Original Research Article

Influence of Different Sowing Dates and Nutrient Management on Yield Attributes and Yield of Wheat (Triticum aestivum L.)

ABSTRACT

A field experiment conducted during Rabi season of 2020-21 and 2021-22 at Livestock farm, Department of Agronomy, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, India to study the Influence of different sowing dates and nutrient management on yield attributes and yield of wheat (Triticum aestivum L.). The twelve treatments consisting of four sowing dates viz. 25th October, 05th November, 15th November and 25th November as main plot treatments and these were super imposed with three nutrient management i.e. Recommended Dose of Fertilizer, 150 % RDF + FYM 15 t ha^{-1}, 150 % RDF + FYM 15 t ha^{-1} + Growth Regulators as sub plot treatments. On the basis of two year study it is evident that sowing of wheat on 5th November was found to be most suitable than rest of the sowing dates as it recorded significantly higher number of effective tillers (399.91 and 411.94 m^{-2}), length of earhead (10.61 and 11.15 cm), number grains earhead^{-1} (45.75 and 46.86), grain (5494 and 5497 kg ha^{-1}) and straw yields (7033 and 7128 kg ha^{-1}) compared to rest of the sowing dates except 25th October during both the year. Among the nutrient management, application 150 % RDF + FYM 15 t ha^{-1} + Growth Regulators recorded significantly higher number of effective tillers (405.51 and 416.72 m^{-2}), length of earhead (9.99 and 10.50 cm), grains earhead^{-1} (45.89 and 46.60), grain (5735 and 5866 kg ha^{-1}) and straw yields (7343 and 7514 kg ha^{-1}) as compared to rest of the nutrient management during both the years.

Keywords: Sowing dates, Yield, Yield attributes, Nutrient management, Recommended dose of fertilizer, Wheat

1. INTRODUCTION

Wheat is the major food crop in India after rice and it is highly sensitive to various biotic and abiotic stresses like weather and inter-seasonal climatic variability (in terms of changes in temperature, rainfall, sunshine hours, etc.), soil conditions, and agricultural inputs like irrigation and fertilizer. In the recent past, extensive research on climate change predicts marked increase in temperature. India's average temperature has inched up by around 0.7°C during 1901–2018 [1] and considered as one of the important factors responsible for low yield in wheat. The low production of wheat in Madhya Pradesh is due to shorter favourable growing period, high temperature with low humidity and short cool spell during

growing season with more fluctuation in temperature. The optimum sowing date depends on rainfall and temperature to maintain high grain yields. Under timely sown condition, wheat crop reaived prolonged favourable growth environment and resulted in higher accumulation of carbon photosynthates which ultimately enhanced higher values of yield attributes including grain yield [2]. Therefore, the optimization of sowing time is an important parameter to attain maximum yield and efficient conversion of biological yield into economic yield.

Nutrient management also affects crop yield because they are crucial for completing the life cycle of the plant and without these, plants are unable to survive and show growth abnormalities, deficiency symptoms and not reproduce normally. Relative to wheat producing states (Punjab and Haryana), Madhya Pradesh is having low productivity 2993 kg ha^{-1} [3]. Such yield gaps can be partially related to the more nutrient ($N+P_2O_5+K_2O$) consumption per unit of gross cropped area in a particular state. Besides this, imbalanced and inadequate nutrient application by farmers is one of the main reasons for low production of wheat. Modal et al. [4] found that higher number of grain $earhead^{-1}$, test weight and grain yield were recorded under combined application of 150% RDF + FYM 15 t ha^{-1}. Farm yard manure (FYM) incorporation along with inorganic nutrients considerably increased yield attributing parameters along with yield [5]. Shri et al. [6] also observed that maximum grain yield was recorded in 150% RDF of NPK with Chlormequat chloride and Tebuconazole applied @ 0.2% and 0.1%.

Wheat yield can be increased 10 to 80% through proper selection of sowing date [7] and proper nutrient management also play vital role in obtaining high yield of wheat [8]. Therefore, an experiment was planned to have knowledge the exact date sowing in Jabalpur district of Madhya Pradesh, India and application of proper nutrient management for maximizing of wheat yield. Keeping the above facts in consideration, the current experiment was conducted in Rabi season of 2020-21 and 2021-22 to study the Influence of Different Sowing Dates and Nutrient Management on Yield Attributes and Yield of Wheat (Triticum aestivum L.)

2. MATERIAL AND METHODS

The field experiment was conducted during Rabi season of 2020-21 and 2021-22 at Livestock Research Farm, Department of Agronomy, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.) which is located at 3°9' North latitude and 79°58' East longitude with an altitude of 411.78 m above mean sea level. The experiment was laid out in split plot design with three replications containing four sowing dates viz., 25th October, 05th November, 15th November and 25th November as main plot treatments and three nutrient managements viz., Recommended Dose of Fertilizer, 150 % RDF + FYM 15 t ha^{-1}, 150 % RDF + FYM 15 t ha^{-1} + Growth Regulators (Chlormequat chloride @ 0.2%) + Tebuconazole @ 0.1%) as sub plot treatments. The half of nitrogen fertilizers was applied as basal along with full P and K fertilizers and remaining N was applied in two equal splits, each of 20-22 days after sowing (DAS) and at 40-42 DAS. Chloromequat Choloride and Tebuconazole growth regulator were sprayed at 45 and 70 day after sowing as per treatments. However, the FYM was applied 15 days before the final land preparation.

Data on yield attributes and yield were recorded as per standard procedure. The number of effective tillers was counted starting at a row length of one meter and afterwards converted to a basis of effective tillers per square meter. Five randomly chosen ear heads from tagged plants were used to measure the length of earhead^{-1}. These ear heads were measured in centimeters from the base to the tip of the ear head. The mean was then calculated. After cleaning, the five ears were manually threshed, and the total number of grains was counted. Following the measurement of biological weight, the yield of grain was measured by threshing each wheat bundle independently for each treatment. The data thus recorded were subjected to statistical analysis as per the method of Gomez and Gomez [9].

3. RESULTS AND DISCUSSION

3.1 Yield attribute and yield of wheat as influenced by dates of sowing

The analysis of data indicated that different sowing dates had significant effect on yield attributes (number of effective tillers, length of earhead and grains earhead^{-1}) and yield of wheat during both the years (Fig 1). The data presented in table 1 indicated that the 5th November sown crop was having significantly higher number of effective tillers (399.91 and 411.94 m^{-2}) as compared to delayed sowing but it was statistically at par with 25th October sowing during both the year (2020-21 and 2021-22) and 15th November sowing during first year (2020-21). Length of ear head (10.61 and 11.15 cm) and grains earhead^{-1} (45.76 and 46.86) in 5th November sowing were also significantly higher than late sowing of wheat on 15th November and 25th November and found to be at par with 25th October sowing during both the year (2020-21 and 2021-22). Higher yield attributes with 05 November sowing might be due to favourable climatic condition, which longer vegetative as well as reproductive phases of the crop and resulted in more interception of solar radiation which impact positively on number of effective tillers, length of ear head and the total grains earhead^{-1}. Similar result has been reported by Yusuf et al. [10]. On the contrary, reduction in number of effective tillers, length of earhead and grains earhead^{-1} was upto 16.55, 16.91 and 11.40 %, respectively, when sowing was delayed by 20 days each time interval up to 25th November as compared to 05th November sowing. This might be due to poor vegetative growth. As Low leaf area index is associated with low photosynthetic rate and it caused poor canopy development thus, it limits the assimilate availability for development, which finally resulted into reduced number of grains earhead^{-1} and length of earhead. Mumtaz et al. [8] also found minimum number of effective tillers with delay in sowing. The results are in line with Singh [11], Baloch et al. [12] and Jat et al. [13].

Grain yield of wheat is a resultant of various yield attributing characters like number of effective tillers, length of ear head and grains earhead^{-1} along with environmental factors. Amalgamating their influence over the grain yield (Fig 1 and Table 2), it was found that the grain yield was greatly influenced with respect to sowing dates. The grain yield was maximum (5494 and 5497 kg ha^{-1}), when wheat was sown on 5th November and proved significantly superior over delayed sowing i.e. 15th November and 25th November but found to be at par with 25 October sowing during both the year (2020-21 and 2021-22). In case of straw yield 05th November sown crop produced significantly higher straw yield (7033 kg ha^{-1} during 2020-21 and 7128 kg ha^{-1} during 2021-22) as compared to other date of sowing except 25th October sowing during both the year (2020-21 and 2021-22) and 15th November sowing during first year (2020-21). The higher yield with 5th November sowing crop due to

favourable weather condition for longer duration and recorded better growth and yield attributed and thud resulted in higher yield of wheat. The decline in grain yield with delay in sowing may be due to exposure of crop to high temperature which reduces length of growing duration. Moreover, the yield attributes like effective tillers, length of earhead^{-1} and grains earhead^{-1} were reduced (Table 1) under delayed sowing which may be responsible for lesser grain yield. Similar views have also been enclosed by Mukherjee [14]. Jat et al. [13], Singh et al. [15] and Amrawat et al. [16].

Table 1. Effect of dates of sowing and nutrient management on yield attributes of wheat

Treatment	Effective tillers (m^{-2})		Length of earhead (cm)		Grains earhead^{-1}	
	2020-21	2021-22	2020-21	2021-22	2020-21	2021-22
Dates of sowing						
D_1 -25 October	379.09	385.37	9.84	10.31	44.52	45.20
D_2 -05 November	399.91	411.94	10.61	11.15	45.76	46.86
D_3 -15 November	360.60	363.71	9.02	9.49	42.57	43.00
D_4 -25 November	333.01	344.46	8.79	9.29	40.50	41.56
Sem ±	**11.72**	**12.15**	**0.25**	**0.28**	**0.60**	**0.81**
CD (p=0.05)	**40.55**	**42.04**	**0.86**	**0.95**	**2.07**	**2.82**
Nutrient management						
N_1- Recommended Dose of Fertilizer	326.30	338.18	9.03	9.50	40.87	41.88
N_2- 150 % RDF + FYM 15 t ha^{-1}	372.64	374.21	9.69	10.19	43.25	43.99
N_3- 150 % RDF + FYM 15 t ha^{-1} + Growth Regulators	405.51	416.72	9.99	10.50	45.89	46.60
SEm ±	**5.34**	**6.51**	**0.08**	**0.09**	**0.35**	**0.36**
CD (p=0.05)	**16.00**	**19.53**	**0.24**	**0.27**	**1.05**	**1.07**

3.2 Yield attributes and yield of wheat as influenced by nutrient management

Nutrient management had significant effect on yield attributes viz., number of effective tillers, length of earhead and grains earhead^{-1}. The highest number of effective tillers (405.51 and 416.72 m^{-2}), length of earhead^{-1} (9.99 and 10.50 cm) and grains earhead^{-1} (45.89 and 46.60) was recorded in the plots receiving 150 % RDF + FYM 15 t ha^{-1} + Growth Regulators and proved statistically superior over 150 % RDF + FYM 15 t ha^{-1} and recommended dose of fertilizer. The optimal and balanced supply of nutrient (macro and micronutrient) from inorganic and organic fertilizers led to recorded higher growth and

development of plants and side by side improve the physical, chemical, biological and hydrological properties of soil which provided the congenial an optimum environment for better growth and development of crops as reflected in terms of superior yield attributes [17] and [18]. Foliar application of growth regulators (Chlormequat chloride @ 0.2 % + Tebuconazole @ 0.1 %) also imposed significant influence on yield attributes of wheat. Similar findings have been given by Mondal et al. [4].

Table 2. Effect of dates of sowing and nutrient management on grain and straw yield of wheat

Treatment	Grain yield (kg ha^{-1})		Straw yield (kg ha^{-1})	
	2020-21	2021-22	2020-21	2021-22
Dates of sowing				
D_1 -25 October	5220	5347	6942	6824
D_2 -05 November	5494	5497	7033	7128
D_3 -15 November	4798	4920	6517	6641
D_4 -25 November	4561	4659	6370	6418
Sem ±	**107**	**86**	**136**	**146**
CD (p=0.05)	**371**	**298**	**472**	**506**
Nutrient management				
N_1- Recommended Dose of Fertilizer	4121	4130	5933	5938
N_2- 150 % RDF + FYM 15 t ha^{-1}	5158	5322	6871	6805
N_3- 150 % RDF + FYM 15 t ha^{-1} + Growth Regulators	5735	5866	7343	7514
SEm ±	**85**	**76**	**148**	**145**
CD (p=0.05)	**256**	**227**	**443**	**435**

Data related to grain and straw yield also significantly influenced by nutrient management. Application of 150 % RDF + FYM 15 t ha^{-1} + Growth Regulators had significantly higher grain (5735 and 5866 kg ha^{-1}) and straw yields (7343 and 7514 kg ha^{-1}) of wheat as compared to other nutrient management during 2020-21 and 2021-22 respectively. The increase in yield might be due to super values of yield attributing characters on account of higher photosynthetic activities under higher fertility level. These results are in close agreement with the results of other researchers Kumar et al. [19] and Ali et al. [20].

Fig 1. Effect of dates of sowing and nutrient management on grain yield

4. CONCLUSION

Sowing of wheat on 5th November and application of 150% RDF+ FYM 15 t ha^{-1} + Growth Regulators was found to be more productive than other treatments.

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