Evaluation of potato hybrids in the parent form of Adretta x Vasilek

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Abstract. This study provides a comparative assessment of the obtained hydrides with their parent varieties in terms of yield, marketability, and phenological observations in the conditions of the Northern forest-steppe of the Tyumen region. This line of experiments is carried out to study the resulting hybrids and select parent forms to obtain more productive breeding material. Completely different and contrasting varieties of Adretta have been selected for the parent forms. Cornflower. In the 350 seeds were obtained from crossed plants, 39 promising hybrids were selected from them. When comparing hybrids with parental forms, on average, 41% of hybrids were equal or had higher yields compared to the maternal form (Adretta variety), and 36% of hybrids were close to the paternal form (Cornflower variety). A significant number of hybrids, 23%, had low yields and were culled. 13% of hybrids had high yields: AB 58/14 (35.24 t/ha), AB 51/10 (31.91 t/ha), AB 50/7 (28.23 t/ha), AB 69/11 (27.26 t/ha), AB 54/8 (26.3 t/ha). According to a number of characteristics, the resulting hybrid material is equally divided along the maternal or paternal line, of the total number, only 1 hybrid had an excess of parental forms in yield.

1 Introduction

The development of new potato varieties requires an increase in complex resistance to major diseases, yield and quality characteristics. The study of new hybrids, their selection, as well as accounting for the growing season and productivity, provides a deeper understanding of the process of creating new varieties, which may affect the selection of parent varieties.

The main indicators of the variety are the yield and quality of tubers [1]. The productivity of varieties can vary significantly by 30-50% depending on the group of ripeness and adaptability [2-3]. In the collection, a difference in plant growth rates is observed in 50% of the varieties, of which the varieties are still divided into several groups and have some differences in the number of main stems, yield, marketability and quality of tubers, and overall profitability [4].

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Potato varieties of the Ural selection show high plasticity when tested in northern conditions, in terms of productivity and marketability [5].

The complex of valuable signs for processing includes yield indicators, dry matter content, taste, elongation of tubers, convenience for mechanical processing, when analyzing varieties of Far Eastern breeding suitable for a number of signs, 10% passed through a complex of valuable signs [6].

For the most complete realization of productivity and increased resistance to adverse conditions and pathogenic organisms of a new variety, it is necessary to optimize agrotechnical techniques and technological features of cultivation, taking into account the biological characteristics of the variety [7]. When studying hybrid populations, the authors claim that more than 70% of hybrid samples surpassed the parent form in productivity and slightly less in disease resistance [8-9].

One of the main influencing techniques in potato cultivation is the use of plant protection and its contribution to the overall variation in potato yield can be 80.0%, and the genotype value is 12.5% [10].

The variety, as one of the main elements of innovative potato cultivation technology, makes it possible to increase the profitability of production not only due to a high level of resistance to the most harmful pathogens and adverse environmental conditions, but also due to the growing season determined genetically and environmental conditions of high yield and product quality [11-13].

The study of the new forms obtained by a number of factors is a complete assessment of the hybrid material when crossing certain varieties.

Objective: to study the effect of parental varieties on hybrid generation during intraspecific hybridization.

2 Materials and methods

The research was conducted in the field in 2021-2022, in the Research Institute of Agricultural Sciences – a branch of the Tyumen Scientific Research Center of the Siberian Branch of the Russian Academy of Sciences, the zone of the Northern forest-steppe. Records and observations were carried out according to standard methodological guidelines adopted in the State Agricultural Network, crop production and plant protection.

The soil in the experimental area is sod-podzolic, sandy loam, medium-sized. The predecessor is grain crops. The planting of tubers in the breeding nursery was carried out according to the standard 75x30 scheme. The method of creating hybrids is intraspecific hybridization followed by selection according to the most important agricultural characteristics. Observations and records were carried out according to the methods of the State variety testing of agricultural crops [14]. The yield data were processed according to B.A. Dospekhov [15]. Processing of statistical data using the Excel program.

Parent forms of varieties: the Adretta variety is a medium-early table variety of German breeding, bred in 1975. It has a good yield and excellent taste, one of the most popular varieties in Russia, both among amateur gardeners and farmers. Maturation period: 70-105 days, starch content 13-18%, average weight of tubers 120-150 g, number of tubers in the bush 15-25 pcs., yield up to 450 kg / ha. Consumer qualities: excellent taste, crumbles when cooked, suitable for any dishes. The shelf life is 98%, even frozen does not become sweet. The color of the peel is yellow. The color of the pulp is yellow. It is recommended for territories with a continental and temperate continental climate, it is well suited for the Central, Far Eastern, Middle Volga, West Siberian regions and the Crimea. Disease resistance: susceptible to scab, blackleg, late blight and rhizoctoniosis [16].

Vasilek variety is a medium–early potato variety (Solanum tuberosum) for table use. It is suitable for dietary nutrition. It was bred by the Federal State Budgetary Research

Institute of Potato Farming named after A.G. Lorch, by crossing the Cast Iron variety and the numbered hybrid D-31-88. It is zoned in the Central region.

The period from germination to harvest is 80-100 days. A plant of medium height, intermediate type. The stems are semi-erect, the leaves are medium-sized, open-type, dark green in color. The corolla is small, pinkish-purple in color. About 15 tubers weighing 77-112 g can form on one plant. The tubers are aligned and have an elongated oval shape. The peel is thin, smooth, blue-purple in color. The flesh is white or light cream. The commercial yield was 93-256 kg/ha. The marketability of tubers is 71-94%, the shelf life is 96%. The taste is very good, the starch content is 10-12%.

The variety is resistant to golden cyst-forming nematode, cancer, medium-resistant to striped and wrinkled mosaics. It is relatively resistant to late blight on tops and tubers [17].

3 Results and Discussion

In 2019, the following varieties were crossed: Adretta × Cornflower. 350 seeds were obtained from crossed plants, 39 promising hybrids were selected from them.

Phenological observations of the parent forms, shown in Table 1.

From Table 1, we observe the emergence of seedlings in the maternal form from 15 to 21 days, in the paternal form from 18 to 24 days, which is typical for our climate. The full budding, the Adretta variety, reached within 46 ± 3 days, and the paternal Cornflower variety in 42 ± 3 days. The Adretta variety reached full flowering in 54 ± 3 days, and the Cornflower variety in 51 ± 3 days.

Phenological observations of hybrids over two years show that the germination phase of hybrids is closer to the paternal form by day and ranged from 23 to 36 days. Many hybrids reached the full budding phase within 53 =3 days, but two hybrids AB 71/8 and AB 71/6 reached the phase in the range of 58 = 3 days. The flowering phase in hybrids AB 72, AB 71/8, AB 66, AB 60/11, AB 58/6 was not observed.

One of the main indicators for evaluating breeding material is the yield and marketability of tubers exceeding the parent varieties. On average for 2 years, the Adretta variety showed a yield of 15.6 t/ha, with a relatively good marketability of over 85%. The Cornflower variety over the past 2 years has shown a not very good yield of about 10.27 t / ha and there were commercial tubers, in the first year more than 79%, and in the second year less than 50%.

When comparing hybrids with parental forms, on average, 16 hybrids were equal or had higher yields compared to the maternal form (Adretta variety), and 14 hybrids were close to the paternal form (Cornflower variety). Also, the 9 remaining hybrids have low yields and have been culled. The highest yields were shown by hybrids in 2021 AB 54/8 (21.39 t/ha) and in 2022 AB 58/14 (35.24 t/ha), AB 51/10 (31.91 t/ha), AB 50/7 (28.23 t/ha), AB 69/11 (27.26 t/ha), AB 54/8 (26.3 t/ha). A stable excess of 2.5–13.9 t/ha of the parent forms in terms of yield in all years was only in the hybrid AB 54/8 (21.39 -26.3 t/ha). The marketability of tubers exceeding 80% in the studied hybrids in 2021 was observed in 33% and in 2022 in 23% of hybrids. Stable marketability of tubers in both years of research was observed in only 7% of hybrids (Table 2).

Table 1. Phases of growth and development of parent varieties and F1 hybrids (2021-2022).

No. p/p	Variety, Hybrid	Phases of development in an average of 2 years, days			
		emergence of seedlings	full budding	the beginning of flowering	Full bloom
	♀ Adretta	18.5±3	46.5±3		54.5±3
	♂ Vasilek	21.5±3	42±3		51±3
	Hybrid F1				
1	A-B 73	26±3	54±3	56±3	62±3
2	A-B 72	33±3	56±3	-	-
3	A-B 71/8	29±3	58±3	-	-
4	A-B 71/6	26±3	58±3	60±3	66±3
5	A-B 70	28±3	55±3	59±3	65±3
6	A-B 69/11	27±3	53±3	58±3	63±3
7	A-B 69/5	28±3	53±3	59±3	65±3
8	A-B 68/15	27±3	54±3	60±3	66±3
9	A-B 67/6	28±3	54±3	60±3	66±3
10	A-B 67/7	27±3	51±3	56±3	62±3
11	A-B 66	29±3	55±3	-	-
12	A-B 64/8	28±3	53±3	59±3	65±3
13	A-B 64/10	28±3	53±3	59±3	65±3
14	A-B 63/14	29±3	53±3	60±3	65±3
15	A-B 63/4	27±3	53±3	59±3	65±3
16	A-B 62/21	28±3	52±3	57±3	63±3
17	A-B 61/5	28±3	53±3	58±3	63±3
18	A-B 61/7	29±3	52±3	58±3	63±3
19	A-B 60/11	25±3	56±3	-	-
20	A-B 60/3	28±3	53±3	58±3	63±3
21	A-B 59/11	27±3	52±3	57±3	62±3
22	A-B 59/7	26±3	52±3	58±3	63±3
23	A-B 58/14	27±3	52±3	58±3	63±3
24	A-B 58/6	31±3	56±3	-	-
25	A-B 57/12	28±3	53±3	58±3	63±3
26	A-B 57/8	28±3	53±3	58±3	63±3
27	A-B 56/6	28±3	53±3	58±3	63±3
28	A-B 56/15	28±3	53±3	58±3	63±3
29	A-B 55/3	27±3	53±3	58±3	63±3
30	A-B 55/6	31±3	54±3	58±3	64±3
31	A-B 55/10	28±3	54±3	59±3	64±3
32	A-B 54/10	28±3	52±3	58±3	63±3
33	A-B 54/8	27±3	52±3	58±3	63±3
34	A-B 53/7	26±3	52±3	58±3	63±3
35	A-B 52/15	28±3	53±3	58±3	63±3
36	A-B 51/10	28±3	53±3	59±3	64±3
37	A-B 51/7	27±3	53±3	58±3	62±3
38	A-B 50/9	27±3	53±3	58±3	63±3
39	A-B 50/7	28±3	53±3	58±3	63±3

Table 2. Productivity and marketability of the obtained hybrids.

Variety, Hybrid		Yield, t/ha			High-quality tubers, %	
		2022	2021	average by year	2022	2021
♀ Adretta		12.36	18.85	15.60	90.43	85.89
♂ Vasilek		8.24	12.30	10.27	79.26	47.27
1	A-B 73	11.66	15.25	13.45	77.44	79.88
2	A-B 72	17.10	14.81	15.95	94.36	94.67
3	A-B 71/8	19.20	6.75	12.97	60.73	85.71
4	A-B 71/6	11.66	5.08	8.37	77.44	62.06
5	A-B 70	10.96	19.90	15.43	80.00	87.22
6	A-B 69/11	27.26	15.53	21.39	80.39	90.23
7	A-B 69/5	20.43	10.08	15.25	77.25	67.82
8	A-B 68/15	22.44	9.55	15.995	85.55	65.13
9	A-B 67/6	7.98	12.18	10.08	17.58	76.25
10	A-B 67/7	17.71	14.72	16.21	73.27	76.19
11	A-B 66	9.64	12.27	10.95	82.73	62.85
12	A-B 64/8	9.99	8.50	9.24	50.88	88.65
13	A-B 64/10	18.76	10.69	14.72	82.71	78.68
14	A-B 63/14	4.73	12.36	8.54	46.30	70.21
15	A-B 63/4	18.41	10.52	14.46	70.48	77.50
16	A-B 62/21	7.10	12.44	9.77	23.46	83.80
17	A-B 61/5	9.73	9.731	9.73	69.37	80.18
18	A-B 61/7	5.79	5.523	5.65	0.00	47.61
19	A-B 60/11	20.78	14.72	17.75	85.23	79.16
20	A-B 60/3	12.45	7.01	9.73	66.90	61.25
21	A-B 59/11	3.42	17.97	10.69	20.51	98.53
22	A-B 59/7	13.76	14.55	14.15	63.06	74.69
23	A-B 58/14	35.24	11.65	23.44	73.63	47.36
24	A-B 58/6	7.36	15.51	11.43	46.43	88.70
25	A-B 57/12	6.93	7.27	7.10	58.23	63.85
26	A-B 57/8	17.71	18.41	18.06	77.23	88.57
27	A-B 56/6	10.08	11.13	10.60	76.52	79.52
28	A-B 56/15	19.11	11.04	15.07	74.77	79.36
29	A-B 55/3	11.84	18.49	15.16	63.70	69.66
30	A-B 55/6	20.43	4.29	12.36	92.27	38.77
31	A-B 55/10	13.76	9.29	11.52	56.05	50.94
32	A-B 54/10	17.36	14.02	15.69	64.65	86.25
33	A-B 54/8	26.30	21.39	23.84	92.33	76.22
34	A-B 53/7	12.19	19.54	15.86	73.38	95.51
35	A-B 52/15	17.10	8.67	12.88	44.62	94.94
36	A-B 51/10	31.91	13.23	22.57	95.60	68.87
37	A-B 51/7	8.94	17.35	13.14	22.55	75.75
38	A-B 50/9	4.73	7.01	5.87	11.11	35.00
39	A-B 50/7	28.23	15.07	21.65	87.58	87.79

4 Conclusion

In comparison with parental forms, fertility is more characteristic of maternal genes, which should be taken into account when choosing parental forms. The growing season in all phases of development is close to the paternal form and even exceeds it by 5 or more days, which indicates a longer process of tuber formation. The growing season is longer, which is why hybrids need more time to form a crop. The following hybrids showed high yields

among the selected hybrids: AB 58/14 (35.24 t/ha), AB 51/10 (31.91 t/ha), AB 50/7 (28.23 t/ha), AB 69/11 (27.26 t/ha), AB 54/8 (26.3 t/ha).

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