

**AVAILABLE MOISTURE RESERVES UNDER SOWING OF SUGAR BEETS
DURING SATURATION OF SHORT-TERM CROP ROTATIONS WITH
DIFFERENT FODDER-GRAIN CROPS**

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The article shows the influence of saturation of five fields crop rotation with spring barley, corn and soybeans on available moisture content under sowing of sugar beets at the beginning and in the end of the vegetation.

Appearance of new farms with different types of menage, that have a narrow specialization on relatively small plots of land, requires the introduction of crop rotations with short rotation [1-3]. Therefore, the direction of researches of crop rotations, which combine growing of fodder-grain crops with the main in beet growing districts technical crop – sugar beet, should be considered actual.

It is known that water is a necessary condition for the existence of all living beings. Moisture deficiency in plants of more than 5-10% (in some of them 20% or more) disturbs the normal process of photosynthesis and yield formation [4]. That's why soil moisture is one of the factors that determine the conditions of cultivation of crops [5], and it is leading factor in conditions of unstable and insufficient humectation [6].

However, sugar beets with their biological characteristics have relatively low transpiration coefficient, nevertheless, due to the formation of dry organic mass of harvest during the vegetation spend more moisture than any other crop. [7] Therefore, sufficient supplies of moisture available for plants is needed to form high yield of sugar beets, which are mainly formed during the summer and autumn-winter period [8], and their number for the time of sowing of sugar beet depends on the moisture consumption by the previous crop and rainfall for the period mentioned above [9].

Methodology of research. Conditions of moisture supply of sugar beet plants were studied in a stationary experiment with five fields crop rotations, laid by professor V.O. Yeshchenko and docent V.P. Opryshko on all the fields in autumn of 1991 and spring of 1992 at the experimental field of department of General Agriculture of Uman NUH. In 2010 its reconstruction was held by exclusion of corn for silage and replacement of half of the cultivated area of peas for soy.

Sown area of the plot is 168 m², placing of variants in the experiment – systematic with triple repetition. Agricultural technology of growing of different crops was common for the region.

Crop rotations in each experiment differed among themselves by the composition of crops and by their alternation, having one common field of sugar beets, on sowings of which was determined the moisture content of soil to the depth of 160 cm at the beginning and in the end of the growing season by means of thermostat-weight method with the following recalculation of available moisture reserves.

Results of research. The results of our research presented in tables 1, 2 and 3 showed that presowing water reserves in half a meter thickness of soil is sufficient enough to form an appropriate level of sugar beet crop. According to the scientific literature, spring reserves of available moisture in 0-150 cm of the soil layer for cultivated crops with average soil fertility should be 180-200 mm.

If consider in details (table 1) available moisture reserves in the 0-160 cm of the soil layer under sugar beet after different predecessors, it can be noted that the replacement of the traditional winter wheat predecessor by unconventional spring barley and soy doesn't cause any regular changes in humidification of half a meter layer of soil under sugar beet sowings.

1. Reserve of available moisture in 0-160 cm of the soil layer under sugar beets after different predecessors, mm

Number of crop rotation	Crops in order of alternation	Years		Average
		2011	2012	
At the beginning of the growing season				
2	Barley-corn-peas-winter wheat-sugar beets	234	273	254
3	Corn-barley-peas-winter wheat-sugar beets	236	276	256
6	Barley-corn-soybeans-barley-sugar beets	239	275	257
7	Corn-barley-soybeans-barley-sugar beets	233	274	254
17	Corn-corn-corn-soy-sugar beets	240	275	258
<i>HIP₀₅</i>		10,7	7,2	–
In the end of the growing season				
2	Barley-corn-peas-winter wheat-sugar beets	72,3	91,2	81,8
3	Corn-barley-peas-winter wheat-sugar beets	71,9	90,3	81,1
6	Barley-corn-soybeans-barley-sugar beets	72,1	90,9	81,5
7	Corn-barley-soybeans-barley-sugar beets	70,4	92,0	81,2
17	Corn-corn-corn-soy-sugar beets	71,4	89,8	80,6
<i>HIP₀₅</i>		4,1	4,7	–

For example in 2011 at the beginning of the growing season after winter wheat available moisture reserves in variant № 2 and 3 were accordingly 234 and 236 mm. And after spring barley in crop rotation № 6 and 7 – 239 and 233 mm. When soybeans were used as a precursor, the moisture amount was the largest – 240 mm. However, this is only on 1 mm more than after barley in crop rotation number №6. In 2012, the available moisture reserves after all three precursors were practically at the same level. The difference between the above-mentioned variants did not exceed 3 mm.

For two years of research, no regular changes in available moisture reserves after various precursors under sowings of sugar beets and in the end of growing season were noticed.

The effect of the pre-precursors during growing of sugar beets after barley on formation of spring reserves of soil moisture and their use can be observed from the analysis of the data of table 2. It showed that substitution of content of pre-precursors of soybean by corn or barley was hardly reflected on the humidification of sugar beet plants neither at the beginning nor in the end of the growing season.

2. Available moisture reserves in the 0-160 cm of soil layer under sugar beets after various pre-precursors, mm

Number of crop rotations	Crops in order of alternation	Years		Average
		2011	2012	
At the beginning of the growing season				
9	Soybean-barley-soybean-barley-sugar beets	240	279	260
12	Soybean-barley-corn-barley-sugar beets	242	276	259
11	Corn-soybean-corn, barley, sugar beets	238	278	258
14	Corn-soybeans-barley-barley-sugar beets	232	279	256
<i>HIP₀₅</i>		11,3	8,4	–
In the end of the growing season				
9	Soybean-barley-soybean-barley-sugar beets	71,8	90,1	81,0
12	Soybean-barley- corn-barley-sugar beets	73,1	89,9	81,5
11	Corn-soybean-corn-barley-sugar beets	72,1	90,7	81,4
14	Corn-soybeans-barley-barley-sugar beets	72,9	91,6	82,3
<i>HIP₀₅</i>		3,1	5,2	–

As corn takes the biggest part in the scheme of the experiment among all crops, there is an interest in the impact of this crop on moisture reserve under sugar beets. But as it can be seen from the table 3, the saturation of crop rotation with such fodder-grain crop does not cause deterioration of water regime of sugar beets. And on the contrary in 2011 at the beginning of the growing season, corn was grown three times before barley as a precursor of sugar beets in crop rotation 16, initial soil moisture reserves were the largest – 242 mm. In 2012, this variant that had 60% of corn, moisture content was the same as in number 13, where corn was less on 20%. However, in crop rotation number 10 with the same proportion of corn (40%) moisture content was least – 272 mm.

Number of remaining available moisture reserves at the end of the growing season of sugar beets is also large, there wasn't any connection with the change of the share of corn in crop rotations within two years of researches.

3. Available moisture content in the 0-160 cm of soil layer under sugar beets with various saturation by corn, mm

Number of crop rotations	Crops in order of alternation	Years		Average
		2011	2012	
At the beginning of the growing season				
7	Corn-barley-soybean-barley-sugar beets	233	274	254
10	Corn-barley-corn-barley- sugar beets	238	272	255
13	Barley-corn-corn-barley-sugar beets	236	278	257
16	Corn-corn-corn-barley- sugar beets	242	277	260
<i>HIP₀₅</i>		10,4	8,7	–
In the end of the growing season				
7	Corn-barley-soybeans-barley-sugar beets	70,4	92,0	81,2
10	Corn-barley-corn-barley- sugar beets	70,9	91,1	81,0
13	Barley-corn-corn-barley-sugar beets	72,8	91,8	82,3
16	Corn-corn-corn-barley-sugar beets	71,3	90,1	80,7
<i>HIP₀₅</i>		4,7	5,4	–

Conclusions. Change in the precursors content for sugar beets, winter wheat to spring barley and soybeans, and in the pre-precursors content – soybeans to corn and spring barley, and the expansion in crop rotation of corn sowings, didn't affect the conditions of supplying of sugar beet plants with moisture.

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Усык С.В.

Запасы доступной влаги под посевами сахарной свеклы при насыщении короткоротационных севооборотов разными зернофуражными культурами

Новые хозяйства узкой специализации, которые имеют относительно небольшие земельные площади, нуждаются в севооборотах с короткой ротацией. Поэтому актуальными являются исследования короткоротационных севооборотов, в которых зернофуражные культуры выращиваются совместно с технической культурой сахарной свеклой.

Сахарная свекла за вегетацию использует большое количество воды. Поэтому для формирования большого урожая необходимо достаточное количество запасов влаги, которое зависит от остатков после предшественника и осенне-зимних осадков.

Определение запасов продуктивной влаги проводили в поле сахарной свеклы, которое было одинаковым для всех севооборотов. Образцы почвы отбирали в начале и в конце вегетации на глубину 160 см. Влажность почвы определяли термостатно-весовым методом с последующим перерасчётом на доступные запасы.

В результате исследований установлено, что замена для сахарной свеклы в качестве предшественника пшеницы озимой на яровой ячмень и сою, использование в качестве предпредшественника сои, кукурузы и ячменя ярового, а также расширение посевов кукурузы до 40 и 60% в структуре посевных площадей не сопровождается закономерными изменениями запасов доступной влаги.

Ключевые слова: севообороты, предшественники, влага, сахарная свекла.

Usyk S.V.

Reserve of available moisture under sowing of sugar-beets during saturation of short-term crop rotation with different grains of fodder crops

New farms of narrow specialization, which have a relatively small land area, need a short crop rotation. Therefore, studies of short crop rotation are relevant in which forage crops are grown together with technical culture of sugar beets.

Sugar beet for vegetation uses a large amount of water. Therefore, to generate a large crop enough moisture is needed, which depends on residues of predecessor and autumn-winter precipitation.

Determination of moisture content was carried out in a field of sugar beet, which is the same for all crop rotations. Soil samples were taken at the beginning and in the end of vegetation at the depth of 160 cm. Soil moisture was determined by the thermostatic method gravimetrically with the subsequent recalculation of the available resources.

The studies found that change in the precursor for sugar beet of winter wheat to spring barley and soybeans, and in the pre-precursor — soybeans for corn and spring barley, the same as the expansion in crop rotation of corn to 60 and 40%, made almost no effect on the conditions of supply of sugar beet plants with moisture.

Keywords: *crop rotation, predecessors, moisture, sugar beets.*