Int.J.Curr.Microbiol.App.Sci (2018) *7*(7): 963-969

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 7 Number 07 (2018)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2018.707.116

Identification of Suitable Date of Sowing and Variety of Wheat (*Triticum aestivum* L.) for South Saurashtra, Gujarat under Changing Climatic Conditions

Bhawani Singh Prajapat*, Ram A. Jat, Aniket Diwedi and Deen Dayal Bairwa

[1]*Department of Agronomy, College of Agriculture JAU, Junagadh 362 001 Gujarat, India*
2 ICAR-Directorate of Groundnut Research, Junagadh 362 001 Gujarat, India

**Corresponding author*

Keywords

Heat stress, Sowing dates, Variety, Wheat

Article Info

Accepted:
08 June 2018
Available Online:
10 July 2018

A B S T R A C T

A field experiment was conducted during *rabi* 2015-16 at Instructional Farm, Department of Agronomy, College of Agriculture JAU, Junagadh to evaluate identification of suitable date of sowing and variety of wheat (*Triticum aestivum L.*) for South Saurashtra, Gujarat under changing climatic conditions. The experiment consisting 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 plot design with three replications. Significantly maximum germination percentage, plant population per square meter, plant height, dry matter accumulation, root dry weight, root length, root volume, crop growth rate from 30 to 60 DAS, maximum number of tillers/plant, effective tillers/meter, total tillers/meter, length of spike, number of grains/spike, weight of spike, test weight, grain yield, straw yield and biological yield was recorded with sowing of GW 366 on 15th November. Protein content in grain, and nitrogen, phosphorus and potassium content of grain and straw as well as their uptake by grain and straw was significantly higher with sowing of GW 366 on 15th November. Maximum net returns was found with sowing of GW 366 on 15th November.

Introduction

Wheat is a major staple crop of India after rice. In India wheat was grown on 30.23 Mha area with total production of 93.50 million tonnes during 2015-16 (Anonymous). There is increasing concern of wheat production getting affected by global warming in India (Valizadeh *et al.*, 2014). Temperature is one of the major factors which play vital role in the reduction of growth and yield parameters of wheat crop. The physiological functions and thereby growth stages are severely affected due to high temperature which also decides the duration of life cycle of wheat plant. Rawson (1986) indicated that rapid phenological development, poor biomass production and sterility were major factors leading to poor yields in wheat grown under high temperature regimes throughout the crop growth period. There is need to quantify the yield reduction in wheat due to high temperature which can be simulated by different dates of sowing under field conditions. Choice of planting date is also a key factor and is studied to assess its impact on yield of many crops, especially wheat and maize (Turner, 2004). Hence, the current investigation was undertaken with the objectives of quantifying wheat yield reduction due to high temperatures and identifying suitable wheat variety for high yield under heat stress.

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 (S_1), 15th November (S_2), 25th November (S_3), and 05th December (S_4) and three varieties in sub plots i.e. GW 322 (V_1), GW 366 (V_2) and GW 173(V_3) was carried 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^{-1}. The soil was medium in available nitrogen (241.0 kg ha^{-1}) and high in available phosphorus (25.5 kg ha^{-1}), and available potassium (259.0 kg ha^{-1}). The crop was sown in rows 22.5 cm apart using 120 kg/ha seed rate. The recommended dose of NPK was 120:60:60 kg/ha. Half dose of nitrogen and full dose phosphorus and potassium was applied as basal while remaining half dose of nitrogen was given in two equal splits 25 and 45 day after sowing. N was applied through urea and DAP, P through DAP and K as MOP. The crops under S_1, S_2, S_3, and S_4 were harvested on 16th February, 23rd February, 25th February, and 27th February, 2016, respectively. The total numbers of irrigations applied were 9, 8, 8, and 6 under S_1, S_2, S_3, and S_4, respectively. Weeds were controlled using pre-emergence application of pendimethalin followed by one hand weeding and interculturing 30 days after sowing. Available N was estimated following Kjeldahl method, available P by Olsen method, and available K by flame photometric method.

Results and Discussion

Effect on growth attributes

Significantly maximum number of germination percentage, plant population per square meter, plant height, dry matter accumulation, root dry weight, root length and root volume, crop growth rate from 30 to 60 DAS was recorded with sowing of GW 366 on 15th November (Table 1). The low germination percentage in case of 05th November and 05th December sowing was due to unfavorable temperature regimes which resulted into less then optimum plant population. The crop sown on 05th December was found to have significantly lesser number of tillers compared to crop sown on 15th November. Maximum plant height, dry matter accumulation, root dry weight, root length and root volume was recorded in GW 366 owing to less affected by temperature fluctuation. These findings supported the results of Mishra *et al.*, (2003), Sanghera and Thind (2014), and Singh and Dwivedi (2015).

Effect on yield attributes and yield

Significantly, maximum number of effective tillers/plant, effective tillers/meter, total tillers/meter, length of spike, number of grains/spike, weight of spike, test weight, grain yield, straw yield, biological yield and harvest index was recorded with sowing of GW 366 on 15th November. The crop sown on 15th November produced significantly more number of effective tillers/plant, effective tillers/meter and total tillers/meter, while minimum number of effective tillers/plant, effective tillers/meter and total tillers/meter was obtained was on 05th December due to less germination counted per meter square. That is because of temperature was not according to the germination and tillering requirement, which results in less number of total tillers/m^2. High temperature reduced the vegetative periods, duration of grain filling and grain development period, thus reduced length of spike, number of grains/spike, weight of spike, grain size, test weight, grain yield, straw yield, which ultimately resulted into lower grain yield and straw yield of wheat as 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 and straw 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 heat shock. Dhaka *et al.,* (2006), Singh *et al.,* (2011) and Jat *et al.,* (2013) also reported similar findings (Table 2).

Effect on total nutrient uptake

Protein yield and nitrogen, phosphorus and potassium content of grain and straw as well as their uptake by grain and straw was significantly higher with sowing of GW 366 on 15th November. Delayed sowing leads to heat stress at grain filling stage, which results in forced maturity and shriveled grains with poor quality and low protein content, which is correlated with low nitrogen content in such grains. These results support findings of Kamani and Singh (2013). In general, the significantly higher uptake of N, P, and K by grain and straw as well as their total uptake is due to higher yield and N, P, and K content in grain and straw with sowing of GW 366 on 15th November. The present findings are in close agreement with the results found by Dhaka *et al.,* (2006).

Effect on available nutrients in soil after harvest

The N, P_2O_5 and K_2O content in soil after harvest was significantly affected by different dates of sowing. Significantly, maximum available N, P_2O_5 and K_2O in soil after harvest of wheat was observed with sowing on 05th December. 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 (Deshmukh *et al.,* 2015 and Mumtaz *et al.,* 2015) (Table 3).

Economics

Maximum net return and B:C ratio was found with sowing of GW 366 on 15th November. The significantly higher yield with no substantial difference in cost of cultivation with sowing on 15th November resulted into higher net return and B:C ratio for GW 366 sown on 15th November. While least net returns and B:C ratio was obtained with GW 173 on 05th December sowing, due to less yield. Ouda *et al.,* (2005) reported that delay in sowing resulted in reduction of grain yield because of exposure of crop to high temperature which reduces length of growing duration (Table 4).

Table.1 Growth characters of wheat as influenced by dates of sowing and varieties

Treatments	Germination Percentage	Initial plant population per square meter (10 DAS)	Plant height (cm) at harvest	Dry matter accumulation/plant (g) at harvest	CGR from 30 to 60 DAS (g)	CGR from 60 DAS to harvest (g)	Root dry weight at harvest (g/plant)	Average root length at harvest (cm)	Root volume/plant at harvest (ml)
Dates of sowing									
S_1	90	182	94.6	20.0	57.59	29.29	13.81	13.86	23.31
S_2	96	186	101.6	21.9	63.01	40.22	14.84	14.42	24.44
S_3	92	183	95.1	21.0	60.18	49.53	14.10	13.95	23.99
S_4	88	175	77.7	18.7	54.17	65.78	12.74	12.43	20.89
S.Em±	1.6	1.87	4.02	0.26	1.48	2.26	0.20	0.32	0.58
C.D. at 5%	5.8	6.47	13.93	0.89	5.13	7.84	0.71	1.09	2.01
C.V.%	2.8	3.08	13.16	3.78	7.58	14.70	4.42	6.94	7.53
Varieties									
V_1	91	182	94.0	20.4	59.57	45.05	13.63	13.73	23.13
V_2	92	181	96.4	20.8	60.80	49.62	14.78	14.23	23.61
V_3	90	181	85.0	20.0	55.85	43.94	12.21	13.03	22.74
S.Em±	0.90	1.16	3.10	0.06	0.65	1.31	0.15	0.14	0.09
C.D. at 5%	NS	NS	9.29	0.19	1.95	3.93	0.46	0.42	0.28
C.V.%	1.69	2.21	11.70	1.07	3.83	9.82	3.83	3.51	1.38

Table.2 Growth characters of wheat as influenced by dates of sowing and varieties

Treatments	Number of effective tillers/plant	Number of effective tillers/ meter	Number of total tillers/ meter	Length of spike (cm)	Grains/ spike	Weight of spike (g)	Test weight (g)	Grain yield (kg/ha)	Straw yield (kg/ha)	Biological yield (kg/ha)	Harvest index (%)
Dates of sowing											
S_1	3.00	81.97	96.63	7.35	35.30	5.89	41.69	4238	6261	10498	40.32
S_2	3.67	93.29	102.56	8.54	43.92	7.18	51.32	5070	6917	11987	42.27
S_3	3.29	88.03	97.90	7.38	39.26	6.51	46.43	4704	6570	11287	41.67
S_4	1.93	71.25	80.36	6.10	28.12	5.13	35.36	3733	5464	9076	40.47
S.Em±	0.13	2.67	1.61	0.34	1.39	0.20	1.46	232.3	126.8	374.7	1.2
C.D. at 5%	0.46	9.25	5.56	1.18	4.80	0.68	5.05	803.9	439.0	1296.8	NS
C.V.%	13.46	9.59	5.11	14.21	11.36	9.53	10.03	15.7	6.0	10.5	8.7
Varieties											
V_1	2.88	83.59	95.89	7.22	36.87	6.10	44.06	4538	6330	10877	41.75
V_2	3.47	88.62	98.83	8.04	40.45	7.06	46.75	4696	6530	11269	41.79
V_3	2.47	78.71	88.37	6.44	32.68	5.37	40.29	4070	6049	9990	40.01
S.Em±	0.10	1.18	1.15	0.23	0.56	0.14	0.029	46.5	29.2	94.9	0.5
C.D. at5%	0.31	3.54	3.43	0.70	1.69	0.43	0.88	139.4	87.5	284.4	1.4
C.V.%	11.97	4.90	4.21	11.12	5.32	8.07	2.32	3.6	1.6	3.1	3.9

Table.3 Growth characters of wheat as influenced by dates of sowing and varieties

Treatments	Protein content of grain (%)	Total N uptake (kg/ha)	Total P uptake by (kg/ha)	Total K uptake (kg/ha)
Dates of sowing				
S_1	11.25	110.56	17.68	106.82
S_2	11.55	134.72	22.14	133.72
S_3	10.39	118.26	19.03	116.28
S_4	9.92	75.09	12.68	74.35
S.Em±	0.27	3.87	0.66	3.31
C.D. at 5%	0.93	13.38	2.27	11.47
C.V.%	7.37	10.58	10.87	9.22
Varieties				
V_1	11.01	111.23	18.36	109.63
V_2	11.32	120.63	20.58	118.56
V_3	10.45	97.11	15.45	95.19
S.Em±	0.14	1.48	0.38	1.39
C.D. at 5%	0.41	4.43	1.15	4.18
C.V.%	4.37	4.67	7.32	4.48

Table.4 Economic of dates of sowing and varieties in wheat

Treatments	Cost of cultivation (ha^{-1})	Net return (ha^{-1})	B: C ratio
Dates of sowing			
S_1	37245	43085	2.2
S_2	36445	58509	2.6
S_3	36445	51959	2.4
S_4	34445	35747	2.0
Varieties			
V_1	36245	49023	2.3
V_2	36245	51951	2.4
V_3	36245	40973	2.1

References

Deshmukh, K.M., Nayak, S.K., Damdar, R. and Wanjari, S.S. 2015. Response of different wheat genotypes to different sowing time in relation to GDD accumulation. *Advance Research Journal of Crop Improment*, 6(2): 66-72.

Dhaka, A.K., Bangarwa, A.S., Pannu, R.K., Malik, R.K. and Garg, R. 2006. Phenological development, yield and yield attributes of different wheat genotypes as influenced by sowing time and irrigation levels. *Agricultural Science Digest*., 26(3): 174-177.

Jat, L.K., Singh, S.K., Latare, A.M., Singh, R.S. and Patel, C.B. 2013. Effect of dates of sowing and fertilizer on growth and yield of wheat (*Triticum aestivum* L.) in an Inceptisol of Varanasi. *Indian Journal of Agronomy*, 58(4): 168-171.

Kamani, J.S.R. and Singh, D. 2013. Variation in radiation used efficiency of wheat as influenced by thermal stress management strategies under late sown condition. *Journal of Agrometeorology*, 15(2): 138-148.

Mumtaz, M.Z., Ahmad, M., Aslam, M., Jamil, M., Soleymani, A. and Shahrajabian, M.H. 2015. Assessing light interception and light extinction coefficient on planting dates of different cultivars of wheat in Esfahan region The 2nd World Sustainability Forum, 2: 1-6.

Mishra, V., Misra, R.D., Singh, M. and Verma, R.S. 2003. Dry-matter accumulation at pre- and post-anthesis and yield of wheat (*Triticum aestivum* L.) as affected by temperature stress and genotypes. *Indian Journal of Agronomy*, 48(4): 277-281.

Sanghera, A.K. and Thind, S.K. 2014. Dry matter accumulation in wheat genotypes as affected by date of sowing mediated heat stress. *International Journal of Scientific Research*, 8(3): 2- 6.

Singh, P. and Dwivedi, P. 2015. Morpho-physiological responses of wheat (*Triticum aestivum* L.) genotypes under late sown condition. *Society for Plant Research*, 28(1): 16-25.

Singh, A., Singh, D., Kang, J.S. and Aggarwal, N. 2011. Management practices to mitigate the impact of high temperature on wheat. *The IOAB Journal*, 2(7): 11-22.

Rawson, H.M., 1986. High temperature tolerant wheat: A description of variation and a search for some limitations to productivity. *Field Crop Res*., 14: 197-212.

Turner, N.C., 2004. Agronomic options for improving rainfall use efficiency of crops in dryland farming systems, *J. Exp. Bot*., No.55, PP.2413–2425.

Valizadeh, J., Ziaei S.M. and Mazloumzadeh, S.M. 2014, Assessing climate change impacts on wheat production. *Journal of the Saudi Society of Agricultural Sciences*, 13: 107–115.

Ouda, S.A., El-Marsafawy, S.M., El-Kholy M.A. and Gaballah, M.S. 2005. Simulating the effect of water stress and different sowing dates on wheat production in South Delta. *Journal of Applied Sciences Research*, 1(3): 268-276.

How to cite this article:

Bhawani Singh Prajapat, Ram A. Jat, Aniket Diwedi and Deen Dayal Bairwa. 2018. Identification of Suitable Date of Sowing and Variety of Wheat (*Triticum aestivum* L.) for South Saurashtra, Gujarat under Changing Climatic Conditions. *Int.J.Curr.Microbiol.App.Sci.* 7(07): 963-969. doi: https://doi.org/10.20546/ijcmas.2018.707.116