STARTING MATERIAL FOR THE BREEDING OF EASILY PRODUCIBLE LENTIL VARIETIES

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Materials and methods. As of January 1, 2021, the National Center for Plant Genetic Resources of Ukraine has a collection comprising 1,101 lentil specimens from 54 countries, including 90 Ukrainian specimens. Of these, 17% are breeding varieties, 45% are breeding lines, 37% are trivially bred varieties and forms, and about 1% are five wild lentil species. The collection specimens were evaluated in accordance with valid methods. Our objective was to evaluate the collection for the traits that determine ease of production and to offer starting material for breeding. Our purpose was to identify sources of valuable economic characteristics for the breeding of easily producible lentil varieties.

Results and discussion. Basing on the multi-year results, we selected and proposed the starting material to create easily producible lentil varieties with the following characteristics: high yields of seeds (11 *macrosperma* sources (Krasnohradska 5 originating from Ukraine [1000-seed weight = 73 g]; 1913 T 15 from Canada [66 g]; UD0600141 from Spain [91 g]; and others) and 25 *microsperma* sources (UD0600707 from Ukraine [34 g]; Miledi from Russia [38 g]; CDC Redcap from Canada [38 g]; and others)); suitability for mechanized harvesting (6 *macrosperma* sources (Mistseva 5 from Ukraine, Ilina from Slovakia, 1921 T 11 from Canada, and others) and 18 *microsperma* sources (Novourenskaya 3565 from Russia, Pozdnyaya from the Czech Republic, CDC Redwing from Canada, and others)); improved biochemical composition and high cooking qualities of seeds (3 *macrosperma* sources (local accessions: UD0600141 from Spain, UD0600329 from Syria, UD0600151 from Mexico) and 10 *microsperma* sources (local accessions: UD0600451 from Bulgaria, UD0600017 from Afghanistan, UD0600979 from Israel, and others)).

Conclusions. For 30 years of intensive work of the National Center for Genetic Resources of Plants of Ukraine, divers and original staring material of lentil has been collected and studied; sources of valuable economic characteristics have been identified for breeding programs of research institutions of Ukraine and other countries.

Key words*: lentil, collection accessions, yield, protein content, digestibility of seeds, ease of production*

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INHERITANCE OF THE PERFORMANCE AND ITS CONSTITUENTS BY COMMON BEAN (PHASEOLUS VULGARIS L.) HYBRIDS AND LINES

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The results of studying the performance and traits that determine it in intervariety hybrid populations of common bean (*Phaseolus vulgaris* L.) grown in the northern forest-steppe of Ukraine are presented. Their significant polymorphism was revealed; the nature of the inheritance of the studied traits included the whole range from positive dominance to depression and was determined by combination of crossing components. It was shown that the selection of idiotypes from hybrid populations should be carried out starting with F_3 and that the harvest index was advisable to use as a selection criterion. The results of studying the created lines in the breeding nurseries of the National University of Life and Environmental Sciences of Ukraine and the National Center for Plant Genetic Resources of Ukraine are summarized.

Key words: *common bean, breeding, variety, trait, hybridization, intervariety hybrids, inheritance of traits, heterosis, breeding accession.*

Bean is a valuable high-protein legume, which is quite common in the global agriculture. In 2016, its area was about 31 million hectares, and the gross harvest exceeded 50 million tons [1]. In many countries, it is the main source of protein (25–28% in seeds of the best varieties), and its amino acid composition is similar to animal proteins. The genus Phaseolus L. is quite polymorphic and includes up to 230 species [2]. In Ukraine, common bean (*Phaseolus vulgaris* L.) is the most widespread. Despite the fact that it is a traditional crop for Ukraine, its area and yields remain rather small: 40.3 thousand hectares and 1.77 t/ha, respectively, in 2019 [3]. The spread of beans in agriculture is hindered, first of all, by the insufficient number of consistently high-yielding easily producible varieties. Although 21 grain bean varieties [4] have been included in the State Register of Plant Varieties Suitable for Dissemination in Ukraine as of 2021, seed production of the crop is unsatisfactory, and the purchase of high-quality seeds for a reasonable price is currently problematic. The significant increase in demand for beans, including for further export, which has been observed recently, attests to the need to boost the breeding effectiveness. Most of modern bean varieties have fairly high potential performances, but the fulfillment of the potential is limited by low homeostaticity and high susceptibility to unfavorable environmental conditions [5], insufficient resistance to pathogens [6], etc. Given considerable climatic changes, the work of international and domestic breeding centers is aimed at exploring the global gene pool of crops, expanding the genetic variability through hybridization, refining methods for selecting elite plants, especially in arid environments [6–9]. Knowledge of inheritance patterns of qualitative and major quantitative traits, features of morphogenesis in hybrid populations in a particular environment will allow for determination of the breeding value of starting material as well as for identification of hybrid combinations and lines with a desirable set of valuable economic traits [10–12].

Our **purpose** was to determine the inheritance nature and polymorphism of the performance and traits that determine it in common bean intervariety hybrids and F_1–F_6 lines and to identify promising genotypes, lines and accessions for further practical breeding.

Material and methods. The field experiments were carried out at the Agronomic Experimental Station of the National University of Life and Environmental Sciences of Ukraine located in the transitional part of the Forest-Steppe in 2006–2016. The soil was typical chernozem; the humus content in the arable layer was 4.58%; pH – 6.8–7.0; the groundwater depth – 4 m. The climatic conditions correspond to a moderate humidity zone with a recent downward tendency in the precipitation amount and an upward tendency in the average daily temperature in some months. Three hybrid combinations were studied (Table 1). F_1–F_6 derived via intraspecies crosses of common bean (*Phaseolus vulgaris* L.) varieties of different ecogeographical origin (Mavka – from Ukraine, Belko – from Yugoslavia, Niger Waly – from Austria, CDC Camino and CDC Rosalee – from Canada) were previously distinguished by a set of economically important features. The study object was peculiarities of expression and inheritance of seed productivity and suitability for mechanized harvesting as well as of traits that determine them. The breeding was conducted according to the full breeding design. We conducted multiple individual selections, starting with F_2. Families were sown separately in wide rows (45 cm wide-space sowing) within the 2^{nd} ten days of May. The seeding rate was 350,000 seeds/ha. The plot area was 1.35–5.4 m^2. Check variety Pervomaiska was sown every 15 accessions. The farming techniques were conventional for the location. When laying out the field experiments, conducting phenological observations, structural analysis of plants, statistical processing of experimental data, we adhered to Ukrainian Extended Harmonized Classifier of the genus Phaseolus L., VA Yepykhov‟s, NA Samaryn‟s, AM Drozd et al.‟s, BA Dospekhov‟s methods, etc. [13–15].

The inheritance nature of traits in F_1 was determined by dominance degree: hp = (F_1 – MP):(P_{max}–MP), where F_1, MP, P_{max} – average values of traits in F_1 hybrid , parents and the best parent, respectively [as Beil GM, Atkins RE described, 16]. The heterosis level in F_1 hybrids was calculated by the following formula: [(F_1–P_{max}) x 100]: P_{max}; the transgression frequency in F_{2-4} – – by the following formula: T_f = (A:B) x 100, where T_f is the transgression frequency, A – the number of hybrid plants with significantly higher value of the trait compared to the best parent, and B – the number of analyzed hybrid plants. The Lewis stability coefficient was calculated by the formula given by AA Zhuchenko [17]: SF_n = HE/LE, where HE and LE are the maximum and minimum values of a trait, respectively, n – the experiment duration.

Results and discussion. As to the performance, F_1 hybrid plants of any of the cross combinations did not exceed the best varieties Mavka and Belko (Table 1). As to the inheritance peculiarities of the performance constituents, they were determined by cross components and included the whole range from superdominance (hp = 1.1–9.4) to depression (hp = –1.5). Our results confirmed the information on the dominance of unrestricted stem growth in F_1 (hp = 1.75–9.40); the heterosis level was 16.5–31.0%. We demonstrated (Tables 1, 2) that intervariety hybridization of common bean expanded the species polymorphism, including due to the emergence of probably transgressive forms in F_2, indicating the inheritance of major quantitative traits by polymery. The transgression frequency and their degree were determined by cross components. Thus, in the F_2 Mavka/CDC Camino hybrid population, the percentage of plants with significantly higher performance compared to the parents was 2.1; in the F_2 Mavka/Niger Waly — 1.3%. No such plants were found in the F_2 Belko/CDC Rosalee population. However, the shares of plants, which were probably transgressive for the lowest pod attachment height and the "the lowest pod beak - soil surface" distance were the highest (37.9% and 37.9% vs. 9.3% and 12.0%, respectively) in this combination. In general, as the results show, the incidence of transgressive forms was also low for the traits determining the seed weight per plant. Their detection in F_2 was significantly complicated by high modification variability and heterosis, which is often observed in the second generation. The share of performance-positive transgressions in F_3 related to the number of probably transgressive forms in F_2 was 50.0% in the Mavka/CDC Camino combination and 12.0% in the Belko/CDC Rosalee combination; they were not detected in the Mavka/Niger Waly hybrid population. In F_4, the percentage of plants that surpassed both parents in terms of performance in the Mavka/CDC Camino combination increased to 66.1%. The results of structural analysis of plants of 32 F_5 breeding lines selected by several economically important traits from 141 sown accessions indicate significant differences between them (Table 3).

By stem growth type, they are determinant plants, 40.4–70.6 cm tall (the average stem length in Mavka was 59.5±1.5 cm), with a curly top, high attachment of the lowest pod (28.0 and 15.8±0.6 cm, respectively), a compressed bush and slight branching. Among the traits determining the suitability of plants for mechanized harvesting, the greatest variability was observed for "the lowest pod beak - soil surface" distance (4.4–18.7 and 7.2±0.7 cm, respectively), as the coefficient of variation was 48.0% (range 23.3–73.7%). The average performance of plants of the selected lines varied 3.5 to 13.8 g (in Mavka it was 6.3±0.6 g) with a coefficient of variation of 21.0–74.7%. There were significant differences in the performance constituents between the lines, in particular in the numbers of productive nodes, pods and seeds per plant. It should be noted that, because of high modification variability of the traits, it is difficult to combine a high performance of plants with a high attachment of the lowest pod, compact bush and determinant type of the stem growth. The identification of genotypes by indirect (quantitative) traits and breeding indices is noteworthy [18, 19].

The breeding indices (number of pods per productive node, number of seeds per pod, 1000-seed weight, harvest index) are more stable compared to the performance and its constituents (Table 3).

Table 1

Inheritance of major quantitative traits by F_1-F_2 common bean hybrids

Trait	Combination											
	Mavka/CDC Camino				Belko/CDC Rosalee				Mavka/Niger Waly			
	F_1			Transgression frequency in F_2, %	F_1			Transgression frequency in F_2, %	F_1			Transgression frequency in F_2, %
	Dominance degree	Inheritance type	Heterosis level, %		Dominance degree	Inheritance type	Heterosis level, %		Dominance degree	Inheritance type	Heterosis level, %	
Stem length	1.75	SD*	16.5	3.6	9.40	SD	28.8	32.0	1.93	SD	31.0	20.2
1000-seed weight	-0.30	II	-11.4	-	-1.50	Dep	-28.6	14.7	-0.75	Do	-18.8	4.0
Number of productive nodes per plant	-0.03	II	-20.0	-	-0.60	Do	-23.1	3.3	1.28	SD	9.5	-
Number of pods per plant	0.28	II	-15.8	-	2.70	SD	6.5	4.0	1.10	SD	2.3	4.0
Number of pods per productive node	2.00	SD	5.6	-	2.00	SD	10.0	-	-0.37	II	-7.2	-
Number of seeds per plant	0.18	II	-27.7	0.7	1.00	Do	0.2	0.7	0.32	II	-28.3	1.3
Number of seeds per pod	0.30	II	-14.3	1.4	0.60	Do	-3.3	0.7	-0.48	II	-30.2	-
Performance	0.92	Do	-2.1	2.1	-0.40	II	-28.4	-	0.83	Do	-6.3	1.3

* – SD – superdominance, Do – dominance, II – intermediate inheritance, Dep – depression

Table 2

Performance in F_2 hybrid common bean populations

Traits	Combination								
	Mavka/CDC Camino			Belko/CDC Rosalee			Mavka/Niger Waly		
	lim	$\bar{x}\pm S_{\bar{x}}$	V, %	lim	$\bar{x}\pm S_{\bar{x}}$	V, %	lim	$\bar{x}\pm S_{\bar{x}}$	V, %
Plant height, cm	8–85	33.5±0.9	30.8	13–92	37.9±1.29	41.8	20–86	44.5±1.6	32.2
Number of productive nodes per plant	1–12	3.6±0.2	48.1	1–15	4.4±0.2	50.9	2–11	5.1±0.3	43.9
Number of pods per plant	2–13	4.6±0.2	47.3	2–18	5.3±0.2	52.1	2–16	6.8±0.4	44.9
Number of seeds per plant	2–55	14.2±0.7	61.9	3–39	12.5±0.6	59.9	3–49	18.7±1.3	59.7
Number of pods per productive node	1–2	1.3±0.03	22.6	1–2	1.2±0.1	17.5	1.0–1.9	1.4±0.03	20.1
Number of seeds per pod	0.7–6.5	3.1±0.1	33.9	0.8–6.5	2.4±0.1	33.8	0.7–4.6	2.8±0.1	35.0
1000-seed weight, g	65.0–640.0	292.6±5.9	23.9	129.0–543.0	307.8±5.2	19.5	73.0–680.0	265.9±11.0	36.7
Performance, g	0.7–15.5	4.0±0.2	61.7	0.6–12.2	3.8±0.2	61.3	0.9–11.3	4.4±0.3	50.8

Table 3

Performance and suitability for mechanized harvesting of the F5 Mavka / CDC Camino breeding lines

Trait	Range	V, %
Stem length	40.4–70.6	12.5
The lowest pod attachment height	13.5–28.0	27.3
“The lowest pod beak - soil surface” distance	4.4–18.7	48.0
Number of productive nodes per plant	3.3–7.7	29.8
Number of pods per plant	4.5–15.3	34.8
Number of seeds per plant	15.1–52.0	38.3
Weight of seeds per plant	3.5-13.8	40.7
Number of pods per productive node	1.2–1.9	20.6
Number of seeds per pod	2.4–6.1	24.9
1000-seed weight	146.6–419.5	17.6
Harvest index	0.13–0.72	18.2

Under arid conditions, the harvest index, which reflects the share of seeds in the total mass of the plant, was low (0.32–0.72). The highest index was recorded in lines 128/12 and 89/12: 0.72 and 0.65, respectively. A previous study [18] demonstrated that there was there a medium to close relationship (r = 0.65–0.78) between the harvest index and performance, with much higher stability of the trait, in groups of indeterminate and determinant varieties of common bean. In the performance assemblage (performance, harvest index, Mexican index, attraction index, ratio of the number of productive nodes per plant to the total number of nodes, ratio of seed weight per plant to the internode length), it is an indicative trait at the level of intervariety phenotypic correlation coefficients (r) of ≥0.5. Therefore, it is advisable to use this trait as a criterion for selecting more productive genotypes in the early stages of breeding.

The average yield from 28 Mavka/CDC Camino breeding lines studied in breeding nursery in years 1 and 2 was 92.8–181.1 g/m^2. 57.1% of the accessions surpassed check variety Pervomaiska (121.8 g/m^2) by 15.4–71.0%. The yield stability coefficient varied 32.6% to 97.1%, indicating a weak response of some of them to changes in environmental factors. In 64.3% of the lines, the yield stability was higher than 70%, and 11 accessions had better values (81.4–97.1%) than the check variety (76.5%), including accessions giving very high yields (higher than the yield from Pervomaiska).

The created breeding material differed significantly in the growing and interphase periods, seed coat color, resistance to lodging and the most common diseases (bacterial blight, bacterial wilt, anthracnose). The selected lines of common bean were further studied in the breeding nurseries according to the full breeding design. Four lines (90/12, 156/12, 159/12, 162/12) were transferred to the National Center for Plant Genetic Resources of Ukraine as sources of economically valuable traits. Certificates of registration of gene pool accessions in Ukraine were issued for lines 162/12 and 156/12. In 2016, bush-shaped plants 162/12 with nutating tops produced a yield of 0.242 kg/m^2 for a 74-day growing period, the performance was 10.5 g; 1000-seed weight — 238 g, number of seeds per pod — 5.0, resistance to the most harmful diseases – 5–7 points. In line 156/12, these indicators were 76 days, 190.0 g/m^2, 9.8 g, 266 g, and 5–7 points, respectively.

Conclusions. The presented results demonstrate the prospects of intraspecies hybridization as a method to create new starting material for grain common bean breeding. It was found that the inheritance nature of major quantitative traits in simple F_1 hybrids was determined by a cross combination of genotypes and included the whole range from positive to negative superdominance. Early generation hybrid populations were highly polymorphic in the manifestation of the performance, suitability for mechanized harvesting and the signs that determine them. The selection of transgressive forms should be carried out starting from the third generation. It is advisable to use the harvest index as a criterion for selecting more productive genotypes. The breeding lines (28) based on the transgressive forms, which were detected in F_2, were studied in the breeding nurseries according to the full breeding design. Four lines (90/12, 156/12, 159/12,162/12) were transferred to the National Center for Genetic Resources of Ukraine as sources of valuable economic traits.

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УСПАДКУВАННЯ ПРОДУКТИВНОСТІ ТА ЇЇ ЕЛЕМЕНТІВ ГІБРИДАМИ ТА ЛІНІЯМИ КВАСОЛІ ЗВИЧАЙНОЇ (PHASEOLUS VULGARIS L.)

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Мета досліджень полягала у визначенні характеру успадкування та ступеня поліморфізму продуктивності та ознак, що її обумовлюють, у міжсортових гібридів та ліній F_1–F_6 квасолі звичайної, виділенні перспективних для подальшої практичної селекції генотипів, ліній і номерів.

Матеріали і методи. Об"єктом дослідження були внутрішньовидові гібридні комбінації F_1–F_6 квасолі звичайної (*Phaseolus vulgaris* L.) від схрещування зразків різного екологогеографічного походження: Мавка/CDC Camino, Бєлко/CDC Rosalee і Мавка/Niger Wally. Досліджували продуктивність та придатність до механізованого збирання, ознаки, їх складові. Селекційну роботу проведено за повною схемою селекційного процесу; метод добору – багаторазовий індивідуальний, починаючи з F_2.

Обговорення результатів. Ступінь фенотипового домінування висоти рослин у F_1 варіювала від 9,4 до -1,75, продуктивності та її складових – від 2,7 до -1,5 од. Частота вірогідних трансгресій у F_2 – від 16,5 до 32,0 та від 0 до 14,7 % відповідно при коефіцієнті варіації від 17,5 до 61,9 %. Меншим ступенем варіабельності відрізнялися індексні ознаки. В F_3 Мавка/CDC Camino частка позитивних за продуктивністю трансгресій склала 50,0, Бєлко/CDC Rosalee – 12,0 % до кількості трансгресивних у F_2 форм. У F_4 Мавка/CDC Camino вона збільшувалася до 66,1 %. За врожайністю стандарт Первомайська перевищили 57,1 % селекційних ліній F_5–F_6. У 64,3 % селекційних ліній стабільність урожайності перевищувала 70 %; кращі, ніж у стандарту (76,5 %) результати (81,4–97,1 %) показали 39,2 % ліній.

Висновки. Показано перспективність методу внутрішньо сортової гібридизації для селекції квасолі. Добір ідіотипів з гібридних популяцій від схрещування контрастних за ознаками компонентів рекомендовано проводити, починаючи з F_3; за критерій добору доцільно використовувати показник збирального індексу.

Ключові слова: *квасоля звичайна, селекція, сорт, ознака, гібридизація, гібриди міжсортові, успадкування ознак, гетерозис, селекційний номер.*

НАСЛЕДОВАНИЕ ПРОДУКТИВНОСТИ И СОСТАВЛЯЮЩИХ ЕЕ ЭЛЕМЕНТОВ МЕЖСОРТОВЫМИ ГИБРИДАМИ И ЛИНИЯМИ ФАСОЛИ ОБЫКНОВЕННОЙ (PHASEOLUS VULGARIS L.)

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Целью исследования было изучение характера наследования и степени полиморфизма продуктивности и составляющих ее признаков межсортовыми гибридами F_1–F_6 фасоли обыкновенной, выделение перспективных для практической селекции генотипов, номеров и линий.

Материалы и методы. Объект исследования – внутривидовые гибридные комбинации F_1–F_6 фасоли обыкновенной (*Phaseolus vulgaris* L.) от скрещиваний образцов разного эколого-географического происхождения: Мавка/CDC Camino, Бєлко/CDC Rosalee и Мавка/Niger Wally. Предмет исследования – продуктивность и пригодность к механизированной уборке, признаки, их составляющие. Селекционная работа проводится по полной схеме селекционного процесса; используемый метод отбора – многоразовый индивидуальный, начиная с F_2. Методы исследований – экспериментально-полевой, лабораторно-аналитический, статистической обработки результатов исследований на ПК.

Результаты исследований. Степень фенотипического доминирования высоты растений у F_1 варьировала от 9,4 до -1,75, продуктивности и ее составляющих – от 2,7 до -1,5 ед. Частота вероятных трансгрессий в F_2 – от 16,5 до 32,0 и от 0 до 14,7 % соответственно при коэффициенте вариации от 17,5 до 61,9 %. Меньшей степенью вариабельности отличались индексные признаки. В F_3 Мавка/CDC Camino доля положительных по продуктивности трансгрессий составила 50,0, Бєлко/CDC Rosalee – 12,0 % к количеству трансгрессивных в F_2 форм. В F_4 Мавка/CDC Camino она увеличивалась до 66,1 %. По урожайности стандарт Первомайская превысили 57,1 % селекционных линий F_5–F_6. В 64,3 % селекционных линий стабильность урожайности превышала 70 %; лучшие, чем у стандарта (76,5 %) результаты (81,4–97,1 %) показали 39,2 % линий.

Выводы. Показана перспективность метода внутрисортовой гибридизации для селекции культуры. Отбор идиотипов из гибридных популяций от скрещивания контрастных по признакам компонентов рекомендовано проводить, начиная с F_3; в качестве критерия отбора целесообразно использовать показатель уборочного индекса.

Ключевые слова: *фасоль обыкновенная, селекция, сорт, признак, гибридизация, гибрид внутривидовой, наследование признака, гетерозис, селекционный номер.*

INHERITANCE OF THE PERFORMANCE AND ITS CONSTITUENTS BY COMMON BEAN (PHASEOLUS VULGARIS L.) HYBRIDS AND LINES

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Purpose. To study the inheritance nature and polymorphism of the performance as well as the traits determining it in intervariety hybrids of common bean (*Phaseolus vulgaris* L.) and to identify promising genotypes and lines for further practical breeding.

Material and methods. The intraspecies F_1–F_6 hybrid common bean (*Phaseolus vulgaris* L.) combinations derived from crosses of varieties of different eco-geographical origin

(Mavka/CDC Camino, Belko/CDC Rosalee and Mavka/Niger Wally) were studied. The study object was the performance and suitability for mechanized harvesting as well as traits that determine them. The breeding was conducted according to the full breeding design. We conducted multiple individual selections, starting with F_2. We used experimental-field and laboratory-analytical methods and statistical processing of data on a PC.

Results and discussion. The degree of phenotypic dominance of the plant height in F_1 hybrids varied 9.4 to –1.75, of the performance and its constituents – 2.7 to – 1.5. The frequency of probable transgressions in F_2 was within 16.5–32.0 and 0–14.7%, respectively, with a coefficient of variation ranging 17.5% to 61.9%. The index traits were less variable. In the F_3 Mavka/CDC Camino the share of performance-positive transgressions was 50.0%; in the F_3 Belko/CDC Rosalee it was 12.0% related to the number of transgressive forms in F_2. In the F_4 Mavka/CDC Camino, it increased to 66.1%. 57.1% of the F_5–F_6 breeding lines gave higher yields than that from check variety Pervomaiska. In 64.3% of the breeding lines, the yield stability exceeded 70%; 39.2% of the accessions were better (81.4–97.1%) than the check variety (76.5%).

Conclusions. Intravariety hybridization was proved to be an effective method for the crop breeding. It is recommended to select idiotypes from hybrid populations from crossing forms have contrasting traits, starting with F_3; it is advisable to use the harvest index as a selection criterion.

Key words: *common bean, breeding, variety, trait, hybridization, intervariety hybrids, inheritance of traits, heterosis, breeding accession.*

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VARIABILITY OF CANNABINOID CONTENTS DEPENDING ON BREEDING METHODS

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Breeding methods are proposed for reducing psychotropic tetrahydrocannabinol, stabilizing the absence of cannabinoids in cannabis cultivars – populations and increasing the contents of cannabidiol, cannabigerol and cannabichromen gaining advantage from valuable collection accessions.

Key words: *breeding, cultivar, mutagenesis, inbreeding, cannabinoids, performance.*

Introduction. In cannabis breeding, a number of techniques have been developed. The techniques allow for the assessment, stabilization and consolidation of the contents or absence of cannabinoid compounds. Current studies are focused on developing approaches to expansion of ranges of genotype expression with subsequent stabilization of valuable traits in the offspring [1].

Literature review and problem articulation. For almost 50 years of breeding for reduction in the narcotic activity of industrial hemp, Ukrainian scientists have achieved the lowest level of tetrahydrocannabinol (THC) in the world – 0.000–0.001%. It is unique that in these studies the dominant trait of the THC presence has been brought to high homozygosity of the population for this trait by selections and targeted cross-pollination of plants without cannabinoids at all. In such a population, there are no plants with a THC content above 1 point, although initially there