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The effect of Integrated Nutrient Supply on Growth and Yield Performance of Wheat (*Triticum aestivium* L.)

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ABSTRACT: Wheat (*Triticum aestivium* L.) is the most important stable food crops in the world. The present investigation was taken at Garaila, Jaunpur, (U.P.) to evaluate the effect of integrated use of organic and inorganic nitrogen with and without zinc sulphate on performance of wheat in alkali soil. The experiment was laid out in randomized block design with 9 treatment and 4 replication, treatment consist of control (no fertilizer), NPK, Zinc and press mud. The result reveal that highest plant height of wheat at harvest (102.45 cm), number of tiller per meter at 90 DAT (157.19), number of spike per meter row (68.17), number of grain per spike (48.08), test weight (gm) (38.46), grain yield q/ha (44.31), straw yield q/ha (67.91) and harvest index (%) (39.488) was found from T8 [60 kg N (press mud) + 60 Kg nitrogen + Zinc] and closely followed by T9 [90 kg N (press mud) + 30 Kg N + zinc]. The organic press mud reported higher in most above parameter. 100 % nitrogen recorded significantly lower as compare to T8 and control plot recorded lowest of all above parameters. The investigation reveals that the integrated use of organic with fertilizer produce higher and sustainable yield of wheat.

Keywords: Sustainable, Organic, Performance, Fertilizer, Integrated and Parameter.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is an important cereal crop, belong to family *poaceae*. Due to its taste and nutritive value it has become the major staple food of different regions of the world (Slafer *et al*., 1994). Wheat crop can be adopted to different agro-climatic conditions and it can be successfully grown in most of the countries of the world. It is considered important for protein contents. The world total area under wheat is approximately ten million hectares, and wheat is providing 1/ 5th on an average of total calorific input to the world, by producing six hundred and twenty one million tons of grain to the world's population (Reynolds *et al.*, 2006). It meets about 73% protein and calories of the average diet (Hossain *et al*., 2003).

During 2019-20 India had a total area of 30.28 million hectares (15.23%) wheat, with 106.21 million tonnes produced and an average productivity of 3.57 tonnes ha^{-1} (GOI 2020). India's population is expected to reach 1.7 billion in year 2050 and production target has been fixed 140 million tonnes (UN report on world population prospect). Green revolution increased the production of wheat in India and a steep jump from 6.82 million tonnes from an area of 9.75 million hectares in 1950-51. It is grown on 227 million hectares, yielding 682 million tonnes with a productivity of 30.0 q ha^{-1} and a total production of 93.5 million tonnes with a productivity of 29.4 q ha^{-1} and an area of 30.2 m ha with a total production of 93.5 million tonnes and a productivity of 29.4 q ha^{-1}. (Anonymous, 2018).

During past three decades, intensive agriculture involving exhaustive high yielding varieties has led to heavy withdrawal of nutrients from soil and caused nutrient deficiency for crop production. Wheat is generally grown in intensive cropping system with higher use of inorganic especially nitrogenous fertilizers (Yadav *et al.*, 2018). Chemical fertilizers supply adequate nutrients timely to the wheat crop, but its high cost, non-availability and lower efficiency causes the by crop, creating in issues like as nitrogen volatilization, leaching, and denitrification (Fazily and Hunshal, 2019).

Keeping in view the importance of organic manures and inorganic fertilizer a study was designed to hypothesize

that water use efficiency, growth and yield attributes of wheat and soil properties could be improved with the use of inorganic and organic fertilizers.

MATERIALS AND METHODS

The field experiment was conducted during *rabi* season of 2018-19 and 2019-20 at farmers field of village Garaila, Jaunpur, near V.B.S.P.U., Jaunpur (U.P.). The experiment was laid out in randomized block design with nine treatments *viz.,* T_1 Control,T_2 RDF (120:60:40) ,T_3 RDF (120:60:40:4.5 zinc), T_4 30 Kg N (Press mud) + 90 Kg N, T_5 60 kg N (Press mud) + 60 kg N, T_6 90 kg N (Press mud) + 30 kg N, T_7 30 kg N (Press mud) + 90 kg N + Zn, T_8 60 kg N (Press mud) + 60 kg N + Zn, T_9 90 kg N (Press mud) + 30 kg N+ Zn, were examined in four replications. Observations on different trail were recorded and the results that obtained are discussed under result and discussion.

RESULTS AND DISCUSSION

A. Effect of Integrated nutrient supply on growth parameters

Plant height. Various levels of nitrogen (organic and inorganic) alone and in combination with press mud influenced the plant height significantly over all the stages. It is further evident from the perusal data that the plant height (102.45 cm) was recorded highest under the treatment T_8 [60 kg N (press mud) + 60 kg N (Urea) + 4.50 kg Zn] and lowest plant height (72.01 cm) was recorded in T_1 (control) at harvest stage.

Increase the organic matter content of the soil, including the "humic substance" that affects nutrient accumulation and promotes root growth, resulting in greater plant growth and taller plants. These findings are in accordance Verma *et al.,* (2000); Chatterjee *et al.,* (2016); Verma *et al.,* (2018).

Number of tillers m^{-1}. The data on tillers m^{-1} were recorded at regular intervals (Table 2) indicated that the tillers m^{-1} steady increase in the number of tillers m^{-1} upto the stage of harvesting (60 DAT), thereafter declined with the advancement in age.

The reduction in the number of tillers after 90 days resulted due to the ageing and senescence which was responsible for dying of the secondary and tertiary tillers. Various levels of nitrogen organic and inorganic fertilizer alone and in combination with press mud influenced the number of tillers significantly over all growth stages. It is further evident from the perusal data that the maximum number of tillers (157.19 m^{-1}) was recorded under the treatment T_8 [60 kg N (press mud) + 60 kg N (Urea) + 4.50 kg Zn] and minimum number of tillers (81.08 m^{-1}) was recorded in T_1 (control) at harvest stage. The increase in number of tillers at different stages under various inorganic fertilizers level alone and in combination with organic sources was due to increasing availability of nutrients in adequate amount at different growth stage of wheat.

Table 1: Effect of integrated nutrient supply on plant height (cm) at different growth stages of wheat crop.

Treatment	Plant height (cm)			
	30DAT	60DAT	90DAT	At Harvest
T_1	21.20	52.40	69.39	72.01
T_2	24.82	58.05	86.69	90.39
T_3	26.71	66.11	93.78	95.98
T_4	25.15	69.48	92.71	93.92
T_5	27.07	72.80	94.16	97.64
T_6	27.62	71.50	93.15	97.05
T_7	27.80	73.04	93.74	97.88
T_8	29.68	75.29	97.88	102.45
T_9	29.41	74.05	94.83	99.03
SEm±	2.16	2.10	3.28	3.57
CD (P = 0.05)	6.48	6.30	9.84	10.71

Table 2: Effect of integrated nutrient supply on tiller m^{-1} at different growth stages of wheat crop.

Treatment	Tiller m^{-1}			
	30DAT	60DAT	90DAT	At Harvest
T_1	35.27	91.20	81.08	53.51
T_2	44.29	116.65	119.87	75.69
T_3	44.54	129.85	137.86	80.71
T_4	44.00	119.47	131.06	76.06
T_5	46.49	134.81	145.62	85.19
T_6	48.46	131.29	149.02	87.68
T_7	49.89	137.45	152.29	92.52
T_8	54.04	141.70	157.19	96.30
T_9	53.01	139.20	154.34	92.97
SEm±	2.45	3.34	1.83	2.95
CD (P=0.05)	7.35	10.02	5.49	8.85

These results is in conformity with the finding of Kler *et al.,* (1992) Neelam *et al.,* (2015); Singh *et al*., (2017).

B. Effect of integrated nutrient supply on yield attributes, grain yield, straw yield and harvest index

In the present investigation yield and yield attributing traits *viz*. number of panicle, number of grains panicle^{-1} , test weight, grain yield (q ha^{-1}), straw yield (q ha^{-1}) and harvest index (Table 3) were discussed. Distinct positive effect of INS was noticed on these yield attributes. All these parameters attained higher values with increasing NPK level from unfertilized to 100 % RDF and further when 25 to 50 % nutrients substituted through organic sources *viz.* press mud brought about appreciable increase in yield attributing characters and finally grain as well as straw yield.

Significantly higher yield attributes test weight, grain yield (q ha^{-1}), straw yield (q ha^{-1}) number of spike, number of grains panicle^{-1}, were recorded with T_8 [60 kg N (press mud) + 60 kg N (Urea) + 4.50 kg Zn] which remained at par to all the treatment where 25-60% N applied as organic source (T_4, T_5, T_6, T_7 and T_9) and also in T_2 and T_3 (100 % RDF) but lowest amount was recorded in T_1 (control). All the yield attributes were higher with the substitution of press mud in combination with 50-75% RDF due slow release and continuous supply of nutrients in balance quantity throughout the various growth stages enables the wheat plants to assimilate sufficient photosynthetic products and thus, increased the dry matter and source capacity, resulted in the production of increased panicles with more number of fertile grains and higher test weight, grain and straw yield. Similar beneficial effect on yield of wheat has been also reported by Dhar *et al.* (2016); Bhargav *et al.*, (2016); Mithilesh and Thomas Abraham (2017); Verma *et al.* (2018).

Harvest Index. The harvest index was computed on the basis of grain yield and total biomass production and presented in terms of per cent as influenced by different INS treatments have been presented in (Table 3). The harvest index (g) of rice varied from 37.894-39.488 g. All the treatments failed to give significant impact on harvest index of rice. The maximum value of harvest index was recorded with T_8 [60 kg N (press mud) + 60 kg N (Urea) + 4.50 kg Zn], which was statistically similar to T_6. Similar findings were reported by index Dhar *et al.*, (2016); Kumar *et al*. (2018).

Table 3: Effect of integrated nutrient supply on yield attributes, grain yield, straw yield and harvest index.

Treatment	Number of spike meter-1 row	Number of grains per spike	Test weight (g)	Grain yield (q ha-1)	Straw yield (q ha-1)	Harvest Index (%)
T_1	39.68	29.51	32.51	27.18	44.55	37.894
T_2	52.22	41.22	35.81	35.54	53.73	39.811
T_3	55.89	42.20	37.15	37.08	57.22	39.321
T_4	52.47	41.47	37.65	36.36	55.28	39.681
T_5	61.43	43.15	37.57	38.29	59.55	39.137
T_6	63.22	43.98	37.39	39.43	57.77	40.428
T_7	56.67	46.98	38.25	37.19	64.89	36.432
T_8	68.17	48.08	38.46	44.31	67.91	39.488
T_9	62.05	44.72	37.96	41.73	67.80	38.560
SEm±	2.45	4.00	1.42	2.39	2.59	1.92
CD (P=0.05)	7.35	12.00	4.26	7.17	7.77	NS

CONCLUSION

The investigation reveals that the integrated use of organic with fertilizer produce higher and sustainable yield of wheat.

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