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Effect of direction of sowing on growth and yield of different wheat (*Triticum aestivum* L.) cultivar in Eastern Uttar Pradesh

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Abstract
The objective of this study was to develop options through different wheat cultivar and direction of sowing a field experiment was carried out at Agromet Research Farm of Narendra Deva University of Agriculture & Technology, Narendra Nagar (Kumarganj), Ayodhya (U.P.) during *Rabi* season of 2016-17. With six treatments consisted of three cultivar of wheat and two direction of sowing. The experiment was conducted in Factorial Randomized Block Design with four replications and the result was revealed that all the growth characters like plant height, dry matter accumulation, number of tillers, leaf area index were significantly higher under East-West direction of sowing over North-South direction of sowing. Among the all cultivars PBW-343 was found significantly superior over NW-1012 (except plant height maximum at NW-1012 at par with PBW-343 and significantly superior over HUW-234) and HUW-234. The grain yield, straw yield and solar light interception were increased significantly under East-West direction of sowing and among the cultivar PBW-343 recoded significantly higher value of above characters over NW-1012 and HUW-234. The maximum net return (Rs. 64058 ha^{-1}) and B:C ratio 1.53 were obtained at E-W direction of sowing along with cultivar PBW-343. Thus it may be concluded that sowing in East-West direction with cultivar PBW-343 was found most suitable for cultivation under Eastern UP.

Keywords: Direction of sowing, solar light interception, cultivar, Heat unit requirement

Introduction
Wheat (*Triticum aestivum* L.) belongs to the family Gramineae (Poaceae). It has been described as the 'King of cereals' because of the acreage and high productivity which also occupies a prominent position in the international food grain trade. Globally, wheat is being grown in 122 countries, Wheat ranks first in the world among the cereals both in respect of area. The nutrient rich cereal is grown in diversified environments; globally wheat occupies around 220 m ha area, holding the position of highest acreage among all crops with an annual production of 764.4 million tons with the average productivity of 3.53 tons/ha). India is a second largest producer of wheat after the China, and has been cultivation in about 29.32 (14% of global area) to produce 103.6 million tonnes of wheat (12.92% of world production) with a record average productivity of 3.53 tons/ha 2019-20 (USDA, 2020) [20].

To improve the production of wheat, as in any other crop, introduction of varieties with a high yield potential is essential. Variety contributes more than 50% of the increased production. In India, numbers of wheat varieties are cultivated but due to fast changing ecosystem these varieties become susceptible to different insects, pests and diseases which cause a decline in yield. It was thus decided to generate a steady flow of new varieties, deriving resistant from diverse sources, to replace the old varieties for sustainable higher production. Wheat revolution was used with the introduction of high yielding dwarf varieties which need high level of management.

Wheat is cool season crop so it's generally grown in north-western and central part of the country in winter season and it require cool climate during the early part of its growth and development. The crop yield and its quality are highly influence by temperature regimes during different phases of crop growth (Sandhu *et al*. 2018) [14]. Due to climate change effect it shrinking the cooling period. Within the growing season itself, warmer temperature shortens the total crop duration. Higher temperature during early vegetative phase results in sparse tillering, poor vegetative growth and early heading and during grain filling phase leads to forced maturity (Reddy, 2014). Perry and Swaminathan (1992) [11] was find that an increase of 0.5°C temperature resulted in decrease in the duration of wheat crop by seven days, which reduced the yield by 0.5 tonnes per hectare of wheat crop in North India. (Wajid *et al.* 2004, Sandhu *et al*. 2018) [22, 14] was observed that a linear relationship between total biomass Production and intercepted PAR was found. For obtaining high yield thus require good agronomic techniques that produce both a high level of radiation interception and a high rate of conversion of intercepted PAR to grain or the economical part. East-West (E-W) sowing direction increased yield over north-south (N-S) direction of sowing in an average season. The results showed a decline in yield due to weed competition, but no effect on weed competition due to row direction. Sowing in an E-W direction may give a yield benefit with no difference in weed seed set (Cook *et al.* 2015) [2]. Keeping these aspects in view, this study was planned to find out the importance of better direction of sowing with better cultivars of wheat crop.

Material and Methods

Experimental site, weather, soil and variety

A field experiment was conducted during *Rabi* season of 2016-17 at Agromet Research Farm of Narendra Deva University of Agricultural and Technology, Kumarganj, Ayodhya (U.P.). Geographically, the experimental site falls under sub humid, sub-tropical climate of Indo-gangatic alluvial (IGP) plains having alluvial calcareous soil and is located at 26.47º North latitude and 82.12º East longitudes with an altitude of 113 meters above the mean sea level. The weekly mean minimum and maximum temperature was 4.9 to 25.3 ^{0}C and 18.0 to 39.6 ^{0}C, total rainfall received was 17.5 mm, total evaporation was 1033.9 mm, relative humidity was 18.2 to 88.2 per cent, and sunshine hours was 1.0 to 9.5 hours, during the entire crop season, respectively. The soil of the experimental site was silt-loam in texture and slightly alkaline in reaction (8.2 pH), low in organic carbon (0.37%) and available nitrogen (194.3 Kg/ha), medium in available phosphorus (15.2 Kg/ha) and potassium (250.3 Kg/ha). PBW-343, NW-1012 and HUW-234 high yielding wheat cultivars was used as the test crop in this experiment. Sowing was done on 29 November 2016, healthy seed were selected @ 100 kg seed ha^{-1} keeping spacing between row 20 cm apart with the help of seed drill. Uniform dose of 120 kg Nitrogen, 60 kg P_2O_5 and 40 kg K_2O ha^{-1} was applied through Urea, Di-ammonium phosphate (DAP) and murate of potash. Half dose of nitrogen and full dose of P_2O_5 and K_2O are applied at the time of sowing as a basal dose. Rest amount of Nitrogen was applied as in two splits $^1/_4$ after first irrigation or 30 DAS and $^1/_4$ dose of nitrogen was applied after second irrigation. The crop was harvested manually by serrated edged sickles at 25 April 2017.

Treatments

The experiment was laid out in Factorial randomized block design with (A) three cultivars *viz*., HUW-234 (V_1), PBW-343 (V_2) and NW-1012 (V_3) and two direction of sowing *viz*., East-West direction (S_1) and North-South direction (S_2 and replicated at fore time. HUW-234 the variety was developed by BHU, Varanasi. The variety is widely adopted in the EPZ is a wheat variety suitable for timely and late sown irrigated conditions. It gives an average yield of 31-35 q ha-1. The variety normally takes early (126-134 days) to mature. PBW-343 it released from Punjab Agriculture University, Ludhiyana and mature in 130 days and give yield up to 50 q ha-1. It is resistant to rust and moderately resistant to Karnal bunt and recommended for irrigated timely sown conditions. NW-1012 it variety was developed by NDUA&T, Faizabad. The variety is widely adopted in EPZ is a wheat variety suitable for timely sown and irrigated conditions. It gives an average yield of 41-45 q ha^{-1}. The variety normally takes early (126-134 days) to mature.

Data collection and analysis method

Data collected for analysis of variables were: initial plant population/m^2, Plant height (cm), number of tiller m^{-2}, dry matter accumulation and leaf area index of all three cultivar were recorded. For determination of initial plant population m^{-2} and tiller m^{-2} was measured by rectangle, plant height five plant were selected and tagged it and measured the plant height in cm by the centimeter scale and dry matter accumulation was measured by cutting 0.5 m^{-2} above ground plant parts were segmented into different components as leaf, stem, leaf sheath and ear and were dried in an oven for 72 hours at 70˚C. After drying to 14% moisture and leaf area index was measured by plants of 20 cm row length were taken and green leaves were separated to record their surface area by automatic leaf area meter. All the leaves were grouped into three *viz.* small, medium and large. Five leaves from each group were taken and their surface area was measured. Leaf area was divided by ground area. For determination of yield crop was harvested at proper stage of maturity as determined by visual observations. Half meter length on either end of each plot and 3 border rows from each side of border were first removed from the each plot. The crop in net plot was harvested for calculation of yield data. For the determination of total available nitrogen (Kg/ha) Alkaline potassium permanganate method (Subbaiah and Asija, 1956) [18], available phosphorus (Kg/ha) Olsen's method (Olsen *et al.*, 1954), available potassium (Kg/ha) Neutral normal ammonium acetate method by using flame photometer (Hanway and Heidel, 1952) [5], Organic carbon (%) Walkely and Black's method (Walkely and Black, 1934) [23] and Soil pH, Electrical Conductivity Bridge meter (Ricards, 1954) [13] were used.

All the data were statistically analyzed by F-test and the mean differences were ranked by DMRT at 5% level (Gomez and Gomez, 1984) [4]. All collected data were subjected to MSTAT-C software package to perform analysis of variance (ANOVA).

Results and Discussion

1. Effect on initial population

The data pertaining to initial plant population as affected by different treatments recorded at 20 days after sowing are presented in Table.1 and result revealed that the initial plant population was non-significantly influenced by cultivars and direction of sowing due to sowing was almost uniform under all the varieties, indicating thereby the uniform seed viability and germination capacity. The germination totally depends on soil temperature, soil moisture and seed germinability. Similar findings were reported by Mishra (2000) [8].

2. Effect Number of tiller (m^{-2})

The number of tillers m^{-2} at 60, 90 days after sowing and at harvest stage were influenced significantly by direction of sowing except 30 DAS having non-significant effect (Table 1). The number of tillers m^{-2} was influenced significantly by different cultivars. Maximum number of tillers was recorded in cultivar PBW-343 and minimum number of tillers was recorded in cultivars Malviya-234. Variation in plant height among cultivars might also be probably due to their genetic characters as well as climatic requirement of the different cultivars. Maximum numbers of tillers were recorded under E-W direction at all the crop growth stages. Variation in number of tillers among direction of sowing might also be probably due to reduction in weed growth in the east-west orientation as the result of better light interception compared to a north-south orientation. The results are corroborated with Bishnoi (2002) [1], Tripathi *et al*. (2009) [19], and Sandhu *et al*. (2018) [14].

3. Effect on dry matter accumulation (m^{-2})

The data pertaining to dry matter accumulation as affected by different treatments recorded at 30, 60, 90, and harvesting stage have been presented in Table.1 significant increase in dry matter accumulation by plants was because of more number of tillers per meter^{-2}. Maximum dry matter accumulation recorded with PBW-343 due to healthy tillers lead to higher nutrients absorption capacity, more number of spike bearing tillers due to less mortality resulted higher dry matter production at harvest stage. Minimum dry matter accumulation recorded with Malviya-234 at harvest stage, which reflected due to less number of spikes bearing tillers m^{-2} resulted less dry matter production. Similar findings were reported by Singh (1998) [16, 17] and Sardana *et al.* (1999) [15]. The Dry matter accumulation influenced significantly due to different direction of sowing at all the stages, except 30 days after sowing. Significant increase in dry matter accumulation was recorded with E-W direction. This might be attributed due to more LAI lead to higher photosynthesis and synthesis of food material in plants. The results are corroborated with Bishnoi (2002) [1], Pandey *et al.* (2015) [9] and Sandhu *et al*. (2018) [14].

4. Effect on plant height (cm)

The plant height taken at 30, 60, 90 days after sowing and at harvest stage have been presented in Table 2. In general, plant height showed an increasing trend from 30 days after sowing to harvest stage. There was rapid increased in height of plant from 30 to 90 days after sowing thereafter increased in height of plant rather slow. Maximum plant height was recorded cultivar NW-1012 and minimum plant height was recorded in cultivar Malviya-234 at all the crop growth stages. Variation in plant height among cultivars might also be probably due to their genetic characters. As per direction of sowing maximum plant height was recorded with E-W direction which was significantly superior over the N-S direction of sowing at 60, 90 DAS and at harvest stage of the crop.

5. Effect on leaf area index

Leaf area index influenced significantly due to different wheat cultivar and direction of sowing at all stages of crop growth except 30 DAS having non-significant effect. (Table 2). The maximum and minimum leaf area index (4.40 and 3.78) at 90 days after sowing was credited to cultivar PBW-343 and cultivar Malviya-234 respectively. It might be probably due to their genetic characters of varieties. Leaf area index was little decreased at 90 days after sowing due to decreasing growth rate and senescence stage which showed drying and shattering of the leaves. The maximum and minimum leaf area index (4.30 and 3.92) at 90 days after sowing was credited to E-W direction and N-S direction respectively. It might be probably due to their genetic characters of varieties and increased rate of light absorption. Leaf area index was little decreased at 90 days after sowing due to decreasing growth rate and senescence stage which showed drying and shattering of the leaves. The results are corroborated with Bishnoi (2002) [1], Tripathi *et al*. (2009) [19] and Jha *et al.* (2012) [6]

6. Effect on grain yield, straw yield and harvest index

The data presented in Table.2 revealed that the grain and straw yield was affected significantly due to cultivars and direction of sowing. Among the cultivars maximum grain and straw yield was recorded with PBW-343 (44.87 q ha^{-1}) and (55.49 q ha^{-1}). The reason behind this may be because of good plant stand, more number of spike bearing tillers, long shoots head and more number of grains spike^{-1} with more test weight. Minimum grain and straw yield recorded with cultivar Malviya-234 might be due to less number of spike bearing tillers, small shoots head and less number of grains spike^{-1} and poor grain development. Similar findings were obtained by Singh (1998) [16, 17], Sardana *et al.* (1999) [15], Daka *et al.* (2006) [3] and Maurya *et al.* (2014) [7].

The grain straw yield significantly increased by direction of sowing having higher yield in E-W direction (44.87 q ha^{-1}) than the N-S direction (37.75 q ha^{-1}). This might be due to more spike length, number of grains spike^{-1}, grain weight spike^{-1}, 1000 grain weight, maximum solar radiation interception and cooling effect. Similar findings were reported by Pathan *et al.* (2006) [10]. Straw yield also significantly influenced by direction of sowing having higher yield in E-W direction (54.91 q ha^{-1}) than the N-S direction. This may be probably due to higher tillers and increased rate of dry matter accumulation. It collaborated with Pathan *et al.* (2006) [10].

Harvest index of wheat was not affected significantly due to cultivar and direction of sowing.

Table 1: Effect of direction of initial plant population, no. of tiller m^{-2} and dry matter accumulation m^{-2} of wheat cultivars

Treatments	Initial plant population (m^{-2})	Number of tillers (m^{-2})				Dry matter accumulation (g) meter^{-2}			
		30 DAS	60 DAS	90 DAS	At harvest	30 DAS	60 DAS	90 DAS	At harvest
Cultivars									
Malviya-234	123.50	138.75	386.50	416.71	393.13	37.47	317.40	651.73	867.33
PBW-343	119.13	154.38	420.13	461.75	442.13	45.11	389.87	729.04	1014.15
NW- 1012	120.50	144.63	398.63	440.88	412.63	41.03	345.40	688.44	937.02
S.Em±	2.94	2.61	7.32	6.99	7.87	1.07	6.40	12.59	22.00
CD (P=0.05)	NS	7.88	22.05	19.57	23.73	3.22	19.30	37.94	66.29
Direction of sowing									
E-W	122.25	148.50	421.75	464.43	427.21	41.56	367.12	710.57	989.91
N-S	119.83	143.33	387.42	415.13	404.71	40.85	334.66	668.90	892.09
S.Em±	2.40	2.13	5.97	5.30	6.43	0.87	5.23	10.28	17.96
CD (P=0.05)	NS	NS	18.00	15.98	19.37	NS	15.76	30.98	54.13

Table 2: Effect of direction of sowing on plant height, leaf area index, grain yield, straw yield and harvest index of wheat cultivars

Treatments	Plant height (cm)				Leaf area index			Grain yield (q h^{-1})	Straw yield (q h^{-1})	Harvest index (%)
	30 DAS	60 DAS	90 DAS	At harvest	30 DAS	60 DAS	90 DAS			
Cultivars										
Malviya-234	20.01	50.15	88.19	87.42	1.35	4.04	3.78	35.64	48.76	42.24
PBW-343	21.02	51.30	91.23	90.32	1.49	4.52	4.40	44.87	55.49	44.59
NW- 1012	22.04	54.02	93.35	92.28	1.43	4.25	4.14	39.81	52.06	43.29
S.Em±	0.45	1.01	0.88	1.12	0.02	0.07	0.08	1.10	1.37	0.66
CD (P=0.05)	1.36	3.03	2.65	3.37	0.06	0.22	0.26	3.31	4.14	NS
Direction of sowing										
E-W	21.28	53.22	92.88	92.06	1.43	4.37	4.30	42.72	54.91	43.92
N-S	20.76	50.43	89.03	87.96	1.41	4.15	3.92	37.75	49.30	43.20
S.Em±	0.37	0.82	0.72	0.91	0.02	0.06	0.07	0.99	1.12	0.54
CD (P=0.05)	NS	2.48	2.16	2.75	NS	0.18	0.21	2.97	3.38	NS

Conclusion

The study on effect of direction of sowing on different wheat cultivar doses on wheat crop indicated its usefulness. Based on the results obtained, it can be concluded that E-W direction of sowing with PBW-343 is a better variety and direction of sowing of wheat because it promote more growth attributes like height, tiller leaf area index, dry matter accumulation, grain and straw yield which finally provide good monetary return with high B:C ratio.

References

1. Bishnoi OP. Impact of meteorological variables on the growth and development of wheat varieties. Journal Agromet 2002;4(1):9-15.
2. Cook A, Wilhelm N, Shepperd W, Richter I. Row orientation and weed competition. Eyre Peninsula Farming Systems Summary 2015, 163-165.
3. Dhaka AK, Bangarwa AS, Pannu RK, Malik RK, Garg R. Phenological development, yield and yield attributes of different wheat genotypes as influenced by sowing time and irrigation levels Agricultural Science Digest 2006;26(3):174-177.
4. Gomez AA, Gomez KA. Statistical procedures for agricultural research. Stat. Proced. Agric. Res. 1984;6:680.
5. Hanway JJ, Heidel H. Soil analysis methods as used in Iowa state college soil testing laboratory. Iowa Agric 1952;57:1-31.
6. Jha S, Sehgal VK, Subbarao YV. Effect of direction of sowing and crop phenotype on radiation interception, use efficiency, growth and productivity of mustard (*Brassica juncea*, L.). Journal of Oilseed Brassica 2012;6(2):257-264.
7. Maurya P, Kumar V, Maurya KK, Kumawat N, Rakesh Kumar R, Yadav MP. Effect of potassium application on growth and yield of wheat varieties, Department of Agronomy, CSAU & T, Kanpur, India 2014;9(4):1371-1373.
8. Mishra DK, Khan RA, Baghel MS. Stability of wheat varieties under various dates of sowing. Annals Agricultural Research 2000;21(4):564-566.
9. Pandey M, Singh T, Singh S. Effect of row orientation and intercropping on dry matter accumulation and growth parameters of bed planted wheat, Department of agronomy, punjab agricultural university, ludhiana-141004 (punjab), India 2015;7(11):757-761.
10. Pathan S, Hashem A, Wilkins N, Borger C. East-West crop row orientation improves wheat and barley grain yields, Department of Agriculture, 1Merredin, 2Northam and 3WAHRI, The University of Western Australia, Agribusiness Crop Updates 2006.
11. Perry ML, Swaminathan MS. Climate change on food production. *Confronting climate changerisk, implications and response,* Cambridge University Press, 1992, 113-125.
12. Reddy SR. Agrometerology, Agronomy of field crops, Kalyani Publishers 2006, 143-144.
13. Richard LA. Diagnosis and improvement of saline and alkali soil. Agric. Handb. U.S. Deptt. Agric., Washington 4-D.C. 60 1954.
14. Sandhu SK, Dhaliwal LK. Effect of row orientation on radiation interception and growth dynamics of wheat. International Journal of Agricultural Sciences 2018;14(1):186-191.
15. Sardana V, Sharma SK, Randhawa AS. Performance of wheat cultivars under different sowing dates and levels of nitrogen under rainfed conditions. Annual Agricultural Research 1999;20(1):60-63.
16. Singh B. To assess the performance of new wheat varieties under late-sown condition with different nitrogen levels. M.Sc. (Ag) thesis submitted to N.D.U.A.&T., Kumarganj, Faizabad 1998.
17. Singh B. To assess the performance of new wheat varieties under late-sown condition with different nitrogen levels. M.Sc. (Ag) thesis submitted to N.D.U.A.&T., Kumarganj, Faizabad 1998.
18. Subbiah SV, Asija GL. Arapid Procedure for the estimation of available N in soil. Curr. Sci. 1956;25:259-260.
19. Tripathi P, Singh AK, Shabdadhar. Organizing researches on rice and wheat meteorology. Technical bulletin, Department of Agril. Meteorology, NDUAT, 2009, 33.
20. USDA. World Agricultural Production. Circular Series, WAP 2020, 6-20,
21. USDA. United States Department of Agriculture [Internet]. 2018. Available from: http://www.fas.usda.gov.
22. Wajid A, Hussain A, Ahmad A, Rafiq M, Goheer AR Ibrahim M. Effect of sowing date and plant density on growth, light interception and yield of wheat under semi-arid conditions. Internat. J Agric. & Biol. 2004;6:1119 - 11 23.
23. Walkey A, Black AL. Analysis of organic carbon. Soil Sci 1934;63(1, 2):3-12.