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*Research Article*

# Growth and Yield Response of Wheat (*Triticum aestivum* L.) in Relation to the Use of Varieties and Bio-Fertilizer

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**ABSTRACT**

*In order to explore the possibility of pushing up the growth and yield attributes of wheat, therefore the present investigation entitled ''Growth and Yield response of wheat (Triticum aestivum L.) in relation to use of varities and bio-fertilizer" has been conducted at the AKS University sherganj satna during rabi season 2020-2021. Under the present investigation, four wheat varieties were evaluated are $V_1$- GW 322, $V_2$- JW 17, $V_3$- JW 3020 and $V_4$- JW 3288, while three levels of biofertilizers and treatments were $B_1$- Azotobacter (10 ml/kg seed) + 500 ml/acre foliar application, $B_2$- PSB (10 ml/kg seed) + 500 ml/acre foliar application and $B_3$- ZSB (10 ml/kg seed) + 500 ml/acre foliar application. Highest plant height (83.66 cm), number of tillers per meter row length (66.47) at 90 DAS while, number of spikes per plant (21.00), spike length (13.53 cm), number of grains per spike (29.40), test weight (41.36 g), grain yield (38.95 q/ha), stover yield (68.21 q/ha) were recorded under the wheat variety GW- 322 sown with biofertilizer of Azotobacter @ 10 ml/kg seed inoculation + 500 ml/acre foliar application.*

***Keywords:*** *Varieties, Biofertilizers, Tillers, Spike, Test weight, Stover yield.*

## INTRODUCTION

Wheat is the most important cereal crop occupies prominent position in Indian agriculture after rice. Wheat (*Triticum aestivam)* is the most important because of its higher calorific values as well as a good supplement for nutritional requirement of human body due to presence of 9-10 percent protein and 60-80 percent carbohydrates (Sharma & Jain, 2014). Globally, wheat is the leading source of vegetable protein in human food, having higher protein content than either maize (corn) or rice, the other major cereals in India.

There are many factors, which are responsible for lower yield levels of wheat crop. Therefore, some efforts have been made to increase the yield by introduction of high yielding new varieties and balanced fertilizer application.

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But there are certain factors on which attention have not been given to increase the per hectare yield of wheat.

Among the several factors for successful crop production, crop variety is an important non-monetary input. Genetic potential of different cultivars varies under different climatic conditions. Studies of all the agricultural system viz. crops, cropping system and farming system are incomplete without the study of effect of weather on them. The potential productivity of these systems depends not only on seed, fertilizers, irrigation but also upon optimum weather conditions. For increase in growth and productivity of wheat crop, date of sowing play important role. It governs the crop phenological development and total biomass production along with efficient conversion of biomass into economic yield. Phenology is the science that relates climate to periodic events in plant life. The rate of plant development at successive stages of growth is important in determining climatic limits of economic production. The development and recommendation of high yielding adaptable varieties considered to be the first step to generate maximum production.

Imbalanced use of fertilizers is an important issue in an Indian agriculture. Latest nutrient- management strategies target to deliver soluble inorganic nutrients directly to crops and have uncoupled carbon, nitrogen and phosphorus cycles spatially and temporally. The existing system of fertilizer application is based on the nutrient demand of individual crop ignoring the carry-over effect of fertilizer or organic manure applied to the succeeding crop to a great extent. Further, sustainable system productivities achieved through integrated use of organic and inorganic sources of nutrients (Singh et al., 2008). Addition of biofertilizers with inorganic fertilizers to soil has been reported to increase the efficiency of applied fertilizers moreover; addition of biofertilizers with inorganic fertilizers improves organic matter content of soil and consequently water holding capacity of soil (Hati et al., 2006). Nutrient replenishment by merely adding chemical fertilizers is often not economically feasible and even in the technically, it may not be in balance with the supply of biofertilizers to enhance nutrient recovery and productivity of wheat (Bhaduri & Gautam, 2012).

Recently, many early durations dwarf varieties have been evolved with high yield potentials as well as responsiveness to high levels of fertilizer as well as biofertilizers. The present study was planned to estimate the suitable wheat variety and biofertilizers and its impact on growth and yield of wheat.

## 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 having Factorial concept with three replications. Different bio-organics and wheat varieties will be allocated to the plots as per treatments. Seed rate used as 100 kg/ha for transplanting with 22.5 x 5.0 cm distance. In this experiment four wheat varieties were tested and these are $V_1$- GW 322, $V_2$- JW 17, $V_3$- JW 3020 and $V_4$- JW 3082, while three levels of biofertilizers and treatments were $B_1$- Azotobacter (10 ml/kg seed) + 500 ml/acre foliar application, $B_2$- PSB (10 ml/kg seed) + 500 ml/acre foliar application and $B_3$- ZSB (10 ml/kg seed) + 500 ml/acre foliar application. The gross and net plot size was 5.0 m x 3.50 m and 4.0 m x 3.0 m, respectively. The fertilizers grades were applied as per treatments. 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 sowing. 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. Required quantity of healthy, bold, unbroken and fully developed seeds of wheat variety was inoculated separately with Azotobacter, PSB and ZSB as per treatment, before sowing

of the crop. 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 (38.99 cm) and number of tillers per meter row length (6.42) at 60 DAS were recorded under the wheat variety GW- 322 sown with biofertilizer of *Azotobacter* @ 10 ml/kg seed inoculation + 500 ml/acre foliar application.

The growth characters of plant are the product of its genetic constitution and environment. The genetic pattern is a fixed quantity for a given plant and determines its potential for maximum growth under favourable environment for its development. Between the varieties, GW- 322 resulted into the significant higher values of all these characters. The differences in growth characters due to varieties may be attributed to their inherent characteristics and adaptability to soil and climatic conditions. The marked variation in growth between varieties could be ascribed to their differential genetic milieu and capabilities to exploit available growth inputs (above and below ground) for overall growth and development. It has been very well documented that tiller production in cereals, initially determined by rate of auxiliary bud growth and later on growth of individual tiller, which is markedly influenced by environmental factors (temperature, photoperiod etc.) as well as availability of mineral nutrients and photosynthates. The results are in close conformity with the findings of Praful Kumar et al. (2015) and Para et al. (2018).

Application of biofertilizers through seed inoculation and foliar application showed slightly more plant height and plant dry matter than their application. This could be attributed to supply of additional N through $N_2$ fixation activities of the inoculated *Azotobacter* biofertilizer. The positive effects of application of *Azotobacter* in wheat on growth attributes have also been reported by Ghetiya et al. (2018), Navsare et al. (2018).

Statistical analysis of the data revealed that maximum number of spikes per plant (21.00), spike length (13.53 cm), number of grains per spike (29.40), test weight (41.36 g), grain yield (38.95 q/ha), stover yield (68.21 q/ha).

The marked increase in most of the yield attributes in variety GW- 322 could be ascribed to overall improvement in crop growth as evident from higher dry matter accumulation at successive stages as well as concentration and uptake of nutrients. These subscribes greater availability of photosynthates and nutrients matching with demand for initiation and growth of each reproductive structures. Significantly higher production of effective tillers by variety GW-322 seems to be due to its capacity to produce higher number of tillers and later on their conversion to effective spike bearing shoots seems to be by virtue of adequate supply of growth inputs (metabolites and nutrients). This type of variations may be owing to variations in the genetic buildup of the varieties. In fact, it is very difficult the inherit all the desirable characters in one variety although efforts are being made in this direction. Such type of variability in the yield-attributing characters in the wheat varieties have been reported by many research workers *viz*., Khairnar et al. (2018), Sanju et al. (2019), Poudel et al. (2020) and Gupta et al. (2021).

Application of *Azotobacter* significantly enhanced the grain production of the wheat crop. This could mainly be ascribed to the increased availability of the nitrogen to the plants through biological nitrogen fixation in rhizosphere by *Azotobacter* caused by the better root development due to more availability of P due to activity of PSB. Thus, the greater availability of nitrogen might have helped in vigorous plant growth, resulting in more dry matter accumulation and ultimately better flowering and ear head development. The increased yield probably may be resulted due to stimulation in germination and thereby increases in plant biomass by the nitrogen fixed by the *Azotobacter*. The results obtained here are in close agreement with the finding of Jat et al. (2018), Malo et al. (2018) and Meena et al. (2019).

**Table 1: Effect of Varieties and Bio-Fertilizers on Growth and Yield of Wheat**

| Treatment | Plant height (cm) | Number of tillers/ m row length | Number of spikes per plant | Length of spike (cm) | Number of grains per spike | Test weight (g) | Grain yield (q/ha) | Stover yield (q/ha) |
|---|---|---|---|---|---|---|---|---|
| | **Effect of varieties** | | | | | | | |
| $V_1$ | 81.98 | 58.36 | 18.78 | 12.71 | 28.91 | 39.85 | 37.56 | 66.91 |
| $V_2$ | 78.75 | 41.98 | 15.16 | 11.08 | 27.69 | 37.53 | 34.34 | 59.02 |
| $V_3$ | 76.35 | 32.13 | 12.84 | 9.97 | 25.76 | 36.07 | 29.63 | 50.18 |
| $V_4$ | 72.43 | 23.31 | 10.44 | 8.63 | 22.80 | 34.43 | 22.53 | 37.15 |
| **S. Em±** | 0.32 | 1.95 | 0.46 | 0.20 | 0.46 | 0.49 | 0.39 | 0.88 |
| **C.D.(P=0.05)** | 0.93 | 5.71 | 1.36 | 0.60 | 1.36 | 1.44 | 1.14 | 2.59 |
| | **Effect of biofertilizers** | | | | | | | |
| $B_1$ | 78.60 | 43.38 | 15.57 | 11.13 | 27.18 | 37.74 | 32.71 | 57.12 |
| $B_2$ | 77.56 | 39.45 | 14.52 | 10.56 | 26.53 | 36.81 | 31.66 | 54.06 |
| $B_3$ | 75.97 | 34.00 | 12.83 | 10.10 | 25.15 | 36.36 | 28.67 | 48.76 |
| **S. Em±** | 0.36 | 2.25 | 0.53 | 0.24 | 0.53 | 0.57 | 0.45 | 1.02 |
| **C.D.(P=0.05)** | 1.07 | 6.60 | 1.57 | 0.69 | 1.57 | 1.66 | 1.31 | 2.99 |
| | **Interaction effect between varieties and biofertilizers** | | | | | | | |
| $V_1B_1$ | 83.66 | 66.47 | 21.00 | 13.53 | 29.40 | 41.36 | 38.95 | 68.21 |
| $V_1B_2$ | 79.33 | 44.93 | 15.73 | 11.44 | 28.40 | 38.28 | 34.76 | 65.80 |
| $V_1B_3$ | 77.21 | 35.40 | 13.60 | 10.45 | 26.60 | 36.56 | 32.78 | 55.56 |
| $V_2B_1$ | 74.21 | 26.73 | 11.93 | 9.07 | 24.33 | 34.77 | 24.35 | 38.91 |
| $V_2B_2$ | 81.80 | 59.00 | 18.80 | 12.64 | 28.87 | 39.22 | 37.56 | 66.30 |
| $V_2B_3$ | 78.87 | 42.87 | 15.40 | 11.04 | 27.53 | 37.50 | 34.21 | 55.63 |
| $V_3B_1$ | 76.49 | 32.00 | 12.73 | 9.88 | 25.73 | 36.11 | 31.21 | 55.49 |
| $V_3B_2$ | 73.07 | 23.93 | 11.13 | 8.69 | 24.00 | 34.40 | 23.67 | 38.83 |
| $V_3B_3$ | 80.47 | 49.60 | 16.53 | 11.94 | 28.47 | 38.97 | 36.18 | 66.22 |
| $V_4B_1$ | 78.06 | 38.13 | 14.33 | 10.76 | 27.13 | 36.83 | 34.05 | 55.62 |
| $V_4B_2$ | 75.36 | 29.00 | 12.20 | 9.57 | 24.93 | 35.54 | 24.89 | 39.50 |
| $V_4B_3$ | 70.00 | 19.27 | 8.27 | 8.12 | 20.07 | 34.12 | 19.56 | 33.71 |
| **S. Em±** | 0.18 | 1.12 | 0.27 | 0.12 | 0.27 | 0.28 | 0.22 | 0.51 |
| **C.D.(P=0.05)** | 0.38 | 2.33 | 0.55 | 0.25 | 0.55 | 0.59 | 0.46 | 1.06 |

## CONCLUSION

It may be concluded that wheat variety GW-322 sown with bio-fertilizer (*Azotobacter* **@** 10 ml/kg of seed + 500 ml/acre foliar application of Azotobacter) brought about significantly superior grain yield (38.95 q/ha), net return (Rs 105350.00/ha) and highest B:C ratio 3.88:1. Hence, on the basis of conclusion it may be suggested that GW-322 sown with Azotobacter @ 10 ml/kg seed inoculation + 500 ml/ acre foliar application can be used at the farmer's field.

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## Conflict of Interest

The author(s) declares no conflict of interest.

## Author Contribution

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

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