

Investigating the Effects of Planting Density on Yield and Yield Components of Chickpea Under Spring Cultivation Conditions in Takhar Province, Afghanistan

Jahid Ahmad Shams¹ and Burhanudin Weqar²

^{1,2}Assistant Professor, Agronomy Department, Agriculture Faculty, Takhar University, AFGHANISTAN.

¹Corresponding Author: jahidshams.takhar@gmail.com

ORCID

<https://orcid.org/0009-0002-0928-8736>



www.jrasb.com || Vol. 2 No. 5 (2023): October Issue

Received: 18-10-2023

Revised: 20-10-2023

Accepted: 23-10-2023

ABSTRACT

A factorial experiment was conducted as randomized complete blocks in three replications at the Agriculture Faculty research farm, Takhar University to quantify the effect of planting density and planting arrangement on some morphological traits. Experimental treatments included 15, 30, 45, and 60 cm row spacing. The harvest was done by hand when all the pods were yellow, and seeds were hard. At the time of the final harvest, ten bushes were randomly selected from each plot and used to determine the performance components (elevation of the bush, the number of pods per plant, the number of seeds per pod, the weight of 100 seeds, and the biological yield). The results showed that the effect of density on performance was not significant. The maximum yield of seeds in the planting arrangement of 30 to 45 cm row distance has been obtained at the rate of 935.76, and 996.15 kg per hectare. The maximum height of the plant was observed at the distance between the rows of 30 cm. The density decreased with increasing the distance between the planting rows from 30 to 45 cm. The number of pods increased from 14.44 to 16.33 pods per plant, i.e., 11.57 percent.

Keywords- Pea, pod, yield, density, seed.

I. INTRODUCTION

Pulses crops have a high nutritional value as a source of protein, and they form a major part of people's food in dry regions of the third world. Peas are a plant suitable for cold and relatively humid regions, and their winter cultivation is desirable in tropical regions (Biabani, 2008). Chickpea is a long-day and winter-friendly plant from the pea family that needs a medium temperature to grow (Miri, 2019). One important characteristic that influences the acceptability of legume food products relates to food texture and sensory qualities, for which the pasting profile of starch is important in different legume species (Santos et al., 2019). Pea is grown by millions of resource-poor farmers on marginal land across the semi-

arid regions of Asia and Africa. Pea is an edible legume that is capable of fixing atmospheric nitrogen in association with Rhizobium bacteria and provides farmers with valuable organic matter and micronutrients (Markeb, 2016); one of the appropriate methods of increasing the yield of chickpeas per unit area is the use of density figures and arrangement compatible with the climatic conditions of each region. In such a way that the minimum planting competition is appropriate, destruction will be created between the bushes.

Excessive concentrations cause the creation of an unsuitable climate, and as a result, excessive shading of the bushes on each other, the spread of diseases and pests, and reduced grain yield (Awaze et al., 1390). Row plants have been determined and used by increasing the

number of seeds of narrow doors for many years, mostly through experimental tests. However, increasing the plant density per unit area without considering other factors may not increase productivity and may lead to a decrease in productivity and quality. Plant performance in chickpeas decreases with increasing density; in other words, the performance of a single plant has an inverse relationship with density. Therefore, in the lower density, the grain performance is reduced (Husaini et al., 1389). To get high yield, it is very important to determine the best planting density. Seed yield results from external and internal competition for environmental factors effective in growth. The maximum yield per unit area is achieved when these competitions reach the lowest level so the plant can use the available growth factors (Haidari et al., 1390). The planting density in peas modifies the dynamics of mass accumulation in the respective organs, and the decrease in row spacing from 35 to 25 cm in Poland increased the pea biomass yield. The pea plants grown at a wider row spacing were higher, and their leaf area was lower. Reported a higher number of branches, pods per plant, and seeds per pod in peas at a wider row spacing, and the row spacing did not have a significant effect on the protein content in seeds; the planting density in peas modifies the dynamics of mass accumulation in the respective organs, and the decrease in row spacing from 35 to 25 cm in Poland resulted in an increase in the pea biomass yield (Bukowski et al., 2022).

This research aims to investigate the effects of row spacing on chickpea plant yield (number of pods per plant, number of seeds per pod, plant height, biological yield, seed yield, weight of 1000 seeds, and number of clusters per plant).

II. MATERIALS AND METHODS

This experiment was carried out in 2023 in the research farm of the Department of Agriculture, Takhar University, in factorial form in completely randomized blocks with three replications and four treatments (15-30-45 and 60 cm). Planting was done in rows and by hand at a distance of 10 cm according to the plan in rows of 15, 30, 45, and 60 cm with high density on March 15. Harvesting was done by hand when the pods were yellow and had hard seeds on June 25. At the time of final harvest, ten plants were randomly selected from each plot and used to determine yield components and morphological characteristics. Measurements included the number of pods per plant, number of seeds per pod, plant height, thousand seed weight, biological yield, and seed yield.

III. RESULTS AND DISCUSSION

Plant height: The interaction effect of the distance between the rows and the planting row on plant height was significant at the 5% probability level. The maximum height of the plant was observed at the distance between

the rows of 30 cm. In other words, the increase in planting density increased the height of the stem. It seems that shading caused an increase in the length between the nodes of the stem, and as a result, the height and number of sub-branches increased. Biabani (2007) stated that the effect of row distance on the number of lateral branches was remarkable. Also, the variance analysis of the plant height trait in Heidari's (1390) research shows that the factors of agricultural season and plant density have a significant difference at the statistical level of 1%. The cultivar factor and the mutual effect of season X have a significant difference at the statistical level of 5%.

Number of pods per plant: The effect of the distance between planting rows on the number of pods per plant was significant. In the study of chickpea yield components, it was observed that the number of pods per plant increased with the increase in the distance between the planting rows, so the density decreased with increasing the distance between the planting rows from 30 to 45 cm. The number of pods increased from 14.44 to 16.33 pods per plant, i.e., 11.57 percent. The results of Kashfi et al.'s research in 2009 have shown that some characteristics of chickpeas, such as the number of branches, the number of pods per plant, the performance of a single plant, and the harvest index have increased at a density of 16 plants per square meter. The results of frade research in 2005 have shown that the most pods/plant were produced at 8 plants/m² (mean, 56.0), and the least at 25 and 36 plants/m² (mean, 17.2 and 14.4 pods/plant, respectively).

Number of seeds per pod: The effect of the distance between planting rows on the number of seeds per pod was significant at the 5% probability level. By increasing the planting distance between the rows, the number of seeds in the pod increased, and the highest number of seeds in the pod at a distance of 60 cm was observed as 2.33 seeds per pod. The research results of Merkeb (2016) showed that the spatial arrangement and population density of pigeon pea did not significantly affect the number of seeds in the pod.

Weight of 100 grains: The effect of the distance between planting rows of 100 seeds was insignificant, the change of planting distances between planting rows was from 45 to 60 cm, and the weight of 100 seeds was from 22.4 to 22.9 grams. The results of research by Biabani (2008) have shown that density treatment has no significant effect on grain yield, and by increasing the distance between plants on the row along with the width of the rows, the yield increases so that the maximum yield in the planting arrangement of 30 cm row spacing is 12,100 kilograms per hectare. Achieved, and the lowest yield is 9087 kg. Prusinski (2022) The planting density significantly affected most of the pea yield structural components, except for 1000 seed weight.

Grain yield: The results of this research have shown that the highest seed yield was obtained at a distance of 45cm (996.15 kg) and 60 cm (1020.14 kg). At this distance, the plant seems to be in suitable conditions; by creating

favorable environmental conditions for plant nutrition, including moisture and light, as well as optimal use of land, by choosing the appropriate planting pattern with a high percentage of certainty, it can increase the yield of chickpeas per unit area. Unlike the seed yield, the values of the structural pea yield components depended significantly on the weather pattern in the research years, the row spacing, and the planting density. The results of Hosseini et al. (2010) showed that the lowest yield was

obtained with 999.4 kilograms per hectare in a density of 20 plants, which is the reason for the increase in yield due to the increase in density due to the reduction of the distance between the plants and the optimal density per unit area and the optimal use of soil moisture and light.

The average grain yield, yield components, and some morphological characteristics of chickpeas in the spacing of different planting rows

Distance Between Row	Plant Height cm	Number of Pods Per Plant	Number of Seeds Per Pod	100 Seed Weight gr/ha	Grain Yield kg/ha
15	59	10.66	0.66	20.53	903.96
30	62.33	14.44	1.66	21.13	935.76
45	53.66	16.33	2	22.66	996.15
60	53.33	16.66	2.33	23.06	1020.14

IV. CONCLUSION

As observed, due to the change in the distance between planting rows, there have been many changes in the yield and components of seed yield, as well as some agricultural traits of chickpeas, which can be briefly referred to below.

Decreasing the distance between planting rows increased the yield of seeds per unit area and plant height in chickpeas. On the other hand, increasing the distance between planting rows due to the lack of competition between plants, the number of sub-branches per plant, the number of pods per plant, the number of seeds per pod, and finally, the harvest indicators have increased. Still, these increases have not been able to compensate for the decrease in yield due to the lack of plants and pods per unit area. In other words, the lack of plants per unit area has caused the maximum environmental production capacity not to be used. Also, based on the results of the conducted experiments, it seems that the maximum yield can be obtained if the planting row distance is 30 cm or the planting distance between the rows is 45 cm in the environmental conditions of Takhar. By examining the grain yield per unit area, it seems that by creating favorable environmental conditions for plant nutrition from moisture and light as well as optimal use of land by choosing a suitable planting pattern with a high percentage of confidence, it is possible to increase the amount of chickpea yield per unit area.

REFERENCE

[1] Ali Nakhzari Moghadam, Ebrahim Gholamoali Pour Alamdari, Zeinab Orseji and Ali A. (2019). Effect of number and pre-sowing and post-emergence herbicides

on performance and performance components of chickpea. p: 188.

[2] Biabani, A. (2008). Investigating the effect of row spacing and plant spacing (plant arrangement) on green pea performance of Shamshiri Charok cultivar. p: 4.

[3] Carla S. Santos, Bruna Carbas, Ana Castanho, Marta W. Vasconcelos, Maria Carlota Vaz Patto, Claire Domoney and Carla B. (2019). Variation in Pea (*Pisum sativum* L.) Seed Quality Traits Defined by Physicochemical Functional Properties. P: 2.

[4] Ewazi, aliriza, Azada mualim nia and ali nastat zada A. (2011). The effect of the distance between and on the planting rows on the yield and yield components of chickpea (Qazvin number) in West Azerbaijan. P: 32.

[5] Fitsum, M. (2016). Effect of Population Density and Spatial Arrangements of Pigeon pea (*Cajanus cajan* L. Millsp) on Productivity of Maize-Pigeon pea Intercropping. P 217.

[6] Heydari, Mohammad Mirzaei. Abbas Maleki. Ahmad Tahmasabi and Shahreh, F. (2011). The effect of planting density on yield and yield components of rainfed chickpea cultivars under spring and fall planting conditions in Ilam region. P:45.

[7] Janusz Prusin'ski and Magdalena, B. (2022). Effect of Planting Density and Row Spacing on the Yielding and Morphological Features of Pea (*Pisum sativum* L.). p: 3-6.

[8] Koshfi, Seyyed Mohammad Hassan. Majnoon Naser Hosseini and Hassan Zeinali, K. (2010). Investigating the effect of plant density and nitrogen initiator fertilizer on the performance and performance components of Cyrus' agricultural chickpea. p:13.

[9] M. M. Mguélez Frade & J. Valencian, B. (2005) Effect of sowing density on the yield and yield components of spring-sown irrigated chickpea (*Cicer arietinum*) grown in Spain. p: 369.