

Original Research Article

Sowing dates and varieties of wheat can affect yield, nutrient content in grain, straw and soil after crop harvest

ABSTRACT

A field experiment was conducted during *Rabi* 2015-16 at Instructional Farm, Department of Agronomy, College of Agriculture JAU, Junagadh to evaluate the identification of the suitable date of sowing and variety of wheat (*Triticum aestivum* L.) for South Saurashtra, Gujarat under changing climatic conditions. The experiment ~~consisting~~ consisted of 12 treatment combinations of four dates of sowing in main plots (05th November, 15th November, 25th November and 05th December) and three varieties in sub-plots (GW 322, GW 366, and GW 173) was carried out in ~~split-split~~ plot design with three replications. Significantly maximum grain yield, N, P and K in grain and straw was recorded with sowing on 15th November ~~as well as~~ and with the sowing of GW 366. Higher available N, P₂O₅, and K₂O in the soil after harvest was found on 05th December and GW 173.

Keywords: Available nutrient; content; soil; sowing; variety.

1. INTRODUCTION

Wheat (*Triticum aestivum* L.) is the world's leading cereal crop in terms of area harvested. Wheat is a thermo-sensitive and ~~long-long~~ day plant. Mexican dwarf wheat (*Triticum aestivum* L.), presently grown in India, also known as common bread wheat and belongs to the ~~dinkale-drinkable~~ series (hexaploid 2n=4x=42), was evolved by Dr. N. E. Borlaug at CIMMYT, Mexico. Wheat is most successfully grown between 30° and 60° N and between 27° and 40° S latitudes. It has the highest protein among all cereals, ranging from 10 to 12%, ~~which is known as gluten and is important known as gluten and is important~~ for the bakery purpose. Wheat also has a high amount of niacin and thiamine amino acids.

In the world, wheat is grown ~~on 220.4 million ha area, with production of a 220.4 million ha area,~~ with 729.0 million tonnes and productivity of 3.30 tonnes/ha (FAO, 2014). In India, wheat has an area of 30.4 million ha and production of 95.85 million tonnes, and productivity of 3145 kg/ha. The low productivity of wheat in Gujarat is mainly owing to factors like low soil fertility, moisture

Comment [A1]: References?

stress due to low ~~water-water~~-holding capacity of ~~the~~ soil, lack of required soil depth, imbalanced use of fertilizers, no or very low use of organic manures, non-availability of quality seed of locally recommended varieties *etc.* Besides ~~the above factors, non-availability of optimum temperature regimes during plant growth and development of wheat, particularly in Saurashtra, is another major factor for low yield of wheat~~at the above factors, non availability of optimum temperature regimes during plant growth and development of wheat, particularly in Saurashtra, is another major factor for low wheat yield in Gujarat.

Comment [A2]: References?

Weather is one of the ~~key-critical~~ factors influencing agricultural production and productivity. Studies indicate that weather during cropping season strongly ~~influencees-affects~~ crop growth, ~~and it accounts for two-third of the variation in productivity while other factors, including soil and nutrient management, accounts.~~ It accounts for two-thirds of the variation in productivity while other factors including soil and nutrient management, account for only ~~one-one~~-third of productivity. The predominant influence of weather is operative even before the crop is sown as the moisture availability and the thermal regime of the seed zone determine the date of sowing and the appropriate genotype to be ~~sownburied~~. ~~In spite of~~~~despite the~~ cultivation of ~~highwide-high~~-yielding varieties, improved cultural practices, and plant protection measures, favorable weather is a must for a good harvest [1].

Among the climatic factors, temperature plays a ~~key-crucial~~ role in determining sowing time and consequently the duration of different phenophases ~~and thus~~. ~~Thus~~, the crop productivity of wheat in almost all wheat growing regions ~~starting-starts~~ from germination to maturity [2]. ~~The physiological functions and growth stages are severely affected with-by temperature, which decides the duration of the life cycle of the wheat plant. Under late sown conditions, the wheat crop forcefully completes its life cycle before the stipulated time available for maturity.~~

Comment [A3]: References?

Therefore, it is important to identify suitable coping strategies to reduce ~~adverse effects of climate change related increase in~~the adverse effects of climate change related to increased temperature on wheat. The date of sowing is one such adaptation strategy ~~which can help to reduce temperature related-adverse affects on~~that can help reduce temperature-related adverse effects on the growth and development of plants. Even though the optimum date of sowing of wheat in south Saurashtra is 15th November, there is ~~need to revalidate the same in light of increase in temperature and decrease in~~a need to revalidate the same in light of increased temperature and decreased number of cold days over the years in Saurashtra [3]. ~~It may require to delay wheat sowing beyond 15th~~

November by few days to escape the effects of increased temperatures on plants. However, to be cautious, more delay may affect wheat performance again by reducing the tillering period and hot weather during critical period of grain filling leading to forced maturity.

Comment [A4]: References?

Further, selection of varieties tolerant to heat stress is another major adaptation strategy to reduce the adverse effects of high temperature on wheat crop. A simulation study found that ~~projected increase in temperature reduced yield of~~ the projected increase in temperature reduced wheat cultivars GW 322 and GW 496 by 38 to 43 % at Anand [4].

2. MATERIALS AND METHODS

A field experiment was conducted during *Rabi* 2015-16 at Instructional Farm, Department of Agronomy, College of Agriculture JAU, Junagadh to quantify the wheat yield losses and identify the suitable wheat variety for high yield under heat stress for South Saurashtra, Gujarat. The experiment ~~consisting of four dates of sowing in main plots viz., 05th November, 15th November, 25th November, and 05th December and three varieties in sub plots i.e. GW 322, GW 366 and GW 173~~ was carried out of four dates of sowing in main plots viz., 05th November, 15th November, 25th November, and 05th December and three varieties in sub plots, i.e. GW 322, GW 366 and GW 173 out in split plot design with three replications. The soil of experimental plot was clayey in texture and slightly alkaline in reaction with pH 7.8 and EC of 0.35 dS/m. The soil was medium in available N (241.0 kg/ha) and high in available P₂O₅ (25.5 kg/ha), and available K₂O (259.0 kg/ha). The crop was sown in rows 22.5 cm apart using 120 kg/ha seed rate. The recommended dose of N, P and K was 120, 60 and 60 kg/ha. ~~Half dose of N and full dose P and K was applied as basal while remaining half dose of N was given in two equal splits 25 and 45 day~~ N and full dose P and K were applied as basal while the remaining half dose of N was given in two equal splits 25 and 45 days after sowing. N was applied through urea and DAP, P through DAP, and K as MOP. Available N, P, and K were estimated by Kjeldahl method [5], Olsen's method [6], Flame photometric method [7], respectively. N in grain and straw was estimated following Kjeldahl method [7], P in grain and straw by Venedo-molybdous phosphoric acid yellow color method [7], and K in grain and straw by flame photometric method [7].

3. RESULTS AND DISCUSSION

3.1 Date of sowing and variety effect on yield

Significantly, maximum grain yield was recorded with the sowing of GW 366 on 15th November. The crop sown on 15th November produced a significantly higher yield parameter. High temperature reduced the vegetative periods, duration of grain filling ~~and grain development period, thus reduced yield parameter, which ultimately resulted into lower grain yield of wheat as, and grain development period, thus reducing yield parameter, which ultimately resulted in lower grain yield of wheat~~ compared to sowing under favorable temperature regimes. Similarly, higher temperature at grain filling, as simulated on 05th December sowing, led to forced maturity, thereby, reducing the grain yield. Moreover, significantly lower plant population with sowing on 05th December also resulted into lower crop yield. ~~Maximum grain yield was recorded in GW 366, owing to stress tolerance, and minimum grain and straw yield was recorded in GW 322 and GW 173 owing~~ Due to stress tolerance, maximum grain yield was recorded in GW 366, and minimum grain and straw yield was recorded in GW 322 and GW 173 due to heat shock. [8], [9] and [10] also reported similar findings.

3.2 Date of sowing and variety effect on N, P and K content in grain and stover

Significantly maximum N content in grain and straw were recorded with sowing on 15th November and ~~was at par with 05th November~~ at par with 05th and 25th November sowing. Whereas, significantly maximum N content in grain and straw were recorded in GW 366 and was at par with GW 322. Delayed sowing leads to heat stress at ~~grain filling stage which results~~ the grain filling stage, resulting in forced maturity and shriveled grains with poor quality, which is correlated with low nitrogen content in such grains and straw. These results support findings of ~~[11] and [12].~~

Significantly maximum P content in grain was recorded with sowing on 15th November and was statistically at par with 05th November sowing. Significantly maximum P content in grain was recorded in GW 366. The effect of different date of sowing and varieties on P content of grain and straw was found to be non-significant.

It was found that dates of sowing had significant effect on K content in grain and straw of wheat. Significantly maximum K content in grain and straw ~~were recorded with sowing on 15th November, being~~ as recorded with sowing on 15th November, at par with 05th November sowing. Maximum K content in grain was recorded in GW 366. Whereas, significantly maximum K content in straw was recorded in GW 366 which remained at par with GW 322. In general, the higher N, P and K content in grain and straw with sowing on 15th November could be due to

favorable temperature conditions leading to better growth and development of plants. The present findings are in close agreement with the results found by [13].

3.3 Date of sowing and variety effect on N, P and K in soil after harvest

It was indicated that different dates of sowing and varieties exerted ~~significant effect on available N, K₂O and P₂O₅ in soil after harvest of wheaa~~ significant effect on available N, K₂O and P₂O₅ in soil after wheat harvest. Significantly maximum available N, K₂O and P₂O₅ in soil after harvest of wheat was observed with sowing on 05th December. Significantly maximum available N and K₂O in soil after harvest was recorded with GW 173. However, significantly maximum available P₂O₅ in soil after harvest was observed with GW 173, being at par with GW 322.

Whereas, significantly minimum available N, P₂O₅ and K₂O in soil after harvest of wheat was recorded on 15th November and GW 366. This could be attributed to low nutrient uptake by plants due to poor growth and development of plants and lower productivity due to unfavorable temperature conditions when sown on 05th December [14] and [15]. The higher N, P₂O₅ and K₂O content in soil after harvest with GW 173 could be attributed to lower productivity and consequent lower uptake as compared to GW 366. These results confirm the findings of [4], [16] and [14].

4. CONCLUSION

~~From the above results, it is concluded that soil 15th November significantly enhances the grain yield.~~ The above results conclude that soil 15th November significantly enhances the grain yield and nutrient content in grain and straw. Among varieties, GW 366 gave better grain yield and nutrient content in grain and straw. Under ~~high-high~~ temperature conditions during sowing and early vegetative growth, as simulated by early sowing on 05th November, GW 322 gave significantly higher grain yield. Similarly, under ~~high-high~~ temperature conditions during ~~the~~ reproductive stage, as simulated by late sowing on 05th December, GW 366 being at par with GW 322 gave statistically superior grain yield other GW 173.

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Table 1. Effect of dates of sowing and varieties on N, P and K content of grain and straw in wheat

Treatments	Grain yield (kg ha ⁻¹)	N content (%)		P content (%)		K content (%)	
		Grain	Straw	Grain	Straw	Grain	Straw
Dates of sowing							
05 th November	4238	1.80	0.56	0.35	0.0444	0.46	1.63
15 th November	5070	1.85	0.59	0.39	0.0470	0.50	1.68
25 th November	4704	1.76	0.54	0.34	0.0465	0.43	1.58
05 th December	3733	1.59	0.38	0.27	0.0416	0.32	1.41
S.Em±	232.3	0.04	0.02	0.01	0.00030	0.01	0.04
C.D. (0.05)	803.9	0.15	0.08	0.04	NS	0.04	0.15
Varieties							
GW 322	4538	1.76	0.53	0.34	0.0448	0.44	1.59
GW 366	4696	1.81	0.55	0.37	0.0480	0.46	1.60
GW 173	4070	1.67	0.48	0.31	0.0418	0.40	1.53
S.Em±	46.5	0.02	0.01	0.01	0.0023	0.01	0.02
C.D. at 5%	139.4	0.07	0.02	0.02	NS	0.01	0.06

Table 2. Effect of dates of sowing and varieties on available N, P₂O₅ and K₂O in soil after harvest of wheat

Treatments	N (kg ha ⁻¹)	P ₂ O ₅ (kg ha ⁻¹)	K ₂ O (kg ha ⁻¹)
Dates of sowing			
05 th November	247.72	20.29	247.72
15 th November	225.08	16.24	225.00
25 th November	237.29	18.35	237.29
05 th December	278.42	26.66	277.30
S.Em±	4.28	0.48	4.70
C.D. at 5%	14.81	1.67	16.27
Varieties			
GW 322	247.84	20.08	247.84
GW 366	237.91	19.63	237.31
GW 173	255.57	21.44	254.74
S.Em±	2.41	0.39	2.69
C.D. at 5%	7.24	1.17	8.08

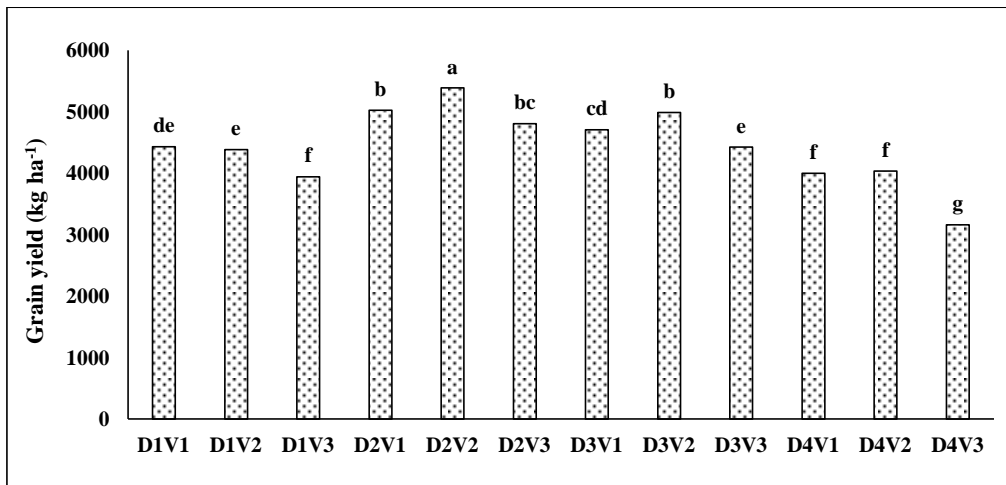


Fig. 1. Interaction effect of date of sowing and varieties on grain yield of wheat

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