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EFFICIENCY OF APPLICATION OF FOLIAR DRESSINGS TO SOYBEAN VARIETIES IN THE CONDITIONS OF THE RIGHT BANK FOREST-STEPPE

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Abstract

Soybean (Glycine hispida Moench.) is a promising legume crop that can solve problems of plant protein and fat, improve soil nitrogen balance and increase food production. It removes significant quantities of nutrients from the soil, so it has the potential to improve the soil's nutrient balance.

There is no doubt about the importance of soybeans as a crop that can solve the problem of vegetable protein and fat, improve the nitrogen balance of soils and increase food production. With an increase in the area of soybean crops, we note a rather low level of crop yields, when the realization of the genetic productivity potential of its modern varieties under production conditions is 50% or less. The reason for this is primarily the violation by farmers of the technological process of crop production and the lack of clear scientifically sound recommendations for cultivation technology. It is therefore an important issue that the increase in productivity of this crop is being studied.

The results of the research on the influence of foliar feeding by multicomponent chelate micro fertilizers on the yield and quality of the soybean grain are given in the article. The passage of growth processes, namely height, density and the factors influencing their passage have been investigated. The maximum survival rates of soybean plants were observed in the variant with double application of the micro fertilizer Vuksal Microplant in the phases of budding and green beans. At the same time the number of plants in Merlin during harvesting was 56.2 units / M2, and the survival rate was 93.2%, while in Kent variety, respectively, 45.7 units / M2 and 91.3%.

The studies revealed that the average daily growth of soybean plants of Merlin variety was in the range of 0.90-0.94 cm, while that of Kent variety was 0.96-1.00 cm.

Keywords: soybean, foliar nutrition, height, density, growth processes, variety.

The demand for soya has grown considerably in recent years and has become consistently high. After all, this crop is financially worth considerably more and is much more expensive than wheat. The demand for soybeans and their processed products increases every year. This is why soy is grown throughout Ukraine, but the largest areas of cultivation and yields are in the central part of Ukraine, particularly in Khmelnitsky, Vinnitsa, Kiev, Kirovograd and Poltava regions.

In 2006 Ukraine ranked first in Europe in terms of soybean production and in 2017 is among the nine largest soybean producing countries in the world and has great prospects for crop expansion. The main factors are the creation and introduction of new generation soybean varieties, the development and implementation of varietal technology for its cultivation, and the popularity of the crop in the market.

One of the important factors, influencing formation of grain yield of soybean is density of plants standing. It is known that in the process of growth and development soybean plants are constantly exposed to natural and anthropogenic factors, and therefore naturally their number may decrease over time. Thus, survival rate is a value that indicates the proportion of plants that survived in the herbage during the period from full sprouting to economic ripeness.

Analyzing the research on the quality of seeds of crops G.N. Alekseychuk and N.A. Laman found that the density of soybean plants depends on the ripeness of the variety. Thus, at the time of harvesting for the majority of varieties of medium and early maturing groups optimal is 600-750 thousand plants per 1 ha, for late maturing groups of varieties - 500-550 thousand / ha [1].

Changing the density of soybean plants influenced the degree of use of the main life factors, and their interaction determined the value of yield and its structure. Illumination and feeding area for soybean are important in yield formation. Regarding density, soybean is a relatively plastic crop. By choosing the best row spacing and seeding rate it is possible to achieve the yield potential of the soybean variety. In soybeans, not only productivity is important, but also other characteristics such as plant height and branching, height of lower bean attachment, lodging tendency, and length of growing season. During the growth and development of the plants there was a constant change in the distribution of their underground and above-ground organs in the horizontal and vertical directions, changing the volumes of space and soil depending on the size and configuration of the feeding area. Plant height and the height of attachment of the lower beans were important indicators affecting the value of the yield. The height of the plants was influenced by the method of sowing. [2].

Sokirko P.G. notes that another factor influencing the productivity of plants is their height. It is known that the dynamics of this indicator during the growing season can be established how the conditions of growth and development of plants in ontogenesis, as well as find the most optimal conditions for the formation of highly productive agrophytocenoses [3].

According to Chinchik A.S. the best indicators of the yield structure in all the studied varieties were noted on the variant with the introduction of full mineral fertilizer in norms and N30P60K60, with the application of seed treatment Rizogumin and the use of micro fertilizer Vuxal [4].

The research was conducted during 2017-2018. On the experimental field of Vinnitsa National Agrarian University. The research was supposed to study the action and interaction of factors: A - variety; B - foliar feeding. Gradation of factors 2x4. Repetition of experience three times. Placement of the variants is systematic in two tiers. The system of fertilization was supposed to apply phosphorus and potassium fertilizers (simple granulated superphosphate and 40% potassium salt) at the rate of P60K60 kg/ha a.d. under the main tillage and nitrogen fertilizers in the form of ammonium nitrate (N30) under pre-sowing cultivation.

Seed dressing was conducted 14 days before sowing with Maxim XL 035 FS dressing (1 l / t seed). Seeds were inoculated with Optimize 200 the day before sowing.

Sowing of soybean was carried out by broad-cut method in the first decade of May using a SUPN-6 seeder, at a thermal regime of 12oC, with embedding it to a depth of 3 cm.

In the experiment SAATBAU soybean varieties in different groups of ripeness were used: Merlin (100 days) and Kent (120 days) with the recommended rates of sowing, namely 650 and 550 thousand units/ha respectively. The varieties were characterized by significant and stable yield and high quality seed composition.

The organo-mineral fertilizer Vuxal Microplant was applied at the rate of 1.5 l/ha. This fertilizer is recommended for foliar feeding of crops grown on intensive technology. The use of Vuksal Microplant guarantees the supply of all microelements necessary for the plant during the period of active growth. It eliminates acute and prevents hidden deficiency of microelements and increases crop productivity. The composition of Vuksal Microplant includes: total nitrogen - 78.0 g / l; water-soluble potassium - 157.0 g / l; water-soluble magnesium - 47.0 g / l; water-soluble sulfur - 202.5 g / l; water-soluble boron - 4.7 g / l; water-soluble copper -7.9 g/l; water-soluble iron -15.7 g/l; water-soluble manganese - 23.6 g/l; water-soluble molybdenum - 0.15 g/l; water-soluble zinc - 15.7 g/l.

Research, counts and observations were carried out according to widely approved methods in crop production. Phenological observations of growth and development of soybean were conducted in accordance with the "Methodology for research on forage production" [5], "Basics of scientific research in agronomy" [6].

The phases of plant growth and development were recorded. The beginning of the phase was established when it occurred in 10% of plants, the full phase in 75% of plants [7];

In the course of field studies, such, phenological observations and records were made:

- Phenological observations were carried out according to the "Methodology of State Variety Testing of Agricultural Crops".
- field germination of soybean seeds and integrity of plants were determined using conventional methods [7].
- plant height was determined by measurements on 25 pegged plants during the main growth and development phases of soybean plants in two non-contiguous replications [7];
- plant density was determined in permanently staked plots, in triplicate [7];
- leaf surface area of soybean plants during the appropriate growth phases was determined by the "whisker" method with subsequent calculations according to the method of A. A. Nechiporovich [8].
- before harvesting, a sample sheaf was taken from each variant to determine the individual productivity of soybean plants.

In the course of the researches, it was established that the indicators of soybean plants density underwent changes in the process of growth and development. So, in the period of full sprouts density of plants in the variety Merlin was in the range 59,7-60,3 pcs. / M2, while before harvesting this figure was 54,4-55,5 M2 for the variety Merlin. Depending on the scheme of application of foliar dressing on soybean the number of plants that remained at the time of harvest seems to differ. On the variant without foliar dressing before harvesting soybean variety Merlin, 54.4 pcs/M2 remained, with a survival rate of 90.4% (Table 1).

Table 1

Standing density and plant survival of soybean phytocenoses as a function of growing practices, (2017-2018 average)

Sort	Foliar applications	Plant density, pcs/M^2		Plant survival rate, % to the number of shoots
		At full sprouting phase	Before harvest	
Merlin	no fertilizer	60,2	54,4	90,4
	during the budding phase	59,7	54,6	91,5
	in green bean phase	59,9	55,5	92,7
	in the budding phase + in the green bean phase	60,3	56,2	93,2
Kent	no fertilizer	49,8	44,6	89,5
	during the budding phase	50,3	45,3	90,1
	in green bean phase	50,0	45,4	90,7
	in the budding phase + in the green bean phase	50,1	45,7	91,3

When using the micro fertilizer Vuxal Microplant in the phase of budding the number of plants compared with the control variant increased insignificantly and amounted to 54.6 units / M2. The survival rate was 91.5%.

The survival rate of soybean plants of the Merlin variety (92.7%) was slightly higher when microfertilizers were applied at the phase of green soybeans. Whereas the density of plants in the period before harvesting was 55.5 units / M2.

The highest survival rates of soybean plants of Merlin were observed in the variant with double application of micro fertilizer Vuxal Microplanta in the phases of budding and green beans. At the same time the number of plants at the harvesting period was 56.2 units / M2, and the survival rate was 93.2%.

Cultivation of soybean sort Kent on the variant without additional fertilization provided formation of the following indicators: number of plants at the period of harvesting - 44.6 units/M2, and survival rate was 89.5%.

The foliar dressing of soybeans at the phase of budding resulted in harvesting of 45.3 plants / M2, while the survival rate was 90.1%. When foliar dressing was applied at the phase of green beans, the number of plants at the time of harvesting was 45.4 pcs/M2, while the survival rate was 90.7%.

The combination of foliar dressing during phases of budding and green beans with the micro fertilizer Vuxal Microplant in the soybean variety Kent contributed to the formation of 45.7 units / M2 plants at the time of harvest, with a survival rate of 91.3%.

Thus, it was found that foliar dressing had no significant effect on the survival rate of soybean plants. Compared to the control variant, plant survival with double application of micro fertilizers increased only by 1.8-2.8%.

A number of scientists note that formation of yield of any crop, including soybean, takes place from the initial phases of their growth and development and practically does not depend on all factors put to study. Studying the processes of soybean plants growth in height, accumulation of their above ground biomass, formation of leaf surface area, etc., it was established that linear growth of plants height during all vegetation tends to increase. However, unfavorable growing conditions can affect this indicator: it can remain without significant changes, i.e., at the same level, or increase insignificantly. Certain periods of growth and development of agricultural plants are generally defined by certain measures of linear height. Plant height gives an estimate of the influence of a particular cultivation factor in any crop [9,10].

Numerous researchers have noted that plant height growth is most strongly influenced by mineral fertilizers [11,12]. In addition, increasing the dose of nitrogen nutrition, leads to significant growth of this indicator. The role of fertilizer in enhancing growth processes such as linear height and accumulation of aboveground mass has been mentioned by a number of other researchers [13, 14, 15].

The study of productivity of soybean varieties, taking into account the intensification of technology found that the best performance elements of yield structure was traced on foliar dressing of micro fertilizer Reakom-S-bean (4 l / ha) in combination with preharvest sowing with ammonium nitrate (10% solution), with the number of beans per plant was 32.0-34.8 units, number of seeds per pod - 2,4-2,6 pieces, weight of 1000 seeds - 151-163,7 g [20].

Of course, the growth of plants in height depends on many other factors of cultivation, such as their moisture supply, stem density of plants, predecessors, biological features of the variety or hybrid, the zone where they are grown, and so on.

Our studies have shown that the linear height of soybean plants varied under the influence of the created nutritional backgrounds and in accordance with the varietal characteristics of the crop.

As a result of our field studies, it was revealed that the height of soybean plants during the growing season underwent changes and significantly depended on the factors studied, namely foliar feedings and varietal characteristics of the crop.

In the course of the research, it was established that the height of the soybean plants of the variety Merlin in the phase of the 3rd leaf was the same in all the variants and was 16.1 cm and in the variety Kent - 16.6 cm. At the flowering initiation phase, the plant height of Merlin soybean plants was between 33.8-35.5 cm and that of Kent soybean plants was 55.1-56.0 cm (Table 2).

At the end of flowering phase, the height of Merlin soybean plants in the variant without dressing was 74,9 cm, with dressing during budding phase - 77,8 cm, during green beans phase - 77,0 cm, and with a combination of dressing - 78,5 cm.

The height of Kent variety soybean plants in this phase (the end of flowering) was 95.6 cm when no top dressing was applied; 97.6 cm when top dressing was applied at the phase of budding and 97.2 cm when green beans were formed. In the variant with a combination of top dressing at the phase of budding and formation of green beans, the height of plants at the phase of the end of flowering was 98.5 cm.

Table 2

Linear growth of soybean plants as a function of variety and foliar application, cm
(average for 2017-2018)

Sort	Foliar applications	Growth and development phases				
		Third trigeminal leaf	Beginning of flowering	Close of bloom	Full seed pot	Average daily gain
Merlin	no fertilizer	16,6	55,1	95,6	111,8	0,96
	during the budding phase	16,6	55,9	97,6	114,1	0,98
	in green bean phase	16,6	55,1	97,2	115,1	0,99
	in the budding phase + in the green bean phase	16,6	56,0	98,5	116,0	1,00
Kent	no fertilizer	16,1	33,8	74,9	88,4	0,90
	during the budding phase	16,1	35,3	77,8	89,6	0,91
	in green bean phase	16,1	33,9	77,0	90,5	0,92
	in the budding phase + in the green bean phase	16,1	35,5	78,5	91,8	0,94

The most significant difference between the variants was in the phase of full seed ripening. The Merlin variety had a plant height of 88.4 cm in the variant without top dressing. At carrying out foliar feeding in a phase of budding the height of plants was within 89,6 cm, in a phase of green beans - 90,5 cm, and at a combination of these phases - 91 8 cm.

The plant height of the variety Kent at this phase was slightly higher. The variant without nutrition had a height of 111.8 cm, with nutrition during the phase of budding - 114.1 cm, during the phase of green beans - 115.1 cm, and with a combination of these phases - 116.0 cm.

The research revealed that the average daily growth of soybean plants of Merlin variety was in the range of 0.90-0.94 cm, while in Kent variety it was 0.96-1.00 cm.

In addition, the leaf surface area of the plants is considered an important indicator for the formation of linear growth. As a photophilic crop, soybean plants produce high yields only when they are optimally fed and well-lighted. Soybean is characterized by high plasticity with respect to plant density, manifested in the change of individual productivity - fluctuations in the number of nodes, branches, beans, seeds, their weight, height of the attachment of lower beans, etc. [16].

Underharvesting of soybean grain is often caused by insufficiently rapid growth of the leaf surface area, as a result of which the crops do not fully realize their photosynthetic capabilities. Therefore, to solve this problem it is necessary to scientifically substantiate the rate of seeding, taking into account the variety features of soybeans and carrying out foliar feedings at the appropriate phases of growth and development.

Our research showed that the leaf area of soybean plants was dependent on the varietal characteristics of the crop and the time of foliar application (Table 3).

The first record of the leaf surface area of soybean plants was made at the phase of the 3rd tee leaf. It was found that the leaf surface area varied depending on the varietal characteristics of the crop. Thus, in the variety Merlin indicators of leaf area were within 9.46-9.52 thousand M^2/ha, while in the variety Kent - 9.50-9.56 thousand M^2/ha.

The area of leaf surface of soybean plants during growth and development gradually increased, and reached its maximum during the period of seed ripening. At the same time in the variety Merlin leaf area in the variant without foliar feeding was 39.44 thousand M^2/ha. At a single feeding of soybean microfertilizer Vuxal Microplanta the area of leaves rose to 41.32 thousand M^2/ha, while the feeding in the phase of green beans - 41.95 thousand M^2/ha. The highest level of leaf area of soybean variety Merlin was in the variant with double application of microfertilizer in phases of budding and formation of green beans and amounted to 42.12 thousand M^2/ha.

Table 3

Leaf area formation of soybean varieties as a function of foliar application, thousand M^2/ha (average for 2017-2018)

Sort	Foliar applications	Growth and development phases				
		Third trigeminal leaf	Beginning of flowering	Close of bloom	Full seed pot	Average daily gain
Merlin	no fertilizer	9,48	32,94	38,08	39,44	29,28
	during the budding phase	9,46	33,85	39,47	41,32	30,84
	in green bean phase	9,52	33,41	38,61	41,95	31,67
	in the budding phase + in the green bean phase	9,47	33,92	39,52	42,12	32,54
Kent	no fertilizer	9,50	34,60	39,76	42,21	31,76
	during the budding phase	9,55	35,43	41,17	42,97	32,32
	in green bean phase	9,53	34,65	40,57	43,18	32,52
	in the budding phase + in the green bean phase	9,56	35,53	41,20	43,53	33,75

Indices of leaf area in soybean variety Kent at the phase of filling the seeds were also the highest and were as follows: without fertilization - 42.21 thousand m^2/ha, with top dressing during the phase of budding - 42.97 thousand m^2/ha, in the phase of green beans - 43.18 thousand m^2/ha. The maximum value of the leaf area was recorded in the variant with a combination of feeding micro fertilizer Vuxal Microplanta in the phases of budding and formation of green beans, which amounted to 43.53 thousand m^2/ha.

In the later phases of growth and development of soybean leaf area of plants decreased, which can be explained by the biological characteristics of the crop, namely the increased outflow of plastic substances from the vegetative mass to the seeds, in turn leads to the gradual dying off and fall of the leaves.

Thus, in the soybean variety Merlin, in the phase of physiological maturity of the seeds low rates of leaf area were observed in the variant without fertilization and amounted to 29.28 thousand m^2/ha, while large - in the variant with double micro fertilization in the phase of budding and green beans was 32.54 thousand m^2/ha.

In the phase of physiological maturity of seeds low indicators of the leaf area of soybean variety Kent were traditionally in the variant without microfertilizer and amounted to 31.76 thousand m2 / ha, while the high (33.75 thousand m^2/ha) were recorded upon the foliar application in the phases of budding and green beans.

It should be noted that foliar feeding by multicomponent water-soluble fertilizer Vuxal Micropalant in general had a positive effect on increasing the leaf area of soybean crops in both varieties.

Thus, we can form the following conclusions: the high rates of survival of soybean plants were observed in the variant with double application of the microfertilizer Vuxal Micropalant in the phases of budding and green beans. At the same time, the number of Merlin cultivar plants at harvest was 56.2 M^2, and survival rate was 93.2 %, while in Kent cultivar it was 45.7 M^2 and 91.3 %, respectively [17,18, 19].

The studies revealed that the average daily growth of soybean plants of Merlin variety was in the range of 0.90-0.94 cm, while that of Kent variety was 0.96-1.00 cm.

The area of leaf surface of soybean plants reached its maximum during the period of seed ripening in variants with double foliar application of top dressing. At the same time representative in the variety Merlin were at 42.12 thousand M^2/ha, and in the variety Kent - 43.53 thousand M^2/ha.

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EVALUATION OF EFFICIENCY OF APPLICATION OF GROWTH STIMULATORS AND MICRO-FERTILIZERS IN MAIZE CROPS

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Abstract

Maize varieties and hybrids are characterized by increased requirements for nutritional conditions and only with a full and balanced supply of nutrients can fully realize their genetic potential. An important measure of modern intensive technologies for growing high yields of corn for grain is the use of biologically active compounds that can affect the intensity of physiological processes and affect the production process of agricultural production. In addition to growth stimulants, much attention is paid to the use of trace elements that are active catalysts that accelerate biochemical reactions and affect their direction. Lack of micronutrients can adversely affect the growth and development of corn plants.

Treatment of corn seeds before sowing with growth stimulant Biolan, normal consumption of 15 ml/t, and during the growing season of corn plants in the phase of 6-7 leaves of foliar spraying with micronutrients Quantum Gold at a rate of 2 l/ha + Chelatin Zinc, 1 l/ha, will allow to obtain grain yield of maize hybrids at the level of 6,79-8,17 t/ha.

Keywords. corn, technology, seeds, growth stimulants, microfertilizers, yield.

Formulation of the problem.

Corn (species Zea maus L.) is one of the main crops of modern world agriculture. This is a culture of versatility and high yields.

Corn grain is an excellent fodder. 1 kg of grain contains 1,34 feed units and 78 g of digestible protein. This is a valuable component of feed. However, corn grain protein is poor in essential amino acids - lysine and tryptophan - and rich in low-value protein - zein. Among cereals, corn is the most valuable in terms of energy nutrition, characterized by a high content of starch and fat, low - fiber.

Ukraine has a great potential for grain production, because the climatic conditions of Ukraine sufficiently meet the biological needs of corn, so now an important area of scientific support of crop production is the creation of varieties and hybrids with high genetic resistance to biotic and abiotic environmental factors [4]. Thanks to the introduction of innovative hybrids and the expansion of sown areas under corn, Ukraine is among the six major producers of corn grain in the world and in the top five exporters [5]. This requires a reassessment of all elements of the technology of growing corn in order to significantly increase grain production in our country.

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