

**EVALUATION OF SAINFOIN (*ONOBRYCHIS*) IN THE SOURCE MATERIAL NURSERY ACCORDING TO NEW SELECTION CRITERIA AT THE INITIAL STAGES OF ORGANOGENESIS**

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**Topicality.** The implementation of new selection criteria will solve the problem of forming the sainfoin resistance to extreme hydrothermal conditions and insufficient moisture. Sainfoin adult plants have a high level of drought resistance, unlike its seedlings, which are sensitive to the air and soil moisture deficit. Therefore, the ability of seedlings to adapt to unfavourable moisture conditions has a positive effect on the further plant development and the formation of their productivity elements. **Purpose.** To evaluate the principles of new selection criteria for sainfoin biotypes in the breeding process at the initial stages of organogenesis. **Materials and methods.** The laying of the nursery of the initial material was carried out using new elements of the technology of growing sainfoin, namely summer sowing. Seeds of samples obtained by positive selection from breeding, seed crops, collections of other scientific institutions and local wild populations of sainfoin were sown. The new criteria for selecting sainfoin biotypes are based on an assessment of the intensity of root system development and the calculation of the coefficient of negative drought effect. General scientific research methods are as follows: field, laboratory, measuring-weight, calculation-comparative, mathematical statistics. **Results.** In the source material nursery of the first year of life, 113 families (45.7 % of the total) formed a root system with a volume of more than 6.5 cm<sup>3</sup> within 2.5 months after sowing. Only 77 families (31.2 % of the total number) had a coefficient of negative drought effect of 0.46 or less, i.e., they are suitable for breeding the highly productive populations in arid climatic conditions. Sowing seeds of families selected according to the new criteria ensured that number of families with a strong root system (more than 6.5 cm<sup>3</sup>) increased from 42.2 % to 57.2 % in the next generation, increased plant survivability during the first year of life from 63.2 % to 87.2–95.0 %, in winter – from 83.3 % to 90.4–94.8 %, and resistance to fungal diseases from 81 % to 90–95 %. In the nursery of the source material, the share of families with the highest number of shoots per plant (> 27 pcs) and plant height (> 20 cm) was 27.4 % and 26.6 %, respectively, and was equal to the number of families with a root volume of more than 7.5 cm<sup>3</sup> – 27.4 %. **Conclusions.** According to the results of determining the root volume of sainfoin plants and calculating the coefficient of negative drought effect, the most productive breeding samples can be selected in the first years of life when using summer sowing with freshly harvested seeds. Selection of breeding material based on new criteria made it possible to identify families with high adaptive potential at the initial stages of plant development in arid conditions.

**Key words:** *breeding, sainfoin, root volume of plant, coefficient of negative drought effect, plant health*

**Introduction.** Sainfoin is the most promising crop for efficient field fodder production in conditions of insufficient moisture and low soil fertility. This legume fodder crop is the least energy-consuming and most resistant to adverse weather conditions that provides complete feed for farm animals. However, there is a challenge to increase the seed and feed productivity of sainfoin due to the low seed multiplication rate [1].

Plant breeding aimed at increasing yield and product quality, resistance to droughts,

extreme air and soil temperatures, pathogens and pests is important to preserve and improve the economically valuable traits of this crop.

As is known, at high drought tolerance of adult sainfoin plants, its seedlings are sensitive to air and soil moisture deficit [2]. Therefore, the adaptation of seedlings to unfavourable moisture conditions has a positive effect on the further plant development and the formation of their productivity elements [3].

In 2011–2015, the researchers of the Donetsk State Agricultural Experimental Station

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of NAAS developed a method to accelerate the breeding process in the Transcaucasian sainfoin (*Onobrychis transcaucasica* Gross.) varieties adapted to the conditions of the south-eastern region of Ukraine based on the reduction of the seed reproduction period as a result of the application of the developed elements of the technology of summer sowing with freshly harvested seeds [4, 5]. The introduction of this method into the breeding process of the Experimental Station has shown its high efficiency. However, the generally accepted selection criteria are not sufficient to solve the breeding problems of developing sainfoin resistance to extreme hydrothermal conditions at the summer sowing.

It is established that intensive development of the root system at the initial stages of sainfoin organogenesis in arid climatic conditions, especially at summer sowing dates, is crucial to prevent seedling death and ensure a satisfactory condition of crops in autumn of the first year of life. Accelerating the growth of the root system is one of the ways to create varieties that have the right properties. This can be achieved as a result of breeding work aimed on selecting sainfoin biotypes with increased root volume. However, methods for determining the volume of the sainfoin root system [6-8] developed currently do not meet the requirements of simplicity, low cost, manufacturability considering a large number of samples and exact results.

The Donetsk State Agricultural Research Station of NAAS has developed an effective method of growing the root system of plants using bottomless split containers [9], but accounting for a large number of samples requires significant labour, material and financial costs.

In 2020, the Donetsk State Agricultural Research Station of NAAS developed a method for growing the root system of sainfoin breeding material in cylindrical containers of 1 m length, made of low-resistance plastic pipes [10]. Such containers are lightweight, technologically advanced, user-friendly and inexpensive in manufacture. For selection purposes, it was sufficient to make only a comparative assessment of the development intensity of the root system in different populations. The high manufacturability, simplicity and significant savings in labour and financial resources were crucial for the decision to use this method in the breeding

process.

As a way of increasing the drought resistance of sainfoin varieties is the development of source material based on the selection of biotypes with consideration of the coefficient of negative drought effect ( $C_{NDE}$ ). Selection method according to this criterion is based on a comparative assessment of the manifestation of the main economically valuable traits when each sample is sown in conditions that differ significantly in terms of moisture supply.

The level of reduction in the manifestation of such traits (in percentage terms) under summer sowing in dry conditions compared to optimal conditions is established to fulfil the current task. The coefficient of the negative drought effect is determined by the formula:

$$C_{NDE} = \frac{x}{y} \times 100 \%,$$

where:  $C_{NDE}$  – coefficient of negative drought effect;  $x$  – degree of trait manifestation under optimal growing conditions (sowing date – 15 April);  $y$  – degree of trait manifestation in drought conditions (sowing date – 10 August).

It was determined that the lower coefficient of negative drought effect means that the absolute value of a population trait decreases less under drought, and the drought tolerance is higher.

Coefficient of negative drought effect was determined according to field germination, seedling survivability and plant condition in the first year of life, winter hardiness, seed yield and green mass.

The purpose of the research is to evaluate the principles of new criteria for selecting sainfoin biotypes in the breeding process at the initial stages of organogenesis.

Objectives of the study are to select new forms of sainfoin plants according to economically valuable traits in the nursery, to study their adaptive potential according to new selection criteria.

**Materials and Methods.** In 2016–2020, the research was carried out at the Donetsk State Agricultural Research Station of NAAS. The source material nursery (SMN) was laid out using new elements of sainfoin cultivation technology (summer sowing) aimed to reduce seed reproduction and accelerate the breeding process. The SMN sowed seeds of samples obtai-

ned by positive selection from breeding and seed crops, collections of other scientific institutions and local wild populations. The material under study (breeding samples and plant forms) was arranged in groups according to individual traits.

Sowing was carried out with a selection seeder SKS-6-10 with a central seeding mechanism with a row spacing of 90 cm at a seed rate of 400 thousand germinating seeds per 1 ha. Area of sown plots was 45 m<sup>2</sup>. The standard Rezonans variety was placed through 20 numbers. The seed yield was determined by threshing the plants from each plot after full seed maturity.

In the course of the research, general scientific research methods were used: field, laboratory, weighing and measuring, calculation and comparison; mathematical statistics methods. In addition, some special methods were used: dialectical, hypothesis, synthesis, observation, economic and mathematical.

All breeding work and primary seed production of new varieties were carried out in accordance with generally accepted methods [11–14].

**Results.** In 2016, two nurseries of source

material were studied to determine the patterns of inheritance of sainfoin resistance to arid environmental conditions by their general state at the end of the growing season in the first year of life and the development intensity of the root system in the juvenile period of plants and to select the best families according to these traits. These nurseries were laid out according to the identical scheme, but in conditions with different moisture supply. Optimal conditions were at sowing date of April 14, 2016, and moisture deficit conditions were at sowing date of August 10, 2016. These sowing dates were used to identify families with a low coefficient of negative drought effect, whose indicators of the main economically valuable traits slightly deteriorated under drought conditions.

In the first year of life, the coefficient of the negative drought effect was determined by the general plant health at the end of the autumn growing season. The research results showed that high air and soil temperatures at the initial stages of plant development when using summer sowing led to deterioration in general plant health compared to crops that were sown under optimal conditions in spring (Table 1).

**Table 1. Characteristics for the source materials of sainfoin according to the general conditions of families in 2016**

Score, points	Sowing date – April 14, 2016		Sowing date – August 10, 2016	
	Number of families, pcs	%	Number of families, pcs	%
5	58	26.6	51	20.6
4	95	43.6	80	32.4
3	59	27.1	96	38.9
2	6	2.7	17	6.9
1	–	0	3	1.2
Total	218	100	247	100

Share of families with 5 and 4 points decreased by 17.2 %. This indicator is relevant in the breeding process as it indicates the adaptive potential of sainfoin plants to adverse environmental conditions. This indicator describes the family's response to adverse factors, and we can use it to select families by comparing the average coefficient of negative drought effect of the entire nursery. Selection of families with the coefficient of negative drought effect lower than the average coefficient for the nursery allows to obtain new populations with higher adaptive potential in the following generations compared to the original population where the selection was carried out.

Plant resistance to unfavourable abiotic factors depends on the development intensity of the root system at the initial stages of organogenesis. With the purpose to determine the best families for this trait and the ability to preserve its manifestation in arid conditions, sowing was carried out in plastic containers, 10 seeds from each family per container in optimal hydrothermal conditions on April 14, 2016, and in arid conditions on August 10, 2016. The volume of the root system was determined by the method of D. A. Sabinin and I. I. Kolosov on 46 days after sowing.

The results of these records and calculation of the coefficient of negative drought ef-

fect on the root system development showed that out of 113 families (45.7 % of the total number in the nursery) with a root volume of more than 6.5 cm<sup>3</sup>, only 77 families (31.2 %) had a coefficient of negative drought effect not exceeding 0.46 (Table 2). They were suitable for development of highly productive populations

in arid climatic conditions. Other 36 families (14.5 %) formed a developed root system, but had insufficient adaptive potential, resulting in a significant inhibition of plant development by adverse abiotic factors (Table 2). These families were subject to culling at the time of selection.

This selection method significantly increa-

**Table 2. Negative drought effect on root volume of sainfoin in the source material nursery**

Root volume, cm <sup>3</sup>	Number of families with C <sub>NDE</sub> < 0.46		Number of families with C <sub>NDE</sub> > 0.46		Total of families	
	pcs	%	pcs	%	pcs	%
> 6.5	77	31.2	36	14.5	113	45.7
< 6.5	14	5.7	120	48.6	134	54.3
Total	91	36.9	156	63.1	247	100

sed the efficiency of the breeding process, but it required to establish the patterns of inheritance of adaptive properties in subsequent generations.

In the spring of 2018, we conducted an experiment to determine the development intensity of the root system in the best families in terms of adaptive potential, 77 families were selected in 2017 from the source material nursery, which was established in 2016. In a previous experiment in plastic containers, these

families were characterised by the maximum root volume (>6.5 cm<sup>3</sup>) with a coefficient of negative drought effect not exceeding 0.46.

We found that sowing with seeds of families selected on the basis of intensive development of root systems ensures an increase in the proportion of families with a powerful root system from 42.2 % to 68.8 % in the next generation (Table 3).

According to the results of this experi-

**Table 3. Inheritance of the ability of intensive development of the root system in the next generation**

Root volume, cm <sup>3</sup>	Original population, sowing date – April 14, 2016		Next generation, sowing date – August 10, 2016	
	number of families, pcs	%	number of families, pcs	%
> 6.5	92	42.2	53	68.8
< 6.5	126	57.8	24	31.2
Total	218	100	77	100

ment, it was found that the development intensity of the root system at the initial stages of organogenesis is an effective selection criterion when applying the method of accelerating the breeding process in summer sowing with freshly harvested seeds. Such selection is an effective way to increase the sainfoin seed and fodder productivity.

In 2017, observations and selections were carried out in the source material nursery for 218 families, which was laid out on 14 April 2015.

The winter hardiness score was 5 points for 37 families, 4 points for 56 families; the spring regrowth intensity score was 5 and 4 for 46 and 62 families, respectively; the leafiness score – for 39 and 53 ones; the fertility score –

for 45 and 61 ones; the productivity score – for 44 and 55 ones; the disease resistance score – for 38 and 49 families (Table 4).

In 2017, the families selected according to these criteria were additionally culled considering the development intensity of the root system in the initial stages of organogenesis, which were determined in 2015 in the first year of life.

Similar work was carried out at SMN, which was laid out in 2016. The nursery included 247 families. For winter hardiness, 52 families received a score of 5 points, 74 families – 4 points, for spring regrowth intensity – 65 and 81 families received 5 and 4 points, respectively, for leafiness – 56 and 70, for fertility – 61 and 75, for productivity – 59 and 72, for disease re-

**Table 4. Characteristics of source material in the SMN of the third year of life**

Score, points	Number of families by selection criteria, pcs					
	condition of overwintering	regrowth intensity	leafiness	fertility	productivity	resistance to diseases
5	37	46	39	45	44	38
4	56	62	53	61	55	49
3	96	59	70	68	64	75
2	17	29	27	21	26	28
1	12	22	29	23	29	28
Total	218	218	218	218	218	218

sistance – 53 and 60 families (Table 5).

The new SMN, laid out on 11 August 2017,

consisted of 124 families. This year, the main

task was to determine the development intensity

**Table 5. Characteristics of source material in SMN of the second year of life**

Score, points	Number of families by selection criteria, pcs					
	condition of overwintering	regrowth intensity	leafiness	fertility	productivity	resistance to diseases
5	52	65	56	61	59	53
4	74	81	70	75	72	60
3	93	50	61	55	66	62
2	19	34	32	37	26	47
1	9	17	23	19	24	25
Total	247	247	247	247	247	247

of the root system of the families at the initial stages of organogenesis and their ability to survive under high temperatures and moisture deficit.

To determine the development intensity of the root system, we have been growing plants in

polypropylene cylindrical containers. As a result of the research, 34 families with a root volume of more than 7.5 cm<sup>3</sup> and 37 families with a volume of 6.5–7.5 cm<sup>3</sup> were identified, which is 27.4 % and 29.8 % of the total number of families in the nursery, respectively (Table 6).

**Table 6. Root volume in the SMN of first year of life**

Root volume, cm <sup>3</sup>	Number of families, pcs	%
> 7.5	34	27.4
6.5–7.5	37	29.8
< 6.5	53	42.8
Total	124	100

The number of families in the SMN increased from 42.2 % of the total in 2016 to 57.2 % in 2017 due to the systematic selection of source material – from a plant with a root system volume of more than 6.5 cm<sup>3</sup>. Therefore, it was decided to select families with an average root system volume of more than 7.5 cm<sup>3</sup> for further work.

The observations revealed close correlations between the development of the root system and the plant health at the end of the growing season in autumn (Table 7).

The proportion of families with the maximum number of shoots per plant (> 27 pcs) and plant height (> 20 cm) was 27.4 % and 26.6 %, respectively, and was compared to the number of families (27.4 %) with a root volume of more than 7.5 cm<sup>3</sup>. Analysing the records and observations of the first year of life, 29 families were selected for further research.

Thus, determining the root system volume of sainfoin plants and calculating the coefficient of negative drought effect allows to select the most productive breeding samples already in the

**Table 7. Condition of plants before cessation of growth season in autumn at SMN of first year of life**

Indicator	Number of families, pcs	%
Number of shoots per a plant, pcs		
> 27	34	27.4
20–27	37	29.8
< 20	53	42.7
Total	124	100
Plant height, cm		
> 20	33	26.6
15–20	35	28.2
< 15	56	45.2
Total	124	100

first years of life when using summer sowing with freshly harvested seeds.

**Conclusions.** The high air and soil temperature observed at the initial stages of sainfoin organogenesis in the summer sowings in the nursery of the source material in 2016 reduced the proportion of families with general condition scores of 5 and 4 points by 17.2 % at the end of the first year of life. This indicator allows us to determine the response of the family to unfavourable abiotic environmental factors and therefore it can be used as a selection criterion for comparison with the average coefficient of the negative drought effect of the entire nursery.

In 2016, in the nursery of the first year of life, it was found that 113 families, which represent 45.7 % of the total number in the nursery, formed a root system with a volume of more than 6.5 cm<sup>3</sup> 2.5 months after sowing. However, only 77 families (31.2 % of the total number) were characterised by the coefficient of negative drought effect at no more than 0.46, i.e. they were suitable for developing highly productive populations in arid climatic conditions. Other 36 families (14.5 %) formed a developed root system; however, they had insufficient adaptive potential, which resulted in a significant inhibition of plant development under the influence

of adverse abiotic factors.

Sowing with seeds of families selected from the source material nursery using positive selection by the intensity of root system growth provided in the next generation of 2017 an increase in the proportion of families with a powerful root system (root volume of more than 6.5 cm<sup>3</sup>) from 42.2 % to 57.2 %, increased plant survivability in the first year of growing season from 63.2 % to 87.2–95.0 %, in winter period – from 83.3 % to 90.4–94.8 %, and resistance to the spread of fungal diseases from 81 % to 90–95 %. This method of selection should be used as an environmentally friendly way to increase the productivity of sainfoin populations.

In 2017, the proportion of families with the maximum number of shoots per plant (> 27) and plant height (> 20 cm) in the source material nursery was 27.4 % and 26.6 %, and was equal to the number of families with a root volume of more than 7.5 cm<sup>3</sup> – 27.4 %. As a result, close correlations between the development of the root system and the plant health were established.

Selection of breeding material according to new criteria allowed to identify families with high adaptive potential at the initial stages of plant development in the arid conditions of the eastern part of the Northern Steppe of Ukraine.

## References

- Cherenkov, A. V., & Tarasenko, O. A. (2005). Ways of increasing the seed productivity of safflower in the conditions of the northern subzone of the Steppe of Ukraine. *Biuletyn In-tu zernovoho hospodarstva UAAN* [Bulletin of Institute of Grain Management of the Ukrainian Academy of Agrarian Sciences], 23–24. 143–146 [in Ukrainian]
- Tarasenko, O. A. (2003). Growth and development of safflower plants in the first year of life. *Kormy i kormovyrobnytstvo* [Fodder and fodder production], 51. 161–162 [in Ukrainian]
- Tarasenko, O. A. (2005). Seed productivity of safflower in the first year of life depending on the method and norms of sowing. *Biuletyn In-tu zernovoho hospodarstva UAAN* [Bulletin of Institute of Grain Management of the Ukrainian Academy of Agrarian Sciences], 26–27. 218–220 [in Ukrainian]
- Havrish, S. L., & Bondareva, O. B. (2021). Pat. of

- Ukraine 147992. State register of patents of Ukraine for utility models [in Ukrainian]
5. Havrysh, S. L., & Vashchenko, V. V. (2016). Dates of summer sowing of asparagus in conditions of high air and soil temperatures. *Visnyk Umanskooho natsionalnoho universytetu sadivnytstva, ch.1 «Silskohospodarski nauky»* [Bulletin of the Uman National University of Horticulture, Part 1 "Agricultural Sciences"], 89, 176–185 [in Ukrainian]
  6. Stankov, N. Z. (1964). *Kornevaya sistema polevykh kultur* [Root system of field crops]. Moscow: Kolos [in Russian]
  7. Tkalic, I. D. (1989). *Biologicheskie i tehnologicheskie osnovy vozdelevaniya ozimoy pshenitsy s promezhutochnymi kulturami na oroshaemykh zemlyah Stepi Ukrainy* [Biological and technological foundations of winter wheat cultivation with intermediate crops on irrigated lands of the Steppe of Ukraine]. (Doctor's Agric. Sci. Diss.) Institut sakharnoy svekly UAAN. Kyiv. Ukraina. [in Russian]
  8. Synytskyi, M. P. (2006). *Ahrotekhnologichni osnovy formuvannya produktyvnosti suchasnykh sortiv yarooho yachmeniu v Pivnichnii pidzoni Stepu Ukrainy* [Agrotechnological basis for formation of productivity of modern varieties of summer barley in northern subzone of Steppe of Ukraine]. (Cand. Agric. Sci. Diss.) In-t zernovoho gospodarstvava UAAN. Dnipropetrovsk. Ukraina. [in Ukrainian]
  9. Viniukov, O. O. (2011). Pat. of Ukraine 65964. State register of patents of Ukraine for utility models. [in Ukrainian]
  10. Havrish, S. L., & Bondareva, O. B. (2021). Pat. of Ukraine 147945. State register of patents of Ukraine for utility models. [in Ukrainian]
  11. Metodicheskie ukazaniya po selektsiyi mnogoletnikh trav [Methodological instructions for the selection of perennial grasses]. (1985). Moscow: Fodder Institute named after Williams. [in Russian].
  12. Babich, A. O. (Ed.). (1994). *Metodyka provedennia doslidiv po kormovyrobnytstvu* [Methodology of experiments on fodder production]. Vinnytsia: N. p. [in Ukrainian]
  13. Dospekhov, B. A. (1985). *Mietodika polievoho opyta (s osnovami statistichieskoy obrabotki rezultatov issliedovaniy)* [Methodology of field experience with the basics of statistical processing of research results] (5<sup>th</sup> ed., rev.). Moscow: Ahropromizdat [in Russian]
  14. Parshykova, T. V. (Ed.). (2010). *Fiziologhiia roslin: praktykum* [Physiology of plants: workshop]. Lutsk: Teren. [in Ukrainian]

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**Гавриш С. Л., Вінюков О. О., Бондарева О. Б. Оцінювання еспарцету в розсаднику вихідного матеріалу за новими критеріями добору на початкових етапах органогенезу.**

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**Актуальність.** Впровадження нових критерії відбору вирішить проблеми селекції щодо формування стійкості рослин еспарцету до екстремальних гідротермічних умов та недостатнього зволоження. **Визначення проблеми.** При високій посухостійкості дорослих рослин еспарцету його сходи є чутливими до дефіциту вологи в повітрі та ґрунті, тому здатність сходів адаптуватись до несприятливих умов зволоження позитивно впливає на подальший розвиток рослин та формування їх продуктивності. **Мета.** Оцінити принципи нових критеріїв добору біотипів еспарцету в селекційному процесі на початкових етапах органогенезу. **Матеріали і методи.** При закладці розсаднику вихідного матеріалу проводилась літня сівба еспарцету. Висівали насіння зразків, які були отримані методом позитивного добору з селекційних, насінневих посівів, колекцій інших наукових установ та з місцевих дикорослих популяцій еспарцету. Нові критерії добору біотипів еспарцету базуються на оцінці інтенсивності розвитку кореневої системи та розрахунку коефіцієнту негативної дії посухи. Методи досліджень: польовий, лабораторний, вимірювально-ваговий, розрахунково-порівняльний, математичної статистики. **Результати.** В розсаднику вихідного матеріалу першого року життя 113 сімей (45,7 % загальної кількості) сформували через 2,5 місяця після сівби кореневу систему з об'ємом більше 6,5 см<sup>3</sup>. Тільки 77 сімей (31,2 % загальної кількості) характеризувалися коефіцієнтом негативної дії посухи на рівні не вище 0,46, тобто були придатні для створення високопродуктивних популяцій в посушливих кліматичних умовах. Сівба насінням сімей, які відібрані за новими критеріями, забезпечила в наступному поколінні збільшення питомої ваги сімей з потужною кореневою системою (більше 6,5 см<sup>3</sup>) з 42,2 % до 57,2 %, підвищення виживання рослин протягом вегетації в перший рік життя з 63,2 % до 87,2–95,0 %, в зимовий період – з 83,3 % до 90,4–94,8 %, стійкість до поширення грибкових захворювань з 81 % до 90–95 %. Питома вага сімей в розсаднику вихідного матеріалу, що мали максимальні показники кількості пагонів на одній рослині (> 27 шт.) і висоти (> 20 см), складала 27,4 % та 26,6 % і була на рівні кількості сімей що мали об'єм кореневої системи більше 7,5 см<sup>3</sup> – 27,4 %. **Висновки.** Визначення об'єму кореневої системи рослин еспарцету та розрахунок коефіцієнту негативної дії посухи дозволяє проводити добір найбільш продуктивних селекційних зразків вже в перші роки життя при застосуванні літньої сівби свіжозібраним насінням. Застосування добору селекційного матеріалу за новими критеріями дозволило визначати сім'ї з високим адаптивним потенціалом на початкових етапах розвитку рослин в посушливих умовах.

**Ключові слова:** селекція, еспарцет, об'єм кореневої системи рослин, коефіцієнт негативної дії посухи, стан рослин