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Studies on socio-economic and technological factors responsible for low production of rice

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Abstract
The study was conducted in Pakur district of Jharkhand to know the socio-economic status of farmers. They were categorized in three groups i.e. small, medium and large farmers which were differ from each other with regard to socio-economic factors and found that 48.88 per cent rice growers has medium level of knowledge. Most of the small category farmers have high technological gap of lack of technological guidance (72.59 per cent) followed by lack of money (64.61 per cent). The different sub practices grouped into 6 categories and found that plant protection measures is one of the major concerns for technological gap. Two sprays of propiconazol 25EC@1ml/L water, one before panicle initiation and second at milking stage was effective in reducing incidence of false smut diseases and increased the grain yields.

Keywords: Rice, socio-economic status, false smut management

Introduction

Rice *(Oryza sativa* L.) has a special significance in Asia, where about 90% of the rice is produced and consumed as a staple food. Rice is staple food of humid areas of Assam, Manipur, West Bengal, Orissa, Jharkhand, Bihar, Eastern U.P. and South India. It prefers low lying and water logged areas where none of the other cereals could be grown. However, evolution of new plant type has made it possible to grow rice even in areas having relatively low rainfall and lighter soil types like Punjab, Haryana, and Western U.P. etc. It has also observed that the yield is much higher in newly acquired areas than the traditional rice growing areas which could be accounted for evolution of high yielding dwarf plant types, better soil and water management practices and efficient nutrient management schedule etc. Rice is one of the major crops of Jharkhand and occupies 7.17 lakh hectares contributing 10.40 lakh tones grain to the state and has direct effect on the economy of the farmers of the state. The average yield of the Jharkhand (1.45 tons/ha) is below the national demonstration yield (1.9 t/ha). Considering the increasing demand of rice due to population increase and decreasing land and water resources available for rice cultivation, it is critical to develop and use rice technologies that will result in higher yields (Virmani and Kumar, 2004).To know the adoption gap present study was made with the objectives of-

1. To study the knowledge level of rice grower about improved practices.
2. To determine the technological gap
3. To identify the constraints responsible for low yield

False smut occurs in almost all the rice growing areas of the world including India, China, Japan, South East Asian countries, North and South America, Myanmar, Sri Lanka, Fiji, and Africa. Epiphytotics of the disease have been reported from India and Philippines. In India; the losses due to false smut have varied between 7% and 75%. The disease occurs in most destructive from in rice fields in Punjab, Haryana, U.P. Bihar and Madhya Pradesh. Singh and Dube (1978) reported 44% Loss of grain yield in cultivar Ratna, 17% in IR-8 and 0.6% in cultivar Prasad. The loss in grain yield is not only due to conversion of individual grain in to smut ball but also due to increased sterility of neighboring florets. There is significant reduction in filled grain and spikelet weight Chib *et al*. (1992) reported that when the percentage of smut balls in the ears was 2, 4.5 and 9.6 the percentage of chaffiness was 4.4, 12.1 and 24.2, respectively.

False smut has recently become an important disease of rice in India. Hybrids are more prone for this disease and fungicides have been extensively tested to manage the disease. Seed treatment with fungicides did not check the disease, but spraying the rice crop with carbendazim and copper fungicides at the time of tillering and pre-flowering effectively controlled the disease and yields increased (Anon., 1990).

Propiconazole or azoxystrobin applied during the boot stage of rice reduced the number of false smut balls in harvested rice grain by 50-75% but yield was not affected. Copper hydroxide fungicides reduced false smut balls in harvested rice by 80% but yield was also often reduced significantly. Barnwal (2011) observed that two sprays of propiconazole (0.1%) was found effective which recorded least false smut disease with number of affected florets panicle (1 of 4.13) with disease severity of 22.2 per cent and disease control over check of 77.6 per cent.

Methodology

The present study was carried out in Pakur district of Jharkhand. Pakur district consists of 6 blocks. The survey were conducted in two blocks(Mahesshpur & Hiranpur) in two stages and categorized in three categories viz. small, medium and large farmers and into three categories on the basis of adoption index(A.I.)viz. low adopter(0-20 % A.I.), medium adopter(21-40% A.I.) and higher adopter(above 40% A.I.).Based on technological gap analysis on farm trial was conducted.

To know the efficacy of fungicides on false smut disease was conducted during kharif 2013 and 2014 on farmer's field of the Pakur district. Twenty one days old seedlings of a susceptible rice variety (Hybrids) were planted in a randomized block design with four treatments and ten replications and the crop was raised following recommended package of practices. The first spray of fungicide was given before panicle initiation and second spray at milking stage.

Observations of the characters under study were recorded for comparing effect of fungicides. For each observation, five randomly selected plants were tagged from each plot and used further for observations. The mean values of the recorded data were taken as the actual values of the respective characters.

(i) Plant height (cm)

Height of the five tagged sample plants were measured in centimeter after 90 DAT (days after transplanting) with the help of wooden scale and their mean value were worked out. Height of the main shoot of the sample plant was measured from the base of the plant to tip of the longest leaf. After panicle emergence, it was measured from base of the plant to tip of the panicle.

(ii) Number of tillers/hill and /m2

Number of tillers per hill was recorded for the five tagged plants at and 90 DAT and average was worked out. Each shoot arising from the plant was counted as tillers including the main shoot. The tillers/m2 was also counted in each treatment from three random spots and average was calculated.

(iii) No. of effective tillers/hill and /m2

Tillers bearing panicles were counted as effective tillers from each sample/hill and averages were worked out. The effective tillers/m2 was also counted in each treatment from three random spots and average was calculated.

(iv) Length of panicle (cm)

The length of panicle was measured in centimeter from the base of rachis to tip of the panicle. The length of five sampled panicles was measured and averages were worked out.

(v) Test weight (g)

Two samples of one thousand grains were drawn from the grain heap of each plot at the time of threshing and weighed by electronic balance in grams and mean was worked out as test weight.

(vi) Grain yield (q/ha)

The yield of grains obtained from each net plot was recorded in kilograms after sun drying of grains and the grain yield per plot was converted into quintal per hectare.

Results and discussion

Socio-economic factors

The frequency distribution of knowledge level, categorized into three categories, shows that 48.88 per cent rice growers has medium level of knowledge. The different sub practices grouped into 6 categories and found that plant protection measures is one of the major concerns for technological gap. Most of the small category farmers have high technological gap. The first and foremost barrier in the technological gap is lack of technological guidance (72.59 per cent) followed by lack of money (64.61 per cent) and is in agreement with findings of Sharma *et.al*.(2007).

Evaluation of technology for plant growth and yield against false smut

Four technological options were evaluated at two different stages of crop growth viz. before panicle initiation and milking stage against false smut under natural conditions. Plant growth parameters, percentage of infected tiller/m^2, percentage of smutted balls and grain yield were recorded. It is obvious from the data (Table 4) that TO 4(Two spray of propiconazol 25EC@1ml/L water, one before panicle initiation and second at milking stage) gave highest number of tillers/m^2 (282.3) followed by TO3 (278.6) over untreated check (257.7). The opposite tread was observed for number of infected tiller/m^2 under study. Although, there was no significant difference in plant height, however, maximum plant height 106.8 cm was recorded in TO 4 followed by TO 3. In regard to number of panicle length, there was no significant difference among the treatments. It was observed that number of panicle length ranged from 22.5 to 27.8. Percentage of infected tiller/m^2 (Table 4) was recorded ranging from 5.2 to 18.3. Among the treatments, TO 4 gave outstanding results for reducing the per cent infected tiller/m^2 (5.2) followed by TO 3 (9.4) over untreated check (18.3). It was observed that applications of fungicides at booting stage did not give significant results for controlling the false smut. All the four technological options significantly reduced the disease. However, the level of performance of chemicals varied the application at different crop stages. In regard to percentage of per cent smutted balls/panicles, TO 4 gave significantly superior results (2) followed by TO 3 (3) over TO 2(4) and untreated check (4).

Pramjit *et al.* (2006) reported that Tilt 25 EC (Propiconazole) and Contaf 5 EC (Hexaconazole) effectively controlled the false smut incidence when these fungicides were applied at boot stage. Many authors reported that the fungus invade into rice spikelets before heading of rice plants i.e., at the booting stage (Ashizawa and Kataoka 2005; Zhou *et al.*, 2003) and infect rice florets. Therefore the result of this study is partially complying with the previous report (Paramjit *et al.*, 2006) Results reflects that the plant height and number of panicles panicle length had no significant differences among the tested chemicals implied that neither the fungicides nor the infection of false smut had any impact for the mentioned traits. Disease infection process of false smut generally happened in the florets at the booting stage, when the effective tiller has already determined. However, there were notable differences for the number of infected panicles per hill. Yashoda *et al.* (2000) also reported the similar results. They found that Carbendazim reduced the disease severity significantly. The nature of false smut incidence generally happened sporadically or aggregation in spaces in the rice field (Nessa *et. al.*, 2015b; Rush *et al.*, 2000). The tested fungicides could not prevent the fungi similarly might be due to nature of natural inoculums distribution pattern in the field. Not only the sporadic distribution pattern of false smut inoculums but also the level of inoculums pressure or aggregation might have influence on the prevention capacity of tested fungicides against the disease.

Table 1: Knowledge level of recommended practices of rice production of different categories of rice grower

Sl. No.	Categories of farmers	Knowledge level					
		Low		Medium		High	
		Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1	Small(48)	15	31.25	24	50.00	9	5.85
2	Medium (32)	7	21.87	15	46.87	10	31.25
3	Big (10)	3	30.00	5	50.00	2	20.00
Total		25	27.77	44	48.88	21	23.33
Rank		II		I		III	

Table 2: Extent of technological gap of package of practices of rice (percentage)

Sl. No.	Improved practices	Categories of respondents											
		Big (10)			Medium (32)			Small(48)			Total (N=90)		
		f	%	Rank	f	%	Rank	f	%	Rank	f	%	Rank
1	Suitable varieties	7	70.00	IV	28	87.50	II	43	89.58	III	78	86.66	II
2	Sowing operation	5	50.00	VI	25	78.12	IV	47	97.91	I	77	85.55	III
3	Fertilizer management	6	60.00	V	29	90.62	I	39	81.25	IV	74	82.22	IV
4	Irrigation management	10	100.00	I	24	75.00	V	38	79.16	V	72	80.00	V
5	Plant protection	9	90.00	II	27	84.37	III	44	91.66	II	80	88.88	I
6	Harvesting & marketing	8	80.00	III	23	71.87	VI	39	81.25	IV	70	77.77	VI
Total		45	75.00	-	156	81.25	-	250	86.80	-	451	83.51	_

F= Frequency, %= Percentage

Table 3: Constraints responsible for the technology of rice cultivation (N=90)

Improved practices	Lack of knowledge	Lack of technical guidance	Lack of availability of inputs	High cost	Lack of money	Low rainfall	Susceptibility of disease	Drought proneness
Suitable varieties	67	67	64	63	76	61	43	48
Field preparation	50	52	5	23	52	9	40	5
Sowing time	61	71	19	-	24	60	41	6
Method of Sowing	69	74	-	60	73	4	25	52
Seed rate	29	53	4	52	60	6	-	53
Seed treatment	64	69	65	24	62	-	10	55
Soil treatment	61	67	34	-	65	-	4	-
Spacing	63	66	-	64	64	-	-	54
Fertilizer application	46	65	30	25	75	51	45	-
Irrigation management	87	61	32	51	55	66	24	55
Weed management	42	77	67	60	76	52	22	49
Pest management	72	74	65	24	64	9	21	50
Disease management	72	75	65	61	74	9	23	58
Harvesting	56	59	-	-	55	-	-	-
marketing	-	-	-	-	-	-	-	-
Total	839	930	450	507	875	327	298	485
Percentage	62.14	72.59	33.33	37.55	64.61	24.22	22.07	35.92
Rank	III	I	V	IV	II	VII	VIII	VI

Table 4: Management of false smut disease of paddy.

Technology option	Total no. of tillers/ m2	Infected no. of tillers/ m2	Plant height (cm)	Panicle length (cm)	Smutted balls/ panicle	1000 seed weight (g)	Grain yield (q/ha)	Cost of cultivation (Rs./ ha)	Gross return (Rs./ ha)	Net Return (Rs / ha)	BC Ratio
TO:1 FP (No/ash spray)	257.7	18.3	104.5	22.5	4	19.3	48.22	26976	43398	16422	1.60
TO:2 Seed treatment with carbendazim 50 WP @ 2g/kg of seed+1 spray of same fungicide @1g/l water before panicle initiation.	265.5	13.7	105.7	24.8	4	21.6	50.55	28200	45495	17295	1.61
TO:3 Seed treatment with carbendazim 50 WP @ 2g/kg of seed+1 spray of Propiconazole25EC@1ml/l water before panicle initiation	278.6	9.4	106.6	26.7	3	23.3	55.77	29564	50193	20629	1.69
TO:4 Two spray of Propiconazol 25EC@1ml/l water, one before panicle initiation and second at milking stage.	282.3	5.2	106.8	27.8	2	24.2	56.60	29943	50940	20997	1.70
CD(5%)	3.38	3.29	NS	NS	0.91	0.52	1.17				

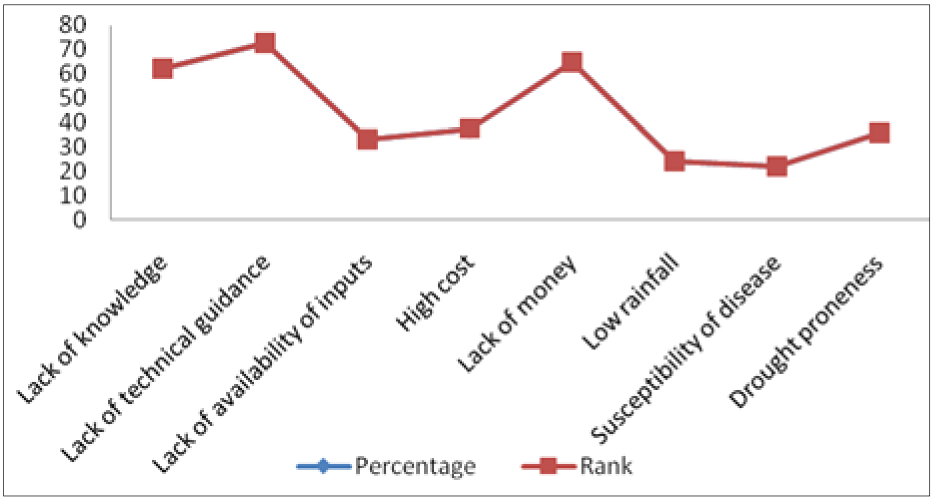

Fig 1: constraints responsible for the technology of rice cultivation

Conclusion

The wider gap in non adoption of new technology by rice grower was observed. A large number of research findings are available but all of them have not reached to farmers which ultimately caused wide gap between available scientific knowledge and its practical adoption. These gaps are responsible for low production of rice. Two sprays of propiconazol 25EC@1g/L water, one before panicle initiation and second at milking stage was effective in reducing incidence of false smut diseases and increased the grain yields.

Although losses due to plant diseases may be reduced by the use of disease resistance cultivars, crop rotation or sanitation practices, fungicides are often essential to maximize crop yields. Fungicides can play an important role in ensuring crop health security by managing devastating diseases in agricultural crops. Fungicides play important role in improving food quality and they also contribute to food safety by controlling many fungi that produce mycotoxins such as aflotoxins,ergot toxins, Fusarium toxins, patulin and tenuazonic acid (Knight *et al* 1997). Fungicides are now well considered to be the second line of defense in plant disease control after disease resistance (Thind, 2015). It is expected that, fungicides will continue to play a role in disease management programs, especially in intensive production systems. However, to maintain their effectiveness and to minimize their effect on human health and on the environment, they should be used in a rational and informed way.

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