Methods of creation of high-yielding, fork-resistant varieties of cotton with a complex of morphological features.

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Abstract: The article presents the methods of selection of parental forms, the use of different selection methods as analytical selection, transgressive selection, convergent selection and their effectiveness for creating new competitive varieties of cotton. Efficiency of application in hybridization of wild and ruderal forms as well as local and foreign cotton varieties in creation of new high-ripening and fork-resistant cotton varieties and lines with improved valuable morphological features. It has been revealed that analytical selection depending on the selection method allows to create new high-ripening, vilt-resistant, high-yielding varieties of cotton, transgressive selection depends on the geographical origin of initial forms and the greatest success in transgressive selection is achieved at return or saturated crosses. Convergent selection method is the most perspective direction in creation of vilt-resistant, early maturing, highly productive varieties and lines that will have the best features of both parental forms. In the process of selection work on the method of analytical selection created a variety of cotton Omad, which was introduced in the State Register in 1999 and zoned by Samarkand region, by the method of convergent selection created a variety of cotton C-8294 (Gurlen), which was introduced in the State Register in 2020 and zoned by Kharezm region.

Keywords: hybrid; backcross; productivity; backcross; box coarseness; fibre yield, length of fibre; rapid ripeness.

Introduction

Nowadays, it is difficult to find a place in the world where cotton fabric, threads, etc. are not used. Despite a sharp increase in synthetic and artificial fibers, the share of consumption of cotton fibers remains very high. The main supplier of cotton fibre to CIS countries is Uzbekistan, which accounts for over 60% of cotton fibre production.

The variety of soil and climatic conditions in Central Asia pose extremely difficult problems for cotton production. Their peculiarity lies in the fact that by the nature of distribution and intensity of manifestation of meteorological factors there is a significant instability by year and during the vegetation period, which is acutely felt at present due to the drying of the Aral Sea. Soil is also characterized by great diversity and predominance of saline and sandy, low fertility lands. Therefore, these factors create certain difficulties in the cultivation of cotton.

In research work on cotton genetics and selection great success has been achieved due to classical methods of selection, but at this stage it is necessary to use new effective methods in selection, as well as to improve methods of hybridization and selection of plants in accordance with the latest achievements of genetic science.

One of the most classical methods of selection of pairs is their selection on the principle of geographical and genetic remoteness. Therefore - selection of parent pairs is the main task of selection. It is necessary to select pairs so that one of the parents was more rapidly maturing, resistant to fork than the zoned varieties.

The most common method of selection with cotton is inter-variety, interlinear and remote intraspecific hybridization. Much attention is paid to the study and selection of initial parental forms by phases of development, productivity, quality and yield of fiber, the size of the boxes, resistance to verticillese fork and other major diseases and pests (fusarium vilt, black root rot, homosis and macrosporiose). Foreign varietal specimens and domestic varieties and lines showing themselves to be the most suitable for this region were used as the initial material for breeding work.

In selection work we widely use in crosses geographical distant forms for obtaining hybrids with increased vitality and their adaptability for different cotton-sowing regions of Uzbekistan.

As a result of many years of breeding work, we have come to the conclusion that in inter-grade, interlinear and remote ecological-geographical crosses preference is given to maternal and paternal forms, which are characterized by high silt resistance, rate of maturity, productivity, yield and quality of fiber, high mass of raw cotton, drought resistance, etc. signs.

At remote intraspecific hybridization with ruderal and wild forms, as well as at interspecific hybridization with other types it is necessary to use backcrosses, i.e. repeated, saturated, and other types of crosses, as one, two, three and four repeated crosses with the best parent forms give good results in creation of new high-ripening and fork-resistant varieties and lines of cotton with improved valuable morphological features.

It should be noted that in breeding work great importance is attached to analytical and synthetic method of selection, as well as various methods of evaluation and selection of plants for early maturation, silt resistance, yield and fiber length, etc. morphological and physiological and biochemical features.

The most common selection methods in cotton breeding are individual and mass selection. Stabilizing, periodic, pedigree and other selection methods as well as methods of convergent and transgressive selection on other agricultural crops are widely used.

Analytical Selection

Analytical selection - selection is based on the use of raw material from natural variety populations by decomposing them into separate lines. By the method of analytical selection L.V. Rumshevich has deduced from unstable to fork variety 8517 relatively vilt resistant variety 115-F, and from susceptible variety 2034 has created with increased resistance to fork on a natural contaminated background variety 131-F and 137-F.

P.V. Mogilnikov in 1929-1931, by selecting resistant plants on the naturally contaminated field from the original Akala-036 sample, developed variety 36-m-2, which was superior to the original in terms of economically valuable features and relatively higher forilt resistance.

I.S. Varuntsyan in 1929) from the variety King Karayazsky has deduced a line L-915, and from the variety Delphoz line L-0700, which had an increased resistance to fork on a naturally contaminated background.

И. Veliyev (1950) by method of selection of King-Karayazsky variety developed variety 01363, and from Stonvale variety 01551, which had relatively high resistance to fork on a natural contaminated field.

F.V. Wojtenok writes that searching for immune individuals within a constant variety will not be very effective, since the created varieties are relatively homozygous in terms of their filt resistance and other characteristics. But it does not exclude the possibility of selection of villto-resistant individuals due to some factors causing changes in this feature in plants changing under the influence of natural variability of immunological properties of cotton (1971).

Wad (1971). A. Avtonomov developed from C-6526 varietyopopulation a highly productive, vilt-resistant variety of cotton C-6530, which has fiber quality of type IV and fiber yield of 38.0-40.0% (1993).

The soon-growing, low-growth forked-resistant variety Omad was developed by analytical method from variety L-02, which had a vegetation period of 125-130 days, plant height of 40-50 cm, raw cotton mass of 6.0-6.5 g, yield 37.0-38.0% and fiber length of 31.5-34.5 mm. It is inferior to the Tashkent-1 variety in terms of wilt resistance.

In the process of selection work, we isolated separate families from L-02 varietyopopulation, which differed in the height of the plant, rate of maturity, fork resistance, length and quality of the fiber and the rate of opening of boxes.

Stabilizing selections were made on the best relatively homogeneous families according to the complex of morphological features as well as fork resistance.

Next year, on a relatively leveled selection material, we carried out an individual selection in order to test them for stabilization of morphological features and fork resistance on a natural infectious fork background. The next year on the best homogeneous families we have carried out repeated stabilizing selection on the basis of marker features and individual selection of vilt resistant plants with a complex of useful morphological features. This cycle was carried out within 5 years.

Later, on the basis of this selection method, we created an early-ripening low-growth homozygous line-158, which is the ancestor of the Omad variety.

Short ripened fork-resistant low-growth variety Omad has a large egg-shaped elongated box (6-7 g), fiber yield 35-36%, fiber length 35-36 mm, the fiber is thin, white and transparent, metric number (tone) 6000-6400, the relative breaking load 28.0-29.0 g. P./tex, micronair 4.4-4.6. Seeds are large, gray, weight of 1000 pcs of seeds 130-135 g. Oil content 18-20%. The length of vegetation period is 105-115 days. With good agricultural machinery variety Omad gives 40.0-45.0 c / ha harvest. Since 1999, entered in the State Register.

Transgressive breeding

The theoretical foundations of transgressive breeding are based mainly on the third Mendeleev law on independent inheritance or the law of free gene combination. This method is based on the fact that many breeding features, primarily yield, rate of maturity, yield and quality of fibers, filt resistance, etc. features are controlled by many genes. That's why genes combination in new genotype affects not separate signs but if possible all positive and negative acting signs, which are determined by hereditary factors. At the same time, it should be noted that transgressive selection largely depends on random factor. An increase in the number of transgressive plants with a complex of useful features can be achieved by preliminary study of the genetic potential of the initial forms attracted for interbreeding. It should be noted that different traits are controlled by different dominant and recessive genes, which at simple intraspecific and complex crosses can give different combination of genes, and at distant intraspecific and interspecific completely different combination of genes, which give a transgressive cleavage with a new combination of signs of superior parent forms in terms of speed, fork resistance, yield, mass of raw cotton in one box, yield and fiber length, which is very important for the breeding process.

The results of study of paired intraspecific, remote intraspecific and interspecific hybrids F1-F8 and backcross hybrids F1B1-F5B1-F4B2 and F3B3 and subsequent generations show that etching of transgressive plants having a complex of useful morphological features (rate of maturity, yield, yield and fiber length, box size, fork resistance, height of the plant, etc.) is about 1-2 percent in each hybrid combination. At the same time, it should be noted that transgressions are observed only when one or both parents do not possess a genotype that provides an extreme degree of phenotypic expression of the feature. There are transgressions of phenotypes when continuous hereditary or non-hereditary changes fluctuate around a certain average, and variability when monogenically controlled features are not fully dominated, in which the distribution curves of hybrid individuals go beyond parental forms, both left and right.

The analysis of complex hybrids by crossing hybrids of the first generation among themselves give a large number and wider formative process in the manifestation of transgressive plants of breeding value. Similar results have been obtained for remote intraspecific and interspecific hybrids F2 and in subsequent generations, as well as for backcross hybrids F2B1-F1B2 and F1B3, etc. Splitting in F2 and subsequent generations can be manifold, if the initial forms chosen for hybridization differ among themselves by a large number of features, and therefore by many genes controlling these features. As a result of different selection methods, we have created transgressive ultra-high-ripening (with a vegetation period of 95-105 days), high-yielding (40.0-43.0%) and high quality fibers of type IV-V, with a mass of raw cotton of one box of 6.0-7.0 g. families and lines, which have relatively high resistance to natural virulent populations of verticillium fungus, where the zoned variety C-6524 is affected by a total of 65-80% wilt and a strong 40-50%.

In the process of studying hybrid material in biological and breeding nurseries, families were identified that have a high level of fork resistance on a naturally-infected fork background, as well as high rate of maturity, productivity, large boxed, high yield and quality fiber type IV-V, which meets international standards.

The selected families outperform the zoned C-6524 and Namangan-77 varieties in terms of speed and wilt resistance. Thus, for example, in terms of the duration of the growing season, new families are faster than C-6524 varieties by 3-20 days, except for 1123, 1269, 1326 and 1276 families, whose growing season is 116, 117 and 119 days, respectively. The fastest growing families are families 1176, 1325, 1003, 1178, 360 and 365 with a vegetation period of 97-99 days (from 50% of seedlings to 50% of ripening).

Families 1174, 1176, 1325, 1339, 1339, 999, 1274, 1276, 1300, 1326, 1329, 1123, 1132, 1191, 1169, 1280, 370 and 376 have the largest mass of raw cotton, with the sizes of one box equal to 6.3-7.8 g. The largest boxes have families 1269, 1300 and 1326, with the sizes of 7.2 and 7.8 g, respectively. Other families have box sizes ranging from 5.2 to 6.2 g.

New families have high fibre yields from 38.2% to 43.5%. Relatively low fiber yield is observed in 1179, 1178, 1283, 360, 365, 367, 1126, 1330 and 1003 families with fiber yield of 36.2-37.7%. The highest.

Convergent Breeding

Convergent selection (English for Convergent Enhancement) is based on parallel return crosses. In order to give a sign of stability from one variety to the soon-to-ripen, productive one. For this purpose, two series of return (saturating) crosses are conducted in parallel and two new lines are obtained, which differ from each other by a small number of genes obtained from parental forms, as the process of crosses is a recombination of genes controlling a particular feature.

Successful application of convergent selection on resistance to agricultural diseases and pests, on productivity, production quantity and other features is contained in numerous foreign sources with its different variants. For example, using the method of convergent selection in sugar beet it was possible to connect single-seed and high yield, etc. (H. Schmalz, 1973).

Source material for convergent crosses was used:

- Early ripening low-growth line L-158, which has a vegetation period of 108-115 days, plant height of 80-90 cm, fiber yield of 35-36%, fiber length of 35.0-36.0 mm, weight of raw cotton of one box 6.0-7.0 g. L-158 is 20.0-30.0% more resistant than C-6524 in terms of wilt resistance;

- medium-growth, medium-white forilt-tolerant line L-302, which has a vegetation period from sowing to 50% of ripening 126-132 days, plant height 95-100 cm, fiber yield 38.0-39.0%, fiber length 33.0-34.0 mm., the mass of raw cotton of one box 5.5-6.0 g. L-302 line has high field resistance to natural more virulent and aggressive populations of V. dahliaeKleb.

The technique of reception viltostojchivyh, soon ripening, highly productive lines consists that on hybrids of the first generation do return or saturation crosses in two directions:

(a) One group of first generation hybrids is crossed with the mother form;

(b) Another group of first generation hybrids is crossed with the paternal form.

The number of return crosses or saturating crosses depends on the breeding goal of the breeder and the genetic control of the improving features in the new convergent variety.

Employees of the laboratory of intensive cotton varieties selection carried out convergent crosses in order to increase the silt resistance of L-158 short-lived low-growth line due to L-302 medium-growth line, which has high field resistance to natural virulent and aggressive populations of V. dahliaeKleb.

In this connection, intraspecific crosses were performed to obtain convergent hybrids, where parent forms L-158 and L-302 participate. The obtained seeds of F0 hybrids were divided into two parts. One part of hybrids F1 L-158 x L-302 served as a mother form for backwards crosses with parent form L-158, and the other part for backwards crosses with father form L-302.

The first group:

1) F1B1((F1L-158 x L-302) x L-158.

2) [F3B1(F1L-158 x L-302) x L-158] x L-158

3) F1B2 [F3B1(F1L-158 x L-302) x L-158] x L-158

4) [F3B2(F1 L-158 x L-302) x L-158] x L-158

5) F1B3 [[F3B2 (F1L-158 x L-302) x L-158] x L-158] x L-158

Group two:

1) F1B1(F1L-158 x L-302)x L-302

2) [F3B1(F1L-158 x L-302) x L-302] x L-302

3) F1B2[F3B1(F1L-158 x L-302) x L-302] x L-302

4) [[F3B2(F1 L-158 x L-302) x L-302] x L-302] x L-302

5) F1B3[[F2B2 ([F1L-158 x L-302] x L-302] x L-302

6) group A F3B3 x F3B3 group B

After receiving two parallel backcrosses of F1B1 hybrids, selections were made for backcrosses of F1B1 and F2B1 hybrids in the following years. Where the paternal form is involved, selection was made for the best features of the paternal form L-302, i.e., forilt resistance and other associated features, and where the paternal form is involved in repeated crosses, selection was made for the best features of the maternal form.

On two flat parallel backcrosses of F3B1 hybrid populations, we performed a second backcross with maternal and paternal form. A similar selection of plants was carried out on the obtained backcross hybrids F1B2 and F2B2, as well as on backcross hybrids F1B1 and F2B1. Then a third backcross with the mother and father forms was performed on the levelled backcross hybrid F3B2 populations. On the obtained two parallel backcross hybrids F1B3 and in the following generations F2B3 and F3B3 were selected to obtain two parallel convergent convergent lines, which are the initial forms of convergent fork-resistant, fast maturing, highly productive cotton line L-408. The duration of selection process in this case, from crossing of parental forms to multiplication of L-408 convergent line is more than 12 years. In the process of selection work on L-408 line the variety C-8294 (Gurlen) from hybrid

combination F3B3 [F3B2 (F1L-158xL-302) x L-158] x L-158) x F3B3 [F3B2 (F1L-158 x L-302) x L-302) x L-302] was created.] The variety has a high rate of maturity (115.0-117.0 days), high yield, with a box size (6.0-6.2 g.), wilt resistance, and a high fiber yield of 37.0-38.0%, with a fiber length of 33.5-34.0 mm.

In G.V. Gulyaev and V.V.'s opinion. Malchenko (1975) the multiplicity of return or saturating crosses can be 3x-4x-5x-6x and 8 times saturation.

Therefore, we have limited ourselves to three return crosses, as forilt resistance is relatively less polymeric than other morphological features. At the same time, it should be noted that each return crossbreeding should pay attention to keeping the best maternal and paternal traits in the two parallel backcross hybrids, respectively, the adopted scheme of crossing.

The importance of convergent crosses can be judged by the obtained rapid-ripening, fork-resistant line L-408, which has a relatively high field fork-resistance to natural more virulent and aggressive populations of V. dahliae fungus, where the zoned variety C-6524 is affected by 60-80% in total and 40-50% in a strong degree.

The created convergent line L-408 in terms of field resistance to fork exceeds the line L-302. In terms of the duration of the growing season (112-118 days) and the size of the box (6.0-6.5 g) is close to the L-158, the yield (38.0-39.0%) and fiber quality and height of the plant at the level of L-302. Fiber quality meets the requirements of V-type.

Therefore, on the basis of the results obtained, it can be noted:

- Convergent selection method is the most perspective direction in creation of silt resistant, early maturing, highly productive varieties and lines that will have the best features of both parental forms;

- the multiplicity of return or saturated crosses depends on the breeding goal of the breeder, genetic control of improved features in the new convergent variety. At the same time, it should be noted that with each increase in return crosses the breeding process lengthenes.

Conclusions:

1) Analytical selection depending on the selection method allows to create new high-ripening, fork resistant, highly productive varieties of cotton, which will have a high yield and quality fiber type IV-V.

2) Transgressive selection is somewhat narrowed in paired crosses, when parental forms differ greatly in geographical origin, in genetic control of traits, especially yield, rapid maturity, yield and fiber length, etc. traits that are controlled by several or many genes.

(3) The greatest success in transgressive breeding is achieved in return or saturated crosses, as well as in complex hybridization through repeated crosses of F1 hybrids for the genetic enrichment of transgressive offspring.

4. The method of convergent selection is the most promising direction in the creation of silt-tolerant, early maturing, highly productive varieties and lines that will have the best features of both parental forms;

5. The frequency of return or saturated crosses depends on the breeding goal of the breeder, genetic control of improved features in the new convergent variety. At the same

time, it should be noted that with each increase in return crosses the breeding process lengthenes.

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