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EFFECT OF NITROGEN AND WEED MANAGEMENT ON NUTRIENT UPTAKE BY WEEDS UNDER DIRECT SEEDED AEROBIC RICE

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ABSTRACT
A field experiment was conducted to assess the effect of nitrogen and weed management practices on yield of rice and nutrient removal by the weeds under direct seeded aerobic rice. The result of the experiment indicate that increased Nitrogen level from 75 to 100 kg/ha had increased the grain yield significantly (5%) though further increase in nitrogen dose (125 kg/ha) increased the grain yield but that was found non-significant. With the increment of nitrogen dry matter accumulation by the plant also increased. Among weed management all the weed management practices were found to be equally effective in reducing the uptake of nutrient by weeds and producing higher grain yield as compare to weedy check. However maximum yield was obtained with the application of pre-emergence of pendimethalin @ 1.0 kg *a.i.* /ha+ BM+ 1HW at 60 DAS. Thus it can be concluded that 100 kg N/ha is sufficient for aerobic rice in which weeds can be managed by integration of chemical and cultural practices.

INTRODUCTION

Rice (*Oryza sativa L.*) is the most important and widely cultivated crop in the world. Asia is the home of rice as more than two billion people are getting 60-70 % of their energy requirement from rice and its derived products. About 90 % of total rice is grown and consumed in Asia. It occupies an important place in the economy of India. Rice crop is the biggest user of fresh water. Rice as a submerged crop is a prime target for water conservation because it is the most widely grown of all crops under irrigation. Rapidly depleting water resources threaten the sustainability of the irrigated rice and hence the food security and livelihood of rice producers and consumers (Tuong *et al.*, 2005). Due to resource constraints, especially water and labourers, direct seeding under dry condition is now emerging new trend in rice cultivation.

Aerobic rice, the term recently introduced in rice cultivation is a practice of direct drilling of seeds in rows and maintaining aerobic condition of the field under limited water availability. According to IRRI scientists, aerobic rice is production systems of rice in which especially developed "aerobic rice" varieties are grown in well drained, non-puddle and saturated soils (Bouman and Lampayan, 2009).In direct seeding weeds are the major problems and pose serious competition for resources to the crop in early stages and cause heavy reduction in yield of rice. Weeds usually grow faster than crop plants and thus absorb nutrient earlier resulting in lack of nutrients for growth of plant. Nitrogen fertilization has pronounced effect on the growth of weeds plant. Weeds not only reduce the amount of N available to the crops but also suppress the crop growth (Blackshaw, 2003). The practice of legume intercropping with cereals crop has ability to suppress weeds growth due to its rapid ground cover and provides nitrogen to the soil. Therefore the present experiment was conducted for managing the weeds by Agronomic practices in aerobic rice at different levels of nitrogen.

MATERIALS AND METHODS

A field experiment was conducted during *kharif* season of 2010 at N. E. Borlaug Crop Research Centre of G. B. Pant University of Agriculture and Technology, Pantnagar. The soil of the experimental field was silt loam in texture with pH 7.94 (Glass electrode pH meter, Jackson, 1973), rich in organic matter 1.84 % (Modified Walkley and Black Method, Jackson, 1973), low in available nitrogen 120.4 kg/ha (Kjeldahl Method, Jackson, 1973), medium in available P_2O_5,17.0 kg/ha (Olsen Method, Black, 1965) and K_2O, 219.0 kg/ha (Neutron Normal ammonium acetate method, Flame Photometry, Jackson, 1973). The experiment comprised of 15 treatments which was laid out in the split plot design (SPD) having nitrogen levels (75, 100 and 125 kg N/ha) in main plot. Weed management practices. *viz*, pre-emergence application of pendimethalin @ 1.0 kg/ha + brown manuring (30 DAS) +1 HW at 60 DAS (W_1), pre-emergence application of pendimethalin @ 1.0 kg/ha + 2 mechanical weeding at 20 and 40 DAS (W_2), pre-emergence application of pendimethalin @ 1.0 kg/ha + brown manuring at 30 DAS (W_3), 2 mechanical weeding at 20 and 40 DAS (W_4) and weedy check (W_5) were

Table 1: Effect of nitrogen levels and weed management practices on yield and yield attributes of rice

Treatment	Dry matter /m^2 at maturity (g)	Sterility %	Grain yield (t/ha)	Harvest index
Nitrogen levels				
N_{75}	726.1	11.7	3.17	0.43
N_{100}	882.3	11.6	3.59	0.41
N_{125}	924.5	12.8	3.57	0.39
CD (5%)	126.4	NS	0.33	0.02
Weed management practices				
W_1(PE + BM + 1HW)	988.0	12.0	4.12	0.43
W_2(PE + 2 MW)	910.1	12.3	3.87	0.43
W_3(PE + BM)	942.4	12.9	4.07	0.44
W_4(2 MW)	905.6	14.2	3.87	0.43
W_5(Unweeded)	475.4	8.8	1.28	0.32
CD (5%)	108.6	2.2	0.47	0.03

Table 2: Effect of nitrogen level and weed management on weed dry weight and nutrient removal by weeds

Treatment Nitrogen levels	Weed dry weight (g) at 60 DAS	Nutrient removed by weeds kg/ha at 60 DAS N	P	K
N_{75}	72.7	14.86	3.01	6.92
N_{100}	78.1	15.89	3.31	8.22
N_{125}	87.9	18.14	3.74	9.25
CD (5%)	NS	NS	NS	2.15
Weed management practices				
W_1(PE + BM + 1HW)	37.8	7.38	1.58	3.63
W_2(PE + 2 MW)	38.4	7.42	1.51	3.67
W_3(PE + BM)	40.3	7.70	1.66	3.90
W_4(2 MW)	35.1	7.20	1.41	3.37
W_5(Unweeded)	246.2	51.80	10.50	26.07
CD (5%)	24.8	5.12	1.10	2.52

N_{75}:75 kg N/ha, N_{100}: 100 kg N/ha, N_{125}: 125 kg N/ha, PE: Pre-emergence application of herbicide, BM: Brown manuring at 30 DAS, HW: Hand weeding at 60 DAS, MW: Mechanical weeding at 20 and 40 DAS

kept in subplots. All the treatments were randomized and replicated four times. Rice variety Pant Dhan-12 was sown at the seed rate of 40 kg/ha in the furrows opened 20 cm apart manually in all the plots. Seeds of Dhaincha (*Sesbania aculeata*) were sown in between the rice furrow (1:1 ratio) @ of 50 kg seed /ha. 2, 4-D the selective herbicide was used for killing *Sesbania* to make the brown manure. Nitrogen fertilizer was applied through urea (46 %) as per the treatments (75, 100 & 125 kg/ha). Phosphorous (60 kg/ha) through Single Super Phosphate and potash (40 kg/ha) as Muriate of Potash were applied uniformly in all the treatments. Half of the nitrogen and full dose of P and K were applied at the time of sowing. Remaining half of nitrogen was top dressed in two equal splits at 30 and 60 DAS. The data on yield attributes and yield of rice were recorded at the time of harvesting. Weed species within the area of quadrate were cut close to the ground surface and air dried in hot air oven maintained at 70 to 75ºC temperature. Weed samples were analyzed for nutrient (N, P and K) uptake at 60 DAS.

RESULTS AND DISCUSSION

Crop growth and yield

Plant dry matter was increased with increasing N levels significantly up to 100 kg/ha. Nitrogen application promoted plant growth which suppressed the ill effect of weeds on crop plant. Increasing N level infect increased the photosynthetic efficiency of crop leading to greater dry matter production. Higher level of nitrogen caused significant increase in dry matter production. This may be due to higher availability of nitrogen to the plants leading to its higher uptake and translocation to the different part of the plant. This is in accordance with the finding of Dubey *et al*. (1983). Nitrogen level did not show significant influence on sterility percent. However, increased N levels had increased the sterility percentage from 11.4 % with 75 kg N/ha to 12.7% with 125 kg N/ha. Harvest index (HI) was influenced significantly due to varying level of nitrogen. Higher HI with initial dose of N was perhaps due to satisfying the basic requirement of nutrient which resulted in higher economic return to the crops as well as more translocation of photosynthates from source to sink.

Increased application of N resulted in significantly higher grain yield (3.58 t/ha) over 75 kg N/ha, however this increase was significant only up to 100 kg of N/ha. Significant increase in grain yield could be attributed to the fact that N application improved the N, P and K uptake by crop plant and ultimately accelerate photosynthetic activities resulting in better growth and yield attributes which laid down the foundation for accumulating higher plant dry matter. These findings are in conformity with those of Roy and Mishra (1999). Among weed management practices W_1 (PE + BM + 1HW) recorded the highest dry matter production and grain yield (4.12 t/ha) which were statistically at par to all other weed management practices except weedy check. Brown manuring of Dhaincha suppressed the weeds and increased the availability of nutrient. Weed management practices had significant effect on sterility percent. W_1 (PE + BM + 1HW) recorded lowest sterility percent than other treatments except weedy check. In case of weedy check

lowest sterility percent was due to the lower number of spikelets/m^2. All the weed management practices were found significantly higher over unweeded (0.32) in producing higher harvest index.

Nutrient removal by weeds

The increased levels of N had increased the nutrient uptake by weeds at 60 DAS but this increased was found statistically non-significant in case of N and P and significant in case of K uptake. Co-culture of *Sesbania* in rice and its subsequent knock down by 2, 4-D ester reduced the weed dry matter accumulation by nearly half as it has smothering effect without any adverse effect on rice yield. Same result was also reported by Gupta *et al*. (2006). Brown manuring of *Sesbania* reduces the weed population and resulted in lower removal of N, P and K. Application of pre-emergence herbicide (Pendimethalin @ 1.0 kg *a.i.* /ha) was found to be effective in controlling weed pressure on the crop in the initial stage of the crop. Mechanical weeding as in case of W_4 (2 MW) incorporated the weeds into the soil which improved the soil aeration and increased nutrient availability to the crop through active mineralization and decomposition. It was also accordance with Prasad and Pandey, 2005. More weeds present in the field suppressed the crop due to nutrient removal and reduced the yield which might be attributed to vigorous growth and development of weeds. Similar results were reported by Roy and Mishra (1999). All the weed management practices except weedy check were found effective in reducing the nutrient uptake by weeds at 60 DAS.

So on the basis of above finding it can be concluded that 100 kg N/ha may be the requirement of nitrogen for aerobic rice. Weeds may be managed by adopting any of the above management practices as all the practice were found equally effective in reducing nutrient uptake by weeds and producing better crop yield.

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