Npk Levels and Weed Management Practices for Rice (*Oryza sativa* L) Under Sri Method of Cultivation

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Abstract: *A field experiment was conducted during summer season at the Instructional-Cum-Research (ICR) Farm, Assam Agricultural University, Jorhat on autumn rice (Oryza sativa L) to find out optimum NPK level and weed management practice under System of Rice Intensification (SRI) method of cultivation. The treatments consisted of four NPK levels (20:10:10, 40:20:20, 60:30:30 and 80:40:40 N:P_2O_5:K_2O kg ha^{-1}) and three weed management practices i.e. weeding with cono weeder at 20 and 40 days after transplanting (DAT), application of pre-emergence herbicide Pretilachlor @ 0.75 kg a.i. ha^{-1} along with one mechanical weeding at 40 DAT and weedy check. The experiment was laid out in randomized block design (RBD) with three replications. The results revealed that both NPK levels and weed management practices brought significant effect in terms of growth, yield and economics of autumn rice under SRI. Among the fertilizer treatment, the NPK level of 80:40:40 N: P_2O_5:K_2O kg ha^{-1} being at par with 60:30:30 kg ha^{-1} produced highest grain yield (3.01 t $ha^{-1)}$. Similarly, weed management practice with mechanical weeding at 20 and 40 DAT gave grain yield of 3.23 t $ha^{-1)}$. The optimum level of NPK was 60:30:30 kg ha^{-1} and the best weed management practice was mechanical weeding at 20 and 40 DAT with the benefit-cost ratio of 1.39 and 1.57, respectively.*

Keywords: *Autumn rice, SRI, weed, NPK level.*

INTRODUCTION

The system of rice intensification (SRI) has been proposed as an integrated and agro-ecologically sound approach to rice cultivation which is said to be the technology that has immense potential for increasing the rice yield under deliberate water management practices and with proper nutrient status of the soil. There has been only a limited study on the response of rice crop to nutrients under SRI with proper management practices of weeds (Raju and Sreenivas, 2008). Normally, chemical fertilizers and herbicides are not being encouraged under SRI; even then chemicals are being applied keeping the fact in mind that the demand of rice crop cannot always be fulfilled by organic substances alone. Thus, SRI has emerged as a better proposition, particularly in autumn season which is comparatively free from flood.

Hence, application of chemical fertilizer with normal released organic manure combined with chemical weed control measure may add a lot in this aspect. Therefore, the present study has been taken to find out optimum NPK level and weed management practice in SRI method of cultivation.

MATERIALS AND METHODS

A field experiment was conducted during summer season at the Instructional-Cum-Research (ICR) Farm, Assam Agricultural University, Jorhat . The experiment was consisted of four NPK levels (20:10:10, 40:20:20, 60:30:30 and 80:40:40 N:P_2O_5:K_2O kg ha^{-1}) and three weed management practices [weeding with *cono* weeder at 20 and 40 days after transplanting (DAT), application of pre-emergence herbicide Pretilachlor @ 0.75 kg *a.i.* ha^{-1} with one

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mechanical weeding at 40 DAT and weedy check]. The seeds of autumn rice (variety – *Mulagabhoru*) was sown in nursery in last week of February and transplanted in first week of March using 11 days old seedlings uprooting from compost trays at 25 cm × 25 cm spacing. The calculated amounts of the fertilizers as per treatment were applied in the form of Urea, SSP and MOP. Urea and MOP were applied in three splits. FYM were applied to at the rate of 2 tonnes per hectare. The amount of the Pretilachlor @ 0.75 kg *a.i.*/ha required for individual plots were calculated out and mixed with sand and were applied to the plots according to the treatment plan after three days of transplanting. The cono weeder was manually run in between the rows according to the treatment plans.

The soil of the experimental field was acidic in reaction (pH 4.78), medium in Wakley and Black's organic carbon (0.71%), alkaline potassium permanganate available nitrogen (274.54 kg ha^{-1}), available potassium (167.41 kg ha^{-1}) and was low in Bray's available phosphorus (19.61 kg ha^{-1}) content. The experiment was laid out in randomized block design (RBD) with three replications. During the growing season the rainfall received was 1382.9 mm which was higher than normal rainfall of 1187.01mm. The temperature ranges from 14.7°C to 34.7°C.

RESULTS AND DISCUSSION

Yield Attributes

The results revealed that NPK level of 80:40:40 kg ha^{-1} produced the highest number of effective tillers/m^2 and 1000-grain weight which were statistically *at par* with those of the NPK level 60:30:30 kg ha^{-1} and were significantly higher than those of the other two levels (Table 1). The length of panicle was not affected significantly by different levels of NPK. The number of effective tillers increased with the increased level of NPK and was due to the availability of major nutrients. The number of filled grain per panicle and 1000 grain weight were found to be highest in the plots receiving the highest level of fertilizer. This may be due to the availability of major nutrient in the maximum tillering stage which might have helped in producing vegetative tillers. Similar results have been repoted by Ullah (2009) and Rajkhowa *et. al.* (2001).

Among weed management practices, mechanical weeding twice at 20 and 40 DAT and application of Pretilachlor @ 0.75 kg a.i. ha^{-1} along with one mechanical weeding, being statistically *at par*, recorded significant effect on effective tillers/m^2 and number of filled grain per panicle over weedy check (Table 1). The higher values in almost all the parameters were recorded under mechanical weeding twice at 20 and 40 DAT except 1000-grain weight. This was probably due to minimal crop weed competition and soil aeration between rows of the crops during mechanical weeding. This result conforms to the findings of Pandey (2009) and Sharif (2011). 1000-grain weight was lowest in weedy check plot and highest in mechanical weeding twice at 20 and 40 DAT (Table 1).

Grain, Straw Yield and Economics

Grain and straw yield was the highest with fertilizer dose of 80:40:40 kg ha^{-1} of NPK and was at par with that of the fertilizer level of 60:30:30 kg ha^{-1} of NPK and significantly higher than those of the other two levels. As would be expected, grain and straw yield of rice was the lowest in weedy check plots. Among different weed management practices, mechanical weeding at 20 and 40 DAT was the most effective resulting in higher grain and straw yield (Table1).

In terms of economics, the treatment of NPK level 80: 40:40 and 60:30:30 kg ha^{-1} and gave the highest benefit: cost ratio (BCR) of 1.39 among the four different NPK levels.

In respect of different weed management practices, two weeding at 20 and 40 DAT was the best with benefit cost ratio of 1.57 (Table 1). This may be due to the fact that two times weeding with cono weeder was cheaper than the cost involved in the weeding with Pretilachlor as pre-emergence along with one mechanical weeding with cono weeder.

Nutrient Status

The total nutrient uptake was significantly affected by both NPK levels and weed management

Table 1
Effect of treatments on yield attributes, grain yield, straw yield and economics of autumn rice

Treatment	*Effective tillers m^{-2}*	*Panicle length (cm)*	*No. of filled grains/panicle*	*1000 grain weight (g)*	*Grain yield (t ha^{-1})*	*Straw yield (t ha^{-1})*	*Weed control Efficiency (%)*	*B:C ratio*
NPK Levels								
20–10–10 kg ha^{-1}	66.7	23.1	125	18.4	1.69	2.63	29.9	0.9
40–20–20 kg ha^{-1}	80.6	23.0	142	19.0	2.11	3.12	25.3	1.06
60–30–30 kg ha^{-1}	102	23.6	151	20.1	2.90	4.05	25.0	1.39
80–40–40 kg ha^{-1}	116	23.8	155	20.2	3.01	4.32	23.0	1.38
S E ±	3.15	0.29	3.9	0.33	0.04	0.09	–	–
CD (0.05)	9.53	NS	11.4	0.98	0.12	0.27	–	–
Weed Management practices								
Mechanical weeding at 20 and 40 DAT	116	23.5	158	19.4	3.23	4.68	37.0	1.57
Pretilachlor with one mechanical weeding at 40 DAT	114	23.4	154	19.5	3.13	4.47	39.7	1.49
Weedy check	43.6	23.2	119	19.3	0.91	1.44	0	0.49
SE ±	2.73	0.25	3.4	0.29	0.03	0.07	–	–
CD (0.05)	7.99	NS	9.36	NS	0.11	0.23	–	–

practices. The highest NPK uptake was recorded with 80-40-40 kg ha^{-1} resulting from presence of higher amount of available in soil (Table 2). This result is in conformity of the findings reported by Sudha and Chandini, 2002. Among the weed management practices ,the total N P K uptake was highest with two times weeding with cono weeder (Table 2). This might be due to the soil aeration which increased the availability of nutrients and simultaneously facilitated the root growth of the crop.

The soil parameters did not vary significantly with NPK levels and weed management practices (Table 2). It might be due to the nutrient fixing capacity of the soil with lower pH as the organic manure application. However, the residual effect of the increasing fertilizer doses was found to increase the available N and K_2O status of the soil.

Weed Control Efficiency

The weed control efficiency was the highest (39.7%) with application of pretilachlor along with one mechanical weeding 40 days after transplanting followed by the treatment of two times mechanical weeding. The pretilaclor treatment resulted in higher weed control efficiency as pretilachlor prevents early emergence and establishment of weed in the plots. Kavitha *et. al.*, 2010 also reported the similar observation on the weed control efficiency by pretilachlor.

Based on the study, it can be concluded that application of 60:30:30 N: P_2O_5:K_2O kg ha^{-1} along with mechanical weeding by cono weeder at 20 and 40 days after transplanting can be used for better crop of autumn rice under System of Rice Intensification (SRI) method of cultivation.

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Table 2
Effect of treatments on total nutrient uptake, soil fertility and soil organic content of autumn rice

	Total nutrient uptake (kg/ha)			*Soil fertility after harvesting (Kg/ha)*			
Treatment	*N*	*P*	*K*	*Organic carbon (%)*	*Available N*	*Available P_2O_5*	*Available K_2O*
NPK Levels							
20–10–10 kg ha^{-1}	62.86	7.67	56.70	0.71	263.62	20.08	163.52
40–20–20 kg ha^{-1}	75.96	9.32	70.88	0.67	271.52	19.96	166.51
60–30–30 kg ha^{-1}	104.35	12.94	95.90	0.72	278.49	19.52	168.75
80–40–40 kg ha^{-1}	110.60	12.96	100.32	0.70	282.44	20.23	170.72
SE ±	2.66	0.42	4.26	0.04	16.51	1.01	4.92
CD (0.05)	7.81	1.24	11.80	NS	NS	NS	NS
Weed Management practices							
Mechanical weeding at 20 and 40 DAT	118.59	14.41	108.69	0.69	279.25	19.46	166.44
Pretilachlor with one mechanical weeding at 40 DAT	112.81	13.69	102.87	0.70	268.75	20.40	168.12
Weedy check	33.93	4.08	31.29	0.71	274.07	19.99	167.56
SE ±	2.30	0.37	3.78	0.04	14.30	0.88	4.26
CD (0.05)	6.76	1.07	11.08	NS	NS	NS	NS

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