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Comparative studies on socio-economic and technological factors responsible for low production of rice in Dumka and Pakur districts of Jharkhand

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Abstract
The study was conducted in Dumka and Pakur districts 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 54.66 per cent rice growers has medium level of knowledge. Most of the small category farmers have high technological gap of lack of technological guidance (69.15%) followed by lack of money (66.22%). 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@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.

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

Introduction
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).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. Epiphytotic of the disease have been reported from India and Philippine. 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) [8] 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) [3] 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.

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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 till erring and pre-flowering effectively controlled the disease and yields increased (Anon., 1990) [1]. 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 Dumka and Pakur district of Jharkhand. The survey were conducted in four blocks (Saraiyahat & Jarmundi of Dumka and Hiranpur and Maheshpur of Pakur districts) 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 2011 and 2012 in Dumka district and 2013 and 2014 in Pakur district on farmer's field. 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, and shows that 54.66 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 (69.15%) followed by lack of money (66.22%) and is in agreement with findings of Sharma *et.al*. (2007) [7].

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/m2, 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/m2 (280) followed by TO3 (278) over untreated check (267). The opposite tread was observed for number of infected tiller/m2 under study. Although, there was no significant difference in plant height, however, maximum plant height 105.8 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 24.1 to 26.1. Percentage of infected tiller/m2 (table 4) was recorded ranging from 5.0 to 16. Among the treatments, TO 4 gave outstanding results for reducing the per cent infected tiller/m2 (5.0) followed by TO 3 (10.3) over untreated check (16.00). It was observed that applications of fungicides at booting stage did not gave 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) [5] reported that Tilt 25 EC (Propiconazole) and Conta f 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) [2, 10] and infect rice florets. Therefore the result of this study is partially comply with the previous report (Paramjit *et al.,* 2006) [5] 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 detemined. 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) [4, 6]. 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(80)	21	28.00	38	50.66	16	21.33
2	Medium (50)	12	24.48	26	53.06	11	22.44
3	Big (20)	3	11.53	18	69.23	5	19.23
Total		36	24.00	82	54.66	32	21.33
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 (20)			Medium (50)			Small(80)			Total (N=150)		
		f	%	Rank	f	%	Rank	f	%	Rank	f	%	Rank
1	Suitable varieties	10	50.00	IV	30	60.00	II	42	52.50	III	82	54.66	II
2	Sowing operation	8	40.00	VI	27	54.00	IV	46	57.50	I	81	54.00	III
3	Fertilizer management	9	45.00	V	31	62.00	I	38	47.50	IV	78	52.00	IV
4	Irrigation management	13	65.00	I	26	52.00	V	37	46.25	V	76	50.66	V
5	Plant protection	12	60.00	II	29	58.00	III	43	53.75	II	84	56.00	I
6	Harvesting & marketing	11	55.00	III	25	50.00	VI	36	45.00	VI	72	48.00	VI
Total		63	52.50	-	168	56.00	-	242	50.41	-	473	52.55	-

F= Frequency, %= Percentage

Table 3: Constraints responsible for the technology of rice cultivation (N=150)

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
1.Suitable varieties	113	113	115	107	128	104	74	88
2.Field preparation	86	78	5	39	89	9	67	11
3.Sowing time	105	119	19	-	42	105	69	10
4. Method of Sowing	115	125	-	104	122	16	44	82
5. Seed rate	48	88	17	89	102	8	-	82
6.Seed treatment	109	116	113	43	107	-	19	74
7.Soil treatment	105	114	59	-	109	-	7	-
8. Spacing	106	112	-	109	108	-	-	61
9. Fertilizer application	79	108	53	43	127	96	76	-
10. Irrigation management	88	103	57	87	95	115	41	78
11. Weed management	118	128	114	104	129	89	37	74
12. Pest management	125	126	109	43	109	19	38	88
13. Disease management	124	127	109	104	127	18	39	99
14. Harvesting	95	99	-	-	96	-	-	-
15. marketing	-	-	-	-	-	-	-	-
Total	1416	1556	770	872	1490	579	511	747
Percentage	62.93	69.15	34.22	38.75	66.22	25.73	22.71	33.20
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)	Total no. of grains/ /panicle	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)	267	16	104.2	24.1	151	4	22.2	47.22	14976	24750	9774	1.65
TO:2 Seed treatment with carbendazim 50 WP @ 2g/kg of seed+1 spray of same fungicide @1g/l water before panicle initiation.	274	14	105.3	25.4	156	4	22.7	50.78	16200	29430	13230	1.81
TO:3 Seed treatment with carbendazim 50 WP @ 2g/kg of seed+1 spray of Propiconazole25EC@1ml/l water before panicle initiation	278	10.3	105.6	25.8	162	3	23.3	57.90	17564	31680	14116	1.80
TO:4 Two spray of Propiconazol 25EC@1ml/l water, one before panicle initiation and second at milking stage.	280	5	105.8	26.1	173	2	24.4	61.89	17843	33660	15817	1.88
CD (5%)	0.91	1.31	NS	NS	3.23	0.91	0.08	2.13				

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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