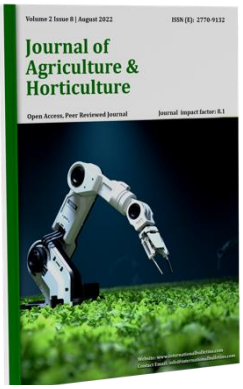

ACCUMULATION OF DRY MATTER IN COTTON UNDER THE INFLUENCE OF DIFFERENT PLANT DENSITIES AND MINERAL FERTILIZER RATES

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Annotation. This article investigates the effect of different plant densities and the application rates of mineral and organic fertilizers on dry matter accumulation in the *Termiz-202* cotton variety. The results showed that increasing plant density reduced the amount of dry biomass accumulated per plant, which is explained by intensified competition among plants for nutrients, light, and moisture. The study also revealed that the combined application of mineral and organic fertilizers enhances photosynthetic efficiency and accelerates the accumulation of dry matter in both vegetative and generative organs.

Keywords. Extra-long staple cotton, Termiz-202 variety, plant density, mineral fertilizers, organic fertilizer — manure, dry matter, leaf, stem, boll, cotton, photosynthetic activity, yield.

Introduction. Photosynthesis plays a central role in the life activity of plants. This is because it is through photosynthesis that plants absorb solar energy and convert it into organic substances. The more photosynthesis occurs, the more organic matter is produced; as a result, the plant's dry matter increases, ultimately leading to higher productivity. Dry matter is the portion of a plant that remains after all the water has been completely evaporated, consisting mainly of organic (carbohydrates, proteins, fats) and inorganic (ash, mineral elements) components [1; 48–64]. Therefore, determining the amount of dry matter is considered one of the important indicators of plant growth and development.

The intensity of the photosynthesis process in plants depends on various factors, among which plant density and sufficient nutrient supply play an important role. Plant density has a dual effect on photosynthesis: on the one hand, competition among plants intensifies, increasing the struggle for light, water, and nutrients; on the other hand, when plants are grown at an optimal density, they can carry out photosynthesis efficiently and accumulate a higher amount of dry matter.

Literature review. According to the scientific research of Anbarasan [2; pp. 25–27], the amount of dry matter is directly related to plant row spacing and the planting system, with significant differences observed as plant density increases. This finding was also confirmed by the research results of Nazarov and co-authors [3; pp. 25–27]. Their experiments showed that when cotton was cultivated using a 60 × 10 cm planting scheme, the dry matter mass obtained per hectare was 4846 kg, whereas under the 60 × 15 cm scheme, this figure increased to 5322 kg. Therefore, the proper selection of planting schemes can enhance the efficiency of photosynthesis, intensify dry matter accumulation, and consequently contribute to a considerable increase in yield.

Methods. The research was conducted in cotton fields, and before harvesting, plant samples were collected in predetermined quantities from each experimental variant. The

collected samples underwent preliminary processing to determine the actual amount of dry matter in the plants.

First, the samples were manually cleaned and then placed into special paper bags. Afterwards, they were dried at 105 °C for 6 hours in a Memmert UN-200 electric drying oven. During the drying process, the samples were regularly monitored and kept until they reached a constant weight. Constant weight refers to the stage at which the recorded mass of the sample shows no difference in repeated measurements.

After drying, the samples were placed in a desiccator for cooling, since materials taken directly from high temperatures have the ability to rapidly absorb moisture from the air. Then, to accurately determine the dry mass, an analytical balance with high sensitivity (up to 0.0001 g accuracy) was used. The results recorded for each variant were documented in separate protocols and later prepared for statistical analysis.

Results. The results of the conducted research showed that there is a certain inverse relationship between plant density and the amount of dry matter accumulated in plants. As the number of plants increases, the amount of dry biomass per individual plant decreases. This situation is primarily explained by the intensified competition among plants for light, water, and nutrients. Under conditions of limited resources, the process of photosynthesis slows down, root system development is hindered, leaf efficiency decreases, and the formation of generative organs is delayed. As a result, the total accumulation of dry biomass is significantly reduced. Therefore, analyzing changes in dry matter content has important scientific and practical significance in determining the optimal plant density.

According to the experimental results, under conditions of 140,000 plants/ha and the application of $N_{250}P_{175}K_{125}$ kg/ha mineral fertilizers (Variant 1), the distribution of dry matter in a single cotton plant was as follows: leaves – 31.8 g, stem – 30.1 g, bolls – 25.6 g, and cotton fiber – 35.4 g. Thus, the total dry biomass per plant amounted to 122.9 g. However, when plant density was increased to 160–180 thousand plants/ha under the same fertilizer background, a decrease in dry matter content was observed. In particular, the total dry biomass per plant was recorded in the range of 117.9–110.2 g. This outcome is mainly explained by the reduction of the feeding area as plant density increases, the limitation of nutrient uptake from the soil, as well as the intensification of competition among plants for light and moisture resources.

In addition, the application of supplementary organic fertilizers produced positive results. Specifically, under conditions of 160,000 plants/ha, when 1.5 t/ha of manure was applied in addition to the mineral fertilizer rate of $N_{250}P_{175}K_{125}$ kg/ha (Variant 3), the amount of dry matter increased compared to the variant with only mineral fertilizer application (Variant 2). Dry matter accumulation was higher by 1.8 g in leaves, 1.6 g in stems, 2.7 g in bolls, and 1.7 g in cotton fiber. As a result, the total dry biomass per plant reached 126.7 g (Table 1). This indicator confirms that the combined application of organic and mineral fertilizers improves the nutritional conditions of plants and accelerates biomass formation.

The highest result was recorded in Variant 7. That is, under conditions of 160,000 plants/ha, when 1.5 t/ha of manure was applied together with N300P210K150 kg/ha mineral fertilizer, dry matter accumulation in all plant organs reached the highest level. This demonstrates that increasing the rate of mineral fertilizers and combining them with organic fertilizers significantly improves the nutrient supply of plants, enhances the efficiency of photosynthetic activity, and consequently accelerates the accumulation of dry biomass.

Overall, the obtained results confirmed that plant density, as well as the integration of mineral and organic fertilizers, have a strong influence on dry biomass formation in cotton crops. Determining the optimal density and fertilizer rates stimulates dry matter accumulation in all plant organs and serves as one of the key factors for increasing yield.

Conclusion. The conducted research shows that plant density and fertilization rates directly affect the accumulation of dry matter in cotton plants. Although the total dry matter content was high at a density of 140,000 plants/ha, increasing the density to 160,000 plants/ha resulted in more efficient biomass accumulation and provided optimal outcomes. In particular, the highest dry matter accumulation was achieved when a higher rate of mineral fertilizers ($N_{300}P_{210}K_{150}$) was applied in combination with manure (1.5 t/ha).

However, further increasing plant density to 180,000 plants/ha reduced the total biomass accumulation, indicating intensified competition for resources. Thus, the optimal plant density for ensuring dry matter accumulation in cotton is 160,000 plants/ha, and its integration with mineral and organic fertilizers guarantees higher efficiency.

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