



EFFICIENCY OF NATURAL HYBRIDIZATION OF VEGETABLE SOYBEANS IN UZBEKISTAN

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ABSTRACT: - Natural hybrids in vegetable soybean cultures are an important source of new starting material for soybean breeding. Systematic production of hybrid plants of vegetable soybeans in Uzbekistan on the basis of natural spontaneous hybridization has been carried out since 2014.

Natural hybridization in vegetable soybeans is carried out mainly by pre-pollination of opened self-pollinated flowers with pollen of unrelated closely growing genotypes. Foreign pollen germinates in the tissues of the pistil simultaneously with its own, which causes intense gametophytic competition. In multi-seeded beans, both hybrid and pseudo hybrid seeds are simultaneously tied, that is, from self-fertilization.

KEYWORDS: Vegetable soybean, variety, hybrid, genotype, natural pollination, parental combinations, maternal, paternal forms.

INTRODUCTION

According to the latest taxonomic classification, the soy belongs to the genus *Glycine*, which has two subgenera: *Soja* and *Glycine*. The cultivated soybean (*G.max*) and its wild relative *G. soja* belong to the subgenus *Soja*. Cultivated vegetable soybeans are common in Southeast Asia and are eaten in

fresh green beans, while wild forms are used only for processing, most of which grow in Australia. The biosystematics of the genus *Glycine* was described by Himovitz et al. (1997).

Hybridization is the main method for performing a soybean breeding program, and it also provides a combination of beneficial

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traits in new varieties. The valuable inheritance of quantitative traits in the economic ratio depends to a strong extent on the genotypic differences in parental forms [5, 10].

Natural hybridization has played and continues to play a crucial role in microevolutionary processes in most self-pollinating crops. For soybeans, it is of considerable interest to study this phenomenon with a view to using it in the creation of source material for the session, as well as preserving the genetic purity of varietal species in the process of selection and seed production. The successful solution of the problem largely depends on the clarification of such fundamentally important issues as the method of pollen transfer and the features of fertilization by unrelated pollen grains [2].

The manifestation of the frequency of outcrossing in cultivated (vegetable) soybeans has a quantitative level of variation, its value is influenced by hereditary, genotype-related and non-hereditary factors caused by the influence of environmental conditions. When studying the patterns of variability in the frequency of spontaneous hybridization in vegetable soybeans, it is complicated by the fact that "internal" and "external" causes act on the trait not directly, but indirectly through the manifestation of other quantitative signs (for example, the pace of passage of development stages; the number and size of flowers; the competitiveness of pollen grains, etc.). [6].

A large number of researchers are of the opinion that the processes of fertilization in plants are under the control of genetic systems. Some of them [1, 7] associate the phenomenon of selectivity in fertilization with the genotype of the maternal organism and believe that homozygous individuals show a

greater tendency to crossbreeding than heterozygous individuals. Other authors [8, 11] assign the main role in the question of gametophytic competition to the genotype of pollen.

Materials and Method

As parents, 9 varieties of vegetable soybeans were taken with alternative features that control the color of plant pubescence (T - corich, t - gray) and the color of the corolla of flowers (W - purple, w - white). In addition, varietal samples differed in origin, length of the growing season, type of growth, height, shape of the bush. Parental forms were sown for repollination on individual plots in pairs in different combinations (30 combinations in total). For a closer spatial arrangement of the components of crossing, a mixture of parents was sown in a ratio of 1: 3 according to the number of seeds. Sowing was carried out according to the scheme of 70 × 20 cm, consisting of five rows 5 m long, the repetition of experiments is fourfold. The extreme (protective) rows of plots were not included in the analysis. Natural hybrids were isolated according to the HIP method.

The frequency of natural hybridization of soybeans was expressed in fractions of one (p). In the statistical processing of experimental data, the method of analysis of variance [4] was used, as well as a modification of this method for indicators of alternative variability [9]. The analysis of the variability of the value of natural hybridization in soybeans in various variants of the experiment was carried out on the basis of a comparison of frequencies in the binomial distribution, the assessment of the correspondence of the splitting by qualitative features to the theoretically expected one was carried out using the criterion χ^2 [3].

Research results

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Studies on the amount of natural hybridization in vegetable soybeans were studied from 2015 to 2022. The results of the studies are presented in Table 1. The data obtained showed that the results obtained, depending on different climatic indicators for the years of research, showed that the proportion of hybrid seeds formed as a result of natural cross-pollination averages 13×10^{-4} . This is an indicator that for every thousand seeds (in biological ripeness) formed on soybean plants, there are one or two seeds tied by foreign

fertilization. This frequency of the event was established on the basis of an analysis of about 410 thousand soybean seeds, so in our opinion it is appropriate to assume that it sufficiently fully characterizes the picture of spontaneous hybridization in this crop.

In this regard, the analysis of the results obtained in other variants was carried out on the basis of a comparison with the average level recorded in the experiment ($13 * 10^{-4}$).

Table 1.

Natural hybridization of vegetable soybeans ($r \times 10^{-4}$) 2015-2022

♀	♂					
	L-04-12	L-06-20	Ilhom	L-09-11	Sulton	X
Izumrud	26	28	6	18	6	17
Universal	19	16	13	17*	5**	14**
L-10-22	11**	9	8	15**	4**	9**
L-597	22	20	10	14	13	16
X	20	18	9	16	7	14

Credible: * - at $P < 0,05$ -, ** - at $P < 0,01$, *** - at $P < 0,001$

As can be seen from Table 1, cross-pollination is observed in all studied varietal samples of parent forms, while the frequency of hybridization ranged from 4×10^{-4} to 42×10^{-4} .

Almost all hybrid combinations had a crossbreeding value close to average. The Emerald variety has shown stability in all variants with regard to the formation of natural hybrids. However, approximately 1: 3 combinations have significant differences in

this indicator compared to the average level characteristic of vegetable soybeans.

Processing of the results of the experiment by the method of dispersion analysis made it possible to establish a significant ($P < 0.01$) dependence of the frequency of outcrossing in soybeans on genetic factors ($\eta^2 = 3.8\%$).

The greatest influence on the size of the intersection was exerted by the genotype of the Ma-Terin form ($\eta^2 = 2.3\%$), and the proportion of influence of the paternal

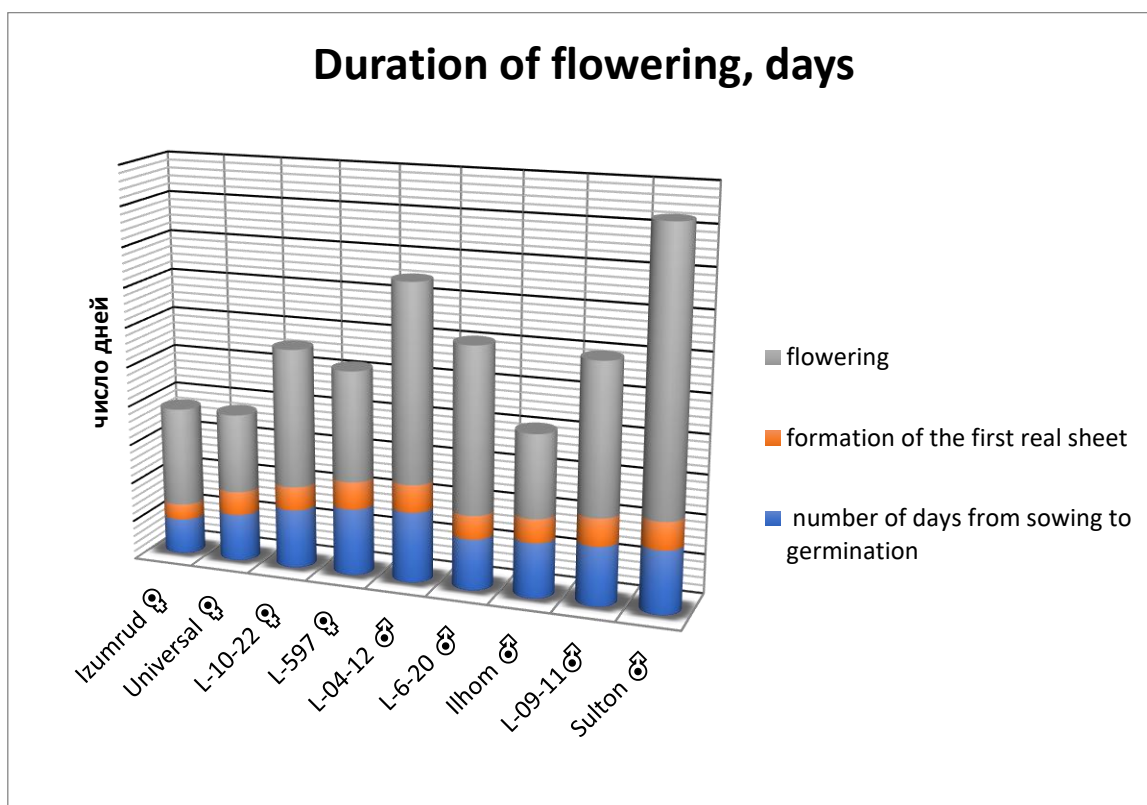
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component was much smaller and amounted to only 0.4%.

Consequently, the studied paternal varietal specimens on average had the same capabilities as pollen donors, with the exception of varietal samples L-04-12 and L-06-20. In contrast, the maternal forms had significant differences in their ability to cross-pollinate. The best maternal forms were Emerald and L-597, the lowest tendency to cross-fertilization was found in L-10-22. In our experiments, there was a significant effect of the efficiency of repollination of the combination of parental forms ($i|2 = 1.1\%$). Consequently, along with the general, the importance of the specific ability of soybean genotypes to natural hybridization also increases.

We believe that the probable causes of this phenomenon may be genetic complexes for controlling singamia, which determine the selectivity of fertilization and also the coincidence of the timing of flowering of parental forms. The basis here is the coincidence of the duration and compatibility of flowering time in the studied genotypes with the magnitude of natural hybridization. It is necessary to select varietal samples of the middle growing season for cross-pollination. Varieties with a late long growing season like Sulton (140 days) are not suitable for crossing with earlier varieties Emerald, Universal, L-10-22.

All experimental varieties used as paternal forms had a long flowering period (from 22-58 days), in maternal forms for this indicator there were differences from 16 days (Emerald) to 35 days (L-10-22) (Fig. 2).



Rice. 2. The number of days from sowing to germination and the duration of flowering of the parent genotypes of vegetable soybeans

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The shortest duration of flowering was noted in the universal and Ilkhom varieties, which, apparently, was the reason for the relatively low frequency of natural (spontaneous) hybridization recorded in them. It is important to synchronize (simultaneously) the moment of the beginning of flowering of parent forms. The efficiency of repollination is higher when the pollinator blooms almost simultaneously with the maternal form (for example, L-09-11 and L-04-12). If the maternal form is late with the onset of flowering, as, for example, in the variants Universal × Sulton, Emerald x Sulton, L-597 × Sulton, then the effectiveness of cross-pollination decreases.

CONCLUSION

Natural hybridization in vegetable soybeans occurs with the greatest frequency when growing plants of parent varieties in close proximity to each other, which is achieved by sowing a mixture of seeds in various ratios in one row, for example, one to three. To carry out effective re-pollination, the optimal ratio of the components of crossing is one in which there are at least three paternal plants per one mother plant.

The most rational scheme for the organization of the nursery of natural (spontaneous) repollination of vegetable soybeans is in compact lysimeters measuring 1.5 x 1.5 m. In each specific block of repollination, one paternal form is used in combination with the entire planned set of maternal genotypes. The proposed scheme in combination with the developed techniques for increasing the frequency of natural hybridization provides an increase in the efficiency of work on obtaining natural (spontaneous) hybrids by 6-8 times.

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