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Effect of Integrated Nutrient Management on Productivity of Rice (*Oryza sativa* L.) and Soil Fertility Status under Rainfed Condition of Meghalaya

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ABSTRACT

The front line demonstrations were conducted at the farmers' field to demonstrate the organic sources of nutrients for maintaining the soil health, reducing the rate of chemical fertilizer and to increase the yield of rice (*Oryza sativa* L). The demonstration was conducted at ten farmers' field covering 6 ha. of land at RiBhoi District of Meghalaya during the year 2017-2018 and 2018-2019. The results of the study revealed that the application of *Azospirillum* @3.5kg/ha + PSB @3.5kg/ha + 30 kg of cow-dung by root dip treatment along with 50% recommended dose of chemical fertilizers had recorded significantly higher yield i.e. 45.72 q/ ha with B.C ratio of 2.43 followed by farmer's practice (24.6 q/ha yield with B.C ratio 1.62). Moreover, the soil nutrient status was also improved at the time of harvesting as compared to farmer practice in both the years. An extension gap of 21.12 q/ ha and technology index 8.56 had been recorded.

Key Words: FLD, Paddy, RCM 10, Soil Health,.

INTRODUCTION

Agriculture is the main economic activity of rural development and considered as most important engine of growth, poverty reduction and socio economic development of the North Eastern India. But the major impact of green revolution and modernisation of agriculture had escaped this region as evidenced by poor adoption of modern technologies, low consumption of fertilisers and other indicators of growth. Meghalaya is located at the North Eastern region of India, with a geographical area of 22429 sq. km and a population of 29.67 lakh. About 81 per cent of the total population of the state lives in rural areas and mainly depends on agricultural activities for their livelihood (Anon, 2011). Rice is the main crop of Meghalaya and maximum number of farmers of Ri Bhoi district is engaged in paddy cultivation during *kharif* season. The application of organic as well as inorganic fertilizers has been very limited among the farmers of this district. The productivity of rice per unit area could be increased by adopting recommended scientific and sustainable management production practices using suitable high yielding varieties of rice crop. Integrated nutrient management (INM) is very much effective for improvement of soil health and productivity of rice (Prasad *et al,* 1995). The organic carbon, available nitrogen, phosphorus and potassium status of soil increased through integrated application of inorganic fertilizers and organic manure (Baishya *et al*, 2015). Singh and Kumar (2014) also reported increased yield and nutrient use efficiency in rice with application of organic fertilizers. Considering the above in view, demonstrations were conducted at the farmers' field with an objective to assess the effect of organic sources of nutrients for maintain the soil health, reduce the rate of chemical fertilizer and to increase the yield of paddy.

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MATERIALS AND METHODS

Demonstrations were conducted at ten different farmers' field of RiBhoi District of Meghalaya during the year 2017-2018 and 2018-2019. The district lies between the North Latitudes 25.15/ and 26.15/ and East Longitudes 91.45/ and 92.15/. The total area of RiBhoi District is 2378 sq. km with a total population of 2, 58,840 (Anon, 2011). The area falls under humid subtropical with an average rainfall of 1000mm to 2500 mm and altitudes of 842 to 882 amsl. The demonstrations were conducted in three villages namely Liarkhla, Kdonghulu and Kyrdem. The area under each demonstration was 0.6 ha with a total area of 6 ha. The treatment comprised of Azospirillum @3.5kg/ha + PSB @3.5kg/ha + 30 kg of cow-dung by root dip treatment along with 50% recommended dose of chemical fertilizers. Farmers' practice included imbalanced fertilizer dose i.e. 3 t/ha of organic manure without seed treatment. The soil fertility statuses were estimated by soil analysis of composite soil sample from each plot before transplanting and after harvesting of crop. The soil of the experimental site was sandy loam and acidic in reaction. The rice variety taken as RCM 10. The RCM 10 (RC Maniphou 10) is a medium tall derivative of cross between Prasad and IR-24. It is tolerant to neck blast and leaf blast (Anon, 2015). The data related to yield parameters and soil fertility status were collected from both the plot before and after the implementation of the programme. The BC ratio, technology gap, extension gap and technology index were calculated (Samui *et al,* 2000).

RESULTS AND DISCUSSION

Crop Yield and Economics Analysis

The data (Table 1) revealed that the application of *Azospirillum* @3.5kg/ha + PSB @3.5kg/ha + 30 kg of cow-dung by root dip treatment along with 50% recommended dose of chemical fertilizer had recorded significantly higher yield i.e. 45.72 q/ ha followed by Farmers practice i.e. 24.6 q/ha. The highest yield was recorded as 47.20 q/ha in the year 2018-2019 and lowest was recorded as 39.25 in the year 2017-2018. Similar yield improvement in wheat using INM was recorded by Bhowate *et al* (2017) and Mubark *et al* (2019). The percentage increase in yield recorded as 185.85. The higher growth and yield of paddy was recorded from various sources of organic manure and inorganic fertilizers applied to the soil (Baishya *et al,* 2015).

The highest B.C ratio was recorded in the demonstrated technology (2.43) followed by Farmers practice (1.62). This may be due to higher yields obtained under recommended practices compared to farmers practice. Similar results have been reported earlier on wheat by Tiwari *et al* (2003). The highest net return Rs. 41,989/- in the year 2018-2019 in the demonstrated technology followed by Rs. 38,727 in the year 2017-2018 were recorded.

Soil Fertility Status

Soil sample were collected before the implementation of the technology and at the time of harvesting. The soil fertility status was significantly increased with the application of organic and inorganic combination from initial to final stage of the crop during both the years of demonstration. It was found that the soil is acidic in nature with high organic carbon content. The organic carbon, available nitrogen, available phosphorus and available potassium status of soil after harvest of the crop increased due to application of the treatment (pH: 4.46, OC: 1.26, N: 396.35 kg/ha, P: 58.92 kg/ ha and K: 162.2 kg/ha) as compared to farmers practice (pH: 5.34, OC: 1.04, N: 310.20 kg/ha, P: 48.96 kg/ha and K: 146.09 kg/ha). It indicated that applications of organic sources with inorganic sources were found more effective in building up soil fertility status as compared to farmers' practice. So, the application of integrated use of recommended fertilizer dose along with bio-fertilizer can successfully maintain and improve the soil fertility. This could save the fertilizer and soil fertility status could also be maintained due to judicious use of fertilizers (Ram *et al*, 2017). Ramesh *et al* (2009) also reported that the integrated nutrient supply

Table 1 Effect of using INM on soil fertility status under rain fed condition.

Year	Area (ha.)	Av. Yield (q/ha.)		% increase	Econ. of demo. (Rs./ha.)				Econ. of check (Rs./ha.)				Technology gap (q/ha)	Extension gap (q/ha)	Technology Index
		Demo	Check		GC	GR	NR	BCR	GC	GR	NR	BCR			
2017-2018	6	45.27	25.40	178.23	29178	67905	38727	2.32	22343	38100	15757	1.71	4.73	19.87	9.46
2018-2019	6	46.17	23.80	193.99	27266	69255	41989	2.54	23213	35700	12487	1.54	3.83	22.37	7.66
Average	6	45.72	24.60	185.85	28222	68580	40358	2.43	22778	36900	14122	1.62	4.28	21.12	8.56
CD (5%)															

system was the most logical concept for managing long term soil fertility and productivity.

Gap Analysis

The extension gap ranged between 19.87- 22.37 q/ha which indicated that there is a need to educate the farmers through various mean for adoption of improved agricultural production to reverse the trend of wide extension gap (**Table 3**). The trend of technology gap ranged between 3.83- 4.28 q/ha reflected the farmers' cooperation in carrying out such demonstration with encouraging results in both the years. The technology index of 7.66 to 9.46 per cent showed the feasibility of the evolved technology at the farmer's field. The reduction in technology index exhibited the feasibility of the demonstrated technology in this region. Baishya *et al* (2015) and Joshi *et al* (2015) also reported the improved rice production, profitability and soil fertility by adopting INM Technology.

CONCLUSION

It can be concluded that application of Azospirillum @3.5kg/ha + PSB @3.5kg/ha + 30 kg of cow-dung by root dip treatment along with 50% recommended dose of chemical fertilizers was found effective for sustainable rice production, profitability and improvement of the soil fertility status. The yield improvement with higher B: C ratio was achieved through the integrated nutrient management approach with bio-fertilizer. Soil fertility status also significantly increased with the application of organic and inorganic combination treatment. The suitable BC ratio reveals the economic viability of the demonstration and convinced the farmers to adopt the Technology.

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Table 2. Effect of using INM on soil fertility status under rain fed condition.

Year	pH		Organic Carbon (kg/ha)		Available Nitrogen (kg/ha)		Available Phosphorus (kg/ha)		Available potassium (kg/ha)	
	Demo.	Check	Demo.	Check	Demo.	Check	Demo.	Check	Demo.	Check
2017-2018	4.52	5.47	1.19	1.01	376.53	300.22	55.52	45.21	157.61	138.52
2018-2019	4.40	5.21	1.33	1.07	416.17	320.18	62.32	52.71	166.79	153.66
Average	4.46	5.34	1.26	1.04	396.35	310.20	58.92	48.96	162.20	146.09
CD (5%)										

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