

# The effect of planting scheme and time on chickpea grain production in drought conditions

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**Abstract.** The article presents the influence of sowing dates and schemes on grain yield structure and yield of Lazzat and Malhotra varieties of chickpeas in drought-condition farming. Abundant and high-quality grain harvest from chickpeas directly depends on the correct determination of the optimal planting period and schemes. The purpose of the study was to determine the effect of planting periods and schemes on the structure and productivity of chickpea varieties in the conditions of typical gray soils of the lowland-hilly region. In the research, the indicators of grain yield structure and yield of pea varieties were observed in Lazzat and Malhotra varieties when planted in early spring 20.02 in the 60x15x1 scheme, that is, the elements of the grain yield structure, the number of pods and grains per plant, were found to be higher compared to the control option 60x6x1 scheme. In the article, the impact of planting periods and schemes of Lazzat and Malhotra varieties of chickpeas included in the State Register of Agricultural Crops on the grain yield structure and productivity was studied and recommendations were made based on the experimental results. Keywords: soil, chickpea, Lazzat, Malhotra, variety, seed, legume, grain, yield, structure, productivity, planting time, planting scheme, plain-hilly region.

## 1 Introduction

Today, the area of chickpea cultivation in the world is 14,573 thousand hectares, which has expanded by 3.3% compared to 2020 [1]. The main countries that grow peas are India, Australia, Pakistan, Argentina, African countries, and Mexico. India is the leader in the production of peas (10,984 thousand/t), its share is 73%. The second place is occupied by Australia (661 thousand/t) and the third place by Pakistan (601 thousand/t). Currently, the yield of peas is 10 ts/ha, which has increased by 2.2% compared to 2020 (<http://www.fao.org/faostat>).

It is assumed that the homeland of the pea (*Cicer arietinum L.*) plant is the mountainous regions of Tajikistan and Uzbekistan. Pea is cultivated in many countries of the world and is

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a crop of agrotechnical, ecological, and economic importance. It has long been a common leguminous cereal crop in the world, and it is used as food and fodder and as a raw material for the processing industry on different continents. In our republic, the biological characteristics of the ecotypes of peas growing in different climatic conditions, including growth dynamics, the formation of crop elements, and indicators such as the weight of 1000 seeds, have not been studied. Among the leguminous crops, the pea plant, which provides a high amount of protein and high-quality oil, has a special feature. Nowadays, peas (*Cicer arretinum L.*) occupy an important place in livestock feed in developed countries of the world [2].

Taking into account the incomparable importance of leguminous crops in increasing the yield, and grain quality of grain crops and increasing the soil fertility of dry lands, their high-yielding, early-early, disease- and drought-resistant, densely branched, tall, non-shedding, protein-rich varieties are adapted to mechanized harvesting, and organizing the introduction of agrotechnology on a scientific basis is a very important task.

The agrotechnics of cultivation of pea varieties newly added to the state register for planting in arid lands of Uzbekistan is little studied. The impact of planting periods and schemes on the structure and yield of grain crops, especially taking into account soil climatic conditions and biological characteristics of new pea varieties, is not sufficiently covered in the literature.

Currently, in various major scientific and research centers of the world, great attention is being paid to creating varieties of peas resistant to extreme conditions, studying the morphophysiological characteristics of the created varieties, increasing their nutritional value, determining the dependence of the yield, crop qualities on cultivation methods, and improving the elements of cultivation technology. In this regard, it is possible to increase their productivity by enriching the soil with biological nitrogen, to save organic and mineral fertilizers, to solve these problems, to study in depth the effect of the biological characteristics of the crop, the reaction of the varieties to the hydrothermal factors of the area and the photosynthetic activity of the planting period and schemes on the crop structure and grain yield is one of the urgent issues [3].

## 2 Materials and methods

The research was conducted in 2015-2017 in the conditions of dry, typical gray soils the farm named New Village Grain Farm, Kichik Chimboy MMTP, Pastdargom district.

Lalmikor consists of alluvial and loess deposits as typical gray soils and is highly carbonated. Typical gray soils are 120.1 thousand hectares in the Samarkand region and 138.0 thousand hectares in the Republic. According to the mechanical structure, the soil is medium and light sandy in some places, and gravel is laid at a depth of one meter. The amount of carbonates is 6-7% CO<sup>2</sup> by section. A large amount of humus in the upper layers is characteristic of these soils. The aquifer layer is residual and below it. The nitrogen content of the driving layer is 1.8%, and the total nitrogen content is 0.1-0.12%. The absorption capacity is 12-14 mg/eq in 100 g of soil.

75-80% of absorbed cations correspond to Ca<sup>2+</sup> ions, 15-20% to Mg<sup>2+</sup> ions. 5-7% of the absorption capacity corresponds to K<sup>+</sup> and Na<sup>+</sup> ions, and Na<sup>+</sup> is almost absent in cultured soils.

The amount of humus in the soil in the 0-30 and 30-50 cm layers was 0.95 and 0.84%, and total nitrogen was 0.06 and 0.04%, respectively. It was found that the amount of nitrate nitrogen is 14.2-7.2 mg/kg, it belongs to the group of soils with very little supply in terms of mobile phosphorus, and it belongs to the group of low supply in terms of exchangeable potassium.

Winds, which are one of the main indicators of climate, are the main source of spreading toxic gases released into the atmosphere. The direction of the winds is affected by the topography of the place, the presence or absence of running water. In the region of the district, winds in the east and northeast direction are repeated. Their average speed reaches 4-5 m/sec.

The climatic conditions of the Zarafshan Valley, including the Samarkand region, are characterized by high temperatures and a sharply changing continental climate due to the large size of the region being far from water bodies. The relief is low-high, rising to the south, north, and east of the Zarafshan River, and decreasing to the west.

In the center of the Zarafshan Valley, Samarkand region, the sum of the high active temperature of 10 °C is on average 4000-4900 °C in the flat part of the region. The hottest period is July, the coldest is January. The climate of the region is sharply continental, the air temperature rises to +42, +43 °C in summer and drops to -22, -23 °C in winter. The summer of the region is hot and dry, the winter is cold, there is a lot of precipitation in the spring, and in the autumn, hot and cold weather alternates.

The vegetation period in Samarkand region is 255-275 days, and the duration of frost-free days is 180-210 days. In autumn, the temperature drops below 15°C in most cases in the third decade of November.

The coldest days of the year were observed in December when the average temperature was + 2.5 -3.4 °C, or slightly higher than the long-term average temperature. The highest average monthly temperature was observed in July, +27.1 +26.4°C, 2.5-2.7 °C higher than in June.

The highest average monthly precipitation fell in winter and spring months, there was almost no precipitation in the summer season, and the amount of precipitation differed sharply from year to year.

The average monthly data of relative air humidity was highest in November, December, January, February, March and April. July, the hottest month of summer, has 35-39% relative humidity, and January, the coldest month of winter, has 70-76% relative humidity.

In the experiment, Lazzat, Malhotro varieties of peas were planted on February 20, March 12, April 1, 60x6 cm; 60x9cm; 60x12cm; 60x15cm and 60x18cm were planted. Field experiments were arranged with 4 returns, the size of the plots was 50 m<sup>2</sup>, and they were arranged in a row, two, and tiered. The predecessor is a clean plow. Except for the methods studied in the experiments, all the technological methods of wheat cultivation were performed on the basis of agrotechnics adopted for this region.

Laboratory, field and production experiments, biometric measurements, phenological observations were carried out on model plants in scientific research works, physiological analyzes were carried out using methodological manuals of UzPITI "Methods of Conducting Field Experiments" [4].

In the experiment, the yield of peas was determined in all variants directly by manual harvesting. The yield was calculated based on standard moisture and 100% purity [5].

1000 grain mass and protein content were determined according to GOST-13586-1-68, and fat content was determined by the Soxhlet method.

- ammophos (N-11%, R205-46%), potassium chloride (60%), ammonium nitrate (34%) were used in the experiment;

The agrochemical properties of the soils of the experimental field were investigated in the following ways:

The content of humus in the soil was determined by the method of I.V. Tyurin, by the method of N-NO<sub>3</sub>-Granwald-Lyaju, by the method of R205-Machigin, and by the method of V.P. Protasov in an alternating potassium flame photocolormeter. Total nitrogen and phosphorus in the soil were determined by K.E. Ginzburg, E.M. Sheglova and V.V. Wilfius, and total potassium by Smith methods.

The economic efficiency of growing peas was calculated according to the methodology of determining the economic efficiency of the results of scientific research in agriculture. The costs of growing one hectare of peas were determined according to the regulations, prices, and grain purchase prices adopted in the republic.

### 3 Results and discussion

The growth, development and productivity of the pea plant are closely related to external environmental factors. Therefore, it is important to ensure sufficient external environmental factors in the cultivation of peas and the selection of varieties. Due to changes in external environmental factors, changes in the number of pods, the number of grains in a pod, and the mass of 1000 grains were determined in the experiments [7].

Taking into account that the pea crop is resistant to drought, as well as cold and diseases, we conducted scientific research on the problems of growing pea as the main crop in dry lands. In this regard, we present the results of scientific research and their analysis in the direction of the impact of spring planting dates on plant productivity of pea varieties under dry conditions.

With a delay in the planting period of peas, the plant height, the number of pods and the number of seeds in it, and the decrease in productivity were observed.

In the experiment conducted on the effect of planting period and scheme on the growth, development and yield of peas, the difference between the planting period and schemes was significant, and if the seedlings were densely placed in the row according to the planting methods, the plant was mobile in relation to the light, and the highest growth rate was observed on February 20 according to the planting dates.

The highest number of pods and the number of seeds per plant were observed in the early planting period (February 20) in the 60x15 cm scheme, where the number of pods per plant was 53.4; 59.9 and 65.8; 70 seeds in Lazzat and Malhatro, respectively, according to the average varieties. was formed, and in the seed sown in the late period (April 1) in the scheme of 60x15 cm, these indicators were on average 47.6; 55.9 and 57.9; 63.9 pieces, respectively, according to the varieties (Table 1).

When peas were sown early, the number of single-seeded pods was less than when sown late. Late seeding increased the number of broken and damaged pods and reduced the number of two- and three-seeded pods. For example, if the number of double-seeded pods in plants planted on February 20 was on average 23.9 units, three-seeded pods averaged 1.2 units, these indicators were 19.1 units and 1.0 units, respectively, in peas planted on April 1, or compared to those planted early It was noted that 4.8 units were less.

It is known that since the number of seeds in legumes is one, two and more, the number of grains in them is slightly more than the number of pods. The number of seeds also increased in the planting time and scheme options with a large number of pods. The most one-seeded pods planting scheme is 60x6 cm in the 1.04 term option, which is 52.0 in accordance with the Lazzat and Malhotra varieties; 52.1 seeds minimum planting 60x18 cm schemes were in the period of 1.04 and amounted to 47.2 and 47.4 units (Table 2).

It was observed in our experiment that the number of pods of a pea plant and the number of seeds in each pod were affected by the planting period of different widths of rows and spacing of seedlings. In all three periods, the number of monocotyledons decreased as the number of seedlings decreased in different planting schemes. If we take the average of the three-year data, in the period of 20.02, in the variant with a planting pattern of 60x6 cm, it is 51.2 in accordance with the Lazzat and Malhotra varieties; 51.4 units; 47.5 in the scheme of 60x15 cm; It was noted that 47.8 pods produced one seed. In these options, the number of two-seeded pods is 39.0 in the option with a planting pattern of 60x6 cm; if it was 39.1 pieces, in the scheme of 60x9 cm this indicator is 40.3; 40.2; 42.2 in the scheme of 60x15 cm; It was

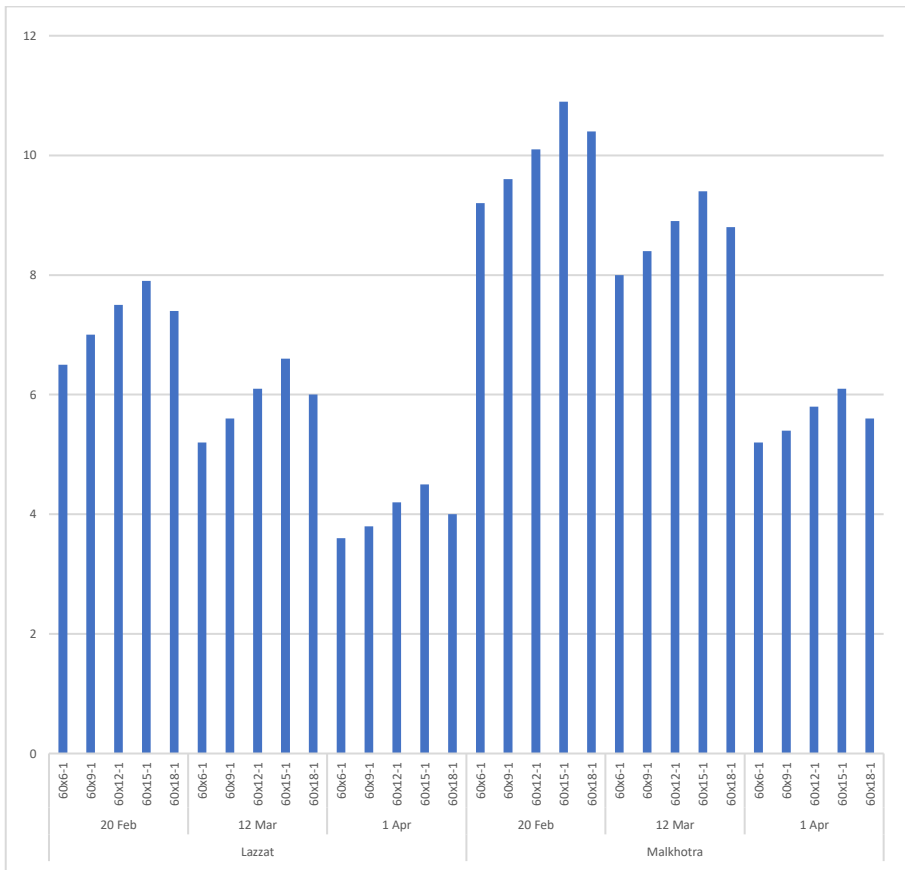
found that there were 42.3 units. The same legal parameters are 60x6 cm in the period of 12.03 and 1.04; 60x9cm; 60x12cm; Also observed in 60x15cm and 60x18cm layout options. The weight of three-grain powder and infected pods was almost the same in all variants. Counting the number of grains in 100 pods showed that the weight of three-grain pods increased and the weight of damaged pods decreased as the thickness of the bush per unit area decreased in all studied row spacings.

**Table 1.** New update times, formation of working elements depending on the scheme, 2015-2017

Planting period	Planting scheme	Lazzat		Malkhotra	
		In one plant number of pods, pcs.	In one plant number of grains, pcs	In one plant number of pods, pcs.	In one plant number of grains, pcs
20.02	60x6cm	40,1	50,6	46,1	57,2
	60x9cm	43,4	54,8	49,2	60,4
	60x12cm	47,1	57,4	53,4	64,1
	60x15cm	53,4	65,8	59,9	70,0
12.03	60x18cm	53,3	65,7	59,7	69,2
	60x6cm	37,2	47,2	43,4	54,4
	60x9cm	40,4	50,4	46,2	57,2
	60x12cm	44,3	55,2	50,4	61,8
	60x15cm	50,7	59,8	57,1	65,9
1.04	60x18cm	50,7	60,0	56,9	65,7
	60x6cm	35,2	44,1	41,2	51,3
	60x9cm	39,3	47,6	45,2	56,4
	60x12cm	41,6	52,8	47,6	58,2
	60x15cm	47,6	57,9	55,9	63,9
60x18cm	47,6	57,8	55,8	63,6	

**Table 2.** Effect of planting time and scheme on the number of seeds contained in pea pods (average of 3 years) 100 compared to legumes, 2015-2017.

Planting period	Planting scheme	Lazzat					Malkhotra				
		Single-seeded beans	Two-seeded beans	Three-seeded beans	Empty beans	Damaged beans	Single-seeded beans	Two-seeded beans	Three-seeded beans	Empty beans	Damaged beans
20.02	60x6cm	51,2	39,0	4,9	2,3	2,6	51,4	39,1	5	2,1	2,4
	60x9cm	49,9	40,3	5,3	2,1	2,4	50,4	40,2	5,2	2,0	2,2
	60x12cm	49,0	40,9	6,1	1,8	2,2	49,3	41,0	6,0	1,7	2,0
	60x15cm	47,5	42,2	6,6	1,7	2,0	47,8	42,3	6,5	1,6	1,8
	60x18cm	46,9	43,1	7,0	1,3	1,7	47,1	43,2	6,9	1,4	1,6
12.03	60x6cm	51,7	39,1	3,4	2,2	3,6	52,0	39,2	3,3	2,1	3,4
	60x9cm	51,6	39,5	3,5	2,0	3,4	51,9	39,6	3,4	1,9	3,2
	60x12cm	50,7	40,7	3,6	1,8	3,2	51,5	40,8	3,0	1,7	3,0
	60x15cm	50,5	41,2	3,7	1,6	3,0	50,8	41,3	3,6	1,5	2,8
	60x18cm	49,2	42,8	3,8	1,4	2,8	49,5	42,9	3,7	1,3	2,6
1.04	60x6cm	52,0	38,2	3,0	2,7	4,1	52,1	38,3	3,1	2,6	3,9
	60x9cm	51,0	38,4	4,3	2,4	3,9	51,1	38,5	4,4	2,3	3,7
	60x12cm	49,5	39,6	5,1	2,1	3,7	49,8	39,5	5,2	2,0	3,5
	60x15cm	49,1	39,8	5,6	2,0	3,5	49,5	39,6	5,7	1,9	3,3
	60x18cm	47,2	41,7	6,1	1,7	3,3	49,4	39,7	6,2	1,6	3,1



**Fig. 1.** Chickpea varieties of planting periods and schemes impact on productivity.

As for its productivity, one can see the same pattern, that is, when the Lazzat and Malhatro varieties of peas are planted in different planting schemes during the February 20 planting period, the high yield is 7.9 per hectare, when planted in a 60x15cm scheme, according to the varieties; 10.9 ts, and 6.6 per hectare during the March 12 planting period; 9.4 ts.ni and 6.1 when planted on April 1; It was 4.5 ts. It was noted that when sowing in the early period of February 20, the yield of pea grain is 3.4-4.8 tons per hectare more than in the late period (April 1). When the experiment was analyzed by years, it had a higher result in 2017 than in 2015-2016. In this case, the climate conditions in 2017, that is, the amount of precipitation is high, the amount of precipitation in the months of February, March, March, May is 204.2 mm, this indicator was 173 mm in 2015 and 76.7 mm in 2016, that is, compared to 2017 It can be explained by the low amount of rainfall in the years 31.2-127.5 mm.

In our experiments, in the region of dry farming in the Kir-adir region, when we planted Lazzat and Malhotra varieties of peas on February 20, when we increased the planting scheme from 60x6 cm to 60x15 cm, the yield was 7.9 according to the varieties; It was 10.9 tons, or the grain yield was 1.4 and 1.7 tons per hectare depending on the varieties. increased. Increasing the planting pattern to 60x18 cm in both cultivars did not show a significant difference in grain yield. With the delay in planting, the grain yield also decreased. In our opinion, there is a lack of moisture and nutrients in the soil when the planting scheme is thickened, that is, when the number of bushes is increased, and when the planting scheme is thinned, when the number of bushes is reduced, grain and crop elements decrease.

## 4 Conclusions

According to the results of the research, it can be concluded that in the region of dry farming, the grain yield structure and yield indicators of Lazzat and Malhotra varieties of peas were observed when planted in the early spring 20.02 60x15x1 scheme, that is, the elements of the grain yield structure are the number of pods and grains per plant compared to the control option 60x6x1 scheme. ; increased to 15 pieces. The optimal planting date is 7.9 per 60x15 cm per hectare in the planting scheme on February 20; 10.9 tons/ha yield was found.

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