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AGRICULTURAL AND BIOLOGICAL INDICATORS OF GRAIN SORGHUM DEPENDING ON THE VARIETAL CHARACTERISTICS OF DOMESTIC AND FOREIGN BREEDING

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Abstract. The main varietal characteristics of grain sorghum were evaluated and compared. Installed the main differences in the qualitative indicators of the structure and productivity of grain sorghum varieties of domestic and foreign breeding.

Introduction. Sorghum is an important crop that is ranked third in the world after wheat and rice. It is the main grain culture of the countries of Africa, India, East Asia and is promising for Ukraine [1]. The main producers of sorghum grain are India (6.2–18.2 million hectares), Nigeria (2.1–6.9 million hectares), Sudan (1.5–7.1 million hectares), USA (1,9–6.5 million ha), Niger (1.0–3.1 million ha). In the US, only 14% of the world's sown area is concentrated, with a gross harvest of about 40% [2].

The main directions in Ukraine and foreign breeding work on sorghum grain are: early ripeness (up to 100 days), fitness for mechanized harvesting (plant height

up to 120 cm, elongated inflorescences of sorghum), yield and grain quality (starch, protein, tannin, lysine content) [2, 3, 15]. Breeders are increasingly paying attention when new varieties of grain sorghum are created – white grains, early ripening, which do not require drying of the grain after harvest, low–growing, easily ground with a grain, with a starch content of grain – up to 78%. With the appearance of such varieties, the prospects of using grain to produce starch (the yield of these varieties is up to 78 kg from 100 kg of grain), alcohol (yield 630–650 l / t), in obtaining gluten–free bakery products [16, 17].

That is why in the current climate change, grain sorghum is considered as an alternative to corn cultivation because it has high productivity and a wide range of uses in food, feed and technical fields [1, 18].

The purpose of the research is to investigate economically valuable indicators of grain sorghum and to establish the main differences in the qualitative indicators of the structure and productivity of grain sorghum varieties of domestic and foreign breeding.

Materials and methods of research. The studies were carried out at the Institute of Bioenergy Crops and Sugar Beets and in educational and scientific production complex's Uman National University of Horticulture.

The studies used different varieties of sorghum grain domestic and foreign breeding. During the growing season, phenological observations were made of plant growth and development and the selection of 1000 grains, number and weight of grains per plant, and yield [19 – 21].

All varieties of sorghum of foreign breeding are characterized by resistance to rash, getting down, and other diseases, they are cold, dry and heat resistant. Here is a brief description of varieties of sorghum of domestic breeding.

Odeskyi 205, grain sorghum, was added to the register in 1995. The average yield of the Odessa variety is 205 – 33–39 c / ha, with the potential – 75 c / ha. Highly intensive grain variety suitable for mechanized harvesting. The growing season is about 110 days. The variety is resistant to soot, bacteriosis. Drought resistant. It is resistant to lodging. Low growth sorghum (120–125 cm).

Sorghum inflorescences (25–30 mm), branching absent, core semi–dry. The leaves are broad, with a dark gray vein. Broom erect 10–12 cm. Weight of 1000 grains 24–28 g. Grain indices – 13.5–13.6% protein, 69–71% starch, 3.0–3.1% fat. The grains are large, red in color, half open. The yield of cereals is 80–85%. The seeds are sown in a well–heated soil with a sowing rate of 30 kg per hectare for sowing on green mass, 7 kg per 1 hectare for sowing on grain.

Dneprelstan grain sorghum. Originator – Institute of Grain Management of UAAS. Sorghum variety has been entered in the State Register since 2006. The grain is large, the mass of a thousand seeds is 34.2–41.6 g. The content of tannin in the grain is small (0.1%). Protein content in the grain – 13.4%, starch – 73.5%. The grain is suitable for making cereals, flour and other food products. Grain yield is 3.91–6.16 c / ha. Suitable for mechanized cleaning. Drought–resistant, cold–resistant. Soot resistance is high and medium, resistant to ash damage.

Kraievyd, grain sorghum. Originator – Institute of Grain Management of UAAS. The variety has been entered in the State Register since 2004. Yield – 3.24 t / ha, at standard level. Lying resistance – 9.0 points, drought – 8.1 points, shedding – 9.0 points. Resistance to blistering soot – 9.0 points. Broom drop – 9.0 points. Protein content – 11.0%, starch – 71.4%. Directions of use – food, feed.

Lan 59, grain sorghum. Originator – UAAN Grain Institute, Sinelnikov Selection and Research Station. The variety has been entered in the State Register since 2007. Early ripening variety. Plants up to 134 cm tall. The average yield for the years of expertise was 3.56 t / ha in the Steppe zone, 54.2 c / ha in the Forest–steppe. Guaranteed supplement – 0.7–3.2 c / ha. Protein content – 11.2–13.4%, starch – 71.3–72.5%. The variety is relatively resistant to lodging, shedding, drought. The disease is insignificant. Direction of use – grain [22].

Research results. Research results. In the investigated varieties of domestic breeding, plant height was 109 – 134 cm, panicle length – 15 – 17 cm. Higher indexes of plant height and inflorescences sorghum 143 and 17 were in the Lan 59 variety, the lowest indices were in the Kraievyd – 15 cm (Fig. 1).

The height of the foreign breeding sorghum varied from 75 to 130 cm, the length of the panicle was 14 to 19 cm. The length of inflorescence of sorghum varied American and Hungarian breeding.

The shortest length of inflorescence of sorghum was characterized by breeding varieties of the USA (Combinemilo) and India (JS–402).

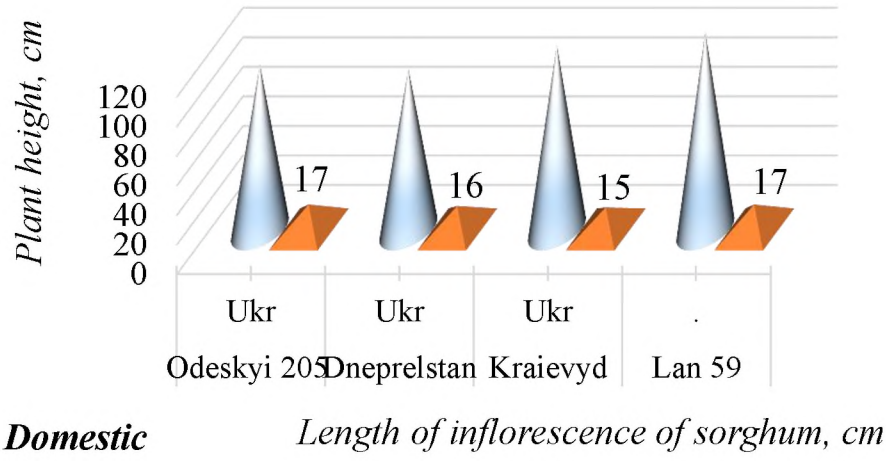

Fig. 1. Comparative characteristics of morphological features of varieties of grain sorghum of domestic breeding

The lowest height was the Russian grade Alpha – 75 cm, but the length of the of inflorescence of sorghum was 17 cm (Fig. 2).

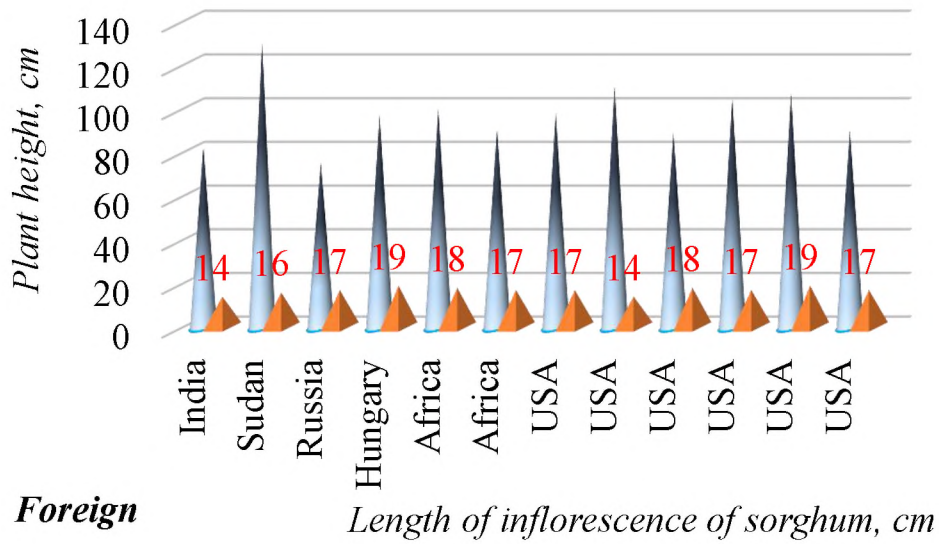

Fig. 2. Comparative characteristics of morphological features varieties of grain sorghum of foreign breeding

Formation of higher yield of sorghum seeds is most influenced by such indicators of the structure and productivity of the variety as: number and weight of grain from one plant and weight of 1000 grains. Sorghum cultivar variety L–318 of Sudanese breeding, formed the lowest grain weight and number of grains from one plant, respectively – 21.0 g and – 789 pcs. with the lowest biological yield – 4.05 t / ha. Other varieties of sorghum of African, Indian, Russian and American breeding yields were slightly higher. The highest indices, among the studied, were characterized by the variety of American breeding Combine milo, in which the weight and number of grains from one plant were respectively – 46.7 g and 1501 pcs., The biological yield level formed at the level – 6.52 t / ha.

On average, the varieties of domestic breeding weight of grain from 1 plant was 30.55 g and the number of grains from one plant – 1444 pieces, and in foreign varieties these figures were 39.44 and 1313pcs. in accordance.

Correlation dependence indicates that the number of grains from one plant has a direct relationship of strong effect on the formation of biological yield of the studied varieties of grain sorghum. The correlation coefficient is r = 0.92, the determination coefficient is $R^2 = 0.8595$ (Fig. 3).

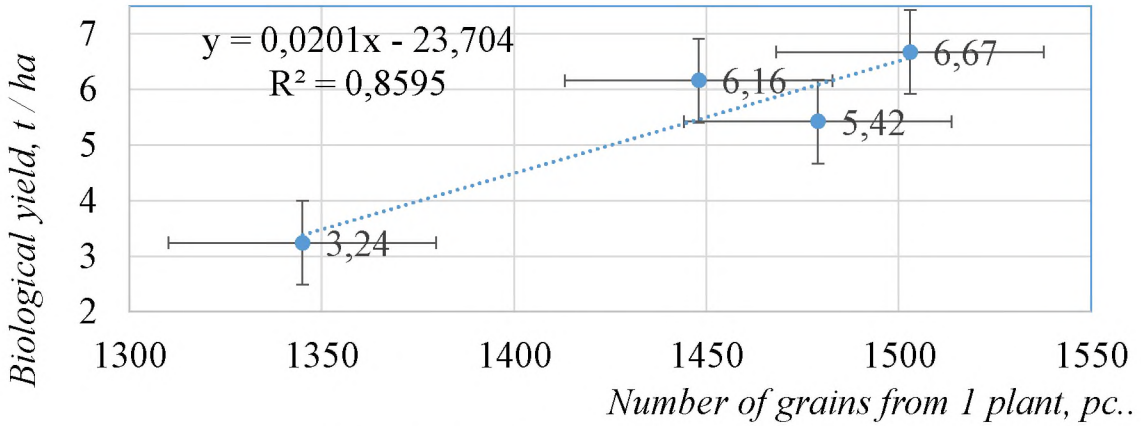

Fig. 3. Correlation dependence of the influence of number of grains from one plant on the formation of yield of varieties of grain sorghum of domestic breeding

Yield of grain sorghum depends on the main indicators of the structure and productivity of the crop. Indicators of mass of 1000 grains in varieties of domestic

breeding ranged from – 24.1 – 35.9 g, and the weight of grain from one plant was – 22.5 – 45.2 g, while biological yield was formed at the level of 3.24 – 6, 67 t / ha.

The weight of 1000 grains on the average for the varieties of Ukrainian breeding was within 28.57 g, and the foreign – 28.94 g.

Among the domestic breeding can be distinguished variety Dneprelstan, which is characterized by higher mass and number of grains per plant, 1000 grains and biological yield. The lowest figures are in the Kraievyd variety.

Based on the results of the correlation analysis, a strong relationship of direct action between the mass of grain from one plant and the mass of 1000 grains was established in the investigated varieties of grain sorghum of domestic breeding, which is r = 0,98; R^2 = 0.96 (Fig. 4).

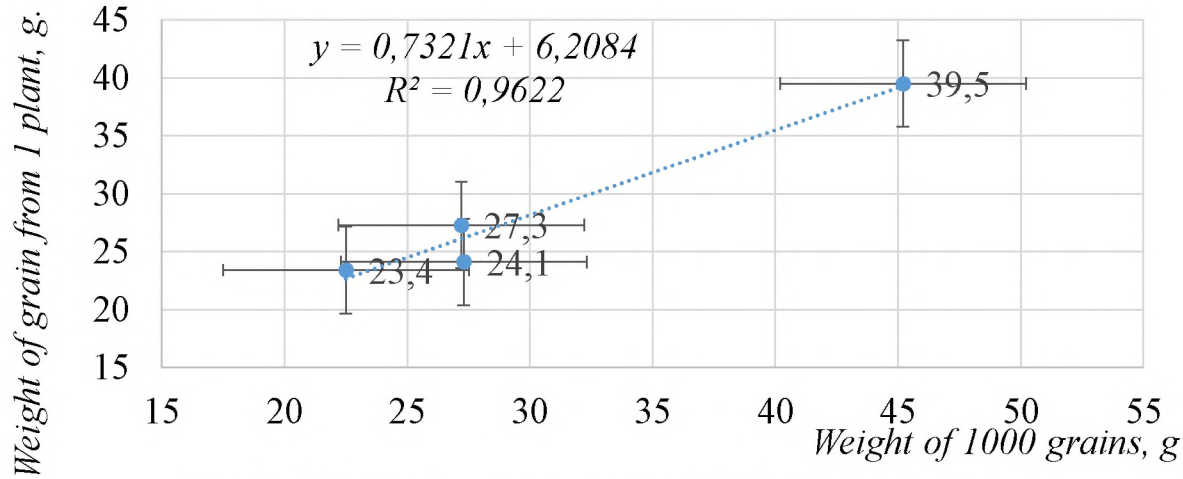

Fig. 4. Correlation dependence of influence of weight of grain from one plant on the formation of mass of 1000 grains in varieties of sorghum of grain domestic breeding

The biological yield of grain on the average for varieties of domestic breeding was in the range – 5.37 t / ha, and for foreign – 5.59 t / ha. However, it should be noted that it was significantly influenced by various factors such as weather, fertilizer content and growth regulators.

It was found that the varieties of American breeding exceeded all other varieties of foreign breeding by all studied parameters. Thus, the weight of grain from one plant averaged by variety – 43.71 g, and the mass of 1000 grains – 32.08 g. The number of grains varied and amounted to 1357 pieces, and biological yield – 6.09 t / ha.

The results of the correlation analysis allow to establish a strong relationship of direct action between the number of grains from one plant and the yield of the investigated varieties of grain sorghum of foreign breeding, which is r = 0,73; R^2 = 0.52 (Fig. 5).

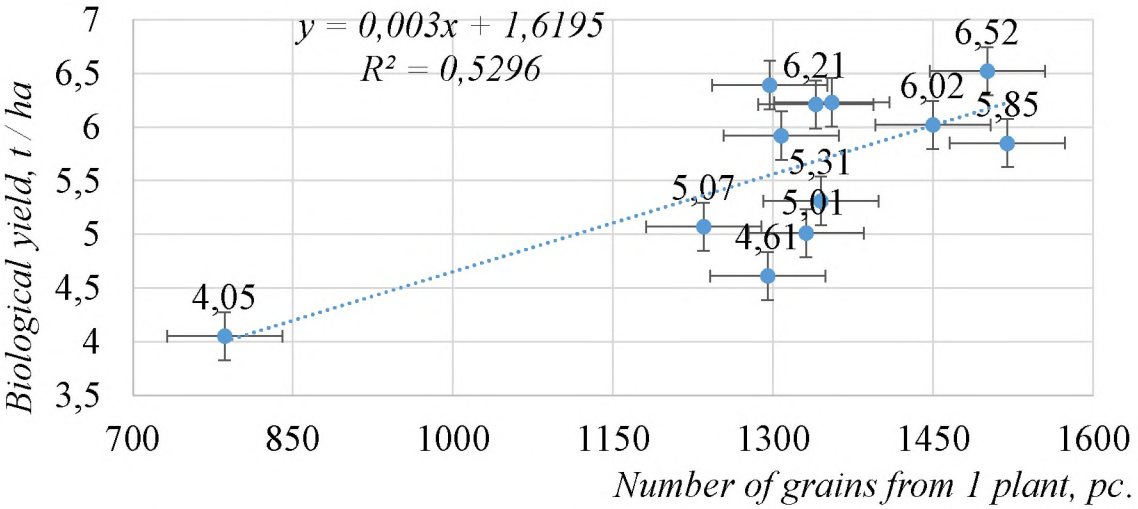

Fig. 5. Correlation dependence of the influence of the number of grains from one plant on the formation of yield of varieties of grain sorghum of foreign breeding

According to the results of the correlation analysis, varieties of foreign breeding showed a weak relationship of direct action between the mass of grain from one plant and the mass of 1000 grains in the studied varieties of grain sorghum, which is r = 0,39; coefficient of determination – R^2 = 0,15 (Fig. 6).

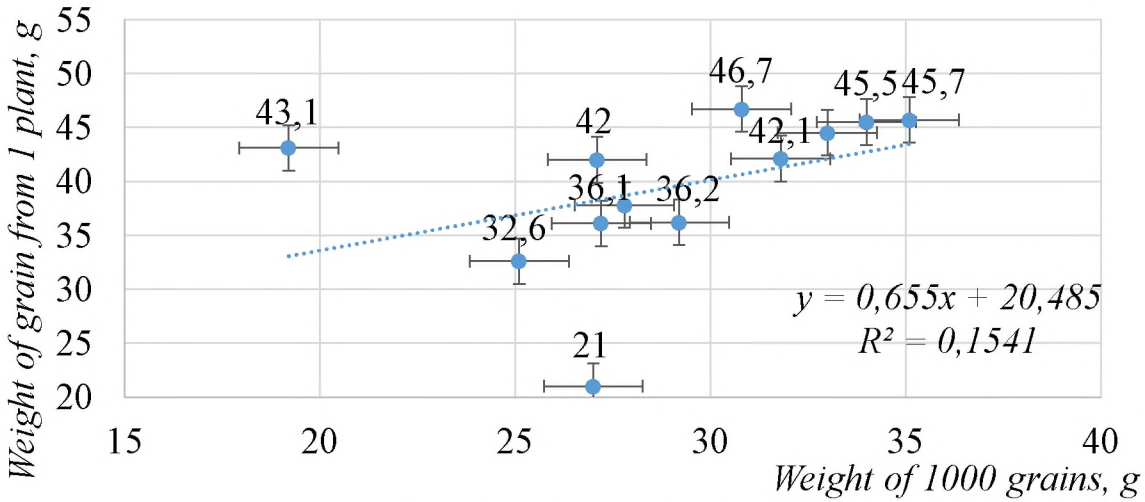

Fig. 6. Correlation dependence of influence of weight of grain from one plant on formation of mass of 1000 grains in varieties of grain sorghum of foreign breeding

Correlation dependences allow to establish the influence of grain weight and number of grains from one plant on yield formation in varieties of foreign breeding.

Conclusions. Significant impact on the formation of grain sorghum yield have the basic elements of the structure and productivity of the crop. Weight of 1000 grains in varieties of domestic breeding ranged from 24.1 to 35.9 g, and the weight of grain from one plant was – 22.5 – 45.2 g, while biological yield was formed at the level of 3.24 – 6.67 t / ha.

Based on the results of correlation dependencies, it is possible to establish both direct and reverse effects and the force of influence on the formation of different indicators of the yield structure.

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