UDC 635.21:631.5

POTENTIAL OF POTATO INTERSPECIFIC HYBRIDS BY THE ABILITY TO TIE MARKETABLE TUBERS

PODHAIETSKYI A.A., Doctor of Agricultural Sciences, Professor
KRAVCHENKO N.V., assistant
Sumy National Agrarian University

Presented the results of studies of determining the potential of interspecific hybrids of potato and their backcrosses concerning limits of manifestation of marketable tubers amount under a bush, the distribution of the researched material on classes of the number of hybrids with a higher expression of the rate than in the best sorts-standards, of stability of annual feature manifestation.

According to the statements of numerous scientists [1-3], the use of interspecific hybridization in breeding potatoes was a "revolution" for culture. Thus, it was possible to solve a number of problems that can not be eliminated using intervarietal crossing. First of all, it concerned the creation of varieties resistant to diseases and pests. Found that resistance to late blight in varieties of interspecific origin compared with those obtained from intervarietal crosses for five mark scale at 1.36 points higher [4]. In addition, the possibility of creating potato varieties resistant to potato cyst nematodes, aggressive races of cancer of potatoes etc. also became possible only after engaging in the practice of breeding relatives of cultivars.

Important to create varieties with high expression of numerous agronomic traits is to transfer breeding on the level of heterosis. Heteroallelism, which is the basis for heterosis breeding [5], can be successfully achieved engaging in crossing varieties of potatoes. That is why the varieties of interspecific origin are characterized by higher expression of numerous features, including polygenic compared with those obtained from intraspecific interbreedings.

An important component of productivity is the amount of marketable tubers, because due to them, the bulk of the yield is formed. Unlike other crops many of their varieties are characterized by numerous but small (5-15 g) tubers [6]. Therefore, it is important to introgress from the last one, valuable genes of features control, which are absent or not evident among cultivars and transfer from varieties during saturating crossings, other agronomic-valuable features.

Research Methods. Depending on the experiment, estimated 359 – 408 interspecific hybrids and their backcrossings obtained using different methods (self-pollination, backcrossing, crossing interspecific hybrids between each other), with involvement during creation of secondary interspecific hybrids of different species and using during saturating crossinsg different varieties.

Research methods generally accepted in potato growing were used [7], especially evaluation of interspecific hybrids and their backcrossings was performed according to methods of testing and maintaining components of the

gene pool.

Soil of Research Field of the Laboratory of source material of potatoes of Department of Biotechnology and phytopharmacology of SNAU where the experiment was carried out, black soil is typical deep medium loamy silty. Humus contents (by Tyurin method) – 3.89%, pH salt extraction – 5.8, hydrolytic acidity (by the Kappen method) – 1.6 mg. / eq. per 100 g of soil, the amount of absorbed bases (by the Kappen method) – 30.2 mg. / eq. per 100 g of soil, lightly hidrolized nitrogen (by the Kappen method) – 87mh/kh soil, mobile phosphorus (using Chirikov method) – 109 mg. / kg. of soil, of exchangeable potassium (by the method of Chirikov) – 100 mg. / kg. of soil.

Meteorological conditions of the years of the research differed significantly among each other. In April, June, July and September 2009, the air temperature was lower than the average for many years. In April, there was hardly any rain, though later they fall relatively uniformly. With the exception of April and September of SCC was favorable for the growth and development of potato (0.6 – 2.4). Other took place in 2010. Each month the average temperature exceeded the perennial data, and in June and August significantly (by 4.2 – 6.6 ° C). Even more it referred to decades. With the exception of the first two decades, high temperature in July of 2010 combined with the lack of rainfalls. In general, for April -August fell to 104.6 mm of rainfall less than on average for many years. The value of SCC in April, May, June, August, was very low (0.1 – 0.6). Similar by weather conditions to 2010 was 2011, which differed by lower temperatures.

Research Results. The obtained data (Fig. 1) indicate a significant difference of interspecific hybrids and their backcrossings by the average number of marketable tubers in the nest, and the impact on the manifestation of external fetures of conditions of years of the research.

Relatively favorable, for the formation of marketable tubers, conditions in 2009 caused that modal class of the distribution of the material was 7,1-9,0 tubers in nest. It contains 29.6% of processed material. Similar values had related classes: 5,1-7,0 9,1-11,0 and tubers in nest. The high potential of processed material concerning the manifestation of features is certified by the ability to forms allocation with high (11,1-13,0 bubbles in the nest) and very high (13.1 and over) expression of index. More over, the proportion of the material, referred to the penultimate class, is relatively high (11.0%).

Proof of availability of interspecific hybrids and their backcrossings according to possibility of forms allocation with many marketable tubers can be comparison of feature manifestation in them and grades-standards. In the best of the last in this regard, Yavir variety of marketable tubers in the nest was 7.0 unit, it was at the upper limit of the second class. This means that 64.9% of hybrids had higher expression rate than in this variety. Concerning the other standard – variety Teteriv, in conditions of 2009 almost all hybrids had the highest expression of symptoms than in it. Fewer amount of marketable tubers in the nest, compared with that variety, had only six hybrids.

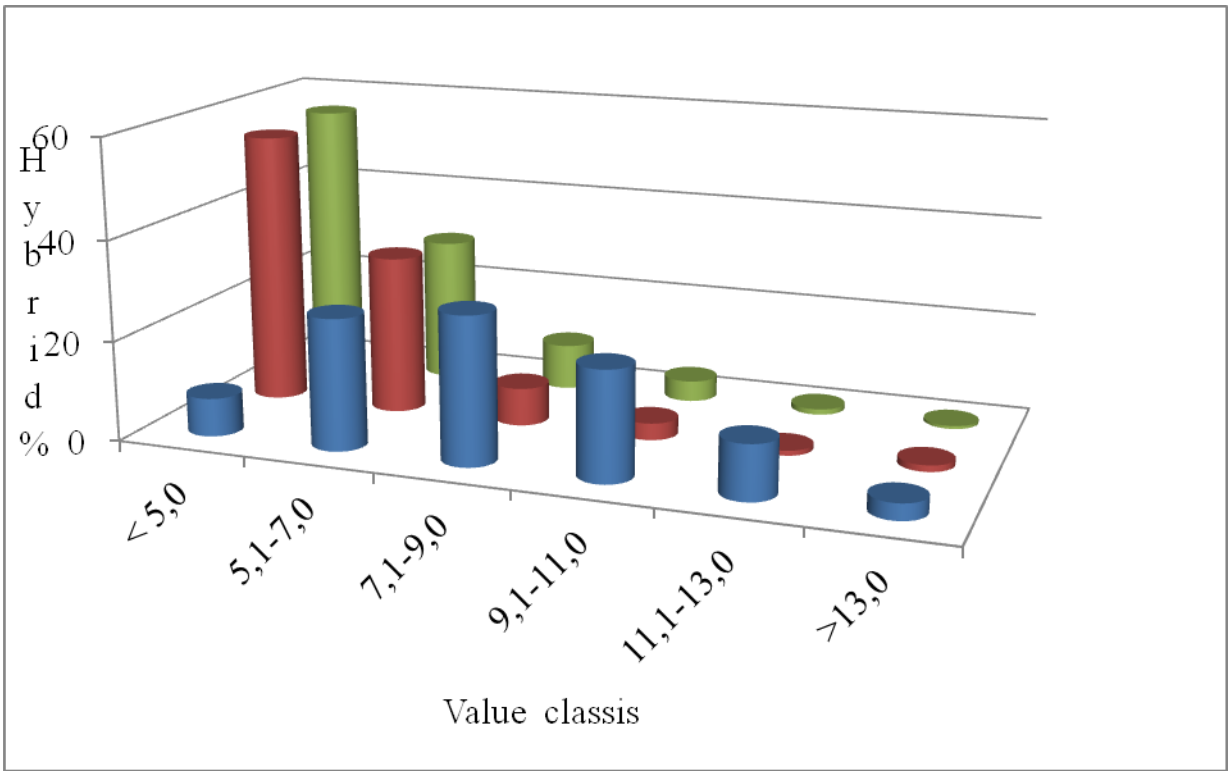

Figure 1. Distribution (in%) of interspecific hybrids and their backcrossings by classes of average amount of marketable tubers in the nest (pcs.)

Standard – variety Yavir: 2009 -7,0; 2010 -5,3; 2011 – 5,5; average – 5,5 pcs / plant

Standard – variety Teteriv: 2009 – 11,7; 2010 – 10,5; 2011 – 6,3, average – 10, 2 pcs / plant

Established limits of traits expression. The minimum value of B^3F_2 characterized six specific hybrid 91.15-41 with an average rate 1.6 tubers in the nest. It means that individual plants of this hybrid had no marketable tubers. The maximum expression of index was found in B^1 of six specific hybrid 04.101/32 – 15,8 marketable tubers in the nest.

Adverse weather conditions of potato growing period in 2010 resulted in tying a small number of marketable tubers by interspecific hybrids and their backcrossings. These data indicate that more than half of processed material (54.8%) assigned to class 5.0 of tubers in the nest and less. In the next class the proportion of hybrids was also high – 31.9%. The first two classes include 86.7% of the estimated shapes. We believe the foregoing indicates a narrow reaction norm of interspecific hybrid genotypes on the formation of marketable tubers, which is especially evident in adverse conditions.

The share of the material in these classes was significantly lower than in 2009. For example, in a class 7,1-9,0 tubers in the nest it reached 3.9 times, next year – 6.5 times, penultimate – 11 times and the last – 2.5 times. At the same time,

it should be noted that in the worst year for the manifestation of feature some hybrids had its high expression.

Total high tubering in variety-standard Teteriv led to a large number of marketable tubers, representing 10.5 pieces in nest. Concidering this, only 12 were characterized by higher expression of index. Compared with the previous year, in 2010, variety–standard Yavir had fewer marketable tubers in the nest (1.3 times). Despite this, 61% of the estimated forms had lower expression of features than this variety.

So, the value of limits of index expression among hybrids was also low. The minimum number of marketable tubers in the nest (0.3 pcs) had two backcrossings: 96.963/30, which is B^1 of six hybrid and 03.36s54 with the origin B^3 of six specific hybrid. By the maximum expression of symptoms (17.1 tubers in the nest) was characterized B^2 of three specific hybrid 91.765/31.

Data of distribution of the material manifestation of symptoms in 2011, similar to the previous one. The maximum proportion of hybrids referred to first class – 5.0 tubers in the nest and less (55.7%). About on half it is lower in the next class – 29.2%. On other classes accounted for only 15.1% of the estimated material.

By feature manifestation two varieties-standards referred to the class with number of marketable tubers in the nest of 5,1-7,0 units. Thus, as in the previous year, the highest expression rate had variety Teteriv, but with a much smaller difference compared to other standard. It is estimated that by the highest manifestation of feature than the above-mentioned varieties were characterized 82 backcrossings, or 22.8% of their total number. Much more hybrids dominated the indicator in a variety Yavir (165 pcs., or 46%). The weather conditions in 2010 were more favorable to the realization of the genetic potential of hybrids compared to standard varieties, than 2011.

Slightly higher is value obtained in 2011 compared to the previous. In two backcrossings was found the same minimum manifestation of feature – 1,0 marketable tuber in the nest. It concerned B2 three-specific hybrid 90.674/51 and B^2 three-specific hybrid 09.21 / 1. Maximum indices value of limits was found in B^1 six specific hybrid 90.676/67 – 18.0 tubers in nest. Even under adverse external conditions for the tying marketable tubers, some backcrossings have high potential in relation to the expression of the indicator.

The obtained data (Table 1) indicate differences in the manifestation of marketable tubers in the nest, depending on the years of the study. The largest share among the selected hybrids with the highest expression rate was found in 2009 (52% of their total number). The foregoing applies lesser to 2010, when the number of such material comprised eight backcrossings. In the last year were allocated only two hybrids (89.715s88 and 04.108/26) with the highest average number of marketable tubers in the nest. Another backcrossing (90.35s394) had the same expression of features in 2009 and 2011. The foregoing can be explained by the specific implementation of genetic control of symptoms depending on the particular meteorological conditions.

The same was observed regarding manifestation of feature in varieties-standards. In 2009, the maximum expression rate had variety Yavir, and in

following – the variety Teteriv. Despite the variability of hybrids for years in 2009 they, with the exception of two backcrossings, dominated by the number of tubers among the best, variety Yavir. In the next year, it concerned only five hybrids, but in the last – 16 or 70% of their total number.

Table 1 shows data of only a small number of hybrids that prevailed on average for three years value of better from varieties-standards. However, they indicate a high potential for material processed of the ability to tie marketable tubers. For example, backcrossing 01.37H43 prevailed the best of standards in 1.3 times. Numerous hybrids (nine of 23) on average for three years had the number of tubers in the nest – 9 and more, indicating their significant value for practical breeding by feature.

1. Average number of marketable tubers in the best interspecific hybrids and their backcrossings (pcs/nest)

Hybrid number	Origin	Year			Average	V, %
		2009	2010	2011		
81.386c97	77.277/3 x P55/102	10,3	6,7	6,8	8,4	24
81.1546c103	56/75 x Polis'ka rozheva	15,3	6,6	6,0	7,9	66
85.368c17	81.1686c8 x Gitte	11,2	9,1	5,3	8,6	35
86.579c14	81.386c18 x Lvivyanka	13,6	10,4	5,2	9,8	43
87.703c1	Polis'ka rozheva x 83.58c1	9,3	14,7	6,8	8,3	49
87.791c4	81.785c12 x Gitte	7,8	12,0	6,5	9,3	31
89.382c18	81.488c32 x Polis'ka rozheva	12,2	7,4	8,0	9,7	27
89.715c88	85.1591c7x Libella	8,3	3,8	12,0	9,0	46
90.35c297	83.47c65 x Granola	11,3	9,1	5,8	9,0	31
90.35c394	– the same -	9,5	8,5	9,5	9,1	6
90.691/1	85.368c17 x Gitte	10,7	5,4	9,2	8,3	33
91.765/15	85.568c9 x Volovetska	6,5	10,5	10,0	9,9	22
97.396c2	90.673/5 x Volovetska	8,4	8,0	7,3	8,0	7
01.23G8	90.691/47 x Omega	9,1	9,4	6,0	8,4	22
01.26G137	91.15-52 x Omega	12,8	7,0	4,2	8,5	52
01.52G29	– the same -	15,6	3,5	7,8	8,1	76
01.36G5	90.35c131 x Nevska	12,3	5,8	7,0	8,5	41
01.37G43	91.318-6 x Nevska	6,0	13,5	9,3	10,1	37
01.39G25	89.721c95 x Omega	8,2	8,3	7,5	8,1	5
03.26c6	90.35c131 x Omega	7,4	8,3	6,3	7,6	13
04.108/26	89.24c34 x Delikat	9,1	6,0	10,7	7,9	30
04.108/49	– the same -	9,7	6,2	9,3	8,3	23
04.14c82	01.37 G49 x Satina	10,0	12,0	5,3	9,1	38
Yavir	Variety – standard	7,0	5,3	4,7	5,5	22
Teteriv	– the same -	11,7	10,5	6,3	10,2	43
NIR_{05}	3,0					

None of the hybrids significantly (at significance level 05) did not exceed the

value of the best among standards the variety Teteriv, although about the other standard such advantage was found in 12 backcrossings.

In spite of high expression rate, the stability of feature manifestation is important. Obtained data indicate that only in three hybrids coefficient of variation did not exceed 7%. In the four of them it was lower than in the variety-standard Yavir, and in 17, compared with the variety Teteriv. Considering that the selection of hybrids was carried out due to the value of the indicator of better standards, which was variety Teteriv, it is logical to compare the coefficient of variation of hybrids with this variety.

Conclusions. The high potential of interspecific hybrids of potato concernig tying many marketable tubers in the nest. It is related to the high value of the upper limit of the expression of index, presence of hybrids in classes with a maximum manifestation of feature. Significant influence of external conditions on the manifestation of features both in interspecific hybrids and standards, and therefore the proportion of hybrids that exceed the value of the best varieties for years was 2.0%, 3.1 and 22.8. Nine of the 23 selected hybrids essentially dominated by the average number of marketable tubers in the slot only one standard – variety Yavir. The coefficient of variation of features manifestation in most hybrids was higher than in the standards (21,7% and 43,4), but in such of them as 90.35s394, 97.396s2 01.39G25 it was within 5,4 – 7,0%.

REFERENCES

1. Assumption EM Biology tsvetenyya potatoes / EM Assumption – Moscow, 1935. – 152 p.
2. Kameraz AY Mezhvydovaya and vnutryvydovaya hybridization potatoes / / Genetics potatoes. Moscow: Nauka, 1973. – P.104 – 121.
3. Bukasov SM Mezhvydovaya hybridization potatoes / S.M.Bukasov / / Proceedings of the Academy of Sciences of the USSR. Series byolohycheskaya. M., 1938. – № 3. – S. 711-722.
4. Zadina J. Prinos mezidrugove hybridizace pro zlepsovani vlastnosti brambor / J. Zadina / / Genetica a slechteri. – 1971. – № 7. – P. 33-40.
5. Mendoza H. A. Some aspects of breeding and in ¬ breeding in potatoes / H. A. Mendoza, F. L. Haynes / / Am. Pot. J. – 1973. – 50. – P.216- 222.
6. Podhayetskyy A.A. Using a potato gene pool for introgression of genes to create the initial breeding material: dis. Doctor of Agricultural... sciences: 06.01.05 / Podhayetskyy Anatoly Adamowicz. – Nemeshaevo, 1993. – 324 p.
7. Guidelines for research on potato / Agrarian Sciences, John -ton potato. – Nemeshaevo, 2002. – 183 p.