UDC 633.63:631.81
VLASENKO V.
Institute of Bioenergy Crops and Sugar Beet NAAS of Ukraine,
e-mail: VVS-5@ukr.net

THE IMPACT OF FERTILIZING PRACTICE ON WATER REGIME OF THE SOIL IN CROPS OF SUGAR BEET

The article stipulates the results of research on the effect of fertilizing in crop rotation on the water regime in crops of sugar beet. It is eestablished that the lowest rate of water consumption was observed in variants manure – 25 t/ha + $N_{170}P_{120}K_{170}$ and manure – 25 t/ha + $N_{170}P_{120}K_{170}$ (without chemical protection), where high doses of mineral fertilizers (86.2 and 84.7 m^3/ton) were applied.

***Keywords**: water regime; content of productive moisture; water consumption; yield; sugar beet; fertilizing practice, the use of water*

Introduction. Sugar beet is high-tech and high-profit crop. Sugar beets cultivation has been traditionally the highest priority cultivation in Ukraine, income from which was the lion's share of the profits from all crops. Their productivity is largely dependent on the area of moisture, level of crop rotation and fertilization system [1-2].

The water regime in the soil is one of the critical factors of crops productivity. Sufficient amount of moisture in the soil reduces dependence of crops productivity from rainfall quantity during the vegetation season. Agronomic properties of soil – feeding regime, air and heat regimes and biological processes in the soil are directly dependent on water regime.

According to V. Zubenko [3], sugar beets use water more economically than other crops from rotation, namely, vetch-oat, winter wheat, because they have deep root system, which develop rapidly in the early growth phases and reaches a depth of 2.5 m. During the vegetation period sugar beets use August and September rainfall.

Y. Tsvey [4] points out that stocks of productive moisture in the soil depend on the predecessors, soil and climatic conditions, the amount and distribution of rainfall during the vegetation period, water and physical properties of soil, fertilization system and initial soil moisture reserves. Therefore, in the present conditions, which appeared in connection with the climate change, improving of soil moisture supply during growth of sugar beets is an urgent task of sugar beets cultivation agricultural technologies.

The aim of research was to investigate the influence of different fertilizing practices on the water regime in crops of sugar beet.

Materials and methods. The research was conducted in ten-field grain-beet crop rotation within a framework of a long-term stationary experiment in Ivaniv EBS during 2010-2012.

Soil of the research field is typical black soil, poor humus hard clay on loess that is defined by the following agrochemical parameters: the humus content in one layer – 4.7-5.1%, pH saline 6.2-6.8, GK – 1.3-3.4 meq/100 g of oil, the amount of inclusion basics - 31-35 mg ekv/100 g soil, mobile phosphorus and exchangeable potassium (by Chirikov) 110-160 and 80-120 mg/kg soil, respectively.

Tillage and tending crops in crop rotation was carried out according to the technological requirements related to areas of unstable moistening of Left-Bank Forest-Steppe of Ukraine. Hybrid sugar beets Oleksandria.

The size of the cultivated field 324 m^2, recorded (control) field – 200 m^2. Placement of sites was systematic, sequential, repetition - triple. In the experiment it was used half rotten cattle manure, and as fertilizers - ammonium nitrate, superphosphate granulated and potassium salt. In option 1 used were elements of biological agriculture (by-products of all crops in the rotation were put into the soil). Recording and observations were carried out in a fallow area of rotation where a fallow-occupied crop was vetch-oat blend for hay and black fallow (option 17). The predecessor of

the sugar beets was winter wheat, except option 6, in which it was pea. In option 15 organic-mineral fertilization system (it was made 10 t/ha of manure + $N_{29,4}P_{40,5}K_{33}$ for the rotation) was used. In option 8 chemical crop protection was not applied, but hand-weeding of weeds.

Research results. Researches have shown that stocks of productive moisture at the time of sowing of sugar beets in half meter layer of soil were in the range of 196.7 to 216.2 mm (Table 1). The presence of a black fallow in rotation increased stocks of productive moisture in the 0-150 cm soil layer to 215.7 mm, whereas, in the option of the rotation with 70% crops and manure fertilization system of 25 t/ha + $N_{48}P_{75}K_{70}$ this indicator was 203.5 mm. In option with the elements of biologization (ploughing of crop remains) researching indexes were close to the option with black fallow.

At the time of the harvest the productive moisture decreased 2.4-2.7 times, which was due to the use of water by plants and weather conditions took place in the vegetation season during the years of investigation (Table 1).

Table 1

Stocks of productive moisture for sugar beets, mm
(Ivanivska DSS, 10-fields grain rotation of stationary experiment) (average in 2010-2012)

No of option	Fertilizing system	Soil layer, cm			
		0-50	50-100	100-150	0-150
For sowing period					
1	Items of biologization (ploughing of crop remains)	66.4	72.1	74.6	213.1
3	Manure – 25 t/ha + $N_{170}P_{120}K_{170}$	69.3	70.6	73.2	213.2
6	Manure – 25 т/га +$N_{48}P_{75}K_{70}$ (70 % crops)	61.7	66.4	75.4	203.5
8	Manure – 25 т/га +$N_{170}P_{120}K_{170}$ (without chemical protection)	63.4	66.1	69.5	199.0
11	$N_8P_{15}K_{10}$ (control)	62.0	62.2	70.1	196.7
12	Manure – 25 т/га +$N_{48}P_{75}K_{70}$	62.0	65.1	72.7	199.8
13	Manure – 25 т/га +$N_{68}P_{105}K_{100}$	64.4	67.3	70.8	202.6
15	Manure – 25 т/га +$N_{48}P_{75}K_{70}$ (organic-mineral)	67.8	69.8	76.3	213.9
17	Manure – 25 т/га +$N_{48}P_{75}K_{70}$ (black fallow and 33 % of sugar beets)	66.2	72.1	77.4	215.7
For harvesting period					
1	Elements of biologization (plowing of crop remains)	38.5	33.0	25.6	97.1
3	Manure – 25 t/ha + $N_{170}P_{120}K_{170}$	37.3	28.7	22.0	88.0
6	Manure – 25 t/ha +$N_{48}P_{75}K_{70}$ (70 % crops)	37.1	23.0	20.7	80.6
8	Manure – 25 t/ha +$N_{170}P_{120}K_{170}$ (without chemical protection)	40.3	24.4	19.5	84.1
11	$N_8P_{15}K_{10}$ (control)	43.6	22.7	21.8	87.0
12	Manure – 25 t/ha +$N_{48}P_{75}K_{70}$	39.3	25.6	26.6	90.2
13	Manure – 25 t/ha +$N_{68}P_{105}K_{100}$	41.6	22.8	22.4	85.5
15	Manure – 25 t/ha +$N_{48}P_{75}K_{70}$ (organic-mineral)	42.6	26.7	21.9	91.3
17	Manure – 25 ton/ha +$N_{48}P_{75}K_{70}$ (black fallow and 33 % of sugar beets)	44.4	30.1	23.9	98.5

At this time stocks of productive moisture on the research option in the general ranged from 80.6 mm - 98.5 mm. Within rotation with 70% crops (option 6) stocks of productive moisture were the least - 80.6 mm. At the same time, in the option 15 where the fallow-occupied crop system was black fallow with 33% of sugar beets in crop rotation and with the system of fertilizing - manure 25 ton/ha + $N_{48}P_{75}K_{70}$ the indicator of soil moisture level was 98.5 mm. First of all, it is determined by an increase in stocks of productive moisture in the 0-50 cm of soil layer to 44.4 mm, and in the 50-100 cm soil layer – to 30.1 mm.

It was found that the using of productive moisture by sugar beets depends both on the fertilization system as well as on the level of productivity of sugar beets (Table 2).

Table 2

Spending of productive moisture in one and a half meter layer of soil during the vegetation season of sugar beets depending on fertilization system (DSS Ivanivska) (average in 2010-2012)

No of option	Fertilization system	Productive moisture, m^3/ha		Consumption of moisture, m^3	Rainfall during the vegetation season, m^3/ha	Consumption of water, m^3/ha	Crop capacity ton/ha	Water consumption coefficient, m^3/ton
		I	II					
1	Elements of biologization (plowing of crop remains)	2131	971	1160	2757	3917	33.2	117.9
3	Manure – 25 ton/ha + $N_{170}P_{120}K_{170}$	2132	880	1252	2757	4009	46.5	86.2
6	Manure – 25 ton/ha +$N_{48}P_{75}K_{70}$ (70 % crops)	2035	806	1229	2757	3986	36.3	109.8
8	Manure – 25 ton/ha +$N_{170}P_{120}K_{170}$ (without chemical protection)	1990	841	1149	2757	3906	46.1	84.7
11	$N_8P_{15}K_{10}$ (control)	1967	870	1097	2757	3854	33.0	116.8
12	Manure – 25 ton/ha +$N_{48}P_{75}K_{70}$	1998	902	1096	2757	3853	40.8	94.4
13	Manure – 25 ton/ha +$N_{68}P_{105}K_{100}$	2026	855	1171	2757	3946	39.5	99,9
15	Manure – 25 t/ha +$N_{48}P_{75}K_{70}$ (organic-mineral)	2139	913	1226	2757	4001	40.2	99,5
17	Manure – 25 ton/ha +$N_{48}P_{75}K_{70}$ (black fallow and 33 % of sugar beets)	2157	985	1172	2757	3929	37.6	104,4
LSD_{05}							**4.19**	
Accuracy of the experiment, %							**3.6**	

Note: *I - the beginning of vegetation of sugar beet; II - the end of vegetation of sugar beet*

The highest coefficient of water consumption per 1 ton of roots was observed in option with elements of biologization (option 1), in control option (option 11), and in option with 70% crops rotation (option 6), and was accordingly - 117.9, 116.8 and 109.8 m^3/ton. The lowest coefficient

was in option 3 and option 8, which used high doses of mineral fertilizers - respectively 86.2 and 84.7 m^3/ton, that was appeared 30.6 and 32.2 m^3/ton less than in the control option.

It should also be noted that in the option 17, which was with a black fallow and 33% sugar beets crop rotation, also tends to increase the coefficient of water consumption - 104.4 m^3/ton, although in comparison with the control option the coefficient decreased by 12.4 m^3/ton. Thus, the cultivation of sugar beets in the field with vetch-oat promotes optimum soil moisture during active plant growth and development of the crops.

Conclusions:

1. The presence of a black fallow in rotation supports increasing in stocks of productive moisture in the 0-150 cm soil layer to 215.7 mm. Rotation with 70% of crops to 203.5 mm. The results in the option with the elements of biologization in the field with vetch-oat were close to the option with the black fallow.

2. The lowest coefficient of water consumption was observed in the options which used high doses of mineral fertilizers - 86.2 and 84.7 $м^3$/ton. Within the increase in crop capacity the coefficient of water supply decreases, i.e. spending of stocks of productive moisture per a ton of roots.

References

1. Роїк М. Буряки: [монографія] / М. Роїк. – К.: XXI вік, 2001. – С.85-110.
2. Барштейн Л.А. Сівозміни, обробіток ґрунту та удобрення в зонах бурякосіяння / Л.А. Барштейн, І.С. Шкаредний, В.М. Якименко. – К.: Тенар, 2002. – С. 488.
3. Зубенко В.Ф. Накопление почвеной влаги после предшественников сахарной свеклы / В.Ф. Зубенко, В.Т. Оноприенко, Л.А. Барштейн // Вестник с.-х. науки. – 1979. – № 5. – С. 35-38.
4. Баланс водного режиму в короткоротаційних сівозмінах / [Я.П. Цвей, Ю.О. Ременюк, Н.М. Мацевецька та ін.] // Цукрові буряки. – 2010. – № 2. – С. 9-11.
5. Барштейн Л.А. Сівозміни – основа інтенсифікації землеробства / [Л.А. Барштейн, Л.Я. Бергульова, А.В. Волянський та ін.]. – К.: Урожай, 1985. – С. 47.
6. Греков М.А. Продуктивность культур в зоне свеклосеяния // Севообороты в свекловичных районах / М.А. Греков. – М.: Колос, 1969. – С. 89-93.

Анотація

Власенко В.С.

Вплив системи удобрення на водний режим ґрунту у посівах буряків цукрових

У статті наведені результати дослідження з впливу системи удобрення в сівозміні на водний режим ґрунту у посівах буряків цукрових. Встановлено, що найменший коефіцієнт водоспоживання спостерігався у варіантах, де застосовувались високі дози мінеральних добрив (варіанти 25 т/га гною + $N_{170}P_{120}K_{170}$ і 25 т/га гною + $N_{170}P_{120}K_{170}$ (без хімічного захисту), відповідно 86,2 та 84,7 $м^3$/т.

Ключові слова: *водний режим, запаси продуктивної вологи, водоспоживання, урожайність, буряки цукрові, система удобрення, використання вологи*

Аннотация

Власенко В.С.

Влияние системы удобрения на водный режим почвы в посевах сахарной свеклы

В статье приведены результаты исследований по влиянию системы удобрения в севообороте на водный режим почвы в посевах сахарной свеклы. Установлено, что наименьший коэффициент водопотребления наблюдался на вариантах, где применяли высокие дозы минеральных удобрений (варианты 25 т/га навоза + $N_{170}P_{120}K_{170}$ и 25 т/га навоза + $N_{170}P_{120}K_{170}$ (без химической защиты), соответственно 86,2 и 84,7 $м^3$/т.

Ключевые слова: *водный режим, запасы продуктивной влаги, водопотребление, урожайность, сахарная свекла, система удобрения, использование влаги*