ISSN 1607-2782 (print)
ISSN 2958-8367 (online)

ҚОРҚЫТ АТА АТЫНДАҒЫ ҚЫЗЫЛОРДА УНИВЕРСИТЕТІНІҢ ХАБАРШЫСЫ

АУЫЛ ШАРУАШЫЛЫҒЫ

ҒЫЛЫМДАРЫ

№1 (68), 2024

1999 жылғы наурыздан бастап шығады
Выходит с марта 1999 года
Published since March 1999

Жылына төрт рет шығады
Выходит четыре раза в год
Published four a year

Қызылорда/Кызылорда/Kyzylorda
2024

МРНТИ 68.31.01 https://doi.org/10.52081/bkaku.2024.v68.i1.130

IRRIGATION PROCEDURE (MODE) OF TOMATO GROWN BY THE LOW PRESSURE DRIP IRRIGATION METHOD

Kopen M.B[1], doctoral student
meruert.kp@mail.ru, https://orcid.org/:// 0000-0001-9982-0428
Otarbaev B.S.[1], candidate of agricultural sciences
bauyrzhan.kzo@mail.ru, https://orcid.org/:// 0000-0001-5937-6465
Aldambergenova G.T. [1], master in land management and cadastre
gulzi_31@mail.ru, https://orcid.org/:// 0000-0003-4583-612X
Shomantaev A.A.[1], doctor of agricultural sciences, professor
shomantayev53@gmail.com, https://orcid.org/ 0000-0003-3089-8651
Isaev S.Kh.[2], doctor of agricultural sciences, professor
sabirjan.isaev@mail.ru

[1]*Korkyt Ata Kyzylorda University, Kyzylorda city, Kazakhstan*
[2]*"Tashkent Institute of Agricultural Engineers, Irrigation and Reclamation", National Research University, Tashkent city, Uzbekistan*

Annotation. Presently, the Republic of Kazakhstan, particularly the Kyzylorda region, grapples with a significant water scarcity issue. In light of this, the utilization of the drip irrigation method plays a crucial role in the judicious management of water resources. In regions like Kyzylorda, characterized by pronounced drought conditions, the efficacy of employing a low-pressure drip irrigation system is notably high. This approach results in an augmented land utilization coefficient, savings in material and labor costs, and an enhanced efficiency in the utilization of irrigation water. The implementation of a drip irrigation system contributes to the improvement of soil nutrition, air circulation, and water-physical properties. It mitigates soil erosion risks, ensures optimal water utilization by supplying irrigation water directly to the roots of each plant, and thereby maximizes the plants' water utilization efficiency. The likelihood of achieving abundant, excellent, and consistent harvests from agricultural crops rises. This method offers several advantages compared to alternative irrigation techniques, including reduced labor costs, preservation of the soil's fundamental structure, prevention of surface soil folds, the ability to concurrently apply fertilizers to the root system area, a potential 30-100% increase in crop productivity, a 50-60% decrease in irrigation water usage, and suitability for use in areas with high slopes.

Keywords: low pressure drip irrigation, water deficit, soil fertility, method of tomato drip irrigation.

Introduction. In order to preserve the soil fertility of the irrigated lands of Kazakhstan, the main element of melioration, the area where the root system of the plant is located, is to create new water-saving technologies and irrigation methods that ensure the supply of nutrients along with irrigation water, and put it into production. In this regard, the drip irrigation system can ensure efficient use of water and land resources in irrigated agriculture.

There is a possibility that the land utilization factor (LUF) when using the drip irrigation system can be increased to 90-95%. The indicator of LUF is very low in the method of systematic irrigation. Drip irrigation system does not waste water as compared to systematic irrigation method. These indicators prove that the efficiency of the drip irrigation system is very high. In systematic irrigation, water losses are used for evaporation, and secondly, during systematic feeding, water is absorbed into the lower layer of the soil - wasted [1-3].

Research methods and materials. The presented article deals with the technology of growing tomato crop using the method of calculating the irrigation regime of the crop in the low-pressure drip irrigation method, which has high economic performance and water saving, and does not require large funds. When determining the irrigation schedule for tomatoes, various factors such as the overall and daily average water requirements of the crop, the volume of irrigation, the frequency of irrigations, and the quantity of water applied are taken into account. The results of the research on tomato crop growth, productivity and economic efficiency of the drip irrigation method, calculation of the main parameters of the low pressure drip irrigation method are presented.

The study was conducted at the experimental farm situated in the winter area of Karaultobe, affiliated with the Kazakh Rice Research Institute named after Y. Zhakhaev (KazRRI). Average daily and total water consumption of tomato crop was studied and determined.

The soil water regime of the study was dependent on the irrigation operation, because only 300 m³/ha of useful precipitation fell during the growing season this year. The moisture content of the soil corresponded to 75% MMC, the moisture content of the soil corresponded to 15%, the moisture reserve in the soil corresponded to 1080 m³/ha. Tomato seedlings were planted on April 30, and the first irrigation was carried out on May 1. In general, the tomato crop was watered 10 times during the growing season in 2022 due to high air temperature.

According to the results of the study, the moisture content of the soil in our case is 70-73%, H=0.5 m, **γ**=1.39 t/m³, β_{max}=21.5% and β_{min}=14.6-15, 8%.

The moisture reserve during vegetation was determined by the following equation [4-6]:

$$W = 100 \cdot H \cdot \gamma \cdot \beta_{min}, \frac{m^3}{ha}, \quad (1)$$

here: W- moisture reserve during vegetation, m³/ha; H - soil moisture depth, m; γ - density of the soil in the reference layer, t/m³; β_{min} is the minimum moisture content of the soil, %.

When tomato seedlings were planted in the open field, the minimum moisture content of the soil was 15.0%, and the moisture reserve in the soil was equal to 1080 m³/ha. This indicator corresponds to 73% of the soil's fertilizer

The order of irrigation of agricultural crops depends on the natural and climatic conditions of the region and the characteristics of the irrigated crop.

In general, the water regime of the soil is formed under the influence of irrigation and precipitation. Water evaporated from the soil and plants is replenished by re-watering. Monitoring of moisture dynamics in the soil layer should be carried out in the intervals from the day of planting tomato seedlings until harvesting the last crop.

Irrigation was carried out when the moisture content of the soil was lower than 70% corresponding to MMC.

It was found that when watering tomatoes with drip irrigation, the humidity of the soil, which corresponds to 70% MMC, decreased 23 times.

The method of determining the moisture reserve in the method of drip irrigation was carried out according to the method of the method of systematic irrigation (equation 1, table 1).

When planting tomato seedlings in an open field, the minimum moisture content of the soil was 15%, and the moisture reserve in the soil was equal to 1090 m³/ha. This indicator corresponds to 72% of the soil's fertilizer.

In order to obtain stable and high-quality crops from agricultural crops, soil irrigation is carried out. Due to the botanical and biological characteristics of tomato, it is an important indicator to correctly determine the depth of moisture of the relevant soil layer in drip irrigation technology. The required soil moisture layer for vegetable crops is 0.3-0.5 m.

The main indicator is the study of the amount of water supplied to one plant and the formation of the soil moisture contour when creating an irrigation regime in the drip irrigation method. Depending on the mechanical composition of the soil and the length of time the soil is moistened, the contour and volume of the soil is formed at different levels during drip irrigation.

In the drip irrigation method, the wetting diameter of the soil surface is taken into account to determine the soil wetting contour, while the wetting diameter of the soil surface and wetting depths are taken into account when determining the volume of the wetting layer.

The contour of soil moisture in the drip irrigation method was determined by the following equation:

$$F = \frac{\pi D^2}{4}, \text{m}^2 \qquad (2)$$

here: D is the wetting diameter, m.

The influence of the duration of irrigation on the depth of soil moisture was determined. As the time of watering increased, the depth of soil hydration was observed (Table 1).

When 20 cm depth of soil, 70% MMC, q=1.2 l/h, was moistened for 60 minutes, the moisture contour of one tomato plant was formed between 0.020-0.030 m^2, and one tomato plant was given water between 0.050-0.065 m^3.

If the soil depth of 30 cm is moistened with 70% MMC, q=1.2 l/h for 130 minutes, the moisture contour of one tomato plant is formed between 0.030-0.050 m^2, the volume of water supplied to one tomato plant is 0.0100-0.01500 m^3.

The soil surface wetting diameter (D) showed the following indicators:

1. q=1.2 l/h - 20 cm deep - 20-24 cm, 30 cm deep - 21-30 cm;

Table 1 – Moisture contour and volume of one plant during drip irrigation of tomato crop [7]

The soil surface wetting diameter, (D),cm	Soil moisture depth, (H),m;	Duration of moistening of the reference layer of the soil, min	Flow of the dropper (q), l/h	Moisture contour of one tomato plant, m^2	Amount of water supplied to one tomato plant, m^3
70% MMC. 1 dropper is installed at the base of one plant					
22	20	60	1,2	0,30	0,0060
25	30	135	1,2	0,044	0,0133

As the water flow of the dropper and the depth of wetting of the soil layer increases, it is observed that the amount of irrigation increases with the amount of wetting of the base of one plant. For tomato crop, it was determined that it is sufficient to place 70% of the soil that can form a moisture contour of 0.050-0.070 m^2 at the base of one plant, 1 dripper per plant, q=1.2 l/h.

The beginning of each irrigation operation was carried out according to the determination of soil moisture, and the end was stopped according to the time required to moisten the reference layer of the soil.

If 20 cm of soil corresponding to 70%, q=1.2 l/h soil moisture is moistened in 70 minutes, 30 cm is moistened in 130 minutes.

The main part of the root system of the tomato crop grows and develops in the area of drip irrigation, which contributes to the active growth of the root system. Fertilizers are directly delivered to the root system of tomatoes together with water, nutrients are better absorbed by the plant. In drip irrigation, the supplied water moves slowly along the soil, ensuring that the soil is not eroded. Compared to other irrigation methods, the advantage of drip irrigation system is very high.

Due to the scarcity of water resources, promising technological small-volume irrigation systems are systems that provide mineral fertilizers, while saving irrigation water directly to the root system of agricultural crops. In such systems, the coefficient of land use (LUC) increases to 95% and prevents wasteful evaporation of water [8].

When using the drip irrigation method, the determination of irrigation and irrigation quantities was carried out according to the following indicators:

- depth of moistening of the soil layer, cm;
- length of irrigation time, min;
- amount of elementary irrigation;
- the number of plants per hectare, units/ha;
- calculated amount of irrigation, m^3/ha;
-watering number, times.

A. Zhatkanbaeva's new equation for determining the amount of elementary irrigation given to one plant in the method of drip irrigation of the tomato crop is proposed [9]:

$$m_э = \left(\frac{t}{60} \cdot q\right) : 1000,\ \frac{m^3}{root}\ ; \quad (3)$$

here: t is the duration of moistening of the reference layer of the soil, minutes; q - water flow of the dropper, l/h; 60 is the number of minutes in 1 hour.

Determining the estimated amount of irrigation:

$$m_H = m_e \cdot n, \frac{m^3}{ha}; \quad (4)$$

here: m_e is the amount of elementary irrigation, m³/root; n is the number of plants per hectare, units.

Depending on its botanical characteristics, the root system develops in the 40-50 cm layer of the soil when the tomato crop is planted in an open field by seedling. In the first month after planting tomato seedlings, the depth of soil moistening was taken as 30 cm. It is taken into account that the root system of the plant does not grow along the deep layer of the soil at this time, as noted by academician A.N. Kostyakov in his works [10-12].

By multiplying the amount of elementary irrigation (m_e) of the tomato crop determined by equation (3) by the number of plants per 1 hectare (in our case n=35705 plants/ha), the calculated amount of irrigation (m_H) in the method of drip irrigation of the tomato crop by equation (4) was determined (table 2).

During the growing season, the tomato crop was watered 19 times: 3 times in May; in season - 5 times; in July - 6 times; in August - 5 times. Irrigation amount M_{br}=2390 m³/ha.

Table 2 – Elementary and calculated irrigation amounts of tomato crop during drip irrigation (70% MMC)

Watering day	Depth of moistening of the soil layer, cm	Duration of irrigation time, minutes	Amount of elementary irrigation, m³/root	Estimated amount of irrigation, m³/ha	Watering number, times
1	2	3	4	5	6
05.05	30	130	0,0025	89	3
13.05		125	0,0024	86	
23.05		130	0,0025	89	

Kyzylorda region desert zone belongs to the steppe, the natural moisture coefficient is equal to $M_c(К_у)$ = 0.20. As a result of the distribution of the amount of tomato irrigation determined by the drip irrigation method by decades, the maximum amount of water given to tomatoes was 270-320 m³/ha between the third decade of June and the first decade of August.

We noticed that the high amount of water consumption during the growing season corresponded to the beginning of the appearance of tomato fruits, the beginning of fruit ripening and the beginning of mass ripening. During these times, 320-820 m³/ha of water was supplied to the tomato fields (Table 3).

As a result of the order of irrigation of the tomato crop in different ways, the following indicators were obtained according to the average values: in systematic irrigation, the average amount of irrigation of the tomato crop was 530 m³/ha, on average, it was irrigated 9 times: if it was irrigated 2 times in May; it was irrigated 3 times in June, 3 times in July, 1 time in August, the average amount of irrigation is 4820 m³/ha.

Table 3 – Distribution of the amount of irrigation by stages of tomato development

Research version	Phases of development names	Distribution of irrigation volume by decades, m³/ha	Total, m³/ha
Drip irrigation	Planting seedlings	80;80;100	260
	Beginning of flowering time	100;180	280
	Beginning of mass flowering	320	320
	The beginning of the appearance of fruits	370;450	820
	Beginning of fruit ripening	370;260	630
	Mass ripening of fruits	180;130	310
	Average amount of irrigation, m³/ha		2620

In the drip irrigation version, the average amount of tomato irrigation was 130 m³/ha, and the average amount of irrigation was 21 times: in May - 4 times, in June - 6 times, in July - 7 times, in August - 4 times, the average amount of irrigation - 2650 m³/ha .

Compared to the drip irrigation option and the systematic irrigation option, the irrigation water efficiency here is on average 2170 m³/ha, that is, the irrigation water efficiency is 55%. (table 4).

Table 4 – The order of irrigation of tomatoes by different methods determined by the years of the study (70% MMC, according to average values)

Research options	Average irrigation amount, m³/ha	Number of irrigation	Irrigation period	Irrigation amount, m³/ha	Economy of irrigation water	
					m³/ha	%
1	2	3	4	5	6	7
Option1. Regular watering (control)	530	9	May 2 June-3 July 3 August-1	4820		
Option2. Drip irrigation	130	21	May 4 June-6 July 7 August 4	2650	2170	55%

Compared to the method of drip irrigation, local moistening of the soil is formed here, and mass moistening is formed in the method of systematic irrigation.

Academician A.N. Kostyakov's water balance of the total water use of the tomato crop in the drip irrigation method:

$$W_{\text{н}} = P + M = T + И + \Delta W, \frac{m^3}{ha}. \quad (5)$$

and

$$E = M_{br} + P + \Delta W, \frac{m^3}{ha}, \quad (6)$$

If it is determined according to the equations, the moisture reserve during the growing season (1), the average daily water use (ΔE) is determined according to the following equations:

$$\Delta \text{E} = \frac{\text{E}_{month}}{N}, \frac{m^3}{ha}, \quad (7)$$

The dynamics of the total water use (E) of the tomato crop in the drip irrigation method showed the following indicators for each month: in May - 15 m³/ha; in season - 33m³/ha; in July - 33 m³/ha and in August - 22 m³/ha.

Table 5 – Average daily water use of tomato crop

Determined date	Soil moisture reserve, m³/ha	Falling on the field, m³/ha			Total water use, m³/ha (E)	Daily average water use m³/ha (ΔE)
		Precipitation (R)	From soil (ΔW)	From irrigation (M_{br})		
1	2	3	4	5	6	7
05.05	1st irrigation	-	-	88	87	13
09.06	5th irrigation	-	-	140	140	31
06.07	10th watering	-	-	126	126	31
03.08	15th irrigation	-	-	130	130	21
22.08	19th irrigation	-	-	130	130	21
Total		546	28	2371	2945	
Balance 546 + 28 + 2371 = 2945 m³/ha						

Tomato water use was equal to 319-302 m³/ha. This situation is connected with high air temperature. 80.5-88.4% of the main balance of the total water use of the tomato crop, the average value was 84.45%.

The average value of total water use of tomato crop is 2960 m³/ha. Input part of the water balance: precipitation 546 m³/ha (18%); from irrigation - 2390m³/ha (80.5%).

When watering the tomato crop in different ways, the water use of tomatoes occurs at different levels. In the method of systematic irrigation, the soil is moistened in bulk, while in the method of drip irrigation, the soil is moistened only at the roots of plants. An increase in air temperature has a great impact on the water use of the tomato crop. Due to the heat of the day, the total and daily water consumption of the tomato crop increases, so the tomato crop was watered a little more.

The average value of the total water use of tomatoes with systematic irrigation at a humidity corresponding to 70% of soil moisture content was 5250 m³/ha, while this indicator was 3110 m³/ha with drip irrigation, that is, it showed a low value of 2140 m³/ha. The highest rate of water use of the tomato crop was in the middle of the growing season. This time coincided with the flowering phase of the tomato plant.

Table 6 – Structure of water use of tomato crop (70% MMC)

Research options	General water use					Daily average water use, m³/ha			
	m³/ha	In it				V	VI	VII	VIII
		V	VI	VII	VIII				
Option 1. Regular watering (control)	4765	1162	1364	1160	1063	35	43	36	32
Option 2. Drip irrigation	2970	420	942	963	651	15	33	33	23

It is necessary to use high-quality seeds or high-quality seedlings in order to obtain abundant and high-quality products from tomato crops. In a field sown by seed, the simultaneous germination of seeds indicates high seed quality, while the rapid growth of planted seedlings means high seedling quality.

Seeds sown in open ground or seedlings planted must be free from diseases and pests. It is known that planting tomato seedlings at the specified depth and at the right time makes it possible to get abundant and high-quality harvest from the crop.

At the time of planting tomato seedlings, the soil moisture corresponding to MMC was 70-75%, and the temperature of the soil depth of 15 cm was +16+17°C. There were 5-7 pieces of leaves in the seedlings taken for planting.

The onset of the extensive flowering stage for tomato plants occurred from June 15 to 27 under conventional irrigation and from June 14 to 25 using drip irrigation. The widespread maturation of fruits commenced from August 17 to 21 with regular watering and from August 15 to 19 with drip irrigation.

Table 7 – Growth and development phases of tomato

Phases of development names	Phase start date	
	Regular watering (control)	Drip irrigation
1	2	3
Planting seedlings (6-10 leaves)	April 29	April 29
Beginning of flowering time	June 7	June 7
Beginning of mass flowering	June 15	June 14
The beginning of the appearance of fruits	June 30	June 28
Beginning of fruit ripening	August 11	August 9
Mass ripening of fruits	August 17	August 15

Control of tomato plants was carried out separately for each version. 10 plants were taken from each replicate in the study field. Plant height was measured every 15 days using a special ruler. Plant height was lower in systematic irrigation compared to drip irrigation.

The average height of the plant in the research options (P_h) was determined by the following formula:

$$P_h = \frac{n_1+n_2+n_3+\cdots+n_{10}}{\sum n}, \text{ cm}, \quad (8)$$

here: $n_1 + n_2 + n_3 + \cdots + n_{10}$ – sequence of plants taken for measurement; n is the total number of plants for measurement, units.

The average height of a tomato plant reached 67.3 cm in systematic irrigation and 68.7 cm in drip irrigation.

Table 8 – Average yield per plant of tomato crop

Research options	Order of set	Average fruit weight, g	Productivity of one plant		Average productivity of one plant, kg/root
			g/root	kg/root	
Regular watering (control)	1st set	80	921	0,921	0,91
	2nd set	92	925	0,925	
	3rd set	103	897	0,897	
	4th set	97	937	0,937	
Drip irriation	1st set	94	1100	1,100	1,05
	2nd set	100	975	0,975	
	3rd set	113	1118	1,118	
	4th set	118	1127	1,127	

The tomato crop was collected 4 times, with regular irrigation, the average weight of the fruit was between 80-102 g, the yield of one plant was 0.890-0.930 kg/plant, and the average yield of one plant was 0.91 kg/plant. The weight of the fruit is 93-115 g when it is harvested 4 times during drip irrigation; 0.970-1.122 kg/root, average yield 0.05 kg/root.

Based on the average yield of one tomato plant (kg/root) and the number of plants per hectare, the main productivity of the tomato crop was determined. In systematic irrigation of tomato crop - 32.0 t/ha yield was obtained, in drip irrigation 38.0 t/ha yield was obtained.

In the systematic irrigation version of tomato crop, the average productivity of one plant was 0.85 kg, and the total main productivity was 31.0 t/ha. In drip irrigation, the average yield of one plant was 1.0 kg, the total main yield was 36.0 t/ha, that is, 5.0 t/ha (14.6%) additional yield was obtained.

Литературы:

[1] **Григоров, М.С.,** Овчинников А.С., Боровой Е.П., Ахмедов А.Д. Современные перспективные водосберегающие способы полива в Нижнем Поволжье. – Волгоград: ВГСХА «Нива», 2010 – С.244.

[2] **Журба, М.Г**. Капельное орошение: проблемы чистой воды и надежности капельниц // Гидротехника и мелиорация. – М., 1982 – №7. – С.37-38.

[3] Капельное орошение (пособие к СниП 2.06.03-85). Мелиоративные системы и сооружения. – Введ. 11.04ю86. – М.:Союзводпроект, 1986. – С.147.

[4] **Литвинов**, **П.И.,** Шевченко И.В. Преимущества подпочвенного и капельного орошения // Вестник с.-х. науки. – М., 1978. – №1. – С.75-81.

[5] **Таттибаев, А.А.,** Зубаиров О.З., Жатканбаева А.О. к вопросу локального микроорошения // «Ізденістер, нәтижелер, Исследования, результаты». Научный журнал. – Алматы, 2003. – №2. – С.121-127

[6] **Зубаиров, О.З.,** Сағаев А. Суғару және оның жүйесін пайдалану. Қала типографиясы. – Қызылорда, 2001. – 98б.

[7] **Көпен, М.Б.,** Шомантаев А.А., Буланбаева П.У.,Утегенова Г.М. Қызылорда облысының суармалы жерлерінде қызанақ дақылын суаруда төменгі-қысымды тамшылату жүйесін қолдану. Қорқыт Ата атындағы Қызылорда университетінің Хабаршысы. – Қызылорда, 2023. – №1 (64), Т.1 – Б.242-250. https://doi.org/10.52081/bkaku.2023.v64.i1.023

[8] **Massatbayev, K.,** Izbassov N., Nurabayev D., Musabekov K., Shomantayev A., Echnology and Regime of sugar beet drip irrigation with plastic mulching under the conditions of the Jambyl region: Sugar beet drip irrigation// Irrigation and drainage, 2016. – V.65. – Iss.5.1. – P.620 – 630.DOJ:10.1002/ird.2084.

[9] **Жатканбаева, А.О**. Қызанақ дақылының өсіп-дамуына суғару тәсілдерінің тигізетін әсерін зерттеу // «Семей қаласының Шәкәрім атындағы Мемлекеттік университетінің Хабаршысы». Ғылыми журнал. ISSN 1607-2774.– Семей, 2016. – №4 (76). – Т.1. – 174-179б. Электронды нұсқа бойынша.

[10] **Костяков, А.Н** Основы мелиорации. – М.: СХГИЗ, 1960. – С.621

[11] **Гричаная, Т.С.,** Першуков Д.А. Применение капельного орошения при возделывании овощных культур на юге Казахстана // Мелиорация и водное хозяйство: проблемы и пути решения. Материалы международной научно-практической конференции (Костяковские чтения). – М., 2016. – Т. 1. – С. 180-184.

[12] **Ахмедов. А.Д.,** Темерев А.А., Галиуллина Е.Ю. Экологические аспекты капельного орошения // Проблемы и перспективы инновационного развития мирового сеьского хозяйства: метериалы междунар. науч.-прак. конф. Саратовского ГАУ. – Саратов, 2010. – С. 156-158.

References:

[1] **Grigorov, M.S.,** Ovchinnikov A.S., Borovoj E.P., Ahmedov A.D. Sovremennye perspektivnye vodosberegajushhie sposoby poliva v Nizhnem Povolzh'e. – Volgograd: VGSHA «Niva», 2010 – S.244. [in Rassuin]

[2] **Zhurba, M.G**. Kapel'noe oroshenie: problemy chistoj vody i nadezhnosti kapel'nic // Gidrotehnika i melioracija. – M., 1982 – №7. – S.37-38. [in Rassuin]

[3] Kapel'noe oroshenie (posobie k SniP 2.06.03-85). Meliorativnye sistemy i sooruzhenija. – Vved. 11.04ju86. – M.:Sojuzvodproekt, 1986. – S.147. [in Rassuin]

[4] **Litvinov, P.I.,** Shevchenko I.V. Preimushhestva podpochvennogo i kapel'nogo oroshenija // Vestnik s.-h. nauki. – M., 1978. – №1. – S.75-81. [in Rassuin]

[5] **Tattibaev, A.A.,** Zubairov O.Z., Zhatkanbaeva A.O. k voprosu lokal'nogo mikrooroshenija // «Izdenister, nətizheler, Issledovanija, rezul'taty». Nauchnyj zhurnal. – Almaty, 2003. – №2. – S.121-127 [in Rassuin]

[6] **Zubairov, O.Z.,** Sagaev A. Sugaru zhane onyn zhүjesin pajdalanu. Qala tipografijasy. – Qyzylorda, 2001. – 98b. [in Kazakh]

[7] **Kөpen, M.B.,** Shomantaev A.A., Bulanbaeva P.U.,Utegenova G.M. Qyzylorda oblysynyn suarmaly zherlerinde қyzanaқ daqylyn suaruda tөmengi-qysymdy tamshylatu zhүjesin qoldanu. Qorqyt Ata atyndagy Qyzylorda universitetinin Habarshysy. – Qyzylorda, 2023. – №1 (64), T.1 – B.242-250. https://doi.org/10.52081/bkaku.2023.v64.i1.023 [in Kazakh]

[8] **Massatbayev, K.,** Izbassov N., Nurabayev D., Musabekov K., Shomantayev A., Echnology and Regime of sugar beet drip irrigation with plastic mulching under the conditions of the Jambyl region: Sugar beet drip irrigation// Irrigation and drainage, 2016. – V.65. – Iss.5.1. – P.620 – 630.DOJ:10.1002/ird.2084.

[9] **Zhatkanbaeva, A.O.** Qyzanaq daqylynyn өsip-damuyna sugaru tәsilderinin tigizetin әserin zertteu // «Semej қalasynyң Shәkәrim atyndaғy Memlekettik universitetiniң Habarshysy». Gylymi zhurnal. ISSN 1607-2774.– Semej, 2016. – №4 (76). – T.1. – 174-179b. Jelektrondy nusqa bojynsha.

[10] **Kostjakov, A.N** Osnovy melioracii. – M.: SHGIZ, 1960. – S.621 [in Kazakh]

[11] **Grichanaja, T.S.,** Pershukov D.A. Primenenie kapel'nogo oroshenija pri vozdelyvanii ovoshhnyh kul'tur na juge Kazahstana // Melioracija i vodnoe hozjajstvo: problemy i puti reshenija. Materialy mezhdunarodnoj nauchno-prakticheskoj konferencii (Kostjakovskie chtenija). – M., 2016. – T. 1. – S. 180-184. [in Rassuin]

[12] **Ahmedov. A.D.,** Temerev A.A., Galiullina E.Ju. Jekologicheskie aspekty kapel'nogo oroshenija // Problemy i perspektivy innovacionnogo razvitija mirovogo se'skogo hozjajstva: meterialy mezhdunar. nauch.-prak. konf. Saratovskogo GAU. – Saratov, 2010. – S. 156-158.). [in Rassuin]

ТӨМЕН ҚЫСЫМДЫ ТАМШЫЛАТЫП СУАРУ ТӘСІЛІ БОЙЫНША ӨСІРІЛГЕН ҚЫЗАНАҚТЫҢ СУАРУ ТӘРТІБІ (РЕЖИМІ)

Көпен М.Б.[1], докторант
Отарбаев Б.С.[1], ауыл шаруашылығы ғылымдарының кандидаты
Алдамбергенова Г.Т.[1], жерге орналастыру және кадастр ғылымдарының магистрі
Шомантаев А.А.[1], ауыл шаруашылығы ғылымдарының докторы, профессор
Исаев С.Х.[2], ауыл шаруашылығы ғылымдарының докторы, профессор

[1]*Қорқыт Ата атындағы Қызылорда университеті, Қызылорда қ-сы, Қазақстан*
[2]*«Ташкент ауыл шаруашылығы инженерлері ирригация және мелиорация институты» Ұлттық зерттеу университеті, Ташкент қ-сы, Өзбекстан*

Аңдатпа. Қазіргі уақытта су тапшылығы Қазақстан Республикасында, әсіресе Қызылорда облысында үлкен мәселеге айналып отыр. Осы орайда су ресурсын үнемді пайдалануда тамшылатып суару тәсілінің алатын орны ерекше.

Құрғақшылық жоғары Қызылорда облысында төмен қысымды тамшылатып суару жүйесін қолданудың тиімділігі өте жоғары. Төмен қысымды тамшылатып суару жүйесін қолданғанда жерді пайдалану коэффициенті ұлғайып, материалдық және еңбек шығындары үнемделеді, суару суының үнемділігі жоғарылайды. Тамшылатып суару жүйесінде топырақтың қоректілігі, ауалық, сулық-физикалық қасиеттері жақсарады, топырақтың эрозиясы болмайды, суару суы әр өсімдік түбіне беріліп отырғаны нәтижесінде өсімдік суды максималды пайдаланады, ауылшаруашылық дақылдарынан жоғары, сапалы және тұрақты өнім алу мүмкіндігі артады. Басқа суару тәсілдерімен салыстырғанда тамшылатып суарудың келесідей артықшылықтары бар: еңбек шығыны төмен; топырақтың негізгі құрылымы сақталады; топырақ бетінде қатпарлар пайда болмайды; сумен бірге өсімдіктің тамыр жүйесі орналасқан аймаққа тыңайтқыштарды беру мүмкіндігі бар; дақыл өнімділігі 30-100%-ға жоғарыласа, суару суының үнемділігі 50-60%-ға төмендейді; жүйені жер еңістігі жоғары территорияларда пайдалану мүмкіндігі бар.

Тірек сөздер: төмен қысымды тамшылатып суару, су тапшылығы, топырақ құнарлығы, қызанақты тамшылатып суару тәсілі

ПОРЯДОК (РЕЖИМ) ПОЛИВА ТОМАТОВ, ВЫРАЩЕННЫХ МЕТОДОМ КАПЕЛЬНОГО ОРОШЕНИЯ НИЗКОГО ДАВЛЕНИЯ

Көпен М.Б.[1], докторант
Алдамбергенова Г.Т.[1], магистр наук землеустройства и кадастра
Отарбаев Б.С.[1], кандидат сельскохозяйственных наук
Шомантаев А.А.[1], доктор сельскохозяйственных наук, профессор
Исаев С.Х.[2], доктор сельскохозяйственных наук, профессор

[1]*Кызылординский университет имени Коркыт Ата, г.Кызылорда, Казахстан*
[2]*Национальный исследовательский университет «Ташкентский институт инженеров ирригации и мелиорации сельского хозяйства», г.Ташкент, Узбекистан*

Аннотация. В настоящее время нехватка воды становится большой проблемой в Республике Казахстан, особенно в Кызылординской области. В связи с этим метод капельного орошения занимает особое место в экономном использовании водных ресурсов.

В Кызылординской области с высокой засухой эффективность применения системы капельного орошения низкого давления очень высока. При использовании системы капельного орошения низкого давления увеличивается коэффициент использования земли, экономятся материальные и трудовые затраты, увеличивается экономия оросительной воды. Внедрение системы капельного орошения способствует улучшению питания почвы, циркуляции воздуха и водно-физических свойств, снижает риск эрозии почвы, обеспечивает оптимальное использование воды за счет подачи оросительной воды непосредственно к корням каждого растения и тем самым максимизирует эффективность использования воды растениями. Повышается вероятность получения обильных, превосходных и стабильных урожаев сельскохозяйственных культур. По сравнению с другими способами орошения, капельное орошение имеет следующие преимущества: низкие трудозатраты; основная структура почвы сохраняется; на поверхности почвы не образуются складки; вместе с водой есть возможность вносить удобрения в зону, где расположена корневая система растения; при повышении урожайности на 30-100% экономичность поливочной воды снижается на 50-60%; есть возможность использования системы на территориях с высоким уклоном земли.

Ключевые слова: капельное орошение низкого давления, нехватка воды, плодородие почвы, метод капельного орошения томатов

МРНТИ 68.35.03: 68.35.31 https://doi.org/10.52081/bkaku.2024.v68.i1.131

ИЗУЧЕНИЕ И ОЦЕНКА ПРОДУКТИВНОСТИ СОРТООБРАЗЦОВ НУТА В УСЛОВИЯХ ЦЕНТРАЛЬНОГО КАЗАХСТАНА

Середа Г.А., кандидат сельскохозяйственных наук
sereda.44@bk.ru, https://orcid.org/0009-0007-4690-766X
Середа Т.Г., магистр агрономии
sereda_t@bk.ru, https://orcid.org/0009-0003-3358-6730

ТОО «Карагандинская сельскохозяйственная опытная станция имени А.Ф.Христенко, Карагандинская область, Казахстан

Аннотация. Культура нута (Cicer arietinum L.) – зернобобовое растение отличается ценными биологическими и пищевыми свойствами, которые требуется использовать в сельском хозяйстве Казахстана. Для растениеводства важны следующие свойства как устойчивость культуры к засухе, сбалансированность химического состава зерна, в первую очередь по белку. В селекционном направлении важно выделить генотипы, способные формировать стабильные урожаи зерна. В условиях сухостепной зоны Центрального Казахстана изучили новые сорта нута, устойчивые к стрессовым факторам среды. В исследовании были задействованы методически обоснованные полевые и лабораторные методы.

В питомнике конкурсного сортоиспытания Карагандинской сельскохозяйственной опытной станции имени А.Ф. Христенко было выделено 4 сорта нута, которые стабильно формировали высокую урожайность и качество зерна. В среднем урожайность зерна по сортам составила 3,8 ц/га, содержание протеина было равно 33,4 %. Между сортами данные показатели отличались: Юбилейный, соответственно: 4,3 ц/га и 32,4%; Краснокутский 36: 4,1 ц/га и 33,6 %; Краснокутский 123: 4,4 ц/га и 31,9 %; Икарда1: 4,3 ц/га и 32,4 %.

Данные сорта можно использовать в качестве исходного материала в дальнейшей селекционной работе.

Ключевые слова: сорт, линия, нут, питомник, испытание.

Введение. В настоящее время и на предстоящие десятилетия увеличивается спрос на семена зернобобовых культур, особенно на такую засухоустойчивую культуру как нут.

Нут (Cicer arietinum L.) относится к семейству Fabaceae и подсемейству Papilionaceae. Это самоопыляемая, диплоидная (2n = 16) культура [1].

Основным подходом к решению проблемы нехватки зерна зернобобовых культур является создание новых сортов нута, основанных на следующих селекционных подходах: генетическая изменчивость, геномная селекция, молекулярные маркеры, включающие локусы количественных признаков (QTL), секвенирование всего генома и транскриптомный анализ [2]; их размножение и организация семеноводства.

Большая контрастность почвенно - климатических условий Центрального Казахстана и низкий биоклиматический потенциал обуславливают постоянный поиск сортов нута с высокой экологической пластичностью. В успешном решении этой проблемы ведущая роль принадлежит научно-обоснованному подбору сортов нута.

Также велика его перспектива в решении актуальной на сегодняшний день проблемы производства растительного белка [3]. Благодаря высокой питательности, нут широко используется в пищу народами Средней Азии, Закавказья, Турции, Болгарии, Испании, Индии, Сирии и других стран. Интенсивное использование нута интерпретируется высокой пищевой и кормовой ценностью этой культуры, которая объясняется высоким содержанием дешевого белка [4, с.55], по полноценности и усвояемости не уступающего белкам животного происхождения. В его семенах содержится от 20,0 до 32,5 % сырого протеина, до 8% жира, 47-60 % крахмала, витамины: A, B1, B2, B6, C, PP, а также макро- и микроэлементы. Нут, как и соя, содержит в семенах достаточное количество масла (отдельные формы до 8%), которое богато ненасыщенными жирными кислотами. Из-за сбалансированного аминокислотного состава и большого содержания метионина и триптофана, по питательной ценности нут превосходит все остальные зернобобовые культуры.

В животноводстве семена нута используют как высокобелковый концентрированный корм. В 100 кг семян нута содержится 122 кормовых единицы. Введение его в рацион животных значительно улучшает перевариваемость кормов, содержащих повышенное количество углеводов [5].

Среди всех зернобобовых культур нут является самой засухо- и жаростойкой культурой, что связано с высоким содержанием связанной воды в тканях листьев, ксероморфной структурой их строения, опушенностью и наличием в них органических кислот [6]. В то же время нут отличается и высокой устойчивостью к холоду. Нут может приспосабливаться к изменению климата под воздействием эпигеномных механизмов взаимодействия растений с окружающей средой [7]. Учитывая огромную практическую ценность этой культуры, особую актуальность приобретает выделение генотипов, способных формировать стабильные урожаи в условиях сухостепной зоны Центрального Казахстана.

Главным направлением исследования является создание и изучение новых сортов нута устойчивых к стрессовым факторам среды, отличающихся высокой продуктивностью с хорошим качеством зерна для возделывания в острозасушливых условиях Центрального Казахстана.

Материал и методы исследований. Исследования проводились в ТОО «Карагандинская сельскохозяйственная опытная станция имени А.Ф. Христенко», расположенная в зоне умеренно-засушливых степей темно-каштановых карбонатных почв. Опыт осуществлялся по типу конкурсного сортоиспытания. Посев питомника проведен 14 и 16 мая (2021-2022 соответственно) по чистому пару с нормой высева 05-0,6 млн. всхожих зерен на гектар сеялкой СН-16. Площадь делянок 30 $м^2$[8,с.6; 9, с.7].

Климат характеризуется резкой континентальностью и засушливостью. Зима холодная с сильной ветровой деятельностью, продолжающейся до 218 дней.

Весна характеризуется быстрым нарастанием положительных температур воздуха с частым возвратом холодов. Частые весенние сильные и сухие ветры, иссушающие мелкоземы с поверхности пахоты и принимающие характер пыльных бурь, приносят большой вред посевам и почвам. Лето жаркое, сравнительно короткое, в большинстве лет засушливое. Метеорологические показатели, представленные в таблице 1, показали, что за 2021 год выпало 260 мм осадков, что ниже многолетних показателей на 59,9 мм [8,с.7-8; 9, с.8-9].

На период вегетации растений приходится всего 91,8 мм, что также значительно ниже нормы (48,9 мм). Самое низкое значение осадков приходится на июль (18 мм), что ниже нормы на 26,3 мм. В третьей декаде июля осадки отсутствовали, в первой и второй декадах августа эффективные осадки также отсутствовали (3,9; 0,3 мм). По температурному режиму самым жарким месяцем был июль, выше среднемноголетних данных - 3,9 °С. Максимальная температура воздуха доходила до уровня 36-38 °С.

Для вегетационного периода 2022 года характерно проявление летнего максимума осадков. Так, в июле их выпало 55,9 мм, что выше нормы - 11,6 мм. Основное количество выпало в первой (29,5 мм) и третьей (25,4 мм) декадах. В остальные месяцы вегетационного периода осадков выпало значительно ниже нормы. Самый жаркий месяц июнь. Среднесуточная температура воздуха была выше нормы на 6°С. Начиная, с апреля, температура воздуха постепенно повышалась до июля, в дальнейшем пошла на снижение.

Таким образом, год был засушливым. Высокие температуры воздуха в начале вегетации растений привели к резкому иссушению верхнего слоя почвы. В результате всходы зернобобовых культур получились изреженные невыровненные по густоте и своему развитию. Только осадки июля исправили положение, образовалась узловая корневая система. Семена, попавшие в сухой слой почвы дали всходы, образовался

CONTENT

RICE CULTIVATION

IMPROVING THE REGIME OF OROSHENIYA RISE
Koshkarov S.I., Bulanbayeva P.U., Shomantayev A.A., Kalmanova G.K., Kenzhalieva B.T. 6

THE FORMATION OF PRODUCTIVITY OF DIVERSIFICATION CROPS ON A DIFFERENT BACKGROUND OF MINERAL FERTILIZERS IN THE CONDITIONS OF RICE CROP ROTATION IN THE KAZAKH ARAL SEA REGION
Tokhetova L.A., Baimbetova G.Z., Abuova N.A, Nurymova R.D., Kenesaliyeva N.N. 15

PLANT GROWING AND AGRICULTURE

STUDY OF ROTATIONAL PASTURES IN THE SEMI-DESERT ZONE OF WESTERN KAZAKHSTAN
Nasiyev B.N., Khiyasov M.G., Zhanatalapov N.Zh., Bekkaliev A.K. 26

SCREENING FOR DROUGHT RESISTANCE IN SPRING SOFT WHEAT FROM VARIOUS GEOGRAPHICAL ORIGINS BY SEED GERMINATION IN SUCROSE SOLUTIONS WITH DIFFERENT OSMOTIC PRESSURE AND ASSESSMENT OF THEIR ADAPTABILITY TO THE ACUTELY DRY CONDITIONS OF WESTERN KAZAKHSTAN
Kalybekova Zh.T., Adrian Goodman., Zuev E.V., Tsygankov V.I., Tsygankov A.V., Kozhabergenova A.B. 35

DEVELOPMENT OF NATURAL HERBAGE ON THE MARGINAL STRIPS OF CULTIVATED FIELDS IN THE NORTH KAZAKHSTAN REGION
Malitskaya N.V., Ashirbekov M.Zh., Kantarbaeva E.E., Sereda S.G., Alibekova A.T. 48

EVALUATION OF THE QUALITY OF GRAIN AND FLOUR OF THE BREEDING LINES OF WINTER WHEAT OF THE NURSERY OF COMPETITIVE VARIETY TESTING, GROWN IN THE CONDITIONS OF THE SOUTH-EAST OF THE REPUBLIC OF KAZAKHSTAN
Suraubayeva A.A., Bayadilova G.O., Kenges., Nurkassymova S.D., Ainebekova B.A., Yerzhebayeva R.S. 59

IRRIGATION PROCEDURE (MODE) OF TOMATO GROWN BY THE LOW PRESSURE DRIP IRRIGATION METHOD
Kopen M.B., Otarbaev B.S., Aldambergenova G.T., Shomantaev A.A., Isaev S.Kh. 70

STUDYING AND EVALUATING THE PRODUCTIVITY OF CHICKPEA VARIETIES IN THE CONDITIONS OF CENTRAL KAZAKHSTAN
Sereda G.A., Sereda T.G. 80

DIAGNOSTICS OF VARIETIES AND LINES OF SOFT SPRING WHEAT FOR DROUGHT RESISTANCE IN LABORATORY CONDITIONS
Kyzdarbekova G.T., Yessenzholov B.Kh., Antaibekova A.M. 88

INVESTIGATION OF THE EFFECT OF DIFFERENT IRRIGATION METHODS ON THE YIELD OF PEPPER AND EGGPLANT
Zhatkanbayeva A.O., Bulanbayeva P.U., Tulepova R.Z., Kenzhalieva B.T., Aldambergenova G.T. 98

OVERWINTERING AND THE HEIGHT OF THE GRAIN PLANTS IN DEPENDENCE ON THE METHODS OF IMPROVEMENT OF CROPS IN THE STEPPE ZONE OF THE PAVLODAR REGION
Kukusheva A.N., Kakezhanova Z.E., Uahitov Zh.Zh., Sarbasov A.K., Shalabaev B.A. 109