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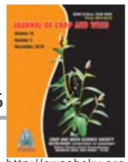

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Standardization of integrated nutrient management for aromatic *Gobindabhog* rice in *Gangetic* alluvial region of West Bengal

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ABSTRACT

A field experiment was conducted at 'C' Block Farm of Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal, India to standardize the integrated nutrient management for scented Gobindabhog rice during kharif (wet) season of 2010 and 2011. The types and doses of organic manures (O_1–O_5) were assigned in main plots and levels of chemical fertilizers (F_1–F_3) in sub-plots in a split-plot design. The treatments could exert significant influence on growth attributes compared to unmanured control (O_1), where the use of FYM and mustard cake resulted in taller plants, greater tiller production, foliage growth and dry matter accumulation of Gobindabhog rice through out the cropping period. Although the application of mustard cake (@ 0.25 or 0.50 t ha^{-1}) was found better toward the production of panicles (306.5 and 303.1 m^{-2}), but the use of FYM @ 5 t ha^{-1} resulted in maximum number of filled grains (143.6 panicle^{-1}) and grain yield (2.93 t ha^{-1}) and were at par with mustard cake @ 0.25 t ha^{-1} (141.5 m^{-2} and 2 .88 t ha^{-1}). The grain yield and protein content were significantly improved with increasing levels of NPK fertilizers from $N_{20}P_{10}K_{10}$ kg ha^{-1} (2.66 t ha^{-1} and 7.22%) to $N_{30}P_{15}K_{15}$ kg ha^{-1} (2.73 t ha^{-1} and 7.512%). Among treatment combinations, the integrated nutrient management dose of FYM @ 5 t ha^{-1} + $N_{40}P_{20}K_{20}$ kg ha^{-1} could be adopted for Gobindabhog rice for higher grain yield (3.01 t ha^{-1}), protein content (7.75%), net profit (Rs. 29100 ha^{-1}, B:C ratio (2.05) and better soil residual status (+20.8 kg N, +13.9 kg P and -9.4 kg K ha^{-1}) or alternatively mustard cake @ 0.25 t ha^{-1} + $N_{20}P_{10}K_{10}$ kg ha^{-1} might be another option of nutrient management in gangetic alluvial region of West Bengal.

Keywords: Aromatic rice, chemical fertilizers, economics, grain yield, organic manure, soil health

Gobindabhog, a short-grained indigenous aromatic rice, is traditionally cultivated in *gangetic* alluvial and *rahr* (lateritic) region of West Bengal for hundreds of years. At present, it is cultivated in about 35,000–38,000 ha land with an average production of 90,000 –1,00,000 tonnes paddy every year (Ghosh, 2019). Farmers cultivate the traditional scented rice in medium-uplands normally with low inputs during *kharif* season, mainly for domestic use like preparation of dessert (*payash*), pulse-intermixed rice (*bhog*), *polao*, etc. in social functions and religious festivals, along with periodic sale to the local rice mills. The premium grain quality including pleasant aroma of *Gobindabhog* rice make the variety potential for large-scale marketing in the country particularly in South Indian states as well as for export in foreign countries after recommendation of Parliament of India during 2011.

In modern intensive farming system, neither organic manures nor chemical fertilizers alone could achieve yield sustainability at high level. Thus, integrated nutrient management (INM) is imperative for quality aromatic rice production in a sustainable way. The tall *indica Gobindabhog* rice is traditionally grown with organic manures or intermixed with chemical fertilizers in recent times, which needs to be refined. Although organic nutrient management practices (50 kg N ha^{-1}) comprising FYM and mustard cake @ 50% RDN each for *Gobindabhog* rice have increased yield and quality (Banerjee *et al*., 2013), but standardization of integrated nutrient dose is of great necessity for increased yield, more profit and higher sustainability of *Gobindabhog* rice cultivation system in South Bengal.Information on these aspect is meagre, hence this experiment was undertaken.

MATERIALS AND METHODS

A field experiment was conducted to standardize the combined dose of organic manure and chemical fertilizers for traditional scented *Gobindabhog* rice during *kharif* (wet) season of 2010 and 2011 at 'C' Block Farm (22°57' N latitude, 88°20' E longitude and 9.75 m above mean sea level) of Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal, India. The soil was sandy-loam (order Entisol), neutral in reaction (pH 6.8), medium in organic carbon (0.61%), available nitrogen (287.3 kg ha^{-1}), phosphorus (48.5 kg ha^{-1}) and potassium (234.7 kg ha^{-1}). The experiment was laid out in a split-plot design with 3 replications, where 5 doses of organic manures (O_1 = Control, O_2 = FYM @ 2.5 kg ha^{-1}, O_3 = FYM @ 5 kg ha^{-1}, O_4 = Mustard cake 0.25 kg ha^{-1}, O_5 = Mustard cake 0.50 kg ha^{-1}), in main plots and 3 chemical fertilizer levels (F_1 = $N_{20}P_{10}K_{10}$ kg ha^{-1}, F_2 = $N_{30}P_{15}K_{15}$ kg ha^{-1}, F_3 = $N_{40}P_{2}0K_{20}$ kg ha^{-1}) in sub-plots. Farm yard manure was applied at 2 weeks

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before transplanting, while mustard cake and chemical fertilizers were given in the experimental plots as per the treatment schedule. Mean N, P and K content of FYM and mustard cake were 0.43, 0.18 and 0.48%, and 4.55, 1.38 and 1.05%, respectively. Urea, single super phosphate (SSP) and muriate of potash (MOP) were used to supply nitrogen, phosphorous and potassium, respectively to the crop.

25 days old seedlings of *Gobindabhog* rice @ 2-3 hill were transplanted at a spacing of 15 × 15 cm (44 hills m^2) in 4 × 3 m plots of the puddled field. Manual weeding was done at 3 and 6 weeks after transplanting (WAT), and other crop management practices were adopted as per standard recommendations. Growth attributes like tiller production, leaf area index (Watson, 1958) and dry matter production were recorded at different stages, lodging (IRRI, 1996) at dough, and yield attributes at maturity. The grain quality parameters like amylose content (Juliano, 1971), and protein content (Sadasivam and Manickam, 1996) were determined during post-harvest period at Aromatic Rice Laboratory, B.C.K.V., Mohanpur, Nadia. Total and available N, P, K in soil and plant were estimated by standard methods (Jackson, 1973), and nutrient uptake was estimated by multiplying the dry matter yield of grain and straw by their respective nutrient percentages. The cost of cultivation, gross return, net return and benefit: cost ratio was calculated based on the market prices of inputs and produces along with the related wages during the years of investigation. The data were analysed using the 'Analysis of Variance' technique as per the procedures described by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Growth attributes

The types and doses of organic manures (O_1-O_5) as well as the levels of chemical fertilizers (F_1-F_3) had significant influence on growth attributes of *Gobindabhog* rice *viz*. plant height at harvest, tiller production at 28 and 56 DAT, and foliage growth at 28, 56 and 84 DAT with few exceptions on LAI (Table 1). Organic manure (FYM and mustard cake) produced taller plants (135.2-138.9 cm) than unmanured control (128.7 cm). Besides, the increment in fertilizers doses from $N_{20}P_{10}K_{10}$ kg ha^{-1} (F_1) to $N_{40}P_{20}K_{20}$ kg ha^{-1} (F_3) increased the plant height and tiller production of *Gobindabhog* rice during both 2010 and 2011. The application of mustard cake @ 0.25 kg ha^{-1} (O_4) or 0.50 kg ha^{-1} (O_5) increased the tiller production during active to maximum tillering phase compared to FYM treated plots (O_2 and O_3) which could be attributed to the fact that greater proportion of nitrogen released from mustard cake became available to Gobindabhhog rice within a short period than the release of nutrients from FYM**.** Manuring or application of chemical fertilizers could improve the pooled LAI values significantly at 28 and 56 DAT, respectively. Although FYM was found usually better than mustard cake towards the foliage growth in the study, but Banerjee *et al.* (2013) reported better effect of mustard cake on LAI of the same crop than FYM and vermicompost in New Alluvial Zone of West Bengal. There was progressive improvement in total dry matter production unit $area^{-1}$ with increase in level of either form of organic manure (FYM @ 5 t ha^{-1} or mustard cake 0.5 t ha^{-1}) or chemical fertilizers ($N_{40}P_{20}K_{20}$ kg ha^{-1}) over their respective lower doses . It might be due to greater capability of plants to assimilate more carbohydrates in the form of tiller production and foliage growth. Similar finding on total dry matter of aromatic rice hybrid (*cv.* Pusa RH 10) was reported by Suman and Bisht, 2010, when nourished with *Sesbania* sp. or wheat straw.

The tall-*indica* type *Gobindabhog* rice had a general tendency to lodge down completely at maturity . The application of either of organic manures (FYM or mustard cake) increased the lodging tendency (score 4.78-5.22) over unmanured control (score 4.44). Similarly, the plants of *Gobindabhog* became more susceptible to lodge down at hard dough stage with increment in fertilizer dose from $N_{20}P_{10}K_{10}$ (F_1) to $N_{40}P_{20}K_{20}$ kg ha^{-1} (F_3) (Table 1).

Yield components and grain yield

The varied doses of organic manures and inorganic fertilizers had significant effect on yield components (*viz.* numbers of panicles m^{-2}, number of filled grains $panicle^{-1}$ and 1000 grain weight) and grain yield (Table 2). Although the application of mustard cake (0.25 or 0.50 t ha^{-1}) was found better (306.5 and 303.1 m^{-2}) than FYM (@ 2.5 or 5 t ha^{-1}) for the production of panicles of *Gobindabhog* paddy, but use of FYM @ 5 t/ha (O_3) resulted in highest number of filled grains (143.6 $panicle^{-1}$) but was at par with mustard cake @ 0.25 t ha^{-1} (O_4) . Both levels of chemical fertilizers ($N_{30}P_{15}K_{15}$ and $N_{40}P_{20}K_{20}$ kg ha^{-1}) were at par with respect to the production of panicles per unit area, which indicated that additional supply of nutrients beyond $N_{30}P_{15}K_{15}$ kg ha^{-1} had no influence on more production of effective tillers of *Gobindabhog* rice .

The application of FYM @ 5 t ha^{-1} (O_3) resulted in highest grain yield (2.93 t ha^{-1}), and was at par with mustard cake @ 0.25 t ha^{-1} (2.88 t ha^{-1}). On the other hand, the grain yield was significantly improved with increment in NPK fertilizers from $N_{20}P_{10}K_{10}$ kg ha^{-1} (2.66 t ha^{-1}) to $N_{30}P_{15}K_{15}$ kg ha^{-1} (2.73 t ha^{-1}), beyond which the additional fertilization of $N_{40}P_{20}K_{20}$ kg ha^{-1} (F_3) had

Table 1: Effect of organic manure and chemical fertilizer on growth attributes of scented *Gobindabhog* rice during *kharif* season (pooled data of two years)

Treatment	Plant height (cm)	Lodging (score)	Number of tillers m^{-2}		Leaf area index (LAI)			Dry matter production (g m^{-2})		
			28 DAT	56 DAT	28 DAT	56 DAT	84 DAT	28 DAT	56 DAT	84 DAT
Organic manure										
$O_{1,}$ Control	128.7	4.4	217.4	300.0	1.73	3.70	4.86	171.5	246.5	408.4
$O_{2,}$ FYM @ 2.5 t ha^{-1}	135.2	4.8	252.7	321.2	1.78	3.94	4.89	182.5	271.0	441.2
$O_{3,}$ FYM @ 5 t ha^{-1}	136.9	5.4	263.2	336.6	1.80	3.81	4.92	188.3	281.4	451.6
$O_{4,}$ Mustard cake @ 0.25 t ha^{-1}	138.9	5.0	270.5	351.0	1.80	3.79	4.83	188.9	281.8	460.9
$O_{5,}$ Mustard cake @ 0.5 t ha^{-1}	134.6	5.2	264.5	360.2	1.80	3.77	4.99	191.9	293.4	462.4
SEm (±)	**0.62**	**0.14**	**1.30**	**1.93**	**0.01**	**0.06**	**0.05**	**1.73**	**2.51**	**2.35**
LSD (0.05)	**1.85**	**0.43**	**3.89**	**5.80**	**0.03**	**NS**	**NS**	**5.20**	**7.54**	**7.05**
Inorganic fertilizer										
$F_{1,}$ $N_{20}P_{10}K_{10}$ kg ha^{-1}	132.9	4.5	247.7	327.1	1.76	3.74	4.86	177.5	266.6	436.3
$F_{2,}$ $N_{30}P_{15}K_{15}$ kg ha^{-1}	134.6	5.1	256.1	332.8	1.79	3.79	4.90	183.5	276.4	445.6
$F_{3,}$ $N_{40}P_{20}K_{20}$ kg ha^{-1}	137.1	5.3	257.2	341.4	1.79	3.87	4.94	192.9	281.5	452.9
SEm (±)	**0.33**	**0.14**	**1.62**	**1.75**	**0.01**	**0.03**	**0.03**	**0.75**	**0.89**	**0.72**
LSD (0.05)	**0.95**	**0.40**	**4.63**	**4.99**	**NS**	**0.08**	**NS**	**2.14**	**2.55**	**2.06**

Table 2: Effect of organic manure and chemical fertilizer on yield components, grain yield, quality and economics of scented *Gobindabhog* rice (pooled data of two years)

Treatment	No. of panicles m^{-2}	No. of filled grains $panicle^{-1}$	1000 grain weight (g)	Grain yield (t ha^{-1})	Amylose (%)	Protein (%)	Total cost of cultivation ($\times10^3$ Rs. ha^{-1})	Gross return ($\times10^3$ Rs. ha^{-1})	Netreturn ($\times10^3$ Rs. ha^{-1})	B:C
Organic manure										
$O_{1,}$ Control	255.1	126.1	10.26	2.34	18.07	6.97	22.4	44.5	22.1	1.99
$O_{2,}$ FYM @ 2.5 t ha^{-1}	274.6	133.3	10.45	2.65	18.12	7.36	25.5	50.2	24.7	1.97
$O_{3,}$ FYM @ 5 t ha^{-1}	296.7	143.6	10.37	2.93	18.40	7.59	27.4	55.3	27.9	2.02
$O_{4,}$ Mustard cake @ 0.25 t ha^{-1}	306.5	141.5	10.46	2.88	18.45	7.45	27.0	54.5	27.5	2.01
$O_{5,}$ Mustard cake @ 0.5 t ha^{-1}		303.1	136.5	10.32	2.71	18.33	7.48	30.4	51.4	21.0
1.69										
SEm (±)	**3.21**	**1.97**	**0.03**	**0.03**	**0.06**	**0.08**				
LSD (0.05)	**9.62**	**5.89**	**0.09**	**0.09**	**0.18**	**0.24**				
Inorganic fertilizer										
$F_{1,}$ $N_{20}P_{10}K_{10}$ kg ha^{-1}	277.4	128.0	10.32	2.66	18.21	7.22	26.5	50.3	23.9	1.90
$F_{2,}$ $N_{30}P_{15}K_{15}$ kg ha^{-1}	290.2	137.6	10.42	2.73	18.27	7.37	26.8	51.7	24.9	1.93
$F_{3,}$ $N_{40}P_{20}K_{20}$ kg ha^{-1}	294.0	143.0	10.38	2.72	18.34	7.51	27.1	51.5	24.4	1.90
SEm (±)	**1.908**	**1.27**	**0.03**	**0.02**	**0.04**	**0.04**				
LSD (0.05)	**5.453**	**3.62**	**0.08**	**0.05**	**NS**	**0.12**				

Table 3. Effect of organic manure and chemical fertilizer on uptake of nutrients by scented *Gobindabhog* rice and changes in soil fertility (pooled data of two years)

Treatment	Total uptake of nutrients (kg ha^{-1})			Residual soil fertility (kg ha^{-1})		
	Nitrogen	Phosphorus	Potassium	Nitrogen	Phosphorus	Potassium
Organic manure						
O_1, Control	35.1	12.33	41.0	284.6 (-27.2)	52.5 (+4.0)	205.1 (-29.7)
O_2, FYM @ 2.5 t ha^{-1}	42.4	16.12	46.6	287.8 (-0.5)	53.1 (+4.6)	211.3 (-23.4)
O_3, FYM @ 5 t ha^{-1}	42.7	16.77	49.6	298.2 (+10.9)	56.8 (+8.3)	220.1 (-14.6)
O_4, Mustard cake @ 0.25 t ha^{-1}	43.0	15.73	49.5	288.1 (+0.8)	52.5 (+4.1)	199.1 (-35.6)
O_5, Mustard cake @ 0.5 t ha^{-1}	41.5	15.16	47.7	300.9 (+13.6)	56.6 (+8.1)	203.5 (-31.2)
SEm (±)	**0.38**	**0.12**	**0.37**			
LSD (0.05)	**1.15**	**0.37**	**1.11**			
Inorganic fertilizer						
F_1, $N_{20}P_{10}K_{10}$ kg ha^{-1}	39.6	14.83	45.4	283.3 (-4.1)	49.7 (+1.2)	204.3 (-30.4)
F_2, $N_{30}P_{15}K_{15}$ kg ha^{-1}	41.3	15.16	47.4	291.5 (+4.2)	54.4 (+5.9)	207.3 (-27.4)
F_3, $N_{40}P_{20}K_{20}$ kg ha^{-1}	41.9	15.68	47.8	300.9 (+13.7)	58.9 (+10.4)	211.9 (-22.8)
SEm (±)	**0.28**	**0.07**	**0.21**			
LSD (0.05)	**0.79**	**0.19**	**0.61**			

FYM= Farm yard manure; Initial soil status, 287.3 kg N, 48.5 kg P and 234.7 kg K ha^{-1}
Figures in parentheses show the changes in soil fertility (%) over initial fertility status.

no effect on the grain yield. Among treatment combinations, FYM @ 5 t ha^{-1} + $N_{40}P_{20}K_{20}$ kg ha^{-1} (O_3F_3) produced the highest grain yield (3.01 t ha^{-1}), being closely followed by FYM @ 5 t + $N_{30}P_{15}K_{15}$ kg ha^{-1} (O_3F_2), mustard cake @ 0.25 t + $N_{20}P_{10}K_{10}$ kg ha^{-1} (O_4F_1) and mustard cake @ 0.25 t + $N_{30}P_{15}K_{15}$ kg ha^{-1} (O_4F_2) in the investigation (Fig.1). Pal *et al.*, 2016 observed that integrated use of 75% inorganic fertilizer + cowdung @ 5 t ha^{-1} to 3 fine aromatic rice varieties resulted in the highest grain yield (3.42 t ha^{-1}) at Mymensingh, Bangladesh.

Grain quality

Gobindabhog had short-bold type white-coloured milled rice with medium-strong aroma. The varied applications of organic manures and chemical fertilizers did not influence the milling quality, physical properties of grain, processing quality and aroma of *Gobindabhog* rice in the investigation. Four organic manure-based treatments (O_2–O_5) improved amylose and protein content of *Gobindabhog* rice over unmanured control (O_1), where application of mustard cake @ 0.25 t ha^{-1} resulted in highest amylose content (18.45%) and FYM @ 5 t ha^{-1} recorded maximum protein content (7.59%) (Table 2). Prakash *et al.* (2002) reported favourable effect of FYM on protein content of Pusa Basmati compared to commercial manures and chemical fertilizers. There was steady increase in amylose and protein content of *Gobindabhog* rice from $N_{20}P_{10}K_{10}$ (18.21% and 7.22%) to $N_{40}P_{20}K_{20}$ kg ha^{-1} (18.34% and 7.51%), but significant differences noted in protein content only. This might be due to greater N supply (40 kg ha^{-1}) leading to better protein synthesis compared to lower N dose (20 and 30 kg ha^{-1}) in the study. Sikdar *et al.* (2008) also reported that the protein content of three aromatic rice varieties (Kalizira, Badshabhog and Tulshimala) was improved with increase in nitrogen level from 40 and 80 kg ha^{-1} Mymensingh, Bangladesh.

Nutrient uptake and residual status

The uptake of N, P and K by *Gobindabhog* rice differed significantly due to both organic manure and chemical fertilizer-based treatments (Table 2). The application of either of organic manures (FYM or mustard cake) at either of the doses recorded greater N, P and K uptake over unmanured control (35.1 kg, 12.3 kg and 41.0 kg ha $^{-1}$). Although the highest N uptake (43.0 kg ha^{-1}) was noted with mustard cake @ 0.25 kg ha^{-1} (O_4), but maximum P (16.8 kg ha^{-1}) and K (49.6 kg ha^{-1}) with FYM @ 5 t ha^{-1} (O_3) .The plants in unmanured control plots (O_1) recorded lowest uptake of N, P and K because they depended on soil inherent fertility status and chemical fertilizers only. N, P and K uptake progressively increased with increment in dose of inorganic fertilizers from $N_{20}P_{10}K_{10}$ kg ha^{-1} (F_1) to $N_{40}P_{20}K_{20}$ kg ha^{-1} (F_3), but beyond $N_{30}P_{15}K_{15}$ kg ha^{-1} (F_2) the marginal improvement was found non-significant.

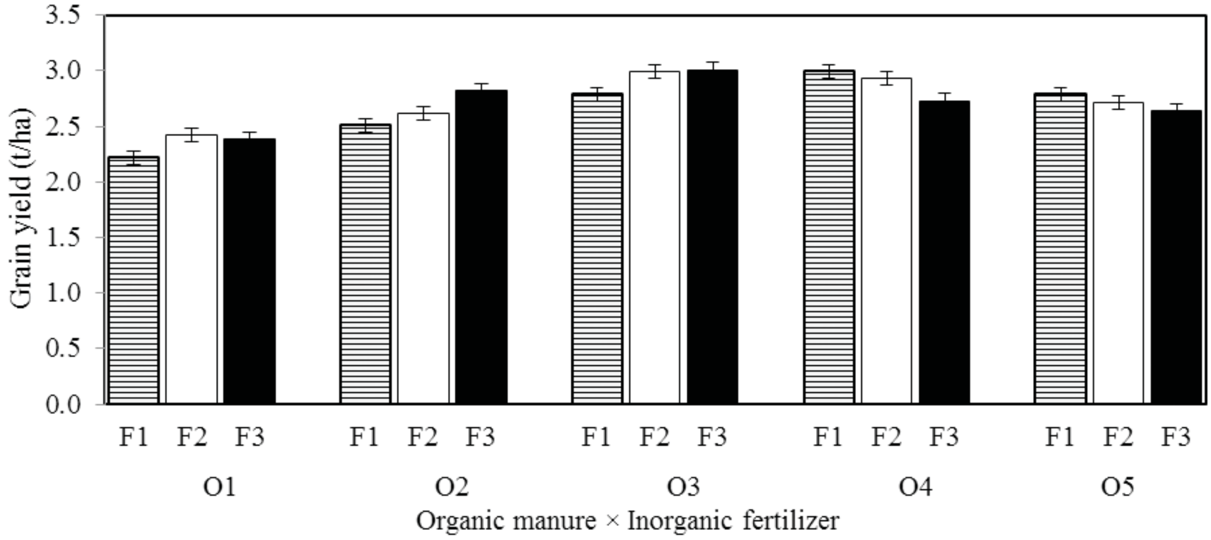

Fig. 1: Interaction effect of organic manure and chemical fertilizers on grain yield of aromatic *Gobindabhog* rice (pooled)

Based on initial soil status (287.3 kg N, 48.5 kg P and 234.7 kg K ha^{-1}) before transplanting of *Gobindabhog* rice during 2010, the nutrient availability from different sources, and doses of organic manures and chemical fertilizers along with N, P and K uptake at harvest resulted in variations in residual nutrient status in soil. There was either positive or negative balance of N among treatments but positive build up in P status and negative changes in K status for all main and sub-plot treatments in the investigation (Table 3). Singh and Chandra (2011) reported that organic mode of nutrient supply recorded significantlty higher soil organic carbon, whereas available N, P and K were favoured by integrated nutrient management system in Basmati rice-based cropping system at Pantnagar, India.

The application of FYM @ 5 t ha^{-1} (O_3) to *Gobindabhog* rice resulted in better residual status (+10.9 kg N, +8.3 kg P and -14.6 kg K ha^{-1}) over other four treatments (O_1, O_2, O_4 and O_5), while the dose of chemical fertilizers ($N_{40}P_{20}K_{20}$ kg ha^{-1}) appeared better (+13.7 kg N, +10.4 kg P and -22.8 kg K ha^{-1}) than rest two lower inorganic fertilizers level (F_1 and F_2) at Kalyani, West Bengal. It was supported by the findings of Chettri *et al*. (2017), where integration of vermicompost with chemical fertilizers helped in improvement of soil health (bulk density, pH, organic carbon, total N and available P) in local scented rice field at Kalyani, West Bengal.

Economics

The common cost of cultivation (Rs. 22,688 ha^{-1}) for *Gobindabhog* paddy included the costs of seeds, seedbed preparation, sowing, land preparation, transplanting, weeding, irrigation, plant protection measures, harvesting, threshing, etc. (Table 3). The treatment cost due to procurement of organic manures and chemical fertilizers led to the differences in total cost of cultivation between Rs. 22,400 ha^{-1} (O_1) and Rs. 30,400 ha^{-1} (O_5), while those for chemical fertilizers between Rs. 26,500 ha^{-1} (F_1) and Rs. 27,100 ha^{-1} (F_3). The application of FYM @ 5 t ha^{-1} (O_3) resulted in highest gross return (Rs. 55,300 ha^{-1}), while application of $N_{30}P_{15}K_{15}$ kg ha^{-1} could generate a gross income of Rs. 51,700 ha^{-1}. The net return from three organic manure-based treatments (O_2, O_3 and O_4) was higher (Rs. 24,700-27,900 ha^{-1}) than unmanured control (Rs. 22,100 ha^{-1}), but the additional cost involvement for mustard cake @ 0.5 t ha^{-1} (O_5) was not compensated due to marginal improvement in both grain and straw yield over the use of mustard cake @ 0.25 t ha^{-1} (O_4). Kumari *et al.* (2010) reported that green manuring + FYM fetched significantly higher net return (Rs. 35,975 ha^{-1}) and B:C ratio (2.61) of scented rice (*cv.* Birsamati) among organic sources at Ranchi, Jharkhand, India. Based on the net return and benefit: cost ratio in the study, the integrated dose of FYM @ 5 t ha^{-1} + $N_{40}P_{20}K_{20}$ kg ha^{-1} (Rs. 28,900 and 2.05) or mustard cake @ 0.25 t + $N_{20}P_{10}K_{10}$ kg ha^{-1} (Rs. 29,600 ha^{-1} and 2.11) could be recommended as economically acceptable integrated nutrient management system for *Gobindabhog* rice in West Bengal during *kharif* season.

Thus, it could be concluded that the integrated nutrient management dose of FYM @ 5 t ha^{-1} + $N_{40}P_{20}K_{20}$ kg ha^{-1} could be recommended for *Gobindabhog* rice for higher grain yield (3.01 t ha^{-1}), protein content (7.75%), net profit (Rs. 29100 ha^{-1}), B:C ratio, (2.05) and better soil residual status (+20.8 kg N, +13.9 kg P and -9.4 kg K ha^{-1}) or alternatively mustard cake @ 0.25t ha^{-1} + $N_{20}P_{10}K_{10}$ kg ha^{-1} might be another option of nutrient management in New Alluvial Zone of West Bengal.

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