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Analysis of Fiber Quality Using Modern Technology in Cotton Seed Production

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Abstract. The quality of the fiber samples prepared for analysis in the laboratories of the elite seed production of cotton until recently using the LPS-4 equipment, which was put into production in the early 60s of the last century, about 300 test samples picked from the seed nursery in the second year, is three, that is, breaking strength g/force, metric number , relative breaking length, g/force/tex, and determination of fiber length, which is one of the main indicators of fiber quality, has long been carried out in laboratory conditions using methods that require a lot of manual labor (velvet board, special comb and rulers). In the course of the research, samples of the elite seed farm "S-8290" cotton variety, picked from the families of the second year seed nursery, were selected by analyzing the yarn spinning coefficient using the innovative technology of Uster HVI Spectrum. Our proposed method is effective not only in increasing work efficiency but also in ensuring genetic purity of cotton varieties. A 15-20% higher yield is possible in the production of genetically pure cotton plants. According to the results of the variational statistical analysis, the modal value of the yarn spinning coefficient of the family samples collected from the second year 2018 seed nurseries of the cotton variety "S-8290" was in the range of 153-155, while it was equal to 156-158 in the family collection samples collected in 2019. In this case, individual selection seeds from families selected for yield coefficient in the first year were planted for next year's crop without any laboratory analysis. As it can be seen from the results of the analysis of the second year, the results of the selection work on the recommended yarn spin coefficient were confirmed by the preservation of the morphoeconomic characteristics of this variety.
Key words: single selection, family selection, first and second year seed nursery, seed propagation nursery, variation series, yarn spinning coefficient, modal value, heredity, field observations.

1 Introduction

At present, it is very important to conduct scientific research on the experience of developed countries, involving advanced technologies in production. Therefore, scientists, in order to increase the efficiency of growing cotton, strive to more fully master the

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theoretical and practical guidelines and widely use the experience of developed countries with advanced technologies [1].

In accordance with the Decree of the President of the Republic of Uzbekistan dated April 17, 2019 No. UP-5708 "On measures to improve the system of state administration in the field of agriculture" in order to provide producers with sufficiently high-quality seeds of agricultural crops, create a national seed brand, organize seed clusters based on the conditions of public-private partnership, encouraging direct investment in the sector in paragraph 5, paragraph 4, paragraph of the resolution of the Cabinet of Ministers dated September 5, 2019 No. 733 "On measures to further improve the development of the seed center under the Ministry of Agriculture of the Republic of Uzbekistan" control over fiber quality test samples in the laboratories of primary and elite cotton seed production were assigned to the regional laboratories "Sifat" of the Agro-industrial complex under the Cabinet of Ministers of the Republic of Uzbekistan [2-5]. This is a very big opportunity in the activities of elite seed farms. In the process of harvesting seeds from the Sifat laboratory, fiber quality indicators are assessed by 14 features. But in the process of selecting the materials of the elite (culling), which feature will be given the main attention, is not shown.

Specialists of elite seed laboratories select seed materials based only on the micronaire index or the relative breaking load of the fiber.

The spinning index (SCI) recommended by us when selecting seed material is formed on the basis of such features as - fiber micronaire (Mic), high average length (Len), relative breaking length (Str), length uniformity index (Unf), light reflection coefficient (Rd) and degree of yellowness (+b). In this regard, it is considered expedient to carry out selection precisely according to the spinning coefficient of the fiber. This enables us to keep a set of characteristics for the quality of fiber samples in accordance with the characteristics of the variety on a scientific basis for many years.

It is known that higher educational institutions and research organizations engaged in breeding and seed production, the Center for Testing Varieties of Agricultural Crops, cotton ginning plants, the Agrosanoat Complex Services Center under the Inspectorate for the Agro-Industrial Complex [6-7] and Ensuring Food Security [8], private and joint textile enterprises analyze indicators For more than 20 years, the quality of cotton fiber has been carried out with the help of a high-tech HVI device [9]. But unfortunately, in the elite cotton seed laboratories, the analysis of the fiber quality of the samples is still carried out using the LPS-4 device, introduced into production in the 60s of the last century, about 300 test samples collected from the seed nursery of the second year are evaluated by three indicators (breaking load g/s., metric number, relative breaking length g/s.tex) adopted 35 years ago.

In addition, when determining one of the main indicators that determine the quality of the fiber - the length of the fiber, a method is still used that requires a lot of manual labor (velvet board, special comb, ruler) and seeds are rejected on this basis [10].

2 Materials and methods

The seed production system has been functioning since 1920, and at present it is the main link providing agricultural production with a new variety and original seeds [11-12]. Three stages have been overcome in the development of cotton seed production. At the first stage, special scientifically based methods were not used in the state seed farms when propagating seeds, the seeds simply multiplied.

In the second stage, special seed farms and control organizations were created. In the third stage in cotton seed production, an interconnected single system was created, consisting of two departments.

Cotton seed production performs such tasks as constant harvesting of homogeneous seeds for economically valuable and morphological characteristics of new and zoned varieties, providing all farms with high-quality, homogeneous seeds, reproduction and introduction of seeds of new varieties, indicators of economically valuable characteristics that exceed cultivated varieties in certain regions. The scientific basis of cotton seed production is genetics. Therefore, all activities in cotton seed production are carried out on the basis of genetic patterns. The seed industry develops the possibilities for the full implementation of yields, requirements and methods for preserving economically valuable traits and biological properties and uses them in practice [13].

N. I. Vavilov in his studies paid special attention to the modification variability occurring in plants under the influence of the external environment [14].

In increasing the uniformity, carrying out seed-growing work on morphological and technological indicators is important in maintaining the purity and quality of the variety [15].

In seed farms, if the seeds of the elite do not meet the requirements for the purity of the variety, then the genetic purity of the seeds of the next generation will be violated. This reduces the ability to fully display economically valuable features and leads to loss of properties in a short time [16].

According to B. Mamarakhimov and others, if a new variety being sown corresponds to the conditions of a given region, then with proper seed production, the economic effect of this variety improves, i.e. the degree of change in the variety under negative influences arising in various environmental conditions will be low [17].

A. Kasimov believes that the length of the fiber depends on the properties of each variety and the heritability of traits, as well as on the agricultural technology carried out in the experiment [18].

Under production conditions, it is impossible to completely avoid the causes leading to a decrease in seed quality. Its slow or fast course depends on the culture of agriculture and the quality of seed production. In agriculture, a private seed-growing system has been developed for each crop, and work is underway to improve it [19].

An urgent task is the harvesting and delivery to the production of seeds of cotton varieties with high fiber quality and other characteristics. This largely depends on the created variety and its cultivation, as well as timely and high-quality harvesting [20].

In the process of seed propagation in primary seed production, in order to stabilize the traits and properties, an important task is the preservation by breeders of plant populations with certain traits and properties. On the recommendation of the breeder, the following processes are carried out - the study of harvested seeds, observation of the population of plants sown in nurseries, rejection of heterogeneous plants, creation of optimal cultivation conditions, separation of seeds of individual selections, measurement work, analysis of variational and statistical indicators of family collections, rejection, visual observation of those left for sowing seeds of samples, cleaning from mechanical impurities [21-25] .

Scientists are entrusted with the task of not only maintaining the stability of the traits of new varieties in generations, but also improving them. These tasks are carried out by the conclusions made on the basis of the variational-statistical analysis of the hereditary and non-hereditary variability of traits in the selected samples in the process of primary seed production by scientists [26-30].

When determining the varietal specificity of plants and families, the influence of conditions and climate, as well as the agrotechnology of cultivation, must be taken into account. Because as a result of changes in agricultural technology and climate, morphological indicators and fiber quality indicators change [31-32].

Primary seed production of cotton varieties included in the State Register is carried out in accordance with the manual "Guidelines for growing seeds of the elite and the first reproduction of zoned cotton varieties."

In accordance with the manual, each elite seed laboratory collects for analysis:

- in the seed nursery of the first year, out of 750-900 families left after field viewings, 200 boxed family collections (on average 800 pieces);

- in the seed nursery of the second year, out of 300-340 families left after field inspections, 100 box test samples (on average 300 pieces) and at least 3000 individual selections [1].

The innovative Uster HVI Spectrum technology was used to evaluate fiber samples harvested from elite nurseries.

The object of the study was the early ripening, high-yielding and wilt-resistant cotton variety C-8290, propagated from 2018 to the present in the elite seed farm “Abdukarimkhozhi ugli Abduvalikhozhi” in the Altiarik district of the Fergana region.

When propagating the seeds of the variety and ensuring the production of high-quality seeds, the work was carried out using the methodological manual by O.V. Kratirov [33] “Propagation of seeds of the elite and the first generation of cotton varieties”, the assessment of fiber quality was carried out in the Sifat laboratory of the Center for the provision of services of the Agrosanoat complex GUK based on Uster HVI Spectrum classification. Mathematical processing of the obtained data was carried out according to B.A. Dospekhov "Methodology of field experience" [34].

3 Results and discussion

In accordance with the current manual in the seed nurseries of the first and second years, field inspections were carried out twice: the first at the beginning of flowering, the second at the mass formation of fruits in plants. In the seed breeding nursery, a field inspection was carried out once and weed clean-up work was carried out several times before testing in seed nurseries.

In 2018, in the first year seed nursery, the first field review was held on July 5-6. At the same time, atypical families and plants from these families were rejected according to such basic morphological features as the shape and size of the leaf, color, degree of omission of the main stem and leaf, type of fruit branch and shape of the bush, 453 plants (1.24%) were infected with thrips , according to sparsity 492 (32.5%) families, 6098 (16.9%) plants, and 465 (9.9%) plants were rejected from non-rejected families.

In the seed nursery of the second year, the first field review was held on July 7-10. According to sparsity, 3 (0.74%) families, 520 (0.38%) plants, and 1691 (1.24%) plants from non-rejected families were rejected.

In the seed nursery of the first year, the second field review was held on July 5-8. As in the first field inspection, in the second field inspection, a rejection was carried out according to the main morphological features, as well as the size and shape of the boxes. According to these traits, 10 (0.6%) families, 304 (0.84%) plants were rejected, due to low yield 17 (1.12%) families, 415 (1.15%) plants, late maturity 42 (2 ,77%) families, 1146 (3.17%) plants, by resistance to spider mites and black aphids 124 (8.18%) families, 3916 (10.9%) plants, by resistance to wilt 57 (3.76 %) families, 1531 (4.31%) plants, as well as 1063 (2.9%) plants from non-rejected families were rejected. In the seed nursery of the second year, the second field review was carried out on August 9-13. During the second field inspection, 24 (5.93%) families, 8400 (6.95%) plants were rejected due to atypicality, 28 (6.95%) families, 9417 (4.8%) plants due to low yield plants, due to late ripening 23 (5.7%) families, 7665 (5.65%) plants, due to resistance to wilt 2 (0.5%) families, 600 (0.4%) plants, due to for resistance to spider mites, 9 (2.23%) families, 3328 (2.45%)

plants, as well as 3074 (2.3%) plants from non-rejected families were rejected. In total, as a result of the field review, 314 families were found fit.

In order to increase the efficiency of elite seed production, the fiber quality of family selection samples was studied on the basis of an analysis of the variational variability of the spinning coefficient - one of the signs that determine the quality of the fiber.

In 2018 spinning ratio selection, 314 family collections were collected from the second year seed nursery. From the collected samples, to determine their fiber quality indicators, 100 g fiber samples were handed over to the Sifat laboratory of the Center for the provision of services of the Agrosanoat complex of the GUK. The results obtained were analyzed by the spinning factor.

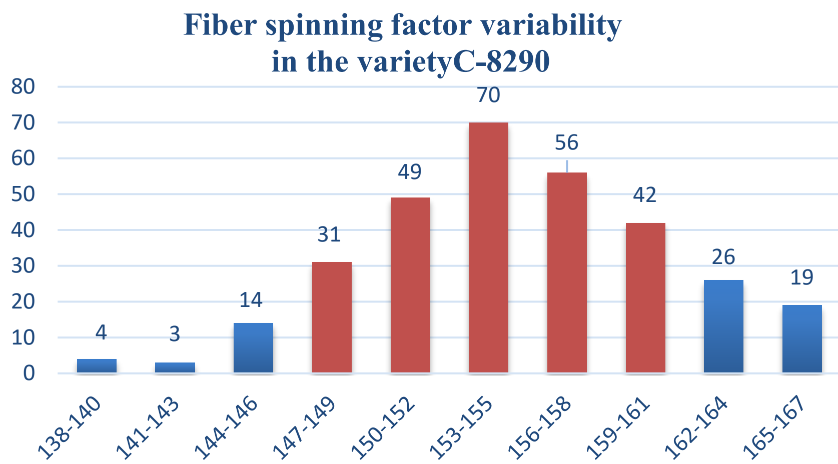

Fig. 1. Fiber spinning factor variability in the variety C-8290

The results of the analysis showed that the largest group in terms of number were families with a coefficient of 153-155. The group with the highest occurrence of families is considered modal. For sowing in the next year, the selection is made of precisely those families whose value is close to modal, i.e. families with a lower value of the spinning coefficient of 147 and a higher value of 161 are rejected. Collected individual selections from a group of families with modal values in the range of 147-161 are recommended for sowing (Figure-1).

In the second year of experience (2019) in the seed nursery of the first year, the first field review was carried out on July 2-3. At the same time, atypical families and plants from these families were rejected according to such basic morphological features as leaf shape and size, color, degree of descent of the main stem and leaf, type of fruit branch and bush shape. According to these traits, 18 (1.2%) families, 505 (1.1%) plants were rejected, 45 (2.9%) families were rejected by thrips, 1352 (3.0%) plants, 238 (15, 6%) families, 2938 (6.7%) plants, as well as 4374 (9.9%) plants from non-rejected families were rejected.

In the seed nursery of the second year, the first field review was held on July 5-9. In this survey, from non-rejected families, rejected plants amounted to 3612 pieces or 2.4%.

In the seed nursery of the first year, the second field review was held on July 28-31. As in the first field inspection, in the second field inspection, a rejection was carried out according to the main morphological features, as well as the size and shape of the boxes. According to these traits, 45 (2.9%) families, 1199 (2.7%) plants were rejected, due to low productivity 52 (3.4%) families, 1508 (3.4%) plants, late ripening 280 (18 ,4%) families, 6145 (14.0%) plants, resistance to spider mites and black aphids 33 (2.2%) families, 904

(2.1%) plants, resistance to wilt 26 (1.7 %) families, 758 (1.7%) plants, as well as 318 (0.7%) plants from non-rejected families were rejected.

In the seed nursery of the second year, the second field review was carried out on August 1-5. During the second field inspection, the following were rejected: due to atypicality 8 (2.0%) families, 2771 (1.8%) plants, due to low yield 21 (5.2%) families, 7144 (4.8%) plants, due to late ripening 23 (5.7%) families, 8132 (5.65%) plants, due to resistance to wilt 2 (0.5%) families, 680 (0.5%) plants, due to 29 (7.2%) families, 11023 (7.3%) plants, as well as 448 (0.3%) plants from non-rejected families were rejected for resistance to spider mites. As a result of the field review, 320 families were found fit.

In 2019, 320 family fees were collected from the seed nursery of the second year from families recognized as fit, and to assess their fiber quality, fiber samples in the amount of 100 g were handed over to the Sifat laboratory of the Agrosanoat Complex Service Center of the GUK. Analysis of the obtained results showed that the largest group consisted of families with spinning coefficients in the range of 156-158.

Based on the results of the analysis, it can be noted that the largest group was made up of families with spinning coefficients in the range of 156-158, and these families have modal values.

For sowing in the next year, families were selected with close indicators of the spinning coefficient to the modal values, i.e. families with a lower value of the spinning coefficient of 147 and a higher value of 164 were rejected. Collected individual selections from families with modal values in the range of 147-164, without any analysis, were recommended for sowing in the seed nursery of the first year (Figure 2).

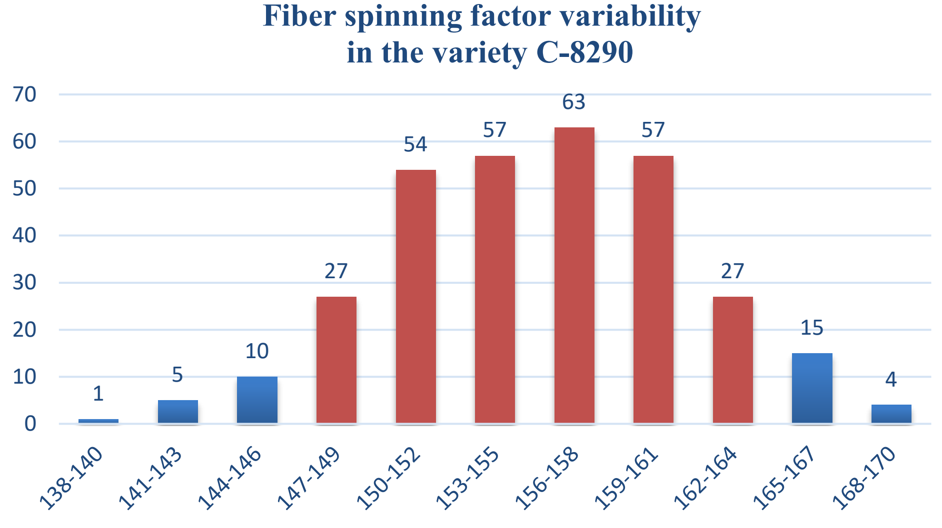

Fig. 2. Fiber spinning factor variability in the variety C-8290

4 Conclusion

Based on the results of the analysis of two-year data obtained on the basis of the proposed method for one variety, a change in the modal value of the fiber spinning coefficient from 154 to 157 was noted.

When determining the varietal specificity of plants and families, it is necessary to take into account the influence of growing conditions on the morphological characteristics of cotton.

Harvested seeds of individual selections collected from groups of families of the seed nursery of the second year with fiber spinning coefficients in the first year in the range of 147-161 and in the second year 147-164 are recommended for sowing at the seed nursery of the first year, as well as seeds harvested from these families at the nursery seed reproduction.

The introduction of modern innovative technology in cotton seed laboratories, the selection based on the recommended spinning factor of the fiber will allow: firstly, it saves labor resources and, secondly, it will increase the degree of accuracy of the analyzes.

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