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Research Article

Evaluation of Chickpea (*Cicer arietinum* L.) Genotypes through Phenological Traits under Different Sowing Dates

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ABSTRACT

The experiment was conducted with ten genotypes of chickpea (Cicer arietinum L.) viz ICCV 88503, ICCV 92944, HC- 1, HC-3, HC-5, H12-64, H13-01, H13-02, H14-01 and H14-04 for three dates of sowing i.e 15th October, 15th November and 15th December in the field in randomized block design during Rabi season of 2017-18 and 2018-19 at Pulses Section, Chaudhary Charan Singh Haryana Agricultural University, Hisar to observe the effect of sowing dates on phenology of chickpea genotypes. The days to initiation, 50 % flowering, podding and physiological maturity were minimum in 15th December sowing and maximum in 15th October sowing. Among genotypes, H13-01 took minimum days to initiation, 50 % flowering, podding and physiological maturity while H14-04 took maximum days and among interaction, H13-01 took minimum days to initiation, 50 % flowering, podding and physiological maturity when sown on 15th December while maximum were observed in H14-04 when sown on 15th October.

Keywords: *Sowing dates, Phenology, Flowering, Genotypes, Cicer arietinum L.*

INTRODUCTION

Chickpea (*Cicer arietinum* L.) also called garbanzo bean or Bengal gram, is an old world pulse and one of the seven neolithic founder crops in the fertile crescent of the near east (Lev-Yadun et al., 2000). Chickpea is the second most important legume crop after dry beans in the world with 14.5 million hectare area under cultivation and 14.7 million tonnes are produced annually with average seed yield of 1014 kg ha^{-1} (FAOSTAT, 2017) whereas in India with 10.76 million hectare area under cultivation and 11.1 million tonnes produced with average seed yield of 1031 kg ha^{-1} (Anonymous, 2017-18). In Haryana, it is grown over an area of 107,000 hectare with total production of 91,000 tonnes and productivity of 850 kg ha^{-1} (Anonymous, 2017-18).

There are two distinct types of cultivated chickpea, *Desi* and *Kabuli*. *Desi* (*microsperma*) types have pink flowers, anthocyanin pigmentation on stems, and a colored and thick seed coat.

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The *Kabuli* (*macrosperma*) types have white flowers, lack anthocyanin pigmentation on stem, white or beige-colored seeds with a ram's head shape, thin seed coat and smooth seed surface. The desi types account for about 80-85% of the total chickpea area and are mostly grown in Asia and Africa and the kabuli types are largely grown in West Asia, North Africa, North America and Europe (Pandey et al., 2005).

In India, Madhya Pradesh, Rajasthan, Maharashtra, Uttar Pradesh, Andhra Pradesh, Karnataka, Chhattisgarh, Bihar and Jharkhand are major chickpea cultivating and producing states contributing more than 95% to the total chickpea area and production. Madhya Pradesh is the single largest producer in the country accounting for over 41% of total production while Maharashtra, Rajasthan, Karnatak, Uttar Pradesh and Andhra Pradesh contribute about 16%, 13%, 8%, 6% and 6% while area contribute about 34%, 19%, 17%, 13%, 6% and 5%, respectively.

There is a specific time for the sowing of particular variety of a crop on specific area and the accurate time of sowing and high yielding cultivars can boost the growth and yield of the crop because sowing time can influence different climatic parameters, such as temperature, moisture, sunlight, etc. affecting plant growth (Salmasi et al., 2006). In northern part of India, it is normally sown during second fortnight of October. Sometime its sowing is delayed depending upon the withdrawal of monsoon and late harvest of preceding *kharif* crop, which ultimately results in poor development (Wang et al., 2006).

Traditionally chickpea varieties cultivated in northern India required low temperature and prolonged winter for better growth. Hence chickpea cultivation was confined to the northern and central regions. With the intensification of wheat cultivation during *rabi* season, the pulse area reduced in the northern states, especially where irrigation facilities were available. This has forced, chickpea to shift towards comparative warmer and harsher growing environment of the southern states (Dixit et al., 2019).

During the last two decades, south Indian and eastern Australian late-sown chickpea has been exposed to heat stress in the growing season, mainly in reproductive phase. In south India, if the rainy season (*kharif)* is extended, then the chickpea sowing in the *rabi* season will be delayed (Ali, 2004). Global temperatures are increasing due to climate change which would have detrimental effects on agricultural crops being grown in arid and semi-arid regions (Wahid et al., 2007) and pulses are sensitive to change in temperature and the late-sown crop is exposed to high temperatures (>35^{0}C) at its reproductive stage in the months of February and March (Berger et al, 2011; Kumar et al., 2012). Phenology, basically concerned with the dates of first occurrence of biological events in their annual cycle. It is very sensitive to small variations in climate, especially to temperature, so study of phenological traits can become a useful traits for temperature changes, especially in the study of climate change and global warming (Meier et al., 2007).

Table 1: Variation in phenological traits of chickpea genotypes under different sowing dates

	Sowing dates															
Genotypes	**Days to initiation of flowering**				**Days to 50% flowering**				**Days to podding**				**Days to physiological maturity**			
	15th Oct.	**15th Nov.**	**15th Dec.**	**Mean**	**15th Oct.**	**15th Nov**	**15th Dec.**	**Mean**	**15th Oct.**	**15th Nov**	**15th Dec.**	**Mean**	**15th Oct.**	**15th Nov.**	**15th Dec.**	**Mean**
H12-64	71.0	66.0	65.5	67.5	88.0	81.0	80.0	83.0	105.3	100.3	98.0	101.2	135.0	130.0	127.0	130.7
H13-01	71.0	65.7	65.3	67.3	88.0	84.7	76.2	83.0	107.0	102.0	94.0	101.0	137.0	131.0	123.3	130.4
H13-02	71.0	69.3	70.0	70.1	88.0	84.3	83.0	85.1	104.6	102.3	98.0	101.7	135.7	131.0	128.0	131.6
H14-01	72.3	70.3	65.4	69.4	89.3	85.3	78.0	84.2	107.0	103.4	94.3	101.6	138.0	131.0	123.0	130.7
H14-04	74.0	73.0	72.0	73.0	91.0	88.0	85.0	88.0	111.7	105.9	101.0	106.2	140.0	135.3	130.7	135.3
HC 1	72.3	71.0	69.0	70.8	89.3	86.0	82.0	85.8	107.6	103.9	96.7	102.7	138.0	131.0	126.0	131.7
HC 3	73.0	71.3	67.0	70.4	90.0	86.3	80.0	85.4	109.0	104.0	94.3	102.4	139.0	132.0	124.0	131.7
HC 5	72.7	72.3	68.3	71.1	89.7	87.3	81.3	86.1	108.1	103.5	97.3	103.0	138.7	132.0	126.0	132.2
ICCV 88503	72.0	70.0	71.0	71.0	89.0	85.0	84.0	86.0	107.0	101.7	100.0	102.9	138.0	131.0	129.0	132.7
ICCV 92944	72.3	72.0	68.0	70.8	89.3	87.0	81.0	85.8	108.5	104.0	97.0	103.2	139.0	133.0	125.3	132.4
Mean	72.2	70.1	68.1		89.2	85.5	81.1		107.6	103.1	97.1		137.8	131.7	126.2	
CD at 5%	Dates of sowing =0.5,Genotypes = 0.7 Dates of sowing x Genotypes =1.3				Dates of sowing =0.4,Genotypes = 0.8 Dates of sowing x Genotypes =1.4				Dates of sowing =0.5, Genotypes = 1.0 Dates of sowing x Genotypes =1.8				Dates of sowing = 0.4, Genotypes = 0.8 Dates of sowing x Genotypes = 1.5			

Depending on where and when the crop is grown, chickpea experiences markedly different thermal regime and photoperiods. Difference in sensitivity to the vernalisation, post vernalisation, temperature and photoperiod determine the differences in the time of the flowering in different chickpea genotypes (Summerfield et al., 1979). According to Krishnamurthy and their co-workres (2011), delayed sowing (10^{th} January and 20^{th} February) experienced high temperature stress at reproductive phase that resulted into early flowering and physiological maturity as compared to normal sown condition (15^{th} November) while Ali et al., (2018) reported that 5^{th} October sowing took more days for phenological traits because at early sown condition the occurrence of long vegetative phase as compared to reproductive phase.

MATERIALS AND METHODS

The experiment was conducted in the field area of Pulses Section, Department of Genetics and Plant Breeding of Chaudhary Charan Singh Haryana Agricultural University, Hisar during *Rabi* 2017-18 and 219-19. Geographically the experimental field was located at 29 º.10**¹** N latitude and 75 º.46 longitude at an elevation of 215.2 meters above the mean sea level. The average rainfall varies from 300-500 mm and About 80-90 per cent of the total rains are received from South-West monsoon during the month of July to September. The minimum temperature in this area reaches upto 0.5 ºC in December and January and the maximum temperature in the area reaches upto 48 ºC during May or June.

Data were collected on days to initiation of flowering, days to 50 % flowering, days to podding and days to physiological maturity. Randomly selected five plants from each plot were marked as observational plants and observations on phenophases such as days to initiation of flowering, 50 % flowering, podding and physiological maturity were recorded and all the collected data were statistically analyzed by pooled analysis of both year (2017-18 and 2018-19) through OPSTAT software at the Computer Centre, Department of Statistics, CCS HAU, Hisar.

RESULTS AND DISCUSSION

The data given in table.1 showed that more number of days were taken to initiation of flowering (72.2 days), 50 % flowering (89.2 days), podding (107.6days), physiological maturity (137.8days) by crop sown on 15^{th} October and least number of days *i.e* (68.1, 81.1, 97.1, 126.2 days) respectively, were taken by crop sown on 15^{th} December when considered irrespective of genotypes. This could be due to high temperature prevailed at 15^{th} October sowing (Max. temp. 33.8 C and Min. temp 15.5 ^{0}C) and low temperature during 15^{th} December sowing (Max. temp. 20.7 ^{0}C and Min. temp. 2.0 ^{0}C) at the time of flowering. The high temperature accelerated the growth period that results into long vegetative phase in 15^{th} October sowing as compared to 15^{th} December sowing. There were significant variations in days to 50% flowering among the ten genotypes. Minimum number of days taken for initiation of flowering, 50% flowering, podding and physiological maturity were recorded in H13-01 *i.e* (67.3, 83.0, 101.0, 130.4 days) and H12-64 (67.5, 83.0, 101.2, 130.7 days) and maximum in H14-04 (73.0, 88.0, 106.2,135.3days) respectively, when considered irrespective of sowing dates. Among interactions the genotype H13-01 took least number of days to initiation of flowering, 50% flowering, podding and physiological maturity *i.e* (65.3, 76.2, 94.0, 123.3days) when sown on 15^{th} December whereas maximum number of days were taken to initiation of flowering, 50% flowering, podding and physiological maturity by H14-04 *i.e* (74.0, 91.0, 111.7, 140.0 days) when sown on 15^{th} October. The minimum days for all phenological traits were recorded in genotype H12-64 and H13-01 might be due to quick accumulation of heat units and maximum days were taken by H14-04 might be due to slow accumulation of heat units. This variation in flowering might be due to the differences in environmental factors, such as day length, temperature and relative humidity which resulted from different sowing dates. Such type of wider variability due to different sowing dates were also reported earlier by (Onyari et al., (2010); Krishnamurthy et al., (2011); Rehman et al., (2015); Ray et al., (2017); Ali et al., (2018) in chickpea.

CONCLUSION

From the results it is concluded that under agroclimatic condition of Hisar maximum phenological traits of *Cicer arietinum* L. genotypes, including days to initiation of flowering, 50% flowering, podding and physiological maturity obtained when these genotypes were sown on October 15th. Among genotypes, H13-01 proved to be more promising among all studied genotypes in terms of all phenological traits.

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REFERENCES

Ali, M.Y., Biswas, P.K., Shahriar, S.A., Nasif, S.O., & Raihan R.R., (2018). Yield and quality response of chickpea to different sowing dates. *Asian Journal of Research in Crop Science 1*(4), 1-8.

Ali, Y., Aslam, Z., Ashraf, M.Y., & Tahir, G.R., (2004). Effect of salinity on chlorophyll concentration, leaf area, yield and yield components of rice genotypes grown under saline environment. *International Journal of Environmental Science and Technology, 1*(3), 221-225.

Anonymous. (2017-18). *Progrees report 2017-18.* All India Coordinated Chickpea Improvement Project.

Berger, J.D., Milroy, S.P., Turner, N.C., Siddique, K.H.M., Imtiaz, M., & Malhotra, R. (2011). Chickpea evolution has selected for contrasting phenological mechanisms among different habitats. *Euphytica 180*: 1–15.

FAOSTAT, (2017). Food and agriculture organization of the united nations (FAO) statistical databases.

Krishanamurthy, L., Gaur, P.M., Basu, P.S., Chaturvedi, S.K., Tripathi, S., Vadez, V., Rathore, A., varshaney, R.K., & Gowda, C.L.L. (2011). Large genetic variation for heat tolerance in the reference collection of chickpea (*Cicer arietinum* L.) germplasm. *Plant Genetic Resources, 9*, 59-61.

Kumar, N., Nandwal, A.S., Yadav, R., Bhasker, P., Kumar, S., Devi, S., Singh, S., & Lather, V.S. (2012). Assessment of chickpea genotypes for high temperature tolerance. *Indian Journal of Plant Physiology, 17*(3&4), 224-232.

Lev-Yadun, S., Gopher, A., & Abbo, S. (2000). The cradle of agriculture. *Science 288*, 1062-1063.

Meier, N., Rutishauser, T., Luterbacher, J., Pfister, C., & Wanner, H. (2007). Grape Harvest Dates as a proxy for Swiss April to August Temperature Reconstructions, *Geophysical Research Letters*. *34*(20), 20705.

Onyari, C.A.N., Ouma, J.P., & Kibe, A.M. (2010). Effect of tillage method and sowing time on phenology, yield and yield components of chickpea (*Cicer arietinum* L.) under semi- arid conditions in *Kenya journal of applied biosciences, 34*, 2156–2165.

Pandey, S., Siddique, K.H.M., Kishore, G.K., (2005). Ascochyta blight of chickpea: biology, pathogenicity, and disease management. *Australian Journal of Agriculture Research 56*, 317-332.

Ray, K., Singh, D., & Jat A.L. (2017). Effect of sowing time and seed rate on growth and yield of chickpea cultivars. *Advance research journal of improvement ssn-2231-640x*L.

Rehman, H., Qamar, R., Rehman, A., Ahmad, F., Qamar, J., Saqib, M., & Nawaz, S., (2015). Effect of Different Sowing Dates on Growth and Grain Yield of Chickpea (*Cicer arietinum* L.) Cultivars under Agro-environment of Taluka Dokri Sindh, Pakistan. *American Journal of Experimental Agriculture 8*(1), 46-53.

Salmasi, S.Z., Golez, K.G., & Moghbeli, S. (2006). Effect of sowing date and limited irrigation on the seed yield and quality of dill (*Anethum graveolens* L.). *Turkry Journal of Agriculture 30*, 281-286.

Summerfield, R.J., Minchin, F.R., Roberts, E.H., & Hadley, P. (1979). The effect of photoperiod and air temperature on growth and yield of chickpea (*Cicer aeritinum* L.). Paper presented at International workshop on Chickpea Improvement (28 Feb. 2 March, 1979). Hyderabad, A.P.

Wahid, A., Gelani, S., Ashraf, M., & Foolad, M.R. (2007). Heat tolerance in plants: an overview. *Environmental Experiment of Botany*, *61*, 199-233.

Wang, J., Gan, Y.T., Clarke, F., & McDonald, C.L. (2006). Response of chickpea yield to high temperature stress during reproductive development. *Crop Science*, *46*, 2171–2178.