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GENETIC ANALYSIS OF INTERSPECIFIC HYBRIDS OF VEGETABLE BEANS

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Abstract
This article describes the genetic analysis of vegetable bean hybrids. Hybridization makes it possible to combine a number of forms of resistance to individual pests or to different types of pests and diseases in a single variety. In the course of selection, plants of the second generation are selected from the hybrid population, characterized by a greater degree of their resistance to pests and other economically valuable traits. The highest percentage of cross-pollination was achieved due to a longer period of simultaneous flowering in the parent pairs. The set of vegetable beans during artificial hybridization directly depends on the time of pollination, as well as on the year of sowing and weather conditions.

Keywords: beans, variety, hybrid, crossing, natural, artificial hybridization.

Introduction

Remote hybridization is the most important method of breeding work. There is not a single agricultural crop that has not been touched by this highly effective method. So far, this is the only method of creating fundamentally new plants that combine the most valuable traits and traits of cultivated and wild plants in their hereditary basis [1].

Whereas in natural hybridization only the maternal parental form is known, and the paternal form remains unknown, in artificial hybridization both parental forms are selected in a planned manner. Hybridization in hybrid forms of plants combines many economically valuable traits with hereditarily fixed traits of resistance to pests [2, 6].

Hybridization allows a breeder to combine a number of forms of resistance to individual pests or to different types of pests and diseases in a single variety. In the selection of pairs for hybridization, the theoretical basis is the Mendelian rules for the inheritance of the desired traits. All hybrid plants in the first generation (F_1) are genetically identical, but they are homozygous or heterozygous for individual resistance genes, which depends on the genetic structure of the parents. Cleavage of these traits occurs. in the second (F_2) and subsequent generations. Therefore, in the course of selection, plants of the second generation are selected from the hybrid population, which are characterized by a greater degree of their resistance to pests and other economically valuable traits [3, 5].

The "Zvezda Vostoka" is early-maturing variety. The duration of flowering is 10-20 days. The flowers are white. The height of the shrub is 50-60 cm. The beans are arranged along the stem with small internodes. The leaf is entire, lanceolate in shape, with a pointed end. The color of the leaf is green. The bob is elongated and oval in shape with a pointed end. The length of the bean is 11,5 cm, the width is 1,9 cm. From 20 to 40 or more beans are formed on one plant,

70% of which are seven-seeded. Seeds in the phase of technical ripeness (green beans) have a milky color with light pink specks, shiny, oval in shape, 1,8 cm long, 0,9 cm in diameter.

The period from mass flowering to technical ripeness is 20-25 days, and from mass flowering to biological ripeness of seeds is 30-40 days. The first harvest of green beans in technical ripeness is carried out 60-65 days after germination. The weight of 1000 green seeds is 510 g. The yield of beans in technical ripeness is 95 c/ha, Biological ripeness of seeds occurs on 80-85 days after germination. The yield of seeds in biological ripeness is up to 35 centners per hectare. At biological ripening, the seeds are hard, yellow in color, the weight of 1000 seeds is 220 g.

The variety "Zvezda Vostoka" is suitable for both spring and summer sowing, in which a full-fledged harvest is formed. It improves soil fertility due to nitrogen fixation by nodule bacteria living on roots [4].

According to our long-term research on hybridization of vegetable beans in Uzbekistan, where the climate is dry and hot, crosses should be carried out only in the morning. We used a method of hybridization in which the flower of the mother plant was prepared for pollination by breaking off all the sepals, removing the corolla petals, and completely castrating it. But it should be taken into account that when using this method, due to the high injury rate of the flower, the success of cuttings remains at the level of 15-20%.

To date, we have developed a new improved method of hybridization in the hot climate of the republic, which requires submission to the Intellectual Property Agency for obtaining a patent. A new method of hybridization of leguminous crops will provide a twofold increase in the frequency of crosses, due to a decrease in the injury rate of mother flowers [5, 6].

Material and Methods

Research on the creation of vegetable bean hybrids under normal conditions with furrow irrigation was carried out by the Research Institute of Vegetables, Melons and Potatoes in 2013-2018 and continued in 2020-2022 at the Institute of Genetics and Experimental Plant Biology in lysimeters using drip irrigation.

Hybrid combinations were created to carry out natural remote hybridization: Zvezda Vostoka×L-06–15; Zvezda Vostoka×L–09–17; Zvezda Vostoka×L-07-20, the local variety Zvezda Vostoka was taken as the maternal sample, and the father's foreign lines: L-06-15, L-09-17, L-07-20. In 2022, hybrid combinations were planted in hybrid nurseries, lysimeter greenhouses, completely covered with anti-mask netting, the size of the greenhouses is 3×12 m. These combinations were planted in the spring sowing period on April 20 and in the summer sowing period on July 10.

In artificial hybridization, complete castration of flowers is most often used, which is carried out by breaking off all sepals, removing the corolla and all anthers [6, 7]. There are techniques in which the anthers are removed without breaking off the corolla of the flower – by means of a unilateral cut [3] or an incision of the calyx with the removal of the corolla [1]. Castration can be carried out in advance (in the evening hours) with pollination from the first half of the

next day, and it is also possible to apply castration with the simultaneous application of fresh pollen on the stigma of the flower in the morning and before noon [2].

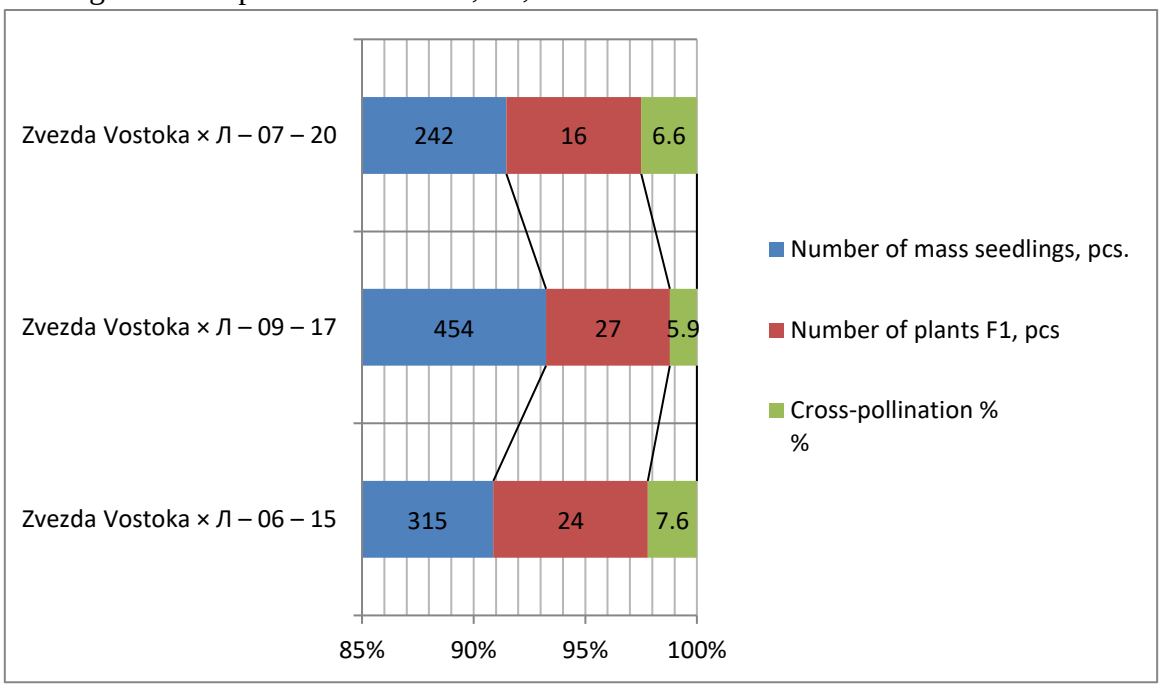
Results

As a result of many years of research on hybridization on the cultivation of vegetable beans in the period from 2015 to 2022, the average monthly air temperature, relative humidity, and the amount of precipitation were studied. All this generally affected the percentage of successful crosses, the data are given in table 1.

Table 1. Weather conditions during the study period

Year	Average monthly air temperature,^{0}C		Relative humidity, %		Amount of precipitation, mm		Luck of Crosses
	may	august	may	august	may	august	total
2015	21,9	25,8	48	33	37	2,1	17,3
2018	20,2	27,0	41	16	11	0	15,8
2022	22,1	26,3	38	17	45	0,6	16,6
Average perennial	23,0	25,0	43	21	41	2,0	16,6

As a result of experiments on crossing vegetable beans during artificial hybridization, a small percentage of cross-pollination from 5,9-7,6 was noted in three combinations.



Rice. 1. Percentage of natural cross-pollination in vegetable bean hybrids

The lowest percentage of cross-pollination was in the combination Zvezda Vostoka × L – 09 – 17 (5.9 %). In the combinations Zvezda Vostoka × L – 07 – 20 and Zvezda Vostoka × L – 06 – 15, this indicator was higher and amounted to 6,6 and 7,6 %. Consequently, the highest

percentage of cross-pollination was achieved due to the longer period of simultaneous flowering in these parent pairs.

Table 3. Set of vegetable beans under artificial hybridization depending on the time of pollination

Yeld	Number of flowers, pcs.		Luck of Crosses, %						Time spend, h	Pollinated flowers in 1 hour, pcs
	Pol-linate	Started	5-6 h.	6-7 h.	7-8 h.	8-9 h.	9-10 h.	average		
2015	310	96	24,3	23,6	18,3	11,2	9,5	17,3	26	12,6
2018	460	157	21,7	18,8	16,8	13,7	8,2	15,8	43	16,2
2022	230	68	26,3	25,8	14,7	9,3	6,8	16,6	31	13,5
∑	1000	321	72,3	68,2	49,8	34,2	24,5	49,7	100	42,3
X	333,3	107	24,1	22,7	16,6	11,4	8,2	16,6	33,3	14,1
$HCP_{0,05}$								1,21		

According to Table 3, the set of vegetable beans during artificial hybridization directly depends on the time of pollination. The most suitable time for better flower set is between 5 and 7 a.m. And also the luck of tying depends on the weather conditions of the year. As can be seen, 2015 was the most favorable year, despite the fact that the number of pollinated flowers was 310 pieces, then 150 pieces less than in 2018 - 460 pieces.

Conclusions

Hybridization allows a breeder to combine a number of forms of resistance to individual pests or to different types of pests and diseases in a single variety. In the course of selection, plants of the second generation are selected from the hybrid population, characterized by a greater degree of their resistance to pests and other economically valuable traits.

The highest percentage of cross-pollination was achieved due to a longer period of simultaneous flowering in the parent pairs.

The setting of vegetable beans during artificial hybridization directly depends on the time of pollination, as well as weather conditions.

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