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RESEARCH PAPER

Effect of different dates of sowing and fertility level on growth, yield and economics of wheat (*Triticum aestivum* L.) in gird zone of Madhya Pradesh

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Abstract : An experiment was conducted during *Rabi* seasons of 2013-14 and 2015 at RVSKVV, Special Agriculture Research Station, Farm, Bhind (M.P.) with 3 sowing dates and 3 fertility levels treatments. The experiment laid out in Split Plot Design with 3 replications on the basis of two year pooled data result revealed that sowing on 25th November with 120:60:40kg/ha NPK, application gave significantly higher grain yield (4.22 t/ ha) and net return (Rs. 53850/ha). Result also prove that the optimum date sowing (25 November) revealed maximum yield attributes, plant height (84.50cm), ear length (8.91cm), grains/ear (47.32) and test weight (39.79g) which were significantly higher than all other showing dates.

Key Words : Crop production, Fertility levels, Sowing dates, Wheat

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INTRODUCTION

Wheat is the second most important cereal crop after rice and widely cultivated in the world. In Madhya Pradesh it is cultivated over an area of 6.2 million ha with total production of 20 million tones with an average yield 3.2 t/ha which is higher than that of national average production (3.0t/ha) DAC (2017), but still below from its potential *i.e.*11.2 t/ha Singh *et al.* (2010). Weather is one of the key factor influencing agricultural production and productivity. In weather factor temperature is the during force of plant development, day length and vernalization moderate its effect. Consequently, different varieties with different genetic make-upmature at different rates but the difference is greater when sown early. In spite of cultivation of high yielding varieties, improved cultivation practices and plant protection measures. Favorable weather is must for good harvest (Rao *et al.,* 1999). Fertilizer constitute an integral part of improved crop production technology. Proper amount of fertilizer application is considered a key to the bumper crop production (Tariq *et al.,* 2007). Inorganic fertilizer holds the key to desired increase in yield of food grains. Studies showed a direct relationship between increased balanced fertilizer uses for higher crop yields. Past many years have shown a significant change in temperature and rainfall pattern. Therefore, it was realized to study

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the effect of different sowing dates and fertilizer levels to cope up with the changing weather pattern of the regions. During the last 10 years variability in onset of monsoon, decreased rainfall and slight increase temperature has prompted to study the effect of sowing date and fertility levels on growth and yield of wheat.

MATERIAL AND METHODS

A field experiment was conducted during *Rabi* season of 2013-14 and 2014-15 at the RVSKVV, Special Agricultural Research Station, Farm Bhind (M.P.). District Bhind is located under Gird Zone of M.P. Mean maximum temperature ranges between range from 42 to 48^{0}C minimum temperature from 4 to 6^0 C. The mean annual rainfall is about 650 mm. The weekly mean maximum and minimum temperature during the experiment period range from 13.50 to 38.70 and 4.70 to 25.30^{0}C, respectively. The soil of experimental site was sandy loam in texture, with pH 7.2, having available nitrogen 186. 32 kg/ha, available P 13.34 kg/ha, available K 201.7 kg/ha and organic carbon 0.41 per cent. The experiment comprised treatments combinations (3 dates of sowing: 25 November, 10 December, 25 December and 3 fertility levels: 120:60:40, 80:40:20 and 40:20:10 NPK kg/ha) with three applications and Split Plot Design. Date of sowing was kept in main plot treatment and fertility level in sub plot treatment with plot size 4.5m x 3.5m. Full dose of phosphorus and potassium and one third nitrogen was applied at the time of sowing through single super phosphate, muriate of potash and urea. Remaining nitrogen was applied in two equal splits at first and second irrigation.

RESULTS AND DISCUSSION

The crop shown on 25 November achieved highest plant height, number of tillers, dry matter accumulation/ plant: being significantly higher than that sown on 10 December and 25 December (Table 1). These might be attributed to maximum length of growing period available to 25 November sown crop in comparison to 10 and 25 December sown crop. Cell division and cell extensions are more sensitive to low temperature than is photosynthesis. Temperature increase tends to stimulate growth, which in turn result in a dilution of carbohydrates. Thus, the findings confirm those of Baloch *et al*. (2010). At 90 days after sowing plant, height was maximum with application of 120:60:40 kg/ha NPK and at this dose number of tillers and dry matter accumulation was maximum. Plant height increased with an increase in fertilizer dose. Similar response was also recorded by Niamatullah *et al*. (2011).

The ear length, grains/ear, ear weight and test weight were influence significantly by the date of sowing. The highest ear length, grains/ear, ear weight and test weight were recorded in 20 November sown wheat followed by 10 December.

All these attributes significantly, decrease with delay in date of sowing. It might be due to longer and

Table 1: Effect of date of sowing and fertility levels on growth and yield parameters of wheat **(Two year pooled data)**

Treatments	Plant height (cm) at 90 DAS	Tillers/meter row length at 90 DAS	Dry matter accumulation/ plant(g) at 90 DAS	Ear length (cm)	Grains / Ear	Ear weight (g)	Test weight (g)	Grain yield	Straw yield (t/ha)	Harvest index (%)	Net return (Rs./ha)	B:C ratio
Date of sowing												
25 November	84.50	126.30	10.10	8.91	47.32	2.44	39.79	4.22	5.23	44.65	53850	3.31
10 December	81.20	120.0	9.81	8.76	45.15	2.32	37.18	3.78	4.79	44.10	46150	3.12
25 December	78.10	111.20	9.20	8.53	43.39	2.17	34.62	3.26	4.10	44.29	37050	2.85
S.E.±	0.9	1.30	0.05	0.05	0.78	0.05	0.92	0.10	0.13	0.31	-	-
C.D. (P=0.05)	2.80	4.10	0.19	0.20	2.29	0.17	3.10	0.34	0.41	NS	-	-
Fertility level (NPK kg/ha)												
120:60: 40	83.60	124.10	10.05	8.90	47.29	2.39	39.81	4.19	5.21	44.57	53325	3.16
80:40:20	81.15	115.70	9.76	8.72	45.43	2.34	37.23	3,68	4.74	43.70	41250	2.90
40:20:10	77.29	109.20	9.31	8.49	43.62	2.20	34.14	3.20	4.20	43.54	36700	2.83
S.E.±	0.70	1.20	0.06	0.05	0.69	0.06	0.79	0.76	0.15	0.29	-	-
C.D. (P=0.05)	2.23	4.69	0.21	0.17	2.31	0.22	2.86	2.51	0.47	NS	-	-

NS= Non-significant

favourable period of ear formation resulting more spikelet development and greater chances of providing long ears containing a large number of grains. Shivpurkar *et al*. (2008) also reported such results. Among the levels of fertility 120:60:40 kg/ha NPK gave the highest ear length, grains/ear, ear weight and test weight closely followed by 80:40:20kg/ha NPK and both were significantly higher than 40: 20:10 kg/ha NPK applications. Potassium ion has a beneficial influence on the development of endosperm cell and hence, on the signed grain weight cereals. The difference inear length might be attributed to their difference in supply of available nutrients. Singh *et al.* (2011) also reported that the yield attributes are mainly controlled by the fertilizer dose.

The highest yield of grains 4.22 and straw 5.23 t/ha and harvest index were recorded in 25 November sown wheat (Table 1) followed by 10 and 25 December sown crop. A significant decrease in yield was recorded with successive delay in date of sowing, but effect on the harvest index was found non-significant. Lower grain yield in late sown wheat could be due to less favourable period for maturity. High temperature and hot winds forced maturity of the crop and maturity period is shortened, this can also occur if the crop is deficient of N and other nutrients which results in decrease in grains and straw yield. The early sown crop on the other hand, having favourable weather conditions for longer duration recorded better growth. These results are in close conformity with the observation of Jat *et al.* (2013). Among the fertilizer doses the highest grain and straw yield and harvest index where recorded with application of NP and K @ 120:60 and 40 kg/ha.

It was significantly superior to application of 80:40:20 and 40:20:10 kg/ha NPK, respectively. The difference in grain yield might be attributed to difference in doses of N, P and K. The lower level of nitrogen nutrition during the grain filling period resulted in yield reduction Jat *et al*. (2013) also reported such results which were largely accounted by the smaller grain obtained in this conditions. Yadav *et al*. (2005) found that the grain yield is mainly contributed by the fertilizers dose.

The nutrient uptake by grain and straw (Table 2) decreased significantly with delayed sowing. The highest nitrogen, phosphorus and potassium uptake by grain 62.25, 15.10 and 20.47 kg/ha, respectively and in straw 41.14, 2.82 and 117.76 kg/ha, respectively, was recorded in the wheat sown on 25 November. The uptake of nutrients by crop is mainly a function of yield of that plant material and efficient development of root systems. With the delay in sowing, the growth and yield of crop reduced, resulting low uptake of nutrients. EL-Gizowy (2009) also found that the nutrient uptake by grain and straw decreased with delay in sowing. Among the dose of fertilizers, the highest amount of N, P and K uptake by grains and straw was observed with N, P and K @ 120:60:And 40 kg/ha. The new high yielding varieties required higher amount of fertilizer and nutrients removal by plants. Similar result were reported Amin *et al*. (2011).

Post-harvest soil (Table 2) of wheat did not show any significant change in pH and electrical conductivity with respect to dates of sowing. However, organic

Table 2 : Effect of date of sowing and fertility levels on nutrient uptake by wheat and post-harvest parameters (Two year pooled data)

Treatments	Nutrient uptake (kg/ha)						Soil parameters					
	Nitrogen		Phosphorus		Potash		pH	Ec (dSm^{-1})	O.C. (%)	Available N (kg/ha)	Available P (kg/ha)	Available K (kg/ha)
	Grain	Straw	Grain	Straw	Grain	Straw						
Date of sowing												
25 November	62.25	41.14	15.10	2.82	20.47	117.76	7.25	0.35	0.67	191.24	14.69	203.84
10 December	55.60	37.53	13.85	2.58	18.29	107.95	7.14	0.34	0.64	187.30	14.17	197.47
25 December	47.70	32.37	12.08	2.23	15.99	92.81	7.28	0.39	0.60	185.75	13.87	196.37
S.E.±	1.62	1.19	0.31	0.09	0.61	1.79	0.03	0.02	0.02	2.61	0.62	3.14
C.D. (P=0.05)	5.30	3.40	1.13	0.27	2.13	5.10	NS	NS	0.06	NS	NS	NS
Fertility level (NPK kg/ha.)												
120:60: 40	61.85	40.95	15.76	2.81	20.23	117.33	7.23	0.34	0.65	192.	15.07	202.71
80:40:20	54.20	37.01	14.02	2.55	18.07	106.76	7.20	0.34	0.62	188.31	14.19	196.24
40:20:10	48.67	33.38	12.35	2.27	15.91	95.01	7.07	0.31	0.59	185.62	13.52	194.58
S.E.±	1.54	1.04	0.33	0.07	0.52	1.92	0.04	0.01	0.01	2.14	0.53	1.79
C.D. (P=0.05)	4.90	3.23	1.27	0.24	1.76	5.87	0.14	0.03	0.04	6.39	1.50	5.21

carbon content of soil decreased significantly with the delay in sowing date as plant vegetative growth decreased due to reduced growing, period of crop, which produced less root and leaves biomass that determined organic carbon status of soil. Maximum organic carbon content recorded in 25 November sown crop. This was statistically at par with 10 December and significantly higher than the 25 December sown crop. Usually organic carbon is mainly control by added organic manure and humus content of soil, but it was also affected by added fertilizer as it affect the production of crop residues and root biomass.

The available nitrogen, phosphorus and potassium contents in post harvested soil (Table 2) were not significantly influenced by the date of sowing. The level of available nutrients increased significantly with each successive increase in fertility level in soil. The higher content of available nitrogen, phosphorus and potassium 120: 60 and 40 kg/ha as compared with application 40: 20 and 10 kg/ha N P K. Amount of added fertilizers determines the availability of nutrients to the crop and its content in post-harvest soil.

An overview the result indicate that crop sown on 25 November with application of 120 : 60 and 40 kg/ha nitrogen, phosphorus and potassium had maximum grain yield (4.22t/ha), net return (Rs.53850/ha) and B:C ratio (3.31). The results are in conformity with Agrawal and Singh (2004).

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