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Influence of plant habitus traits on formation of seed productivity in flax

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Abstract: The studies were carried out at the Institute of Oilseed Crops of the National Academy of Agrarian Sciences of Ukraine in 2019/2020. The material of the study was interspecific hybrids of the second generation obtained in the system of dialel crosses with the participation of two wild annual homostylic species *L. angustifolium* and *L. hispanicum* with n = 15 and three accessions of cultivated flax: L 5 (Czech Republic), L 6 (India), M 32/2 (Ukraine). Correlation analysis of habitus traits of a flax plant with the number of bolls was carried out. As a result of studies between the height of the plant and the number of stems on the plant, there is no relationship; between the height of the plant with the number of lateral shoots and the number of bolls, weak and medium correlations, and sometimes their absence, were established (r = +0.218…+0.559; r = +0.253…+0.698, respectively). Medium and strong correlations were found between the number of stems on a plant with the number of side shoots and the number of bolls (r = +0.334…+0.892; r = +0.482…+0.818). Exceptionally strong and stable over the years correlations were observed between the number of lateral shoots on the plant and the number of bolls (r = +0.700…+0.922). The main trait of the habitus of a flax plant, which significantly affects the number of bolls on them, is the number of lateral shoots. This trait can be used as a reliable criterion for selecting plants for breeding for high seed productivity.

Keywords: *Linum usitatissimum* subsp. humile (Mill.) Chernom; *Linum angustifolium* Huds.; *Linum hispanicum* Mill.; interspecific hybrid of the second generation; plant habit; correlation coefficient

INTRODUCTION

The main direction in breeding work with oil flax (*Linum usitatissimum* subsp. humile (Mill.) Chernom) is the creation of varieties with high yield that can provide stable profits in agricultural production. In recent years, the Ukrainian market has seen a negative trend in the production of oilseed flax, one of the reasons is low yield (Rudik, 2020). An effective means of increasing crop yields is the introduction into production of flax varieties with a high genetic potential for productivity, which depends on the wide genetic diversity of the source material (Poliakova & Lyakh 2016; Kryvosheieva et al., 2020; Porokhovinova et al., 2021). Of great importance for solving this problem is the further improvement of the culture using the latest breeding methods, taking into account the genetic characteristics of the parental components and subsequent selection based on the idea type of the variety.The low efficiency of breeding is associated with the lack of a clear understanding among the breeder of exactly what traits should be used to select high-yielding genotypes that have a decisive influence on the productivity potential of oil flax (Zaika et al., 2020).

New productive forms with useful neoplasms can be obtained using interspecific hybridization with wild homostylic annual flax species with n = 15, which cross well with cultivated flax, such as *L. angustifolium* Huds., *L. hispanicum* Mill., *L. bienne* Mill., *L. crepitans* Dumort. Due to their biological characteristics, these species are valuable genetic sources of a large number of bolls, stems, shoots, early maturation, resistance to adverse environmental conditions and diseases (Poliakova, 2016). The diversity of alleles of wild species when introduced into hybridization with cultivated flax makes it possible to introgression and increase heterozygosity, resulting in a wide variety of genotypes with new combinations of properties and traits. Working with such source material is the basis for the success of genetic breeding work to obtain plant forms with such useful characteristics as multi-stem and multi-shoot, increased resistance to biotic and abiotic environmental factors (Lyakh & Soroka, 2008; Poliakova, 2014; Poliakova & Gudoshnik, 2015; Tovstanovska & Lyakh, 2019; 2020).

Obtaining a new source material of flax, created with the participation of the germplasm of wild species, requires a thorough study of the relationship between the traits that determine the seed productivity of the plant. The presence and nature of correlations determines the degree of possible combinations in a new variety of useful traits during hybridization. The connection with a sufficiently high value of the correlation coefficient makes it possible at the early stages of breeding to carry out a preliminary assessment of the breeding material and predict the prospects of genotypes. Thanks to the knowledge of correlations, valuable forms can be distinguished by indirect traits, when direct evaluation is difficult (Mostovenko & Semeniy, 2012; Maslinskaya et al., 2014; Meena et al., 2020).

When creating varieties with the highest possible level of productivity, breeders take into account a complex set of morphological, biological and physiological characteristics that determine the level of yield in specific growing conditions. However, the starting point is the seed productivity of the plant. This is a complex trait with a genetically polygenic basis, the level of which depends on the contribution of many elements. However, the leading trait in the formation of high seed productivity is the number of bolls per plant (Andronik & Ivanova, 2017; Golub et al., 2021).

No less significant in the breeding of oil flax for high productivity are traits of plant habitus. Since the cultivation of oil flax in Ukraine is focused on obtaining seeds, the height of the stem does not matter as much as for fiber flax. However, in the modern world, the bilateral use of oil flax is increasingly noted, which is confirmed by the intensive development in the countries of Western Europe of production for the processing of its fiber. Characterization of oil flax stems makes it possible to identify promising sources for breeding for short fiber and resistance to lodging. The organization of industrial processing of straw and the production of products based on flax raw materials can be a solution to increase the economic efficiency of the crop (Rozhmina et al., 2019; Porkhuntsova & Tomasheva, 2020).

Important breeding traits of oil flax are branching of the stem, both basal (the number of stems formed at the soil level) and in the inflorescence (branching of the main and side stems). The number of stems and shoots on an oil flax plant is very important in shaping the number of bolls on them (Kalinina & Lyakh, 2007; Poliakova, 2019; Tovstanovska & Lyakh, 2019). Currently, varieties of oil flax grown in Ukraine are characterized by small branching - within 1-3 pieces of stems per plant. Therefore, to increase the yield, these traits require further selection refinement. In addition, improving habitus traits will increase the vegetative mass of flax plants, which will increase its competitiveness against weeds and reduce moisture evaporation from the soil surface (Poliakova, 2019).

The aim of the study is to study the dependence of habit traits on the number of bolls in interspecific hybrids of the second generation in various weather conditions in order to identify high correlation coefficients and increase the efficiency of individual selection of productive forms of flax.

MATERIAL AND METHODS

The research was conducted at the Institute of Oilseed Crops of the National Academy of

Agrarian Sciences of Ukraine in 2019-2020. The research material was interspecific F_2 hybrids obtained in the system of diallel crossings with the participation of two wild annual homostylous species (*L. angustifolium* Huds. and *L. hispanicum* Mill.) and three samples of cultivated flax : L 5 (Czech Republic), L 6 (India), M 32/2 (IOC NAAS, Ukraine). The parental forms used by us in crossings were contrasting in terms of the investigated traits.

Thus, the wild species were characterized by a branched creeping stem, more leafiness than that of cultivated flax, early maturity, short growth (25.6-37.9 cm) compared to samples of cultivated flax, the height of which was 42.9-64.5 cm, a large number of stems per plant (5.5-6.8 pieces) versus 1.4-3.2 pieces. in cultivated flax samples, a large number of lateral shoots per plant (18.5-19.8 pcs.) against 7.9-15.3 pcs. in samples of cultivated flax. The number of bolls per plant in wild species was also much higher compared to samples of cultivated flax – 53.4-66.1 pcs. against 12.6-36.9 pcs. (Table 1).

Hybrids of the second generation were sown in the F_2 hybrid nursery in duplicate according to the methodological recommendations in blocks according to the scheme: maternal form – direct and reverse F_2 hybrids – parental form (Lyakh and Polyakova, 2008). Plots 2.0 m long, row spacing – 0.15 m. Structural analysis according to habitus characteristics (plant height, number of stems per plant, number of lateral shoots per plant) and the number of bolls per plant was carried out on 200-250 hybrid plants of the second generation and 20 plants of parental forms.

Statistical data processing (arithmetic mean, standard error, correlation coefficient, correlation coefficient criterion) was performed according to B. A. Dospekhov using the MSTAT-C computer program. It is considered that at r < 0.3, the relationship between the features is weak, r = 0.3-0.7 – medium, and at r > 0.7 – strong (close) (Dospekhov, 1985).

The agro-climatic conditions of the growing season of oil flax in 2019-2020 were different in terms of the main hydrothermal indicators (temperature regime, amount of precipitation, their distribution over decades), which contributed to a more objective study of the hybrid material. As can be seen from Table 2, April 2019 and 2020

Table 1. Characteristics of parental forms of flax, 2019-2020

Parent form	Parameter	Plant height, cm	Number of stems per plant, pcs.	Number of side shoots per plant, pcs.	Number of bolls per plant, pcs.
L. angustifolium	min-max	31-43	4-9	15-28	69-158
	$\overline{X}$±Sx	37.9±0.69	5.5±0.28	18.5±0.83	53.4±3.67
L. hispanicum	min-max	23-35	6-10	18-36	87-192
	$\overline{X}$±Sx	25.6±1.13	6.8±0.41	19.8±0.65	66.1±3.59
L 5	min-max	38-62	1-3	6-17	12-29
	$\overline{X}$±Sx	47.2±1.08	1.5±0.21	8.9±0.97	19.3±1.21
L 6	min-max	34-48	1-3	5-15	7-18
	$\overline{X}$±Sx	42.9±0.79	1.4±0.13	7.9±0.50	12.6±0.48
M 32/3	min-max	51-68	1-5	6-19	22-43
	$\overline{X}$±Sx	64.5±0.91	3.2±0.24	15.3±1.21	36.9±2.82

$\overline{X}$ *– Arithmetic mean; Sx – Arithmetic mean error* at the time of sowing and germination, it was characterized by less precipitation compared to the long-term averages (13.0 and 15.0 mm versus 35.0 mm). The amount of precipitation in May and June 2020, in the "budding-flowering" phases, exceeded the indicaters for 2019 (63.0 and 63.9 mm versus 47.6 and 26.0 mm), as well as the long-term averages (40.0 and 62.0 mm). In July, during the filling and maturation of seeds, the amount of precipitation in the years of research was slightly below the long-term norm. The total amount of precipitation in 2019 amounted to 120.7 mm against 177.2 mm in 2020. The air temperature in the three months of vegetation (April-June) in 2019 exceeded the indicaters for 2020. Thus, 2019 was drier and less favorable for the growth and development of flax plants compared to 2020 (Table 2).

RESULTS

Due to the fact that the most fully productivity can be assessed only at the final stages of selection, when there is a sufficient number of seeds, it is very important to have assessment methods that can be used when selecting elite plants at earlier stages. The number of bolls is a leading feature that affects the formation of high seed productivity of flax plants. Therefore, in our studies, we conducted a correlation analysis of the dependence of this feature on the traits of habitus, such as the height of the plant, the number of stems and the number of lateral shoots on the plant. As a result of these studies, certain dependence was revealed, which must be taken into account in breeding work with flax.

In the conditions of 2019, the trait "plant height" did not correlate with the number of bolls or correlated to a weak and moderate degree (r = +0.262…+0.470). This is a modification relationship that arose and disappeared under the influence of growing conditions. With the number of lateral shoots, the relationship between the height of the plant was not found or was weak and medium (r = +0.293 ... + 0.539), with the number of stems – no correlation was found. The established trend should be taken into account when creating tall forms, since an increase in plant height may not be accompanied by an increase in stem branching, and hence the number of bolls (Table 3).

The relationship of the trait "number of stems per plant" with the number of bolls in all crossing combinations was medium (r = +0.482…+0.670), with the number of side shoots – medium and strong (r = +0.334…+0.794). That is, an increase in basal branching, as a rule, contributes to the formation of more side shoots and bolls on them (Table 3).

The trait "number of lateral shoots per plant" correlated strongly with the number of bolls. For all hybrid combinations, exceptionally high (from +0.700 to +0.851) correlation coefficients were found, which indicates that plants with large lateral branching form a larger number of bolls (Table 3).

In 2020, the correlation of plant height with the number of bolls, stems, and side shoots was similar to 2019. Dependence was mostly weak,

Table 2. Weather conditions of the flax growing season, 2019-2020

Month	Sum of rainfall (mm)			Average monthly temperature (T °C)		
	2019	2020	Average long-term indicators	2019	2020	Average long-term indicators
April	15.0	23.0	35.0	13.0	10.2	8.5
May	47.6	63.0	40.0	20.2	15.8	16.0
June	26.0	63.9	62.0	25.2	24.3	19.4
July	32.1	27.3	58.0	22.5	25,5	22.6
Total	120.7	177.2	195.0	-	-	-

Table 3. Correlations between traits of habit and the number of bolls in interspecific F_2 hybrids of flax in 2019

Trait	Crossing combination	Number of bolls per plant	Number of lateral shoots per plant	Number of stems per plant
Plant height	*L. angustifolium* × L 5	0.172±0.08	0.047±0.08	0.005±0.08
	L 5 × *L. angustifolium*	0.032±0.08	0.048±0.08	0.013±0.08
	L. angustifolium × M 32/2	0.344*±0.07	0.539*±0.06	-0.015±0.08
	M32/2 × *L. angustifolium*	0.262*±0.07	0.211±0.08	0.022±0.08
	L. hispanicum × L 6	0.470*±0.07	0.293*±0.07	-0.007±0.08
	L 6 × *L. hispanicum*	0.379*±0.07	0.034±0.08	-0.158±0.08
	M32/2 × *L. hispanicum*	0.414*±0.07	0.303*±0.08	-0.022±0.08
	degree of correlation	*not detected, weak-medium (0.262-0.470)*	*not detected, weak-medium (0.211-0.539)*	*not detected*
Number of stems per plant	*L. angustifolium* × L 5	0.551*±0.06	0.613*±0.06	-
	L 5 × *L. angustifolium*	0.610*±0.06	0.777*±0.05	-
	L. angustifolium × M 32/2	0.486*±0.08	0.334*±0.08	-
	M32/2 × *L. angustifolium*	0.640*±0.06	0.794*±0.04	-
	L. hispanicum × L 6	0.670*±0.06	0,783*±0.05	-
	L 6 × *L. hispanicum*	0.482*±0.08	0.658*±0.07	-
	M32/2 × *L. hispanicum*	0.549*±0.06	0.727*±0.05	-
	degree of correlation	*medium (0.482-0.670)*	*medium-strong (0.334-0.794)*	-
Number of lateral shoots per plant	*L. angustifolium* × L 5	0.700*±0.05	-	-
	L 5 × *L. angustifolium*	0.736*±0.05	-	-
	L. angustifolium × M 32/2	0.806*±0.04	-	-
	M32/2 × *L. angustifolium*	0.762*±0.05	-	-
	L. hispanicum × L 6	0.849*±004	-	-
	L 6 × *L. hispanicum*	0.704*±0.05	-	-
	M32/2 × *L. hispanicum*	0.851*±0.03	-	-
	degree of correlation	*strong (0.700-0.851)*	-	-

*Note: *– significant at p< 0.01*

rarely average. In this regard, in general, the height of the plant cannot be considered as a feature by which selection can be carried out to increase the seed productivity of flax. Only in some hybrid combinations is there a slight tendency to increase the number of shoots and bolls in taller forms.

The more favorable conditions of 2020 influenced the strengthening of the relationship between the number of stems on the plant and the number of bolls. Mostly, medium and high correlation coefficients were observed (r = +0.633...+0.818). Between the number of stems and the number of lateral shoots, with the exception of one combination, the relationships were strong and amounted to +0.698...+0.892 (Table 4).

The presence of medium and high positive correlations stable over the years in pairs of traits "number of stems-number of bolls" and "number of stems-number of shoots" makes it possible to consider the trait "number of stems per plant" as a fairly reliable criterion for selecting plants with a high seed mass from a plant (Table 4).

The closest relationship is established between the number of bolls and the number of lateral shoots on the plant. A strong positive correlation

Table 4. Correlations between traits of habit and the number of bolls in interspecific F_2 hybrids of flax in 2020

Trait	Crossing combination	Number of bolls per plant	Number of lateral shoots per plant	Number of stems per plant
Plant height	*L. angustifolium* × L 5	0.698*±0.05	0.559*±0.06	0.224*±0.07
	L 5 × *L. angustifolium*	0.402*±0.07	0.276*±0.07	0.038±0.08
	L. angustifolium × L 6	0.495*±0.07	0.363*±0.08	0.079±0.08
	L 6 × *L. angustifolium*	0.374*±0.07	0.317*±0.07	0.028±0.08
	L. angustifolium × M 32/2	0.447*±0.07	0.329*±0.07	0.232*±0.07
	M 32/2 × *L. angustifolium*	0.300*±0.07	0.218*±0.08	0.073±0.08
	L. hispanicum × *L* 5	0.195±0.08	0.071±0.08	-0.077±0.08
	L 5 × *L. hispanicum*	0.058±0,08	-0.112±0,08	-0,047±0,08
	L. hispanicum × *L* 6	0.379*±0.07	0.195±0.08	0.117±0.08
	L 6 × *L. hispanicum*	0.318*±0.07	0.337*±0.07	-0.006±0.08
	L. hispanicum × M 32/2	0.150±0.08	0.066±0.08	0.013±0.08
	M 32/2 × *L. hispanicum*	0.253*±0.07	0.197±0.08	0.032±0.08
	degree of correlation	*not detected, weak-medium (0.253-0.698)*	*not detected, weak-medium (0.218-0.559)*	*not detected, weak (0.224-0.232)*
Number of stems per plant	*L. angustifolium* × L 5	0.633*±0.05	0.740*±0.05	-
	L 5 × *L. angustifolium*	0.738*±0.05	0.698*±0.05	-
	L. angustifolium × L 6	0.649*±0.05	0.771*±0.05	-
	L 6 × *L. angustifolium*	0.756*±0.05	0.833*±0.05	-
	L. angustifolium × M 32/2	0.720*±0.05	0.749*±0.05	-
	M 32/2 × *L. angustifolium*	0.713*±0.05	0.856*±0.04	-
	L. hispanicum × *L* 5	0.748*±0.05	0.764*±0.05	-
	L 5 × *L. hispanicum*	0.750*±0.05	0.755*±0.05	-
	L. hispanicum × *L* 6	0.650*±0.05	0.786*±0.05	-
	L 6 × *L. hispanicum*	0.685*±0.05	0.764*±0.05	-
	L. hispanicum × M 32/2	0.818*±0.05	0.892*±0.04	-
	M 32/2 × *L. hispanicum*	0.792*±0.05	0.855*±0.04	-
	degree of correlation	*medium-strong (0.633-0.792)*	*medium-strong (0.698-0.892)*	-
Number of lateral shoots per plant	*L. angustifolium* × L 5	0.746*±0.05	-	-
	L 5 × *L. angustifolium*	0.814*±0.04	-	-
	L. angustifolium × L 6	0.882*±0.04	-	-
	L 6 × *L. angustifolium*	0.872*±0.04	-	-
	L. angustifolium × M 32/2	0.817*±0.04	-	-
	M 32/2 × *L. angustifolium*	0.921*±0.03	-	-
	L. hispanicum × *L* 5	0.887*±0.04	-	-
	L 5 × *L. hispanicum*	0.782*±0.05	-	-
	L. hispanicum × *L* 6	0.727*±0.05	-	-
	L 6 × *L. hispanicum*	0.810*±0.04	-	-
	L. hispanicum × M 32/2	0.892*±0.04	-	-
	M 32/2 × *L. hispanicum*	0.922*±0.03	-	-
	degree of correlation	*strong (0.727-0.922)*	-	-

*Note: *– significant at p< 0.01*

was observed for all crossing combinations without exception, with coefficient values from 0.727 to 0.922. It should be noted, based on the analysis of the data in Tables 2 and 3, that different growing conditions of interspecific hybrids of the second generation did not affect the strength of the connection between this pair of traits. In view of this, during breeding for increased seed productivity, it is necessary to rely on this correlation for purposeful selection of plants based on the "number of shoots per plant" trait, especially in early generations (Table 4).

DISCUSIONS

Scientific data on the correlations of flax productivity traits are few and have significant contradictions. Thus, according to the results of the correlation analysis, a positive relationship of medium strength was established between the height of the plant and the number of bolls (Maslinskaya et al., 2014; Suleimenova, 2019; Golub et al., 2021), which suggests that as the height of the plant increases, the number of bolls on it will also increase. At the same time, a path analysis revealed a weak or negative correlation between these characteristics, which is consistent with our data (Maslinskaya et al., 2014). According to the results of studies of genotypic and phenotypic correlations by scientists G. Nedi and G. Nepir, it was established that the height of the plant was one of the main features that contributed to the increase in yield, on the basis of which the authors came to the conclusion that this feature can be used as a key criterion in individual selection plants (Nedi & Nepir, 2020).

Research carried out by Meena et al. (2020) showed that the trait "number of bolls per plant" had a strong positive direct effect on the weight of seeds per plant and is one of the important traits in the flax breeding program for high yield. Similar conclusions were made by other scientists (Dogra et al., 2020). It has been proven that the number of bolls is one of the main traits by which elite plants are selected (Golub et al., 2021). Therefore, during the individual selection of plants, as well as when plots are lacking in terms of yield in the selection nursery of the first year, first of all, it is necessary to take into account the number of bolls on one plant (Maslinskaya et al., 2014).

When studying the correlations between the traits of the habit of the linseed plant, it was established that tall growth was accompanied by a greater number of lateral shoots and a lower degree of basal branching of the stem, and significant basal branching contributed to the formation of a greater number of lateral shoots. The relationship between the traits "number of lateral stems" and "number of lateral shoots", "plant height" and "number of lateral shoots" was positive in direction and moderate in strength ($r=0.49$ and $r=0.42$, respectively) , and the relationship between the traits "plant height" and "number of lateral stems" was weakly negative ($r= -0.34$) (Kalinina & Lyakh, 2007; Lyakh & Soroka, 2008). Instead, Poliakova (2020) established a strong relationship between the height of the plant and the number of stems – $r = 0.83$.

The results of research by foreign scientists indicate a positive relationship between the yield of linseed, the number of bolls and the number of shoots. Research (Paul & Kumar, 2019; 2020; Thakur et al., 2020) proved the direct effect of stems and side shoots on the number of bolls and their indirect effect on the biological yield of flax. At the same time, lateral shoots demonstrated a stronger positive effect on the mass of seeds from the plant compared to stems. The authors believe that when creating high-yielding flax varieties, the selection strategy should focus on lateral shoots and stems (Paul & Kumar, 2019). Thus, the authors concluded that stems, lateral shoots, bolls, plant height and other traits can be used as a breeding index to improve seed yield (Patial et al., 2018). Our data established that the main feature of the habit of the plant, which strongly affects the number of bolls, is the number of lateral shoots. Such contradictions regarding the interrelationships of flax traits in the scientific literature are obviously explained by conducting research in different agro-climatic conditions and on different breeding material, most often with a narrow range of variability. Manifestation of traits of flax plant habit and relationships between them can vary depending on growing conditions (Lyakh & Soroka, 2008; Kalinina & Lyakh, 2009; Maslinskaya, 2021).

The seed production of a plant is a polygenically inherited trait, and the expression of its constituent components, in particular, plant height, the number of lateral shoots, the number of lateral stems, the number of bolls, depends on the environmental conditions, the genotype, and the specificity of the interaction of individual genotypes with the environment (Kalinina & Lyakh, 2009; Andronik & Ivanova, 2017). Some genotypes may be more sensitive to environmental conditions, others less sensitive. The level of plant productivity is determined both by the inheritance of the genotype and the environment where the potential is realized, and, most importantly, by the soil and climatic conditions necessary for normal plant growth and development (Mostovenko & Semeniy, 2012; Maslinskaya, 2021). In our research, the more favorable conditions of 2020 compared to 2019 influenced the high manifestation of traits of the habit of flax plants and the formation of a large number of bolls on them. This, in turn, affected the level of correlation coefficients, which were higher in the more favorable weather year 2020. The maximum expression of traits of interspecies hybrids in F_2 populations made it possible to evaluate them objectively.

Interspecific hybrids of flax, obtained from crossing with wild species *L. angustifolium* Huds and *L. hispanicum* Mill. have in their genotype alleles of increased branching genes. In our studies, the progeny of interspecific hybrids that split were distinguished by a wide variety of forms and combinations of traits. Their variability, due to the large contrast of parental components in terms of habit, was significantly higher than in populations from intraspecific crosses. Therefore, this hybrid material served as an optimal model for studying and determining correlation coefficients as accurately as possible. It is no less important that the wide genetic variability for various traits provides the opportunity to select the necessary forms with improved indicators of seed productivity of the plant (Tovstanovska & Lyakh, 2022).

CONCLUSIONS

As a result of determining the relationships between the features of the plant habit and the number of bolls in interspecies flax hybrids of the second generation, on average over two years of research, it is shown:

-lack of relationships between plant height and the number of stems on the plant. Only some weak correlations were detected (r = +0.224...+0.232);

-Weak and medium unstable correlations over the years, and sometimes their absence – between the height of the plant and the number of bolls on the plant (r = +0.253...+0.698), between the height of the plant and the number of lateral shoots on the plant (r = +0.218...+0.559);

-Medium and strong stable correlations over the years – between the number of stems per plant and the number of bolls per plant (r = +0.482...+0.818), as well as between the number of stems per plant and the number of side shoots per plant (r = +0.334...+0.892);

-Strong stable correlations over the years – between the number of lateral shoots on a plant and the number of bolls on a plant (r = +0.700...+0.922).

It was established that the height of the plant cannot be considered a reliable feature when selecting for seed productivity; the feature "number of stems on a plant" significantly affects the formation of the number of bolls.

The main feature of the habitus, which has a direct effect on the number of bolls, is the "number of lateral shoots on the plant". It can be considered a reliable trait for selection and used in breeding for high seed productivity.

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