The Pharma Innovation Journal 2023; 12(10): 2377-2380

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(10): 2377-2380

www.thepharmajournal.com
Received: 02-08-2023
Accepted: 08-09-2023

Ravindra Kumar Bhagat
Department of Agronomy, IGKV, Raipur, Chhattisgarh, India

Mahanand Sahu
Department of Agronomy, IGKV, Raipur, Chhattisgarh, India

Dev Narayan
Department of Agronomy, IGKV, Raipur, Chhattisgarh, India

Rajeshwari Dhurve
Department of Agronomy, IGKV, Raipur, Chhattisgarh, India

Dipendra Pankaj Porte
Department of Agronomy, IGKV, Raipur, Chhattisgarh, India

Satya Narayan
Department of Agronomy, IGKV, Raipur, Chhattisgarh, India

Corresponding Author:
Ravindra Kumar Bhagat
Department of Agronomy, IGKV, Raipur, Chhattisgarh, India

Effect of varying sowing date and fertilizer rates on growth and yield of wheat (*Triticum aestivum* L.)

Ravindra Kumar Bhagat, Mahanand Sahu, Dev Narayan, Rajeshwari Dhurve, Dipendra Pankaj Porte and Satya Narayan

Abstract
In the *rabi* season of 2020–21, a field experiment was conducted at Barrister Thakur Chhedilal College of Agriculture and Research Station, Bilaspur, Chhattisgarh, on the instructional farm, to study the "Effect of varying sowing date and fertilizer rates on growth and yield of wheat (*Triticum aestivum* L.)". The experiment was set up as a split plot with three replications, the main plot being D_1 (October 25, 2020-21), D_2 (5 November 2020-21), D_3 (15 November 2020-21) and D_4 (November 25, 2020-21) with four sowing dates. The sub plot treatments were NM_1 (RFD), NM_2 (150% RFD + FYM 15 t ha^{-1}) and NM_3 (150% RFD + FYM 15 t ha^{-1} + Growth regulators). The 5^{th} of November crop and NM_3 (150% RFD + FYM 15 t ha^{-1} + Growth regulators) had significant effects on the crop's growth, yield attributes and yield of wheat. The findings showed that, when compared to different sowing dates, the wheat crop seeded on November 5^{th} had the highest growth in terms of plant height, number of tillers (m^{-2}), and number of active leaves; yield attributes (spike length (cm), number of grains ear^{-1} head and test weight); and yield (grain and straw yield). The treatment NM_3 (150% RFD + FYM 15 t ha^{-1} + Growth regulators) was comparable to NM_2 (150% RFD + FYM 15 t ha^{-1}) in terms of fertilizer rates, maximum growth, yield traits and yield.

Keywords: Wheat, sowing date, fertilizer rate, growth regulator and yield

Introduction

Wheat (*Triticum aestivum* L.) is the second most important food grain in India after rice. Wheat is known as king of cereals. The series of agricultural changes following the utilization and exploitation of Norin10 dwarfing gene in wheat after 1965 was called "Green revolution". The impact of green revolution made India self-sufficient in food grain production. Wheat is a crop that self-pollinates and is a member of the poaceae family. In the global perspective, India ranks second in terms of wheat production, accounting for around 12% of worldwide wheat production. It also ranks second in terms of wheat consumption, after only China, with a substantial and increasing demand for wheat (Anonymous, 2019–20). In India, between 82 and 85 percent of crops are irrigated; the remaining portion is farmed in a rain-fed environment. With a total production of 109.52 million tonnes and a productivity of 3464 kg ha^{-1}, wheat has covered 31.76 million hectares in India (USDA, 2021) [18]. Wheat grows on around 112 (000, ha) of land in Chhattisgarh. It produces 150 (000, t) of wheat annually, with an average productivity of 1340 kg ha^{-1} (Director's Report, 2020–21). Having a nutritious composition of 9.2 g fat, 44.7 g carbohydrate, 28.7 g starch, 16.0 g total sugar, 22 mg vitamin E, 45 mg niacin, 0.72 mg riboflavin and 2.01 mg thiamin per 100 g of wheat makes it a good diet for health (Kumar *et al.*, 2011) [3].

One of the most significant non-monitory inputs that affect wheat crops' production is the timing of the sowing process. Nearly 50% of the wheat in Chhattisgarh is sown after the first week of December and is severely affected by the heat, which lowers yield. Late-planted wheat suffers from significant yield losses, which might amount to 40% to 50%. Heat stress has already been shown to significantly affect wheat production and quality reduction (Stone & Nicolas 1995) [4]. In addition to meeting all other conditions, the wheat crop needs a favorable winter of about 100 to 110 days in order to produce its maximum yields. Temperature is one of the primary climatic variables that affect when to sow a crop, how long certain phenophases last, and ultimately how productive a crop is. The date of planting is a crucial management decision to maximize wheat grain yield. In comparison to late sowing, normal sowing has a longer growth period, which allows for the accumulation of more biomass, leading to better grain and biological yields (Singh and Pal 2003) [5].

The productivity of wheat depends upon the nutrient supplying capacity of the soil and fertilizers schedule there on. Among the major nutrient, high yielding varieties of wheat have been found highly response to nitrogen fertilization. However, in absence of phosphorus, nitrogen remains unutilized. A chronic worldwide constraint to sustainable wheat production is lodging that often decreases photosynthetic ability and biomass production, deteriorates seed quality, and creates difficulties to harvest operations (Zhang *et al.*, 2017) [6]. The use of growth retardants found to be most effective for managing the problem of lodging (Zhang *et al.*, 2017) [6]. Wheat is an important cereal crop and requires a good supply of nutrients especially nitrogen for its growth (Mandal *et al.*, 1992). In such circumstances, maintaining soil fertility and crop yield may require the integrated use of chemical and organic fertilizers and manures.

Materials and Methods

In the Barrister Thakur Chhedilal College of Agriculture and Research Station's instructional farm in Bilaspur, Chhattisgarh, a field experiment was conducted during the 2020–21 *Rabi* season. At 298 metres above mean sea level, Bilaspur is situated at latitude 22.09˚ N and longitude 82.15˚ E. The state of Chhattisgarh is divided into three agro climatic zones; Bilaspur is located in the state's plains zone. The soil of experimental site was sandy clay soil in texture and neutral in reaction, medium in organic carbon content, low in available nitrogen and medium in available phosphorus and available potash. The average temperature was ranged from 14.96ºC to 30.63ºC during whole crop growing period. The total rainfall of 41.70 mm was received during crop season *rabi* 2020-21 and the highest rainfall (22.60 mm) was recorded during the meteorological week number 7 (February, 15-21). Split plot design was used for the experiment, with three replications and four sowing dates—D_1 (October 25), D_2 (November 5), D_3 (November 15), and D_4 (November 25)—main plotted and three fertilizer rates *viz*., NM_1 (RFD), NM_2 (150% RFD + FYM 15 t ha^{-1}) and NM_3 (150% RFD + FYM 15 t ha^{-1} + Growth regulators) as sub plot treatments. GW 366 (wheat) cultivars were employed in the investigation. 100 kg ha-1 of seed and 20 cm between rows were the suggested seeding rates and spacing, respectively. A recommended fertilizer dose of 120:60:40:20 N:P:K kg ha^{-1} was applied through urea, Single super phosphate, murate of potash respectively. 50% nitrogen with full dose P and K was applied as basal dose at sowing time and remaining 50% nitrogen was applied in two equal split i.e. ¼ at after first irrigation (CRI) and second dose at second irrigation in all the treatments. Following the standard procedure for split plot design, the growth and yield data were statistically examined to determine the critical differences (CD) at the 5% significant level.

Results and Discussion

Effect of sowing date and fertilizer rates on growth of wheat crop

The data pertaining to the wheat growth significantly affected by varying date of sowing and fertilizer rates and are presented in Table 1. The data on plant height treatment 5th November (D_2) sowing date recorded taller plant followed by sowing date of 15th November (D_3) at 90 DAS and harvest. Whereas, shortest plants were observed under date of sowing 25th November (D_4) at 90 DAS and at harvest. West Bengal reported that plant height was significantly more with mid-November sowing than rest of the sowing dates. Thus the findings confirm those of Baloch *et al.* (2010) [8].

Among nutrient management the highest plant height was recorded under the application of 150% RFD + FYM 15 t ha^{-1} (NM_2) recorded taller plant which was at par with RFD (NM_1) at 60 and 90 DAS. At harvest nutrient managements 150% RFD + FYM 15 t ha^{-1} (NM_2) recorded taller plant which was significantly superior then others, the shortest plant was noticed under application of RFD (NM_1) at 30 DAS whereas application of 150% RFD + FYM 15 t ha^{-1} + Growth regulators (NM_3) were recorded shortest plant at 60 DAS 90 DAS at harvest. Since nitrogen is a component of all proteins and the protoplasm of living cells, it has a significant impact on the growth and development of plants. It encourages vegetative development by increasing photosynthesis and cell expansion and multiplication, whereas phosphorus is essential for the metabolism of proteins and energy. Bindia *et al.* have published findings that are comparable to this (2005).

The data on number of tillers (m^{-2}) significantly higher were recorded with sowing of 5th November (D_2) at 60 and 90 DAS however, at harvest under sowing date of 5th November (D_2) was observed higher number of tillers followed by sowing of 15th November (D_3). Significantly inferior number of tillers per meter square was recorded under sowing date of 25th October (D_1) at all the growth stages. The results are in agreement with the findings of Anwar *et al.*, (2007) [9].

Among fertilizer rates the maximum number of tillers (m^{-2}) was recorded under application of treatment 150% RFD + FYM 15 t ha^{-1} + Growth regulators (NM_3) was recorded higher number of tillers which was at par with 150% RFD + FYM 15 t ha^{-1} (NM_2) at 30 DAS. All most same trend fallowed at 60 DAS, 90 DAS and harvest stage. Poor number of tillers per meter square was recorded under treatment RFD (NM_1) at all the growth stage. The result also confirmed the findings of Fazily *et al.*, (2019) [10]. The organic manures posses almost all essential nutrients including micronutrients, hormones and enzymes required for crop growth and development.

The data on number of active leaves significantly higher were recorded at 60 DAS higher number of active leaf $plant^{-1}$ was recorded under 5th November (D_2) treatment which was at par with 15th November (D_3) and 25th November (D_4). Among different date of sowing, treatment 25th October (D_1) date of sowing was recorded lowest number of leaf $plant^{-1}$. This might be due to proper supply of nutrients, which increase leaf area and photosynthesis. The higher production of photosynthatesd above-mentioned treatments produced more number of leaves and its area.

Among nutrient managements practices the application of 150% RFD + FYM 15 t ha-1 + Growth regulators (NM_3) proved significantly superior under observation then other RFD (NM_1) and 150% RFD + FYM 15 t ha^{-1} (NM_2) treatment, this might be due to the organic manure possess almost all essential nutrient including micronutrients, hormones and enzymes required for crop growth and development.

Influence of fertilizer rates and planting date on wheat yield attributes and yield

Variations in the planting date and fertilizer rates had a substantial impact on the wheat yield attributes data, which are displayed in Table 2.

Spike length (cm)

The highest spike length was observed under 5th November (D_2) sowing date, followed by 15th November (D_3) and 25th November (D_4). Lowest spike length was observed under 25th October (D_1) sowing date. Similar results were reported by Baloch *et al.*, (2010) [8].

Among various fertilizer rates treatment 150% RFD + FYM 15 t ha^{-1} + Growth regulators (NM_3) recorded maximum spike length which was at par with 150% RFD + FYM 15 t ha^{-1} (NM_2). Lowest spike length was recorded under RFD (NM1). Comparable results were reported by Sheoran *et al.* (2017) [11].

Number of grains ear^{-1} head

The 5th of November (D_2) was the sowing date with the largest number of grains per ear head, comparing the 15th and 25th of November (D_3) sowing dates. The planting date of October 25 (D_1) yielded the least amount of grains per ear head. The treatment with the highest number of grains ear^{-1} among the nutrient managements was 150% RFD + FYM 15 t ha^{-1} + Growth regulators (NM_3), followed by treatment with 150% RFD + FYM 15 t ha^{-1} (NM_2), and the treatment with the lowest number of grains ear^{-1} was RFD (NM_1).

Test weight

1000 grain weight of wheat was higher under 5th November (D_2) date of sowing followed by 15th November (D_3) and minimum 1000 grain weight was observed under 25th October (D_1). The results are in agreement with the results of Islam *et al.* (2008) [12].

Among different nutrient managements 150% RFD + FYM 15 t ha^{-1} + Growth regulators (NM_3) recorded heavier grains which was statistically at par with RFD (NM_1) and 150% RFD + FYM 15 t ha^{-1} (NM_2).

Grain and straw yield

Variations in the date of sowing and fertilizer rates had a substantial impact on the data related to the wheat yield, grain yield, straw yield and harvest index. These data are shown in Table 3. The number of effective tillers (m^{-2}), the number of fertile grains $panicle^{-1}$, and the test weight were used to determine the grain yields. 5th November (D_2) provided a noticeably greater seed yield (46.33 q ha^{-1}), as compared to 25th October (D_1) and 25th November (D_4), but was significantly at par with 15th November (D_3) (44.28 q ha^{-1}). The average yield ranged from 37.20 to 46.33 q ha^{-1} in different dates of sowing treatment. Goverdhan *et al.* (2019) [13] and Randhawa *et al.* (1977) [14] have similarly found higher wheat grain yields on November 16.

Among different fertilizer rate grain yield was higher under treatment 150% RFD + FYM 15 t ha^{-1} + Growth regulators (NM_3) (44.83 q ha^{-1}) followed by 150% RFD + FYM 15 t ha^{-1} (NM_2) (43.46 qha^{-1}) the minimum grain yield was acquire under RFD (NM_1) (37.36 q ha^{-1}). Related results were reported by Convertry *et al.* (2011) [17], who reported that application of inorganic fertilizer RDF (120:26.4:50 NPK ha^{-1}) along with organic manure FYM 5t ha^{-1}, bio fertilizer *i.e.* Azotobactor, PSB and VAM recorded 22% more grain yield than RDF. The result also confirmed the finding by Kushwaha and Singh (2002) [15]. Table 3 shows that straw yield of wheat followed the trend of variations similar to that of seed yield for different date of sowing treatment. Among nutrient managements practices the treatment 150% RFD + FYM 15 t ha^{-1} + Growth regulators (NM_3) recorded higher straw yield which was significantly superior then RFD (NM_1) and 150% RFD + FYM 15 t ha^{-1} (NM_2) under study. Thus the result confirms by Saikia and Kalita (2021) [16].

Harvest index

Table 3 displays information on the wheat harvest index that was noted throughout harvest. Among different date of sowing 5th November (D_2) recorded higher harvest index and 25th October (D_1) date of sowing treatment had the lower harvest index. However, the nutrient management practices could not bring about any significant difference for harvest index.

Table 1: Effect of sowing date and fertilizer rates on growth of wheat crop

Treatment	Plant height (cm)			Number of tillers (m^{-2})			Number of active leaves $plant^{-1}$	
	60 DAS	90 DAS	At harvest	60 DAS	90 DAS	At harvest	30 DAS	60 DAS
Date of sowing								
D_1 (25th Oct)	70.02	82.33	82.00	282.67	308.11	302.00	8.31	16.17
D_2 (5th Nov)	72.27	85.00	84.51	328.67	380.67	377.11	9.29	18.24
D_3 (15th Nov)	71.31	84.70	83.97	313.00	355.78	353.78	9.22	17.81
D_4 (25th Nov)	70.31	80.92	80.72	302.44	334.56	331.00	8.96	17.39
S.Em ±	0.49	0.29	0.54	3.29	3.89	7.11	0.35	0.28
C.D.(P=0.05)	NS	1.02	1.87	11.39	13.44	24.61	NS	0.97
Nutrient Management								
NM_1 (RFD)	71.49	83.75	82.86	298.25	312.50	306.67	8.75	16.08
NM_2 (150%RFD+FYM 15t ha^{-1})	72.39	84.61	84.48	309.58	356.50	352.92	8.97	17.45
NM_3 (150%RFD+FYM 15t ha^{-1}+GR)	69.04	81.36	81.06	312.25	365.33	363.33	9.12	18.68
S.Em ±	0.57	0.33	0.40	3.43	6.07	3.70	0.20	0.30
C.D.(P=0.05)	1.70	1.00	1.21	10.28	18.21	11.09	NS	0.91
Interaction (A × B)								
S.Em ±	1.14	0.66	0.81	6.86	12.15	7.40	0.20	0.61
C.D.(P=0.05)	NS	NS	NS	20.56	NS	NS	NS	NS

Table 2: Effect of different sowing date and fertilizer rates of yield attributing characters of wheat

Yield attributing characters of wheat			
Treatment	**Spike Length (cm)**	**Number of grains ear^{-1} head**	**Test Weight (g)**
Date of sowing			
D_1 (25th Oct)	7.09	29.62	41.86
D_2 (5th Nov)	8.48	32.39	45.08
D_3 (15th Nov)	8.04	31.59	44.13
D_4 (25th Nov)	7.71	30.74	42.11
S.Em ±	0.25	0.48	0.66
C.D.(P=0.05)	0.85	1.66	2.28
Nutrient Management			
NM_1 (RFD)	7.31	29.41	41.84
NM_2 (150%RFD+FYM 15t ha^{-1})	7.90	31.32	43.56
NM_3 (150%RFD+FYM 15t ha^{-1}+ GR)	8.29	32.53	44.48
S.Em ±	0.26	0.76	0.65
C.D.(P=0.05)	0.77	2.27	1.94
Interaction (A × B)			
S.Em ±	0.51	1.51	1.29
C.D.(P=0.05)	NS	NS	NS

Table 3: Effect of different sowing date and fertilizer rates of grain yield, straw yield and harvest index of wheat

Treatment	**Grain yield (q ha^{-1})**	**Straw yield (q ha^{-1})**	**Harvest index (%)**
Date of sowing			
D_1 (25th Oct)	37.20	42.27	46.82
D_2 (5th Nov)	46.33	49.53	48.44
D_3 (15th Nov)	44.28	48.84	48.05
D_4 (25th Nov)	39.72	43.49	47.68
S.Em ±	1.13	0.87	0.38
C.D.(P=0.05)	3.90	3.01	NS
Nutrient Management			
NM_1 (RFD)	37.36	41.45	47.84
NM_2 (150%RFD+FYM 15t ha^{-1})	43.46	46.83	48.07
NM_3 (150%RFD+FYM 15t ha^{-1}+ GR)	44.83	49.83	47.33
S.Em ±	0.85	0.96	0.47
C.D.(P=0.05)	2.55	2.88	NS
Interaction (A × B)			
S.Em ±	1.70	1.92	0.94
C.D.(P=0.05)	NS	NS	NS

Conclusion

From the present investigation it is concluded that treatment 5th November (D_2) and treatment 150% RFD + FYM 15 t ha^{-1} + Growth regulators (NM_3) recorded was found to be the best treatment among the different treatments with growth, yield attributes and yield under Bilaspur, Chhattisgarh.

References

1. Anonymous. Ministry of Agriculture and Farmers Welfare, Govt. of India; c2019-20.
2. Anonymous. ACRIP on Wheat and Barley, Progress Report. Crop Improvement; c2020-21. p. 1.
3. Kumar P, Yadav RK, Gollen B, Kumar S, Verma RK, Yadav S. Nutritional contents and medicinal properties of wheat: A Review. Life Sciences and Medicine Research. 2011;22:1-10.
4. Stone PJ, Nicolas ME. A survey of the effects of high temperature during grain filling on yield and quality of 75 wheat cultivars. Australian Journal of Agricultural Research. 1995;46:475-92.
5. Singh S, Pal M. Growth, yield and phenological response of wheat cultivars to delayed sowing. Indian Journal of Plant Physiology. 2003;8(3):277-286.
6. Zhang Y, Su S, Tabori M, Yu J, Chabot D, Baninasab B. Effect of selected plant growth regulators on yield and stem height of spring wheat in Ontario. J Agric. Sci. 2017;9:30-421.
7. Mandal NN, Chaudhry PP, Sinha D. Nitrogen, phosphorus and potash uptake of wheat (var. Sonalika). Env. Econ. 1992;10:297-97.
8. Baloch MS, Shah ITH, Nadim MA, Khan MI, Khakwani AA. Effect of seeding density and planting time on growth and yield attributes of wheat. J Anim. Plant Sci. 2010;20(4):239-242.
9. Anwar J, Khan SB, Rasul I, Zulkiffal M, Hussain M. Effect of sowing dates on yield and yield components in wheat using stability analysis. International Journal of Agriculture and Biology. 2007;9(1):129-132.
10. Fazily T, Hunshal CS. Effect of organic manures on yield and economics of late sown wheat (*Triticum aestivum* L.). International Journal of Research and Review. 2019;6(1):168-171.
11. Sheoran S, Raj D, Antil RS, Mor VS, Dahiya DS. Productivity, seed quality and nutrient use efficiency of wheat (*Triticum aestivum*) under organic, inorganic and integrated nutrient management practices after twenty years of fertilization. Cereal Research Communications. 2017;45(2):315-325.
12. Islam MS, Jahiruddin M. Effect of sowing dates on the yield and yield contributing characters of wheat. *J* Agrofor. Environ. 2008;2(2):139-141.
13. Goverdhan M, Pasha ML, Reddy DM. Evaluation of wheat (*Triticum aestivum)* genotypes under different dates of sowing in Telangana. IJCS. 2019;7(3):1508-1512.
14. Randhawa AS, Jolly RS, Dhillon SS. Effect of seed rate and row spacing on the yield of dwarf wheat (Kalyansona) under different sowing dates. J Res Punjab Agric Univ; c1977.
15. Kushwaha BL, Katar S. Response of wheat to row spacing, seed rate and fertility level under late-sown condition. Journal-article Plant-Archives. 2002;2(1):123-126.
16. Saikia TP, Kalita B. Yield maximization in wheat (*Triticum aestivum* L.) through nutrient and lodging management; c2021.
17. Coventry DR, Poswal RS, Yadav A, Gupta RK, Gill SC, Chhokar RS, Cummins JA. Effect of tillage and nutrient management on wheat productivity and quality in Haryana, India. Field Crops Research. 2011;123(3):234-240.
18. USDA, 2020. World Agricultural Production. January 2021