EasyChair Preprint

№ 3800

The Most Favorable Method for Construction of a Drying and Watering Network for Growing Potatoes

N. Martinova and K. Shavazov

July 9, 2020

N. Martinova[1], K. Shavazov[2].

THE MOST FAVORABLE METHOD FOR CONSTRUCTION OF A DRYING AND WATERING NETWORK FOR GROWING POTATOES

Abstract: The dynamics of precipitation during the growing season of plants in the Moscow region are analyzed, the need for irrigation measures to obtain a sustainable crop is investigated, ways of irrigation water supply and the presence of water sources are considered. The possibility of building drainage - watering network to maintain optimal values of water - air balance at each time interval during the growing season of the plants is considered. The methods of water drainage from waterlogged areas are analyzed and methods for constructing a network are proposed.

Key words: drainage, sprinkling, drip irrigation, drainage-watering network.

1. Introduction.

The climate in the Moscow region is characterized by an uneven distribution of precipitation both in the annual cycle and over the period of many years of observation, that is, there is an alternation of years with excessive moisture and moisture deficiency during the growing season of plants [1]. So, the average monthly rainfall in the spring and summer period ranges from 20 to 85 mm. In the period of snowmelt, the soils are very waterlogged. This, in some years, is the reason for the delay in sowing, which leads to a shift in agro-technical terms [2]. The solution to the problem is the construction of a drainage network. This will allow timely removal of excess moisture from the root layer and increase soil aeration [3]. The maximum load on the drainage network occurs during snowmelt [4]. If the discharge is carried out in a special pond - drive, then in the future this water could be used for irrigation during a period of moisture deficiency [5].

[1] Russian State Agrarian University named after K.A. Timiryazev, 127550, Russia, Moscow Pryanishnikova d. 19. Email: yourim2@rambler.ru

[2] Tashkent Institute of Irrigation and Agricultural Mechanization Engineers, Qori Niyozi str, 39, 400000, Tashkent, Uzbekistan, Tel. +998 71 237-19-84; +99893 567-65-85, *e-mail:* kadirjon.shavazov@bk.ru

Therefore, to ensure optimal values of water - air balance throughout the growing season, it is necessary to build a drainage and watering network [6]. This will allow irrigation during a period of precipitation deficit and remove excess moisture in the event of overmoistening of the soil [8]. The drained water should be stored to ensure the next watering.

2. Method.

To ensure optimal values of the water – air balance, the inflow and outflow of moisture during the growing season should be predicted. Precipitation is unstable both throughout the growing season and according to long-term observations (Table 1).

The average daily rainfall during the growing season

Year of research	Daily rainfall, mm / day.			
	may	june	july	august
2016	3,37	2,56	3,86	4,43
2017	1,58	2,34	3,12	2,46
2018	0,65	1,82	2,74	0,74

Water consumption of plants, in particular, potatoes, is also uneven during the growing season [9]. In the early period of development, the daily consumption of potatoes is small, since there is enough moisture in the mother tuber. But it is during this period that the soils are waterlogged, as they are filled with melt water. Water consumption reaches its maximum values at the end of the growth of tops and flowering, in the future it decreases slightly (Table 2).

Potato daily water intake

№	**Vegetation period**	**Daily water consumption, m3 / ha**
1	Landing - seedlings	16
2	Shoots - the beginning of budding	28
3	Start of budding - full bloom	32
4	Full bloom - the end of the growth of tops	35
5	The end of the growth of tops - technical ripeness of tubers	27

However, it is during this period that the highest values of average annual temperatures are observed, and as a result, the highest volatility [10]:

$$V = 0{,}0018(25 + t)^2(100 - \omega)0{,}8, \text{мм}$$

where: t - the average monthly temperature, ω - the average monthly humidity.

The dynamics of changes in evaporation during the growing season is shown on the graph (Fig. 1).

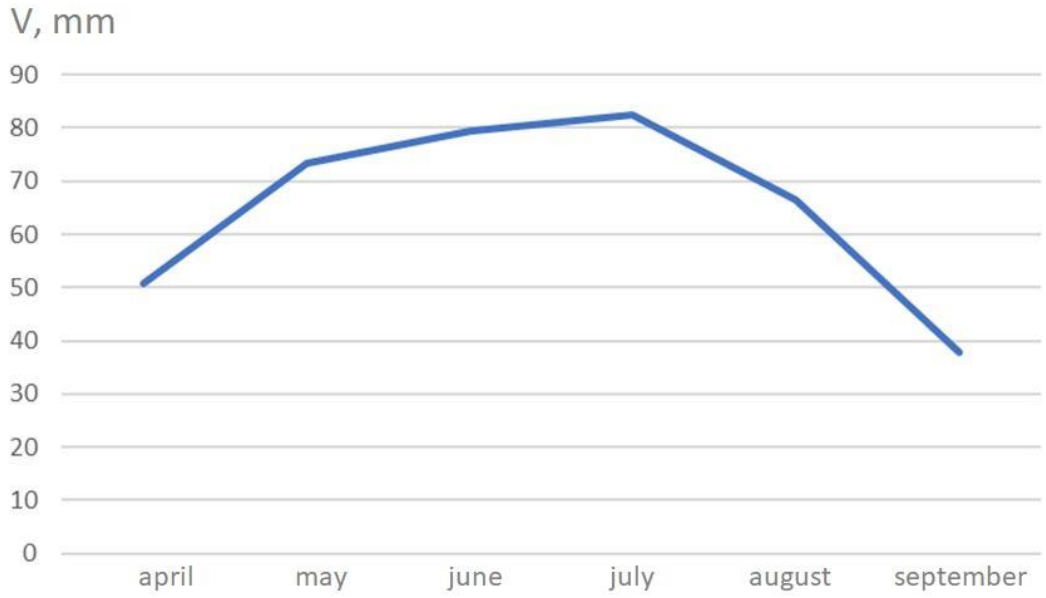

Figure 1 – **Values of volatility during the growing season**

There are several ways to build drainage systems. A network of channels - drives with a gateway system is used. This construction has a high cost and can be used only at large reclamation sites, moreover, this scheme cannot exclude waterlogging of soils.

Also known is the design of a drainage and watering system using ponds - storage tanks, where water is supplied by pumps. This method is energy-consuming, in addition, drives drive the earth out of agricultural circulation and impede the operation of agricultural machinery.

It is supposed to moisten the developed territory by means of subsoil irrigation or sprinkling. The disadvantage of the first is the shallow depth, which

with prolonged use during freezing and thawing of the soil will lead to high-altitude deformations and a decrease in the volume of water supply.

The use of sprinkling equipment will lead to an increase in operating costs, as well as difficulties in the passage of sprinkler machines among the objects of the reclamation system.

3. Results and discussion.

To ensure optimal water consumption regimes and improve water supply and removal of excess moisture depending on external conditions, it is proposed to use a drainage network as a drainage system, and a drip irrigation system as a humidification system (Fig. 2). Water for drip irrigation can be obtained from storage collectors.

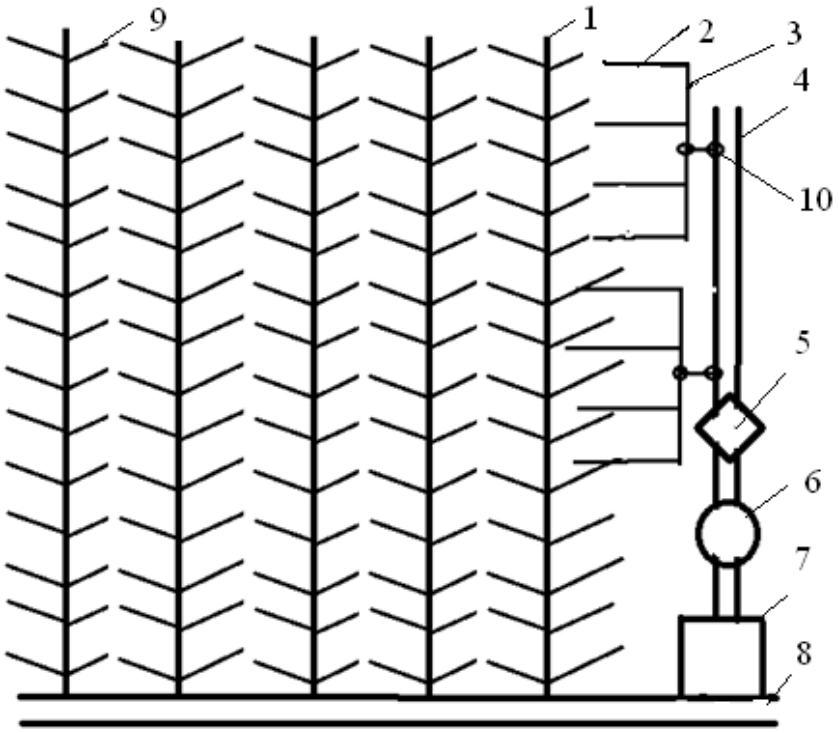

Figure 1 - **Drainage and watering system:**

1-collector drainage network; 2-drop line; 3-way line; 4-way manifold; 5-filtration station; 6-pump station; 7-drive; 8-trunk channel; 9-drain; 10-valve.

During snowmelt, water from the main canal is partially supplied to the drive, where it settles and partially clarifies. Then it is transported by a pump to a distribution manifold and, after filtration, enters the drip line by irrigation. The

advantage of drip irrigation is the ability to deliver water directly to the root zone, virtually eliminating the loss of filtration into deeper layers and evaporation.

4. Conclusions.

To regulate the water - air balance, it is rational to use a drainage - watering network. This reclamation construction will allow you to collect excess moisture from waterlogged areas, accumulate in the storage collector and distribute during a period of precipitation deficit. This will allow at any time to adjust the amount of water consumption and calculate the irrigation rate, creating optimal conditions for the growth and development of plants.

List of references.

1. Dubenok N.N. Responsiveness of various varieties of potatoes to the water regime of light chestnut soils of the Lower Volga region / N.N. Dubenok, D.A. Bolotin, S.D. Fomin, A.G. Bolotin // Bulletin of the Lower Volga Agricultural University: science and higher professional education. 2017. - No. 4. - Page 22-29.

2. Martynova NB Machine for laying a drip tape in a potato comb / NB. Martynova, A.Yu. Korneev // International technical and economic journal -2019.- №2. -Page 15-20.

3. Karapetyan M.A. The productivity of a potato harvester and the quality of harvesting tubers depends on preplant soil preparation / M.A. Karapetyan, A.M. Shipantsov // Potatoes and vegetables, 2012. - No. 4 - Page. 7.

4. Balabanov V.I. Actual technique. Overview of innovative developments for sowing and tillage. / IN AND. Balabanov // Agrotechnology and technology. - 2019. - No. 1. - Page 18-19

5. Abdulmazhidov, H.A. Comprehensive design and strength analysis of environmental engineering machines designs in the Inventor Pro system / Kh.A. Abdulmazhidov, A. S. Matveev // Bulletin of the Federal State Educational Institution of Higher Professional Education "Moscow State Agroengineering University named after V.P. Goryachkin" .- 2016. –№2. - Page 40-46.

6. Korneev A.Yu. Development of a drip tape stacker design based on the grimme gf 75/4 comb for use in growing potatoes / A.Yu. Korneev, N.B. Martynova // Bulletin of the Moscow State Agroengineering University named after V.P. Goryachkin, 2018. - Vol. 2 (84) - Pages 18-22.

7. Korneev A.Yu. Plow working body for the construction of reclamation canals of semi-elliptical profile in the drainage zone / A.Yu. Korneev, N.B. Martinova // Bulletin of the Moscow State Agroengineering University named after VP Goryachkin, 2017. - Vol. 2 (78) - Page 26-29.

8. Reyes-Cabrera, J. Drip as alternative irrigation method for potato in Florida sandy soils / J. Reyes-Cabrera, L. Zotarelli, D.L. Rowland, M.D. Dukes, S.A. Sargent // American Journal of Potato Research; 2015; 91 (5): 504-516.

9. Melikhov V.V., Green technologies: the basis for integration and clustering of subjects at the regional level of economy / V.V. Melikhov A.A. Novikov, L.N. Medvedeva, O.P. Komarova // Contributions to economics; 2017: 365-382.

10. Borodychev V.V, Optimal irrigation control based on modern computational algorithms / V.V. Borodychev, M.N. Lytov, A.S. Ovchinnikov, V.S. Bocharnikov // Bulletin of the Lower Volga Agro-University Complex: science and higher professional education. - 2015. - No. 4 (40). - Page 21-28.