Original Research Article

Performance of Timely Sown Wheat (*Triticum aestivum* L.) Genotypes Under Restricted Irrigation Conditions in the Eastrern Regions Of Uttar Pradesh.

ABSTRACT

The field experiment was conducted during *Rabi* 2021-2022 genotypes at Wheat Breeding experimental Field, Naini Agriculture Institute, SHUATS, Prayagraj,Uttar Pradesh.The Soil of the experimental plots was sandy loam in texture with neutral soil reaction (pH 6.7). The experiment was laid out with six genotypes (NERI-301, NERI-302,NERI-303,NERI-304,NERI-305 and NERI-306) in a Randomized Block Design with four replications. Study revealed that growth parameters viz., higher plant height (105.26cm), number of effective tillers/hill (10.00/hill), and plant dry weight (22.13 g/plant) were recorded significantly higher for the genotype NERI-305.For yield attributing parameters viz., number of effective tillers (6.55/hill), number of grains/spike (63.07/spike),and test weight (49.38 g) were significantly highest for the genotype NERI-304, and yield parameters viz, grain yield (4.74 t/ha), harvest index (41.52%) were recorded significantly higher for the genotype NERI-304. spike length (13.35 cm) and straw yield (6.69t/ha) were r significantly highest for the genotype NERI-301. From the above findings gross return (1,18,500.00 INR/ha), net return (82,314.00 INR/ha) and Benefit cost ratio (2.27) were significantly highest for the genotype NERI-304.The genotype NERI-304 was found to be more potential as well as economically viable and productive over rest of the genotypes.

Keywords*: *Genotype, productive, viable, evaluation

1.INTRODUCTION

Wheat belongs from family Gramineae or Poaceae and genus (Triticum). Many species of wheat which together make the genus Triticum the foremost widely grown wheat (*Triticum aestivum* L.), also known as the-king of cereals. The wheat cultivation has also been symbol of green revolution, self-sufficiency in food and sustained production.

Wheat (*Triticum aestivum* L.) is grown on more land area worldwide than any other crop and is a close third to rice and corn in total world production. Wheat production is about 70 million tonnes per year in India and counts for approximately 12% of world production. Being the second largest in population, it is also the second largest in wheat consumption after China, with a huge and growing wheat demand. Wheat has a narrow geographic land base of production as compared to rice or pulses. Wheat is a temperate crop requiring low temperatures and most of the country is tropical. India wheat production increase is driven principally by yield growth and by shift in production from other crops to wheat and an increase in cropping intensity. Among the major factors that affect yield, fertilizer use appears to have less effect in recent years while expansion in irrigated and high yielding variety (HYV) area seem to play a more important role in raising yield. Depending on the population and income growth, poverty alleviation and the rate of urbanization, a demand-supply gap may open at a rate of about 1 to 2% per year, which is equivalent to 0.7 to 1.4, million tonnes of wheat, growing larger over the years.

Prayagraj (Allahabad) is the Southern Eastern part of the state Uttar Pradesh, where sowing of wheat is done in first week of November to late December. During winter month from December to January temperatures drop down to as low as 5^{o}C. In Allahabad optimum temperature for germination of wheat seed is 20-25^{o}C, 16-20^{o}C for tillering, 20-23^{o}C for growth, 23-25^{o}C in grain filling stage for successful growth and yield. Vegetative stages of wheat are germination or seedling, crown root initiation (CRI), tillering and jointing. Reproductive and post anthesis stages are booting, heading, flowering (anthesis), grain filling (milk, soft dough and hard dough), ripening and maturity. Time span of each development stages depends on genotypes, temperature, day- length and sowing date.

There are a number of constraints in increasing the production of wheat like suitable variety according to agro climatic zones, quality seeds, recommended dose of nutrients, timely sowing, timely irrigation, adjustment of plant population by suitable method of sowing and weed control. As a result of extensive efforts, the area under high yielding varieties were found to increase from 1.89 million hectares in 1966-67 to 27.36 million hectares in 1998-99. Various cropping sequences like late rice-wheat, early pigeon pea-wheat, sugarcane-wheat, maizewheat, rice-toria-wheat have pushed wheat sowing in December and January.

Among the various factors influencing grain yield, availability of water and varieties are of supreme importance. In India, the demand for water resources is exceeding the supply and the competition for this scarce water among the various sector like domestic, industrial and agricultural use is becoming intense. Water is the key input for all recommended agronomic practices and therefore efficient utilization of irrigation water is essential for wheat and other crops. Wheat require appreciable amount of water on its different physiological stages of crop growth and development to expose higher potentials of yield of super quality. In wheat, irrigation scheduling is followed depending on the availability of water. Considerable area (86%) sown under wheat has an access to irrigation, however, crop sown in about 14- 15% of the area, which amounts approximately to 4 million hectares, depends on rain. Hence, failure of monsoon followed by absence of winter rains largely reduces area as well as productivity. However, there is a need to quantify the irrigation need of the crop. Number and time of irrigation play crucial role in crop productivity and farmer's net return as a whole (Mukherjee, 2016).

In India, a major breakthrough in wheat production started in 1967/1968 with the introduction of dwarf Mexican wheat production increased by more than one-and a half time from 10.4 million tonnes in 1964-65 to 16.5 million tonnes in 1967-68. A study of annual growth rates for area production and yield per hectare shows that the rate of increase in area under wheat was the highest during 1950s and the least during 1980s. The average increase in the growth rate of area under wheat during 1950-2003 was 2 % (Kumar *et al.,* 2007) however, the growth rate of production of wheat was the highest during 1960s, mainly owing to the introduction of high-yielding dwarf Mexican wheat that led to the Green Revolution or rather Wheat Revolution. Continuous increase in area under high-yielding varieties, which increased from 35.3 % of the total wheat area in 1970-71 to 90.2 % in 2000-01. Also the wheat area under irrigation increased from 34.0% in 1950-51 to 88.3 % in 2000-01 and the fertilizer consumption increased from 55 thousand tonnes in 1950-51 to 28.1 million tonnes in 2010-11. The total area under the crop is about 29.1 million hectares area with an annual production 102.2 million tonnes and average productivity 3.5 tonnes per hectare during 2018-

19. Area under wheat crop 15% of the total cultivated area of India. The availability of wheat has increased from about 79 g/capita/day to more than 186 g/capita/day, despite the doubling of the population since 1961. Per capita availability of wheat grain is 65.4 kg per year in 2019.

Among food grains wheat stands next to rice, both in area and production. The major wheat grown in north western part of the country like States are Uttar Pradesh, Punjab, Haryana, Madhya Pradesh, Rajasthan, Bihar, Maharashtra, Gujarat, and Himachal Pradesh. These States contribute about 99.5% of total wheat production in the country. Remaining States, namely, Jharkhand, Assam, Chhattisgarh Delhi, and other North Eastern States contribute only about 0.5% of the total wheat production in the country. The major increase in the productivity of wheat has been observed in the states of Punjab, Haryana and Uttar Pradesh.

Higher area coverage is reported from Uttar Pradesh in recent years. Uttar Pradesh has major share of total food grain production of 32.75 million tonnes with an area of 9.54 million hectares, which makes it the major producer state in the country and share highest wheat grain production 32.75 million tonnes, followed by Punjab (18.24 million tonnes), and Madhya Pradesh (15.47 million tonnes). Uttar Pradesh shares 32.74%, Punjab accounts 12.08%, and Madhya Pradesh shares 18.95% of total wheat production in India. Punjab have the highest productivity 5.1tonnes per hectare followed by Haryana 4.92 tonnes per hectare, and average productivity is of Uttar Pradesh is 3.43 tonnes per hectare.

The new wheat genotype needs to evaluate for their agronomic performance under irrigated and different environmental conditions was conducted during *Rabi* 2021-2022 Wheat Breeding Experimental Field, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Science, Prayagraj (Allahabad), Uttar Pradesh, India.

2.MATERIALS AND METHODS

2.1 Study Site

The experiment was carried out during *Rabi* season of 2021-2022 at Wheat Breeding Experimental Field, Naini Agricultural Institute, SHUATS, Prayagraj (UttarPradesh) which is located at 25^{o}24’ 33” N latitude, 81^{o}51’12”E longitude and 96m altitude above the main sea level. The area is situated on the right side of river Yamuna by the side of Prayagraj, Rewa Road about 5 km away from Prayagraj (Allahabad) city.All the facilities required for the crop cultivation were available.

2.2 Experimental Design and Cultivation Conditions

The experiment was conducted in Randomized block design consisting of nine genotypes replicated four times each and was allocated randomly in each replication. The wheat was sown on 07th November 2021 with plant geometry of 20 cm x 10 cm. The genotypes were G_1 - NERI-301, G_2 - NERI-302, G_3 - NERI-303, G_4 - NERI-304, G_5 - NERI-305 and G_6 - NERI-306 respectively.

2.3Measurements and Statistical Analysis

The experimental data recorded was subjected to statistical analysis by adopting the Fishers method of analysis of variance (ANOVA) as described by Gomez and Gomez (1984). The data collected from the experiment was subjected to statistical analysis using ICAR WASP software. Critical difference (CD) values were calculated by the ‘F’ test was found significantly at 5% level.

3.RESULTS AND DISCUSSION

3.1 Evaluation on Growth Attributes:

3.1.1 Plant height (cm)

The plant height measured increased with advancement of crop growth(Table.1).At harvest,an significantly higher plant height (105.26 cm) was recorded for the genotype NERI-305. However,was stastically similar to genotype NERI-306 (plant height of 103.65 cm) .The statistical analysis of data between different genotypes indicates that significant effect on plant height was mainly due to genetic potential of genotypes and can also affected by environmental factors like temperature, water, sunlight and nutrient uptake during its cropping period. Similar findings have been reported by Reddy *et al.* (2020).

3.1.2 Number of tillers /hill

At harvest an significantly higher number of tillers per hill (10.00) was recorded for the genotype NERI-305. However the genotype NERI-306 with the number of tillers per hill(9.80 respectively) were statistically at par with (NERI-305). Increase in growth parameters depends on irrigation by 90 % and nutrient uptake during vegetative stage, it is an importance factor during tillers formation stage and yield depends on number of tillers developed during vegetative stage which is mainly due to genetic diversity and higher inheritance of character of seeds. Tillers may contribute negatively or positively to wheat productivity which is maximum in early stages and decrease at harvest Elhani *et al.* (2007) also reported similar result.

3.1.3 Plant dry weight (g/hill)

At harvest maximum plant dry weight (22.13 g/hill) was recorded in the genotype NERI-305.However,dry weight (22.06 g/hill) recorded in the genotype NERI-306 were statistically at par with NERI-305 .The increase of dry weight was slow in the early stages of plant growth but increased rapidly with the advancement of plant age in all the genotypes. The increase in dry weight might be due to emergence of new tillers parallel with advancement of crop growth. Similar findings have been reported by Asif *et al.*, 2012 and Shahrajabian *et al.*, 2013.

3.2 Yield and Yield Attributes:

3.2.1 Number of effective tillers/hill

Effective tillers/hill was significantly affected by different genotypes which was recorded higher number of effective tillers/hill (6.55 tillers/hill) with NERI-304 over rest of the genotypes whereas, significantly lower number of effective tillers/hill (5.80 tillers/hill) was recorded with NERI-306 genotype. However, NERI-301, NERI-302, NERI-303, NERI-305 with (6.48 tillers/hill, 6.37 tillers/hill, 6.21 tillers/hill, 5.96 tillers/hill) respectively were statistically at par with NERI-301,NERI-302.Maximum yield per plant under irrigated condition is determined by tillers and high tillering capacity recognized to be a good criterion to produce high grain yields. Tillers allow plants to produce more grains per spike which helps in producing higher grain yield. Significant variation between new Wheat lines for morphological and yield components similar results was recorded by B.K.Pandey and N.K.Verma *et al.*(2018).

3.2.2 Spike length (cm)

The length of the spike was recorded and tabulated in (Table 2).On perusal of data it is apparent the length of spike varied significantly due to different genotypes.The length of spike has a direct positive relation with the number of grain/spike and affecting grain yield and the crop.The longer spike length (13.35cm)was with the genotype(NERI-301).However,with spike lengths (13.32cm and 13.30cm) were statistically at par with the genotype NERI-302 and NERI-304.This among different genotypes thus producing spikes of different length which is in close conformity with the results of mushtaq *et al.*(2011).

3.2.3 Number of grains/spike

Data related to number of grains/spike was recoreded and embodied in (Table 2).Number of grains/spike was found stastically significant among all genotypes (63.07)was recorded in the genotype NERI-304.However genotype NERI-301 with number of grains/spike was stastically at par with the genotype NERI-304.Many factors are responsible to affect grains/spike such as genotype, cultural practices used like seeding rates, planting dates and soil fertility etc., and growing conditions like air and soil temperature, soil water status and nutritional status in addition to weather change can impact this characters Similar findings were reported by Kilic and Gursoy (2010).

With increasing the number of irrigations the percentage of filled grains per spike also increased Ahmad and Kumar (2015).

3.2.4 Grain yield (t/ha)

The data presented in Table 2. showed that, effect of genotypes on grain yield found to be significant. The grain yield (4.74t/ha)found significantly higher in the genotype NERI-304.However, it was par with the genotypes NERI-301,NERI-302,NERI-303 and NERI-305 with the grain yield of (4.64t/ha,4.43t/ha.4.43t/ha and 4.35t/ha respectively).The higher in the genotype NERI-304 is due to the yield attributes like effective tillers per hill, number of grains per spike, length of the spike(cm) and thousand grain weight (g) of the seeds which were significantly higher.The highest grain yield was correlated with longer spike, growth duration, partitioning higher crop growth rate and grain spike weight ratio at anthesis phase(Gill,2009).

Enhancing grain yield potential is the most important objective in wheat breeding program.Expression of grain yield is dependent upon genetic potential and environmental factors and their interaction. The genetic yield potential of wheat genotypes might be dependent on favourable conditions and suitable agronomic practices to be expressed similar findings were reported by sheela Barla(2019)

3.2.5 Straw yield (t/ha)

Data related to straw yield was evaluated and tabulated in Table 2.The genotype NERI-301 was recorded with significantly higher straw yield (6.69t/ha).However the genotypes NERI-304 with the straw yield (6.67t/ha respectively) were statistically at par with the genotype NERI-301.The higher straw yield in the genotype NERI-304 is due to higher significant values in the growth attributes like plant height (cm), number of tillers per hill and the dry weight of the plant. In general,taller genotypes tend to produce more straw per unit area due to the higher straw yields. However, due to the higher plant dry weight in the genotype.

Other factors such as application of fertilizer, seed rate and growth habit may also be involved in the expression of the straw yield trait. Similar findings were reported by Sheela Barla (2019).

4.CONCLUSION

Based on the experimental findings it is concluded that genotype (NERI-304) was found more productive(4.74t/ha) and as well as economical (82,314.00 INR/ha)with B:C ratio (2.27).As conclusions are drawn based on one-season, further trails may be required for considering it for recommendation.

REFERENCES

Asif, M., M. Maqsood, A. Ali, S.W. Hassan, A. Hussain, S. Ahmad and M.A. Javed. (2012). Growth yield components and harvest index of wheat (*Triticum aestivum* L.) affected by different irrigation regimes and nitrogen management strategy. Sci. Int. 24: 215-218.

Ahmad,A. and Kumar,R.(2015). Effect of irrigation scheduling on the growth and yield of wheat genotypes .*Agricultural Science Digest***. 35** (3) :199-202.

B.K. Pandey, N.K. Verma , Shweta Devi, V.N. Jalikatti, Anil Kumar and Pravesh Kumar (2021) Effect of Varieties and Irrigation Methods on Growth and Yield of Wheat (Triticum aestivum L.) *International Journal of Agriculture Innovations and Research* Volume **9**, Issue 4, ISSN (Online) 2319-1473.

Dhiman Mukherjee. (2017). Evaluation of performance of new wheat cultivar under different row spacing. *Int.J.Curr.Microbiol.App.Sci.* **6**(6): 3186-3191.

Elhani, S., Martos, V., Rharrabti, Y., Royo, C. and Garcia del Moral, L.F. (2007) Contribution of main stem and tillers to durum Wheat (*Triticum turgidum* L. var. durum) grain yield and its components grown in Mediterranean environments. *Field crop Research* **103**: 25-35.

Gill, DS. (2009). Agro-Physiological traits for screening heat tolerant lines of wheat (*Triticum aestivum* L.) under late sown conditions. Indian Journal of Agricultural Rsearch.**43**(3):211-214.

Kilic,H. and Gilirsoy, S.(2010). Effect of seeding rate on yield and yield components of durum wheat cultivars in cotton-wheat cropping system. *Scientific Research and Essays*. **5**: 2078-84.

Kumar, R., Singh, R.P. and Singh, N.P. (2007). Indian Wheat Economy and Trade Prospects Challenges ahead; *Indian Journal of Agricultural Marketing.,* **21**(1) 55.

Mushtaq ,T., Hussain, S., Bukhsh, M.,Iqbal, j.and Khaliq,T. (2011). Evaluation of two wheat genotypes Peformance of under drought conditions at different growth stages. *Crop* *and Environment* **2**: 20-27.

Reddy, B.S.K. Umesha, C. Sree, C.N. and Prashanthi, M. (2020) Agronomic evaluation of wheat (*Triticum aestivum* L.) genotypes under north eastern plain zones. *International Journal of Chemical Studies* **9**(1):200-202.

Mohamad Hesam Shahrajabian ., Xuzhang Xue ., Ali Soleymani ., Peter Oko Ogbaji ., Yuegao Hu (2013) International Journal of Farming and Allied Sciences Evaluation of physiological indices of winter wheat under different irrigation treatments using weighing lysimeter *IJFAS* Journal, **2**-(24): 1192-1197.

Sheela Barla and RR Upasani. (2020) Performance of wheat varieties under different irrigation condition .*Journal of Pharmacognosy and Phytochemistry* 2019; SP**5**: 205-207.

Table 1: Evaluation of Wheat genotypes on Growth attributes

Genotypes	Plant height (cm)	Number of Tillers /hill	Plant Dry weight (g/hill)
NERI-301	92.25	8.80	21.33
NERI-302	96.75	8.20	21.69
NERI-303	100.56	7.80	21.18
NERI-304	98.53	9.20	21.87
NERI-305	105.26	10.00	22.13
NERI-306	103.56	9.80	22.06
F Test	S	S	S
SEm (±)	0.59	0.13	0.13
CD (P=0.05)	1.78	0.39	1.39

Table2: Evaluation of Wheat genotypes on Yield and Yield attributes

Genotypes	No. of effective tillers/hill	Spike length (cm)	No. of Grains/spike	Grain Yield (t/ha)	Straw Yield (t/ha)
NERI-301	6.48	13.35	62.45	4.64	6.69
NERI-302	6.37	13.32	56.83	4.43	6.25
NERI-303	6.21	11.94	55.66	4.43	6.24
NERI-304	6.55	13.30	63.07	4.74	6.67
NERI-305	5.96	12.38	55.57	4.35	6.08
NERI-306	5.80	12.28	49.60	3.16	5.18
F Test	S	S	S	S	S
SEm (±)	0.09	0.20	0.27	0.28	0.11
CD (P=0.05)	0.26	0.59	0.82	0.86	0.33