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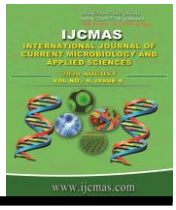

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Integrated Crop Management Approach for Profitable Rice Production in Uttara Kannada District, India

M. Shivashenkaramurthy[1*], Roopa S. Patil[1], M. J. Manju[1], H. M. Santhos[2], Annapurna Neeralagi[1] and Siddappa S. Kannur[1]

[1]ICAR-Krishi Vigyan Kendra, Sirsi-581401, Uttara Kannada, Karnataka, India
[2]ICAR-Krishi Vigyan Kendra, Hanumanamatti, Haveri, Karnataka, India

**Corresponding author*

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A B S T R A C T

Front line demonstrations were conducted in Uttara Kannada district of Karnataka state during Kharif season in the year 2017, 2018 and 2019 to increasing rice productivity and income by replacement of Abhilash old variety with promising high yielding improved variety PSB-68 and traditional practice with integrated crop management. Study revealed that over the years, PSB-68 Paddy variety with integrated crop management approach was superior over Abhilash variety with farmer practices. The higher plant height, number of tillers, panicle length, number grains per panicle, grain weight per panicle, grain yield and straw yield were recorded in demonstrated plot as compared to farmer practice. The gross returns, net return and B: C ratio were higher in demonstrated plot. The pooled data indicated that there was increase of grain yield by 42.12 % and straw yield by 30.53% over farmers practice. Similarly, the gross returns and net returns were increased by 41.41% and 75.50%, respectively. Data reported that there was reduction of incidence of insect pest *viz.*, stem borer, leaf folder, brown plant hopper and ear head bug and diseases *viz.*, blast, brown spot and grain discoloration with plots receiving integrated crop management. Whereas, farmers practice plot recorded higher incidence of insect pest and disease.

Introduction

Rice is the seed of the grass species *Oryza sativa* L. As a cereal grain, it is the most widely consumed staple food for a large part of the world's human population, and is considered as the "global grain". It is the agricultural commodity with the third highest worldwide production, after sugarcane and maize (Suthar, *et al.,* 2016). Asian countries consume about 90 percent of the rice grown and produced in the world. With varied geoclimatic condition, Uttara Kannada district has varied topographical soil condition and rainfall pattern is ideally suited for cereal, cash crops, horticultural and other plantation crops. Rice is one of the most important cereal crop which grown under rainfed situation in both low and upland situations. Front line demonstrations can play important role to minimize the adoption gap and increase the productivity and income for the farmers.

Integrated Crop Management (ICM) is the best way foren hancing productivity. It combines the best of traditional methods with appropriate modern technology, balancing the economic production of crops with positive environmental management. ICM practice plays a significant role in producing higher yield of rice among the different practices. It also helps in the maintenance of soil structure and fertility, improvement of soil fertility, prevent build-up of pests, diseases and weeds, prevent damage to soil, water, avoid loss of biodiversity and reduce environmental damage and production cost, while majority of the farmers are not generally not aware and not following ICM practices.

The general objectives of frontline demonstration is to demonstrate under farmer's field condition, the superior production, potentials and benefits of the latest improved technologies including new production technologies, high yielding crop varieties and recommendations for different region. In this regard, present study was conducted ICM demonstration at different locations in Uttara Kannada district of Karnataka state. These demonstrations focused on increasing rice productivity and income by replacement of Abhilash old variety with promising high yielding improved variety PSB-68 and integrated crop management.

Materials and Methods

The study was conducted by Krishi Vigyan Kendra, Sirsi (Uttara Kannada District), University of Agricultural Sciences, Dharwad, Karnataka, in the farmers field of adopted villages of Uttara Kannada district during *Kharif* season under rainfed situation for years of 2017-18, 2018-19 and 2019-20.Front line demonstrations were conducted to increasing rice productivity by replacement of Abhilash old variety with promising high yielding improved variety PSB-68 and integrated crop management. The soil of the experimental site were sandy clay loam and lateritic soil. The demonstrations consisted of Integrated crop management including new variety of paddy PSB-68 in comparison with farmers practice with Abhilash variety. The details regarding implementation of demonstration are shown in Table 1. The details of technologies demonstrated in farmers field under front line demonstration are presented in Table 2.

Nursery techniques

Seedlings were raised in wet method of nursery. Twenty five kilo gram rice seeds required for one acre area of demonstration were soaked in 50 litres of solution of Carbendazim fungicide (2 g/ litre water) for 12 hours. After soaking, seeds were separated from solution and kept for sprouting in gunny bag for 24-36 hours. The sprouted seeds were broadcasted uniformly on raised wet beds. Required compost and fertilizers were applied for healthy seedlings.

Land preparation

Main field was ploughed for two times followed by cultivator and brought soil to good tilth condition. Dolomite lime was applied at time of passing cultivator one month before transplanting to bring soil pH to normal range. Nutrients were supplied to the crop as per the package of practices. After receiving rains, when main field was filled with water, puddling operation was done using tiller with rotovator. Field was levelled and twenty five kilogram of Zinc sulphate per hectare was applied along with 250 kg of powder form of farm yard manure and continued the last tiller operation. After soil become good condition like cream on cake in the next day of puddling, transplanting was done.

Transplanting

Eighteen to twenty five days age old seedlings were used for transplanting. The roots of up-rooted seedlings were dipped in biofertilizer solution containing Azospirillum and Phosphorus solubilizing bacteria (PSB) for 15 minutes. Treated seedlings were transplanted manually on the puddled and levelled field having maximum of 1 cm water level in the field. *Whereas,* 30-32 days age old seedlings were used in farmers practice plot having 10-15 cm water level in the main field during transplanting.

Observations recorded

Observations on Crop

Crop observations like plant height (cm), number of tillers per hill, panicle length (cm), number of grains/panicle, grain weight/ plant (g), grain yield (kg/ha) and straw yield (t/ha) were recorded at harvesting stage. The percentage increase in grain yield and straw yield in demonstrated plot over farmers practice plot were calculated.

Observation on Insect pest

Observations on damage potential of stem borer and leaf folder was observed in randomly selected five hills in five different places in an acre area and computed as per the formulae.

$$\text{Percent dead heart} = \frac{\text{Number of dead hearts/hill x100}}{\text{Number of total tillers/hill}}$$

$$\text{Percent leaf damage} = \frac{\text{Number of damaged leaves/hill x100}}{\text{Total number of leaves/hill}}$$

Observations on Brown plant hopper (BPH) were recorded by counting population adult/nymph in randomly selected five hills and ear head bug were recorded by counting population infestation on panicle per hill. The percent control of all insect pest were calculated.

Observation on Diseases

The data regarding the occurrence of the blast disease was collected one week after the last application of fungicides by using the disease rating scale of 0-9 developed by International Rice Research Institute (IRRI. 1996) and then converting into per cent disease by using the formula.

$$\text{Disease \%} = \frac{\text{Sum of the scores x 100}}{\text{Number of observation x highest number in rating scale}}$$

Economics

The gross returns, net returns, cost of production and B:C ratio were worked out based on the market. B:C ratio was calculated by dividing gross returns by cost of cultivation.

Results and Discussion

Effect of Integrated Crop Management on Growth and yield parameters of paddy

In all the three years of front line demonstrations, the growth and yield parameters of rice were influenced by integrated crop management practices (Table 3). During *kharif* 2017, the higher plant height (141.4 cm), number of tillers/hill (13.6), Panicle length (17.6 cm), number grains/panicle (151.9) , grain weight /plant (5.3 g) were reported in demonstrated plots. *Whereas*, farmers practice recorded lower plant height (132.8 cm), number of tillers/hill (10.2), number grains/panicle (139.5), grain weight /plant (5.2 g). Khatun *et al.,* (2018) reported that Integrated crop management

practices also had a significant effect on most of the yield and yield contributing character like total tillers/plant, panicle length, number of spikelets/panicle, number of grains/ panicle, grain yield and straw yield. Grain yield and straw yield of rice were also higher with demonstrated plot (Table 3 and Fig 1&2). *Whereas,* farmers practice had recorded lower grain yield of 3760 kg/ha and straw yield of 4.26 t/ha. There was increase of 37.77 % in grain yield and 22.07 % in straw yield over farmers practice. Similar trends were observed during *kharif* 2018 and *kharif* 2019. Integrated Crop management produced the grain yield of 9.67 t/ ha compared to 8.52 t/ ha from farmers practice, resulting in a 13.5% increase in grain yield over farmers practice (Wang *et al.,* (2017).The improvement in growth and yield parameters of rice was due to Integrated crop management like application lime, addition farm yard manure, incorporation of dhiancha green manure, application zinc sulphate, seedling treatment with biofertilizers, transplanting young age seedlings, recommended dose of fertilizers and reduced pest and disease incidence. Growth parameters, yield components and yield rice increased with increasing lime rate in association of fertilizer in acidic soil (Ferdous *et al*.,2018). Rice yield and biomass increased rapidly due to increased use of chemical fertilizers along with biofertilizers (Gautam, *et al.,* 2008 and Ghosh, *et al.,* 2013, Mondal, *et al.,* 2015). Integrated nutrient management has been shown to considerably improve rice yields by minimizing nutrient losses to the environment and managing the nutrient supply (Kumarand Yadav, 2008).

Among the three years of front line demonstrations, data recorded on growth and yield parameters of paddy were higher during *kharif* 2018. The improvement in growth and yield parameters during *kharif* 2018 were due to incorporation of higher green biomass of dhiancha (8.5 t/ha DM) which was sown during May month and produced higher biomass and transplanting of young age seedlings (18-20 days). Similar trend was observed during *kharif* 2019 also. Puli *et al*., 2017 reported that incorporation of green manure with recommended dose of fertilizer recorded significantly higher growth and yield attributing characters. The maximum grain yield, straw yield and biological yield were obtained from the field that practiced Integrated crop management. This results were found because all favourable conditions received in the field of ICM practice. This result was supported by Wang *et al.,* (2017). Lower values were reported during *Kharif* 2017. During *kharif* 2017, dhiancha was sown during month of June and hence produced lower biomass that had lower influence on growth and yield parameters of rice.

The pooled data also showed similar trend with respect to growth and yield parameters in demonstrated plot as compared to farmers practice (Table 3). The study conducted by (Suthar, *et al.,* 2016) observed that cultivation of rice with improved technologies has been found more productive and grain yield might be increase up to 9.12 per cent and given opinion that improvement in demonstration plot was due replacement of practice with new variety and improved crop management practices. Wolie and Admassu (2016) reported that rice yield and yield contributing traits significantly increased with the use of green manure and farm yard manure in combination with chemical fertilizer than individual sources. Due to the incorporation of dhaincha biomass in soil, the grain yield was increased (up to 39%) compared to the control (Sarwar *et al*., 2017). Prasad and Singh (1984) also reported the combined effect of inoculation of *biofertilizers* in rice with application of Nitrogen increased number of tillers, growth,nutrient uptake and yield of rice. Devi *et al.,* 2019 reported that higher growth and yield parameters were

observed by transplanting 2-3 seedlings with age of 15 days. Suman and Sheeja (2018) revealed that, application of Zinc either as foliar spray or soil application caused significant improvement in growth and yield attributes and yield of rice. Khan *et al.,* (2002) reported similar results.

Effect of Integrated Crop Management on Insect pests in Paddy

The incidence of insect pest on rice was influenced by the integrated crop management practices in all three years as compared to farmer practice (Table 4). Incidence of stem borer (1.62 %), Leaf folder (1.76%), BPH population (8.4 /hill) and ear head bug population (1.2/hill) were less during *kharif* 2017. *Whereas,* farmers practice recorded higher incidence of stem borer (9.52 dead heart %), Leaf folder (7.83 % leaf damage /hill), Brown plant hoppers (BPH) population (37.8/hill) and ear head bug population (4.2 /hill). The *per cent* control of stem borer (82.98 %), Leaf folder (77.52 %), BPH (77.78 %) and Ear head bug (71.43 %) were higher with demonstrated plots over farmer practice. Installation pheromone traps was played role in trapping stem borer male moths and checked the population. Spraying of chlorpyriphos @ 2ml/l and Profenophos @ 2ml/l had controlled stem borer and leaf folder effectively in demonstrated plot. During *kharif* 2018 and 2019 also, similar results were reported.

The pooled data also indicated that there were reduced incidence of stem borer, leaf folder, BPH and ear head bug as compared to farmers practice (Table 4). Singh and Hasan, 2017 reported that chlorpyriphos @ 2ml/l was the best in reducing leaf folder and stem borer population and improving the yield of rice. Mehra (2003) recorded the application of Imidacloprid 200 SL @ 150 ml/ha as the most effective treatment against BPH, gall midge and green leaf hopper of rice. There were no adverse effect on different biological parameters of rice crop *viz.*, plant height, panicle length, total tiller, number of grains per panicle were observed. Krishnakumar and Visalakshi (1989) found that application of malathion was effective controlling earhead bug infestation. Kaushik Chakraborty (2011**)** reported suppression of rice ear head bug (*gundhi bug*), *Leptocoryzaacuta* Th. population by neem formulations.

Effect of Integrated Crop Management on diseases in Paddy

The integrated crop management practices had influence on disease control in all three years as compared to farmer practice (Table 5). During *kharif* 2017, incidence of blast (1.50 %), brown spot(0.5%) and grain discolouration(0.0 %) were less. *Whereas,* farmers practice recorded higher incidence of blast (21.66 %), brown spot(8.55%) and grain discolouration (30.66).The data on *per cent* control of blast (93.08 %), brown spot (94.15 %) and grain discolouration (100%) were showed higher with demonstrated plots over farmers practice. Application of Carbendazim @1g/l and tricyclazole @ 0.8 g/l at 30 days after planting and booting stage had controlled diseases effectively in demonstrated plot.

This in conformity with the findings of Naik *et al.,* (2012) and Balgude and Gaikwad (2016).Seed treatment with carbendazim also played role in checking disease incidence in demonstrated plots. Smut incidence was observed in PSB -68 demonstrated paddy variety (0.5 %).*Whereas,* Abhilash check variety was free from smut disease. Similar trends were observed during *kharif* 2018 and *kharif* 2019. The pooled data on incidence of blast, brown spot, grain discolouration and smut disease also showed similar results (Table 5).

Table.1 Details of the demonstrations

S.No	Particulars	*Kharif* 2017		*Kharif* 2018		*Kharif* 2019	
		Demo Plot(ICM)	**Check Plot (Farmer Practices)**	**Demo Plot(ICM)**	**Check(Farmer Practices)**	**Demo Plot(ICM)**	**Check (Farmer Practices)**
1	Paddy variety	PSB-68	Abhilash	PSB-68	Abhilash	PSB-68	Abhilash
2	Area under each Demonstration (ha)	0.4	0.2-0.4	0.4-0.8	0.2-0.4	0.2-0.4	0.2-0.4
3	Total area of demonstrations (ha)	8.0	4.0	8.0	4.0	4.0	4.0
4	No. of farmer or Demonstrations	15	15	10	10	11	11
5	Villages	Kanakoppa, Kanagod, Hudelkoppa, Devarasikoppa, Kadakoda,Kalagara and Achnalli		Haraganalli, Narebail, Achnalli		Haraganalli, Narebail, Achnalli	
6	Taluk	Sirsi		Mundgod and Sirsi		Mundgod and Sirsi	
7	Soil Type	Laterite		Laterite		Sandy clay loam and Laterite	
8	Situation	Rainfed		Rainfed		Rainfed	
9	Date of sowing of dhiancha	II week of June	--	IV week of May	--	IV week of May	--
10	Date of sowing	6^{th} to 8^{th} July, 2019	6^{th} to 8^{th} July, 2019	5^{th} to 6^{th} July, 2019	4^{th} to 6^{th} July, 2019	4^{th} to 6^{th} July, 2019	4^{th} to 6^{th} July, 2019
11	Date of Transplanting	30^{th} July to 6^{th} Aug, 2019	5^{th} to 10^{th} Aug,2019	26^{th} to 30^{th} July, 2019	5^{th} to 10^{th} Aug,2019	30^{th} July to 4^{th} Aug, 2019	5^{th} to 10^{th} Aug,2019
12	Date of Harvest	8^{th} to 12^{th} Dec, 2019	8^{th} to 15^{th} Dec, 2019	5^{th} to 15^{th} Dec, 2019	6^{th} to 13^{th} Dec, 2019	6^{th} to 13^{th} Dec, 2019	6^{th} to 13^{th} Dec, 2019

Table.2 Details of the Technologies demonstrated under Front line demonstrations

S.No	Particulars	*Kharif* 2017		*Kharif* 2018		*Kharif* 2019	
		Demo Plot (ICM)	**Farmer Practices**	**Demo Plot (ICM)**	**Farmer Practices**	**Demo Plot (ICM)**	**Farmer Practices**
1	Rice variety	PSB-68	Abhilash	PSB-68	Abhilash	PSB-68	Abhilash
2	Seed rate (kg/ha)	62.5	100	62.5	100	62.5	100
3	Lime Application	7.5 q/ha	Not applied	5.0-7.5 q/ha	Not applied	5.0-7.5 q/ha	Not applied
4	Green manure crop	Dhaincha	Not adopted	Dhaincha	Not adopted	Dhaincha	Not adopted
5	Farm Yard Manure	2.0-2.5 t/ha	1.0-2.0 t/ha	3.0-4.0 t/ha	1.0-1.5 t/ha	2.5 -3.0 t/ha	1.5-2.0 t/ha
6	Zinc Sulphate application	10 kg/ha	Not applied	10 kg/ha	Not applied	10 kg/ha	Not applied
7	Seed Treatment with Carbendazim	@ 2g/l and soaking seeds for 12 hours	Not adopted	@ 2g/l and soaking seeds for 12 hours	Not adopted	@ 2g/l and soaking seeds for 12 hours	Not adopted
8	Biofertilizers (Azosperillum and PSB)	Seedlings root treatment	Not adopted	Seedlings root treatment	Not adopted	Seedlings root treatment	Not adopted
9	Seedlings age for transplantation	25-28 days	30 days and above	18-20 days	30 days	20-25	30-32 days
10	Transplanting Depth	Shallow (2-3 cm)	Deep (> 8 cm)	Shallow (2-3 cm)	Deep (> 8 cm)	Shallow (2-3 cm)	Deep (> 8 cm)
11	Spacing	20 x 15 cm	20 x 10 cm	20 x 15 cm	20 x 10 cm	20 x 15 cm	20 x 10 cm
12	No. of Seedlings /hill	2-3	4-6	2-3	4-6	2-3	4-6
13	Fertilizer application	100:50:50 kg NPK/ha	70-75 % RDF	100:50:50 kg NPK/ha	75-80 % RDF	100:50:50 kg NPK/ha	80-85 % RDF
14	Blast management	Tricyclazole @ 0.8 g/l	Carbendazim @ 1g/l	Tricyclazole @ 0.8 g/l	Carbendazim @ 1g/l	Tricyclazole @ 0.8 g/l	Carbendazim @ 1g/l
15	Stem borer management	Pheromone Traps And Chlorpyriphos @ 2 ml/l Profenophos @ 2ml/l	Monocrotophos @ 1ml/l	Pheromone Traps Spray of Chlorpyriphos @ 2 ml/l	Chlorpyriphos @ 2 ml/l	Pheromone Traps Spray of Chlorpyriphos @ 2 ml/l Profenophos @ 2ml/l	Monocrotophos @ 1ml/l
16	Leaf folder management	Chlorpyriphos @ 2 ml/l	Passing Thorny Branches	Chlorpyriphos @ 2 ml/l Profenophos @ 2ml/l	Passing Thorny Branches Chlorpyriphos @ 2 ml/l	Chlorpyriphos @ 2 ml/l	Passing Thorny Branches
17	BPH management	Imidacloprid @ 0.25 ml/l	Chlorpyriphos @ 2 ml/l	Imidacloprid @ 0.25 ml/l	Chlorpyriphos @ 2 ml/l	Imidacloprid @ 0.25 ml/l	Chlorpyriphos @ 2 ml/l
18	Ear head bug management	Neem oil @ 5 ml/l Malathion @ 2 ml/l	Chlorpyriphos @ 2 ml/l	Neem oil @ 5 ml/l Malathion @ 2 ml/l	Chlorpyriphos @ 2 ml/l	Neem oil @ 5 ml/l Malathion @ 2 ml/l	Chlorpyriphos @ 2 ml/l

Table.3 Effect of Integrated Crop Management on Growth and Yield Parameters of Rice

Parameters	2017-18		2018-19		2019-20		Pooled data	
	Demo	Check	Demo	Check	Demo	Check	Demo	Check
Plant height (cm)	141.4	132.8	139.5	130.4	140.5	131.8	140.4	131.7
No. of Tillers/hill	13.6	10.2	17.1	10.7	15.6	8.3	15.4	9.7
Panicle Length (cm)	17.6	15.5	21.2	15.1	20.6	15.5	19.8	15.3
No. of grains /panicle	151.9	139.5	155.92	130.6	155.8	127.2	154.5	132.4
Grain weight /plant (g)	5.3	5.2	5.5	5.4	5.4	5.3	5.4	5.3
Grain Yield (kg/ha)	5182	3760	7544	5474	7290	4835	6672	4690
% increase in Grain yield	37.77	-	37.82	-	50.78	-	42.12	-
Straw yield (t/ha)	5.2	4.26	7.40	5.21	6.92	5.45	6.51	4.97
% increase in Straw yield	22.07	-	42.31	-	27.21	-	30.53	-
Dhiancha Dry matter production (t/ha)	4.1	-	8.5	-	7.2	-	6.6	-

Table.4 Effect of Integrated Crop Management on incidence of Insect Pest in Rice

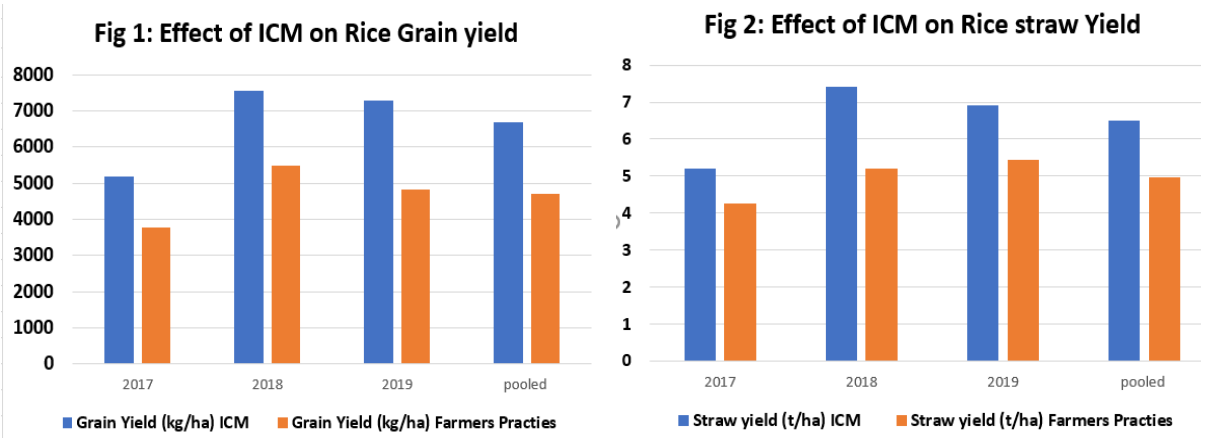
Parameters	2017-18		2018-19		2019-20		Pooled data	
	Demo	Check	Demo	Check	Demo	Check	Demo	Check
Stem borer incidence (% Dead heart)	1.62	9.52	0	5.2	1.76	10.46	1.13	8.39
% Control of Stem borer	82.98	-	100	-	83.17	-	88.72	-
Leaf folder Incidence (% Leaf damage /hill))	1.76	7.83	3.5	25.00	2.66	15.33	2.64	16.05
% Control of Leaf folder	77.52	-	86.00	-	82.27	-	81.93	-
BPH Population (Nymph/Adult/Hill)	8.4	37.8	5.6	33.7	5.4	23.6	6.47	31.70
% Control of BPH	77.78	-	83.38	-	77.12	-	79.43	-
Ear head bug population / hill	1.2	4.2	0.5	3.2	1.0	4.8	0.9	4.07
% Control of Ear head bug	71.43	-	84.38	-	79.17	-	78.33	-

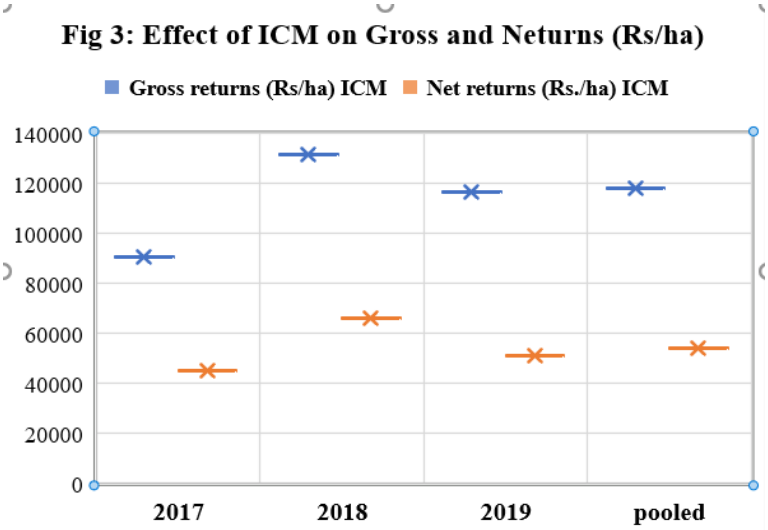
Table.5 Effect of Integrated Crop Management on Incidence of diseasesin Rice

Parameters	2017-18		2018-19		2019-20		Pooled data	
	Demo	Check	Demo	Check	Demo	Check	Demo	Check
Blast disease incidence (%)	1.50	21.66	0.87	19.1	2.31	33.69	1.56	24.82
% Blast control	93.08	-	94.45	-	93.14	-	93.56	-
Brown Spot	0.5	8.55	1.00	10.5	1.20	12.65	0.9	10.57
% Brown Spot control	94.15		90.48	-	90.51	-	91.71	
Grain discolouration (%)	0.0	30.66	2.5	28.96	3.5	25.86	2.0	28.49
% Control of grain discolouration	100.0	-	91.38	-	86.47	-	92.62	-
Smut disease Incidence (%)	0.5	0.0	1.5	0.0	2.25	1.0	1.42	0.33

Table.6 Effect of Integrated Crop Management on Economics of Rice cultivation

Parameters	2017-18		2018-19		2019-20		Pooled data	
	Demo	Check	Demo	Check	Demo	Check	Demo	Check
Gross returns (Rs/ha)	90748	66534	131440	84829	116618	87753	117876	80680
% Increase in Gross returns	36.39	-	54.95		32.89	-	41.41	-
Cost of Cultivation (Rs/ha)	45533	41780	65390	52944	65500	54950	58808	49891
Net returns (Rs/ha)	45215	24754	66050	34809	51118	32803	54128	30789
% increase in Net returns	82.66	-	89.75	-	55.83	-	75.80	-
B:C ratio	1.99	1.59	2.01	1.66	1.78	1.60	2.00	1.64





Effect of Integrated Crop Management on Economics of Paddy cultivation

The economics of rice cultivation was influenced by integrated crop management practices (Table6 and Fig 3) in all three years. During *kharif* 2017, the higher gross income (Rs.90748/ha) and net income (Rs.45215/ha) was recorded in demonstrated plot. *Whereas*, farmers practice had recorded lower gross returns (Rs.66534/ha) and net returns (Rs.41780/ha). The higher cost of paddy cultivation was recorded with demonstration plot (Rs.45533/ha) and lower value with farmers practice (Rs. 41780/ha) . Increased cost of production in demonstrate plot was due to increase use of inputs like fertilizers and higher labours involved for harvesting and threshing operation for increased yield and biomass. The higher B: C ratio was recorded in demonstrated plot (1.99) as compared to framers practice (1.59). Similar trends were observed during *kharif* 2018 and *kharif* 2019. Among the three years of front line demonstrations, *kharif* 2018 had higher gross returns (Rs.131440/ha), higher net returns (Rs.66050/ha) and B: C ratio (2.01) followed by *Kharif* 2019. This was due to higher grain and straw yield intern due to increased growth and yield parameters.

The results of study conducted be Senthil Kumar *et al.*, (2019) revealed that treatment receiving application of *Sesbania aculeata*@ 6.25 t ha-1 + 150:50:50 kg NPK ha-1 recorded relatively higher growth, yield and

economics than other treatments. Similar findings were reported by Revathi *et al*., (2014). There was significant improvement in yield attributes and economics of rice due to application of NPK @ 150 + 60 + 40 + Azotobactor and PSB 5 kg /ha (Singh *et al.*,2015). Lower values were with *Kharif* 2017. During *kharif* 2017, dhiancha was sown during month of June and hence produced lower biomass that had lower influence on growth and yield parameters of paddy. This caused the reduction in gross returns, net returns and B:C ratio as compared to other two years of demonstrations. The pooled data on economics of rice cultivation also showed similar higher gross returns, net returns, cost of cultivation and B: C ratio in demonstrated plot as compared to farmers practice (Table 6). Suthar *et al.,* (2016) reported that the adoption of improved technology under Frontline demonstrations recorded higher average gross returns (57932 Rs/ha), net returns (34432 Rs/ha) and B: C ratio (1:2.53) compared to farmers practice.

From the study, It could be concluded that integrated crop management was the approach for getting maximum yield of rice and returns with higher B:C ratio.

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References

Balgude,Y.S and Gaikwad, A.P. (2016). Integrated Management of Grain Discolouration Disease in Paddy. *Journal of Rice Research*, 9 (2):59-62.

Devi, K.N., Narayan, G., Singh, K.K., Devi, M.A., Singh, H.A. and Singh, A.D. (2019). Effect of Age and Number of Seedling per Hill on Growth and Yield of Black Scented Rice (*Oryza sativa* L.) Variety '*Chakhao Poireiton*' under Manipur Condition. *Int. J. Curr. Microbiol. App. Sci 8*(7): 1738-1745.

Ferdous, S.A., Miah, M.N.H., Hoque, M., Hossain, M.S. and Hasan, A.K., (2018). Enhancing rice yield in acidic soil through liming and fertilizer management. *Journal of Bangladesh Agricultural University*, 16(3): 357–365.

Naik, G.R., Naik, G.B., Naik, B.T. and Naik, K.R. (2012).Fungicidal management of leaf blast disease in Rice. *Global Journal of Bioscience and. Biotechnology*, 1 (1): 18-21.

Gautam, A.K., Kumar,D., Shivay,Y.S. and Mishra,B.N. (2008). Influence of Nitrogen Levels and Plant Spacingon Growth, Productivity and Quality of Two Inbred Varieties and a Hybrid of Aromatic Rice. *Archives of Agronomy and Soil Science*, 54 (5): 515-32.

GhoshM, Swain DK, Jha MK. and Tewari, V.K. (2013). Precision Nitrogen Management Using Chlorophyll Meter for Improving Growth, Productivity and NUse Efficiency of Rice in Subtropical Climate. *Canada Journal of Agricultural Science*, 5 (2): 253-66. IRRI (1996). Standard evaluation system for rice. 4th ed. IRRI, Manila, Phillipine.

Kaushik Chakraborty (2011).Extent of suppression of rice ear head bug population by different neem formulation in field of paddy cultivar Swarnamashuri (MTU 7029) during *kharif* season. *Journal of Agricultural and Biological Science,* 6: (12)37-41.

Khan, M.U., Qasim, M. and Jamil, M.(2002). Response of rice to zinc fertilizer in calcareous oils of D. I. Khan. *Asian J. Plant Sci.* 1 (1): 1-2.

Khatun, N., Rahman, M.A. and DeviP. (2018).Integrated crop management (ICM) for increasing rice production in Barind area. African Journal of Agricultural Research, 13(16): 886-889

Krishna kumar,R. and Visalakshi, R.(1989). Relative toxicity of insecticides to ricebug *Leptocorisa acuta Thunb. Entomon;* 14: (3-4) 365-366.

Kumar,J. and Yadav,M.P.(2008).Effect of Integrated Nutrient Management on Growth, Yield Attributes, Yieldand Economics of Hybrid Rice (*Oryza sativa* L.).*Research on Crops,* 9: 10-3.

Mehra, V.P. (2003). Bio-efficacy of confidor insecticide and evaluation of advance rice breeding lines against brown plant hopper *Nilaparvata lugens* (Stal.) *M.Sc. (Ag.) Thesis*, IGAU, Raipur (C.G.). Mondal, S.,Mallikarjun,M.,Ghosh, M., Ghosh,D.C. and Timsina,J. (2015). Effect of Integrated Nutrient Management on Growth and Productivity of Hybrid Rice. *Journal of Agricultural Science and Technology*, B 5:297-308

Prasad, J. and Singh, R.S.(1984).Effect of Azolla, seedling bacterization with Azotobacter and *Azospirillum* with and without nitrogen on paddy (*Oryza sativa*). *Indian J. Agril. Res.*, 18: 63-67.

Puli, M,R., Prasad, P.R.K., Jayalakshmi, M. and RaoBS (2017). Effect of Organic andInorganic Sources of Nutrients on NPK Uptake by Rice Crop at Various Growth Periods. *Research Journal of Agricultural Sciences*, 8(1): 64-69.

Revathi,P.,Suneetha Devi,K.B., Gopal Reddy, B., Rao, V.P., Padmaja,G.and Shiv Shanker, A. (2014).Influence of Planting Methods and Integrated Nutrient Management on Growth, Yield and Economics of Rice. *Journal of Rice Research*, 7 (1 & 2):62-76.

Sarwar, A.K.M.G., Hossain, S.M.Z. and Chanda, S.C. (2017). Effect of *Dhaincha* accessions on soil health and grain yield of rice. *Biosci. Agric. Res.* 13(2): 1140-1145.

Senthil Kumar, N., Suresh, S., Paramasivan,M. (2019).Performance of rice under integrated nutrient management in southern region of Tamil Nadu. *Journal of Pharmacognosy and Phytochemistry*, 2019; SP2: 735-736.

Singh, H. and Hasan, W. (2017).Bio-efficacy of chlorpyrifos and Fipronil insecticides against insect pests of Paddy. International Research Journal of Natural and Applied Sciences, 4(6): 22-32.

Singh, R.K., Kumar,P.,Prasad, B., Singh, S.B. (2015). Effect of biofertilizers on growth, yield andeconomics of rice (*Oryza sativa* L.). *Internat. Res. J. Agric. Eco. & Stat.*, 6 (2): 386-391.

Suman, B.M. and Sheeja, K.R.(2018).A review on zinc and boron nutrition in rice. *Journal of Applied and Natural Science*,10 (4): 1180 -1186

Suthar, J.V., Chawda, S.K,, Patel, A.T,, Pastagia, J.J. and Patel,B.B. (2016).Impact of Front Line Demonstration on the yield of Poha Rice (*Oryza Sativa*) in Surat District.*J.Bio.Innov*.5(4): 588-593.

Verma,S. (2006). Studies on Paddy brown plant hopper infestation at farmer's field and bio-efficacy of some newer insecticides. *M.Sc. (Ag.) Thesis*, Department of Entomology college of Agriculture Indira Gandhi Agricultural University, Raipur.

Wang, D., Huang, J. and Peng, S. (2017). Integrated crop management practices for maximizing grain yield of double season rice crop. Sci. Rep. 7:38982.

Wolie, A.W. and Admassu, M.A. (2016) Effects of Integrated Nutrient Management on Rice (Oryza sativa L) Yield and Yield Attributes, Nutrient Uptake and Some Physico- Chemical Properties of Soil: *A Review. Journal of Biology, Agriculture and Healthcare*, 6, (5): 20-26.

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