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RESEARCH PAPER

Response of bread wheat (*Triticum aestivum* L.) and durum wheat (*Triticum durum* Desf.) genotypes to different sowing time on growth, yield attributes and yield in North Gujarat agro-climatic conditions

MUKESH KUMAR MAN*, I. N. DODIA[1] AND K. M. CHOUDHARY[2]
Department of Agronomy, C. P. College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, SARDARKRUSHINAGAR (GUJARAT) INDIA

Abstract : A field experiment was conducted on loamy sand soil at the Agronomy Instructional Farm, S. D. Agricultural University, Sardarkrushinagar to study the response of bread wheat (*Triticum aestivum* L.) and durum wheat (*Triticum durum* Desf.) genotypes to different sowing time in North Gujarat Agro-climatic conditions during *Rabi* season of the year 2008-09.The treatment consisted of four sowing times *i.e.*, 10th November (early), 25th November (timely), 10th December (late) and 25th December (very late) and four wheat varieties (*viz.*, GW 322, GW 496, GW 173 and GW 1139). The results of experiment revealed that the plant population at initial and harvest, test weight, harvest index were remained unaffected due to different sowing times. Plant height of wheat genotypes increased remarkably higher under10th and 25th November sowing. While, days to 50 per cent heading and days to physiological maturity were noticed significantly higher up from 10th November to 10th December sowing times. The values of number of spikes per meter^{-2} (292 to 304), length of spike (7.41 to 7.83 cm) and number of grains per spike (40.86 to 43.88) was noticed higher upto 10th December sowing times. Remarkably, the higher grain yield kg ha^{-1} was produced when wheat crop sown from 10th and 25th November (4000 to 4200 grain kg ha^{-1}) and in case of straw yield upto 10th December was found ideal. Increase in grain yield (kg ha^{-1}) was 5.00, 6.84 and 25.24 per cent as well as 4.27, 3.82 and 16.16 in straw yield (kg ha^{-1}) higher as compared to early, late and very late (10th November, 10th December and 25th December) sowing times. The result of mean data of varieties indicated that the different growth parameters *viz.*, plant height, days to 50 per cent heading, days to physiological maturity were significantly influenced and maximum values of these parameters were recorded by wheat variety GW 322. However, plant population at initial and harvest, harvest index and protein content were remained unaffected due to different varieties. Significantly higher values of yield attributes *viz.*, number of spikes per meter^{-2} (305), length of spike (8.12 cm) and number of grains per spike (42.24) were observed in variety GW 322 while, test weight was recorded significantly higher by variety GW 1139. The wheat variety GW 322 produced significantly higher grain yield 4137 kg ha^{-1} and straw yield 6338 kg ha^{-1} which was increased by 4.84, 3.49 and 21.51 per cent higher over varieties GW 496, GW 173 and GW 1139, respectively.

Key Words : Wheat, Durum wheat, Genotypes, Sowing time

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*** Author for correspondence:**
[1]Main Wheat Research Station (S.D.A.U.) VIJAPUR (GUJARAT) INDIA
[2]Department of Agronomy, Haryana Agricultural University, HISSAR (HARYANA) INDIA

INTRODUCTION

Wheat has been described as the "staff of life or king of cereals" and one of the most important staple food crop cultivated in at least 43 countries of the world. Wheat has its own outstanding importance as a human food; it is rich in carbohydrate and protein. About 35 per cent of the world's population directly or indirectly depends upon wheat for food and about 20 per cent of protein supply of the world comes from wheat alone (Rao, 1974). Thus, India, today ranks II after China in wheat growing countries. Wheat is cultivated in almost all the states of India, but its extensive cultivation is confined to Uttar Pradesh, Punjab, Haryana, Madhya Pradesh, Rajasthan and Gujarat in India, wheat is cultivated under irrigated as well as rainfed conditions. The different wheat varieties recommended under timely sown conditions, are extensively popularized due to its leaf and stem rust resistant with higher yield responsive to fertilizer and other agricultural inputs. The crop management factor sowing times is an important non-monitory crop production practice. The proper time of sowing exploit a distinguished effect on growth and eventually on the yield of wheat crop. The optimum time for sowing wheat depends upon the nature of variety and the temperature, for timely and late sown; varieties of long and short duration are preferred, respectively. The high yielding dwarf wheat varieties are most sensitive to date of sowing, hence, optimum time of sowing contributes more towards yield and very early sowing in first week of October resulted in lower yield (Singh *et al.*, 1974).

The time of sowing exerts a marked effect on the growth and eventually on the yield of the wheat crop; therefore wheat must be sown at the optimum time. The optimum time for sowing is decided by several factors, the most important of which is the temperature during the growing season. Even in the cause of the temperature, it has been found that the ideal temperature for the different stages of wheat plant varies considerably. Most of our earlier varieties were sensitive to the length of the day, when sown late they flower, either too quickly or too late. In both the cases, they gave poor performance. The low soil temperature inhibits the germination of the seed and causes delayed emergence and slow growth of seedling. Also due to the slow development of roots, the uptake of nutrients is also slow. Durum wheat is the only tetraploid species of wheat widely cultivated today. Durum is the hardest of all wheat. Its high protein content and gluten strength make durum good for pasta and bread. It is not, however, good for cakes, which should be made from soft wheat or they will be tough, because of the high gluten content of durum. Semolina made from durum is used for premium pastas and breads. Recent introduction and evaluation of high yielding dwarf wheat's is a significant land mark in Indian agriculture. Traditional varieties of wheat are quite tall and hence lodging of these varieties under higher fertilizer application. Because of this reason, traditional varieties have low yielding capacity or limited capacity to yield.

MATERIAL AND METHODS

An experiment was conducted during 2008-2009 at Agronomy Instructional Farm, C.P. College of Agriculture, S.D. Agricultural University, Sardarkrushinagar. The soil at the experimental site was loamy sand with low available nitrogen (149.00 kg/ha), medium in available phosphorus (26.31 kg/ha), high in available potassium (287.00 kg/ha) and low in sulphur (7.0 ppm). The experiment was laid out in Split Plot Design with four replications. The gross and net plot size were 6.00 m x 2.76 m and 5.00 m x 1.84 m, respectively. The experiment comprises of sixteen treatments as given in Table 1 and 2. The wheat was sown in different sowing times *viz.*, 10th November, 25th November, 10th December and 25th December with four wheat genotypes *viz*., GW 322, GW 496, GW 173 and GW 1139 andseed rate of triticum and durum wheat were 120 kg/ha, respectively. The triticum and durum wheat were fertilized with 120:60:00 NPK kg/ha in the form of DAP and urea, respectively. The first irrigation was given immediately after the sowing as the sowing was done in dry conditions. The second irrigation at 21 days and subsequent irrigations were given at 10 to 12 days intervals. Wheat crop was irrigated 9 times (290 mm) (including two common irrigations for germination and seeding establishment). The wheat crop was harvested in different times the second fortnight of February, first fortnight of March, second fortnight of March and first fortnight of April (10th November, 25th November, 10th December and 25th December). Yields of wheat seed and fodder were recorded it was calculated on the basis of market rate of triticum and durum wheat crop. On visual observation damage of insect and pest was not severe in crop.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Effect of sowing times :

Growth parameter :

Data presented in Table 1 indicated that sowing time (S_2) 25th November recorded significantly higher plant height (79.38 cm) at harvest, being at par with (S_1) 10th November and (S_3) 10th December sowing time as compared to S_4 sowing time *i.e.*, 25th December. While, significantly the lower plant height (70.65cm) was observed under sowing of 25th December (S_4) but remained at par with (S_3) sowing time *i.e.*, 10th December. The increase in plant height was registered under S_2 (25th November) 4.93, 6.10 and 12.35 per cent over sowing times S_1 (10th November), S_3 (10th December) and S_4 (25th December), respectively. This was might due to timely wheat sown condition showed better adaptability of weather parameters like lower gap between minimum and maximum temperature, relative humidity, lower evaporation resulting better soil moisture availability with nutrients, which in turn led to profuse growth in terms of taller plants and very early or late and very late conditions retarded the growth in terms of plant height. This result corroborate with the finding of Lathwal and Thakral (1999) and Zende *et al*. (2005). The effect of different sowing times to 50 per cent heading was found significant (Table 1). All the previous three sowing times S_1, S_2 and S_3 [10th November (59.03), 25th November (60.22) and10th December (58.93)] being at par with each other taken significantly more number of days to 50 per cent heading than S_4 (25th December) sowing time. However, wheat sown on (S_4) sowing time taken significantly the least days (54.20) to 50 per cent heading. The effect of different sowing time to physiological maturity was found significant. The 10th November sowing time of wheat (S_1), being at par with S_2 and S_3 (25th November and 10th December) taken significantly more number of days (107.16) to physiological maturity than S_4 (25th December) sowing time. However, wheat sown on (S_4) sowing time taken significantly the least number of days (98.16) to physiological maturity, but found identical with (S_3) sowing time. The days required for 50 per cent heading and physiological maturity in early (10th November), timely

Table 1: Effect of sowing times and wheat varieties on initial and final plant population per meter row length, plant height (cm), days to 50 per cent heading, physiological maturity, number of spikes per metresquare, length of spike (cm) and number of grains/ spike, test weight (g), grain and straw(kg ha^{-1}) and harvest index by wheat crop as influenced by sowing times and varieties

Treatments	Plant population /metre row length		Plant height (cm)	Days to 50 per cent heading	Days to physio-logical maturity	No. of spikes/ metre^2	Length of spike (cm)	Number of grains/spike	Test weight (g)	Yield (kg ha^{-1})		Harvest index (%)
	Initial	Final								Grain	Straw	
Sowing times (S)												
10thNovember (S_1)	57.81	51.95	75.65	59.03	107.16	300.90	7.51	41.57	43.68	4000	6186	39.99
25thNovember (S_2)	58.95	52.62	79.38	60.22	104.42	304.14	7.83	43.88	44.39	4200	6378	40.53
10th December (S_3)	57.74	52.09	74.81	58.93	102.28	291.90	7.41	40.86	43.55	3931	6109	39.73
25th December (S_4)	57.07	50.50	70.65	54.20	98.16	280.83	7.13	37.34	42.03	3353	5302	39.02
S.E.±	1.31	1.03	1.62	1.20	2.10	6.23	0.15	0.92	0.81	68.61	109.29	1.22
C.D. (P=0.05)	NS	NS	4.59	3.23	5.55	15.28	0.46	2.57	NS	269.39	429.14	NS
C.V.%	8.17	7.26	8.54	7.44	7.81	9.71	9.61	8.81	7.11	7.09	7.29	9.78
Varieties (V)												
GW 322 (V_1)	58.34	52.36	77.52	60.86	104.14	304.97	8.12	42.24	40.32	4137	6338	39.52
GW 496 (V_2)	57.62	51.88	76.84	57.86	109.40	301.63	7.50	40.77	41.97	3946	6078	39.74
GW 173 (V_3)	57.93	51.53	74.16	57.41	95.23	303.36	7.27	41.68	40.82	3997	6104	39.81
GW 1139 (V_4)	57.68	51.38	71.97	56.26	103.24	266.81	7.00	38.94	50.55	3404	5456	40.20
S.E.±	1.39	1.07	1.58	1.24	2.08	6.27	0.17	0.94	0.84	60.78	93.17	1.24
C.D. (P=0.05)	NS	NS	4.54	3.49	5.31	16.53	0.49	2.68	2.38	172.55	264.51	NS
C.V.%	6.75	9.02	7.86	8.21	7.48	8.34	7.71	7.22	9.25	6.28	6.22	10.21
Interactions	NS	NS	NS	NS	NS	NS	(S x V)	(S x V)	NS	(S x V)	(S x V)	NS

NS = Non-significant

S_2 (25th November) and late S_3 (10th December) sown conditions were found equal as compared to very late S_4 (25th December) sowing time. This was because of upto 10th December wheat crop enjoyed congenial weather conditions like long cold spell resulting lower rate of photosynthesis leading to delayed or increase in more number of days required to 50 per cent heading and maturity and in case of very late sown condition (25th December) due to increase in temperature resulting rapid rate of photosynthesis and dry matter accumulation decreased or enhanced the days of 50 per cent heading and physiological maturity. The results are in conformity with those reported by Kumar *et al*. (1998) and Deshmukh *et al*. (2015).

Yield parameters :

Different sowing times to number of spikes per metre square were found significant (Table 1). All the earlier three sowing times of wheat S_1, S_2 and S_3 (10th November, 25th November and 10th December) found identical and produced significantly more number of spikes per metre square over (S_4) sowing time. However, wheat sown on (S_4) sowing time noticed significantly the lower number of spikes per metre square and was on a par with (S_3) 10th December sowing time. The wheat sown on 25th November (S_2) significantly emerged longer spike than 25th December (S_4) sowing time and was at par with S_1 and S_3 sowing times (10th November and 10th December). While, S_4 (25th December) sowing time emerged shorter spike than S_2 (25th November) but was found identical with S_1 and S_3 (10th November and December) sowing times. The increase was under (S_1) 7, (S_2) 8 and (S_3) 3 per cent in case of number of spikes per meter square as well as (S_1) 5, (S_2) 9 and (S_3) 3 per cent increase of length of spike, respectively over S_4 sowing time. This was because of due to optimum cold spell enjoyed by the wheat crop which in turn led to development of number of spikes per meter square and length of spike. Whereas, in late sown condition due to short spell of cold or rise in temperature the rate of development of spikes per meter square and length of spike was retarded. This result corroborate with the finding of Patil and Itnal (2002); Tyagi *et al*. (2003) and Zende *et al*. (2005). An examination data indicated that the effect of different time of sowing on number of grain per spike was found significant. Significantly the maximum numbers of grains per spike (43.88) were produced when sowing was done on 25th November (S_3) as compared to sowing times S_3 and S_4 (10th December and 25th December). However, Sowing times S_1 and S_3were found at par with each other. However, sowing time (S_4) significantly produced the least number of grains per spike. The increase in grain number over S_4 was 11, 17 and 9 per cent in S_1, S_2 and S_3 sowing time, respectively. This was might be because of congenial weather parameters at the time of grain development which increased the number of grains per spike after that *i.e.* late and very late sown condition and rise in temperature the grain development was restricted. This results findings by Patil and Itnal (2002); Ram *et al.* (2004) and Zende *et al*. (2005). The effect of sowing times on test weight [1000 grain weight (g)] remained unaffected. This was due to the fact that bolder size of durum wheat grain sown in very late sowing condition (25th December) and rise in temperature, leading to equal grain weight of all wheat sowing times.

Yield :

The results indicated that grain yield of wheat was found significantly influenced due to different sowing times (Table 1). Wheat crop sown on 25th November being at par with S_1 (10th November) S_3 (10th December) produced significantly higher grain yields 4200 kg ha^{-1} than S_4 (25th December) sowing times. However, S_4 (25th December) sowing time significantly produced the least grain yield (3353 kg ha^{-1}).The effect of different sowing times to straw yield (kg ha^{-1}) was found significant. All the previous three sowing times S_1, S_2 and S_3 (10th November, 25th November and 10th December) being identical with each other produced significantly higher straw yield (6186, 6378 and 6109 kg ha^{-1}), respectively over S_4 (25th December) sowing time. While, wheat sown on (S_4) sowing time produced significantly the least straw yield (5302 kg ha^{-1}). The increase in grain and straw yield kg ha^{-1} was higher over S_4 sowing time (3353 and 5302 kg ha^{-1}) under S_1 (19), S_2 (25) and S_3 (17) as well as S_1 (16), S_2 (20) and S_3 (15) per cent, respectively. This was might be due to the fact that upto 10th December sowing of all the growth and yield parameters mitigated heat stress and simultaneously the crop had enjoyed better and congenial weather parameters with the better development of growth and yield attributes which in turn led to higher yield. The results are in conformity with these reported by Patel *et al*. (1999); Singh and Dhaliwal (2002); Patil and Itnal (2002); Zende *et al*. (2005) and Shirpurkar *et al*. (2008). However, the harvest index

remained unaffected due to different sowing times. This may be due to the fact that different sowing times of wheat narrow down ratio of grains and straw resulting non-significant effect.

Effect of genotypes :

Growth parameter :

The data (Table 1) of wheat varieties were non-significant due to initial and final plant population. Plant height of aestivum variety V_1 (GW 322) being at par with V_2 (GW 496) and V_3 (GW 173) produced significantly the taller plants (77.52 cm) as compared to durum variety V_4 (GW 1139). While, the durum cultivar V_4 (GW 1139) noticed significantly the shorter plants (71.97 cm) than V_1 and V_2 (GW 322 and GW 496) but found at par with variety V_3 (GW 173). The increase in plant height was registered under V_1 (GW 322) 0.88, 4.53 and 7.71 per cent over cultivar V_2 (GW 496), V_3 (GW 173) and V_4 (GW 1139), respectively. The wheat cultivar V_1 (GW 322) taken significantly more number of days (60.86) to 50 per cent heading than cultivar V_4 (GW 1139). But, both the cultivars remained at par with V_2 and V_3 (GW 496 and GW 173). However, cultivar V_4 (GW 1139) taken the least number of days (56.26) to 50 per cent heading. The wheat cultivar V_2 (GW 496) taken significantly more number of days (109.40) to physiological maturity than cultivars V_3 and V_4 (GW 173 and GW 1139) and statically at par with V_1 (GW 322) variety. But, variety V_1 was also found statically at par with variety (V_4) GW 1139. However, cultivarV_3 (GW 173) taken significant the least number of days (95.23) to physiological maturity. This was might be due to the fact that different genetic make up of wheat varieties played a role in respected of days required for 50 per cent heading and maturity days. Simultaneously, cultivars GW 322 and GW 496 have more consumption and utilization power of nutrients at early, timely and later sowing times resulting higher dry matter accumulation leading to higher plant growth which required more days to mature.

Yield parameters :

The number of spikes per metre square found significant (Table 1). All the preceding three aestivum varieties of wheat V_1, V_2 and V_3 (GW 322, GW 496 and GW 173) being at par attained significantly more number of spikes per metre square as compared to V_4 (GW 1139). While, wheat variety V_4 (GW 1139) produced significantly the least number of spikes per metre square. The cultivar V_1 (GW 322) produced significantly longer spike (8.12 cm) at harvest than rest of all cultivars. However cultivar V_4 (GW 1139) registered the shorter length of spike (7.00 cm) and found at par with cultivar V_3 (GW 173). But variety V_2 (GW 496) was also found at par with variety V_3. The wheat cultivar V_1 (GW 322) being at par with V_2 (GW 496) and V_3 (GW 173) produced significantly higher number of grains per spike (42.24) at harvest as compared to cultivar V_4 (GW 1139). However, the cultivar V_4 significantly registered the lower number of grains per spike (38.94) and was found at par with cultivar V_2. Significantly, maximum test weight of 50.55 g was recorded by wheat variety GW 1139 as compared to rest of all other aestivum genotypes (GW 322, GW 496 and GW 173). The lower test weight was gained by GW 322 (V_1) variety but found at par with V_2 and V_3. The increase in number of spikes per meter square in cultivars V_1 (GW 322) was 1.10, 0.53 and 14.30 per cent over V_2 (GW 496), V_3 (GW 173) and V_4 (GW 1139), respectively. Likewise, the increase in length of spike (cm) of cultivar V_1 (GW 322) was 8.26, 11.69 and 16.00 per cent over V_2 (GW 496), V_3 (GW 173) and V_4 (GW 1139), respectively. Simultaneously, the increase in number of grains per spike in cultivar V_1 (GW 322) was 3.60, 1.34 and 8.47 per cent V_2 (GW 496), V_3 (GW 173) and V_4 (GW 1139), respectively. But, in case of 1000-grain weight all the aestivum (GW 322, GW 496 and GW 173) wheat genotypes found identical. This was significantly lower than durum genotype (GW 1139). The highest significant test weight was recorded by cultivar V_4 (GW 1139) 50.55 g as compared to rest of the aestivum genotypes. The decrease in the test weight was 25.37, 20.44 and 23.83 per cent under cultivars V_1 (GW 322), V_2 (GW 496) and V_3 (GW 173) as compared to V_4 (GW 1139). This was only because of all the aestivum (GW 322, GW 496 and GW 173) genotypes recorded higher values of spikes per meter square, length of spike and number of grains per spike has homogenous genetic makeup in respect of all three spikes parameters. But, in case of test weight of grains the durum wheat (GW 1139) registered the highest value than aestivum genotypes because of its genetic better make up having bolder seed size. The results are in conformity with these reported by Tripathi *et al.* (2005); Patel (2005) and Verma *et al.* (2005).

Yield :

The grain yield (kg ha^{-1}) was found significant (Table

1). The aestivum wheat varieties V_1 (GW 322) and V_3 (GW 173) being at par with each other produced significantly higher grain yields 4137 and 3997 kg ha^{-1}, respectively over durum variety V_4 (GW 1139) 3404 kg ha^{-1} which was found significantly least. However, V_2 (GW 496) and V_3 (GW 173) were found identical with each other. The wheat cultivar V_1 (GW 322) being at par with V_2 and V_3 (GW 496 and GW 173) produced significantly higher straw yield (6338 kg ha^{-1}) than V_4 (GW 1139). However, cultivar V_4 (GW 1139) produced the least straw yield (5456 kg ha^{-1}). The increase was higher under variety V_1 (GW 322) 4.84, 3.49 and 21.51 per cent in grain yield and 4.27, 3.82 and 16.16 per cent in straw yield as compared to V_2 (GW 496), V_3 (GW 173) and V_4 (GW 1139), respectively. This may be due to the fact that all the three aestivum wheat varieties have higher capacity of uptake of nitrogen, phosphorus, potash and other macro and micro nutrients as they have more consumption and utilization power leading to higher dry matter accumulation and their translocation in different growth and yield attributes resulting higher grain and straw yield compared to durum variety *i.e.*, GW 1139. The results obtained in present study are in close agreement with those reported by Sardana and Sharma (2000); Jadhav and Karanjikar (2001); Patel (2005); Verma *et al*. (2005) and Shripurkar *et al*. (2008). However, harvest index showed non-significant effect due to different wheat varieties.

Interaction effect :

The mean of data interaction effect of different sowing times and wheat varieties on length of spike, number of grains per spike, grain yield (kg ha^{-1}) and straw yield (kg ha^{-1})were recorded significant (Table 2). The treatment combination S_2V_1 (25th November sown X GW 322) registered significantly the longest spike (8.91 cm) as compared to rest of all the treatment combinations. While, S_4V_4 treatment combination noticed significantly shorter spike (6.76 cm), which was at par with S_3V_4, S_1V_3, S_4V_2 and S_2V_4 treatment combinations. The treatment combination S_2V_1 (25th November sown X GW 322) registered significantly the higher number of grains per spike (46.95) being at par with S_2V_2 (25th November sown X GW 496) treatment combination than rest of all other treatment combinations. While, S_4V_4 treatment combination noticed significantly the lower number of grains per spike (34.25) and found at par with treatment combination S_4V_2. The treatment combination S_2V_1 (25th November sown X GW 322) produced significantly the higher grain yield (4642 kg ha^{-1}) being at par with S_2V_2

Table 2 : Interaction effect of sowing times and wheat varieties on length of spike (cm), number of grains/spike, grain and straw yield (kg ha^{-1})

Sr. No.	Treatments	Length of spike (cm)	Number of grains/spike	Yield (kg ha^{-1})	
				Grain	Straw
1.	S_1 V_1	8.17	42.78	4323	6563
2.	S_1 V_2	7.64	41.38	405	6361
3.	S_1 V_3	7.03	41.22	4053	6254
4.	S_1 V_4	7.21	40.89	3859	5567
5.	S_2 V_1	8.91	46.95	4642	6873
6.	S_2 V_2	7.94	44.64	4366	6570
7.	S_2 V_3	7.34	42.04	4176	6230
8.	S_2 V_4	7.13	41.87	3615	5841
9.	S_3 V_1	7.95	41.37	4121	6430
10.	S_3 V_2	7.32	40.15	3985	6031
11.	S_3 V_3	7.48	43.08	4233	6392
12.	S_3 V_4	6.89	38.78	3385	5585
13.	S_4 V_1	7.45	37.87	3461	5484
14.	S_4 V_2	7.08	36.91	3367	5350
15.	S_4 V_3	7.21	40.34	3527	5542
16.	S_4 V_4	6.76	34.25	3058	4831
S.E.±		0.14	1.19	121.55	186.33
C. D. (P=0.05)		0.44	3.48	345.10	529.03
C.V.%		7.71	7.22	6.28	6.22

and S_1V_1 treatment combinations over rest of all treatment combinations. While, S_4V_4 (25th December sown X GW 1139) treatment combination noticed significantly lower grain yield (3058 kg ha^{-1}) which was found at par with S_3V_4, and S_4V_2 treatment combinations. The treatment combination S_2V_1 (25th November X GW 322) registered significantly the higher straw yield (6873 kg ha^{-1}) being at par with S_1V_1, S_2V_2, S_3V_1, S_1V_2 and S_3V_3 treatment combinations over rest of all treatment combinations. While, S_4V_4 treatment combination produced significantly the lower straw yield (4831 kg ha^{-1}) being at par with S_4V_2 treatment combinations.

This was because of better and congenial weather parameters enjoyed by the wheat genotypes upto 10th December sowing *i.e.*, optimum cold spell which favoured and enhanced the values of growth and yield attributes which also reflected on grain as well as straw yield. The findings are in conformity with those reported by Patel *et al*. (1999); Jadhav and Karanjikar (2001); Ram *et al*. (2004) and Shirpurkar *et al*. (2008).

It is observed from the data that different sowing times and varieties and interaction effect (S x V) did not exert their significant influence on the harvest index.

Conclusion :

From the experimentation, it can be concluded that for securing higher yield, wheat variety GW 322 should be sown during 10th to 25th November and for late sowing (upto 10th December) condition GW 173 should sown in North Gujarat Agro-Climatic conditions.

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