Yield, quality and lightness of melons depending on nutrition conditions in Northern Turkmenistan

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Abstract. In the conditions of Northern Turkmenistan, to increase the sugar content in fruits, optimal and cost-effective rates of mineral fertilizers were calculated for the autumn-winter melon varieties Gulyabi Dashoguzskaya, nitrogen 90, phosphorus 90 and potassium 60 kg/ha. And also to increase soil fertility and melon productivity, it was recommended to apply manure of 30 t/ha once every three years for the main plowing. At the application rate (nitrogen 90, phosphorus 90 and potassium 60 kg/ha) in compliance with equal shares of nitrogen for pre-sowing treatment and in the phase of 3-4 leaves, phosphorus in equal shares for plowing and before sowing, potassium for plowing and the general agricultural background, it was obtained 27.0−29.0 t/ha crop.

1 Introduction

In Turkmenistan, the issues of fertilizing melons have been worked out very poorly and the existing recommendations are mainly focused on materials obtained in Uzbekistan, which are sometimes contradictory in nature.

S.I. Kobytev recommends applying at least 3 fertilizing treatments for melons. On fertile soils of Lebap velayat, start the first fertilizing after the first watering before the first hilling, the second before the second hilling and the third after the first harvest [9].

A.Mukhamedov, having studied the norms and timing of applying mineral fertilizers in the conditions of the middle reaches of the Amu Darya, came to the conclusion that that to obtain high yields of melon with good sugar content of the fruits of the Kyzyl Gulyabi variety, $N_{100}P_{120}K_{60}$ should be applied. Nitrogen is applied in the first feeding in the phase of 4-5 true leaves, phosphorus 50% for plowing and the rest in two feedings, potassium for plowing. With one-sided application of nitrogen, the sugar content and taste of the fruit pulp decreased.

R. Ovezov for the same melon growing zone recommends applying nitrogen 100, phosphorus 120, potassium 40 kg/ha in the following periods; for plowing phosphorus 60, potassium 40 kg/ha; in the first feeding (in the phase of 3-4 leaves), nitrogen 100 and

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phosphorus 60 kg/ha (Recommendations on technology for cultivating melons and melons, 1974).

K. Ovezova recommends applying the optimal norms for melons in Turkmenistan ($N_{100}P_{120}K_{40}$) during their next distribution; the entire norm of potassium and 60% of phosphorus for plowing and the rest in 2 feedings, the first in the phase of 4-5 leaves ($N_{100}P_{30-40}$), at the beginning of fruit formation (P_{10-20}) [9].

The effect of rational fertilizer rates on increasing the yield of melon and increasing the taste of its fruits is also evidenced by the works of V.F. Belik, A.I. Ermakov and G.A. Lukovnikova, R.D. Ovezov and K. Ovezova, S.M. Rytova and D.G. Kholodova [9].

2 Materials and methods

However, it should be noted that the literary sources that describe the experiments there is very little information on storing melon fruits.

In the works of B. Allaev and M. Orazbaeva [2], Z.I. Koreysha [9], E.I. Novikova, N.A. Palilov, B.A. Rubin and L.V. Motlitsky, V.F. Tserevitinov and A.A. Kolesnik [9] reflect various methods of storing melons and biochemical transformations of substances during long-term storage. Very little has been described about local storage conditions for melons and the effectiveness of different storage conditions.

Many researchers have mainly studied the effect of fertilizers on soil fertility. In the works of N.K. Balyabo, G.A. Dyuzhev, E.A. Zhoryakov, Z.Ch. Zhurbitsky, S.A. Kudrin and O.V. Nemolovskaya, I. Madraimova, B.P. Machigina, V.D. Pannikov, V.G. Mineeva A.L. Toropkina, Yu.K. Chuprikova and I.V. Gulyakin [9] noted that mineral fertilizers mainly increase soil fertility. Large doses of organic fertilizers not only maintain soil fertility, but also help increase humus in the soil.

3 Results and Discussion

Melons are responsive to fertilizers. But an increase in yield and an increase in the taste of melon fruits is achieved with the rational use of fertilizers [10].

By activating the growth, development and formation of the vegetative and reproductive organs of melon, mineral and organic fertilizers help to increase the productivity of melon.

Our research conducted at the educational farm of the Turkmen Agricultural Institute on old irrigated meadow soil in the period 2013-2014 testifies to the high effectiveness of fertilizers on the melon harvest (Table 1).

Table 1. Melon productivity depending on fertilizer rates.

Option experience	Fruit yield, t/ha				Sugar accumulation, t/ha	
	year 2013	year 2014	Average in 2 years	Increase yield	general	increase
Control	13.6	11.44	12.52	-	1.52	-
Manure 30 t/ha	21.54	17.41	19.36	6.84	2.71	1.13
Background+$N_{80}P_{100}K_{60}$	30.21	29.81	29.53	17.01	4.27	2.75
Background+$N_{120}P_{120}K_{60}$	43.02	42.65	42.84	30.32	6.50	4.98
Background+$N_{180}P_{180}K_{90}$	45.61	44.04	44.90	32.38	5.72	4.20
Background+$N_{240}P_{240}K_{120}$	44.01	43.87	43.95	31.43	4.84	3.32

According to Table 1, the use of 30 t/ha of manure gives an average annual yield increase of 6.84 t/ha, or 1.5 times more than in the control. Even greater efficiency is observed from the combined use of organic and mineral fertilizers. Here the yield increase

ranges from 17.01 to 32.38 t/ha with the greatest increase from $N_{180}P_{180}K_{90}$ against the background of manure. However, these rates of mineral fertilizers, although they give the maximum yield, compared to the rates of $N_{120}P_{120}K_{60}$, accumulate less sugar by 0.78 t/ha. This circumstance indicates the need for a cautious approach to the application of mineral fertilizer rates, especially nitrogen, which, in combination with abundant irrigation, produce large yields of low-quality fruits that also quickly deteriorate during storage [1, 3, 5].

Subsequent studies (2016-2018) were aimed at studying the responsiveness of melon to fertilizer according to a more disaggregated scheme (Table 2).

Table 2. Melon fruit yield depending on fertilizer rates.

Options experience	Total yield by year, t/ha			Total yield on average for 3 years, t/ha	Average yield increase, t/ha	Harvest of commercial products		
	2016	2017	2018			Total, t/ha	in % of total harvest	Yield increase, t/ha
Control, used	15.51	14.97	12.93	14.47	-	11.03	7.62	-
Manure, 30 t/ha	18.97	20.19	22.05	20.40	5.93	18.90	9.27	7.87
$N_{60}P_{30}K_{30}$	20.57	24.71	24.43	23.24	8.77	17.99	7.74	6.96
$N_{60}P_{60}K_{30}$	21.60	26.03	25.89	24.51	10.04	21.12	8.62	10.09
$N_{90}P_{30}K_{30}$	23.79	25.83	25.52	25.05	10.58	20.61	8.23	9.58
$N_{90}P_{60}K_{30}$	26.02	29.57	28.36	27.98	13.51	21.51	7.68	10.58
$N_{90}P_{60}K_{60}$	28.10	26.27	24.56	26.31	11.64	20.27	7.71	9.24
$N_{120}P_{60}K_{60}$	29.91	25.03	24.70	26.55	12.08	18.36	6.92	7.33
$N_{120}P_{90}K_{60}$	30.87	32.13	30.10	31.03	16.56	17.16	5.53	6.13
$N_{120}P_{90}K_{90}$	33.04	33.07	30.93	32.35	17.88	17.67	5.46	6.64
$N_{150}P_{120}K_{90}$	31.63	31.66	31.07	31.45	16.98	17.99	5.72	6.96
$N_0P_{120}K_{90}$	17.91	16.70	15.45	16.78	2.31	15.00	8.99	3.97
NSR_{05}, t/ha		1.96	0.82	0.04	-	-	-	-

The experimental data given in Table 2 show that the best response of melon plants was traced to complete mineral fertilizer. If from the use of manure the increase in fruit yield by year of the experiment ranged from 3.46 to 9.12 t/ha (on average 5.93 t/ha), then from NPK it was noticeably higher, respectively 5.06-16.14 and 8.77-17.88 t/ha.

With an increase in the norms of mineral fertilizers to $N_{120}P_{90}K_{90,}$ the total fruit yield increased and averaged 32.35 t/ha over 3 years, or 2.24 times more than the control without fertilizers. A further increase in the norms of mineral fertilizers to $N_{150}P_{120}K_{90}$ all the years of the experiments reduced the fruit yield [6, 12, 18].

Of the elements of mineral nutrition, the greatest responsiveness is observed from nitrogen fertilizer. So, when adding $P_{120}K_{90}$ the average yield increase was 2.31 t/ha, then with the additional use of N_{150} it increased to 16.91 t/ha.

However, phosphorus-potassium fertilizers have a positive effect on the level of commercial production, under the influence of which it accounted for 89.9% of the total fruit harvest. Nitrogen fertilizers reduced the percentage of marketable fruits to 57.2%.

Manure has a positive effect on the yield of marketable products. Almost the entire yield (92.7%) is obtained from marketable fruits, which, in general, amounted to 18.90 t/ha or 7.87 t/ha above the unfertilized background.

The greatest effect from the applied mineral fertilizers is observed at the rates of nitrogen 90, phosphorus 60 and potassium 30 kg/ha. In this case, the average marketable fruit yield over 3 years was 21.53 t/ha, or approximately twice as high as the control. A subsequent increase in mineral fertilizer rates reduced the commercial yield, bringing it to the level of 17.16 t/ha, or 25.5% less than in the $N_{90}P_{60}K_{30}$ option [15, 18].

The experiments conducted indicate the advisability of applying moderate rates of mineral fertilizers of the order of 90 kg/ha of nitrogen, 60 of phosphorus and 30 of

potassium, ensuring the production of 26.0-30.0 t/ha of melon fruits with a yield of high-quality fruits of up to 77%.

The nutritional value of melon fruits mainly lies in the high content of carbohydrates, mainly sugars, that are easily digestible by the human and animal body [17, 21].

According to A.I. Ermakov and G.A. Zhukovnikova [9, 16], melon contains from 4.6 to 15.8% sugar, including glucose 2.0-3.6%, fructose 0.5-3.6% and sucrose 1.0-11.2% .

Central Asian winter melons, according to available data, contain 6.5-8.2% sugar, according to Z.I. Koreisha [19] from 6.0 to 10.6%. Of the external conditions that contribute to an increase in sugar content, the main ones are solar development and dry air, combined with sufficient water supply and plant nutrition.

According to the information available in the literature, phosphorus and potassium fertilizers increase the amount of sugars in fruits, while one-sided nitrogen nutrition, on the contrary, reduces the sugar content of fruits: joint moderate nutrition with all three elements does not worsen the quality of fruits, in most cases even increases the sugar content in fruits [20-21].

The positive effect of organic and mineral fertilizers on improving the quality of melons, in particular on the accumulation of sugar in the fruits, is also evidenced by the results of our research.

Thus, according to field experiments at the educational farm of the Turkmen Agricultural Institute (Table 3), the Gulyabi orange melon variety, when grown on unfertilized plots, contained 12.2-12.3% sugar in the fruits.

When applying 30 t/ha of manure, it contributed to an increase in the amount of sugar by 1.7-1.9%, or its total accumulation of 2.71 t/ha, which is 1.78 times more than in the option without fertilizer.

Table 3. The effect of fertilizers on the sugar content in melon fruits.

Options experience	Sugar content, %			Accumulation of sugar in the crop, t/ha	
	years		Average for 2 years	Total	Increase
	2013	2014			
Control	12.2	12.3	12.2	1.52	-
Manure 30t/ha	14.1	14.0	14.0	2.71	1.19
Background+ $N_{80}P_{100}K_{60}$	14.8	14.2	14.5	4.27	2.75
Background+ $N_{120}P_{120}K_{60}$	15.3	15.0	15.2	6.59	4.98
Background+ $N_{180}P_{180}K_{90}$	13.2	12.3	12.7	5.72	4.20
Background+ $N_{240}P_{240}K_{120}$	11.7	10.2	11.0	4.84	3.32

Based on the manure background, mineral fertilizers provide a further increase in the amount of sugar only at rates $N_{120}P_{120}K_{60}$, where the fruits contained 15.0-15.3% sugar with a sugar accumulation of 6.50 t/ha or 4.3 times higher than in the control version. A subsequent increase in fertilizer rates, especially such as $N_{240}P_{240}K_{120}$, sharply reduces the content of $N_{120}P_{120}K$ 60 by 4.2% and by 1.2% in relation to the unfertilized background [11,13].

Results of experiments 2016-2018 The effect of fertilizers on the sugar content of Gulyabi Dashoguz melon fruits is given in Table 4.

Table 4. Sugar content in melon fruits depending on fertilizer (data 2016-2018).

Options experience	Sugar content, % years			Average for 3 years	Accumulation of sugar in the crop, t/ha	
	2016	2017	2018		Total	increase
Control, used	8.4	9.0	7.6	8.3	0.91	-
Manure, 30t/ha	10.2	11.0	11.5	10.9	2.06	1.15
$N_{60}P_{30}K_{30}$	10.9	12.0	11.6	11.5	2.07	1.16
$N_{60}P_{60}K_{30}$	14.1	14.0	12.6	13.5	2.85	1.94
$N_{90}P_{30}K_{30}$	12.4	12.6	10.7	11.9	2.45	1.54
$N_{90}P_{60}K_{30}$	13.9	13.4	12.9	13.4	2.89	1.98
$N_{90}P_{60}K_{60}$	14.7	13.8	10.2	12.9	2.61	1.70
$N_{120}P_{60}K_{60}$	9.1	10.9	9.4	9.8	1.80	0.89
$N_{120}P_{90}K_{60}$	9.2	10.3	10.5	10.0	1.71	0.80
$N_{120}P_{90}K_{90}$	9.4	10.6	9.4	9.8	1.73	0.82
$N_{150}P_{120}K_{90}$	7.6	9.2	8.7	8.5	1.53	0.62
$N_0P_{120}K_{90}$	11.0	10.7	11.9	11.2	1.66	0.77

Studies have shown that the minimum sugar content in melon fruits is typical for the version without fertilizers (7.6-9.4). Fertilizers, both organic and mineral, increase the sugar content of fruits. In particular, applied manure at a dose of 30 t/ha increases the sugar content in fruits by an average of 2.6% when the yield of sugar in commercial products is 2.06 t/ha, or 2.26 times more than the unfertilized background. All rates of mineral fertilizers, relative to the background, contributed to an increase in the sugar content of fruits, but this had the greatest effect in options 4 and 6, where small rates of mineral fertilizers $N_{60}P_{60}K_{30}$ and $N_{90}P_{60}K_{30}$ were applied. Increasing rates of minerals, especially nitrogen 150 when combined with $P_{120}K_{90}$, reduced the sugar content to the level of 8.5%, that is, approximately to the level of the unfertilized background [14]. Our studies also examined the effect of fertilizers on the accumulation of nitrates in melon fruits (Table 5).

Table 5. Nitrate nitrogen content depending on fertilizer rates in melon fruits, mg/kg.

Options experience	N-NO $_3$ on years			Average for 3 years	Deviation from control, %
	2016	2017	2018		
Control, used	29.3	30.1	29.7	29.7	-
Manure, 30 t/ha	31.5	31.9	34.1	32.5	9.4
$N_{60}P_{30}K_{30}$	34.0	31.1	36.6	33.9	14.1
$N_{60}P_{60}K_{30}$	33.9	29.7	36.6	33.4	12.5
$N_{90}P_{30}K_{30}$	44.6	34.3	45.0	41.3	39.1
$N_{90}P_{60}K_{30}$	41.6	34.1	46.1	40.6	36.7
$N_{90}P_{60}K_{60}$	46.2	33.7	46.1	42.0	41.4
$N_{120}P_{60}K_{60}$	47.1	36.6	47.1	43.6	46.8
$N_{120}P_{90}K_{60}$	48.2	39.2	48.2	45.2	52.2
$N_{120}P_{90}K_{90}$	50.0	47.1	50.5	49.2	65.6
$N_{150}P_{120}K_{90}$	47.6	71.9	76.4	65.3	11.98
$N_0P_{120}K_{90}$	31.2	30.4	39.2	33.6	13.1

If we approach the analysis based on the maximum permissible concentration of nitrates in fruit pulp of 90 mg/kg, then the data presented show that the amount of nitrates, depending on the nutritional conditions studied, is significantly lower than the MPC norm. It was the smallest (29.3-30.0 mg/kg), it was the control, as well as when applying manure (31.5-34.1 mg/kg), potassium phosphorus (30-39 mg/kg) and $N_{60}P_{60}K_{30}$ (30-36 mg/kg).

With the subsequent increase in nitrogen fertilizer rates, the amount of nitrate nitrogen in fruits increased, reaching a maximum at a nitrogen rate of 150 kg/ha against the background $P_{120}K_{90}$ on average over three years $P_{120}K_{90}$ mg/kg.

During the years of experiments, at the beginning of storage of fruits on melons, tastings were held with the participation of teachers and students of our university. The pulp of the fruits was assessed by sweetness, juiciness, and tenderness.

Orgonoleptic assessment of taste qualities was carried out using a 5-point system. Very tasty (5 points) there were fruits with full mineral nutrition at rates of nitrogen 60-90, phosphorus 60 and potassium 30 kg/ha from 35 to 41%, or 2.5-3.0 times more than on an unfertilized background and with high rates of nitrogen fertilizers.

The same dependence was noted for fruits with 4 points. Fruit tasting also showed a direct dependence of the deterioration in the taste of melon pulp on an increase in the norms of mineral fertilizers.

Thus, the results of our research have shown +9 that moderate rates of mineral fertilizers of nitrogen 90, phosphorus 60 and potassium 30 kg/ha provide the largest mass of ecologically pure products of high quality.

One of the important tasks in melon growing is to extend the period of fresh consumption of melons. By organizing storage, you can increase the period of consumption of fresh fruits by 5-6 months.

In Central Asia, storage in free, well-ventilated storage rooms or in vacant residential premises is widespread. To store marketable products, special melon storage facilities “Gavun Khana” are used.

Store melons in pendants, nets or bags made of various materials, which are suspended on special U-shaped racks with cross bars. When hung, melons are stored better and longer.

According to the Chardzhou melon experimental station, good results were achieved by the easy storage method on shelves [4]. For larger quantities of melons, the most accessible and less labor-intensive is storage in film boxes.

By as a result of the experiments of E.V. Oshevskaya at the Bykovskaya melon experimental station, it is better to store melons when hanging them in nets. Storage on racks, even with bedding, increases the spoilage of melons. This is also indicated by experiments with autumn-winter “Chardzhou” melons [9] .

Z.Y. Koroisha [9] divides melons according to the degree of keeping quality into 3 groups. She classifies winter melons in the third group. These melons can be stored for several months, and in the first two months the amount of water-soluble sugars in the stored fruits increases slightly as a result of the hydrolysis of fiber and pectins. In general, pectin substances largely determine the shelf life of fruits. Fruit containing 0.05-2.5% of pectin substances on a dry weight basis, they are non-stable and poorly transportable, but non-stable, more than 10% have high shelf life and transportability.

During storage, melon fruits decrease in mass due to the processes of evaporation and oxidation of sugars occurring in them. F.V. Tserevitinov and A.A. Kolesnik [9] found that over three months of storage the loss was 10.6%, and in the first 15 days it was significantly greater than in the subsequent period.

In late-ripening winter varieties of melons, during the first period of maturation, the content of sucrose increases and the amount of monosaccharides decreases, i.e. The melon is ripening. In particular, in Gulyabi varieties, the process of sugar accumulation lasts for two months, then it begins to be consumed for respiration and an increase in the percentage of sucrose.

With the existing variety of storage methods, in particular folk ones, for the conditions of Northern Turkmenistan there is no recommendation on the simplest, most rational and cost-effective methods that allow storing melons for a long time.

Taking this into account, we in the period 2016-2018. The effectiveness of methods for storing different varieties of melons was studied: on a bed of sand laid on an earthen floor: on racks (in cells) on a bed of straw and reeds, suspended on garters and large-mesh nets made of cattail (stems of the local plant).

Every year from September 25 to October 10, 20 fruits of the studied variety or 10 fruits per storage method were placed for storage in storage sheds with thick walls [7-8].

The shelf life of melon fruits is significantly influenced by the level of nutrition during their cultivation. This is evidenced by our three-year research (2016-2018) on the storage of melon fruits of the Gulyabi Dashoguz variety, obtained as a result of the use of manure and various rates of mineral fertilizers.

When stored on sand, depending on the fertilizer, for a 6-month period (from 10.10 to 10.04), from 55 to 90% of the fruits were preserved with a natural loss of weight from 6.8 to 22.3% (Table 6).

Compared to unfertilized backgrounds, organic fertilizer only slightly reduced the percentage of natural loss. Significant changes in the keeping quality of melon fruits occurred with the use of mineral fertilizers. The largest number of preserved fruits (18 out of 20 pieces) was observed in fruits grown with the addition of $N_{90}P_{60}K_{30}$ (90%). The same option also gave the smallest loss in fruit weight 5.8%. With a subsequent increase in the rates of mineral fertilizers, especially nitrogen $N_{150}P_{120}K_{90}$, the persistence of fruits dropped sharply (to 55%) with a high level of natural loss (22.3% or 5.7% more than control). The exclusion of 150 kg/ha of nitrogen from the diet increased the safety of fruits to 70% while reducing the loss of fruits to 14.5%.

Table 6. Keeping quality of melon fruits when stored on sand (average for 3 years).

Experience Options	Safety of 20 fruits during 6-month storage, %	Natural decline	
		%	Relative to control, %
Control, used	70	16.6	−
Manure, 30 t/ha	70	14.9	−1.7
$N_{60}P_{30}K_{30}$	75	12.7	−3.9
$N_{60}P_{60}K_{30}$	85	7.1	−9.5
$N_{90}P_{30}K_{30}$	80	10.7	−5.9
$N_{90}P_{60}K_{30}$	90	5.7	−10.8
$N_{90}P_{60}K_{60}$	80	10.4	−6.2
$N_{120}P_{60}K_{60}$	65	17.8	+1.2
$N_{120}P_{90}K_{60}$	60	20.3	+3.7
$N_{120}P_{90}K_{90}$	65	17.3	+0.7
$N_{150}P_{120}K_{90}$	55	22.3	+5.7
$N_0P_{120}K_{90}$	70	14.5	−2.1

When melon fruits are stored on rings of upland reed leaves over the same period, a similar effect of fertilizers appears (Table 7).

Noticeable changes in the keeping quality of fruits were noted when using complete mineral fertilizer. With fertilizer rates of $N_{90}P_{60}K_{30}$, natural loss in fruit weight is reduced to 10.1%, and with a further increase in fertilizer rates, the safety of fruits decreases and natural loss increases.

When storing fruits on sand, a negative effect on keeping quality is noted from fertilizer rates $N_{150}P_{120}K_{90}$, mainly due to nitrogen nutrition. In this case, more than half (55%) of the fruits are spoiled, and the weight of preserved fruits decreases by 20.2%.

Table 7. Keeping quality of melon fruits when stored on reed rings (average for 3 years).

Experience Options	Safety of 20 fruits during 6-month storage, %	Natural decline	
		%	Relative to control, %
Control, used	75	14.0	−
Manure, 30 t/ha	70	13.5	−0.5
$N_{60}P_{30}K_{30}$	70	13.6	−0.4
$N_{60}P_{60}K_{30}$	75	10.4	−3.6
$N_{90}P_{30}K_{30}$	65	12.3	−1.7
$N_{90}P_{60}K_{30}$	75	10.1	−3.9
$N_{90}P_{60}K_{60}$	65	12.5	−1.5
$N_{120}P_{60}K_{60}$	55	15.7	+1.7
$N_{120}P_{90}K_{60}$	50	16.8	+2.8
$N_{120}P_{90}K_{90}$	55	17.0	+3.0
$N_{150}P_{120}K_{90}$	45	20.2	+6.2
$N_0P_{120}K_{90}$	70	14.1	+0.1

During the storage period of melons on garters (Table 8), the minimum natural loss of fruit weight was on the $N_{90}P_{60}K_{60}$ -5.0 %, and $N_{60}P_{60}K_{30}$ -7.0 % variant than on the unfertilized melon, which is at the same level with control. At a high rate of mineral fertilizers $N_{150}P_{120}K_{90,}$ low shelf life of 60% of the preserved fruits was noted with a natural loss of their weight of 16.8%.

Summary data on the assessment of the keeping quality of melon fruits under various storage methods under the influence of fertilizers are given in Table 8, from which it follows that for all backgrounds of fertilization, the best keeping quality of the fruits is observed when they are stored on garters in large-mesh nets. This method increases the shelf life of fruits by 15-20% compared to other methods.

Fertilizers in all cases at moderate rates, no more than 90 kg/ha of nitrogen, 60 kg/ha of phosphorus and 30 kg/ha of potassium, maintain a high level of shelf life of fruits up to 90% for 6 months of storage. The same fertilizer rates ensure a low percentage of fruit weight loss (natural loss) at the end of their storage: 5.8 on sand, 10.1 on reed rings, 5.5 suspended in nets.

Table 8. Keeping quality of melon fruits when stored on garters (average for 3 years).

Experience Options	Storability of 20 fruits after 6 months of storage, %	Natural decline	
		%	Relative to control, %
Control, used	90	13.1	−
Manure, 30 t/ha	85	13.5	−0.4
$N_{60}P_{30}K_{30}$	80	12.0	−1.1
$N_{60}P_{60}K_{30}$	90	7.0	−6.1
$N_{90}P_{30}K_{30}$	85	10.1	−3.0
$N_{90}P_{60}K_{30}$	90	5.5	−7.6
$N_{90}P_{60}K_{60}$	85	10.1	−3.0
$N_{120}P_{60}K_{60}$	70	14.8	+1.7
$N_{120}P_{90}K_{60}$	65	15.0	+1.9
$N_{120}P_{90}K_{90}$	70	15.6	+2.5
$N_{150}P_{120}K_{90}$	60	16.8	+3.7
$N_0P_{120}K_{90}$	75	13.7	+0.6

Melon fruits grown against the background of higher rates of mineral fertilizers, especially nitrogen, impair the keeping quality of the fruits, reducing their preservation rates and sharply increasing the natural loss of fruits.

Table 9. Keeping quality of melon fruits under various storage methods (average for 3 years).

Experience Options	Fruit preservation, %			Natural loss of fruit weight, %		
	on the sand	on reeds rings	on garters	on the sand	on reeds rings	on garters
Control, used	70	75	90	16.6	14.0	13.1
Manure, 30 t/ha	70	70	85	14.9	13.5	13.5
$N_{60}P_{30}K_{30}$	75	70	80	12.7	13.6	12.0
$N_{60}P_{60}K_{30}$	85	75	90	7.1	10.4	7.0
$N_{90}P_{30}K_{30}$	80	65	85	10.7	12.3	10.1
$N_{90}P_{60}K_{30}$	90	75	90	5.7	10.1	5.5
$N_{90}P_{60}K_{60}$	80	65	85	10.4	12.5	10.1
$N_{120}P_{60}K_{60}$	65	55	70	17.8	15.7	14.8
$N_{120}P_{90}K_{60}$	60	50	65	20.3	16.8	15.0
$N_{120}P_{90}K_{90}$	65	55	70	17.3	17.0	15.6
$N_{150}P_{120}K_{90}$	80	45	60	22.3	20.2	16.8
$N_0P_{20}K_{90}$	65	70	75	14.5	14.1	13.7

4 Conclusion

- Old-irrigated meadow soils of Northern Turkmenistan are poorly provided with digestible forms of nutrients, as a result of which their productive capacity is low and amounts to 12.0-15.0 t/ha of melon fruits. To increase the fertility of these soils, rational use of fertilizers is necessary.
- Systematic application of mineral and organic fertilizers under melon stabilizes the content of humus and total nitrogen in the soil, enriches it with other nutritional elements. The content of mobile forms of nutrients is directly dependent on fertilizer rates.
- The consumption of nutrients by plants is directly dependent on the norms of mineral fertilizers. For each centner of melon fruit harvest, depending on nutritional conditions, they consume from 0.48 to 0.77 kg of nitrogen, 0.23-0.43 kg of phosphorus and 0.70-1.13 kg of potassium. At high rates of mineral fertilizers, the removal of nutrients per unit of yield increases.
- Manure and moderate rates of mineral fertilizers ($N_{90}P_{60}K_{30}$) contribute to early vigorous shoots, accelerate the rate of flowering, fruit formation and fruit ripening by 3-4 days.
- The optimal and highly effective rates of mineral fertilizers for melon turned out to be 90 kg/ha of nitrogen, 60 of phosphorus and 30 kg/ha of potassium. They ensured an average total yield of 280 centners per hectare of fruit over 3 years, with the highest yield of marketable products being 215 centners, or 77% of the total harvest.
- An additional reserve for increasing the productivity of melon is the use of manure, which in doses of 30 t/ha ensured an average annual yield of 20.4 t/ha, mainly a high-quality commercial type (92.7% of the total harvest), or 71.5% more than the unfertilized background.
- Manure and moderate rates of mineral fertilizers not only significantly increase the yield of melon fruits, but also improve their quality (sugar content on average up to 13.5%, or 1.6 times more than control), ensure high taste of the fruits and their juiciness and tenderness.
- The best way to store melons is on garters in large-mesh nets, where the preservation of fruits for 6 months was 15-20% higher than other storage methods. Moderate fertilizer rates ($N_{90}P_{60}K_{30}$) ensure fruit safety of up to 90% with low (up to 5.5%) natural loss of fruit weight.

Proposals to production.

In the conditions of Northern Turkmenistan on old irrigated meadow soils with insufficient content of digestible forms of nutrients, the optimal and cost-effective rates of mineral fertilizers for autumn-winter melon varieties are nitrogen 90, phosphorus 60 and potassium 30 kg/ha. Such application of fertilizers, subject to the timing of applying nitrogen fertilizers in equal shares for pre-sowing treatment and in the phase of 3-4 true leaves, phosphorus in equal shares for plowing and before sowing, potash for plowing and the general agricultural background, ensures the production of 27.0-29.0 t/ha of environmentally friendly products of high quality.

To increase soil fertility and melon productivity, it is recommended to apply manure 30 t/ha once every three years for the main plowing, which resulted in the production of melon fruits of 19.0-22.0 t/ha or 1.5 times more than the unfertilized background in the educational farm of the Turkmen Agricultural Institute.

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