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Research Article

Influence of Integrated Nutrient Management in Wheat (*Triticum aestivum* L.) Under Vindhya Region of Satna

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ABSTRACT

In order to explore the possibility of pushing up the growth and yield attributes of wheat therefore present investigation entitled "Influence of integrated nutrient management in wheat under Vindhya region of Satna" have been conducted at the AKS University, Sherganj, Satna (M.P.) during rabi seasons of 2020- 21. Under the present investigation treatments evaluated were Control plot,100% NPK recommended $N_{120}P_{60}K_{40}$ kg/ha, 75% NPK, 50% NPK recommended + application of Sagarika, 50% NPK + Azotobacter, 50% NPK + $ZnSO_4$ @ 25 kg/ ha, 50% NPK + $ZnSO_4$ @ 25 kg/ha + Azotobacter, 50% NPK + Vermicompost @ 3 t/ha + $ZnSO_4$ @ 25 kg/ha + Azotobacter, 75% NPK + Azotobacter, 75% NPK + $ZnSO_4$ @ 25 kg/ha, 75% NPK + $ZnSO_4$ @ 25 kg/ha + Azotobacter and 75% NPK + Vermicompost @ 3 t/ha + $ZnSO_4$ @ 20 kg/ha + Azotobacter. The variety (GW- 322) of wheat was sown on 12th November, 2020. Experiment was conducted in Randomized block design replicated thrice. Analyzed data of the treatment indicated significantly highest plant height (86.49 cm), tillers per meter row length at 90 DAS (163.53), spike length (18.08 cm), number of grains per spike (40.27), test weight (44.86 g), grain (48.61 q/ ha) and straw yield per hectare (56.25 q/ ha) were recorded when 75% NPK + Vermicompost @ 3 t/ha + $ZnSO_4$ @ 20 kg/ha + Azotobacter was evaluated .However it was also brought into light that use of 75% NPK + Vermicompost @ 3 t/ha + $ZnSO_4$ @ 20 kg/ha + Azotobacter were superior growth and yield was noticed.

Keywords: *spike, tillers, grain, straw, test weight.*

INTRODUCTION

Wheat (*Triticum aestivum* L.) is an important staple food crop, which grown ancient time in the world and known as 'king of cereal' belongs to the family 'Poaceae'. The total area under wheat cultivation in the world during 2018-19 was 218.2 million hectares with an annual production of 765.5 million tons and average productivity of 3.51 tons/ ha (USDA, 2019).

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India is the second largest producer of wheat next to China, which produces about 99.9 million tons of wheat from an area of 29.6 million hectare with an average productivity of 3.37 t /ha. The area, production and productivity of crop in Madhya Pradesh were 5.91 million ha, 17.69 million tonnes and 2993 kg/ ha, respectively during 2003-04 (Anonymous, 2016).

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 limitations to its application. Therefore, in recent years use of organic manures has gained priority over the chemical fertilizers in order to meet food demands of the growing population of the world. In order to improve soil organic carbon to sustain soil quality and future agricultural productivity, application of organic manures and biofertilizers are the best option (Jan & Boswal, 2015).

The recent research findings indicated that a judicious combination of organic and inorganic fertilizers with biofertilizers will maintain long term soil fertility better and sustain higher levels of productivity. The basic concept determining the principles of integrated nutrient management (INM) is the maintenance and improvement of soil fertility for sustaining crop productivity on long term basis. This may be achieved through combined use of all possible sources of nutrients and their scientific management for optimum growth, yield and quality of different crops and cropping systems. But the appropriate combination of different sources of nutrients varies according to the system; land use, ecological, social and economic condition at the local level. Hence, present investigation was carried out to study the growth, yield and qualitative behavior of wheat to define optimum dose under integrated use of bio-organics and fertilizers.

MATERIALS AND METHODS

The experiment was carried out at instructional Farm, Faculty of Agriculture, AKS University, Satna (M.P.) during *rabi* season 2020- 21. The experiment was conducted in randomize complete block design with three replications. The treatments were; **T_1=** Control plot, **T_2=** 100% NPK recommended $N_{120}P_{60}K_{40}$ kg/ha, **T_3=** 75% NPK, **T_4=** 50% NPK recommended + application of Sagarika, **T_5=** 50% NPK + Azotobacter, **T_6=** 50% NPK + $ZnSO_4$ @ 25 kg/ ha, **T_7=** 50% NPK + $ZnSO_4$ @ 25 kg/ha + Azotobacter, **T_8=** 50% NPK + Vermicompost @ 3 t/ha + $ZnSO_4$ @ 25 kg/ha + Azotobacter, **T_9=** 75% NPK + Azotobacter, **T_{10}=** 75% NPK + $ZnSO_4$ @ 25 kg/ha, **T_{11}=** 75% NPK + $ZnSO_4$ @ 25 kg/ha + Azotobacter and **T_{12}=** 75% NPK + Vermicompost @ 3 t/ha + $ZnSO_4$ @ 20 kg/ha + Azotobacter. The wheat variety (GW-322) was sown on 12th November, 2020 using 100 kg seeds per ha. The gross and net plot size was 5.0 m x 3.5 m and 4.0 m x 3.0 m, respectively. The N, P_2O_5 and K_2O were applied through urea, single super phosphate and muriate of potash, respectively. Full recommended dose of phosphorus and potassium at the rate of 60 kg P_2O_5 /ha and 40 kg K_2O /ha, respectively was uniformly applied to each plot (except control plots) as basal dose before transplanting. Nitrogen @ 120 kg/ha was applied to plots in the form of Urea. Half dose of nitrogen was applied as basal dose at the time of sowing and remaining half dose of nitrogen was applied in two equal splits at 30 and 60 DAS i.e., at tillering and late jointing stage. In the experiment biofertilizers i. e. Azotobacter was used for this investigation. Wheat seeds were inoculated with Azotobacter culture as per treatments of @ 20 g/ kg seed by using 10 packets (200 g each packet) for 100 kg seed of wheat needed for sowing one-hectare area. Vermicompost was applied as per treatments at the time of sowing and thoroughly mixed in surface layer manually. Zinc was applied as per treatment through zinc sulphate

($ZnSO_4.7H_2O$). The other crop management practices were followed as per standard recommendation. The crop was harvested at the physiological maturity. All the other agronomic practices were applied uniformly to all the treatments.

RESULTS AND DISCUSSION

Data regarding plant height and number of tillers per meter row length are reported in Table- 1. Statistical analysis of the data revealed that maximum plant height (86.49 cm) and number of tillers per meter row length (163.53) at 90 DAS were observed under the integrated nutrient management treatment of 75% NPK + Vermicompost @ 3 t/ha + $ZnSO_4$ @ 20 kg/ha + Azotobacter while, lowest values were observed under the control.

Statistical analysis of the data revealed that highest spike length (18.08 cm), number of grains per spike (40.27), test weight (44.86 g), grain (48.61 q/ ha) and straw yield per hectare (56.25 q/ ha) recorded under the integrated nutrient management treatment with 75% NPK + Vermicompost @ 3 t/ha + $ZnSO_4$ @ 20 kg/ha + Azotobacter.

The increase in growth attributes with this treatment might be due to improved photosynthetically active leaf area for longer period during vegetative and reproductive phases, led to more absorption and utilization of radiant energy which ultimately resulted in higher dry matter accumulation and significant increase in plant growth. It is an established fact that organic manure improves the physical, chemical and biological properties of soil and supplies almost all the essential plant nutrients for growth and development of plants along with growth hormones and beneficial microbes which might have developed more favorable environment of nutrients in soil for longer period resulted in increased plant height, new shoots and increased dry matter accumulation. It is fact that organic matter acts as a chelate for nutrients and soluble chelates probably increase their availability and uptake to plants and mobility in soils.

Nutritional condition as evident from increased in vegetative growth might be due to combined application of *Azotobacter* application was also superior with vermicompost in growth parameters at all the growth stages. This might be directly associated with the increased availability of nitrogen through biological fixation and solubility in soil to be readily utilized by the plants as they are atmospheric nitrogen fixers. The results of the present investigation are in conformity with those of Mali et al. (2016) and Neelam et al. (2018).

The favourable effect of applied zinc on these parameters might be assigned to its physiological functions in the plants. It has metabolically important role in plant growth, development and synthesis of proteins, enzyme activation, oxidation and revival reactions and metabolism of carbohydrates. The investigation is in conformity with various workers as Meena et al. (2016), Berkesia et al. (2018) and Kumar et al. (2021).

The increase in yield attributes with the application of vermicompost in increasing rate might be due to higher availability of balanced plant nutrients throughout the crop period specially at critical stages of plant, favourable C:N ratio, better utilization of nitrogen for reproductive growth rather than for vegetative growth, functional role of nitrogen in the plant body i.e. in multiplication, cell elongation and tissue differentiation (Singh & Meena, 2004). The combined inoculation of *Azotobacter* with vermicompost also gave highest values of yield attributing characters. The improvement in yield of crop was limited when these bio-fertilizers were used singly, however, a significant additive effect was observed when they were used in combination.

Further, vermicompost increase the efficiency of added chemical fertilizers in soil and increased rate of humification. Humic acid in vermicompost enhances the availability of both native and added micronutrients in soil and thus plant growth, yield attributes and yield increased (Singh et al., 2010). The significant improvement in straw and biological yields with the addition of vermicompost seems to be on account of

grater accumulation of dry matter right from the early stage of crop growth by virtue of increased photosynthetic efficiency and nutrient accumulation.

Combined application of bio-organics and fertilizer with micronutrients levels showed significant positive interaction on number of effective tillers of wheat. The combined application of vermicompost with fertilizer in optimum level obtained maximum number of effective tillers. The enhanced early vegetative growth of plant, dry matter accumulation and vigorous root system resulted in more spike which consequently increased the number of spikes bearing tillers significantly. Stimulated vegetative growth of wheat on account of adequate and prolonged supply of essential nutrients in integrated nutrient management treatments receiving vermicompost in addition to increasing levels of RDF manifested itself in increased yield attributes. These findings are in accordance with the results of Dahiya et al. (2019), Kumar et al. (2019), Parashar et al. (2020a) and Yadav et al. (2020).

Table- 1: Effect of integrated nutrient management on growth and yield of wheat

Tr.	Plant height (cm)	Tillers per meter row length	Spike length (cm)	Number of grains per spike	Test weight (g)	Grain yield (q/ha)	Straw yield (q/ha)
T_1	70.48	65.53	11.10	32.27	36.20	13.17	36.05
T_2	84.39	132.00	16.10	37.43	42.54	46.28	45.20
T_3	81.14	116.60	14.68	36.00	40.20	18.56	44.34
T_4	76.57	85.80	12.98	33.47	38.20	14.56	42.29
T_5	77.31	92.40	13.32	33.87	38.54	15.14	42.83
T_6	79.42	112.20	13.82	34.60	39.20	16.83	42.87
T_7	80.30	113.67	14.13	35.13	39.87	17.78	43.19
T_8	85.73	144.47	16.78	38.40	42.87	47.44	45.51
T_9	82.06	126.87	14.96	36.40	40.54	21.33	44.45
T_{10}	82.86	127.60	15.62	36.47	41.20	22.36	44.64
T_{11}	83.67	128.33	15.23	36.87	41.87	46.00	44.92
T_{12}	86.49	163.53	18.08	40.27	44.86	48.61	56.25
S. Em±	0.75	2.60	0.20	0.41	0.67	1.35	0.15
C.D. P=(0.05)	2.19	7.57	0.57	1.19	1.94	3.94	0.43

CONCLUSION

Based upon this experiment it is concluded that application of the 75% NPK + Vermicompost @ 3 t/ha + ZnSO4 @ 20 kg/ha + *Azotobacter* recorded the significantly higher grain yield (48.61 q/ha), maximum gross returns (₹ 142225.00 Rs/ ha) and maximum net returns (₹ 111830.00 Rs/ ha), while highest B: C ratio of 1:3.85 were obtained with the application of 100% NPK.

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Conflict of Interest

The author(s) declares no conflict of interest.

Author Contribution

Both authors contributed equally to establishing the topic of the research and design experiment.

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