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The Influence of Sowing Dates and Schemes on the Formation of Yield Attributes of Chickpea Varieties in the Rainfed Area of the Southern Region of Uzbekistan

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Annotation: Chickpea is an important source of protein for millions of people in the developing countries, particularly in South Asia, who are largely vegetarian either by choice or because of economic reasons. Seed is the main edible part of the plant and is a rich source of protein, carbohydrates and minerals especially for the vegetarian population. The current study aimed to investigate the effects of chickpea sowing dates and schemes on yield attributes of chickpea. The objects of study were the local chickpea varieties such as "Obod", "Malhotra" and "Jahongir". In the conditions of rainfed area, the highest yield elements of chickpea varieties were recorded in the February 1st sowing date, especially in the 60×12-1 planting system.

Keywords: chickpea, sowing dates, plant density, scheme, effect, variety, rainfed area, productivity, bush, gramm, grain.

INTRODUCTION

Chickpea is an important source of protein for millions of people in the developing countries, particularly in South Asia, who are largely vegetarian either by choice or because of economic reasons [3; 7]. In addition to having high protein content (20-22%), chickpea is rich in fiber, minerals (phosphorus, calcium, magnesium, iron and zinc) and β-carotene. Its lipid fraction is high in unsaturated fatty acids. Chickpea plays a signify can't role in improving soil fertility by fixing the atmospheric nitrogen [6;10]. Chickpea meets 80% of its nitrogen (N) requirement

from symbiotic nitrogen fixation and can fix up to 140 kg N ha-1 from air. It leaves substantial amount of residual nitrogen for subsequent crops and adds plenty of organic matter to maintain and improve soil health and fertility. Because of its deep tap root system, chickpea can withstand drought conditions by extracting water from deeper layers in the soil profile [11].

Self-pollinated crop, chickpea (Cicer arietinum L.) is one of the most important legume crop belongs to the family Leguminoceae having true diploid (2n= 2x= 16) of 738 Mbp genome size [13]. Chickpea is known by different names in India viz. Channa or Gram or Bengal gram or Chani in Haryana, Rajasthan, Uttarakhand, Uttar Pradesh, Bihar, Madhya Pradesh, Chattishgarh, Jharkhand etc, Boot (Orrissa), Chole (West Bengal), Chole (Punjab), Harbar (Maharashtra), Kadale (Karnataka), Kadalai (Tamil Nadu), Kadala (Kerala) and Sanagulu (Andhra Pradesh) [12].

A crop grown for seed production requires extra efforts and investments than a crop grown for grain. While taking up seed production, high priority should be given to maintenance of genetic and physical purity of the seed [18]. Chickpea is grown in rabi (postrainy season) following a kharif (rainy season) crop or kharif fallow. The sowing is done in the month of October or November. Late sowing (December-January) should be avoided as the late-sown crop may experience moisture stress and high temperatures at the critical stage of pod-filling, leading to reduced yield and seed quality [15]. Isolation of a seed crop is done by maintaining a distance from other nearby fi elds of the same crop and other contaminating crops. Chickpea being a self-fertilized crop has a very low outcrossing percentage (0-1%). In India, an isolation distance of 10 m for foundation seed and 5 m for certify ed seed is required [20]. Chickpea can be successfully grown in a variety of soil types including coarse-textured sandy to fi ne-textured deep black soils vertisoils). However, the best suited soils are deep loams or silty clay loams with a pH ranging from 6.0 to 8.0. Saline soil and fi elds with a high-water table are not suitable for chickpea. Fertilizer requirements depend on the nutrient status of the fi eld, and thus, vary from fi eld to fi eld. Therefore, the doses of fertilizers should be determined based on the results of soil test. The generally recommended doses for chickpea include 20-30 kg nitrogen (N) and 40-60 kg phosphorus (P) ha-1. If soils are low in potassium (K), an application of 17 to 25 kg K ha-1 is recommended. There will be no response to application of K in soils with high levels of available K. Total quantities of N, P and K should be given as a basal dose. Foliar spray of 2% urea at flowering has been found beneficial in rainfed crops.

Chickpea is generally grown as a rainfed crop, but two irrigations, one each at branching and pod filling stages, are recommended for higher yield. Higher number of irrigations may lead to excessive vegetative growth in heavy soils [19]. Weed management: Chickpea is a poor competitor with weeds at all stages of growth. Pre-emergence herbicides, such as Fluchloralin @ 1 kg a.i. ha-1 or Pendimethalin @ 1.0 to 1.5 kg a.i. ha-1 were found effective in controlling early flush of weeds. Mechanical and/or manual weeding can be done where wide row spacing is used.

It is one of the most essential legume food plants in sustainable agriculture system due to its low production cost, wider adaptation, ability to fix atmospheric nitrogen which fits in various crop rotations and existence prolific tap root system [14; 1053-1058-Pp]. Chickpea play significant role in maintaining the fertility of soil by fixing nitrogen up to 140 kg ha-¹ per year [4;490-509-Pp]. The yield index of crops is a very complex quantitative characteristic, and is one of the main indicators in the evaluation, selection of varieties and the development of agrotechnical measures [2;11]. Its complexity is explained by its dependence on soil fertility, sowing rate, timing, water and nutrient regime, as well as the biological characteristics of varieties. One of these factors is sowing date, sowing rate and amount of nutrition [5;16]. Chickpea varieties are divided into 5 groups based on 1000 seed weight: very small (<50 g), small (50-150 g), medium (151-250 g), large (251-350 g) and very large (>350 g). Planting large seeds within these groups has a significant impact on yield and crop quality [1; 9; 17].

SOIL AND CLIMATIC CONDITIONS OF THE EXPERIMENTAL AREA

Since the experimental area is located in the middle zone of the Kamashi district of the Kashkadarya region, the soil and climatic conditions of the region are close to average. However, the influence of precipitation, temperature, and winds leads to certain changes in the growth, development, and productivity of crops grown in the region. Such cases occur more often in loamy soils. That is why the data obtained in our experiments differ sharply from year to year. The area where the experiment was conducted belongs to the foothill loamy soil region of the region, and the soil is light gray soil. The area of light gray soils in the Kashkadarya region is 548,000 hectares. These soils are widespread in the vicinity of the Kashkadarya River, in the plains and foothills. The soil-forming rocks are loess, diluvial and proluvial. The humus content in such soils is very low (0.8-1.4%), highly carbonate, medium and light loamy.

The amount of mobile phosphorus and exchangeable potassium is also insufficient. The experimental site is 500-750 meters above sea level, and is not saline, as it is located 150-200 meters above the plains. Since the experimental region consists of loamy lands, there was no significant change in the soil structure during farming. However, as a result of the systematic development of farming on such lands, the biomass in the arable layer of the soil increases, increasing the efficiency of farming. Because as organic matter in the soil increases, its water-physical properties also improve. Light gray soils have been studied very little, and the studies that have been conducted are mainly geographical in nature.

RESEARCH METHODS AND TECHNIQUES

Field experiments were conducted in the foothills of the Kashkadarya region in the fertile soil-climatic conditions. The experiment consisted of 27 variants and was arranged in 3 replications.

The width of the furrow in the experimental field is 60 cm. The experiment was conducted for 3 years (barley-pea crops) in a short rotation crop rotation system. The varieties of peas included in the State Register of "Obod", "Malhotra" and "Jahongir" were planted in the experiment. Agrotechnical measures were carried out in accordance with the dissertation work program and based on the recommended methods.

RESULTS AND DISCUSSION

In a 3-year field experiment, the effect of planting dates and planting schemes on yield elements of chickpea varieties was clearly evident in 2020. The best results were recorded in variants planted in February and placed in a 60×12-1 scheme.

It was observed that the indicators of the “Obod” variety planted on February 1, 2020 varied depending on the planting systems. According to the weight of 1000 grains, the 1st option planted in the 60×6-1 planting system yielded 354.8 g, the 2nd option planted in the 60×9-1 planting system yielded 357.1 g, and the 3rd option planted in the 60×12-1 system yielded the highest result of 359.5 g. The yield of 1 bush was 7.32 g; 11.88 g; 12.87 g according to the sequence of variants. The number of grains in 1 bush was also observed to increase accordingly, by 20.0 grains, 32.5 grains, and 35.2 grains.

In the "Malhotra" variety, the numbers are in the same order, but the indicators are slightly higher: the weight of 1000 grains in the 4th variant planted with the 60×6-1 planting system is 346.6 g, in the 5th variant planted with the 60×9-1 planting system it is 348.2 g, and in the 6th variant planted with the 60×12-1 planting system it is 350.3 g. The highest value in terms of productivity per plant was recorded in the 6th variant planted in the 60×12-1 planting system, which was 13.81 g, which was 0.94 g higher than the “Obod” variety. In terms of the number of grains per plant, the “Malhotra” variety in the 6th variant planted in the 60×12-1 planting system was 37.7 grains, which was an increase of 2.5 grains compared to the standard “Obod” variety.

In the "Jahongir" variety, the 1000-grain weight was between 322.7 g, 325.3 g, and 327.4 g in variants 7, 8, and 9, respectively, and the plant yield per bush was also 6.76 g, 10.93 g, and 12.15

g, respectively, depending on the planting system. The number of grains per bush was 18.5 grains in the 7th variant planted in the 60×6-1 planting system, 29.9 grains in the 8th variant planted in the 60×9-1 planting system, and 33.2 grains in the 9th variant planted in the 60×12-1 planting system.

Table-1. The influence of planting dates and schemes on the formation of yield elements of chickpea varieties in the conditions of rainfed area, (2020 year)

№	Varieties	Planting schemes	Weight of 1000 grains, grams	Productivity of 1 bush, grams	Number of grains per plant, grain/unit
01 February					
1	Obod (St)	60x6-1	354,8	7,32	20,0
2		60x9-1	357,1	11,88	32,5
3		60x12-1	359,5	12,87	35,2
4	Malxotra	60x6-1	346,6	7,79	21,3
5		60x9-1	348,2	12,39	33,9
6		60x12-1	350,3	13,81	37,7
7	Jahongir	60x6-1	322,7	6,76	18,5
8		60x9-1	325,3	10,93	29,9
9		60x12-1	327,4	12,15	33,2
15 February					
10	Obod (St)	60x6-1	357,5	7,75	21,2
11		60x9-1	360,2	12,51	34,2
12		60x12-1	361,7	14,52	39,7
13	Malxotra	60x6-1	348,3	8,43	23,1
14		60x9-1	351,6	13,71	37,5
15		60x12-1	352,8	16,03	43,8
16	Jahongir	60x6-1	324,7	7,36	20,1
17		60x9-1	327,2	11,62	31,8
18		60x12-1	329,4	13,43	36,7
01 March					
19	Obod (St)	60x6-1	352,7	5,66	15,5
20		60x9-1	354,3	9,16	25,1
21		60x12-1	356,6	10,52	28,8
22	Malxotra	60x6-1	344,7	6,14	16,8
23		60x9-1	347,4	9,92	27,1
24		60x12-1	349,5	11,61	31,7
25	Jahongir	60x6-1	321,4	6,55	17,9
26		60x9-1	324,7	8,72	23,8
27		60x12-1	326,5	10,87	29,7

In the "Jahongir" variety, the 1000-grain weight was between 322.7 g, 325.3 g, and 327.4 g in variants 7, 8, and 9, respectively, and the plant yield per bush was also 6.76 g, 10.93 g, and 12.15 g, respectively, depending on the planting system. The number of grains per bush was 18.5 grains in the 7th variant planted in the 60×6-1 planting system, 29.9 grains in the 8th variant planted in the 60×9-1 planting system, and 33.2 grains in the 9th variant planted in the 60×12-1 planting system.

When the sowing date was February 15, a slight increase in grain mass was observed in the “Obod” (St) variety compared to the results from February 1: variant 10 - 357.5 g, variant 11 - 360.2 g, variant 12 - 361.7 g. The productivity of 1 bush and the number of grains decreased

slightly compared to the February 1 sowing: variant 10 - 7.78 g and 21.2 grains, variant 11 - 12.51 g and 34.2 grains, variant 12 - 14.52 g and 39.7 grains. In the 13th variant of the "Malhotra" variety planted in the 60×6-1 planting system, the weight of 1000 grains was 348.3 g, the productivity of 1 bush was 8.43 g, and the number of grains in 1 bush was 23.1. In the 14th variant planted in the 60×9-1 planting system, the weight of 1000 grains was 351.6 g, the productivity of 1 bush was 37.5 g, and the number of grains in 1 bush was 23.1. In the 15th variant planted in the 60×12-1 planting system, the weight of 1000 grains was 352.8 g, the productivity of 1 bush was 16.03 g, and the number of grains in 1 bush was 43.8. In the "Jahongir" variety, it was determined that in the same period, the weight of 1000 grains in the 16th, 17th, and 18th variants of the planting system sequence was 324.7 g, 327.2 g, 329.4 g, the productivity of 1 bush was 7.36 g, 11.62 g, 13.43 g, and the number of grains in 1 bush was 20.1 bush/plant, 31.8 bush/plant, and 36.7 bush/plant.

On March 1, the 19th variant of the "Obod" variety planted in the 60x6-1 planting system produced a 1000-grain weight of 352.7 g, a plant yield of 5.66 g, and the number of grains in 1 plant was 15.5 plants/plant, the 20th variant planted in the 60x9-1 planting system produced a 1000-grain weight of 354.3 g, a plant yield of 9.16 g, and the number of grains in 1 plant was 25.1 plants/plant, and the 21st variant planted in the 60x12-1 planting system produced a 1000-grain weight of 356.6 g, a plant yield of 1052 g, and the number of grains in 1 plant was 28.8 plants/plant.

A significant decrease was observed in the "Malhotra" variety in March. In the 22nd, 23rd, and 24th variants of the planting system sequence, the 1000-grain weight was 344.7 g, 347.4 g, 349.5 g, the productivity of 1 bush was 6.14 g, 9.92 g, 11.61 g, the number of grains in 1 bush was 23.1 bush/plant, 37.5 bush/plant, and 43.8 bush/plant. In the "Jahongir" variety, the 1000-grain mass of the 25th, 26th, and 27th variants planted in March was 321.4 g, 324.7 g, and 326.5 g, and the productivity of 1 plant was 6.55 g, 8.72 g, and 10.87 g, and the number of grains in 1 plant was 17.9 plants/plant, 23.8 plants/plant, and 29.7 plants/plant.

According to the results of a 3-year study, the "Obod" (St) variety, planted in the 60×6-1 planting system with a planting date of February 1, option 1, yielded a 1000-grain weight of 345.1 g, a plant yield of 5.59 g, and a number of grains per plant of 15.32. In option 2, when planted in the 60×9-1 planting system, the weight of 1000 grains was 347.3 g, the yield of 1 plant was 9.39 g, and the number of grains in 1 plant was 25.73. In variant 3, planted in the 60×12-1 planting system, the weight of 1000 grains was 348.8 g, the productivity of 1 bush was 9.83 g, and the number of grains in 1 bush was 26.94 grains. In variant 4, planted in the 60×6-1 planting system, the weight of 1000 grains was 337.4 g, the productivity of 1 bush was 5.99 g, and the number of grains in 1 bush was 16.45 grains. This (St) was slightly higher than the "Obod" variety, but the yield was lower. In option 5, when the "Malhotra" variety was planted in the 60×9-1 planting system, (St) was slightly higher than the "Obod" variety, with a 1000-grain weight of 340.1 g, a plant yield of 10.22 g, and a number of grains in 1 plant of 27.96. The highest grain number and productivity in the experiment were observed in the "Malhotra" variety in the 60×12-1 planting system, that is, the weight of 1000 grains was 342.9 g, the productivity of 1 bush was 11.09 g, and the number of grains in 1 bush was 30.37.

Table-2. The influence of planting dates and schemes on the formation of yield elements of chickpea varieties in the conditions of rainfed area, (3 year average data)

№	Varieties	Planting schemes	Weight of 1000 grains, grams	Productivity of 1 bush, grams	Number of grains per plant, grain/unit
01 February					
1	Obod (St)	60x6-1	345,1	5,59	15,3
2		60x9-1	347,3	9,39	25,7

3		60x12-1	348,8	9,83	26,9
4	Malxotra	60x6-1	337,4	5,99	16,4
5		60x9-1	340,1	10,22	27,9
6		60x12-1	342,9	11,09	30,3
7	Jahongir	60x6-1	318,1	5,05	13,8
8		60x9-1	320,5	8,50	23,2
9		60x12-1	322,8	9,30	25,4
15 February					
10	Obod (St)	60x6-1	347,2	5,29	14,5
11		60x9-1	349,7	8,88	24,3
12		60x12-1	351,1	9,68	26,5
13	Malxotra	60x6-1	339,1	5,77	15,8
14		60x9-1	342,0	9,58	26,2
15		60x12-1	344,4	10,37	28,4
16	Jahongir	60x6-1	320,6	5,52	15,1
17		60x9-1	322,6	8,13	22,2
18		60x12-1	324,9	9,35	25,6
01 March					
19	Obod (St)	60x6-1	343,3	3,78	10,3
20		60x9-1	345,1	6,27	17,2
21		60x12-1	347,2	6,66	18,2
22	Malxotra	60x6-1	338,0	4,12	11,3
23		60x9-1	339,5	6,65	18,2
24		60x12-1	341,1	7,34	20,1
25	Jahongir	60x6-1	316,8	4,80	13,1
26		60x9-1	319,2	6,48	17,7
27		60x12-1	320,5	7,80	21,3

The "Jahongir" variety, planted on February 1, had lower results than the other two varieties in all three planting systems, namely, in the 7th variant planted in the 60×6-1 planting system, it was 318.1 g - 5.05 g - 13.88 pieces; in the 8th variant planted in the 60×9-1 planting system, it was 320.5 g - 8.50 g - 23.29 pieces; in the 9th variant planted in the 60×12-1 planting system, it was 322.8 g - 9.30 g - 25.41 pieces.

In the “Obod” (St) variety planted on February 15, the 10th variant planted in the 60×6-1 planting system had a 1000-grain weight of 347.2 g, a plant yield of 5.29 g, and a number of grains per plant of 14.51 pieces. In the 11th variant “Obod” (St) variety planted in the 60×9-1 planting system, the result was 349.7 g - 8.88 g - 24.31 pieces; in the 12th variant planted in the 60×12-1 planting system, the result was 351.1 g - 9.68 g - 26.51 pieces.

In the 13th variant of the “Malhotra” variety planted in the 60×6-1 planting system, the weight of 1000 grains was 339.1 g, the productivity of 1 bush was 5.77 g, and the productivity of 1 bush was 15.81 units; in the 14th variant planted in the 60×9-1 planting system, the weight of 1000 grains was 342.0 g, the productivity of 1 bush was 9.58 g, and the productivity of 1 bush was 26.21 units; in the 60×12-1, the weight of 1000 grains was 344.4 g, the productivity of 1 bush was 10.37 g, and the productivity of 1 bush was 28.4 units, which was slightly higher than the “Obod” (St) variety.

In the “Jahongir” variety, the 1000-grain weight in the 16th variant planted in the 60×6-1 planting system was 320.6 g – 5.52 g – 15.11 units; in the 17th variant planted in the 60×9-1 planting system, it was 322.6 g – 8.13 g – 22.21 units; in the 18th variant planted in the 60×12-1 planting system, it was 324.9 g – 9.35 g – 25.60 units.

In the 19th variant of the “Obod” variety, planted on March 1, the yield elements decreased minimally among the variants planted during this period, amounting to 343.3 g - 3.78 g - 10.3 units. In the 20th variant, planted in the 60×9-1 planting system, the yield elements amounted to 345.1 g - 6.27 g - 17.2 units. When planted in the 60×12-1 planting system, the results increased slightly and amounted to 347.2 g - 6.66 g - 18.2 units. In the same period, the yield elements of the “Malhotra” variety sown in the 60×6-1 planting system were 338.0 g – 4.12 g – 11.3 units; in the 60×9-1 planting system, 339.5 g – 6.65 g – 18.2 units; in the 60×12-1 planting system, 341.1 g – 7.34 g – 20.1 units.

CONCLUSION

In the “Jahongir” variety planted in this period, the yield elements indicators in all 3 planting systems showed a significant decrease compared to the period on February 1. That is, in the 60×6-1 planting system, 316.8 g – 4.80 g – 13.1 units; in the 60×9-1 planting system, 319.2 g – 6.48 g – 17.7 units; 60×12-1 was 320.5 g – 7.80 g – 21.3 grains.

In the conditions of rainfed area, the highest yield elements of chickpea varieties were recorded in the February 1 planting, especially in the 60×12-1 planting system. High results were observed in the 60×12-1 planting system of the "Malhotra" variety in all periods.

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