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Morpho-Phenological Development Indicators Of Tomato Plants In Karakalpakstan Conditions

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Abstract: This study presents the results of phenological observations of tomato (Solanum lycopersicum L.) under the conditions of Karakalpakstan. The findings revealed significant variation in morpho-phenological traits among the experimental variants. Plant height ranged from 23.3 to 28.9 cm, the number of branches varied between 6.8 and 10.1, while the number of flowers ranged from 16.5 to 19.5 per plant. The highest values were recorded in Variant 4, which demonstrated superior vegetative and generative development compared to other variants. These results are of great importance for evaluating the adaptability and yield potential of tomato.

Keywords: Tomato, morphological traits, phenology, yield, breeding.

Introduction: In the process of vegetable crop cultivation worldwide, agrotechnical measures and the application of various herbicides play an important role in maintaining and effectively utilizing soil fertility. According to the results of scientific research conducted in recent years, the rational application of agrotechnical and chemical measures provides opportunities to improve the physical and chemical properties of the soil, reduce contamination with weed seeds, create favorable conditions for normal growth and development of crops, and consequently increase yield and quality indicators.

In this regard, taking into account the spread of weeds and their quantitative contamination levels, and applying biological, agrotechnical, and chemical methods in combating them, is one of the urgent scientific and practical issues in growing high-quality vegetable yields.

According to international sources, more than 30,000 species of weeds are distributed in agricultural lands worldwide, of which 1,800 species cause significant economic damage annually. The diversity and number of weeds are increasing year by year. For example, while more than 2,000 species were recorded in CIS countries after the 1990s, 841 species belonging to 72 families have been identified in Uzbekistan. Of these, 519 species are annuals and 322 species are perennial weeds. The greatest damage to agriculture comes from annual weeds [1].

Tomato (Solanum lycopersicum L.) crops, like other vegetables, suffer serious damage from high levels of weed infestation. According to scientific sources, weeds can reduce tomato yields by 35-70%. Therefore, improving the phytosanitary situation in tomato-growing areas, developing and implementing weed control measures based on resource-saving methods, has particular scientific and practical importance.

The diverse distribution of weeds in agricultural lands, their habitats, and biological differences in growth and development create problems for farmers in achieving high yields. Especially in areas where groundwater is located close to the surface, rhizomatous weeds (couch

grass, wheatgrass, reed, knotgrass) are widespread, and if measures are not taken against them in time, they develop rapidly, occupy crop areas, and sharply reduce the possibility of cultivating agricultural crops.

Globally, losses of up to 30-40% of yield due to weeds, diseases, and pests have been recorded. For example, annual yield losses amount to 500-510 million tons in grain crops, 65-75 million tons in sugar beets, 125-135 million tons in potatoes, and 78-79 million tons in vegetables. In monetary terms, this indicator is estimated at $75 billion USD in damage annually [3].

Studying the biological characteristics of weeds distributed in the meadow-alluvial soils specialized in vegetable growing in the Republic of Karakalpakstan, correctly selecting agrotechnical measures against them, and using herbicides at optimal times and rates in chemical control positively affects soil microbiological processes and allows increasing vegetable crop yields. Therefore, in-depth study of weed distribution, development of effective control methods, and their scientific substantiation determine the relevance of this research.

METHODS

The research work was carried out at the experimental plot of the Aral Sea Basin International Innovation

Center under the Ministry of Ecology, Environmental Protection and Climate Change of the Republic of Uzbekistan, located in the territory of Samonboy village citizens' assembly, Amudaryo district, Republic of Karakalpakstan.

Scientific research work was carried out based on methodological guidelines developed by the Research Institute of Botany of Uzbekistan, the Research Institute of Plant Protection of Uzbekistan, and the scientific production centers of agriculture of Uzbekistan (Tashkent, 1995-2000).

The experiment was conducted in field conditions according to the classical field experiment method. The study consisted of 10 variants and 3 replications, with variants arranged systematically in the experiment.

To determine the emergence dynamics of tomatoes, observation work was carried out in specially designated 1 linear meter areas for each variant in replications I and III of the experiment. Based on the observations obtained, the phenological development stages of tomatoes were recorded.

In determining the emergence dynamics and growth indicators of tomatoes, the methodological manual "Methods of Conducting Field Experiments" (Tashkent, 2007) [2] was used.

RESULTS AND DISCUSSION

The rapid course of tomato growth and development is closely related to a number of factors: planting dates, soil moisture, air temperature, and high reproductive, pure seed material.

Our experiments showed that tomato crops were significantly weakened during the vegetation period in areas contaminated with weeds. In particular, the abundance of weeds slowed down the initial development of plants, negatively affecting the degree of branching and the formation of generative organs.

However, in variants where herbicides were applied, we observed that tomato plants developed better compared to the control (without herbicide). Plant height was taller, the number of branches was greater, and the flowering process was significantly accelerated. This indicates that in conditions where weed competition was reduced, tomato plants used soil moisture and nutrients more efficiently.

Overall, while growth and development indicators of tomatoes were low in control variants contaminated with weeds, morpho-phenological development significantly improved in variants where herbicides were applied. These results show that scientifically based application of effective herbicides in vegetable growing is an important factor in accelerating vegetative growth of crops, ensuring good survival of seedlings in the field, and increasing yield potential.

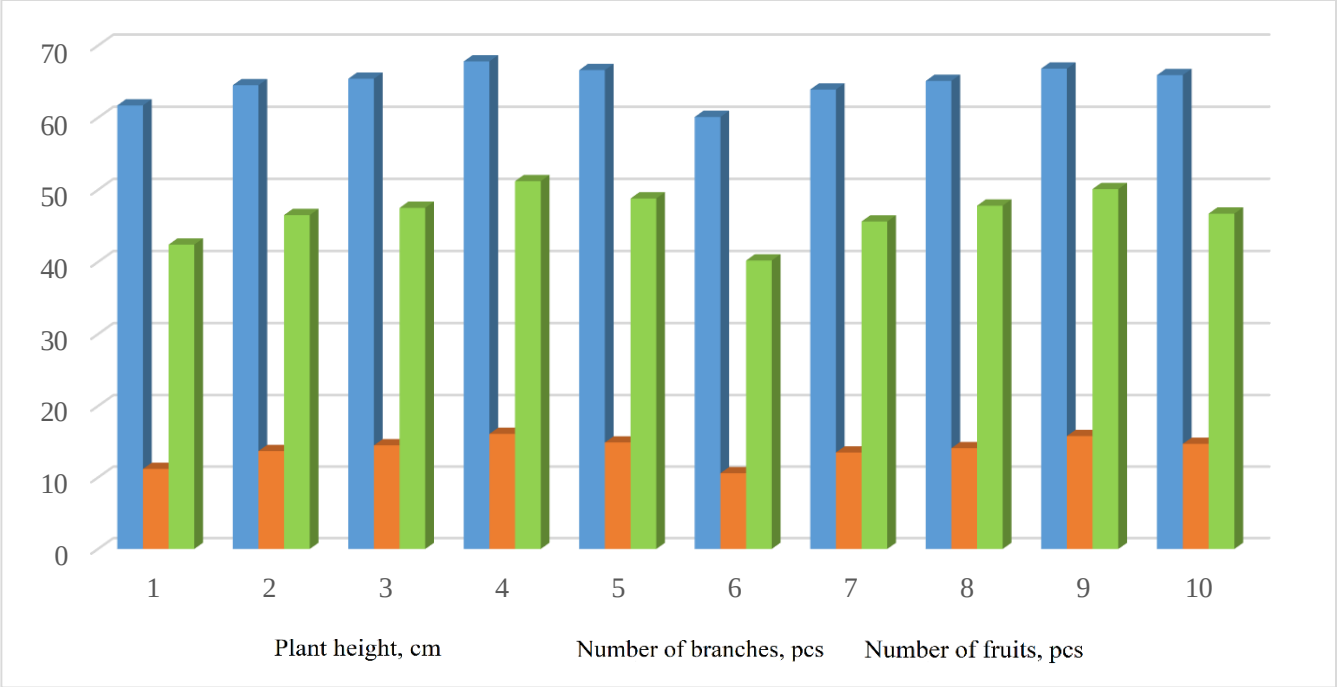

Figure 1. Results of phenological observations on tomatoes in the experimental field

As a result of phenological observations, morpho-biological development indicators of tomato plants—plant height, number of branches, and number of flowers—were found to differ significantly depending on variants and applied backgrounds (Table 1).

Plant Height. According to experimental results, in the plowing-salt washing + chiseling + harrowing (BACKGROUND-1) background, tomato plants in control-1 variant averaged 24.7 cm, reaching 27.9 cm when Gezagard 50, 50% (2.0 l/ha, standard) was applied. Within this background, in variants where Titus, 25% (30-40-50 g/ha) preparation was applied, plant height increased to 28.1-28.9 cm.

In the plowing-salt washing + plowing + harrowing + rolling (BACKGROUND-2) background, plant height in control-2 variant was 23.3 cm, reaching 27.5 cm when Gezagard 50, 50% (2.0 l/ha) was applied. Within this background, when Titus, 25% (30-40-50 g/ha) was used, plant height was recorded in the range of 27.8-28.5 cm.

Number of Branches. In BACKGROUND-1, the number of branches in control-1 variant averaged 7.2 pieces, reaching 7.9 pieces when Gezagard was applied. In variants where Titus preparation was applied, branching was higher, recorded at 9.5-10.1 pieces. In BACKGROUND-2, the average number of branches in control-2 variant was 6.8 pieces, reaching 7.5 pieces when Gezagard was applied, and 8.8-9.7 pieces in variants where Titus preparation was applied.

Number of Flowers. Observations on generative development of tomatoes also differed significantly across backgrounds. In BACKGROUND-1, the number of flowers in control-1 variant averaged 17.5 pieces, reaching 18.2 pieces when Gezagard was used, and increasing to 18.7-19.5 pieces in variants where Titus preparation was applied. In BACKGROUND-2, the number of flowers in control-2 variant was 16.5 pieces, 16.9 pieces when Gezagard was used, and in the range of 17.4-18.6 pieces when Titus was applied.

As can be seen from the results, vegetative (plant height, number of branches) and generative (number of flowers) development indicators of tomatoes significantly improved compared to control variants under the influence of chemicals used against weeds in both background conditions. In particular, the high morpho-phenological indicators in variants where Titus preparation was applied clearly demonstrate its effective impact. This increases the competitiveness of tomato plants and is of great importance in determining future yield potential.

CONCLUSION

Morpho-phenological development indicators of tomato plants differed significantly depending on variants and backgrounds. The lowest results were recorded in control variants, with plant height of 23.324.7 cm, number of branches 6.8-7.2 pieces, and number of flowers around 16.5-17.5 pieces. When Gezagard 50, 50% (2.0 l/ha) was applied, all indicators increased compared to the control. When Titus, 25% preparation was applied at a rate of 30-50 g/ha, tomato growth and development showed the highest indicators (height 28.9 cm, number of branches 10.1 pieces, number of flowers 19.5 pieces).

The results show that in Karakalpakstan conditions, the

application of effective herbicides against weeds in tomato cultivation is of great importance in increasing yield potential.

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