UDC 633.63+631.82:631.67

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INFLUENCE OF MINERAL FERTILIZERS AND WAYS OF ITS USE ON THE PRODUCTIVITY OF SUGAR BEET DURING THE TRICKLE IRRIGATION

To get high and guaranteed crop of sugar beet in the South Ukraine is possible only under irrigation. The estimated dose use of mineral fertilizers together with optimum regime of trickle irrigation allows reaching the high profitability of sugar beet irrigation.

Key words: *sugar beet, mineral fertilizer, productivity, saccharinity, bioethanol, energy outlet.*

Introduction. Nowadays, the problem of power regeneration energy_is the issue to be solved. That is way, it is common to get and use energies, which are accumulated by the plants due to photosynthesis.

Power generation technologies based on plant biomass are at the first stage of development in Ukraine, but still they have broad asset and prospects.

Besides ecological aspects the produce of bioethanol (as a biofuel) and its use still have positive affect:

- There is less influence of oil import and there is more energy independence;
- Diversity in agricultural economics and agricultural regions development;
- Working place creation;
- An increase in national budget;
- An increase in agriculture productivity.

As a result of these statements, the main principle of state policy in the field of alternative fuels is the influence on both unproductive fuels and energy minerals in terms of development and rationalism for fuel production with purpose of fuel and energy resources economy and decrease in import relief action.

Sugar beet is the crop, from which, it is reasonable and possible to produce bioethanol. But to get the guaranteed crop in the South territory of Ukraine is possible only on irrigated area. And the South Ukraine has its high bioclimatic potential (the amount of effective temperatures and long vegetation period) or agroclimatology factors. It is possible to get sugar beet crop of high stability for bioethanol produce while rationally combining irrigation, fertilizers and crop rotation.

While considering these positive aspects, it is obvious to study the influence of trickle irrigation and fertilizers on sugar beet grow. That is way the object of this research is to study the cooperation process of irrigation regimes, doses and ways of fertilizing for high productivity and quality sugar beet gain under the trickle irrigation for bioethanol production.

Data and research technique. Since 2011-2013s, on the Mykolaiv SARSII research station, within the Ighul irrigation area, there was studied the character of beet sugar growth, development and productivity in terms of doses and ways of fertilizing on the background of two regimes of trickle irrigation. The sugar beet was grown in terms of trickle irrigation under the generally accepted technique. The research scheme is presented in the tab №1. Prewatering moisture level of the 0,3 m soil was maintained at 70-80-80% of the lowest moisture capacity during the irrigation regime I , according to the periods of sugar beet growth. Prewatering moisture level was maintained at 70% of the lowest field moisture capacity during the irrigation regime II, according to all the periods of sugar beet growth.

The mineral fertilizers were used on certain areas in the following ratio:
65% of certain dose of the nitrogen fertilizers and 90% of the phosphatic manures were applied to basic tillage; 10% of all the fertilizers were applied to drills during the seeding; 25-30% of phosphatic manures were applied together with watering

during the trickle irrigation to the sugar beet phase of 2 pairs true leaves on certain areas.

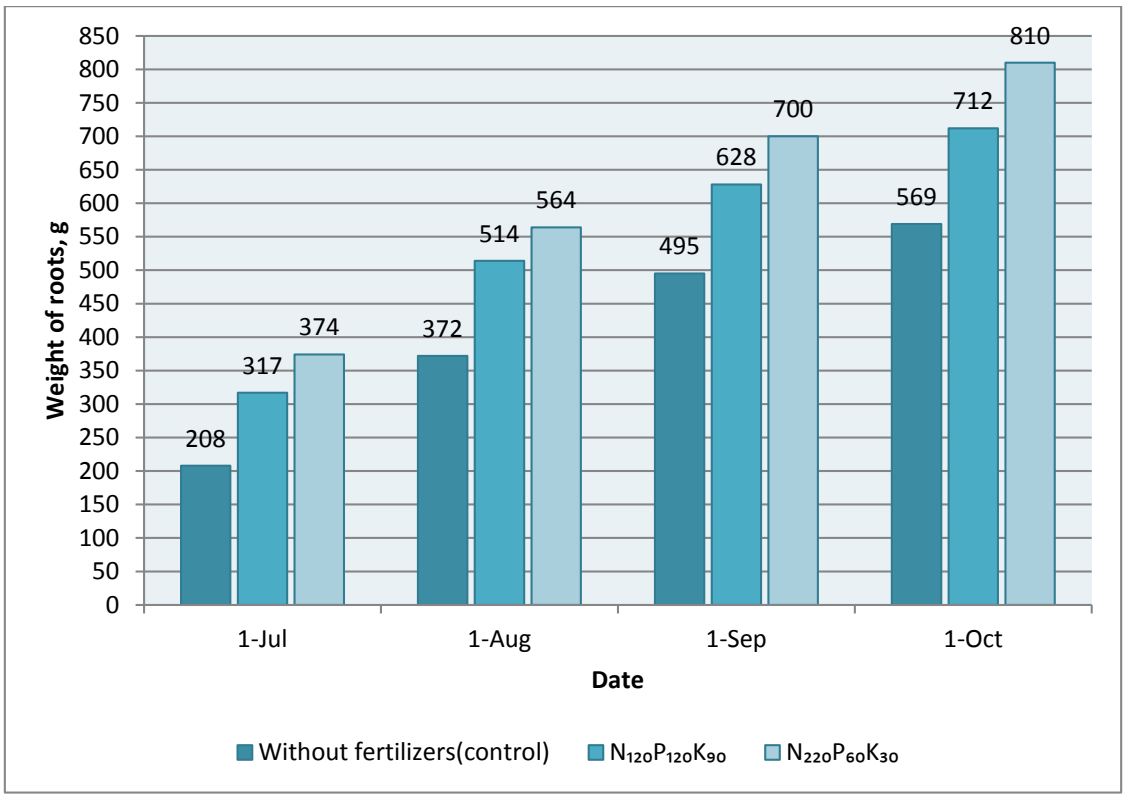
The research was repeated four times. The square area is 100 м^2, the discount area is 25 м^2. The Olexandria hybrid was seeded.

The investigation findings and discussion. While observing, there was considered that, in the variants, which were studied, the growth and development phase passing was simultaneous within the variant. It was also considered that, there is a differentiation between the variants of leaf shuttering in drills and between them. In addition to this, during all the years of research period, it was marked that these phases came 1-4 days earlier. It is explained as a result of mineral fertilizers effect on active growth.

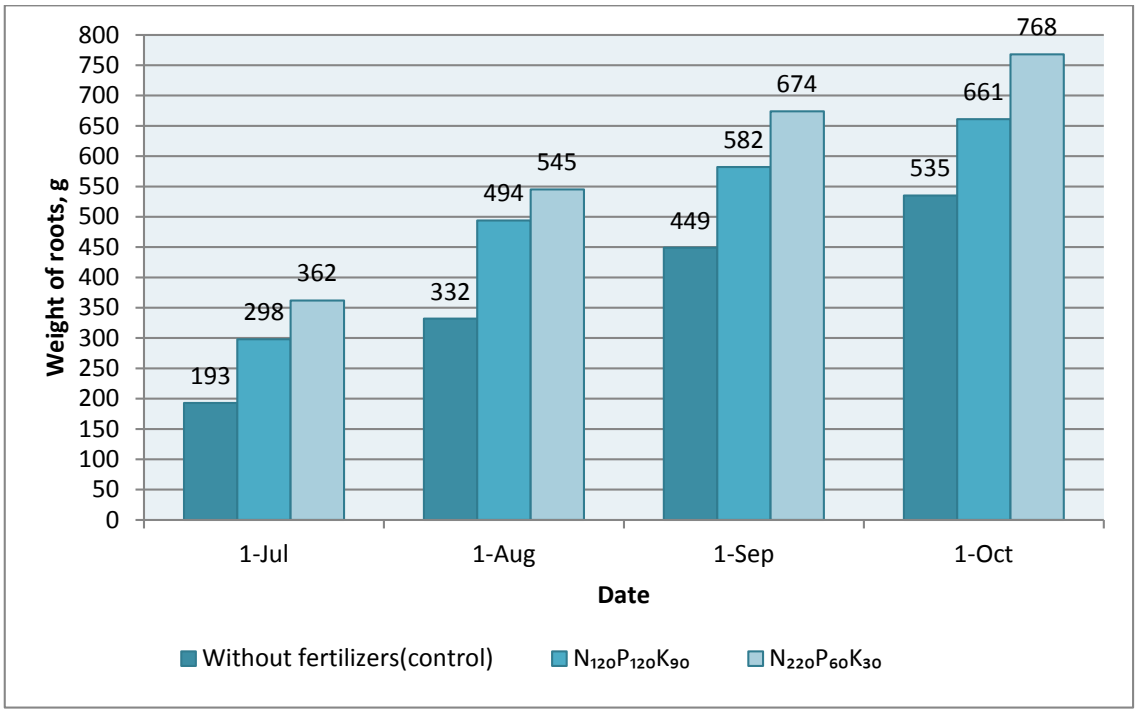
The mineral fertilizers applied on certain areas influenced to a large degree the overgrowth of the root crop and its leaves.

Thus, in the 1.07 period, during three years, at the average the overgrowth in the variants with fertilizer dose (recommended) $N_{120}P_{120}K_{90}$ was 1,4-1,5 fold higher, than in the control variant (non- fertilized), and the overgrowth in the variants with fertilizer dose (calculated) $N_{220}P_{60}K_{30}$ was 1,7-1,8 fold higher (scheme 1, 2). The leaves mass within this period was higher 1,2-1,3 and 1,5-1,6, than the appropriate indicators on the control variant.

Further, there was mentioned the continuous increase in overgrowth of the root crop in all the variants. But the fertilized one had higher overgrowth rate. Thereby, within the 01.07 and 01.08 periods, the root crop mass was increased by 139-164 g. There was an increase by 196-197 g in the variants with the fertilizer dose (recommended) $N_{120}P_{120}K_{90}$ and, by 183-190, in the variants with the fertilizer dose (calculated).



Scheme 1. The relation between sugar beet overgrowth dynamics and nutrition background (70-80-80% - the lowest moisture capacity of the irrigation regime)



Scheme 2. The relation between sugar beet overgrowth dynamics and nutrition background (70-70-70% - the lowest moisture capacity of the irrigation regime)

The irrigation regime influenced the overgrowth rate of the root crop. There also was noticed the differentiation in drills within the second part of the vegetation period. At the average, the root crop overgrowth of the irrigation regime №1(70-80-80% - the lowest moisture capacity) was by 4-10% higher than, the irrigation regime №2 (70-70-70% - the lowest moisture capacity during all the periods of sugar beet growth). Thereby, the root crop overgrowth conditions of the regime №1(70-80-80% - the lowest moisture capacity) were more favourable.

The regularity of the area differentiation under the effect of the research factors stayed firmly to the end of sugar beet vegetation period and influenced the yield index (Scheme 1).

Table 1

The effect of both nutrition regime and growth on sugar beet productivity (in the 2011-2013s)

Sl. No.	Fertilizing variant Factor B	Root crop productivity, mt/ha			The average productivity (in the 2011-2013s), mt/ha	± to the control, mt/ha	Sugar capaci-ty %	Conven-tional sugar recove-ry, mt/ha
		2011	2012	2013				
Irrigation regime I 70-80-80% of the lowest moisture capacity, factor A								
1	Non-fertilized (control)	42,2	48,8	43,5	44,8	-	15,8	7,1
2	$N_{120}P_{120}K_{90}$	87,0	58,6	68,4	71,3	26,5	16,0	11,4
3	$N_{180}P_{50}K_{30}$	92,9	62,6	94,1	83,2	38,4	15,2	12,6
Irrigation regime II 70-70-70% of the lowest moisture capacity, factor A								
1	Non-fertilized (control)	40,8	45,3	39,1	41,7	-3,1	15,8	6,6
2	$N_{120}P_{120}K_{90}$	83,9	54,6	62,0	66,8	22,0	16,1	10,8
3	$N_{180}P_{50}K_{30}$	89,8	57,8	90,5	79,4	34,6	15,3	12,1

LSD (least significant difference) $_{05}$, ha A – 2,81, B – 2,29, AB – 3,97

The recommended dose of mineral fertilizers applied $N_{120}P_{120}K_{90}$ effected the productivity increase of root crop in both irrigation regimes on the 22,0-26,5 t/ha

territories in relation to the control. The most essential increase was marked in the variants with the calculated dose applied - $N_{220}P_{60}K_{30}$ – 34,6-38,4 t/ha.

The irrigation regime I (70-80-80% of the lowest moisture capacity) was more favorauble for sugar beet growth and provided the increase in relation to the irrigation regime II (70-70-70% - the lowest moisture capacity during all the periods of sugar beet growth) to a great extent.

The irrigation regime I, which was more intensive, together with mineral fertilizers provided the increase in bioethanol recovery(calculated), with the dose $N_{220}P_{60}K_{30}$ – by 82% and with the dose of fertilizers $N_{120}P_{120}K_{90}$ - by 61% in relation to the control (scheme 2).

Table 2

The energy recovery from the unit area of sugar beet in relation to the regimes of both nutrition and irrigation

Sl. No	Fertilizing variant Factor B	Bioethanol recovery (calculated), t/ha	± to the control, mt/ha	Energy recovery, mJ/ha	± to the control, %
Irrigation regime I 70-80-80% % of the lowest moisture capacity, factor A					
1	Non-fertilized (control)	3,4	-	85000	-
2	$N_{120}P_{120}K_{90}$	5,5	2,1	137500	62
3	$N_{180}P_{50}K_{30}$	6,2	2,8	155000	82
Irrigation regime II 70-70-70% of the lowest moisture capacity, factor A					
1	Non-fertilized (control)	3,2	-0,2	80000	-6
2	$N_{120}P_{120}K_{90}$	5,1	1,7	127500	50
3	$N_{180}P_{50}K_{30}$	5,9	2,5	147500	73

The irrigation and nutrition regimes of sugar beet, which were studied during the research, effected to a great extent the final results – the cost-efficiency measure of the crop growth (Tab 3). The non-fertilized sugar beet growth resulted in high prime cost of the product (439-415 UAH/t) and appeared unprofitable. The mineral

fertilizers use effected positively the productivity of sugar beet. Thus, the recommended fertilizer dose $N_{120}P_{120}K_{90}$, which was used, influenced the rate of the root crop prime cost (323-341 UAH/t). The level of profitability under these conditions is 17,1-23,4%. The highest level of profitability was provided by the variants with the calculated dose of the fertilizers - 45,2-50,0% under the prime cost of the root crop at the rate of 276-267 UAH/t. It is noteworthy, that the improvement in soil moisture conditions (the use of irrigation regime I 70-80-80% % of the lowest moisture capacity) on all the fertilizing backgrounds enhanced greatly the profitability of sugar beet growth.

Table 3

The economical efficiency of sugar beet growth under the conditions of trickle irrigation in relation to the both nutrition and irrigation regimes, (in the 2011-2013s).

Sl. No.	Parameters	Research variants					
		70-80-80 % of the lowest moisture capacity			70-70-70 % of the lowest moisture capacity		
		1	2	3	1	2	3
1	Root crop productivity, t/ha	44,8	71,3	83,2	41,7	66,8	79,4
2	Root crop sale price, t/ha	400	400	400	400	400	400
3	Gross revenue, UAH. thous.	17,9	28,5	33,3	16,7	26,7	31,8
4	All charges included t, UAH.	18,6	23,1	22,2	18,3	22,8	21,9
5	Net income, UAH. thous.	-0,7	5,4	11,1	-1,6	3,9	9,9
6	Prime cost, UAH./t	415	323	267	439	341	276
7	Profitability level, %	-	23,4	50,0	-	17,1	45,2

Resume

1. The use of mineral fertilizers together with trickle irrigation provides the increase in productivity of root crop at the rate of 49,1-85,7%.

2. The highest productivity level of sugar beet under the conditions of trickle irrigation is gained by the calculated fertilizers dose together with irrigation regime, which supports the moisture of worked level of soil at the level not lower than 70-80-80% of the lowest moisture capacity, according to the periods of sugar beet growth.

3. The calculated dose of fertilizer use together with trickle irrigation optimal regime allows gaining the root crop product with prime cost at the rate of 267-276 UAH/t and to provide the profitability at the rate not lower than 45,2-50,0%.

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Анотація

Бутов В.М., Коцюрубенко Н.І., Оглобліна В.М.

Вплив мінеральних добрив та способів їх внесення на продуктивність цукрових буряків в умовах краплинного зрошення

Одержання гарантованих високих урожаїв цукрових буряків у південному Степу України можливо тільки в умовах зрошення. Застосування розрахункових доз мінеральних добрив у поєднанні з оптимальним режимом

краплинного зрошення дозволяє досягти високої рентабельності вирощування цукрових буряків.

Ключові слова: *цукрові буряки, мінеральні добрива, продуктивність, біоетанол, вихід енергії.*

Аннотация

Бутов В.Н., Коцюрубенко Н.И., Оглоблина В.Н.

Влияние минеральных удобрений и способов их внесения на продуктивность сахарной свеклы в условиях капельного орошения

Получение гарантированно высоких урожаев сахарной свеклы в южной степи Украины возможно только в условиях орошения. Применение расчетных норм минеральных удобрений в сочетании с оптимальным режимом капельного орошения позволяет достичь высокой рентабельности выращивания сахарной свеклы.

Ключевые слова: *сахарная свекла, минеральные удобрения, продуктивность, биоэтанол, выход энергии.*