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EFFECT OF FERTILIZER TREATMENTS ON GROWTH, PRODUCTIVITY, INSECT- PEST AND DISEASE INCIDENCES ON RICE

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ABSTRACT

The effect of fertilizer treatments (O, N, NP and NPK doses in kg/ha) on growth, productivity, insect-pest and disease incidence on rice in Gangetic alluvial soil (Entisol) of West Bengal under rainfed condition was evaluated in 1987 and 1988. The balanced fertilisation made highest increment on plant height, number of tillers, but phosphate fertilisation along with nitrogen exerted marked effect on dry matter production at panicle initiation stage. Increased number of matured panicles/m² due to NPK fertilisation resulted in higher grain and straw yield. Phosphorus along with nitrogen showed significant effect on number of filled grains/panicle and test weight. Nitrogen either alone or coupled with phosphorus exhibited higher degree of incidence of gall midge and yellow stem borer but NPK lowered the incidence of rice bug, leaf folder, gall midge and yellow stem borer. NPK increased the bacterial leaf-streak infestation significantly than either of N or NP treatments.

KEY WORDS : Balanced Fertilisation, Dry Matter Accumulation, Insect-pest and Disease

The modern high yield dwarf rice varieties are highly responsive to applied nutrients. Increased growth due to fertilisation particularly when it is unbalanced, causes plants more vulnerable to different pests and diseases, particularly during the rainy season (June to September) in West Bengal. The present paper deals with the studies on the effect of different fertiliser combination on growth, yield and yield components, insect-pest and disease incidences in rainfed rice.

MATERIALS AND METHODS

The investigation was carried out at the experimental farm of Bidhan Chandra Krishi Viswavidyalaya, Kalyani, West Bengal. The soil is entisol, neutral in reaction, low in nitrogen, medium in available phosphorus and potassium contents.

The experiment was conducted during the wet seasons of 1987 and 1988 in a randomised block design with three replications, using rice cultivar CR 222 MW10.

There were four fertiliser treatments *viz.*, Control, N₈₀, N₈₀ P₄₀, N₈₀P₄₀K₄₀ (kg/ha of the nutrients). The nitrogen was applied as urea and out of 80 kg N/ha, half was applied as basal and the remaining half in two equal splits. Phosphate and potassic fertilisers were applied as basal as single super phosphate and muriate of potash respectively. The crop was transplanted during the third week of July at 20 x 10 cm spacing. The natural occurrence of insect-pests and disease as influenced by fertilizer treatments, was quantified by direct counting of pests or injury symptoms in a m² cropped area following standard methods.

RESULTS AND DISCUSSION

Tillers and dry matter accumulation

Fertilizer application significantly increased the number of tillers/m² particularly where it received only N (Table 1). The role of P of tiller enhancement was evident and was also reported earlier by Bhattacharyya and Chatterjee (1978) and Mandal and Chatterjee (1985).

Phosphatic fertilizer application along with N caused highest dry matter accumulation at panicle initiation stage and 15 days after flowering (Table 1.) Increased dry matter accumulation might be due to phosphate fertilizer application and to some extent with potassium (Ghosh and Chatterjee, 1979).

Yield components

NPK treatment increased the number of panicles/m² more than those recorded by N and NP treatments. Significant effect of fertilizer combination on number of filled grains/panicle was also recorded. In 1988, application of NPK exerted significant effect on number of filled grains/panicle. In 1987, N application exhibited highest effect on test weight and in 1988, NPK showed the same trend although at par with NP combination.

Highest grain yield was recorded with balanced fertilization (Table 2). The increment over control was 74 per cent as compared to 60 per cent for NP, 29 per cent for N in 1987 and in 1988, the rates of increment over control were 53 per cent NP and 30 per cent for N respectively. Similarly,

balanced fertilisation with NPK recorded highest straw yield.

Insect-pest and disease incidence

The fertilizer combinations did not show any pronounced effect on green leaf hopper population at different growth stages but when nitrogen fertilizer was balanced with both P and K fertilizers, the decrease in pest population was more than those receiving N alone or N and P in combination (Table 3.) At early tillering stage, fertilizer treatments, affected stem borer incidence significantly. N along with P increased the stem borer infestation over control. But when NP was balanced with K-fertilizer there was decreasing trend of damage, ranging from 18 to 23 per cent over NP treatment. Significant effect of fertilizer on gall midge incidence was recorded at mid tillering and at later stage of growth. N fertilisation increased the gall midge incidence in order of 82 per cent (36 DAT) and 73 per cent (53 DAT) which was much higher than those recorded under other fertilizer combinations. When nitrogen was balanced with P and K, there was reduction in gall midge incidence ranging from 14 per cent (36 DAT) to 36 per cent (53 DAT) over N fertilised plots. Fertilizer treatments did not show any significant effect on rice leaf folder and rice bug incidences, but in 1988, NP fertilizer combination exhibited profound influence on rice bug infestation on rice at later stages of growth.

Different fertilizer combinations significantly increased the disease incidence at mid-and late tillering stages of rice but not at early tillering

Table 1. Effect of fertilizer combinations on growth attributing characters of rice

Fertilizer combination (kg/ha)	Plant height (cm)		Number of Tillers/m ²				Dry matter accumulation (g/m ²)		
	1987	1988	1987		1988		1987		
	Growth Stages						Growth Stages		
			21 DAT	36 DAT	21 DAT	36 DAT	PI 15	DAF	PI
Without Fertilizer (F ₀)	63.50	62.71	376	376	324	405	148	342	121
N ₈₀	73.95	65.51	392	393	343	421	339	757	152
N ₆₀ P ₄₀	75.63	70.43	412	429	367	429	394	673	197
N ₈₀ P ₄₀ K ₄₀	78.44	71.08	450	450	362	450	335	702	186
SEm ±	1.55	2.36	0.13	0.29	31.47	12.13	42.15	67.74	17.42
CD (P = 0.05)	4.54	NS	NS	0.37	NS	NS	123.67	198.68	51.09

PI - Panicle initiation; DAF = Days after flowering; DAT = Days after transplanting.

Table 2. Effect of fertilizer combinations on yield components and grain and straw yield of rice

Fertilizer combination (kg/ha)	Number of mature panicle/m ²		Number of filled grains/panicle		1000 grain weight (g)		Grain yield (q/ha)		Straw yield (q/ha)	
	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988
F ₀	348	351	52	58	21.67	19.94	16.51	19.11	19.58	22.13
N ₈₀	373	376	69	61	22.49	20.13	21.35	24.88	28.78	31.67
N ₈₀ P ₄₀	376	386	63	61	22.66	20.06	26.06	26.60	31.48	28.74
N ₈₀ P ₄₀ K ₄₀	408	413	63	64	22.06	20.90	28.81	29.23	32.60	39.51
SEm ±		26.02	3.54	1.29	0.25	0.27	1.79	1.55	0.39	6.67
CD (P = 0.05)	NS	NS	11.00	3.78	0.72	NS	5.26	4.54	1.15	NS

Table 3. Effect of fertilizer combinations on insect-pest and disease incidences in *kharif* rice

Fertilizer combination (kg/ha)	Pest incidence/m ²																
	Early tillering stage (26 DAT)					Mid tillering stage (35 DAT)					Late stage (53 DAT)						
	GLH	YSB	GM	LF	BLS	GLH	YSB	GM	LF	BLS	GLH	YSB	GM	RB	BLS		
F ₀	4.3	1.3	0.7	0.9	13.1	3.1	1.1	0.9	1.3	1.2	3.2	0.7	0.9	1.2	1.5	1.3	0.7
N ₈₀	3.8	2.0	0.7	1.0	10.9	6.0	0.8	1.1	2.4	1.6	6.6	0.8	1.1	2.1	1.0	1.6	1.1
N ₈₀ P ₄₀	3.6	1.8	1.3	0.9	9.2	6.5	0.7	1.1	2.3	1.7	5.8	0.9	1.1	1.7	1.3	2.1	1.2
N ₈₀ P ₄₀ K ₄₀	4.8	1.6	1.0	1.4	7.4	7.3	0.8	0.8	2.1	1.3	7.0	0.7	0.8	1.3	1.0	1.2	1.9
SEm ±	0.8	0.3	0.1	0.1		1.1	0.05	0.05	0.2	0.2	0.6	1.0	0.05	0.2	0.1	0.3	0.2
CD (P = 0.05)	NS	NS	0.4	NS	NS	NS	NS	NS	0.7	NS	1.9	NS	NS	0.6	NS	NS	0.8

GLH - Green leaf hopper; YSB - Yellow stem borer; GM - Gall midge; LF - Leaf folder; RB - Rice bug; BLS - Bacterial leaf streak.

stage. Fertilizer application increased the incidence of bacterial leaf streak disease more than those recorded under control. Increase of bacterial leaf streak infestation due to N fertilisation was reported earlier by Rao and Devadath (1978).

During the year 1987 and 1988, the weather conditions were variable. In the year 1987, amount of monsoon rain during the life period of crop was 24 per cent lower than long term average and the distribution of monsoon rain was erratic i.e., 20% - 28%, 21%, 8% and 2% as compared to normal distribution of 19%, 19%, 20%, and 13% for monthly average of June, July, August, September and October respectively. But in 1988, amount as well as distribution of monsoon rain was more or less normal. The maximum temperature ranged from 32.5^o to 35.3^oC in 1987 and from 30.2^o to 33^oC in 1988 where normal maximum temperature ranged from 29.7^o to 36.8^oC. The minimum temperature was normal in both the years. The maximum RH (%) ranged from 84 to 87 and from 87 to 93 in the year 1988. Thus the variable weather conditions did not allow pest incidences to go beyond threshold limit as reported by

Krishnaiah (1983). Hence crop yields were not affected by the pests and disease, although the nutrients caused variations in disease and pest incidences.

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