PRODUCTIVITY OF COTTON LINES IN VARIOUS SOIL AND CLIMATIC CONDITIONS OF UZBEKISTAN

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Abstract

The productivity of cotton lines of the G.hirsutum L. species was estimated in the Tashkent, Fergana and Kashkadarya regions of the Republic of Uzbekistan. Ten lines of different genetic origin were tested. The influence of genotype and environment on their productivity was analyzed. The results of three-year experiments showed that the environment has a greater effect on the variability of a trait than the genotype. To find the optimal variety-geographical point option, it is necessary to conduct a series of tests.

Keywords: Yield, cotton (Gossypium hirsutum L.), genotype, environment, analysis of variance, genotype–environment interaction, regional trials, trait stability.

УРОЖАЙНОСТЬ ЛИНИЙ ХЛОПЧАТНИКА В РАЗЛИЧНЫХ ПОЧВЕННО-КЛИМАТИЧЕСКИХ УСЛОВИЯХ УЗБЕКИСТАНА

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Аннотация

Проведена оценка урожайности у линий хлопчатника вида *G.hirsutum* L. в Ташкентской, Ферганской и Кашкадарьинской областях республики Узбекистан. Испытывали 10 линий различного генетического происхождения. Проведен анализ влияния генотипа и среды на их урожайность. Результаты трехлетних экспериментов показали, что среда в большей степени влияет на изменчивость признака, нежели генотип. Для нахождения оптимального варианта сорт-географический пункт необходимо проводить ряд испытаний.

Ключевые слова: урожайность, хлопчатник (Gossypium hirsutum L.), генотип, среда, дисперсионный анализ, взаимодействие генотип–среда, региональные испытания, стабильность признака.

Introduction

As a method for increasing the accuracy of variety assessment by yield without extending the study period, Nettevich E.D. (2001) recommends sowing it in one year in several points. Simultaneous study of a variety in several points with variation in sowing dates, predecessors, fertilizers and other factors is more informative compared to growing it using different technologies in one point. The aim of the research was to determine the influence of genotype, environment and their interaction on the yield of cotton lines of different origins, as well as to identify the most productive lines in a particular region that showed stability of the trait over the years. The experiments were laid out in the Tashkent, Fergana and Kashkadarya regions of the republic randomly, in four replicates. To determine the influence of genotype and environment factors on the variability of the trait, a two-factor analysis of variance with repetitions was used. As can be seen from Table 1, the average yield indicators for the three regions in 2018 differed significantly from each other for the studied lines. The most productive were lines 765 - 37.3 c/ha. For five studied lines (681, 655, 705, 481, 998), the yield ranged from 33.6 to 35.1 c/ha. For three lines 956, 595 and 782, this

indicator was at the level of 25.1, 27.8, 28.1 c/ha, respectively. The lowest yield was noted for line 752 - 24.7 c/ha. The yield of most lines varied greatly by region. Moreover, for two groups of lines (in the Tashkent and Kashkadarya regions, the average yield per group was approximately the same 28.0 and 29.4 c/ha). The average yield for the group tested in the Fergana region was much higher: 37.1 c/ha.

Table 1**Analysis of variance of cotton line yield**

Source of Variation	SS	df	MS	F	P-Value	F critical
Sample	2256.307	9	250.7008	10.23363	1.04E-10	1.985595
Columns	1884.432	2	942.2159	38.46133	8.47E-13	3.097698
Interaction	960.2455	18	53.34697	2.177628	0.008679	1.719592
Within	2204.797	90	24.49775			
Total	7305.781	119				
Genotype	30.9%					
Environment	25.8%					
Interaction	13.1%					
Random Variance	30.2%					

A two-factor analysis of variance of yield showed a reliable effect of both the genotype factor and the environmental factor on yield. Thus, the share of the genotype influence on the variability of the trait in our experiments was 30.9%, and the environment affected 25.8% (Table 2). The interaction of these two factors also turned out to be significant - 13.1%.

The most productive in 2019 were the L-705 line in the Tashkent region - 31.99 c / ha, the L-998 line in the Fergana region - 45.75 c / ha, and the L-782 line in the Kashkadarya region - 45.12 c / ha (Table 1). The least productive in all three regions was the L-655 line. The yield by region was 20.54, 31.11 and 27.81 c / ha, respectively. It should be noted that the most productive lines were not the best in yield in the Tashkent region, but in two other regions the productive lines L-595 (39.67 and 38.99 c/ha) and L-681 (42.02 and 38.49) showed high results.

Table 2 **Two-way analysis of variance of cotton yield lines.**

Source of Variation	SS	df	MS	F	P-Value	F critical
Sample	1405.576	9	156.1751	8.380372	5.56E-09	1.985595
Columns	4848.787	2	2424.393	130.0932	2.8E-27	3.097698
Interaction	659.4107	18	36.63393	1.96578	0.019839	1.719592
Within	1677.224	90	18.63582			
Total	8590.997	119				
Genotype	0.16					
Environment	0.56					
Interaction	0.08					
Random Variance	0.20					

A two-way analysis of variance for yield in 2019 showed significant differences between lines and between groups of lines by region. However, the share of genotype influence on yield was small, namely 16% (Table 3). On the contrary, the share of environment influence on yield was higher and amounted to 56%. The interaction of genotype-environment factors was 8% in our experiments, and the share of unaccounted factors on yield was 20%. In 2020, the studied lines showed different yields. Thus, the average indicators for the three regions varied from 33.2 c/ha for line 782 to 41.6 c/ha for line 681 (Table 1). Significant differences in yield were also observed among the groups tested in different regions. The best indicator was observed in the Fergana region - 42.5 c/ha on average for the group. In the Tashkent region, this figure was 31.2 c/ha, and in Kashkadarya - 34.2 c/ha. The yield of the overwhelming majority of lines varied greatly depending on the region of cultivation.

Table 3 **Variance analysis of yield of cotton lines in 2020**

Источник вариации	SS	df	MS	F	P-Value	F critical
Выборка	848.4592	9	94.27325	3.802498	0.000423	1.985595
Столбцы	2741.44	2	1370.72	55.2878	2.18E-16	3.097698
Взаимодействие	1242.766	18	69.04257	2.784822	0.00075	1.719592
Внутри	2231.321	90	24.79245			
Итого	7063.987	119				
Генотип	12.0%					
Среда	38.8%					
Взаимодействие	17.6%					
Случайные отклонения	31.6%					

A two-factor analysis of variance for yield in 2020 revealed significant differences in yield both between lines and between line groups by region (Table 4). In this experiment, as in the previous year, the yield was largely influenced by the environment - 38.8%, the genotype influenced by 12%, the share of their combined influence was 17%. Unaccounted for factors turned out to be quite significant - 31.6%.

Thus, a significant influence of the environment on yield indicates a complex structure of this trait. Lines 681 and 765 were identified as showing consistently high yield indicators. The results of this experiment allow us to conclude that when selecting for cotton yield, it is necessary to take into account that the environment significantly affects it, and to find the optimal variety-geographical point option, it is necessary to conduct a series of tests in different cultivation regions.

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