

INFLUENCE OF DIFFERENT SOWING METHODS, FERTILIZER RATES, PINCHING AND HARVESTING TERMS ON YIELD AND COST-EFFECTIVENESS OF COTTON VARIETIES

N.Y. Seyidaliyev*, Kh. G. Khalilov, K.E. Babayeva, M.Z. Mammadova

Azerbaijan State Agricultural University, Ganja, Azerbaijan

Abstract. In accordance with increasing the fertility and fiber quality indicators of the cotton plant various research works are being conducted. The agrotechnical techniques applied in the research had a diverse effect on cotton varieties fertility increase. More yield was obtained in both varieties with 90x10x1 (111 thousand plants) sowing scheme, N₁₀₀P₅₀K₄₀ fertilizer rate, pinching on August 1 and harvesting on September 25. Fertility was 37,6 cent/ha in Ganja-103 variety and 43,7 cent/ha in Ganja-110 variety. Depending on agrotechnical techniques, the economic indicators of both varieties differed to some extent. In the Ganja-103 variety, the highest indicator was observed in the version of 90x10x1 (111 thousand plants) sowing scheme, N₁₀₀P₅₀K₄₀ fertilizer rate, pinching on August 1 and harvesting on September 25 version, the net produce in that version was 1610 manat and profitability level as 133,1 %. In the Ganja-110 variety, of 90x10x1 (111 thousand plants) sowing scheme, N₁₀₀P₅₀K₄₀ fertilizer rate, pinching on August 1 and harvesting on September 25 version net produce was 1980 manat and profitability level as 152,7 %. Economic indicators in Ganja-110 variety were higher.

Keywords: Cotton, yield, pinching, harvesting terms, sowing methods, fertilizer rates, production value, costs, net income, profitability.

***Corresponding Author:** N.Y. Seyidaliyev, Azerbaijan State Agricultural University, Ganja, Azerbaijan, e-mail: rkqbabayeva@rambler.ru

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1. Introduction

The development of cotton growing development is a priority area in Ilham Aliyev's policy. Adversion and implementation of the State Program related to the development of this field, increasing subsidies to farmers and other support techniques inspire cotton farmers to achieve high results.

“The State Program for the development of cotton growing in the Republic of Azerbaijan for 2017-2022” (hereinafter - the State Program) is aimed at strengthening the state support for cotton growing and solving problems in this field (Aliyev, 2017).

It is widely known that cotton growing as one of the strategic and significant areas of the agricultural sector that brings foreign currency to the country, differentiates by its high indicators in terms of labor intensity and the volume of the total output.

The existence of advantageous natural climatic conditions and traditions for cotton production in our republic, the demand for raw materials of the processing industry at the expense of local production, furthermore, the export potential of cotton and final products

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fabricated from it, ensure further development of cotton growing as an essential requirement. Hereafter, the creation of favorable circumstances for the development of cotton growing in the country have been set out as one of the priority tasks of the agrarian policy.

Republican Conference on “Cotton-growing-2022: upcoming tasks” was held in Salyan on 26 January 2022. Minister of Agriculture; Chairman of Azerbaijan Melioration and Water Management JSC; General Director of Azerbaijan Industrial Corporation attended the meeting held in the district executive authority. Furthermore, representatives of the Office of the Ministry of Agriculture and its subordinate institutions, heads of cotton supply and processing companies, management staff of the Azerbaijan State Agrarian University, responsible persons of the regional executive power structure, heads of the State Agrarian Development Centers of cotton-growing regions, farmers engaged in cotton cultivation participated.

Cotton growing is one of the agriculture areas with strong traditions in our country. The development of this sector has a positive impact on the growth of our farmers' income and the level of employment in the region. Moreover, cotton growing has become one of the most profitable directions of agriculture, increasing the interest of farmers in this field every year. Consequently, increased interest in this area, the volume of cotton-growing and average yield indicators are ascending year by year.

Cotton plant's correlation to nutrients is not the same at various stages of development. One ton of raw cotton requires 50 kg of nitrogen, 11 kg of phosphorus, 50 kg of calcium, 10 kg of each of sulfur, magnesium and sodium, 2 kg of iron, 200 g of boron, less than 50 g of copper and other elements.

The warm weather is a desirable situation in the cotton industry. Therefore, cotton is cultivated mainly in hot zones in our country. In addition, the optimum air temperature for seed germination and good yield is 25-30 °C.

Cotton plants require sunlight. Open areas with sunlight throughout the day considered favorable for cotton. In such conditions, the cotton plant tries to keep its leaves perpendicular to the sun's rays. When the sun goes down, the leaves hang down, as if they are “sleeping”. Most cotton varieties are typical short-day crops (9-10 hours). Light duration during the day is considerable for the normal development of the plant. It is straightforward to observe that cotton leaves are always turned towards the sun. Long-lasting cloudy and foggy days have a bad effect on the cotton plant, prolonging its vegetation period. Maturation and opening of cones are delayed. Lack of sunlight can also cause shedding of bar organs. All types of cotton plants require short days. Good fruiting is observed when the length of the day is 10-12 hours. Sensitivity to short day effect is felt in cotton plant 3-9 days after receiving the output. Because of this feature, they plant the cotton plant in a short period and reap the harvest. The vegetation period of the cotton plant takes about 6 months, which mainly coincides with the summer period and less often with the spring and autumn seasons.

During that period, the number of sunny days is usually high and the plant can produce good crops. According to the results of numerous studies, it has been determined that cotton is more demanding of nitrogen and phosphorus elements in the first period of its development. Since the growth of dry mass increases intensively after the beginning of budding, the demand for nutrients increases accordingly. The dynamics of accumulation of organic matter is intensive from the time of flowering to the ripening of cotton fiber. In the beginning process of cotton ripening, the growth of the vegetative parts of the plant stops and the dry mass increases due to the development of bar organs.

As the dry mass increases, the plant requires more nutrients. Cotton consumes more nutrients during the period from flowering to mass maturity. Unlike other types of medium-fiber cotton, the demand for water and nutrients increases starting from the budding phase (Balci *et al.*, 2020).

As in all plants, the variety has an exceptional role in the growth and development, productivity and quality indicators of the cotton plant. Productive, disease-resistant, machine-harvested, etc. are supremacy qualities of varieties.

In view of the fact that the varieties are fast growing, 85-90% of the crop should be given as first and second varieties. Their cones weigh no less than 6 grams in large-medium fiber ones and no less than 3 grams in fine-fiber ones, giving raw cotton from each cone, the bush is not very branched (type I-II);

At the end of ripening process, it should stick well in the stalks and not fall to the ground, it should have long and very strong fiber, high fiber output and high oil output (Yakhyoev *et al.*, 2002).

If phosphorus is not enough in the first period, the plant's root system slows top development and the formation of fruit bodies as well. The maximum amount of nitrogen and phosphorus in vegetative organs mainly falls during the period of mass flowering. Later, those nitrogenous compounds gradually decrease in the plant organs and this is explained by their flow from the vegetative organs to the cone. Until flowering, the nitrogen that the plant receives from the soil is mainly spent on the formation of leaves. During the period of cone formation, the demand of bar organs for nitrogen and other nutrients increases significantly.

Seyidaliyev & Khalilov (2019) proved that keeping 160,000 plants per hectare in the Mil and Karabakh regions of the Republic of Azerbaijan in the sowing scheme of 60 cm between rows increases fertility by 5-7 cent/ha.

In accordance with his studies in the conditions of the Mil plain Seyidaliyev (2012) proved that, based on that the yield of cotton was 6-8 cent/ha higher in the 1-4-0 irrigation scheme under the conditions of N₂₅₀P₂₀₀K₇₅ fertilizer norm.

In connection with the results of his research work, Djumayev (2017) emphasized that the main task of selection works is to obtain new high-yielding, disease- and pest-resistant, high-quality fiber yielding, quick-maturing varieties of medium-fiber cotton varieties. If it is possible to shorten the vegetation period of this type of cotton varieties by 20-25 days, by cause of the conducted research, the cotton will be harvested by the end of September and the yield per hectare can be increased by 30-40%. In every instance, there are right set of circumstances to increase the efficiency of selection by the hybridization method both in the crossbreeding process and in the subsequent work on the hybridization material (Djumayev, 2017).

Dragavtsev & Yakushev (2015) according to his long-term continuous research, underlined that the high and quality yield of each plant conditioned upon the correct performance of selection works, the obtained varieties and hybrids fertility, along with their resistance to diseases and pests. Under normal natural and climatic conditions, any cultivated plant variety should retain its genetic characteristics for a long time. In recent times, innovative technologies are more preferred in the creation of new cotton varieties in Azerbaijan.

Seyidaliyev *et al.* (2022), in regard to their research, noted that in the Ganja-110 variety, the sowing scheme of 90x10x1 (111 thousand plants), the fertilizer rate of N₁₀₀P₅₀K₄₀ per hectare, the net produce in the variant of pinching on August 1 and harvesting on September 25 is 1851 manat and profitability level is 211.5%; Those

indicators were 1628 manat and 186.0%, in 90x15x1 (74 thousand plants) sowing scheme, N₁₀₀P₅₀K₄₀ fertilizer rate per hectare, in the variant of pinching on August 1 and harvesting on September 25; Furthermore, 90x10x1 (111 thousand plants) sowing scheme, N₁₂₀P₇₅K₅₀ fertilizer rate, pinching on August 12 and in the version collected on October 15, the net produce was 1660 manat and the profitability level was 189.7%, for the N₁₂₀P₇₅K₅₀ fertilizer rate, in the version collected on August 15, the net produce was 1546 manat and the profitability level was 176.6%.

Seyidaliyev & Khalilov (2022) Cotton needs for fertilizer. The coefficient of use of nitrogen in the soil by the cotton plant is equal to 50%, phosphorus to 15-20%, potassium to 65-70%. Therefore, it is recommended to give nitrogen and phosphorus fertilizers more than the amount required by the plants. The efficiency of the given fertilizers depends considerably on the correct ratio of nitrogen and phosphorus.

Bigarayev & Huseynov (2012), consistent with his experiences, noted that, after the completion of competitive variety tests on varieties and hybrids of relevant plants, including economic utility tests, tests of difference, similarity and stability, correspondingly, tests carried out in other state institutions and private farms, the relevant data on the results will be fully investigated and analyzed by the State Service. Afterwards that varieties with high competitiveness and which can ensure a guaranteed yield increase will be identified and registered in order to be put to use in production and varieties that meet the conditions of patentability will be issued with the right of protection and authorship certificate documents.

Seyidaliyev et al. (2021), by virtue of the long-term research, mentioned that the distinguishing feature of the fertilization system is that fertilizers are not available to apply without studying the agrochemical characteristics of the plants. Incipiently, it is achievable to determine the rate and amount of fertilizers taking into account the physical and chemical properties of the soil.

The production of 1 ton of raw cotton requires 50 kg of nitrogen, 50 kg of phosphorus, 11 kg of potassium, 50 kg of calcium, 10 kg of each of sulfur, magnesium and sodium, 2 kg of iron, 200 grams of boron, less than 50 grams of copper and other elements.

After nitrogen and phosphorus, potassium is one of the most important elements that enter the cotton plant in the soil. Cotton is also demanding of this nutrient.

At the same time, in cotton, that potassium is required less than nitrogen, towards the end of its development, from the first period of development until the formation of 2-3 true leaves, the need for potassium exceeds the need for nitrogen.

Meanwhile there is a lack of potassium during the budding period, many leaves fall off, the weight of the stem decreases. If the plant is not well supplied with this substance, the flow of sugars from the leaves to the bar organs is disrupted. This situation slows down the formation of fiber and structural elements of the seed.

Effective use of land in cotton farms, for the purpose of protect and restore its fertility, development of new crop rotation cycles and land cultivation systems suitable for these crop rotations is one of the main issues. Accordingly, crop rotation plays a determining role in protecting the ecological system, restoring and improving soil fertility, including rational use of land. Therefore, it is not in vain that crop rotation is considered soil sanitation and fertility factory.

The best predecessors for cotton are legumes, followed by cereals. However, clover is considered the best predecessor plant for cotton among the mentioned plants. Alfa-alfa enriches the soil with nitrogen through its tubers. Alfa-alfa has great agrotechnical

significance in increasing soil fertility, improving its water-physical properties and preventing soil erosion. Alfa-alfa is also a method of biological control in the fight against wilt disease of cotton. Therefore, after Alfa-alfa, “Vercilium fungi”, which are considered the main causative agents of wilt disease, are destroyed in the soil. Alfa-alfa collects more roots and aboveground mass in the network and in the process of plowing, the soil is enriched with organic matter and the cotton plant, which alternates after the clover, uses these favorable conditions.

The agrotechnical techniques applied in 2021 had a different consequence on the increase of fertility in cotton varieties. More yield was obtained in both varieties with 90x10x1 (111 thousand plants) sowing scheme, N₁₀₀P₅₀K₄₀ fertilizer rate, pinching on August 1 and harvesting on September 25. Productivity was 36,5 cent/ha in Ganja-103 variety and 41,6 cent/ha in Ganja-110 variety. Furthermore, those versions demonstrate higher cost-effectiveness.

The agrotechnical techniques implemented in 2022 had a different effect on the increase of fertility in cotton varieties. More yield was obtained in both varieties with 90x10x1 (111 thousand plants) sowing scheme, N₁₀₀P₅₀K₄₀ fertilizer rate, pinching on August 1 and harvesting on September 25. Fertility was 37,6 cent/ha in Ganja-103 variety and 43,7 cent/ha in Ganja-110 variety.

In both varieties, 90x10x1 (111 thousand plants) sowing scheme, N₁₀₀P₅₀K₄₀ kg fertilizer rate per hectare, sowing on August 1 and harvesting on September 25 were more fruitful. The fertility of the Ganja-110 variety was higher over the years.

Table 1. Influence of different sowing methods, fertilizer rates, pinching and harvesting terms on yield of cotton varieties (2021-2022)

Variants					Yield (cen/ha)	
Varieties	Sowing methods	Fertilizer rates	Pinching terms	Harvesting terms	2021	2022
Ganja-103	90x10x1(111 thousand pieces of plants)	N ₁₀₀ P ₅₀ K ₄₀	01 August	25 September	36,5	37,6
	90x15x1(74 thousand pieces of plants)	N ₁₀₀ P ₅₀ K ₄₀	01 August	25 September	34,7	35,8
	90x10x1(111 thousand pieces of plants)	N ₁₂₀ P ₇₅ K ₅₀	12 August	15 October	36,9	37,0
	90x15x1(74 thousand pieces of plants)	N ₁₂₀ P ₇₅ K ₅₀	12 August	15 October	35,1	36,2
Ganja-110	90x10x1(111 thousand pieces of plants)	N ₁₀₀ P ₅₀ K ₄₀	01 August	25 September	41,6	43,7
	90x15x1(74 thousand pieces of plants)	N ₁₀₀ P ₅₀ K ₄₀	01 August	25 September	37,9	39,0
	90x10x1(111 thousand pieces of plants)	N ₁₂₀ P ₇₅ K ₅₀	12 August	15 October	38,6	39,7
	90x15x1(74 thousand pieces of plants)	N ₁₂₀ P ₇₅ K ₅₀	12 August	15 October	36,8	37,9

Table 2. Influence of different sowing methods, fertilizer rates, pinching and harvesting terms on cost-effectiveness of cotton varieties (2021-2022)

V a r i a n t s					Yield (cen/ha)		Total production value, man.		Production costs, man.		Net produce, man.		Profitability, %	
Varieties	Sowing methods	Fertilizer rates	Pinching terms	Harvesting terms	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
					Ganja-103	90x10x1(111 thousand pieces of plants)	N ₁₀₀ P ₅₀ K ₄₀	01 August	25 September	36,5	37,6	2555	2820	975
90x15x1(74 thousand pieces of plants)	N ₁₀₀ P ₅₀ K ₄₀	01 August	25 September	34,7		35,8	2429	2685	952	1200	1477	1485	155,1	123,8
90x10x1(111 thousand pieces of plants)	N ₁₂₀ P ₇₅ K ₅₀	12 August	15 October	36,9		37,0	2583	2775	986	1206	1597	1569	162,0	130,1
90x15x1(74 thousand pieces of plants)	N ₁₂₀ P ₇₅ K ₅₀	12 August	15 October	35,1		36,2	2457	2715	964	1200	1493	1515	155,0	126,3
Ganja-110	90x10x1(111 thousand pieces of plants)	N ₁₀₀ P ₅₀ K ₄₀	01 August	25 September	41,6	43,7	2912	3277	994	1297	1918	1980	192,9	152,7
	90x15x1(74 thousand pieces of plants)	N ₁₀₀ P ₅₀ K ₄₀	01 August	25 September	37,9	39,0	2653	2925	973	1265	1680	1660	172,7	131,2
	90x10x1(111 thousand pieces of plants)	N ₁₂₀ P ₇₅ K ₅₀	12 August	15 October	38,6	39,7	2702	2977	987	1220	1715	1757	173,8	144,0
	90x15x1(74 thousand pieces of plants)	N ₁₂₀ P ₇₅ K ₅₀	12 August	15 October	36,8	37,9	2576	2842	982	1244	1594	1598	162,7	128,5

The agrotechnical techniques implemented in 2021 indicated a disparate consequence on the cost-effectiveness of the experiment. Ganja-103 variety 90x10x1 (111 thousand plants) sowing scheme, N₁₀₀P₅₀K₄₀ fertilizer rate per hectare, net produce 1580 manat and profitability level indicated as 162,1 % in the variant of pinching on August 1 and harvesting on September 25;

90x15x1 (74 thousand plants) sowing scheme N₁₀₀P₅₀K₄₀ fertilizer per hectare norm and in the version of the pinching on August 1 and the harvesting on September 25, those indicators were 1477 manat and 155,1 %;

90x10x1 (111 thousand plants) sowing scheme, N₁₂₀P₇₅K₅₀ fertilizer rate, in the version that pinching was carried out on August 12 and harvesting on October 15, the net produce indicated 1597 manat and the profitability level was 162,0 %;

90x15x1 (74 thousand plants) sowing scheme N₁₂₀P₇₅K₅₀ fertilizer rate per hectare, in the version where pinching was carried out on August 12 and harvesting on October 15, the net produce was 1493 manat and profitability level was 155,0 %.

Ganja-110 variety 90x10x1 (111 thousand plants) sowing scheme, N₁₀₀P₅₀K₄₀ fertilizer rate per hectare, net produce - 1918 manat and profitability level indicated 192,9 % in the variant of pinching on August 1 and harvesting on September 25;

90x15x1 (74 thousand plants) sowing scheme, N₁₀₀P₅₀K₄₀ fertilizer per hectare norm, in the version of pinching on August 1 and harvesting on September 25, those indicators were 1680 manat and 172,7 %;

90x10x1 (111 thousand plants) sowing scheme, N₁₂₀P₇₅K₅₀ fertilizer norm, in the version of pinching on August 12 and harvesting on October 15, the net produce - 1715 manat and the profitability level was 173,8 %;

90x15x1 (74 thousand plants) sowing scheme, N₁₂₀P₇₅K₅₀ fertilizer norm, in the version of pinching on August 12 and harvesting on October 15 the net produce was 1594 manat and the profitability level indicated 162,7 %.

In 2022, agrotechnical techniques had a distinctive consequence on the cost-effectiveness of the experiment. Ganja-103 variety 90x10x1 (111 thousand plants) sowing scheme, N₁₀₀P₅₀K₄₀ fertilizer rate per hectare, net produce - 1610 manat and profitability level outlined 133,1 % in the variant of pinching on August 1 and harvesting on September 25;

90x15x1 (74 thousand plants) sowing scheme, N₁₀₀P₅₀K₄₀ fertilizer per hectare norm and in the variation of the pinching on August 1 and the collection on September 25, those indicators were 1485 manat and 123,8 %;

90x10x1 (111 thousand plants) sowing scheme, N₁₂₀P₇₅K₅₀ fertilizer rate, the net produce was 1569 manat and profitability level was 130,1% in the version of pinching on August 12 and harvesting on October 15;

90x15x1 (74 thousand plants) sowing scheme, N₁₂₀P₇₅K₅₀ fertilizer rate, the net produce was 1515 manat and profitability level was 126,3% in the version of pinching on August 12 and harvesting on October 15.

Ganja-110 variety 90x10x1 (111 thousand plants) sowing scheme, N₁₀₀P₅₀K₄₀ fertilizer rate per hectare, net produce 1980 manat and profitability level indicated 152,7% in the variant of pinching on August 1 and harvesting on September 25;

90x15x1 (74 thousand plants) sowing scheme, N₁₀₀P₅₀K₄₀ fertilizer per hectare norm, in the version of pinching on August 1 and harvesting on September 25, those indicators were 1660 manat and 131,2%;

90x10x1 (111 thousand plants) sowing scheme, N₁₂₀P₇₅K₅₀ fertilizer norm, in the version of pinching on August 12 and harvesting on October 15, the net produce - 1757 manat and the profitability level was 144,0%;

90x15x1 (74 thousand plants) sowing scheme, N₁₂₀P₇₅K₅₀ fertilizer norm, in the version of pinching on August 12 and harvesting on October 15, the net produce was 1598 manat and the profitability level was 128,5%.

2. Conclusion

1. A variety of research works are being conducted in accordance with increasing the fertility and fiber quality indicators of the cotton plant, which is considered one of the essential crops for our country. The implementation of each agrotechnical measure applied in the research work in the optimal period had a positive consequence on the structural indicators of the varieties.

In particular, the agrotechnical techniques applied in the research area had a different effect on the increase of productivity in cotton varieties. More yield was obtained in both varieties with 90x10x1 (111 thousand plants) sowing scheme, N₁₀₀P₅₀K₄₀ fertilizer rate, pinching on August 1 and harvesting on September 25. Productivity in 2021 in Ganja-103 variety- 34,7-36,9 cent/ha and in Ganja-110 variety – 36,8-41,6 cent/ha, in 2022 in Ganja-103 variety – 35,8-37,6 cent/ha and Ganja- 110 variety as 37,9-43,7 cent/ha.

2. Depending on agrotechnical techniques, the economic indicators of both varieties differed to some extent. In the Ganja-103 variety, the highest indicator was observed in the version of 90x10x1 (111 thousand plants) sowing scheme, N₁₀₀P₅₀K₄₀ fertilizer rate, pinching on August 1 and harvesting on September 25. In 2021, the net produce in that version is 1580 manat and profitability levels 162,1%. In the Ganja-110 variety was 1918 manat, the profitability level was 192,9%. In 2022, the net produce of the Ganja-103 variety was 1610 manat, the profitability level was 133,1%; of the Ganja-110 variety - 1980 manat, the profitability level was 152,7%. Ganja-110 variety was higher in economic indicators as well.

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