policies from the government in terms of efficient extension for adoption at the grass root levels.

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