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Varietal Performance of wheat under agro-ecological conditions of Uttarakhand

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Abstract

Variety plays an important role in producing high yield of a crop. Because of genetic variation, different cultivars of crop differ in their growth and developmental behaviour as well as response differently to varied input, prevailing environment and management practices. Apart from other management practices high yielding varieties play an important role in enhancing the production of wheat. Number of tillers, number of spikelets, panicle length, grain size, grain yield and other yield contributing characters differ from one variety to another. Therefore, selection of suitable varieties is also of prime importance. Generally, modern wheat varieties consume nutrient and water in high quantity. Therefore, consumption of inputs also differs from one variety to another. As PBW 373 is a common variety grown for more than 20-25 years in Dehradun, Haridwar and Udham Sing Nagar, expanding research on other new cultivars also need to be test for their potential under Uttarakhand conditions. The study's findings suggest that new varieties can effectively replace old one, leading to increased yields in a more sustainable way that doesn't harm soil or people.

Keywords: Varieties, wheat, growth, yield, economics

Introduction

Among the cereals, wheat (*Triticum aestivum* L.) rank first in terms of nutritional value and it is considered as the most important field crop in the world covering 220.10 m ha and with a production of 763.26 m t (USDA, 2019). It is used as staple food by more than one third of the world's population. As one of the commonest cereal crops, it plays an important role in daily energy intake and in many developing nations, provides over 50% of the daily caloric intake (Cakmak, 2008). In India, wheat is the 2nd most important food crop next to rice with a production of 99.87 m t in 29.65 m ha in the year 2018-19. The share of wheat to total food grain production in India is around 35% and it occupies about 23.3% of the total area under food grains (MoA&FW, 2019). Keeping in view of the growing population demand, wheat production needs to achieve a targeted demand of 140 million tonnes by 2050 (ICAR-IIWBR, 2015) [20]. It is quite clear that sustaining wheat productivity is essential to both food as well as nutritional security in India.

Green revolution has greatly increased the food crop production in India with the introduction of high yielding, dwarf, fertilizer-responsive varieties of rice and wheat. This made India self-sufficient in food grain production, but the demand for food has been increasing as the population of the country is increasing tremendously, approximately at the pace of 1.2% every year over the existing population of 1.3 billion. Cereals play an important role to meet the global food demand, particularly in developing countries where cereal-based production system is the predominant source of nutrition and calorie intake. As per the estimate, around 50-70% more cereal would be required by 2050 to satisfy the increasing food demand of the 9 billion world population (Singh *et al.*, 2011) [44]. In the 21st century, stagnant cereal production necessitate special initiatives to meet the increasing demands. As a result, physical, economic, and ecological access to food still remains our major challenge.

Effect of varieties on growth parameters

During the rabi season of 2011, Kumar *et al.* (2014) conducted a field experiment in Allahabad,

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Uttar Pradesh, on nine different varieties of wheat. The purpose of the experiment was to investigate the responses of wheat when it was grown in conditions of poor fertility and inadequate irrigation. They found that variety K 9533 had the largest plant height possible, measuring 120.49 centimetres, whereas variety PBW 502 had a height of 90.02 centimetres and a dry weight of 123.00 grams when it was harvested.

In their field experiment conducted in Jammu during the kharif season of 2016–2017, Kumar *et al.* (2015) reported that the growth characteristics of all three wheat cultivars (HD-2967, RSP-561, and RAJ-3077) remained comparable to one another. At Pantnagar, Srivastava *et al.* (2016) conducted a field experiment in which they employed a number of different wheat cultivars. They found that the shoots of UP 2628 received the greatest amount of dry matter accumulation, followed by the shoots of UP 262, PBW175, and UP 2554. Following a period of two years in which field trials were conducted on wheat, Ghasal *et al.* (2017) came to the conclusion that HD 2932 had the greatest CGR at 30–60 DAS on average. Additionally, HD 2894 had maximal NAR, which was comparable to that of HD 2932, and PBW 343, which was significantly superior to HD 2851, HD 2687, and HD 2967 at both the 30–60 and 60–90 DAS stages.

A field experiment that was carried out in Jammu by Singh *et al.* (2017) ^[44] during the years 2016 and 2017. In terms of growth characteristics such as plant height, CGR, and RGR, they reported that all three kinds that were examined (HD-2967, RSP561, and RAJ-3077) stayed comparable and comparable to one another. During the course of an experiment that was carried out in Allahabad in 2017–2018 on a variety of wheat varieties at various times, Ali *et al.* (2018) made the observation that out of the twelve early-sown varieties, HD-2967 achieved a considerably higher maximum plant height of (92.66 cm) in comparison to PBW-502 (79.06 cm) and HUW-234 (89.26 cm). In a field experiment conducted during the winter (rabi) season of 2016-17 at Allahabad, Praveen *et al.* (2018) evaluated the growth characteristics of various cultivars of wheat. They discovered that HD 2967 achieved the highest plant height and the greatest number of tillers compared to the other two types (PBW-502 and PBW-154).

A field experiment was carried out in Gwalior by Rai *et al.* (2018) during the academic years 2013–2014 and 2014–2015. The researchers came to the conclusion that the varietal treatments had a substantial impact on the growth characteristics obtained at various periods of observation. Out of the parameters, the LAI, CGR, and AGR all grew up to 90 DAS, while the RGR climbed up to 60 DAS and then fell after that. In addition, Sharma *et al.* (2016) ^[42] reported findings that were not dissimilar. During their two-year field experiment at MAU, Ram *et al.* (2018) ^[34] found that the variety HD 2967 performed much better than KRL 213, HD 2733, PBW 550, PBW 502, and DBW 39 in terms of all growth parameters, including LAI, CGR, RGR, and NAR. This was the case for all eight growth characteristics. The researchers Goverdhan *et al.* observed that the plant height of PDW 315 was much higher than that of other genotypes while they were working on three different varieties of wheat in Hyderabad.

Effect of varieties on yield attributes and yield

Pradhan *et al.* carried out a field experiment on two wheat cultivars, PBW 502 and DBW 17, during the winter (rabi) season of 2009–10 and 2010–11, respectively. The experiment was carried out in the field. When it came to grain yield and above-ground biomass yield, they discovered that both cultivars

were statistically equivalent to ones another.

The researchers Kumar *et al.* carried out a field experiment in New Delhi during the winter season of 2011-12 and 2012-13. The experiment focused on four different types of wheat, namely "HD 2967," "WR 544," "HD 2987," and "HD 2931." "HD 2967" was the variety that produced significantly greater effective tillers per square metre, spike length, spikelets per spike, grains per spike, and grain yield compared to the other types.

In Pantnagar, Mathpal *et al.* conducted research on two wheat genotypes that were very different from one another. These genotypes were UP 2628 and UP 262. They came to the conclusion that UP 2628 produced a higher grain yield than UP 262. However, UP 262 generated a greater amount of total dry matter and straw than other varieties.

Kumar *et al.* conducted an experiment in New Delhi during the winter seasons of 2013–14 and 2014–15. The results of the experiment revealed that the wheat variety "HD 2967" had better grain and straw yields compared to the other varieties. New Delhi was the location where Ghasal *et al.* (2017) carried out their field trials over the years 2013–14 and 2014–15. In comparison to the other six wheat types, the results showed that HD 2967 had the longest and heaviest spike, which was very similar to HD 2687. Additionally, HD 2967 had the largest grain yield, which was much higher than PBW 343. According to the findings of a pot research that was conducted in Pantnagar by Rawat *et al.* (2017), the plant with the highest grain production and the highest average dry matter yield per plant at harvest was UP 2628, whereas the plant with the lowest value was UP 262.

Jammu was the location of a field experiment that was carried out by Singh *et al.* (2017) ^[44] during the kharif season of 2016 2017. It was found that HD-2967 had the maximum grain yield, which was comparable to that of the variety Raj-3077. On the other hand, the number of ear heads per square metre, spike length, spike weight, test weight, straw production, and biological yield were all comparable among all three wheat varieties.

Ali *et al.* conducted research on various wheat varieties and found that HD-2967 had the highest number of spikes per plant (8.33), spike length (13.98), grain yield per plant (18.30), and test weight (35.6) among the twelve early sown varieties. This was noted among the wheat varieties. On the other hand, PBW-502 reported a number of spikes per plant of 7.06, spike length of 11.94, grain yield per plant of 16.63, and test weight of 40.4, whereas HUW-234 recorded a number of spikes per plant of 7.36, spike length of 11.48, grain yield per plant of 17.91, and test weight of 36.1.

A field experiment on yield characteristics and yield of various wheat varieties was carried out by Praveen *et al.* (2018) during the winter season of 2016-17 in Allahabad. The experiment was conducted in the field. When compared to the other two types, they found that HD 2967 had the greatest spikelet spike-1, number of grain spike-1, test weight, grain yield, straw yield, and harvest index. Additionally, it had the highest aggregate weight. Out of the three cultivars, PBW-502 had the longest spike length, according to the information recorded.

In a similar vein, Ram *et al.* (2018) ^[34], who were working at MAU, observed that out of the six potential wheat varieties that were investigated, HD 2967 had the largest number of tillers, grains spike-1, and ultimately a greater grain yield. between their experiment on wheat that took place in Hyderabad between the years 2010-2011 and 2011-2012, Goverdhan *et al.* observed that among the varieties that were evaluated, the grain yield of PDW 315 was much higher than that of Raj 4037, and it was

comparable to that of HP4080.

An experiment was carried out by Patel *et al.* (2019) in Varanasi during the rabi seasons of 2013-2014 and 2014-2015 in order to determine the variety of wheat that would be most suitable for the conditions of eastern Uttar Pradesh, which are characterised by late sowing. The results showed that HUW 510 had significantly higher values of yield and yield contributing features, such as spike length (cm), number of grains spike⁻¹, test weight, grain yield, and straw yield. This was followed by HUW 234, PBW 373, and Kundan.

Effect of varieties on nutrient uptake

An experiment was carried out in the field by Kumar *et al.* (2015) in New Delhi during the winter season of 2011-12 and 2012-13. The experiment was conducted on four different types of wheat, namely HD 2967, WR 544, HD 2987, and HD 2931. Between the several types, HD 2987 had a nitrogen uptake that was noticeably higher than that of the other varieties. It was found that HD2987 had significantly higher levels of phosphorus and potash compared to WR 544 and HD 2931.

According to Kumar *et al.* (2016), who conducted an experiment in New Delhi during the winter seasons of 2013-14 and 2014-15, it was found that the cultivar with the highest overall uptake of nitrogen, phosphorus, and zinc was "HD 2967." This was in comparison to the other cultivars. While Ghasal *et al.* (2017) were working on various varieties of wheat (*Triticum aestivum* L.) in New Delhi, they observed that among the many wheat varieties, the highest levels of nitrogen, phosphorus, and potassium were found in grain of HD 2967, HD 2967, and HD 2687, respectively. On the other hand, the cultivars HD 2851, PBW 343, and HD 2894 were found to have the greatest relative levels of nitrogen, phosphorus, and potassium in their straw. When it comes to the intake of nutrients, HD 2967 showed a larger uptake of nitrogen, phosphorus, and zinc, whereas variety HD 2894 showed a higher uptake of potassium.

HD 2967 reported considerably greater levels of nitrogen, phosphorus, and potassium uptake by grain, straw, and total uptake when compared to the other six wheat genotypes, according to Ram *et al.* (2018) ^[34], who conducted a field experiment on wheat genotypes over the course of two years. Patel *et al.* (2019) conducted an experiment in Varanasi during the rabi seasons of 2013-14 and 2014-15 in order to determine the variety of wheat that would be most suitable for late-sown circumstances in eastern Uttar Pradesh. The results of the experiment revealed that the total amount of nitrogen, phosphorus, and potassium that wheat varieties absorbed was greatly influenced by the variety. It was found that cultivar HUW 510 had significantly greater levels of nutrient uptake, namely for nitrogen, phosphorus, and potassium.

Effect of varieties on economics

A field experiment was carried out by Kumar *et al.* (2015) in New Delhi during the winter season of 2011-12 and 2012-13. The experiment was conducted on four different kinds of wheat, namely "HD 2967," "WR 544," "HD 2987," and "HD 2931." Not only did HD 2987 have the highest gross returns, but it also had the highest net returns and the highest B:C ratio among the types. While Kumar *et al.* (2016) were conducting an experiment on wheat varieties in New Delhi, they discovered that the HD 2967 wheat variety had greater net returns and a benefit:cost ratio than other wheat varieties.

Experiments in the field were carried out by Ghasal *et al.* (2017) in New Delhi during the years 2013-14 and 2014-15 on a variety of wheat cultivars. In comparison to the other six

genotypes, the results showed that HD 2967 had the highest net returns and benefit-cost ratio. Kumar *et al.* (2017) conducted a field experiment in Patna during the winter seasons of 2013-14 and 2014-15, using five different genotypes of wheat. They reported that among the wheat varieties, "K 7903" recorded significantly the highest gross returns and net income, as well as the benefit: cost ratio. Following closely behind was "HD 2967." During the course of their two-year field experiment on wheat, Ram *et al.* (2018) ^[34] made the observation that, among the genotypes, HD 2967 ended up being the most successful in terms of achieving the highest net returns and B: C ratio. An experiment was carried out by Patel *et al.* (2019) in Varanasi during the rabi seasons of 2013-14 and 2014-15 in order to determine the variety of wheat that would be most suitable for the conditions of eastern Uttar Pradesh, which are characterised by late sowing. When compared to the other cultivars, the results showed that HUW 510 had the highest gross return, net return, and benefit-to-cost ratio in both of the years that were studied.

Conclusion

Apart from other management high yielding varieties also play an important role in enhancing the production. Number of tillers, number of spikelets, panicle length, grain size, grain yield and other yield contributing characters differ from one variety to another. So, selection of suitable varieties is also of prime importance.

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