Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; SP1: 2418-2421

Rajan Chaudhari
Department of Agricultural Meteorology, Narendra Deva University of Agriculture & Technology Narendra Nagar, Kumarganj, Faizabad, (U.P), India

SR Mishra
Department of Agricultural Meteorology, Narendra Deva University of Agriculture & Technology Narendra Nagar, Kumarganj, Faizabad, (U.P), India

Pawan Kumar
Department of Agricultural Meteorology, Narendra Deva University of Agriculture & Technology Narendra Nagar, Kumarganj, Faizabad, (U.P), India

Devraj Singh
Department of vegetable Science Narendra Deva University of Agriculture & Technology Narendra Nagar, Kumarganj, Faizabad, (U.P), India

Sharvan Kumar
Department of vegetable Science Narendra Deva University of Agriculture & Technology Narendra Nagar, Kumarganj, Faizabad, (U.P), India

Correspondence
Rajan Chaudhari
Department of Agricultural Meteorology, Narendra Deva University of Agriculture & Technology Narendra Nagar, Kumarganj, Faizabad, (U.P), India

Effect of crop growing environment on yield and yield components of wheat cultivars (*Triticum aestivum* L.)

Rajan Chaudhari, SR Mishra, Pawan Kumar, Devraj Singh and Sharvan Kumar

Abstract
A field experiment was conducted during the *Rabi* season of 2015 to access the "Effect of crop growing environment & yield and yield components of wheat cultivars (*Triticum aestivum* L.)" in silty loam soil at Agro-meteorological Research Farm, N.D. University of Agriculture & Technology, Kumarganj, Faizabad. The experiment was conducted with Randomized block design and replicated four times with nine treatments combinations consisted of three dates of sowing viz. S_1 (15th November), S_2 (30th November) and S_3 (15th December) and three cultivars viz. V_1 (PBW-373), V_2 (DBW-17) and V_3 (PBW-550). Plant height, number of tillers, leaf area index, dry matter, and yield attributes parameters were recorded at different growth stages. All the biometric parameters decreased with delay in sowing. Among the different varieties of wheat.

Keywords: Plant height (cm), Number of tillers /m^2, LAI, Dry matter accumulation (g/m^2), GDD and Yield &yield attributes

Introduction
Wheat (*Triticum aestivum* L.) belongs to the *poaceae* family. It is the important cereal crop, and has been considered as integral component of the food security system of several nations. It hold second rank in the world among the cereals both in respect of acreage 221.76 m ha^{-1} and production 696.64 mt. (Anonymous 2012-13). In India total area under wheat is 29.40 m ha^{-1} with the total production of 93.62 mt and productivity 2.95 tonnes ha^1. Uttar Pradesh ranks first in respect of area and production which is about 9.25 mha^{-1} with the total production of 25.60 mt and productivity of 27.90 qha^{-1}, but the average productivity in our state is comparatively much lower than that of Punjab and Haryana. Wheat is a major staple food crop after rice is south East Asia. The wheat acreage in South Asia is more than 36 million ha which is around 16% of the global wheat area and production is around 95 million tonnes which is around 15% of world wheat (Anonymous 2012–13). In India wheat also occupies second place after rice. Wheat is winter crop of northern, central and occur peninsular region of country. About 91% of total wheat production is contributed by six states in the country (Uttar Pradesh, Punjab, Haryana, Madhya Pradesh, Rajasthan and Bihar). Seasonal temperature is an important climatic factor which has profound effects on the yield of Rabi crops. Changes in seasonal temperature affect the grain yield, mainly through phonological development processes. Winter crops are especially vulnerable to high temperature during reproductive stages and differential response of temperature change (rise) to various crops has been noticed under different production environments (Kaur and Hundal, 2007). The effect of temperature on the wheat productivity can easily by seen in Central India because of high inter-annual fluctuations in the productivity due to fluctuations in seasonal temperature. The productivity of wheat is largely dependent on the magnitude of temperature change. One ^{0}C increase in temperature throughout the growing season will have no effect or slight increase on productivity in north India. But, an increase of 2 ^{0}C temperature reduced potential grain yield at most of the places (Agrawal and Sinha, 1993). In India, wheat is grown in almost all the states coming in North and Central region. It is generally sown during October to December and harvested from February to May month. Wheat is a Rabi crop. It is sown in mid-October to mid-November and harvested in March. It grows well in cool, moist climate and ripens in a warm, dry climate. The cool winters and the hot summers are conducive to a good crop. A cloudless sky having bright sunshine during ripening and harvesting periods will make better quality wheat. Winter rainfall is ideal. It is a long day plant. Temperature ranging between 20 to 25 ^{o}C is ideal for seed sowing and germination. Where as the optimum temperature for vegetative growth ranges from 16 to 22 ^{o}C. During the grain development wheat requires a mean maximum temperature of about 25 ^{o}C for at least 4-5 weeks

Wheat is grown well in those areas where annual rainfall ranges between 1200 mm to 1600 mm. Winter wheat generally completes its life-cycle most rapidly when grown in low temperatures during the early stages of growth but high temperature is required during the later stages of growth (Bobade 2010). Wheat is a cool-season crop, hence cool weather during vegetative development and warm weather for maturity is deemed ideal for wheat. The lowest minimum cardinal temperature for wheat is 4-5 ^{0}C called the base temperature. The optimum cardinal temperature about 25 ^{0}C and the maximum about 30-32 ^{0}C is best temperature in North West India. Warm temperature during the early growth of wheat may retard heading (Warren and John. 1963). The impact of even short period of high temperatures during the grain period setting in wheat crop cause to reduce the yield significantly. For the evaluation of the effect of high temperatures on yield in addition the temperature, the planting date is equally important as it influences the developmental stage of the crop especially when the high temperatures occur around flowering period where most annual crops are extremely sensitive to high temperature stress.

Materials and methods

The present investigation entitled "Effect of crop growing environment & yield and yield components of wheat cultivars (*Triticum aestivum* L.)"was carried out during *Rabi* 2015 at Instructional farm, of Narendra Deva University of Agriculture and Technology, Narendra Nagar, Kumarganj, Faizabad (U.P.). The details of materials and methods employed & techniques adopted during the course of experimentation has been described in this chapter. The experiment was conducted in Randomized Block Design (RBD) and replicated the three times. The details of experiment has been described elsewhere Rajan Chaudhari 2015. The different growth parameters studied were measured as Plant height (cm), Number of tillers /m^2, Leaf area index, Dry matter accumulation (g/m^2), Growing Degree Days (GDD), No. of effective tillers/m^2, Test weight (gm),Grain yield(q/ha),Straw yield (q/ha) and Harvest index(%),

Result

Plant height of wheat cultivars recorded at various growth stages as affected by sowing dates and varieties have been presented in (Table-1). Plant height increased successively with age of crop. It is evident from the data that different dates of sowing and variety influenced plant height significantly at all the stages except 15 DAS. Taller plants were obtained at 15th November which was significant over rest both of dates. Shorter plants were recorded under late sowing (15th December) conditions. Varieties had significant variation on plant height at all the stages except 15 DAS. It was quite evident from the data that higher plant height was obtained in DBW- 17 which was at par with PBW-373 at all the stages while significantly superior over PBW-550 variety. Data also showed that PBW-550 variety recorded smaller height of plant all the stages.

Number of tillers/m^2 on wheat cultivars recorded at various growth stages as affected by sowing dates and varieties have been presented in (Table-2). The number of tillers increased successively with age of crop. It is evident from the data that different dates of sowing and variety influenced number of tillers significantly at all the stages except 15 DAS. The maximum number of tillers was obtained at 15th November which was significant over rest both of dates. The minimum number of tillers was recorded under late sowing (15th December) conditions. Varieties had significant variation on number of tillers at all the stages except 15 DAS. It was quite evident from the data that maximum number of tillers was obtained in DBW- 17 which was at par with PBW-373 at all the stages while significantly superior over PBW-550 variety. Data also showed that PBW-550 variety recorded minimum number of tillers at all the stages.

Leaf area index (LAI) of wheat crop as affected by different dates of sowing and varieties recorded at successive growth stages have been presented in (Table-3). LAI increased successive till 60 DAS and there after declined. It is quite obvious from the data that the LAI was significantly affected due to different dates of sowing at all the stages. Significantly higher leaf area index was obtained at sowing date 15th November as compared to sowing done on 30th November, while sowing dates 15th December proved lowest LAI at all the stages of crop. Leaf area index was affected significantly at all the stages due to varieties. Highest leaf area index 1.40 was recorded in DBW-17 variety. Data also reveal that PBW-550 recorded lowest 1.20 leaf area index at all the growth stages.

Dry matter accumulation as influenced by dates of sowing on varieties have been presented in (Table-4). It is quite obvious from the data that dry matter accumulation varied significantly due to sowing dates at all the stages of wheat. It was recorded higher under the treatment when wheat was sown on 15th November which was higher while significantly superior over rest both of the sowing dates. Late sown wheat recorded lowest dry matter at all the stages. Dry matter accumulation was affected significantly at all the stages due to varieties. Higher dry matter accumulation was recorded in DBW-17 variety which was at par with PBW-373 while significant over PBW-550 variety recorded lowest dry matter accumulation at all the growth stages.

Growing degree days (GDD) to accumulated Heat Unit requirement of wheat cultivars at different Phenophases as affected by different sowing temperatures and varieties have been presented in (Table-5). The maximum heat Unit (GDD) requirement from sowing to maturity were recorded 1744.90 days at growing environment (15th November) while minimum accumulated growing degree days from sowing to maturity 1603.65 days was observed under growing environment (15th December). Late sowing temperature recorded minimum GDD requirement at all the stages. Different varieties had marked influence on the Thermal unit/Accumulated heat unit/ growing degree days of wheat cultivars at all the phenophases. Maximum Thermal unit/GDD/Accumulation heat unit requirement from sowing to maturity 1696.40 ˚C days were obtained in DBW-17 variety, while minimum thermal unit was obtained in PBW-550 Variety (1685.15˚C days) from sowing to maturity of wheat cultivars.

Grain yield (q/ha) as affected by sowing temperatures and varieties have been presented in (Table-6). Perusal of data showed that different sowing temperatures influenced significantly to the grain yield. Maximum grain yield (42.14 q/ha) was recorded when crop was sown on 15th November which was significantly superior over 30th November and 15th December sowing temperatures. The minimum grain yield (37.98 q/ha) was recorded when sowing was done at 15th December sowing temperatures. The grain yield (q/ha) was significantly affected by different varieties. Maximum grain yield (42.60) was recorded with DBW-17 variety followed by PBW-39.40) and then PBW-550. Straw yield (q/ha) as affected by sowing temperatures and varieties have been

presented in (Table-6). Perusal of data showed that different sowing temperatures influenced significantly to the Straw yield. Maximum Straw yield (59.96) was recorded when crop was sown on 15th November which was significantly superior over 30th November and 15th December sowing temperatures. The minimum Straw yield (54.05) was recorded when sowing was done at 15th December sowing temperature. The Straw yield (q/ha) was significantly affected by different varieties. Maximum Straw yield (60.20) was recorded with DBW-17 variety followed by PBW-373 (56.90) and then PBW-550. Test weight (g) as affected by sowing temperatures and varieties have been presented in (Table-6) perusal of data showed that different growing environments influenced significantly to the test weight. Maximum test weight (42.7) was recorded when crop was sown on 15th November which was significantly superior over 30th November and 15th December sowing temperatures. The minimum test weight (39.7) was recorded when sowing was done at 15th December sowing temperatures. Test weight was significantly affected by different varieties. Maximum test weight (42.60) was recorded with DBW-17 variety followed by PBW-373 (44. 20) and then PBW-550 Harvest index (%) as affected by sowing temperatures and varieties have been presented in (Table-6) perusal of data showed that sowing temperatures influenced on significantly to the harvest index. Maximum harvest index (41.27) was recorded when crop was sown on 15th November which was significantly superior over 30th November and 15th December sowing temperatures. The minimum Harvest index (40.39) was recorded when sowing was done on 15th December sowing temperatures. The Harvest index (%) was affected by different varieties. Maximum Harvest index (41.44) was recorded with DBW-17 variety followed by PBW-373 (42.60) and then PBW-550.

Table 1: Plant height (cm) of wheat cultivars as affected by different treatments.

Treatments	15 DAS	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS	105 DAS
Dates of sowing							
15 Nov	15.0	24.0	53.7	70.36	81.35	87.00	89.73
30 Nov	14.8	23.5	51.8	67.92	78.52	83.97	86.60
15 Dec	14.2	22.6	48.4	63.42	73.33	78.42	80.87
SEm±	0.21	0.33	0.73	0.96	1.16	1.18	1.35
CD at 5%	NS	0.96	2.12	2.77	3.36	3.43	3.90
Cultivars							
PBW-373	14.7	22.9	51.4	67.20	77.90	83.30	85.40
DBW-17	15.2	25.8	54.9	70.50	80.20	85.60	88.30
PBW-550	14.3	21.5	47.8	64.00	75.10	80.50	83.50
SEm±	0.21	0.33	0.73	0.96	1.16	1.18	1.35
CD at 5%	NS	0.96	2.12	2.77	3.36	3.43	3.90

Table 2: Number of tillers/m^2 of wheat cultivars as affected by different treatments.

Treatments	15 DAS	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS	105 DAS
Dates of sowing							
15 Nov	44.6	72.3	171.0	241.3	300.6	317.7	324.4
30 Nov	43.9	70.9	184.0	233.0	290.2	306.7	313.1
15 Dec	42.3	68.1	166.0	217.5	271.0	286.4	292.4
SEm±	0.66	1.00	2.48	3.29	4.10	4.33	4.42
CD at 5%	1.90	2.90	7.16	9.51	11.85	12.52	12.78
Cultivars							
PBW-373	43.0	70.0	181.7	226	282	298	305
DBW-17	46.0	74.5	175.4	240	305	321	328
PBW-550	42.0	67.0	163.8	222	275	292	297
SEm±	0.66	1.0	2.48	3.29	4.10	4.33	4.42
CD at 5%	1.90	2.90	7.16	9.51	11.8	12.52	12.78

Table 3: Leaf area index of wheat cultivars as affected by different treatments.

Treatments	30 DAS	60 DAS	90 DAS	105 DAS
Dates of sowing				
15 Nov	1.34	4.68	4.06	3.06
30 Nov	1.3 1	4.52	4.55	2.96
15 Dec	1.26	4.22	4.33	2.76
SEm±	0.020	0.064	0.06	0.042
CD at 5%	0.059	0.18	0.17	0.121
Cultivars				
PBW-373	1.30	4.40	4.47	2.88
DBW-17	1.40	4.77	4.69	3.15
PBW-550	1.20	4.47	4.31	2.75
SEm±	0.020	0.064	0.06	0.042
CD at 5%	0.059	0.18	0.17	0.12

Table 4: Dry matter accumulation (g/m^2) of wheat cultivars as affected by different treatments

Treatments	30 DAS	60 DAS	90 DAS	At Harvest
Dates of sowing				
15 Nov	55.1	576.6	935.1	1016.7
30 Nov	54.0	556.5	902.5	981.3
15 Dec	51.9	519.7	842.8	916.4
SEm±	0.76	7.86	12.75	13.87
CD at 5%	2.20	22.71	36.84	40.06
Cultivars				
PBW-373	53.5	545.4	888.0	966.6
DBW-17	55.7	571.1	922.2	1000.5
PBW-550	51.9	537.5	870.4	947.5
SEm±	0.76	7.86	12.75	13.87
CD at 5%	2.20	22.71	36.84	40.06

Table 5: Growing degree days (GDD) at different phenophases (˚C days) of Wheat cultivars as affected by different treatments.

Treatments	Emer-gence Stage	CRI stage	Tillering stage	Jointing stage	50% flowering	Milking stage	Dough stage	Maturity stage
Dates of sowing								
15 Nov	97.25	332.50	533.75	744.00	939.90	1180.65	1301.01	1744.90
30 Nov	95.75	273.25	464.25	625.15	935.15	1160.40	1287.65	1725.65
15 Dec	94.50	208.00	402.65	583.65	919.15	1116.65	1279.90	1603.65
Cultivars								
PBW-373	93.95	270.25	463.75	648.85	930.50	1105.36	1285.35	1693.90
DBW-17	96.66	271.25	466.88	650.95	935.40	1109.90	1289.52	1696.40
PBW-550	92.75	269.65	460.25	645.15	925.15	1100.15	1279.85	1685.15

Table 6: Grain yield, straw yield, Test weight and harvest Index of wheat cultivars as affected by different treatments.

Treatments	Grain yield (q/ha)	Straw yield (q/ha)	Test weight (gram)	Harvest Index(%)
Dates of sowing				
15 Nov	42.14	59.96	42.07	41.27
30 Nov	40.68	58.88	41.23	40.85
15 Dec	37.98	56.05	39.60	40.39
SEm±	0.64	0.82	0.58	0.59
CD at 5%	1.85	2.38	1.70	1.72
Cultivars				
PBW-373	39.40	56.90	42.20	40.91
DBW-17	42.60	60.20	42.60	41.44
PBW-550	38.80	54.80	38.10	41.45
SEm±	0.64	0.82	0.58	0.59
CD at 5%	1.85	2.38	1.70	1.72

Conclusion

It is concluded that study in DBW-17 showed higher plant height, more dry weight, more growing degree days (GDD) and higher yield as compared to PBW-373 and PBW-550. Higher seed yield (42.14 q/ha) was recorded under 15th November sowing date.

Reference

1. Anonymous. Wheat seed survey report, Religare relative Research, 2012-13
2. Agrawal PK, Sinha SK. Effect of increase in carbon dioxide and temperature on wheat yield in India. Journal of Agrometeorology. 1993; 48:811-814.
3. Bobade P. Influence of weather parameters on growth and yield of wheat cultivars under different thermal environments. Thesis department of agrometeorology, IGKV Raipur, 2010, 1-6.
4. Kaur P, Hundal SS. Effect of temperature rise on growth and yield of wheat: A simulation study. Journal of Agriculture Research (PAU). 2007; 44(1):6-8.
5. Waren HL, John HM. Warm temperature during the early growth of wheat may retarde heading. In Cereal Crops. The Macmillan Company, New York, 1963.