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YIELD OF AMARANT DEPENDING ON THE VARIETY

Amaranth is grown as a grain, fodder, vegetable, medicinal, ornamental crop. It has significant prospects for cultivation in Ukraine. Saratovsky VV [1] notes that even the climatic conditions of Prykarpattia are suitable for growing amaranth. Its yield can reach 30 kg / ha, amaranth seeds contain 12-18% protein and 5-17% oil [2].

Amaranth food prevents various diseases. It is able to increase immunity, which is very important now in the era of the coronavirus. Amaranth oil is not inferior in quality to sea buckthorn and is widely used to treat radiation sickness, burns, etc. [2].

Production areas in Europe are quite low, only about 1000 hectares. Amaranth is grown in Slovakia, Hungary, and Italy. There are no accurate statistics on amaranth sown areas in Ukraine. Various figures are given - from 1000 thousand hectares to 5000 thousand hectares.

In order to expand amaranth crops in Ukraine, it is necessary to study and develop intensive cultivation technologies focused on specific soil and climatic zones [4]. For this relatively new culture, most elements of technology need to be studied and refined [5]. In particular, the impact of climate change and irrigation [6].

There are practically no data on the use of such macronutrients as magnesium, sulfur, calcium in the technology of amaranth cultivation. There are no recommendations for the introduction of trace elements. Namely, due to the scientifically sound fertilizer system it is possible to increase the yield to 4.0 - 5.0 t / ha.

Therefore, most elements of amaranth cultivation technology need additional study, taking into account the soil and climatic conditions of the cultivation zone.

The use of amaranth varieties adapted to growing conditions is important in terms of ensuring high yields of this promising crop.

Amaranth is one of those plants with which breeding work began relatively recently [7]. With the help of selection you can significantly improve the quality of amaranth grain and increase its yield. Of great value are the new varieties, which in certain soil and climatic conditions prevail in terms of yield varieties grown here, given that the cost of production of amaranth seeds is minimal.

According to a study by IT Goptsi et al. [8] identified a specific morphotype of plants of this culture, which corresponds to a particular direction of use. Grain-type varieties have the following characteristics: low plant growth (up to 1 m), unbranched, with a large dense or semi-dense panicle, with a high percentage of female flowers, friendly maturation; seeds of white, golden or pink color with a weight of 1000 seeds up to 1 g, crude protein content up to 18.0–19.0%, starch content - 58.0–59%, grain yield up to 30 c / ha; suitability for mechanized harvesting. The grain group of amaranths is also characterized by such characteristics as panicle length, panicle productivity, seed moisture during harvesting and nutritional qualities of seeds.

Amaranth is a plant of tropical origin with C4-type photosynthesis and is characterized by more efficient use of water and high productivity [9, 10]. Therefore, the potential of modern varieties of this crop varies between 8 - 15 t / ha, but the average grain yield in Ukraine is 2.8-3.5 t / ha [4].

The research was conducted in the research field of Lviv National Agrarian University. The soil of the experimental site is dark gray podzolic light loam, which was characterized by the following indicators: humus content (by the Turin method) - 2.10%, pH - 6.08, lightly hydralized nitrogen - 110 mg / kg of soil, mobile forms of phosphorus (by the Chirikov method) - 128 mg / kg of soil, mobile forms of potassium (according to Chirikov) - 114 mg / kg of soil, copper content - 1.25 mg / kg and zinc - 1.06 mg / kg, manganese (according to the method of Peive-Rinkis) - 16 , 0 mg / kg, boron (according to the Rinkis method) - 0.94 mg / kg, iron - 128, 0 mg / kg.

Hydrothermal conditions differed from the average long-term data. It was warmer and more precipitation fell. In 2019, the average temperature during the growing season was 16.1 ° C, which is 1.3 ° C higher than long-term data. In 2020, these indicators were 15.3 ° C and 0.5 ° C, respectively, in 2021 14.8 ° C, which corresponded to the average long-term data. In 2019, the growing season fell by 53 mm above the norm, in 2020 - by 129 mm, in 2021 - by 73 mm. For more information on the months of the growing season, see in fig. 1, 2, 3.

The total area of the plot was 30 m^2, accounting - 20 m^2. The studies were performed in triplicate.

Seven varieties of amaranth were studied.

Statistical data processing was performed using Microsoft Excel and "Statistica 6.0".

Due to global climate change, it is important to establish the response of amaranth to new growing conditions. The dependence of the level of realization of the genetic potential of amaranth varieties on weather conditions is quite high. At the same time, the greatest influence on crop productivity in all soil and climatic zones have the conditions of humidity and temperature, which are formed during the growing season and, especially, in the first half of the growing season.

In our studies, the yield of amaranth grain varied depending on the hydrothermal conditions of the year. In 2019, the yield was lower compared to 2021 and fluctuated depending on the variety in the range of 2.08 - 4.11 t / ha (Figure). The difference between the lowest yield in the variety Ultra and the highest in the variety Kharkiv 1 was 2.03 t / ha.

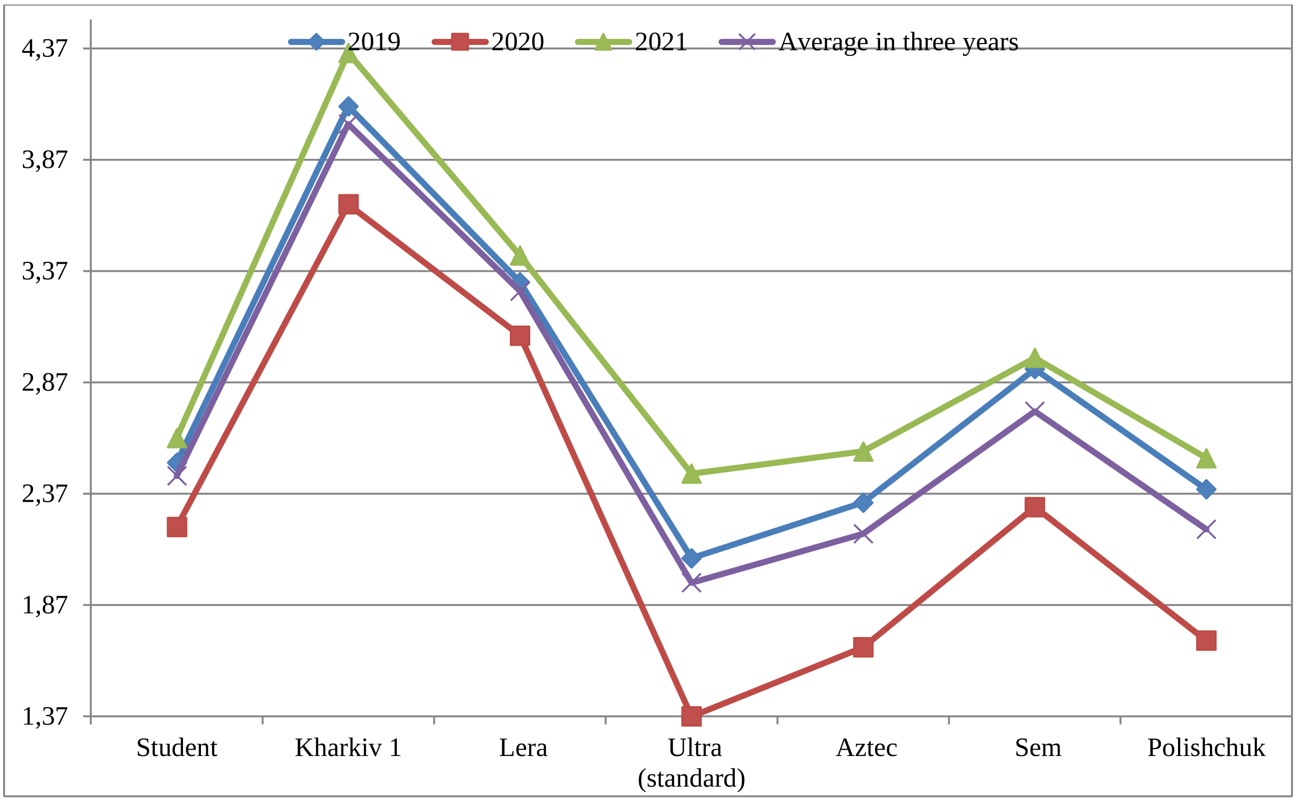

Fig. 1 – Yields of amaranth seeds depending on the variety

SSD_{05} 2019p. - 0,15 t / ha; 2020p. - 0,16 t / ha; 2021 p. - 0,19 t / ha

The lowest grain yield of all studied varieties was in 2020 and ranged from 1.37 to 3.67 t / ha (Figure). The difference between the lowest yield in the variety of amaranth Ultra and the highest in the variety Kharkiv 1 is 2.30 t / ha.

The reason for the decline in yields in 2020, as in 2019, was excessive rainfall. However, in contrast to 2019, when soil moisture was observed in May, in 2020 a longer period of two months was very wet - May and June.

Correlation - regression analysis showed that the amount of precipitation during the growing season with equal force affects the grain yield of all studied varieties of amaranth. Strong feedback was found: for the variety Kharkivsky 1, Ultra and Lera the correlation coefficient was r = -0.82, r = -0.82 and r = -0.83, and for the varieties Student, Aztec, Polishchuk and Sam respectively r = -0.86, r = -0.87, r = -0.91 and r = -0.95.

This dependence for the variety Kharkiv 1 can be described by the regression equation:

$$Y = 0.12X + 3.803$$

where Y is the yield, t / ha;

This equation reliably describes the process of formation of amaranth yield, which confirms the coefficient of multiple correlation (R = -0.82), between the resultant sign and the argument the relationship is quite close. The coefficient of determination is equal to R2 = 0.121.

The hydrothermal conditions of 2021 were the most favorable for the formation of amaranth grain yield. Yields depending on the variety varied in the range of 2.46–4.35 t / ha. The difference between the lowest yield in the Ultra variety and the highest in the Kharkiv 1 variety is 1.89 t / ha.

On average, in three years, among the varieties of amaranth, the lowest grain yield was obtained in the variety Ultra - 1.97 t / ha (Table 1). The Aztec variety also had a low yield of 2.19 t / ha, which is 0.22 t / ha higher than the Ultra variety (11.2%). The grain yield of the Polishchuk variety was formed at almost the same level - 2.21 t / ha, or 0.24 t / ha more than the Ultra variety (12.2%). In the Student variety the yield was 2.45 t / ha, ie higher than the Ultra variety by 0.48 t / ha (24.4%). Variety Sam with a yield of 2.74 t / ha exceeded the Ultra variety by 0.77 t / ha (39.1%).

As a result of research it was established that the highest yields on average in three years were formed by Kharkivsky 1 and Lera varieties. In the Lera variety the yield was 3.28 t / ha, which is 1.31 t / ha higher than the Ultra variety (66.5%). The highest yield was obtained in the variety Kharkivsky 1, which was 4.03 t / ha, or higher than in the variety Ultra by 2.06 t / ha (104.6%). Compared to the Lera variety, the increase in yield in the Kharkiv 1 variety is 0.75 t / ha or 22.9%.

Yields of amaranth, as a drought-resistant crop, decreased in the years (2019 and 2020) with excessive rainfall in the first half of the growing season. The highest yield (2.46-4.35 t / ha) was formed in 2021, in which the amount of precipitation in May, June and July was within normal limits. A strong inverse correlation (r = -0.82 –r = -0.95) was found between the yield of amaranth varieties and the amount of precipitation.

In the conditions of the western Forest-Steppe, with sufficient and excessive moisture supply on dark gray podzolic light loam soil, the highest grain yield (4.03 t / ha) among the seven studied varieties of amaranth was obtained in Kharkiv 1. The lowest yield was formed in 1.9 Ultra ha), which is less than the variety Kharkiv 1 by 2.06 t / ha.

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