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Performance of Pusa Basmati- 1509 Under Varying Levels of Fertility in A Light Texture Soil of Western Uttar Pradesh

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ABSTRACT
A field experiment was conducted during Kharif season 2014 at Crop Research Centre (Chirauri) of S.V.P.U.A.&T., Meerut (U.P.) to evaluate the soil fertility status and performance of Pusa Basmati-1509 under varying levels of fertility in a light texture soil of Western Uttar Pradesh. The treatments comprised control, 100 % NPK, 100 % NPK + 25 kg $ZnSO_4.7H_2O$, 125 % NPK, 125 % NPK + 25 kg $ZnSO_4.7H_2O_4$, 150 % NPK, 150 % NPK + 25 kg $ZnSO_4.7H_2O$, 100 % NPK + 2 ton vermicompost, 100 % NPK + 2 ton sesbania, replicated thrice in a randomized block design by using "F" test. The experimental results revealed that growth attributes at different stages (plant height, number of tillers), yield attributing traits (grains panicle^{-1}and test weight), yields viz.,grain (38.50q ha^{-1}), straw (49.83q ha^{-1}) and biological (88.33q ha^{-1}) in rice were significantly superior with the application of additional 25 % more NPK over use recommended N, P and K along with 25 kg $ZnSO_4.7H_2O$ ha^{-1}
Key words : *Pusa Basmati-1509, soil fertility, vermicompost, NPK Zn content*

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INTRODUCTION

Rice is the most important staple food crop which is grown in more than 100 countries, predominantly in Asia. Globally rice provides 21% of energy and 15% of protein requirements of human populations [6]. China and India are the largest rice producing and consuming countries in the world. India produced 106.4 m tonnes of rice and made 40% contribution to the total food grain production of the country [1]. The productivity of rice in India is higher than that of Thailand and Pakistan but much lesser than that of Japan, China, Vietnam and Indonesia. Uttar Pradesh is the 2nd largest rice growing state after West Bengal in the country, in which rice is grown over an area of 58.6 lakh hectares with a production of 144.1 lakh tonnes and the productivity of 2460 kg ha^{-1} [2].

The production of aromatic rice is declining fast even in the native areas of adaptation due to poor yield and quality traits including aroma. [15]. The traditional varieties of scented rice grown in Haryana are tall and prone to lodging particularly when a higher dose of nitrogen is applied. Therefore, growing suitable dwarf varieties of scented rice with higher yield and acceptable quality is important to increase the production of basmati rice [5].

A majority of soils in the world are mineral soils and organic soils occupy only a small area. N deficiency in mineral soils and crops is widespread. Nitrogen application can improve the root system, so that water and nutrient absorption are facilitated. Adequate P increases straw strength in cereals and quality of cereal grain crops is improved and disease resistance enhanced under adequate P availability. Plants require K for the photosynthesis transfer of radiant energy into chemical energy through production of ATP.

Zinc is essential for several biochemical processes in the rice plant. Yaseen *et al.* [14] observed that Zn application increased the grain and straw yields of Basmati-385 over those obtained by application of NPK+ Green Manure.

Most of the Indian soils less fertilate due to deficiency of one or more essential plant nutrient. Integrated nutrient management (INM) aims to improve soil health and sustain high level of productivity and production [11]. *Sesbania cannabina* is a multipurpose leguminous crop and is widely used as green manure crop to increase the yield of rice. It is grown during the summer season and is widely adaptable to different adverse climatic conditions like drought, waterlogging, soil salinity, etc [9].

Green manuring with Dhaincha (*Sesbania aculeata*) alone can meet the total nitrogen requirement of Basmati rice.

Scented rice is high yielding variety and it require huge quantity of nutrients for obtaining optimum yield. Under such circumstances, integrated use of vermicompost and fertilizers in proper proportions appears to be the right practice of plant-nutrition [4].

Nutrients requirement for a variety depends on duration of crop and soil properties. The soils of Western Utter Pradesh light in texture therefore fertilizer recommendation for these soils will be different than fine textured soils. Since Pusa Basmati- 1509 is recently released variety and littlle work had been conducted on its nutritional requirement according to soil condition therefore present study was conducted to study the Soil fertility status and performance of Pusa Basmati- 1509 under varying levels of fertility in a light texture soil of Western Uttar Pradesh.

MATERIALS AND METHODS

The experiment was conducted at the Crop Research Center, Chirauri of Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut (U.P.) which is located at a latitude of 29^0 40′ North and longitude of 77^0 42′ East and at an altitude of 237 meter above mean sea level (MSL). Meerut lies in the heart of Western Uttar Pradesh and has semi arid to sub-tropical climate India The soil texture of experimental field was sandy loam having 4.40 (g kg^{-1})organic carbon, EC (0.11 dSm^{-1}), 123.37 kg/ha available N, 12.32 kg available P, 244.43 kg available K, DTPA extractable Zinc 0.97 (mg kg^{-1}) and pH 8.03. The nine treatment viz. Control without NPK (**T_1**), 100% RDF(**T_2**), 100% RDF+25 Kg$ZnSO_4.7H_2O$ ha^{-1} (**T_3**) 125% RDF (**T_4**), 125% RDF+25 Kg $ZnSO_4.7H_2O$ ha^{-1}(**T_5**) ,150% RDF(**T_6**), 150% RDF+25 Kg $ZnSO_4.7H_2O$ ha^{-1}(**T_7**), 100% RDF+2 ton vermicompost ha^{-1}(**T_8**), 100% RDF+2 ton sesbania ha^{-1} (**T_9**) were replicated three times in Randomized Block Design The crop variety used for sowing was Pusa Basmati -1509 @25 Kg ha^{-1}. The seedling of rice variety Pusa Basmati-1509 was raised in nursery plot by "Wet bed method". A seed bed of 8 x 1.25 m size was prepared in dry condition and three beds were required. On sowing date, the beds were flooded with water and puddle& manually. After leveling, a mixture of 135 g urea (60 $kgha^{-1}$) and 187.5 g single super phosphate (30 $kgha^{-1}$) per bed was broadcasted and incorporated in to the soil. Various doses of urea, DAP,MOP and Zinc Sulphate as per treatment requirement were applied in different plots, 50% of nitrogen, full dose of phosphorus, potash and zinc sulphate was applied as basal and remaining 50% nitrogen top dressing in two equal splits. The plot size for transplanting was 5 x 4 m = 20 m^2. Vermicompost and *Sesbania rostrata* were used in T_8 and T_9alongwith N,P,K whereas in T_1 no fertilizers were used. Two days after transplanting pretilachlore @ 1.5 liter ha^{-1} was applied to control the weed. In order to control stem borer, leaf hopper, gundhi bug and other insects, the recommended insecticide as Cartap hydro chloride 4G @ 20 Kg ha^{-1} and to control the disease recommended fungicide as Carbendazim @ 0.1% etc were applied on the basis of economic threshold level (ETL).The data regarding growth characters, yield attributes and yield were analysed with statistical analysis and significance of treatments were tested with the help of 'F' test.

RESULTS AND DISCUSSION

Effect on growth

The data regarding growth, yield and yield attributes character viz. plant height, number of tillers per meter row length, number of grains per panicle, test weight, dry matter accumulation presented in table no. 1. The data regarding growth clearly shows remarkable effect on all growth and yield characters except number of grains per panicle under different combination shown significant result with the application of 150% RDF+25 Kg $ZnSO_4.7H_2O$ ha^{-1} (T7).It is evident from the table no. 1 that plant height measured increased with the advancement in crop growth. At tillering stage the maximum plant height (60.79 cm) measured in the 150% NPK+25 kg $ZnSO_4.7H_2O$ (T_7)was found significantly superior than all the treatments with exception of T_5 and T_6 which were found at par to T_7. Minimum plant height (44.98 cm) measured in T_1 (control) was significantly lower than all the treatments. At panicle initiation (P.I.) stage the maximum plant height 72.90cm recorded in $T_7$was significantly higher than all the treatment with exception of T_5 and T_6 which were at par to T_7. The minimum plant height(56.35cm) recorded in T_1 was significantly lower than all other treatments. At harvesting of rice with of exception T_5 and T_6, the maximum plant height (88.83cm) measured in $T_7$with the application of 150% NPK+25kg $ZnSO_4.7H_2O$ was significantly higher than rest of the treatments. The minimum plant height (73.41cm) recorded in T_1

was significantly lower than all the treatments. Plant height measured with the application of RDF(T_2) (78.38 cm) was statistically at par to T_3, T_8 significantly higher than T_1 and lower than the rest of the treatments. Taller plant height in T_7 followed by T_6 and T_5 were recorded since the soil was deficit in nitrogen increase in plant height with increasing nitrogen dose is well expected. The results of present study are in agreement with findings of several investigation Hati and Mishra *et al.*[7], Tomar and Das [13] and Kumar *et al.*[8].

The highest number of tillers per meter row length (49.33) at tillering stage were found in T_7, where150% NPK+ 25kg $ZnSO_4.7H_2O$was applied and it was found statistically at par to T_5,T_6 and significantly superior than all the other treatments. The minimum number of tillers recorded in T_1(34.00) were statistically at par to T_2, T_3 and significantly lower than the rest of the treatments. At panicle initiation stage the highest number of tillers per meter row length (64.67) found in T_7were significantly higher than all the other treatments. The minimum number of tillers was measured in T_1 (42.33) which was significantly lower than all other treatments. At harvesting of rice, the highest number of effective tillers per meter row length (62.33) recorded in T_7 were significantly higher than the tillers counted in all the treatments. The minimum number of tillers were measured in T_1 (38.00) which was significantly lower than the all other treatments. . The increase in number of tillers may be due to the fact that higher nutrient supply convert carbohydrate into protein which inturn elaborated in protoplasm. Nitrogen also increase the proportion of protoplasm to cell wall material and lead several consequence, one of them being an increase in size of cell which expressed morphologically increase growth attributes [3].

At tillering stage of rice the highest dry matter accumulation 12.18 q ha^{-1}recorded in the treatment (T_7) with the application of 150% NPK+ 25 kg $ZnSO_4.7H_2O$ was statistically at par to T_5,T_6,T_9 and significantly superior than rest of the treatments. Minimum dry matter accumulation 5.17 q ha^{-1}recorded in T_1 (control) was significantly lower than all the treatments. At panicle initiation stage of rice, with of exception T_5, T_6 and T_9 the highest dry matter accumulation 33.01 q ha^{-1}recorded in$T_7$150% NPK+ 25kg $ZnSO_4.7H_2O$ was significantly superior than all the treatments. Minimum dry matter accumulation 14.52 q ha^{-1} recorded in T_1 (control). The increase in dry matter accumulation under 150 % RDF of NPK along with 25 kg $ZnSO_4.7H_2O$was probably due to super optional level of nutrient application which had promoted tillering and plant height with increased cell division, enlargement, photosynthesis and protein synthesis which are responsible for quantitative improvement in plant growth. The similar opinions were also forwarded by Tomar and Das [13] and Tharmraj *et al.*[12] and Kumar *et al.*[8]. They reported that application of excess nitrogen with recommended P and K accumulates substantial amount of dry weight as compared with recommended NPK.

Table 1. Effect of different fertility levels on growth, yield and yield attributes of Pusa Basmati-1509 at different stages

Treatment	Plant height (cm)			Number of tillers per meter row length			Number of grains per panicle	Test weight(g)	Dry matter accumulation (q ha-1)		Yield (q ha-1)		
	Tillering Stage	P.I. Stage	Harvesting Stage	Tillering Stage	P.I. Stage	Harvesting Stage			Tillering stage	P.I. stage	Biomass	Grain	Straw
T1	44.98	56.35	73.41	34.00	42.33	38.00	56.67	27.83	5.17	14.52	45.70	19.93	25.77
T2	52.79	63.43	78.38	37.33	48.33	46.00	58.00	29.27	8.44	22.65	63.67	27.93	35.73
T3	53.45	64.25	79.96	38.33	51.33	48.33	65.33	29.82	9.59	25.52	67.50	29.47	38.03
T4	55.78	66.76	83.79	40.67	56.33	53.67	66.33	30.72	10.14	27.72	74.00	32.27	41.73
T5	58.43	69.94	85.19	46.00	60.33	57.67	70.67	31.36	11.66	31.79	83.83	36.53	47.30
T6	59.45	71.10	86.22	45.00	59.67	56.33	74.67	30.66	12.09	32.36	83.67	36.50	47.17
T7	60.79	72.90	88.83	49.33	64.67	62.33	76.33	31.49	12.18	33.01	88.33	38.50	49.83
T8	55.10	65.30	81.38	38.66	53.33	50.00	61.00	31.03	9.66	26.84	69.50	30.30	39.20
T9	56.91	68.66	84.47	41.00	58.67	56.67	74.00	31.08	11.43	31.24	81.50	35.53	45.97
SEm±	1.21	1.19	1.24	1.51	1.31	1.36	7.93	0.64	0.27	0.67	3.49	1.74	1.80
CDat 5%	3.65	3.59	3.74	4.55	3.95	4.11	N.S.	1.93	0.82	2.03	10.56	5.25	5.45

Effect on yield and yield attributes

Maximum number of grains per panicle and test weight was observed under T_7, while minimum attributes were found in control plot. Number of grains per panicle was differ non significantly. At harvest of rice biomass (grain + straw) ranged from 45.70 to 88.33 q ha^{-1}. The highest biomass 88.33 q ha^{-1} recorded in the T_7 with the application of 150% NPK+ 25 kg $ZnSO_4.7H_2O$ was statistically at par to T_5, T_6 and T_9 and significantly superior than rest of the treatments. Minimum biomass 45.77 q ha^{-1} recorded in T_1 (control) was significantly lower than all the treatments. The highest grain yield 38.50 q ha^{-1} recorded in the treatment T_7 with the application of 150% NPK+ 25 kg $ZnSO_4.7H_2O$ was statistically at par to T_5, T_6, T_9 and significantly higher than the remaining treatments. Minimum grain yield 19.93 q ha^{-1} recorded in T_1 (control) was significantly lower than all the treatments.

The highest straw yield 49.83 qha^{-1}recorded in the treatment T_7 (150% NPK+ 25 kg $ZnSO_4.7H_2O$) was statistically at par to T_5, T_6, T_9 and significantly superior than rest of the treatments. Minimum straw yield 25.77 qha^{-1} recorded in T_1 (control) was significantly lower than remaining treatments. The increase in yield contributing traits under these treatments might be due to better supply of nutrient at the time of P.I. stage besides increase in photosynthesis area, higher photosynthetic activity and more translocation of photosynthesis towards sink. Our results are in conformity with earlier finding as reported by Pooniya *et al.*[10]. The increments of yield under this treatments was mainly due to production of new meristemic tissue while additional application of NPK and Zn which play vital role various enzymatic and metabolic activity of plant, whereas K play catalytic role in activation of several enzyme, besides improvement in yield attributing (Table 1.) characters under this treatments (T_7) which were mainly governed by the growth parameters and favourable source, sink relationship. Similar findings were also reported by Kumar *et al.*[8] who emphasizes that incorporation of excess of NPK facilitated nutrients elements to the rice grain and straw. Moreover, higher biological yield was mainly due to combined effect of grains and straw similar results were also reported by Kumar *et al.*[8].

CONCLUSION

On the basis of above findings it can be concluded that treatment T_7 [150% RDF+25 Kg $ZnSO_4.7H_2O$ ha^{-1}] shows the best results with respect to significant growth, yield and yield attributes and yield. over rest of the treatments except being at par with 125% RDF+25 Kg $ZnSO_4.7H_2O$ ha^{-1}(**T_5**) ,150% RDF(**T_6**),100% RDF+2 ton sesbania ha^{-1} (**T_9**). Therefore treatment T_7 [150% RDF+25 Kg $ZnSO_4.7H_2O$ ha^{-1}] is recommended for higher yield in rice crop.

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