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EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON RICE CROP VARIETY PANT DHAN 4

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Abstract

A field experiment was carried out during *Kharif* season of 2010 and 2011 to study the effect of different nutrients treatments on the productivity of rice. Application of NPK with FYM and Zn proved to be superior in recording the highest plant height, primary branches and secondary branches. The continuous use of fertilizers and manures for a longer period of time affects the soil nutrient status. The change in soil depends on the crop type and amount of fertilizers and manures used and pre status of soil. When imbalanced fertilizers doses are given to the rice-wheat cropping system, they showed a considerable decline in crop productivity and soil fertility.

Key words : Rice, NPK, FYM, plant height, primary and secondary branch.

Introduction

In India, rice occupies an area of 44 million hectare with an average production of 90 million tones with productivity of 2.0 tons per hectare. Demand for rice is growing every year and it is estimated that in 2025 the requirement would be 140 million tons. To sustain present food self-sufficiency and to meet future food requirements, India has to increase its rice productivity by 3 per cent per annum (Thiyagarajan and Selvaraju, 2001). Although, the area of rice in India is decreased to 43.97 million hectare, but the production increased to 100 million tones (FAO, 2012). Ninety percent of total world's rice is grown and consumed in south and Southeast Asia, where the normal consumption of rice ranges 300-800gm per day per person (Virk and Barry, 2009). Hence, the green revolution saw an increase consumption of chemical fertilizers namely nitrogen (N), phosphorus (P) and potash (K). One of the reasons for problems of soil salinity and alkalinity in agricultural regions of India is the indiscriminant and faulty use of fertilizers. There is a recommended level of fertilizer for each crop and soil, which is known as the optimum level (Kundu and Vashist, 1991). Fertilizer use above or below this level creates imbalance which in turn causes environmental problems. Green revolution has brought serious ecological problems. Farmers are increasingly complaining of depleting fertility of soils, soil salinity and alkalinity and problems of ground water pollution this could be due to inefficient use of fertilizers (Sharma, 1993). The application of essential plant nutrients particularly macro and micronutrients in optimum quantity and right proportion through correct methods and time of application is the key to increased and sustained crop production. Therefore, it is important to understand fertilizers use behavior and role of factors influencing fertilizer consumption at the national and state level because intensity of fertilizer use varies from state to state and area to area (Jaga and Patel, 2012).

Materials and Methods

The present investigation was done at Norman E. Borlaug Crop Research Centre of G.B. Pant University of Agriculture & Technology, Pantnagar (U.S. Nagar), Uttarakhand, India. Different fertilizer treatments were given to the rice crop variety Pant Dhan 4. This is a medium maturing (130 days) semi dwarf and high yielding variety of rice. It has field tolerance to bacterial leaf blight and yielding potential of 8 t ha^{-1}. Nitrogen, phosphorous, potassium and zinc were supplied through urea, single super phosphate, muriate of Potash and zinc sulphate (LR grade), respectively. Treatment combination constitute of $\mathbf{T_1}$ (control), $\mathbf{T_2}$ (N_{120}), $\mathbf{T_3}$ ($N_{120}P_{40}$), $\mathbf{T_4}$ ($P_{40}K_{40}$), $\mathbf{T_5}$ ($N_{120}K_{40}$), $\mathbf{T_6}$ ($N_{120}P_{40}K_{40}$), $\mathbf{T_7}$ ($N_{120}P_{40}K_{40}$+Zn), $\mathbf{T_8}$ ($N_{120}P_{40}K_{40}$+FYM), $\mathbf{T_9}$ ($N_{120}P_{40}K_{40}$+ZnF+FYM) $\mathbf{T_{10}}$ (N_{180} P_{80} K_{40}+ZnF+FYM), T_{11}(N_{150} $P_{40}K_{40}$), $\mathbf{T_{12}}$ (N_{180} P_{80} K_{40}+ZnF), $\mathbf{T_{13}}$ (N_{180} P_{80} +ZnF), $\mathbf{T_{14}}${$N_{120}P_{40}K_{40}$ (DAP)}. N = Nitrogen, P = P_2O_5, K=K_2O, Zn= Zinc, f= foliar application, DAP = Diammonium Phosphate.

Plant height

Plant height of the three randomly selected plants from each replication was measured in cm at 60 and 90 days after sowing. After flowering the height was measured from soil level up to the tip of plants.

Primary and secondary branches

Three panicles at maturity stage were taken from each plot. The primary and secondary branches per panicle were counted. The number of primary and secondary branches was estimated by taking average number of branches of three plants at maturity stages.

Results

Plant height

The data for the plant height of rice (table 1) showed that the plant height was significantly affected by the application of N, P, K, Zn and FYM in different combination. Combined fertilizer treatments gave significantly maximum plant as compared to NPK alone. Plant height appeared to be considerable at 60 and 90 DAS. During 2010 At 60 days after sowing maximum plant height was recorded by N_{180} P_{80} K+Znf+FYM (72.00cm), which was significantly different for all the treatments except NPK+FYMr, NPK+ZnF+FYMr, N_{150} PK, N_{180} P_{80} K+ZnF, N_{180} P_{80} +ZnF and NPK (DAP). Control (34.42cm) showed least increment in plant height, for which all the treatments were found significantly different except N, NP, PK and NK.

During 2011 at 60 DAS maximum plant height was recorded by N_{180} P_{80} K+Znf+FYM (70.75cm), which was significantly different from all the treatment except NPK+FYMr, NPK+ZnF+FYMr, N_{150} PK, N_{180} P_{80} K+ZnF, N_{180} P_{80} +ZnF and NPK (DAP). Control (33.58cm) showed the least increment in plant height which was found significantly different from all the treatment except N, NP, PK and NK.

During 2010 at 90 days after sowing N_{180} P_{80} K+Znf+FYM (85.33cm) showed maximum height which was significantly different from all the treatment except NPK+Znf+FYM, N_{180} P_{80} K+Znf+FYM, N_{150} PK, N_{180} P_{80} + Znf, NPK (DAP) while control (45.33cm) showed minimum plant height which was significantly different from all the treatments except N, NP, PK and NK.

During 2011 at 90 days after sowing N_{180} P_{80} K+Znf+FYM (83.42cm) showed maximum plant height which was significantly different from all the treatment except NPK+FYMr, NPK+ZnF+FYMr, N_{150} PK, N_{180} P_{80} K+ZnF, N_{180} P_{80} K +ZnF, N_{180} P_{80} +ZnF and NPK (DAP) while minimum height was recorded for control (46.50cm) which was significantly different from all the treatments except N, NP, PK and NK. Similar results were found by Gebrekidan (2006).

Primary branches

The data presented in table 2 showed that during 2010 N_{180} P_{80} K+Znf+FYM (16.75) was observed maximum number of primary branches, which was significantly different from all the treatment while control (9.83) showed minimum number of primary branches which was significantly different for all the treatments except N, NP and PK. During 2011 N_{180} P_{80} K+Znf+FYM (15.49) showed the maximum number of primary branches, which was found significantly different to all the treatment except NPK, NPK+Zn, NPK+FYM, NPK+Znf+FYM, N_{150} PK, N_{180} P_{80} K+Znf, N_{180} P_{80} +Znf, NPK (DAP). At the same stage minimum number of primary branches was shown by control (10.58) Control showed the minimum number of primary branches which was significantly different for all the treatments except N, NP, PK and NK. Tabar *et al.* (2012) also obtained the similar results.

Number of secondary branches

During 2010 maximum number of secondary branches shown by N_{180} P_{80} K+Znf+FYM (45.42) which was significantly different from all the treatment except N_{150} PK and N_{180} P_{80} +Znf. control (24.92) was observed least number of secondary branches, which was significantly different from all the treatment except N, NP, PK and NK was found non significantly different.

During 2011 N_{180} P_{80} K+Znf+FYM, (43.50) was recorded maximum number of secondary branches which was significantly different for all the treatment except NPK+FYM, NPK+Znf+FYM, N_{180} P_{80} K+Znf+FYM, N_{150} PK, N_{180} P_{80} +Znf, NPK (DAP) whereas control (22.08) showed minimum number of secondary branches which was significantly for all the treatment whereas non significantly different for N, NP, PK and NK. Similar results were found by Tilahun *et al*. (2013).

Table 1 : Effect of different nutrients on plant height of rice variety Pant Dhan 4 at 60 and 90 days after sowing in *kharif* 2010 and 2011.

S. no.	Treatments	Plant height (cm)			
		60 DAS 2010	60 DAS 2011	90 DAS 2010	90 DAS 2011
T_1	Control	34.42±0.41	33.58±1.21	45.33±3.00	46.50±1.46
T_2	N	37.00±8.48	36.17±2.98	53.17±2.31	53.50±5.85
T_3	NP	34.92±0.64	35.83±2.54	53.50±6.34	50.25±5.44
T_4	PK	38.17±0.70	37.92±0.59	54.25±1.84	52.50±3.70
T_5	NK	35.50±0.75	39.34±3.64	51.00±1.74	52.50±1.86
T_6	NPK	50.67±0.69	55.00±1.33	63.58±3.05	64.50±1.59
T_7	NPK+Zn	51.92±7.81	53.75±1.21	75.50±2.34	72.17±1.55
T_8	NPK+FYMr	65.08±5.27	67.34±1.99	76.42±2.12	77.25±3.65
T_9	NPK+ZnF+FYMr	69.33±4.98	65.67±2.04	74.00±1.51	75.58±1.99
T_{10}	$N_{180}P_{80}$K+ZnF+FYMr	72.00±4.14	70.75±1.30	85.33±1.97	83.42±3.28
T_{11}	N_{150}PK	69.75±3.25	67.08±2.01	80.08±2.13	78.50±2.80
T_{12}	$N_{180}P_{80}$K+ZnF	65.58±1.30	69.33±0.68	72.08±8.30	78.75±2.25
T_{13}	$N_{180}P_{80}$+ZnF	66.17±0.83	68.17±2.02	76.42±4.33	78.92±4.13
T_{14}	NPK (DAP)	65.33±1.62	67.50±0.77	80.92±3.80	80.67±2.80
	S.Em.±	4.09	2.04	3.46	3.19
	CD at 5%	11.71	5.85	9.92	9.12

Table 2 : Effect of different nutrients on number of primary branches at the time of maturity on rice variety Pant Dhan 4 in *kharif* 2010 and 2011.

S. no.	Treatments	Number of primary branches/panicle	
		2010	2011
T_1	Control	9.83±0.39	10.58±1.44
T_2	N	11.08±0.28	11.41±1.32
T_3	NP	10.66±0.23	11.41±1.05
T_4	PK	11.08±0.58	12.08±1.36
T_5	NK	11.5±0.61	11.58±0.83
T_6	NPK	13.66±0.49	14.16±1.00
T_7	NPK+Zn	14.58±0.15	14.24±0.82
T_8	NPK+FYM	14±0.47	14.33±1.34
T_9	NPK+Znf+FYM	15±0.70	14.75±1.34
T_{10}	$N_{180}P_{80}$K+Znf+FYM	16.75±0.34	15.49±1.19
T_{11}	N_{150}PK	14.66±0.33	14.66±1.12
T_{12}	$N_{180}P_{80}$K+Znf	14.416±0.68	13.25±0.56
T_{13}	$N_{180}P_{80}$+Znf	13.83±0.21	13.41±1.13
T_{14}	NPK (DAP)	14.08±0.65	14.08±0.78
	S.Em. ±	.50	1.06
	CD at 5%	1.43	3.05

Table 3 : Effect of different nutrients on number of secondary branches at the time of maturity on rice variety Pant Dhan 4 in *kharif* 2010 and 2011.

S. no.	Treatments	Number of secondary branches/panicle	
		2010	2011
T_1	Control	24.92±1.43	22.08±0.79
T_2	N	26.83±1.43	25.09±0.45
T_3	NP	27.58±1.38	26.17±0.51
T_4	PK	25.83±1.23	25.17±0.34
T_5	NK	27.75±1.23	25.25±0.64
T_6	NPK	35.33±1.73	32.34±0.73
T_7	NPK+Zn	35.75±2.32	37.25±4.27
T_8	NPK+FYM	40.00±1.95	38.50±2.26
T_9	NPK+Znf+FYM	40.50±1.73	39.42±1.11
T_{10}	$N_{180}P_{80}$K+Znf+FYM	45.42±1.80	43.50±0.28
T_{11}	N_{150}PK	44.50±1.58	40.75±1.45
T_{12}	$N_{180}P_{80}$K+Znf	41.42±1.81	42.67±0.65
T_{13}	$N_{180}P_{80}$+Znf	43.33±2.21	41.75±2.26
T_{14}	NPK (DAP)	41.33±1.90	42.09±2.65
	S.Em.±	1.39	1.71
	CD at 5%	4.00	4.90

Discussion

It was observed that for all the stages both the year increase in plant height was promoted by the integrated dose of NPK with Zn & FYM however, if any one of the nutrient lacking, showed less increment in plant height. The increase in plant height in response to application of N fertilizers is probably due to enhanced availability of nitrogen which enhanced more leaf area resulting in higher photo assimilates and thereby resulted in more dry matter accumulation. Effect of different macronutrients is highly influence the number of primary and secondary branches. The above data showed that for primary and secondary branches best performance was shown by N_{180} P_{80} K+Znf+FYM as it had maximum amount of N and P with Znf and FYM favorable effect of integrated nutrient management on the proliferation of roots and thereby increasing the uptake of plant nutrients from soil and ultimately increase the vegetative growth of rice plant.

Conclusion

From the above results, it may be concluded that N_{180} P_{80} K+Znf+FYM was observed as the best treatment for all the parameter as Zn is an essential micronutrient and FYM helps in slow release of nitrogen, increase water holding capacity of soil it also works as soil conditioner, whereas when any one of the nutrient is missing it negatively affect the physiology of rice plant. NPK+Znf+FYM, was showed non significant difference with N_{180} P_{80} K+Znf+FYM, which reveal the fact that NPK+Znf+FYM can also be used to reduce soil pollution.

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