Evaluation of breeding material of awnless rump (Bromus inermis Leyss.) For productivity in agrophytocenoses mixed with alfalfa

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Abstract. In recent decades, the tendency of climate aridization has been increasing in the main agricultural regions. This has a negative impact on the productivity of agricultural crops. In this regard, an important task is to identify the most tolerant to changing conditions species and varieties of forage grasses with the most adaptive potential, the cultivation of which will make it possible to compensate for extreme manifestations of climatic changes. Awnless rump (Bromus inermis Leyss) is one of the most widespread and long-term forage perennial grasses that grow in almost all areas where grasses are possible. This crop can be used in fodder production for hay and pasture use, as well as hay and bulky canned fodder. However, the forage productivity of awnless rump has increased insignificantly over the past 50 years, which is explained by insufficient selection. Traditionally, the breeding and evaluation of new varieties of rump was previously carried out in its single-species crops. To increase the efficiency of the economic use of herbs, it is necessary to reorient breeding programs to develop new highly productive varieties with increased resistance to a complex of factors of biotic, abiotic and operational stress. Phytocenotic breeding is an important aspect of the biogeocenotic approach to the breeding of awnless rump. Creation of a new starting material of rump, with increased phytocenotic plasticity, will significantly increase the productivity of grass mixtures based on this culture. As a result of selection work, samples with high complementarity were obtained in grass mixtures with alfalfa varia (Martyn) Arcang.)

Keywords: awnless rump, initial material, mixed sowing, fodder and seed productivity.

1. Introduction
In recent years, aridity and drought have become major global problems due to their environmental and socio-economic consequences. Increasing aridity causes a decrease in the biological and economic productivity of terrestrial ecosystems and poses a serious threat to ecological processes [1]. Trends and dynamics of climatic changes noted in recent decades around the world are expressed in an increase in the frequency and intensity of extreme events, in particular, such as an increase in temperature in general, leading to an increase in aridity, have a negative impact on the stability of agricultural production. The harmful effects of climate change on food security can be neutralized by introducing
stress-resistant crops and varieties into production that are able to overcome the negative consequences of aridization [2, 3]. Under the conditions of increasing climate aridization, it becomes an important task to identify the most tolerant species and varieties of forage grasses for specific soil and climatic conditions with the most adaptive potential, the cultivation of which will compensate for the extreme manifestations of climatic changes. In this case, the tolerance of agricultural crops means the ability of populations, varieties, plants to tolerate the adverse effects of one or another limiting environmental factor without a sharp decrease in productivity [4].

The genus Bromus L. includes more than 150 species, of which about 10 are used in agriculture, and the rest have the status of weeds. The main species used in production are B. catharticus from the South American complex and B. inermis from the Eurasian group [5]. In the conditions of the Central Black Earth Region of Russia, awnless rump (Bromus inermis Leyss) is the most demanded in fodder production for hay and pasture use, as well as in the preparation of hay and bulk canned fodder among perennial bluegrass grasses, especially in the steppe regions. Awnless rump is a sod-forming perennial herbaceous species grown mainly for the production of hay, as well as for use in pastures. Awnless rump is characterized by high adaptability to dry climate [6, 7]. In terms of the yield of green mass, fodder qualities, drought resistance, the ability to grow in areas with different soil and climatic conditions, awnless rump occupies one of the first places among perennial bluegrass grasses. In terms of winter hardiness, it is unmatched among perennial grasses; it tolerates severe winters with little snow [8].

Despite the efforts made, the forage productivity of awnless rump has increased insignificantly over the past 50 years of selection [9]. To plan the breeding process and improve the efficiency of seed production, detailed knowledge of the method of reproduction of the species, based on the study of its biological characteristics, is required. Fertilization occurs mainly through cross-pollination. The complex polyploid nature and predominantly cross-pollination of the awnless rump presupposes the widespread use of the heterosis effect in the breeding of this species, which can be maintained for a long time in the panmictic populations of this culture [10]. Panmictic rump populations cannot drastically change their characteristics and properties in space and time under the prevailing environmental conditions and biocenotic relationships in the process of reproduction of the variety. The selection of such grasses, as a rule, is aimed at improving heterogeneous populations [11]. In the created complex hybrid populations, individuals can freely interbreed with each other, and in the process of reproduction of such varieties-populations, a balanced system is formed, which can maintain the effect of heterosis for a relatively long time [10].

To increase the efficiency of the economic use of herbs, it is necessary to reorient breeding programs to develop new highly productive varieties with increased resistance to a complex of factors of biotic, abiotic and operational stress based on the biogeocenotic approach [12]. In this regard, phytocenotic breeding is an important aspect of the biogeocenotic approach in the selection of perennial grasses, the varieties of which must be adapted for growing in a closed herbage of forage agroecosystems and for long-term use. Analysis of the data available in the literature indicates the important role of competition between plants in the field for the formation of yield. Only 10-20% of the potential genetically determined productivity of an individual plant is realized in the field. About 50% of the total variance of phenotypes is due to genetically and ecologically determined differences in the competitive ability of plants [13].

When breeding perennial forage grasses, the main objection to the selection in a sparse monospecific sowing of them The development of multi-component thickened forage grasses is a tendency to select strong competitors with high productivity potential and the ability to capture living space at the expense of neighbors, but do not realize their potential in a genetically homogeneous and dense cenosis [14].

In breeding focused on the use of phytocenotic effects arising from the interaction of different species and population structures, varieties are formed to create long-lived multicomponent forage agrophytocenoses and agroecosystems. Therefore, the selection of highly productive forms must be carried out under conditions of mixed sowing - on the stress gradient of phytocenotic selective media [12].
The efficiency of cultivation of perennial grasses is largely determined by the effectiveness of selection in a particular natural region and the advantages of new varieties. The previously created rump variety Pavlovsky 22/05 is highly productive, suitable for cultivation in various environmental conditions, with different duration of economic use. However, at the station, previously, the assessment of promising material in breeding nurseries was carried out only in single-species crops. Varieties created in the absence of interspecific competition cannot fully realize their adaptive and productive potential. Therefore, breeding work was launched at the station to create highly productive varieties of legumes and grasses with a high level of phytocenotic resistance and compatibility in multi-species agrophytocenoses [15].

Purpose of work. To create for the conditions of the Central Black Earth a promising breeding material of awnless rump with high potential productivity, resistant to the stress effects of abiotic and biotic environmental factors, which should have good feed qualities, a high level of phytocenotic resistance, and suitable for growing in the steppe zone.

2. Materials and Methods
Research was carried out at the Voronezh Experimental Station on perennial grasses on awnless rump in field and meadow crop rotations. At the station, research has begun on the creation of highly productive varieties of legumes and grasses with a high level of phytocenotic resistance and compatibility in multi-species agrophytocenoses. At the same time, interspecific and interspecific hybridization, polycross are used, followed by targeted individual and mass selection to achieve the highest productivity of forage mass and seeds, the intensity of regrowth, and resistance to unfavorable environmental factors. The task of creating a cultivar with a certain level of phytocenotic compatibility in multi-species agrophytocenoses for the conditions of the steppe part of the CBER was set for awnless rump.

In all the years of research, meteorological conditions significantly differed from each other and from the average long-term indicators. The average daily air temperature exceeded the average annual values, and in some months the excess was 4.1 - 5.8 ° C. For the establishment of nurseries, a site with fertile, cultivated soils typical for the zone and leveled relief was chosen.

3. Results and Discussion
Breeding studies were carried out according to the phytocenotic program and were aimed at creating competitively compatible in grass mixtures and ecologically complementary varieties that provide a hay yield of 70-80 c / ha, seeds of 4-5 c / ha. It was carried out after the creation and introduction in 2010 into the State Register of a new variety of awnless rump Voronezh 17, which was approved for use in 1, 4 and 5 regions. The new cultivar belongs to the awnless rump of the steppe ecotype.

The cultivar is a complex hybrid population created from the samples obtained from the interspecific crossing of the straight rump with the awnless rump variety Pavlovsky 22/05, on the basis of long-term biotypic selection and subsequent polycross of the interspecific hybrid and promising genotypes of the introduced domestic and foreign source material of the rump. Further testing of the new variety Voronezhsky 17 and promising samples for the floodplain conditions of the Central Black Earth Region with high potential productivity continued. In the breeding nursery, samples were studied in single-species inoculation and subsequent polycross of the interspecific hybrid and promising genotypes of the introduced domestic and foreign source material of the rump. Further testing of the new variety Voronezhsky 17 and promising samples for the floodplain conditions of the Central Black Earth Region with high potential productivity continued. In the breeding nursery, samples were studied in single-species inoculation and mixed with alfalfa. The mixture consisted of 70% rump and 30% alfalfa from the seeding rate. In the first year, with the early spring sowing period, a full-fledged one cut was formed. Alfalfa predominated in the grass mixture on all plots. According to different numbers, its content ranged from 63% (Pavlovsky standard 22/05) to 80%. On the sowing of the second year of life, alfalfa also prevailed in the first and second cuttings. According to different numbers, its content for two cuttings was more than 60%. Voronezh 17 had the best score of 69.2%. And only one room standard Pavlovsky 22/05 had 40.8%.

In the breeding nursery of the awnless brood in 2011, the study was carried out in a single-species crop and in a mixture with alfalfa varia (Medicago sativa L. nothosubsp.varia (Martyn Arcang.). The mixture consisted of 70% rump and 30% alfalfa from the full seeding rate. In the year of sowing, a full-
fledged one cut was formed. Alfalfa predominated in the grass mixture on all plots. According to different numbers, its content ranged from 68.1% to 84.1% (Pavlovsky standard 22/05 had 63%). On the sowing of the second year of life in 2012, alfalfa also prevailed in the first and second cuttings. According to different numbers, its content for two cuttings was more than 50%. And only one number had an alfalfa content of 49%, the Pavlovsky 22/05 standard had 40.8%.

In 2013 and 2014, at the sowing of the third and fourth years of the life of the grass mixture, rump predominated. According to different numbers, its content for two cuttings in 2013 ranged from 53.7 to 76.2%, in 2014 - from 71.5 to 86.0%. Pavlovsky standard 22/05 had 81.1% and 83.9%, respectively. On average, over four years, the alfalfa content ranged from 31% to 53.8%. This longevity of alfalfa guarantees the cereal component of the grass mixture an available amount of biological nitrogen and improves the quality of the forage by increasing the collection of protein. The data obtained show that the standard variety Pavlovsky 22/05 turned out to be the most aggressive. The content of alfalfa in the mixture with this variety was more than 50% only in the year of sowing, in the second year of life it was 40%, and in the third and fourth years it was already less than 20%. The studied samples have greater plasticity and phytocenotic compatibility in alfalfa grass mixture.

In terms of the productivity of the forage mass, eight samples out of the eleven samples of awnless rump mixed with alfalfa exceeded the standard (12.64 t/ha) over four years on average. In terms of the productivity of only rump, all samples were below the standard (87.2 c/ha). In a single-species sowing of rump, on average, three samples out of eleven exceeded the standard (10.08 t/ha) from 5 to 15% over three years.

4. Conclusion
The arid weather conditions that have developed over the years of research made it possible to select samples of awnless rump with a higher resistance to stress factors. When selecting numbers for economically valuable indicators, the phytocenotic plasticity of the studied samples was taken into account, suitable for creating multicomponent legume-cereal agrophytocenoses for fodder purposes under conditions of climate aridization.

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