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Effect of sowing dates and varieties on yield attributes and yield of chickpea (*Cicer arietinum* L.)

R. K. PANDEY, P. K. TYAGI AND K. C. SHUKLA[1]

J. N. K. V. Vidayalaya, Deptt. of Agro., College of Agriculture, Tikamgarh-472 001 (M. P.)
Corresponding author's email: pktyagi197071@yahoo.com

Abstract

A field experiment was conducted to study the effect of sowing dates and varieties on yield attributes and yield of chickpea under irrigated condition during rabi *2012-13 at College of Agriculture, Tikamgarh (Madhya Pradesh). The experiment was laid out in split-plot design with three replications consisted three sowing dates* viz*., October 25, November 14 and December 4 and three varieties* viz*., JG 322, JG 11 and JG 16 as main plot and sub-plot treatments, respectively. The crop sown on October 25 resulted into significantly more number of effective pods (plant^{-1}), more number of seeds (pod^{-1}), higher seed yield (kg ha^{-1}), higher biological yield (kg ha^{-1}) and higher straw yield (kg ha^{-1}) as compared to November 14 and December 4 sown chickpea crops. However, sowing dates were failed to influence the 100-seeds weight and harvest index (%) significantly. Among varieties, JG 16 exhibited significantly more number of effective pods (plant^{-1}), higher 100-seeds weight (g), higher seed yield (kg ha^{-1}), higher biological yield (kg ha^{-1}) and higher straw yield (kg ha^{-1}) followed by JG 11 and JG 322. Varieties were failed to influence the number of seeds (pod^{-1})and harvest index significntly.*

Key words: Chickpea**,** *Cicer arietinum* L., sowing dates, varieties, yield, yield attributes.

Introduction

Chickpea (*Cicer arietinum* L.) is a premier pulse crop of India grown in *rabi* season under various cropping systems. In India, it is grown on an area about 9.91 million hectares with an annual production of 8.22 million tonnes and average productivity is 895 kg ha^{-1} (Anonymous 2012). It is a rich source of protein (18-22%), carbohydrate (62 %), B-group vitamins, and certain minerals *viz*., Ca, Fe etc. and vitamin C in green stage. Numerous environmental and genetic variables interact during the growing period of chickpea in determining its productivity. Among the various agronomic practices, sowing time is single most important factor influencing the yield of chickpea. Optimum sowing time of chickpea may vary from one variety to another and also from one region to another due to variation of agro-ecological conditions. Different planting dates subject the vegetative and reproductive stages of the plant to various temperature, solar radiation and day length (Yadav *et al*., 1999). Chickpea is usually sown between mid October to mid November. However, sowings are often delayed when grown in sequence with *kharif* crops. The exposure of crop to low temperatures during germination and seedling establishment and to high temperature during flowering and seed formation phases under delay-sown chickpea results in drastic reduction in yield. Yield loss in chickpea can vary between 30% and 60% depending on genotype, sowing time, location, and climatic conditions during sowing season. Some chickpea genotypes have capacity to tolerate drought and in that case sowing time can be delayed. However, earlier or late sowing caused drastic reduction in yield and net profit compared with timely sowing (Dixit *et al*., 1993).

It is also a fact that specified genotypes does not exhibit the same phenotypic characteristics in all environmental conditions. Improved cultivar is also an important tool, which have geared production of mustard in many countries of the world. In addition to many other factors responsible for achieving higher yields, cultivars with higher yield potential and a wide range of adaptability to adaphic and climatic conditions is essential for increasing yield per unit area, ultimately boosting up total production. The chickpea genotypes differ in their yielding ability, this calls for a need to generate more information on the response of chickpea genotypes to the dates of sowing for greater yields in a given agro-climatic conditions. Hence, keeping in view of above facts, a field experiment was conducted to study the effect of sowing dates and varieties on

[1]Deptt of Plant Physiology, JNKVV, College of Agriculture, Tikamgarh-472 001 (M.P.)

yield attributes and yield of chickpea under irrigated condition at Tikamgarh district (Madhya Pradesh).

Materials and Methods

The field experiment was conducted at Research Farm, J.N.K.V.V., College of Agriculture, Tikamgarh (24° 43' N latitude and 78° 49' E longitude at an altitude of 358m above mean sea level), Madhya Pradesh during *rabi* 2012-13. The experiment was laid out in split-plot design with three replications. The main plot treatments consisted of three sowing dates *viz*., October 25, November 14 and December 4 and the sub-plot treatments consisted of three varieties *viz*., JG 322, JG 11 and JG 16. The soil of experimental field was clay to clay loam with pH 6.9, low in available nitrogen (265 kg/ha), rich in available P_2O_5 (25.7 kg/ha), medium in available K_2O (254 kg/ha) and carbon content (0.5 %). The full recommended doses of nitrogen (20 Kg N ha^{-1}), phosphorus (40 Kg P_2O_5 ha^{-1}) and potassium (20 kg k_2O ha^{-1}) were applied at sowing. The chickpea crop was sown in lines 30 cm apart drawn by *kudali* using a seed rate of 80 Kg ha^{-1}. All other agronomic and plant protection measures were applied as per recommendations. Yield attributes were recorded from the five plants sample collected at the time of harvest. The crop harvested from net plot area was threshed after 4-5 days of sun drying and the seed yield of net plot was then converted into kg ha^{-1}. Before threshing of the crop harvested from net plot, the sun dried whole plant samples (biological yield) were weighed and then converted into kg ha^{-1}. Straw yield is obtained by subtracting seed yield (kg ha^{-1}) from biological yield (kg ha^{-1}). The harvest index (HI) was calculated by diving the economic yield by biological yield.

Results and Discussion

The data pertaining to yield attributes and yield as influenced by sowing dates and varieties are summarized in Table 1. Crop sown on October 25 resulted into significantly more numbers of pod plant^{-1} and numbers of seed pod^{-1} followed by November 14 and December 4 sown chickpea crops. This may be attributed to favourable environmental effect on plant growth and development under October 25 sown crop, which reflected into more number of pods plant^{-1} and number of seeds pod^{-1}. Variation in sowing time beyond optimum was found to decrease the number of pods (plant^{-1}) and it was also reported earlier by Dixit *et al.* (1993). However, 100-seed weight among the different dates of sowing was not differed significantly. Similar non-significant seasonal effect on 100-seed weight was also reported by Chaitanya and Chandrika (2006) and Ahmed *et al*., (2011).

The significantly higher seed yield (kg ha^{-1}), straw yield (kg ha^{-1}) and biological yield (kg ha^{-1}) were recorded in October 25 sowing followed by November 14 and December 4. (Table 1). The higher seed yield (1715 kg ha^{-1}) produced by October 25 sowing might be attributed to improved yield attributing *i.e*., number of pods (plant^{-1}) and number of seeds pod^{-1}. The favourable effect of early sowing (October 25) on sink component could be attributed to better development of the plants in terms of plant height and dry matter production (data not given) leading to increased bearing capacity due to optimum growth on account of favourable temperatures during early vegetative phase. Pezeshkpur *et al*. (2005) also agreed that early planting dates had higher yields of chickpea.

Consecutive 20 days delay in sowing from October 25 to November 14 and December 4 caused a loss in seed yield by 14.1% and 26.3%., respectively. The decrease in seed yield per hectare with delay in sowing occurred primarily due to the lower biomass build up which led to reduced bearing capacity owing to slower growth on account of lower temperatures during early vegetative growth phase and the overall shorter life span and reduced seed filling span and sink strength (pods number). The reduction in seed yield under delayed sowings due to shortening of life span coupled with lesser biomass production in chickpea crop had also been reported by Tobe *et al*. (2013). Ahmed *et al*., (2011) also reported earlier that total dry matter production decreased with delay in sowing which was reflected in grain yield. The drastic reduction in the seed yield (1264 kg ha^{-1}) under December 4 sowing could also be attributed to shortening of reproductive phase caused by forced maturity because of sudden rise in temperature during maturity phase. This resulted in lesser number of pods plant^{-1}, which ultimately decreased the seed yield (kg ha^{-1}).

The reduction in straw and biological yield under delayed sowing occurred primarily due to slower growth on account of lower temperature during early vegetative growth phase and the overall shorter life span of crop caused reduction biomass production. The earlier findings of Ahmed *et al*., (2011) corroborate these results. The harvest index among different sowing dates was not found significant. Similar results had also been reported by Fallah (2008) and Shamsi (2010).

Among different varieties, JG-16 produced significantly more number of pod plant^{-1} and higher 100-seeds weight as compared to *cvs*. JG 11 and JG 322. However, number of seeds pod^{-1} did not differ significantly among different varieties. The differences in yield attributing characters of these varieties could be attributed to their genetic constitution. The differences in yield attributes of different chickpea varieties had also been well documented by Chaitanya and Chandrika (2006) and Sardar (2009), Similarly, JG 16 also produced significantly higher seed yield (kg ha^{-1}), straw yield (kg ha^{-1}) and biological yield (kg ha-

Table 1: Effect of different treatments on yield attributes and yield of chickpea

Treatments	No. of pods (plant^{-1})	No. of seeds (pod^{-1})	100 seed weight (g)	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index (%)
Sowing dates							
25th Oct. 2012	30.5	1.37	18.1	1715	2897	4612	32.4
14th Nov. 2012	24.7	1.23	17.6	1474	2521	3995	31.0
4th Dec. 2012	20.2	1.20	17.6	1264	2105	3369	31.1
S.Em±	0.3	0.05	0.23	39	68	70	1.3
CD at 5%	1.3	0.16	NS	159	274	284	NS
Varieties							
JG-322	23.3	1.20	15.6	1377	2383	3761	30.8
JG-11	24.5	1.27	18.0	1478	2428	3906	30.8
JG-16	27.6	1.33	19.8	1597	2712	4309	30.8
S.Em±	0.5	0.05	0.27	25	81	64	0.7
CD at 5 %	1.6	NS	0.89	79	253	199	NS

^{1}) followed by *cvs*. JG 11 and JG 322. However, straw yield and biological yield between JG 11 and JG 322 were found non-significant. Cultivar JG 16 recorded 7.45% and 13.8% higher seed yield over *cvs*. JG 11 and JG 322, respectively. The higher seed yield in *cv*. JG-16 might be due to more number of pods plant^{-1} and 100-seeds weight. The lower seed yield (kg ha^{-1}) in *cv*. JG 322 might be due to lesser number of pods plant^{-1} and 100-seeds weight. The varietal differences in seed yield of chickpea had also been reported by Chaitanya and Chandrika (2006) and Shamsi (2010). The significant behavior of varieties in relation to seed yield could also be attributed to the differential trend in respect of biomass partitioning towards reproductive parts. Another probable reason for the significant difference in seed yield among the varieties could be due to fact that the varieties have different compensation mechanisms which affect the seed yield. The harvest index among different varieties was not found significant. The varietal differences in harvest index had also been reported by Kumari *et al.* (2012).

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