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The Effect Of Various Agrotechnological Measures On The Chickpea Plant And The Number Of Weeds In Rainfed Fields

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Abstract: This article presents the research results on the impact of fertilization rates on the number of chickpea plants and weeds in rainfed fields. The research was conducted at the “Zomin Bodomtepa Adiri” farm, located near the Zomin National Nature Park in the Zomin district.

Keywords: Soil fertility, mineral fertilizers, various agrotechnological measures, mulching, crop rotation, number of plants, weeds.

Introduction: According to the Strategy for the Development of Agriculture of the Republic of Uzbekistan for 2020–2030, important strategic tasks have been defined, including: “…the consistent development of agricultural production, strengthening the country's food security, increasing the production of environmentally friendly products, and mitigating the negative impact of global climate change on the development of agriculture.” Therefore, it is of particular importance to improve the agrophysical and agrochemical properties of soils widespread in rainfed areas, to make effective use of natural moisture, and to increase soil fertility and crop productivity by cultivating leguminous crops and studying their effect on soil fertility.

At present, the area of land used for agricultural crop cultivation globally amounts to 1.6 billion hectares, of which 1.3 billion hectares are rainfed lands, accounting for 60% of agricultural output. Therefore, ensuring the effective use of rainfed lands in agricultural production and maintaining and increasing soil fertility through improved methods of cultivating leguminous crops is one of today's pressing tasks.

Efficient use of rainfed lands, alongside irrigated areas, is essential to more fully meet the population’s needs for grain and flour products, high-protein and dietary legumes, oilseeds, and vegetable crops.

Rainfed fields have specific soil and climatic conditions, and the farming systems and agrotechnologies applied differ from those used in other regions. This is primarily due to the sharply continental climate, with cold winters and hot summers. Most precipitation falls in winter and spring. In many years, starting from the second half of May, precipitation significantly decreases, temperatures rise, and both air and soil become dry, which slows photosynthesis. Under such conditions, all agrotechnological measures should aim to ensure the effective use of natural moisture [1].

The research is being conducted at the "Zomin Bodomtepa Adiri" farm, located near the Zomin National Nature Park in Zomin district. Geographically, Zomin district lies in the western part of Jizzakh region. The area consists of sedimentary rocks from the Paleozoic era (Silurian, Devonian, Carboniferous periods), including limestone, crystalline schist, and sandstone. Karst formations are widespread in areas composed of Devonian limestone, including karrens and sinkholes, especially on the edge of the Supa plateau and the Koʻlsoy gorge. Paleogene and especially Neogene deposits, including reddish clay, sandstone, and conglomerates, are widely spread in the central part of the Koʻlsoy and Qizilmozorsoy basins, forming a variety of landforms. The climate of the National Nature Park is a typical mountainous climate, with cold winters and relatively cool summers. According to the Koʻlsoy meteorological station, the absolute minimum temperature is –32°C, and the absolute maximum is +33°C. The highest temperatures are recorded in July and August, and the lowest in December and January. The frost-free period lasts approximately 140 days. The long-term average annual precipitation ranges from 450 mm to 700–800 mm. Winters in the park are stable and last about 5 months. In high mountain areas, snow cover persists from November until May–June [2].

Research Methods

The field experiments in this study were conducted based on the methodological guidelines developed by scientists of UzPITI (Uzbek Research Institute of Plant Industry and Technologies), namely the "Methodological Manual for Conducting Field Experiments". The methods for determining plant population and weed density were based on the State Variety Testing Methodology for Agricultural Crops, and statistical analysis of the obtained data was carried out in accordance with B.A. Dospekhov's methodological work "Methods of Field Experiments". The applied agrotechnological practices were based on recommendations developed by the Scientific Research Institute of Rainfed Agriculture.

Research Results

Increasing soil fertility and achieving stable yields in rainfed areas are among the most pressing agro-economic challenges. The research indicates that leguminous crops, particularly chickpeas, play a significant role not only in ensuring food security but also in enriching the soil with nitrogen, thereby helping to restore and improve its fertility.

Field experiments were conducted with 10 variants in 3 replications. Two main agrotechnological approaches were tested in this experiment:

- A1 – Traditional technology
- A2 – Mulching technology

During the vegetation period, plants were supplied with mineral fertilizers and biopreparations in various dosages.

Each technology group (A1 and A2) included five variants, which differed by:

- Type and quantity of fertilizer
- Application method
- Use of additional substances (biopreparations, fungicides, insecticides)

In each variant, the number of plants per 1 m² permanent plot was observed, and both total and average values were recorded.

Traditional Technology (A1)

In the traditional technology (A1), plant density varied depending on the type and method of fertilizer application:

- Variant 1 (control, no fertilizer): Average of 22 plants per 1 m²
- Variant 2: Application of $P_{40}K_{40}$ via broadcasting and N_{30} during leaf emergence resulted in an average of 23.5 plants
- Variant 3: Application of phosphorus and potassium via band (localized) method, with nitrogen applied during leaf emergence, recorded 24.5 plants on average
- Variant 4: A combined NPK fertilizer strategy applied in two stages resulted in an average of 25.3 plants
- Variant 5: This variant included all of Variant 4's treatments, with the addition of a biopreparation (Rokogumin), a fungicide, and an insecticide, leading to an average of 25.8 plants under traditional technology conditions (see Table 1)

Table 1.

Effect of Chickpea Cultivation on Plant Population as a Means to Improve the Fertility of Rainfed Soils through the Enhancement of Legume Cultivation Methods

Technology	№	Variants	Number of Plants in a 1 m² Permanent Plot				Total	Average
			1	2	3	4		
A1 – Traditional Technology	1	Control variant without fertilizers	23	22	20	23	88	22,0
	2	**P_{40} K_{40}** applied before sowing by broadcasting + **N_{30}** at the 3–4 true leaf stage (spraying)	27	20	24	23	94	23,5
	3	**P_{30} K_{30}** applied locally (band method) + **N_{30}** at the 3–4 true leaf stage (spraying) – branching stage	25	26	24	23	98	24,5
	4	**N_{20} P_{30} K_{20}** applied locally (band method) + **N_{20}** at the 3–4 true leaf stage (spraying) – branching stag	25	26	23	27	101	25,3
	5	**N_{20} P_{30} K_{20}** applied locally (band method) + **N_{20}** at the 3–4 true leaf stage (spraying) + **RG (Rokogumin biopreparation)** – 2.5 L/ha + **fungicide** – 0.15 L/ha + **insecticide** – 0.15 L/ha – branching stage (suspension formulation)	27	28	25	23	103	25,8
A2 – Sowing Based on "Mulching" Technology (Using Straw)	1	Control variant without fertilizers	25	24	25	26	100	25,0
	2	**$P_{40}K_{40}$** applied before sowing by broadcasting + **N_{30}** at the 3–4 true leaf stage (spraying)	23	24	28	27	102	25,5
	3	**$P_{30}K_{30}$** applied locally (band method) + **N_{30}** at the 3–4 true leaf stage (spraying) – branching phase	26	28	27	25	106	26,5
	4	**$N_{20}P_{30}K_{20}$** applied locally (band method) + **N_{20}** at the 3–4 true leaf stage (spraying) – branching phase	28	26	28	27	109	27,3
	5	**$N_{20}P_{30}K_{20}$** applied locally (band method) + **N_{20}** at the 3–4 true leaf stage (spraying) + **RG (Rokogumin biopreparation)** – 2.5 L/ha + **fungicide** – 0.15 L/ha + **insecticide** – 0.15 L/ha – branching phase (suspension)	27	28	28	29	112	28,0

In the A2 – Mulching Technology, mulching was performed using straw. The experimental results were significantly higher compared to the traditional technology. Under this approach, the number of plants in each variant was higher—even in the control variant without fertilizers, a noticeable difference was observed, with an average of 25 plants/m². In Variant 2, the plant count reached 25.5. In Variant 3, with band fertilizer application, this indicator increased to 26.5. In Variant 4, an average of 27.3 plants was recorded. The best result was observed in Variant 5, where biopreparations and protective agents were applied — yielding 28.0 plants/m². This technology helped retain soil moisture, thereby improving seed germination rates and seedling viability. The organic cover created a favorable microclimate, increasing microbial activity in the soil, while integrated treatment with biopreparations and fertilizers enhanced plant health and development.

In conclusion, the mulching technology proved superior to traditional methods, having a significant positive effect on plant population. The fertilizer-free control under mulching technology showed results comparable to fertilized variants in the traditional system, with 25 plants/m². Band fertilization allowed for efficient fertilizer use, contributing to improved outcomes. The combined use of biopreparations, fungicides, and insecticides strengthened plant vitality and biological activity.

The experiments demonstrated that regardless of soil conditions, modern agrotechnical approaches—especially ecological and biological technologies—serve as effective tools for improving soil fertility and achieving stable yields.

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