Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(1): 1622-1625
Received: 10-11-2018
Accepted: 12-12-2018

Vipul Singh
Department of Agronomy, Narendra Deva University of Agriculture and Technology, Ayodhya, Uttar Pradesh, India

Ravi Shanker Singh
Department of Agronomy, Narendra Deva University of Agriculture and Technology, Ayodhya, Uttar Pradesh, India

Raghvendra Singh
Department of Agronomy, Narendra Deva University of Agriculture and Technology, Ayodhya, Uttar Pradesh, India

BN Singh
Department of Agronomy, Narendra Deva University of Agriculture and Technology, Ayodhya, Uttar Pradesh, India

Ankit Tiwari
Department of Agronomy, Narendra Deva University of Agriculture and Technology, Ayodhya, Uttar Pradesh, India

Correspondence
Vipul Singh
Department of Agronomy, Narendra Deva University of Agriculture and Technology, Ayodhya, Uttar Pradesh, India

Influence of wheat varieties and phosphorus levels on the yield contributing characters, yield & economics of wheat (*Triticum aestivum* L.) under late sown condition

Vipul Singh, Ravi Shanker Singh, Raghvendra Singh, BN Singh and Ankit Tiwari

Abstract
A field experiment was carried out at Agronomy Research Farm of Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.) during Rabi season of 2013-14 to study the response of late sown wheat varieties to different phosphorus levels. Sixteen treatment combinations and consisted of four levels of phosphorus (0 kg P_2O_5 ha^{-1}, 30 kg P_2O_5 ha^{-1}, 60 kg P_2O_5 ha^{-1}, 90 kg P_2O_5 ha^{-1}) and four varieties of wheat (HUW-234, NW-2036, HD-2643 and DBW-14).The experiment was conducted in Split Plot Design (S.P.D.) with three replications on silt loam having organic carbon (3.8%), nitrogen (203 kg ha^{-1}), phosphorus (12.25 kg ha^{-1}) and potassium (265 kg ha^{-1}). The yield components like number of spikes per square meter, spike length (cm), number of grains $spike^{-1}$, grain yield (q ha^{-1}), straw yield (q ha^{-1}) and phosphorus uptake at harvest (kg ha^{-1}) were maximum under 90 kg P_2O_5 ha^{-1} and among the varieties DBW-14 being at par with NW-2036. Harvest index and 1000-grain weight (g) were not influenced significantly due to phosphorus levels and varieties. The maximum net return (Rs. 50584.3 ha^{-1}) was obtained at 60 kg P_2O_5 ha^{-1} with DBW-14 and B: C ratio 1.97 was computed with the same variety DBW-14 at 60 kg P_2O_5 ha^{-1}. Thus it may be concluded that phosphorus levels of 60 kg P_2O_5 ha^{-1} proved as the most suitable practice for the yield potential of late sown wheat. Among the varieties DBW-14 was found most suitable for cultivation under late sown condition for achieving higher yield and economics.

Keywords: Wheat crop, wheat varieties, phosphorus levels, late sown condition

Introduction
Wheat is self-pollinated crop & it has been described as the ‘king of cereals’. Wheat is the world’s most widely cultivated food crop. It is eaten in various forms by more than one thousand million human beings in the world. In India it is second important staple food crop, rice being the first. Besides staple food for human beings, wheat straw is a good source of feed for a large population of cattle in our country. Wheat compares well with other important cereals in its nutritive value. Besides, their significance in nutrition, they are principally concerned in providing the characteristic substance ‘gluten’ which is very essential for bakers.

Wheat grain contains about 8-15% protein, 65-70% carbohydrates, 1.5% fat, 0.8-2.0% minerals, 15% moisture, 2.0-2.5% fibre, 33% thiamine, 36% niacin.

Globally, wheat is being grown in 122 countries and occupies an area 215.61 million hectare and production nearly 696.64 million tonnes of wheat with the average yield of 2.91 t/ha (FAO, 2012-13). The country produced 92.46 mt. of wheat during 2012-13 an area 29.65 million hectare and productivity 3.12 tonnes/ha. (Directorates of Economic & Statistics, Government of India; 2012-13).

Balanced fertilizer improves the soil health as well as boost the productivity of wheat. The overall varietal response to phosphorus application was noted significant in case of all yield attributes, yields and economics. All these yield attributes contributed to higher grain yield and finally to the income with increasing rates of phosphorus application.

New high yielding varieties being relatively, thermo sensitive, performed better even under late sown condition. Because of low temperature in the month of December and January, no other crop is so competitive and remunerative as short duration high yielding varieties of wheat.

Late sown wheat occupies now a sizeable area in Uttar Pradesh either due to late harvesting of preceeding crops or due to excessive moisture in the field as a result of prolonged monsoon rains. In delayed sowing, the crop is forced to mature in short period resulting low yields, therefore, selection of proper varieties and their fertility management can play an important roles in maintaining the productivity.

Phosphorus plays a key role in energy transfer and protein metabolism. It is an important structural component of many bio-chemical including nucleic acids. DNA and RNA associated with control of hereditary processes. Phosphorus is basic input to obtain high yield of wheat. It promotes healthy root growth, early maturity of crop and seed development and translocation of photosynthesis from source to sink. Therefore, phosphorus is very important element to enhance the production of wheat. Deficiency of phosphorus may cause premature leaf fall and dead necrotic areas may be developed on leaves or fruits and leaves may turn dark to blue green colour. Phosphorus being an energizer element is considered beneficial for late sown wheat (Singh and Prasad 1996).

The present study was to find out the response of wheat varieties to phosphorus application in late sown conditions.

Materials and Methods

The field experiment was conducted at Agronomy Research Farm, Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.), during *Rabi* season of 2013-2014. The experimental site falls under sub-tropical zone in Indo-Gangatic plains and lies between 26º47' north, latitude 82º12' east, longitudes at an altitude of about 113.0 metre from mean sea level. The experiment was laid out in split plot design with four varieties (HUW-234, NW-2036, HD-2643 and DBW-14) in main plots and four phosphorus levels (0, 30, 60 and 90 kg P_2O_5 ha^{-1}) in sub plots. The treatment was replicated three times. Sowing was done on 30 December 2013 using 125 kg seed ha^{-1} in row 20 cm apart. An uniform dose of 150 kg N + 40 kg K_2O ha^{-1} was applied to all treatments. Full dose of phosphorus as per treatments and potassium along with half of the nitrogen were applied as basal while remaining half dose of nitrogen was top-dressed at first irrigation.

Table 1: Yield contributing characters & yield of late sown wheat as influenced by different wheat varieties and phosphorus levels

Treatments	No. of spikes (m^{-2})	Length of spike (cm)	Number of grains spike^{-1}	1000 grain weight (g)	Straw yield (qha^{-1})	Harvest index (%)
Varieties						
HUW-234	415.00	9.20	42.00	38.20	43.75	40.50
NW-2036	462.00	9.40	48.00	39.10	50.03	40.80
HD-2643	421.00	9.30	44.00	43.30	44.42	40.45
DBW-14	466.00	9.50	50.00	43.80	51.74	40.40
SEm±	9.51	0.19	0.58	0.74	1.01	0.88
CD (P=0.05)	32.94	NS	2.00	2.56	3.51	NS
Phosphorus levels (kg ha^{-1})						
0	392.00	9.00	38.00	38.70	42.40	40.19
30	431.00	9.20	45.00	40.70	45.04	40.45
60	465.00	9.50	49.00	42.20	51.10	40.65
90	476.00	9.70	52.00	42.80	51.39	40.85
SEm±	9.09	0.19	1.02	0.86	1.08	0.81
CD (P=0.05)	26.26	0.55	2.94	2.49	3.12	NS

Table 2: Economics of various treatment combinations

Treatment combinations	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})	Cost of cultivation (Rs. ha^{-1})	Gross income (Rs. ha^{-1})	Net return (Rs. ha^{-1})	B:C (Rs. rupee^{-1} invested)
$V_1 P_0$	26.21	39.00	23108.0	52933.5	29825.5	1.29
$V_1 P_1$	28.14	41.52	24495.8	56673.0	32177.2	1.31
$V_1 P_2$	32.19	47.11	25663.7	64656.0	38992.3	1.52
$V_1 P_3$	32.65	47.37	26610.5	65394.0	38783.5	1.46
$V_2 P_0$	30.35	44.60	23108.0	61042.5	37934.5	1.64
$V_2 P_1$	32.58	47.48	24495.8	65349.0	40853.2	1.67
$V_2 P_2$	37.27	53.88	25663.7	74560.5	48896.8	1.91
$V_2 P_3$	37.80	54.15	26610.5	75397.5	48787.0	1.83
$V_3 P_0$	26.56	39.69	23108.0	53716.5	30608.5	1.32
$V_3 P_1$	28.52	42.25	24495.8	57514.5	33018.7	1.35
$V_3 P_2$	32.62	47.73	25663.7	65515.5	39851.8	1.55
$V_3 P_3$	33.09	48.01	26610.5	66276.0	39665.5	1.49
$V_4 P_0$	30.88	46.33	23108.0	62536.5	39428.5	1.71
$V_4 P_1$	33.15	48.90	24495.8	66757.5	42261.7	1.73
$V_4 P_2$	37.92	55.68	25663.7	76248.0	50584.3	1.97
$V_4 P_3$	38.46	56.04	26610.5	77139.0	50528.5	1.90

Results and Discussion

Yield Contributing Characters

No. of spikes (m^{-2})

The data presented in Table and depicted in Figure revealed that number of spikes (m^{-2}) was significantly influenced by varieties and phosphorus levels. A perusal of data in table revealed that the maximum number of spikes per square meter row length recorded in variety DBW-14 was at par with NW-2036 and significantly superior over rest of the varieties. Application of 90 kg P_2O_5 ha^{-1} produced significantly higher number of spikes (m^{-2}) which was at par with 60 kg P_2O_5 ha^{-1} and significantly superior over other phosphorus levels. Interaction effect between varieties and phosphorus levels was not significant.

The variety DBW-14 gave higher number of spikes per meter^{-2}, grain spike^{-1} and test weight except length of spike than other varieties (Table). It might be due to the genetic character of the variety like more reproductive shoots producing capacity, more spike length etc. Minimum yield contributing characters were credited to HUW-234. It was due to less reproductive shoots, less spike length as well as less number of grain spike^{-1}. The results were in conformity with those of Singh and Singh (1991) [11] and Brijkishor (1998) [1].

Application of 90 kg P_2O_5 ha^{-1} was maintained highest number of spikes (m^{-2}), length of spike (cm), number of grains spike^{-1}, test weight because of phosphorus levels encouraged the thickness of stand. Concentration of nutrient in soil tends to encourage concentration of root. Proliferation of root in heavy fertilized soil is related to build up of high concentration of nutrients in all that hasten division and elongation. This favours the root branching accompanied by high shoots development, plant height and dry matter production which contributed to higher yield attributes through increased photo synthetic activity of leaves. Besides, translocation of assimilates from source to sink also increased under higher phosphorus which led to better yield attributes. The significantly lower yield attributes, were registered with the application of 0 kg P_2O_5 ha^{-1} because plants were unable to find more nutrients under this fertilizers dose which resulted in poor growth and yield attributes. These resulted are in close conformity with Regmi *et al.* (1985) [6] and Patel *et al.* (1991) [3].

Length of spike (cm)

The data revealed that the length of spike were not influenced significantly by varieties. As regards phosphorus levels, spike length increased significantly up to 90 kg P_2O_5 ha^{-1} being at par with 60 kg P_2O_5 ha^{-1} and 30 kg P_2O_5. However, it was significantly superior over control. Interaction effect was not significant.

Minimum yield contributing characters were credited to HUW-234. It was due to less reproductive shoots, less spike length as well as less number of grain $spike^{-1}$. The results were in conformity with those of Singh and Singh (1991) [11] and Brijkishor (1998) [1].

Application of 90 kg P_2O_5 ha^{-1} was maintained highest number of spikes (m^{-2}), length of spike (cm), number of grains $spike^{-1}$, test weight because of phosphorus levels encouraged the thickness of stand. Concentration of nutrient in soil tends to encourage concentration of root. Proliferation of root in heavy fertilized soil is related to build up of high concentration of nutrients in all that hasten division and elongation. This favours the root branching accompanied by high shoots development, plant height and dry matter production which contributed to higher yield attributes through increased photo synthetic activity of leaves. Besides, translocation of assimilates from source to sink also increased under higher phosphorus which led to better yield attributes. The significantly lower yield attributes, were registered with the application of 0 kg P_2O_5 ha^{-1} because plants were unable to find more nutrients under this fertilizers dose which resulted in poor growth and yield attributes. These resulted are in close conformity with Regmi *et al.* (1985) [6] and Patel *et al.* (1991) [3].

Number of grains $spike^{-1}$

The number of grains $spike^{-1}$ influenced significantly by varieties and phosphorus levels. The maximum number of grains $spike^{-1}$ was found with variety DBW-234, which was at par with variety NW-2036 and significantly superior over rest of the varieties. Application of 90 kg P_2O_5 ha^{-1} produced significantly higher number of grains $spike^{-1}$ at all the stages of growth which was significantly more than rest levels of phosphorus. Interaction effect between varieties and phosphorus levels was not significant.

The variety DBW-14 gave higher number of spikes per $meter^{-2}$, grain $spike^{-1}$ and test weight except length of spike than other varieties (Table). It might be due to the genetic character of the variety like more reproductive shoots producing capacity, more spike length etc. Minimum yield contributing characters were credited to HUW-234. It was due to less reproductive shoots, less spike length as well as less number of grain $spike^{-1}$. The results were in conformity with those of Singh and Singh (1991) [11] and Brijkishor (1998) [1].

Application of 90 kg P_2O_5 ha^{-1} was maintained highest number of spikes (m^{-2}), length of spike (cm), number of grains $spike^{-1}$, test weight because of phosphorus levels encouraged the thickness of stand. Concentration of nutrient in soil tends to encourage concentration of root. Proliferation of root in heavy fertilized soil is related to build up of high concentration of nutrients in all that hasten division and elongation. This favours the root branching accompanied by high shoots development, plant height and dry matter production which contributed to higher yield attributes through increased photo synthetic activity of leaves. Besides, translocation of assimilates from source to sink also increased under higher phosphorus which led to better yield attributes. The significantly lower yield attributes, were registered with the application of 0 kg P_2O_5 ha^{-1} because plants were unable to find more nutrients under this fertilizers dose which resulted in poor growth and yield attributes. These resulted are in close conformity with Regmi *et al.* (1985) [6] and Patel *et al.* (1991) [3].

1000 grain weight (g)

The data revealed that the maximum 1000-grain weight (g) was recorded with variety DBW-14 which was at par with HD-2643. However, as regards phosphorus levels, 90 kg P_2O_5 ha^{-1} recorded higher test weight being at par with 60 kg P_2O_5 ha^{-1} and 30 kg P_2O_5 ha^{-1} and significantly superior over control. Interaction effect between varieties and phosphorus levels was not significant.

The variety DBW-14 gave higher number of spikes per $meter^{-2}$, grain $spike^{-1}$ and test weight except length of spike than other varieties (Table). It might be due to the genetic character of the variety like more reproductive shoots producing capacity, more spike length etc. Minimum yield contributing characters were credited to HUW-234. It was due to less reproductive shoots, less spike length as well as less number of grain $spike^{-1}$. The results were in conformity with those of Singh and Singh (1991) [11] and Brijkishor (1998) [1].

Application of 90 kg P_2O_5 ha^{-1} was maintained highest number of spikes (m^{-2}), length of spike (cm), number of grains $spike^{-1}$, test weight because of phosphorus levels encouraged the thickness of stand. Concentration of nutrient in soil tends to encourage concentration of root. Proliferation of root in heavy fertilized soil is related to build up of high concentration of nutrients in all that hasten division and elongation. This favours the root branching accompanied by high shoots development, plant height and dry matter production which contributed to higher yield attributes through increased photo synthetic activity of leaves. Besides, translocation of assimilates from source to sink also increased under higher phosphorus which led to better yield attributes. The significantly lower yield attributes, were registered with the application of 0 kg P_2O_5 ha^{-1} because plants were unable to find more nutrients under this fertilizers dose which resulted in poor growth and yield attributes. These resulted are in close conformity with Regmi *et al.* (1985) [6] and Patel *et al.* (1991) [3].

Yield

Straw yield (qha^{-1})

The data presented in Table and depicted in Figure revealed that the straw yield was affected significantly due to varieties and phosphorus levels. The highest straw yield of 35.10 q ha^{-1}

was obtained with DBW-14 which was at par with NW-2036 and significantly superior to other varieties. However, the lowest straw yield was recorded with HUW-234. Phosphorus levels had significant effect on the straw yield. The maximum straw yield was obtained of 35.50 q ha^{-1} with 90 kg P_2O_5 ha^{-1} which was significantly superior to 0 kg P_2O_5 ha^{-1} and 30 kg P_2O_5 ha^{-1}. However, the lowest straw yield was recorded with 0 kg P_2O_5 ha^{-1}, which was at par with 60 kg P_2O_5 ha^{-1}. The interaction effect between varieties and phosphorus levels was found not significant.

The highest straw yield was credited to variety DBW-14 followed by variety NW-2036 (Table). The reason behind this may be because of good plant stand, more number of spike bearing shoots, long spike head and more number of grains $spike^{-1}$ with more test weight. The results obtained in the present investigation in accordance with those obtained by Singh (1998) [9] and Sardana *et al.* (1999) [8]. The varieties did not differ significantly in harvest index.

The higher straw yield was obtained with the application of 90 kg P_2O_5 ha^{-1} followed by 60 kg P_2O_5 ha^{-1}. The magnitude of difference was computed to the tune of 10%. Higher yield was weighed with the higher phosphorus levels might be due to adequate nutrient availability which contributed to increased dry matter accumulation, higher yield attributes and thus led to the higher yield under the treatment. Productivity of a crop is collectively determined by vigour of the vegetative growth and yield attributes. Better, vegetative growth coupled with higher yield attributes resulted in grain and straw yield. Reduced phosphorus dose of 0 kg ha^{-1} produced lowest yield due to poor growth, metabolic process and yield attributes. Similar findings were reported by Rai *et al.* (1982) [5]; Sandhu *et al*. (1985) [7] and Nitis (1987) [2].

Harvest index (%)

The data pertaining to harvest index were recorded and presented in Table and depicted in Figure. Harvest index was influenced non-significantly with varieties and phosphorus levels.

Harvest index (%) was not significantly due to varying doses of phosphorus (Table). However, its values was found higher under 90 kg P_2O_5 ha^{-1} due to proportionately higher grain to straw ratio as harvest index is the function of economic yield to total biological yield.

Minimum yield contributing characters were credited to HUW-234. It was due to less reproductive shoots, less spike length as well as less number of grain $spike^{-1}$. The results were in conformity with those of Singh and Singh (1991) [11] and Brijkishor (1998) [1].

The significantly lower yield attributes, were registered with the application of 0 kg P_2O_5 ha^{-1} because plants were unable to find more nutrients under this fertilizers dose which resulted in poor growth and yield attributes. These resulted are in close conformity with Regmi *et al.* (1985) [6] and Patel *et al.* (1991) [3].

Economics

The maximum cost of cultivation (Rs 26610.5 ha^{-1}) recorded at 90 kg P_2O_5 ha^{-1} with all the varieties, due to additional cost of phosphorus fertilizers and the same cost for each variety. The highest gross return (Rs. 77139 ha^{-1}) was recorded with 90 kg P_2O_5 ha^{-1} with the variety DBW-14 due to higher grain yield and straw yield. The lowest gross return (Rs 52933.5 ha^{-1}) was obtained with variety HUW-234 under 0 kg P_2O_5 ha^{-1} (Table).

Highest net return (Rs 50584.3 ha^{-1}) obtained under the treatment combination of 60 kg P_2O_5 ha^{-1} with the variety DBW-14 and lowest net return (Rs 29825.5 ha^{-1}) recorded with variety HUW-234 under 0 kg P_2O_5 ha^{-1} was due to lowest gross return in proportion to cost of cultivation under this combination. Maximum benefit cost ratio (1.97) obtained from treatment combination of 60 kg P_2O_5 ha^{-1} with the variety DBW-14. The minimum benefit cost ratio (1.29) obtained with variety HUW-234 under 0 kg P_2O_5 ha^{-1}. It was due to lowest net return under this treatment combination (Table). Same findings are also reported by Singh and Uttam (1995) [12].

References

1. Brijkishor. To assess the performance of newly developed strains of wheat under zero tillage condition with varying nitrogen levels. M.Sc. (Ag.) thesis submitted to N.D.U.A & T., Kumarganj, Faizabad, 1998.
2. Nitis IT. Fertilizers application to winter wheat with different sowing dates. Agrokhimiya. 1987; 4:46-50.
3. Patel NM, Patel RB, Patel KK. Response of wheat varieties to nitrogen and phosphorus. Indian J Agron. 1991; 36(4):255-256.
4. Patel NM, Patel RB, Patel KK. Response of wheat (*Triticum aestivum* L.) varieties & nitrogen & phosphorus. Indian J Agron. 1991; 35(3):302-303.
5. Rai RK, Sinha MN, Singh M. Studies on direct & residual effect of P on growth & yield of maize & wheat sequences. Indian J Agron. 1982; 27(4):354-362.
6. Regmi KR, Sharma and Pal M. Dry matter accumulation & nutrients uptake in wheat as influenced by cluster bean residual & direct fertilization of wheat. Indian J Agron. 1985; 30(2):254-256.
7. Sandhu HS, Brar SS, Gogoi NN, Singh G. Phosphorus needs of wheat sown on different dates & after different kharif. Crops J Res. P.A.U. 1985; 22(2):206-212.
8. Sardana V, Sharma SK, Randhawa AS. Performance of wheat cultivars under different sowing dates and levels of nitrogen under rainfed conditions. Ann. Agri. Res. 1999; 20(1):60-63.
9. 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.
10. Singh SP, Singh HB. Effect of irrigation time and nitrogen level on wheat (*Triticum aestivum)* under late-sown condition of western UP. Indian J Agron. 1991; 36:41-42.
11. Singh SP, Singh HB. Productivity of late sown wheat as influenced by seed condition and variety. Indian J Agron. 1991; 36(1):38-40.
12. Singh VPN, Singh SS, Uttam SK. Response of wheat varieties to nitrogen under late sown condition. Indian Journal of Agronomy. 1995; 42(2):202-204.