THE INFLUENCE OF DURATION AND DEPTH ON THE NUMBER AND WEIGHT OF NODULES IN THE ROOTS OF CHICKPEA VARIETIES

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Abstract.

In the article, the fact that due to the incorrect application of mineral fertilizers to the land, the sudden change of organic matter in the soil composition, the annual decrease in the amount of humus, the violation of the biological balance in the soil, and, as a result, the decrease in soil fertility, resulting in the deterioration of the biological and physical-chemical properties of the soil of irrigated lands. It is explained in detail that the increase of harmful bacterial and fungal disease-causing microorganisms leads to a decrease in the productivity of crops.

Based on this, the task of our research is to find out the effect of autumn planting dates and depth on the number and mass of nodules formed in the roots of chickpea varieties on irrigated land, as well as their effect on soil fertility, and introduce them to production. The article presents the research materials and methods, the results of the research, and the results of the number and mass of the nodules formed in the root during the budding, flowering, and podding phases of the chickpea varieties planted at different times and depths in autumn. According to the results of the research, it was determined that the amount of nitrogen in the form of ammonium and nitrogen in the form of nitrate is preserved in the soil under the influence of the chickpea crop, and the reason for the improvement of the nitrogen regime of the soil under the influence of the chickpea crop is the large amount of protein and nitrogen in the residues of this crop. it has been proven to change in a positive direction. It is emphasized that after chickpeas, the soil nutrition regime will be improved and more alternative conditions will be created for the nutrition, growth, and development of the following crops.

KEYWORDS: chickpea, soil fertility, nodule bacterium, bio-nitrogen, active strain.

1. Introduction

Currently, as a result of the incorrect application of mineral fertilizers to the ground, there is a sharp change in the composition of organic matter, a decrease in the amount of humus from year to year, a violation of the biological balance in the

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soil, and as a result, a decrease in soil fertility. This causes serious problems in the development of agriculture today [1].

It is time to develop a farming system aimed at enriching with organic matter while maintaining and increasing soil fertility.

Today, the area of chickpea cultivation in the world is 14,573 thousand hectares, which has increased by 3.3% compared to 2007 [1]. The main countries producing chickpeas are India, Australia, Pakistan, Argentina, African countries, and Mexico. India is the leader in the production of chickpeas (10,984 thousand tons), and its share is 73%. The second place is occupied by Australia (661 thousand tons) and the third place by Pakistan (601 thousand tons). Currently, the yield of chickpeas is 10 ts/ha, which has increased by 2.2% compared to 2007.

Currently, in various major scientific and research centers of the world, great attention is being paid to creating varieties of chickpeas resistant to extreme conditions, studying the morpho-physiological 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, increasing their productivity by enriching the soil with biological nitrogen, allowing them to save organic and mineral fertilizers, deepening the research related to the biological properties of the crop, the reaction of the varieties to the hydrothermal factors of the area, and photosynthetic activity in solving these problems are considered urgent issues.

Beneficial bacteria living in the roots of leguminous crops accumulate biological nitrogen, and they improve the amount of organic matter in the soil, and water-physical properties of the soil, and increase soil fertility. Nitrogen collected by leguminous crops is biological nitrogen, which allows the prevention of the accumulation of nitrates in plant products, the growth of harmful microflora that quickly decomposes organic substances in the soil, and the growth of clean products [4; 6, 7, 8].

The chickpea plant, like other leguminous crops, has the property of absorbing nitrogen from the air and synthesizing protein compounds. The assimilation of nitrogen in the air is carried out with the participation of nodule bacteria (Rhizobium cicer) located in the nodules of the chickpea root system [5, 7].

Different from other groups of crops, leguminous crops can fix atmospheric nitrogen and assimilate difficult-to-assimilate phosphorus compounds in the soil by living a symbiotic life with bacteria. Chickpeas are included in the list of the best predecessors in planting.

Fungal bacteria living in chickpea roots accumulate biological nitrogen, and they improve the amount of organic matter in the soil, and water-physical properties of the soil, and increase soil fertility. Nitrogen accumulated in chickpea roots is biological nitrogen, which allows preventing the accumulation of nitrates in plant products, the growth of harmful microflora that quickly decomposes organic substances in the soil, and the growth of clean products [2].

Based on these issues, studying the agrochemical properties of the soil, its changes under the influence of the chickpea plant, and the effect of these changes on the chickpea plant are among the urgent problems in our research.

2. MATERIALS AND METHODS

2.1. Research area.

Ishtikhon district is one of the southern districts of the Samarkand region. Compared to other districts of the region, the weather conditions are hot and dry, and have a low amount of precipitation. Since the farms of the district are located in the flat region of the region, the temperature of the air is warm for a long time, and early spring and late winter are observed. In the soil and climatic conditions of this district, it is possible to harvest 2 times a year from some field crops of potatoes, vegetables, and oilseed crops, and it is proven in practice. Also, the representatives of leguminous crops, the quick-cooking varieties of mung beans, soybeans, and chickpea nuts are being grown as chickpea crops on the land that has been cleared from the previous grain crops (stubble land).

2.2. Experiment design.

Field experiments were conducted at the Samarkand Research Institute of Cereals and Legumes Scientific Research Station in 2018-2020. The soil of the field is irrigated grass -gray soil, medium loam according to its mechanical composition.

The agrochemical description of the soils of the experimental field is as follows: the amount of humus in the plowed (0-30 cm) and under-plowed (30-60 cm) layers is 1.20; 0.74%, total nitrogen 0.080; 0.068; phosphorus 0.190; 0.093 and potassium 2.1; It was determined to be 1.6%.

The volume mass of the driving layer is 1.31-1.34 g-cm ^{3}, the porosity is 30-35%. The amount of humus in the soil is 1.3%.

The soil of the place where the experiments were conducted, the parent rock that forms the grassy-gray soil, mainly consists of loess and alluvial deposits, and high carbonation is found, therefore, it was determined that the water absorption medium of the soil is neutral and weakly alkaline (pH) 7.2. Underlying these deposits are layers of gravel, sand, and silt. Sizot water level (2.0 - 3.05 m), fresh. Hydromorphic soils are distributed in this region, and meadow-gray soils with frequent agro-irrigation are distributed in irrigated and old irrigated soil layers.

Experiments were carried out in the following system to study the effectiveness of the combination of autumn planting dates and planting depths on the growth, development, and grain yield of chickpeas.

2.3. Chickpea varieties and scheme.

In the experiment, the Yulduz, Uzbek-32, and Lazzat varieties of chickpeas were planted in the fall on November 20, November 30, and December 10 at a depth of 3-5 cm, 6-9 cm, and 10-12 cm using 270,000 viable seeds per hectare of land and the planting depth was studied. According to the requirements of the I-

class seed standard, seeds with fertility of not less than 95%, moisture content not higher than 14%, and seed purity of 100% were used for the seed to be planted.

The area of the experimental field was 60 m ^{2} (length 25 m, width 2.4 m), and it was carried out in four iterations.

In the experiment, in the planting scheme of chickpeas, the row spacing of 60 см was made and the seedling spacing in the row was made. 6 смChickpea seeds were planted in the soil in autumn on November 20, November 30, and December 10 at a depth of 3-5 cm, 6-9 cm, and 10-12 cm. Before experimenting, the land 30 смwas plowed to a depth of 25. Before the experiment, the plowed land was plowed to prevent moisture from flying away, and before planting, the land was smoothed and divided into plots.

Chickpea care in the experiments was carried out based on agrotechnologies adopted for this region.

Lazzat, Yulduz, and Uzbekiston-32 varieties of field chickpeas were used in the experiment.

All observation, measurement, calculation, and analysis in field experiments were carried out based on generally accepted methods and recommendations [3].

Field experiments were arranged with 4 returns, the size of the considered plots was 60 m ^{2}, 2 tiers.

The statistical analysis of the results obtained in the field experiments was calculated using the WinQSB-2.0 and Microsoft Excel programs according to the B.A. Dospekhov method [2].

2.4. The agrochemical and agrophysical properties of the soils of the experimental field were investigated in the following ways:

- the amount of humus in the soil according to the method of I.V. Tyurin, total NPK amounts according to the improved methods of I.M. Maltseva and L.P. Gritsenko, mobile forms of nutrients in the soil - nitrogen in the form of nitrate - according to the Grandwald-Lyaju method, mobile phosphorus. The volume mass and porosity of the soil were determined by the method of N.A. Kachinsky used cylinders from the 0-30 cm layer of the soil of the experimental field using the method of Machigin, the exchangeable potassium P.V. Protasov method;

“Methods of agrochemical analyzes of soils and plants in Central Asia”, “Methods of the agrochemical, agrophysical, microbiological research in irrigated cotton areas”, and “Methods of conducting field experiments” were used in the agrochemical and agrophysical analysis of soil samples.

Leaf level, crop photosynthetic potential (EFP), and net photosynthesis productivity (FSM) were determined according to the method of A.A. Nichiparovich.

To study the growth and development of peas, the following phenological observations and biometric measurements were carried out:

- the laboratory fertility of seeds was determined by Interstate standard 12037. in 4 returns of 50 seeds;

- the field germination of seeds, the number of stems (twice during the growing

period, i.e. at the beginning and the end of the growing period in all options in the 1st and 3rd repetitions) were determined;

All observations in the field experiment were carried out at odd returns.

2.5. The following main development phases of peas have been identified:

1. Germination;
2. Budding;
3. Flowering;
4. Formation of pods;
5. Ripening.

The beginning of each phase of growth and development of chickpeas was marked when 10% and the full period were observed in 70% of the plants. The thickness of the pea bush, germination, storage, and other parameters were determined in 1-m-sized odd returns.

For the analysis of crop structure, 25 plants were taken from each experimental variant.

2.6. The following observations were made related to the growth and development of peas:

1. Laboratory and field germination of seeds;
2. Duration of plant development periods;
3. The thickness of the bush at the time of germination;
4. The fact that the harvest is stored until harvesting;
5. The height of the plant, the height of the location of the first lower leg;
6. The number and weight of root nodules;
7. The ratio of the root mass of the above-ground part of the plant;
8. Level of foliage of the plant;
9. Crop structure;
10. Productivity and grain quality indicators;
11. The effect of peas on soil agrochemical indicators was evaluated.

Experiments were conducted every year in other adjacent fields. 0-30 soil samples were collected annually before planting and after harvest of the pea crop before the experiment; 30-50; cm layers were taken and the amount of humus, nitrogen, phosphorus, and potassium was determined.

To determine the number and amount of nodules on the roots, 10 plants were taken and the roots were washed. The roots were dried in the open air, and the number of nodules was determined by weighing on a scale.

3. RESULTS AND DISCUSSION

Chickpeas, like other legumes, enrich the soil with nitrogen compounds using nitrogen-fixing bacteria in their roots. Along with producing a protein-rich crop, chickpeas help enrich the soil by fixing nitrogen with the help of bacteria from the roots. Chickpeas are a good predecessor crop for cereal crops, it enriches the soil with nitrogen and increases productivity. However, budding bacteria are not

always present in the roots. The most favorable conditions for their reproduction are soil moisture, porosity, and bacteria developing well in fertile soils.

In the experiment, the number and mass of nodules formed in the roots of the Yulduz, Uzbekistansky-32, and Lazzat chickpea varieties were determined in the autumn at different periods and planting depths in the budding, flowering, and podding phases.

Fungal bacteria in the roots of chickpea varieties play an important role in increasing soil fertility, they live in symbiosis with leguminous crops, and their activity directly depends on the existing strains in the soil and the factors that affect them, in particular, water, air, heat and other parameters of the soil. In our experiments, it was proven that it directly depends on the sowing period and depth of the seeds of chickpea varieties, that is, when the optimal planting period (November 30) and depth (6-9 cm) are changed to other options, the lack of nodule mass in the roots of chickpea varieties was revealed in statistical analyzes.

In the budding, flowering, and podding phases of the chickpea crop in all studied varieties, the average number of nodules in the budding phase was 17.1-20.9 pieces and the mass was 1.31-1 in the Yulduz variety in the experiments of 2015 in the varieties of planting dates and planting depths. 60 g, the number of pods in the flowering phase is 21.1-22.1 units and the mass is 1.76-2.09 g, and in the podding phase the number of pods is 20.1-23.2 units and the mass is 1.91-2.20 grams if reached, 17.9-21.2 units in the experiments of 2016; 1.40-1.62 g; 20.5-23.2 pieces; 1.81-2.17 g; 20.8-23.9 units; 1.99-2.28 grams, in the experiments of 2017 this figure was 19.4-21.9 units; 1.47-1.76 g; 21.5-23.4 pieces; 1.91-2.18 g; 22.5-25.3 pieces; 2.17-2.45 grams, and the average number of buds by year is 18.1-21.3 pieces in the budding phase; 1.39-1.66 g, 20.7-23.0 pieces in the flowering phase; 1.83-2.15 g and 21.1-23.5 pieces in the podding phase; It was 2.02-2.31 grams.

According to this indicator, when the Uzbekistansky-32 variety was studied in 2015 experiments, the average number of buds in the budding phase was 18.7-19.7 units and the mass of buds was 1.26-1.34 g, the average number of buds in the flowering phase was 20.5-21.9 the mass of seeds and pods was 1.56-1.74 g, and the number of pods in the podding phase was on average 21.1-22.8 pieces and the mass of pods was 1.74-1.89 g, while in the experiments of 2016 it was 19.1- 20.4 pieces; 1.27-1.41 g; 20.7-22.3 pieces; 1.59-1.81 g; 21.1-22.9 units; 1.77-1.97 grams, in the experiments of 2017, this figure was 19.4-20.8 units; 1.31-1.49 g; 21.1-23.1 units; 1.61-1.97 g; 21.1-23.1 units; 1.85-2.02 grams and the average number of buds in the budding phase is 19.1-20.3 pieces and the mass of buds is 1.28-1.41 g, the number of buds in the flowering phase is 20.8-22.4 pieces and buds the mass is 1.59-1.84 g and the number of pods in the budding phase is 21.4-22.9 pieces and the mass is 1.79-1.96 grams. In the Lazzat variety, this indicator is the average number of pods in the budding phase of 2015 in the experimental varieties of 16.5 - 18.7 pieces, and the mass of buds is 1.16-1.25 g, the number of buds in the flowering phase is 17.1-19.4 pieces and the mass of buds is 1.48-1.65 g, and the number of buds in the pollination phase is 17.8-20,1 piece and the mass of buds was 1.63-1.75 grams, while in the experiments of 2016, it was 16.7-18.9

pieces; 1.15-1.29 g; 17.6-19.9 units; 1.55-1.70 g; 17.9-20.5 pieces; 1.66-1.79 grams, in the experiments of 2017, this indicator was 17.8-20.1 units; 1.23-1.41 g; 18.8-21.1 units; 1.67-1.83 g; 18.9-21.1 units; 1.75-1.91 grams, and the average number and mass of buds by year are 17.0-19.2 pieces in the budding phase; 1.18-1.32 g, 17.9-20.1 pieces in the flowering phase; 1.57-1.73 g and 18.2-20.6 pieces in the podding phase; It was 1.68-1.82 grams.

Carried out (2015-2017), the number and mass of nodules in the roots of chickpea varieties planted in autumn, when analyzed by year, had a high result in 2017, and the formation of nodules in the budding phase compared to 2015 was 0.9-1 in all types of sowing period and planting depth. , 6 pieces; 0.11-1.16 g, 1.-2.0 pieces in the flowering phase; 0.09-0.13 g and 1.1-2.1 pieces in the podding phase; 0.14-0.25 g, compared to 2016, 0.6-1.4 pieces in the budding phase; 0.14-0.16 g, 0.2-1.5 pieces in the flowering phase; 0.01-0.06 g and 1.0-1.4 pieces in the podding phase; being higher by 0.08-0.17 grams. The climate conditions in 2017, i.e., the amount of precipitation and the optimal temperature, had a significant effect on the activity of nodule bacteria in the chickpea root. During the periods of nodule formation, i.e., the air temperature in April and May, the indicator was the same in all experimental years. average relative humidity was 24.5% in 2017, this figure was 15.5% in 2015, 20% in 2016, and average in [2017] The relative humidity was higher by 4.5-9.0% compared to 2015-2016, which led to an increase in the number of nodules in the chickpea root.

Analyzing the results obtained according to the phases of plant development, it was shown that the formation of nodule mass in the roots of chickpea varieties increases until the podding phase.

Table 3.1

The effect of planting periods and depths on the number and weight of nodules in the roots of chickpea varieties, g (2015-2017)

Planting periods	Planting depth	1 plant					
		Budding		Flowering		Beaning	
		Number, piece	Weight, g	Number, piece	Weight, g	Number, piece	Weight, g
Yulduz Variety							
November 20	3-5	19.6	1.52	22,1 _	2.01	22.5 _	2.17
	6-9	20.3	1.56	22.4	2.07	23.3	2.25
	10-12	20.7	1.54	22.6	2.02	23.1	2.18
November 30	3-5	20.2	1.60	22.6	2.09	23.4	2.24
	6-9	21.3	1.66	22.9	2.15	24.1	2.31
	10-12	20.9	1.61	23.0	2.10	23.5	2.24
December 10	3-5	18.1	1.39	20.7	1.83	21.1	2.02
	6-9	19, 5	1.48	21, 6	1.90	22.3	2.11
	10-12	18, 7	1.42	20, 9	1.85	21.2	2.05
Uzbekistansky-32 variety							
November 20	3-5	19.1	1.29	21, 0	1.68	21.6	1.80
	6-9	19.7	1.34	21, 5	1.73	22, 0	1.88

Planting periods	Planting depth	1 plant					
		Budding		Flowering		Beaning	
		Number, piece	Weight, g	Number, piece	Weight, g	Number, piece	Weight, g
	10-12	19.3	1.30	21, 3	1.69	21.7	1.82
November 30	3-5	19.9	1.35	22, 0	1.79	22.4	1.87
	6-9	20.3	1.41	22, 4	1.84	22.9	1.96
	10-12	20.2	1.38	22, 2	1.80	22.6	1.89
December 10	3-5	19.6	1.28	20, 8	1.59	21.4	1.79
	6-9	19.2	1.32	21, 3	1.64	21.9	1.83
	10-12	19.4	1.30	21, 0	1.61	21.7	1.81
Flavor Variety							
November 20	3-5	17.1	1.21	18, 0	1.62	18.4	1.68
	6-9	17.8	1.26	18, 7	1.66	19.1	1.74
	10-12	17.6	1.20	18, 4	1.63	18.8	1.71
November 30	3-5	18.3	1.26	19, 1	1.69	19.6	1.77
	6-9	19.2	1.32	20, 1	1.73	20.6	1.82
	10-12	18, 4	1.28	19, 4	1.71	19.8	1.79
December 10	3-5	17.0	1.18	17, 9	1.57	18.2	1.68
	6-9	17.6	1.23	18, 5	1.61	19.0	1.72
	10-12	17.4	1.20	18, 2	1.58	18.6	1.70

In the experiment, the highest indicator of planting dates in all varieties was shown in the variant planted at a depth of 6-9 cm in the third decade of November (30.11) according to average years. In this period, the number of buds of the Star variety planted at a depth of 6-9 cm compared to the varieties planted at a depth of 3-5 cm and 10-12 cm, the number of buds in the phases of budding, flowering, and podding is 2.3-3.0 pieces and the mass of buds is 2.7-3. Up to 2 grams, 1.2 pieces in Uzbekistan-32 variety; up to 1.3-2.3 grams and 2.2-2.4 pieces in the Flavor variety; It was found to be as high as 1.4-1.5 grams.

4. CONCLUSION

In conclusion, it can be said that among the varieties, the highest number of tubers weight was observed in the Yulduz variety, and according to the options of planting periods and planting depths, the average number of tubers per plant was 21.1-24.1 units and the mass was 2.02-2.31 grams. When planted in autumn at different planting dates and planting depths, the highest number and mass of tubers among the varieties is observed in variants planted at a depth of 6-9 cm in the third decade of November (30.11), compared to other planting dates and planting depths, the number of tubers is 1.5-2.4 pcs. and the mass of tubers was found to be high up to 0.06-0.29 grams.

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