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Determination of the Effect of Mineral Fertilizers on the Yield of Seedless Varieties of Grapes

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Abstract: In the article, our experiments on the effect of mineral fertilizers on the yield of seedless grape varieties showed that in the Kishmish irtishar variety of grapes, the maximum number of grape bunches per vine –around 39.9-was determined in the variant when applied mineral fertilizer N160P120K40, in which the number of grape bunches was 4 .7 more than in the first control and 2.2 - in the second control. In this variant, in the application of mineral fertilizers N240P180K60 at least 37.1 pcs of grape bunches were recorded. Although this fertilizer rate was less than on the experimental variants, it was 2.9 and 0.4 more on the vine than on the control variants, respectively.

Keywords: seedless, grapes, mineral, pieces, variant, at the expense, fertilizer, although, grape bunch, absolute, unfertilized, inconsiderable, concentration, solution, therefore, pieces until, around, productivity, berries.

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Introduction One of the main conditions for the further development of viticulture, one of the most important branches of agriculture in the Republic of Uzbekistan, to increase the quantity and quality of grapes is that mineral fertilizers are one of the important factors that significantly increase the yield of not only grapes, but any agricultural crops. Providing the vine with a sufficient amount of minerals not only increases the number of grape bunches formed in the bush, but also increases their average weight. This, in turn, provides an increase in productivity per unit area. Our experiments on the effect of applying mineral fertilizers on the yield of seedless grape varieties showed that the maximum number of bunches for the Kishmish Irtysh variety was 39.9 pcs. in the variant applied with mineral fertilizer $N_{160}P_{120}K_{40}$, in this variant the number of bunches was 4,7 more than in the first control, and 2.2 more than in the second control. In this variant, at least 37.1 of grape bunches were registered due to mineral fertilizers $N_{240}P_{180}K_{60}$. Although this fertilizer rate was less than on the experimental variants, it was 2.9 and 0.4 pcs. more on the vines than on the control variants, respectively. In the experimental variant of mineral fertilizers $N_{200}P_{150}K_{50}$ in the Kishmish Irtishar grape variety, the number of bunches in the vine was intermediate and had 3.5 more pcs than in the first control and 0.8 pcs - in the second control. Experimental data show that mineral fertilizers had a significant impact on the mass of grape heads. At the same time, in the grape variety Kishmish Irtyshar, the heaviest grape bunches - an average of 284.7 g was registered of in the control variant given at the expense of mineral fertilizers $N_{160}P_{120}K_{40}$. It was noted that the increase in the average weight of grapes compared to the absolute control (unfertilized) was 29.3% (see table -1.1).

Table-1.1 The number of bunches in the vine of seedless grape varieties and the influence of the rate of mineral fertilizers on their average weight, 2018-2019

T/p	Variant	Grape bunches on the vine, pcs	Weight of grape bunches	
			g.	control, % rel.
Kishmish Irtishar				
1	Unfertilized -control	34,2	220,2	100,0
2	$N_{120}P_{90}K_{30}$ – control	36,7	252,6	-
3	$N_{160}P_{120}K_{40}$	38,9	284,7	129,3
4	$N_{200}P_{150}K_{50}$	37,5	255,3	115,9
5	$N_{240}P_{180}K_{60}$	37,1	248,0	112,6
Kishmish Sogdiana				
1	Unfertilized -control	33,8	390,1	100,0
2	$N_{120}P_{90}K_{30}$ – control	35,1	410,3	-
3	$N_{160}P_{120}K_{40}$	39,9	460,6	118,1
4	$N_{200}P_{150}K_{50}$	37,4	455,8	116,8
5	$N_{240}P_{180}K_{60}$	37,1	452,5	116,0
Kishmish Botir				
1	Unfertilized -control	35,6	385,2	100
2	$N_{120}P_{90}K_{30}$ – control	37,8	420,7	-
3	$N_{160}P_{120}K_{40}$	40,1	445,6	115,7
4	$N_{200}P_{150}K_{50}$	39,4	439,3	114,0
5	$N_{240}P_{180}K_{60}$	39,1	438,9	113,9

The data in the table show that a further increase in the rate of mineral fertilizer did not lead to a further increase in the average weight of the vines, but to its decrease, albeit insignificant. This is due to the negative effect of the plant on the excessive concentration of mineral fertilizers in the soil solution. In grape varieties Kishmish Sogdiana and Kishmish Botir, the influence of the rate of

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fertilization on the number of bunches in the vine has the same trend as in the previous variety. Consequently, the maximum number of grape bunches per vine was 39.9 and 40.1 pcs. - fixed on this variant due to mineral fertilizers N_{160} P_{120} K_{40}. At the same time, the increase in the number of grape bunches in the vine was 6.1 in the Kishmish Sogdiana variety compared to the first control and 4.8 in the second control, and in the Kishmish Botir variety this figure was higher by 4.5 and 2.3, respectively. In varieties Kishmish Sogdiana and Kishmish Botir, the norm of mineral fertilizers led to an increase in the average weight of grape bunches. The largest, i.e. 460.6 and 445.6 g of grape bunches, according to varieties, were noted in this variant due to mineral fertilizers N_{160} P_{120} K_{40}, respectively. The increase in this mass of grape bunches relative to the absolute control (unfertilized) variant was about 18.1 and 15.7%, respectively. A slight increase in the rate of mineral fertilizers did not give a significant change in the weight of the vines, and at slightly lower rates, it was observed to remain at the level of the above rate. The change in the number of grape bunches in the vine and their average weight when applying mineral fertilizers in different doses ultimately led to a difference in the total yield of the vine and the yield per unit area for both variants of the experiment. The data of our experience showed that the highest yield in the Kishmish Irtyshar grape variety - up to 15.8 kg of mineral fertilizers was obtained on the variant given at the expense of N_{160} P_{120} K_{40}. With such a rate of fertilization, the increase in the yield of a vine compared to the absolute control (unfertilized) variant was 4.7 kg. According to the experimental variants, the lowest yield in the vine - about 14.5 kg of mineral fertilizers was noted in the experimental variant given at the expense of $N_{240}P_{180}K_{60}$. When applying mineral fertilizers due to N_{200} P_{150} K_{50}, the average yield of the vine in the experimental variant was intermediate and equaled 15.2 kg. In these fertilization rates, it was noted that the yield of the bush was higher in both controls, although it differed in one way or another. The influence mineral fertilizer norms on the yield of seedless grape varieties are more manifested in the results obtained per unit area. Thus, the highest yield of the Kishmish Irtyshar grape variety-221.4 c/ha was determined in this experimental variant when applied N_{160} P_{120} K_{40}mineral fertilizers. The additional yield obtained at this rate of fertilizer application in relation to the absolute control was 39.5 %.

The minimum yield in terms of fertilizer application rates-208.8 c/ha of mineral fertilizers was determined in the above variant of the experiment due to N_{240} P_{180} $K_{60.}$ With such a rate of fertilizer application, the yield was higher than in both controls, although the lowest value in the experimental variants.

In the experimental variant when applied $N_{200}P_{150}K_{50}$ mineral fertilizers, the yield was intermediate between the above options, the additional yield obtained compared to the absolute control was 35.8%.

The same trend was observed in the influence of mineral fertilizer norms on the yield of grape varieties Kishmish Sogdiana and Kishmish Botir.

Therefore, the highest yield 18.1 kg and 16.7 kg per vine by variety was obtained in the application of N_{160} P_{120} K_{40} mineral fertilizers, on this experimental variant, respectively. With such a fertilizer application rate, the amount of additional yield obtained relative to the absolute control option was 5.7 kg and 5.3 kg, respectively. A further increase in mineral fertilizers in these varieties did not lead to a further increase in the average yield of the vine (see table 1.2).

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Table 1.2 The influence of mineral fertilizer norms on the yield of seedless grape varieties, 2018-2019

T/p	Experimental variants	The average yield of vine, kg	Productivity	
			c/ha	control, % rel.
Kishmish Irtishar				
1	Unfertilized -control	11,1	158,7	100
2	$N_{120}\,P_{90}\,K_{30}$ – control	13,5	199,5	-
3	$N_{160}\,P_{120}\,K_{40}$	15,8	221,4	139,5
4	$N_{200}\,P_{150}\,K_{50}$	15,2	215,5	135,8
5	$N_{240}\,P_{180}\,K_{60}$	14,5	208,8	131,6
Kishmish Sogdiana				
1	Unfertilized -control	12,4	179,7	100
2	$N_{120}\,P_{90}\,K_{30}$ – control	15,6	211,8	-
3	$N_{160}\,P_{120}\,K_{40}$	18,1	248,7	138,4
4	$N_{200}\,P_{150}\,K_{50}$	17,9	247,6	137,8
5	$N_{240}\,P_{180}\,K_{60}$	17,1	246,6	137,2
Kishmish Botir				
1	Unfertilized -control	11,4	128,9	100
2	$N_{120}\,P_{90}\,K_{30}$ – control	13,9	151,0	-
3	$N_{160}\,P_{120}\,K_{40}$	16,7	195,5	151,7
4	$N_{200}\,P_{150}\,K_{50}$	15,9	187,7	145,6
5	$N_{240}\,P_{180}\,K_{60}$	15,1	186,6	144,8

The data in the table show that the difference in the yield of a vine under the influence of the rate of mineral fertilizers in the varieties Kishmish Sogdiana and Kishmish Botir, also led to a change in the yield per unit area. The highest yields of these varieties 248.7 and 245.5 c/ha were noted when applied N160 P_{120} K_{40} mineral fertilizers on the experimental variant. The increase in the yield of grape varieties at this rate of fertilization compared with the absolute control reached 38.4% and 51.7%, respectively, by variety. An increase by applying $N_{240}\,P_{180}\,K_{60}$ of mineral fertilizers did not provide a further increase in the yield. However, it should be noted that even with these fertilizer rates, the yield was significantly higher than in the absolute control. It is known that seedless grape varieties are grown in Uzbekistan mainly for the production of dried grapes - kishmish raisins. Today, large-fruited varieties of raisins are in high demand not only in our country, but also in foreign countries. The production of high-quality raisins from large varieties can serve to further increase the country's export potential. Therefore, in our experiments, we studied the effect of the amount of mineral fertilizers on the yield of dried products from seedless grape varieties. For this grape variety Kishmish Irtishar, Kishmish Sogdiana and Kishmish Botir, grown on the background of various amounts of mineral fertilizers, were dried using the Obzhosh method using 10 kg of raw materials. The peculiarity of this method of drying is that the grapes are first processed (blanched) in a mixture of caustic soda in boiling water, then the grapes are divided into baskets of 2-3 kg each and placed in an alkaline (0.3-0.4%) boiling pot and kept within 3-6 seconds.

With this technology, thin cracks appear in the thin skin of the tubercles and wax dust disappears on the tubercles. This ensures rapid evaporation of moisture from the aggregates and a reduction in drying time. Baskets with grapes taken out of the pot are placed on racks for several minutes to allow the solution to drain, and then laid out on trays or in the field. After 3-4 days, the grapes laid out for drying are rolled up and dried until ready, drying takes 6-12 days. The yield of dry product in this

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method makes up 25-26%. Experiments have shown that the application rates of mineral fertilizers had a significant impact on the quantity and quality of dried products from seedless grape varieties. Consequently, the highest yield about 2.62 kg of dried product was noted in the Kishmish Irtyshar grape variety grapes in the experimental version when given mineral fertilizers $N_{160}\,P_{120}\,K_{40}$. In this variant of the experiment, the increase in the yield of finished products relative to the absolute control was 8.3%. Depending on the application rate of mineral fertilizers, the lowest dry product yield was noted in the experimental variants $N_{200}\,P_{150}\,K_{50}$ and $N_{240}\,P_{180}\,K_{60}$, or, in other words, the rate of mineral fertilizers increased further can be seen that an excessive increase in the rate of application of mineral fertilizers does not allow a constant increase in the yield of dried products.

The reason for the high yield of the dried product in the variant with the optimal dose of mineral fertilizers is due to the maximum increase in the amount of soluble dry matter (SDM) in the fruits. The results of the experiment showed that the amount of mineral fertilizers had a significant impact on the yield of dried product both in the Kishmish Sogdiana and the Kishmish Botir varieties. Therefore, $N_{160}P_{120}K_{40}$ mineral fertilizers application variant of the experiment, the maximum amount of dry product yield 2.52 kg and 2.51 kg was determined, respectively. With this fertilizer option, the increase in the dry product yield relative to the absolute control was about 12.0 and 6.8%, respectively. The results of the experiments show that a constant increase in fertilizer rates for these varieties did not have a positive effect on the yield of dried products, and the yield of finished products was 2.49 kg and 2.46-2.47 kg, or it was about of 10.7% and 104.7-105.1 % respectively. (see table 1.3).

Table 1.3 The effect of mineral fertilizers on the yield of dried products from seedless varieties, 2018-2019

T/p	Variant	Amount of raw grapes for drying,kg	Dry product yield	
			kg	control,% rel.
Kishmish irtishar				
1.	Unfertilized -control	10,0	2,42	100,0
2.	$N_{120}\,P_{90}\,K_{30}$ – control	10,0	2,52	-
3.	$N_{160}\,P_{120}\,K_{40}$	10,0	2,62	108,3
4.	$N_{200}\,P_{150}\,K_{50}$	10,0	2,55	105,4
5.	$N_{240}\,P_{180}\,K_{60}$	10,0	2,55	105,4
Kishmish Sogdiana				
1	Unfertilized -control	10,0	2,25	100,0
2	$N_{120}\,P_{90}\,K_{30}$ – control	10,0	2,38	-
3	$N_{160}\,P_{120}\,K_{40}$	10,0	2,52	112,0
4	$N_{200}\,P_{150}\,K_{50}$	10,0	2,49	110,7
5	$N_{240}\,P_{180}\,K_{60}$	10,0	2,49	110,7
Kishmish Botir				
1	Unfertilized -control	10,0	2,35	100,0
2	$N_{120}\,P_{90}\,K_{30}$ – control	10,0	2,48	-
3	$N_{160}\,P_{120}\,K_{40}$	10,0	2,51	106,8
4	$N_{200}\,P_{150}\,K_{50}$	10,0	2,47	105,1
5	$N_{240}\,P_{180}\,K_{60}$	10,0	2,46	104,7

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Differences in the quality of grapes grown on the background of different amounts of mineral fertilizers are also noted due to changes in the amount of SDM. Differences were noted in the tasting price of dried products from the Kishmish Irtyshar and Kishmish Sogdiana varieties, depending on the rate of fertilizer application. At the same time, the highest tasting scores in terms of size, color, fullness, meet texture and taste of dried Kishmish Irtyshar grapes were recorded for grape products grown on the background of mineral fertilizers N_{160} P_{120} K_{40}, and amounted to 9.5. points (see table1.4).

Table-1.4 Tasting price of dried products from seedless grapes grown on the background of various amounts of mineral fertilizers, 2018-2019

T\p	Variant	Tasting price, in points					General point
		Size	Color	Fullness	Consistency	Taste	
Maximum points		1,0	1,0	1,0	2,0	5,0	10
Kishmish irtishar							
1	Unfertilized -control	0,6	0,5	0,4	1,1	4,3	6,9
2	N_{120} P_{90} K_{30} – control	0,7	0,8	0,7	1,5	4,3	8,0
3	N_{160} P_{120} K_{40}	1,0	0,9	0,9	1,7	4,9	9,5
4	N_{200} P_{150} K_{50}	0,9	0,8	0,7	1,6	4,5	8,5
5	N_{240} P_{180} K_{60}	0,9	0,8	0,7	1,6	4,5	8,5
Kishmish Sogdiana							
1	Unfertilized -control	0,7	0,7	0,7	1.5	4,2	7,9
2	N_{120} P_{90} K_{30} – control	0,8	0,8	0,7	1,7	4,4	8,4
3	N_{160} P_{120} K_{40}	0,9	0,8	0,8	1,8	4,9	9,2
4	N_{200} P_{150} K_{50}	0,8	0,8	0,7	1,7	4,6	8,6
5	N_{240} P_{180} K_{60}	0,8	0,8	0,7	1,7	4,6	8,6
Kishmish Botir							
1	Unfertilized -control	0,7	0,7	0,7	1.5	4,1	7,8
2	N_{120} P_{90} K_{30} – control	0,8	0,8	0,7	1,6	4,3	8,1
3	N_{160} P_{120} K_{40}	0,9	0,8	0,8	1,8	4,8	9,1
4	N_{200} P_{150} K_{50}	0,8	0,8	0,7	1,7	4,5	8,5
5	N_{240} P_{180} K_{60}	0,8	0,8	0,7	1,7	4,5	8,5

With an overdose of mineral fertilizers, a slight decrease in taste and other quality indicators of dried products was noted. Consequently, when applying mineral fertilizers due to N_{200} P_{150} K_{50} and $N_{240}P_{180}K_{60}$, the dry yield of grapes grown in the experimental variant is estimated at 8.5 points. Obviously, it makes no sense to overestimate the rate of application of mineral fertilizers in increasing the yield of dried product and its quality. In conclusion, the observations showed that the quality of the dried product in the grape varieties Kishmish Sogdiana and Kishmish Botir, grown on the background of different norms of mineral fertilizer, also differed based on the trend observed in the above variety. At the same time, the highest tasting price - 9.2 and 9.1 points for mineral fertilizers grown on the background of $N_{160}P_{120}K_{40}$ mineral fertilizers. In these varieties, the increase in the rate of fertilizers also did not affect the quality of the dried product and had a lower value than the variant parameters set at the optimal rate. It can be concluded that increasing the rate of fertilizers to the optimum value has a positive effect on productivity, crop quality and the quality of the dried product obtained from them but excessive fertilization does not allow getting positive results.

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