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INFLUENCE OF CULTIVATION METHODS ON THE FORMATION OF INDIVIDUAL PRODUCTIVITY OF AMARANTH

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ABSTRACT

Today we can say that amaranth is a valuable fodder, food and medicinal plant, the green mass of which can be used in livestock production both in fresh form and for the preparation of silage and protein-vitamin concentrate. In terms of amino acid balance, green mass of amaranth is of the same quality as alfalfa, but compared with other legumes has a higher lysine content. For pigs, the protein of green mass of amaranth is close to the ideal.

Amaranth seeds have high nutritional value and contain oil, which has bactericidal activity and anticancer effect. Compared to other agricultural plants, amaranth spends two to three times less water to form a unit of organic matter.

However, the introduction of amaranth into culture in Ukraine requires determining its appropriate place in the structure of fodder and food resources, justification of agroecological and technological bases of cultivation, identification of species with high adaptive potential and high ability to realize productivity, creation of varieties of appropriate directions of use, development of cultivation technology. No less important is the economic efficiency of amaranth production.

Keywords: amaranth, linear growth, density, yield, variety, individual performance.

Amaranth refers to crops of universal use. It is a food, fodder, medicinal, technical and ornamental plant. Prospective is the use of amaranth in medicine as an anti-inflammatory, styptic, diuretic, antibacterial agent, as well as in cancer. Amaranth is a source of valuable biologically active compounds that can be used in various areas of the economy [1, 2, 3].

Juan Manuel Vargas López, a researcher from the University of Sonora (Mexico), recalls Spanish chronicles of the time, indicate that Aztec territory of over 5,000 hectares was planted with amaranth and yielded 1.5 to 2 tons of grain per year, giving it the third largest area occupied, after corn and beans [4].

The U.S. government funds special programs on amaranth. All this made it possible to begin industrial production of amaranth products. Now on the shelves of diet stores in the U.S. you can see up to 30 items of products with amaranth additives from bread and candy to meat grown on amaranth fodder, which costs 25% more than conventional [5].

In Ukraine, amaranth spread in 1989 - 1992. However, the lack of high-yielding varieties, failure to comply with agricultural practices of cultivation did not allow to fully realize the potential of this crop. At farms Mironovsky, Boguslavsky districts of Kyiv region, Gaisin district of Vinnitsa region amaranth yield reached 800-1020 kg / ha of green mass.

This culture provides a high yield of not only green mass, but also grain. In the Polissya zone amaranth is harvested at an average yield of 20-25 kg / ha, and in the south of Ukraine - more than 40 kg / ha of grain. Amaranth reproduction rate through fractional seeds and low seeding rate (1.5-2 kg / ha) is high. Thus, one amaranth plant provides from 300 to 600 thousand seeds, which is enough for seeding on the area of 0.1-0.2 ha [6-7].

A characteristic feature of amaranth leaf mass can be considered a relatively high content of monosaccharides (65.6-96.5% of reduced), high concentrations of ash (16-24%) and fiber (25.7%). Green mass of amaranth can become not only one of the main sources of high-protein vegetable products, but also a protein component of livestock rations, including as a raw material for the preparation of silage mixed with green mass of high-sugar crops [8-9].

The oil also contains tocopherols (2%), phytosterols (2%), phospholipids (10%) and other biologically active substances. The unique biochemical composition of amaranth oil (comparable to sea buckthorn oil) determines its wide application, for example, as an anti-burn and healing agent. Amaranth grain contains on average 8% or more oil in which up to 20% squalene was found [10, 11, 12].

Amaranth belongs to the high-protein crops. Thus, the yield of protein per hectare of the crop on average is about 200 kg, while that of barley and wheat is an order of magnitude lower than that of amaranth. If we estimate conditionally protein quality as 100 points, amaranth protein has 75-82, cowpea - 72, soybean - 68, wheat - 57, corn - 44 points. The high quality of protein is due to the fact that most of the seeds occupy the germ contains all the essential amino acids. The total protein content in the seeds of different amaranth species varies from 17.8 to 13.7% [13].

Due to studies [14], four main phenophases are distinguished: branching, budding, flowering, and fruiting. The vegetative phase begins from seed germination to the formation of generative organs. On average, it lasts 48 days in A. caudatus and A. emeritus, 93 days in A. hybrids, and 71 days in A. mantegarzianus. The onset of the following phenophases in different species and cultivars is observed at different times: the earliest formation of inflorescences is in A. corruptus, A. cadatus on 37-44 days, in A. mantegarzianus - on 59 days. Later in A. haberdus - 69 days.

Flowering occurs in A. *cruentus* and A. *caudatus* on 47-58 days, in A. *haberidus* on 98 days. The beginning of fruiting on day 69-75 is observed in A. *cruentus*, A. *caudatus*, and A. *mantegarzianus*, A. *haberidus* on day 120-140. The budding phase is short (28 days); the flowering phase is the longest during the growing season [15].

An important biological feature of amaranth is its ecological plasticity, which manifests itself in good adaptability to different soil and climatic conditions. It should be noted that the significant advantages of amaranth include high drought tolerance, responds well to agrotechnics and fertilizers, high reproduction rate and low seed rate, resistance to pests [15-16].

Pre-cultivars. Amaranth is placed in forage and field crop rotations. It may be preceded by annual and perennial grasses, cereals and legumes, potatoes, fodder beets and other row crops. The best predecessors for amaranth are those that release the field early. After them it is possible to qualitatively clear the soil of weeds.

Tillage. The main task of tillage for amaranth is to control weeds, its leveling, fertilizing. After stubble predecessors, the first stubble shallowage is carried out in two tracks to a depth of 6-8 cm. On clogged plots in 10-12 days after the first one, the second shallowing on a depth of 10-12 cm is carried out. In autumn, winter plowing is carried out.

In spring, close the moisture with heavy harrows in two trails. Before sowing, the soil is carefully leveled, brought to a fine state, and rolled. The first spring cultivation is carried out at a depth of 8-10 cm, the second - 6-8, pre-sowing - 3-5 cm.

The timely and qualitative soil preparation allows the seeds to be uniformly sown and ensures favorable sprouts [17, 18].

Fertilizers. Amaranth responds well to mineral fertilizers, increasing the crop yield. Complete mineral fertilizer (Nrk) on soils with low potassium content should be applied in a ratio of 1: 1:

2. 2. In experiments conducted in the 1990s in RUE "Scientific and Practical Center of the National Academy of Sciences of Belarus on Agriculture," the highest yield of amaranth was obtained when using fertilizers at a dose of N90-120P60K90; it was 281-295 kg / ha of green mass. When only nitrogen fertilizers (N90) were applied, the yield decreased by 15% compared to the same dose on the background P60K90 [3, 17, 13, 19].

Amaranth should be sown when the weather is constantly warm and the soil warms up to 8-10°C. At the same time, good results are also obtained by sowing amaranth in June, but always in moist soil. In three-year studies conducted by RUE "Scientific and Practical Center of the National Academy of Sciences of Belarus on Agriculture", no definite dependence between the timing of sowing amaranth and its yields was established. Analysis of yield structure showed that from early to late sowing dates the proportion of leaves increased from 27 to 34%, and protein content in plants increased from 16.0% at sowing on April 26 to 19.9% at sowing on May 24. At early sowing dates, amaranth sprouts appear in 19-20 days, at later dates - in 8-10 days [20].

It is preferable to sow amaranth early for silage in the first decade of June. The depth of seed embedding into the soil should be 0,5-1,5 cm. Deviation from these parameters leads to prolongation of mass appearance of seedlings due to uneven germination, to their weakening and liquefaction [21].

Seeding rates of amaranth depend on the width of row-spacing and vary from 0.8 to 3 kg / ha. In experiments conducted by NPC on agriculture, it was found that with a row spacing of 60 cm it is 0.8-1 kg of seeds per hectare, with 45 cm - 1.2-1.4 kg / ha, with 15 cm - 2.5-3 kg / ha of seeds. In wide-row sowing (60 cm) with an increase of seeding rate from 0.5 to 1500000. Seeds per 1 ha yield of green mass of amaranth increased from 237 to 286 kg / ha. A further increase in seeding rate did not lead to a significant change in yield. When determining seeding rates, it should be taken into account that, despite the high laboratory germination (95%), amaranth seeds provide a fairly low field germination (about 35%) even under relatively favorable conditions [22].

Amaranth can be sown both in wide rows and in continuous rows. Seeding with a row spacing of 45 cm is considered optimal. At this inter-row width, 12-row beet seeders can be used for sowing, and then inter-row tillage can be used for weed control.

The environment is characterized by a diverse combination of conditions for the existence of plants. Very often plants are affected by adverse environmental factors, under certain conditions can be life-threatening or cause deviations in the course of physiological processes. Plants have to constantly adapt to a complex of factors changing environment in different climatic zones and maintain a relatively stable equilibrium of physiological processes. Of the unfavorable factors, the most common are: ground and atmospheric drought, high and low temperature, excess salts and lack of oxygen in the soil, the effects of harmful gases, dust and heavy metals in the air. In particular, all these factors affect the safety (survival) of amaranth plants by the time of harvesting (Table 1).

Table 1

Standing density and survival rate of amaranth plants depending on variety and sowing method

Method of sowing	Sort	Plant density, pcs / m2						Plant survival,%		
		in the germination phase			before harvesting					
		2019	2020	cep.	2019	2020	cep.	2019	2020	cep.
Linear, 15 cm	Ultra	89	85	87	52	43	48	58	51	55
	Lera	90	88	89	54	48	51	60	55	57
	Helios	91	88	90	56	40	48	62	45	53
Wide row, 45 cm	Ultra	75	71	73	68	52	60	90	73	82
	Lera	73	72	72	64	55	60	88	76	82
	Helios	74	74	74	72	62	67	97	84	90
Wide row, 70 cm	Ultra	56	55	56	53	44	49	95	80	87
	Lera	54	54	54	49	43	46	91	80	85
	Helios	56,4	55	56	54	50	52	96	91	93

Thus, on average for two years, the higher percentage of preservation of amaranth plants was noted in the variant with a row spacing of 70 cm, which is explained by more favorable conditions for growth and development of amaranth due to inter-row tillage in this variant.

Particularly, if in the period of complete sprouts density of plants per square unit was by 16-33 plants/m2 higher in the variant with line sowing due to the higher seeding rate (100-110 thousands seeds/ha), by the period of harvesting the number of amaranth plants in the variant with line sowing was 14 plants/m2 lower (average by years and varieties) compared with inter-row sowing, i.e. plants survived by 30-34% less here. The highest density before harvesting was noted in amaranth sowing with 45 cm row spacing, which in 2020 and 2019 conditions was 52 and 68 pcs/m2 respectively at the time of harvesting of plants, that is, in 2020 plant survival was lower by 14%, which is associated with harsher agrometeorological conditions of amaranth growing season, which were in this year.

We also noted a tendency of changing the coefficient of plant survival depending on the variety. Thus, on average by sowing method for the variety Ultra, this indicator was 68 and 81% in 2020 and 2019, respectively, for the variety Lera - 70 and 80% for the variety Helios - 73 and 85%.

On average for two years, the highest survival rate of amaranth plants was observed in the variant with seeding at 70 cm for the variety Helios - 93%, which is 6-8% higher than the variety Ultra and Lera.

The juvenile age state of plants in amaranth is specific, since hidden growth is observed. A week or two after germination, depending on the timing of sowing, growth of the above-ground part slows down and within 3-4 weeks there is intensive development of only the root system. It is during this period, careful weeding of young plants is necessary, otherwise they will be choked by weeds, which, in turn, will affect the productivity of the crop. Thus, on average, for two years the lowest level of weed infestation was observed when sowing with a row spacing of 70 cm. And at the beginning of the crop vegetation, the total number of weeds in the experimental variants was from 5.5 to 10.8 pcs. / M2 depending on the method of seeding. The greatest number of weeds was observed when using row cropping method - 10.8 pcs./M2 .

At the time of harvesting amaranth weed infestation of crops decreased by 2.9-4.5 times, but the general trend remained: crops with row spacing of 70 cm had 30% less weed infestation compared to other variants of the experiment (the average for 2019-2020). Thus, due to the possibility of inter-row cultivation in the crops with row spacing of 70 cm, the weed infestation of the stem was less. Due to the greater number of plants in this variant increased the competitiveness of such crops in the fight against weeds, there was inhibition of growth and development of the latter.

Weed infestation was also determined by weather conditions of individual years. Thus, in 2019 we observed a lag in the development of not only cultivated plants, but also weeds. Compared with 2020, the number of weeds in amaranth crops was 7-18% lower at the beginning of the growing season and 14-18% lower before harvesting the crop.

One of the main features characterizing the rate of growth and development of cultivated plants is the height of the central stem. Weather conditions of growing years, as well as different spatial placement of plants in the crop influenced the growth of amaranth plants. Table 2 shows the results of plant height accounting depending on the width of the row spacing and variety.

Table 2

The height of amaranth grain plants depending on the variety and method of sowing

Method of sowing	Sort	2019	2020.	Average for 2019-2020.
Linear, 15 cm	Ultra	139	132	136
	Lera	140	124	132
	Helios	133	126	130
Wide row, 45 cm	Ultra	117	108	113
	Lera	116	106	111
	Helios	115	102	109
Wide row, 70 cm	Ultra	105	92	99
	Lera	105	92	99
	Helios	101	90	96

In particular, it should be noted that in more favorable on moisture availability in 2019, the height of amaranth plants was greater in crops with a row spacing of 15 cm - 137 cm, and in crops with a row spacing of 45 and 70 cm - it was 21-34 cm less. A similar pattern was observed in 2020. Linear growth rates in 2019. were also slightly higher than 2019 (Figures 3.2, 3.3).

On average, however, the following trend was observed over the two years: as plants densified on 1 hectare and with row spacing narrowed to 15 cm, amaranth plant height increased, and by a significant amount (22-35 cm). This can be explained by the fact that in plots with 15 cm row-spacing the plants competed with each other more strongly by clustering in rows, so in the struggle for light and nutrients they actively increased the height compared to the variant where the width of the row-spacing was 45-70 cm. The growth rate of plants in the initial period was largely determined by varietal characteristics. In the first one to one and a half months of the growing season, most of the varieties studied in 2020 had a height of 26 cm in the variety Helios to 27 cm in Ultra and Lera, and in 2019 from 31 cm in Ultra and Helios to 32 cm in Lera varieties.

From the second month of vegetation comes a period of intense growth and after 50 days, the difference in plant height ranges from 54 to 60 cm in all varieties studied.

In the variety Ultra, plant height was the least variable over the years of cultivation - 111-118 cm. Apparently, plants of this variety are more resistant to low precipitation deficit compared to Lera and Ultra varieties, and therefore, they differed in greater plant height uniformity within the variety. However, it was still noted that in 2020 with lower precipitation compared to 2019, amaranth plants of all varieties studied differed in height between 7% and 12%.

A great role for the formation of a high yield of amaranth is played by biological features of varieties and the complex of economically useful traits associated with them. Our studies found that the value of the elements of amaranth yield structure differed depending on the variety and method of sowing (Table 3).

Table 3

Elements of amaranth yield structure depending on the variety and method of sowing

Sowing method, Row spacing	Sort	lenght of panicle	Chick weight, g	Weight of a plant, g	Weight of 1000 seeds, g
2019					
Linear, 15 cm	Ultra	52,4	78,4	157	0,67
	Lera	62,6	85,7	171	0,69
	Helios	63,3	95,2	190	0,69
Wide row, 45 cm	Ultra	56,1	81,8	164	0,70
	Lera	66,2	91,8	184	0,70
	Helios	69,2	93,5	187	0,70
Wide row, 70 cm	Ultra	58,0	85,1	170	0,72
	Lera	69,9	98,6	197	0,72
	Helios	69,5	100,6	201	0,73
2020					
Linear, 15 cm	Ultra	45,6	70,0	140	0,60
	Lera	54,4	76,5	153	0,62
	Helios	55,0	85,0	170	0,62
Wide row, 45 cm	Ultra	48,8	73,0	146	0,63
	Lera	57,6	82,0	164	0,63
	Helios	60,2	83,5	167	0,63
Wide row, 70 cm	Ultra	50,4	76,0	152	0,65
	Lera	60,8	88,0	176	0,65
	Helios	60,4	89,8	180	0,66

Average for 2019-2020					
Linear, 15 cm	Ultra	49,0	74,2	148	0,64
	Lera	58,5	81,1	162	0,66
	Helios	59,1	90,1	180	0,66
Wide row, 45 cm	Ultra	52,5	77,4	155	0,67
	Lera	61,9	86,9	174	0,67
	Helios	64,7	88,5	177	0,67
Wide row, 70 cm	Ultra	54,2	80,6	161	0,68
	Lera	65,4	93,3	187	0,68
	Helios	64,9	95,2	190	0,69

First, it was determined that the varieties differed in the length of the panicle. The longest tassel was formed in the variety Helios - 63 cm on average over two years, while the length of the panicle of Lera and Ultra was 62 and 52 cm respectively, which is 2-21% less than in the variety Helios (average by method of sowing). Secondly, the varieties differed from each other by such an important indicator as 1000 seed weight. The lowest weight of 1000 seeds was formed in variety Ultra - 0.64-0.68 g on average for two years. Other varieties exceeded this indicator by 0,1-0,2 g. Thus, it was determined that the weight of 1000 seeds of early maturing varieties of amaranth Ultra was the lowest.

Melon weight is a derivative of the number of seeds in the panicle and the weight of 1000 seeds. In different varieties of amaranth it varied in the range 74,2 -95,2 g, the lowest its weight was recorded in varieties Lera and Ultra, the highest - in the variety Helios. This means that the grain variety Helios was larger and more weighty. This is evidenced by the higher weight of 1000 grains of this variety. In our experiments, the variety Helios formed the largest mass of grain per plant - 183 g, which is 5-18% more than for other varieties. Higher coarseness of the Helios variety ensured the highest seed yield compared to the other studied varieties.

The wide-row method of sowing created better conditions for the formation of elements of the yield structure of amaranth plants. For example, such an important indicator as weight of 1000 seeds decreased with narrowing of row-spacing in the crops. Thus, the highest this indicator was noted in wide-row crops with row spacing of 70 cm - 2.05 g, and the lowest - in row crops (1.96 g).

Plants in wide-row crops (45 and 70 cm) exceeded plants in row crops by 8-11% in panicle length, by 3-10% in panicle weight, by 3-10% in plant weight.

Weight of grains per plant is determined primarily by the number of mature panicles and the weight of 1000 seeds. On average for two years, when sowing the variety Helios wide-row method (70 cm) formed the most productive plants on such indicators as the weight of 1000 seeds - 0.69 g and the highest weight of the panicle - 95.2 g.

Weather conditions also influenced the elements of the yield structure of amaranth plants - better indicators were noted in growing varieties in 2019 compared with the more arid year 2020. For example, while in 2019 the 1000 seed mass for amaranth varieties was 0.67-0.73 g, in 2020 the average was 0.7 g less, ranging from 0.60 to 0.66 g. The length of the panicle was also lower, an average of 15% compared to 2019. While in 2019 the weight of the panicle per plant reached 140-180 g, in 2020 this figure dropped to 78-101 g per plant. So, in an insufficiently favorable 2019, the individual productivity of the plant was lower than in 2020, which also caused a lower seed yield.

Taking into account the prospects of amaranth use, the following directions of its improvement are possible: creation of varieties for use as seeds, fodder, oil and for landscaping.

Varieties for seeds - low plants (up to 110 cm), unbranched, with a large dense or nepivshchilnuyu panicles, with a high percentage of female flowers, rapid maturation, seeds of white, golden or pink, with 1 g weight of 1000 seeds, with a crude protein content of 18.0-19.0%, starch - 58.0-59%, the yield to 30 kg / ha, fit for mechanized harvesting.

The main indicator of the economic value of grain amaranth varieties is their seed yield, which is measured in quintals or tons per unit area.

Optimization of sowing methods of plants is an important issue in agrotechnics of culture. The choice of sowing method should be determined primarily by the peculiarities of the variety and the architectonics of the plant. The area of plant nutrition, which is determined by density and method of sowing, depends on the provision of light, moisture and nutrients to plants, affects photosynthesis, seed formation and individual plant productivity. In the thickened crops, the competition of plants for moisture, nutrients and deteriorates the light regime of the leaves of the lower and middle tiers, causes a decrease in yields. Thickened crops have poor competition with weeds, which also reduces the yield of the crop.

Yield records of varieties by years of research are shown in Table 3.6. As evidenced by the above data, the level of grain amaranth yield was influenced by the studied factors (variety and method of sowing), as well as agrometeorological conditions of the year of cultivation. Thus, as noted in the previous section, 2019 was more favorable in terms of rainfall, temperature and relative humidity during the growing season.

Table 3.6

Yields of grain amaranth varieties depending on the method of sowing, cwt/ha

Sowing method (A), Row spacing	Sort B)	2019.	2020	Average for 2019-2020
Linear, 15 cm	Ultra	22,2	6,3	14,3
	Lera	23,4	6,2	14,8
	Helios	24,9	7,1	16,0
Wide row, 45 cm	Ultra	36,2	9,3	22,8
	Lera	27,7	7,5	17,6
	Helios	32,5	8,8	20,7
Wide row, 70 cm	Ultra	35,8	9,1	22,5
	Lera	32,5	9,1	20,8
	Helios	40,2	12,2	26,2
Average for 2019-2020 pp.		30,6	8,4	

HIP_{05}, c / ha (2019): A – 0,31; B – 0,31; AB – 0,54,
HIP_{05}c / ha (2020): A – 0,10; B – 0,10; AB – 0,17.

At the same time, the yield of varieties averaged 30.6 kg / ha, which is 3.6 times higher than in 2020 (8.4 kg / ha average of varieties). Low level of amaranth yield in 2020 is due to the lack of moisture during the growing season of plants.

The results show that all varieties formed an average yield for two years at the level of 19.5 kg / ha. The highest yield of amaranth was obtained in the variety Helios - 21.0 kg / ha, which is 1.2 kg / ha or 6% more compared to the variety Ultra, and by 3.3 kg / ha or 18% more than the variety Lera (Fig .3.8).

When choosing the method of sowing, it is necessary to take into account the high demand of amaranth to the feeding area, as well as the peculiarities of the cultivar being grown. In our experiments, the highest grain yield was obtained when sowing amaranth by wide-row method at 70 cm - 23.2 kg / ha (the average for varieties).

But in the context of varieties there were some differences. Thus, the highest yield of seeds of variety Ultra was formed when sowing in broad strokes as at 45 cm and at 70 cm (between these options was no significant difference) - 22.5-22.8 kg / ha, which is by 8.2-8 5 kg / ha higher than for the row method of sowing.

In the variety Helios and Lera high yield was obtained when sowing broad-band method at 70 cm, with the variety Helios in this variant noted the maximum yield - 26.2 kg / ha, which is by 3,8-5,4 t / ha higher than in other varieties.

Thus, the method of sowing had a great influence on the formation of amaranth seed yield, the best conditions for growth and development of plants were created by sowing in wide rows. In these variants and were obtained high values of yield.

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CHEMICAL PROTECTION OF SOYBEAN CROPS AGAINST WEEDS

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ABSTRACT

One of the most pressing problems in the development of domestic agriculture is the significant weeding of crops, including soybeans. Soil and climatic conditions of Ukraine mainly contribute to the cultivation of this crop.

At the beginning of the growing season, soybeans grow relatively slowly, and weeds compete with them for moisture, nutrients, light use, and so on. This results in low crop competitiveness compared to weeds. Yield losses from weeds can average 30 to 50%, and sometimes they can die completely.

To control weeds in soybean crops should use soil herbicide Frontier® Optima k.e., 1,0 l/ha + in phase 5 trifoliate soybean leaves post-emergence herbicide Korum p. K., 1,5 l/ha + South Africa Metholate, 1,0 l/ha + in the phase of the beginning of soybean budding foliar application of the microfertilizer Quantum - Molybdenum Chelate (Mo), 0,5 l/ha, as a result of which it is possible to obtain soybean seed yield at the level of 2,94 t/ha.

Keywords: Soy, agrocenosis, technology, weeds, herbicides, seeds, yield.

Formulation of the problem.

Soybeans are a universal legume and oilseed, the seeds of which are used for food, fodder and technical purposes. Among annual cereals and legumes in terms of protein content and quality, it ranks first, and the amount of oil is second only to peanuts. In the group of field oilseeds, soybeans provide the highest yield of cake and meal.

The production of this culture at the global level is growing rapidly, it largely depends on the food security of civilization. It is grown in major agricultural regions in 90 countries. World production of this crop has reached 253 million tons. Its crops absorb 20 million tons of biological nitrogen. Due to it, the world economy receives more than 128 billion dollars a year [1].

High yields, extreme stress resistance, powerful return of each sown hectare at low production costs can not leave indifferent any farmer. No other crop is able to ensure the accumulation of such an amount of protein and oil, even with very high soil fertility, sufficient levels of headlights and intensive watering. Under favorable weather conditions in 2018, the gross harvest of soybeans in Ukraine reached 4,3 million tons, which brought our country to 8th place among its world producers. However, the potential of the crop is much higher: in Europe, one hectare produces an average of 3-4 tons of grain, while in Ukraine only 2 tons. The main reason is high weediness and insufficiently effective protection of soybean crops [10].

With the development of intensive technologies for growing crops, scientists Zabolotny O.I., Zabolotna A.V., [4] state that to reduce the negative impact of herbicides on cultivated plants, it is advisable to combine their use with biological drugs, under the influence of which metabolic processes increase plants, develops a stronger aboveground and underground mass, the optimal photosynthetic apparatus is formed, which in general ensures the growth of crop productivity.

Therefore, the development of the most efficient, least economically and environmentally friendly weed control system using chemical plant protection products for growing soybeans in different farming systems is an extremely important element of innovative development in crop production.

Analysis of recent research and publications.

Glycine max (L.) Merrill is the main legume in the world. It belongs to the strategic cultures and meets the most basic needs of mankind.

Soybeans are a very popular type of legume that is used in many areas of food and industrial production. These products are in demand in the wholesale market, so it makes sense for farms to work towards soybean production. Interest in growing this crop continues to grow as new opportunities open up for its marketing abroad, especially in a country like China, the world's largest importer of soybeans.

As the world's main grain legume, soybeans are grown in a large agricultural belt on an area of over 85 million hectares. In terms of sown area, it ranks fourth in the world after wheat, rice and corn. Since the mid-1970s, world soybean production has increased from 30 to 200 million tons [9].

Soybeans have a high rate and volume of world production because it has a growing demand in the market, helps to solve the following urgent tasks: increase grain production; vegetable protein production; oil production; replenishment of soil nitrogen reserves; strengthening the economy. In the future, the scale of world production and the direction of use of this culture will expand.

One of the most pressing problems in the development of domestic agriculture is the significant weeding of crops, including soybeans. Soil and climatic conditions of Ukraine mainly contribute to the cultivation of this crop.

Obtaining high and sustainable soybean yields is based on high agricultural crops: the latest varietal composition, pre-sowing tillage and sowing, comprehensive control of weeds, pests and diseases, harvesting and post-harvest processing. At the beginning of the growing season, soybeans grow relatively slowly, and weeds compete with them for moisture, nutrients, use of light, and so on. This results in low crop competitiveness compared to weeds. Yield losses from weeds can range from an average of 30 to 50%, and sometimes they can die completely.

Soybeans are left with weeds for 2-3 weeks from sowing to the appearance of the first trifoliate leaf. At this time, the future harvest is genetically laid down. If soy is not protected at this time, it genetically reduces the yield potential, and this process is irreversible. The most optimal period for weed control is the phase from the first to the third trifoliate leaf of the crop (this is the period from which soybeans are most "resistant" to action against dicotyledonous and cereal herbicides) [3].

At the beginning of the growing season, soybeans are quite competitive against weeds due to the significant reserves of plastic substances in the seeds and intensive growth. But later, the short length of the stem, slow growth in the initial period of development, low crop density (50-60 pieces/m^2) do not allow it to compete with weeds. Therefore, field litter is a significant obstacle to obtaining high and stable soybean yields. During the critical growing season on a weed background, soybeans significantly reduce their productivity. According to generalized long-term data, each quintal of raw mass of weeds causes a shortage of more than 13 kg of soybean seeds [12].

Weeds are one of the main factors limiting the production of soybean seeds. They reduce crop productivity through competition for nutrients, light and water, and serve as a breeding ground for pests, pathogens and other pathogens.

A number of scientists Shevchenko M.S., Shevchenko S.M., Derevenets-Shevchenko K.A., etc., in their work note that the decrease in gross harvest of crops due to weeds is 25-30%, in some cases exceeding 50% [14].

By absorbing large amounts of nutrients from the soil, weeds impair the normal growth and development of cultivated plants. Due to the lack of appropriate measures to protect crops, weeds are able to absorb 160-200 kg/ha of nitrogen, 55-90 kg/ha of phosphorus and 170-250 kg/ha of potassium [5].

One of the main reasons for the decline in crop yields is the high weediness of crops. It is determined by the potential stock of weed seeds in the soil and its long-term viability.

The higher the stock of seeds and organs of vegetative reproduction of weeds in the soil, the more it will germinate under favorable conditions in subsequent years. Despite the intensive use of herbicides in the cultivation of crops, the potential weediness of the arable layer is not reduced [8].

The total stock of weed seeds that can germinate in crops is too large for crops to compete with them. In addition, not all weeds germinate at the same time, but have a long period of germination during almost the entire growing season.

Surveys of arable land conducted in different regions of Ukraine revealed that at the turn of 2000, the average stock of weed seeds in the arable soil layer (0-30 cm) was 1,47-14,2 billion units/ha. At this level of potential soil weeding, the number of weeds many times exceeded the thresholds of harmfulness and guaranteed the emergence during the growing season from 2 to 5 thousand pieces/m^2 of their seedlings [6].

Weed populations are almost ubiquitous in the structure of agrophytocenoses, forming for each field its species composition and number of individual weed species, as well as the potential stock in the soil of their seeds and vegetative reproductive organs. Well-known Ukrainian herbologist Ivashchenko II notes that modern weed populations have acquired a set of features that allow them to withstand intense anthropogenic impact, both mechanical and chemical [5].

Therefore, in crop crops it is extremely important to regulate the species composition of weeds, taking into account the biological characteristics of their development, distribution routes and control measures. The system of protection of soybean plants should be aimed both at the destruction of segetal vegetation and at preventing the formation of seeds. It is important to use in crop rotation units with high weed efficiency and increase the competitiveness of field crops in agrophytocenoses. Successful solution of these problems leads to the improvement of biological productivity of crops, including soybeans, improving the quality of the crop and the economic feasibility of its cultivation.

One of the most important elements of technology that frees soybeans from competition is protecting them from weeds with herbicides. The choice of herbicide should take into account the species composition of weeds of each agrocenosis. Knowing the history of the field over the past years and taking into account the predecessor, you can more effectively choose the active substance of the herbicide or a mixture of several active substances.

An integral part of intensive soybean production technology is the use of effective post-emergence herbicides that can effectively control weed infestation. Modern post-emergence herbicides, including preparations containing two or more active substances, provide significant productivity of soybean crops with high grain quality. To increase the economic efficiency of herbicide application, tank mixtures of several preparations and several application periods should be used. Mixtures of post-emergence herbicides with the addition of complexes of microfertilizers and biologically active substances are highly effective. This significantly reduces the possibility of resistance in most weeds. Rational weed control using microfertilizers provides high weed competitiveness, accelerates the growth and symbiotic potential of the crop, accelerates the yield and improves the biochemical quality of the product.

Thus, the intensive technology of soybean cultivation involves the use of chemical plant protection measures, which leads to an increase in pesticide load on agrocenoses and the environment. To reduce the toxic effects of herbicides, reduce their consumption rates, it is necessary to use herbicide compositions and microfertilizers in soybean cultivation technology, but the main attention should be paid to proper crop rotations and scientifically sound tillage systems.

The purpose of the study is to substantiate the feasibility of using soil and post-emergence herbicides to control weeds and foliar application of microfertilizers in soybean agrocenoses in the experimental field of VNAU village Agronomichne.

Presenting main material.

In the modern sense, agrophytocenoses are characterized by a certain floral composition, structure, relationships of plant organisms with each other and the natural environment, self-regulation, dynamism and historicity, but differ from natural formations in that they are artificially created and maintained only by constant human effort. The main structural components of agrophytocenoses are populations of cultivated plants and weeds, the initial parameters of the latter are largely influenced by humans.

The concept of modern integrated protection of cultivated plants from weeds provides: prevention of replenishment of the seed bank of weeds in the soil by reducing their seed productivity and inflow from the outside; reducing the intensity of weed seed germination from the existing bank in the soil to natural death; provocation and friendly germination of weed seeds in the pre-sowing and post-harvest periods with the subsequent destruction of their seedlings by tillage tools; strengthening the competitiveness of cultivated plants against weeds, which eliminates or significantly reduces the formation and entry of weed seeds into the soil.

Controlling the number of weeds in the crops provides an opportunity to respond in a timely manner and eliminate possible problems, and to successfully control the number of weeds, you need to have complete information about their quantitative and species composition. One of the means of control is the constant monitoring of weed distribution in crops [7].

Species diversity of weeds has expanded significantly in recent decades. Along with common weeds, there are species that were characteristic only of a certain soil and climatic zone. The main reasons for the increase in weediness of field agrophytocenoses are, first of all, significant reserves of viable seeds and organs of vegetative reproduction of weeds in the soil, due to the specialization of farms on extremely profitable crops, crop rotation, withdrawal of some technological operations from cultivation. soil, application of high doses of nitrogen fertilizers, violation of methods and terms of grain harvesting, high cost of herbicides, etc.

One of the factors influencing the species composition of weeds in the fields is natural, but much more than natural conditions, the species composition and number of weeds depends on the biological properties and agricultural techniques of cultivation.

The species composition of weeds is formed depending on their adaptability and structure of sown areas of crops. Weed dominance in the agrobiocenosis is based on herbicide resistance, a wide range of seed germination, morphological plasticity and the presence of neotenic features [13].

The joint growth of weeds and cultivated plants of different species in agrophytocenoses is due to their ecological and biological specificity, as well as the unusual conditions of growth. Due to the growth in agrophytocenoses of a significant amount of weeds, between sown crops and weeds intensifies competition for light, moisture, nutrients, which ultimately affects the level of crop yields and quality of crop products. Their distribution largely depends on abiotic, biotic and agrotechnical factors.

The actual species composition of weeds in crops of different crops is formed depending on the biological characteristics of a particular crop, soil and climatic conditions of the zone and cultivation technologies. The distribution of weeds and their species composition in crops of certain crops is determined by the ecological characteristics of individual species, ie their relationship to the main environmental factors - heat, moisture, light, etc.

Not only biological groups but also individual weed species react differently to weather conditions. Thus, in conditions with high soil moisture, field axes, white quince, bitters, common butterbur, and plantain grow better. Under conditions with moderate humidity are distinguished - asterisk middle, common plywood, self-seeding poppy, bitter mustard, common butterbur and others. But arid conditions are typical - sticky butterbur, common oats, thistles, talaban field.

The nature and degree of weediness of soybean crops are determined primarily by the potential reserves of seeds and vegetative organs of weed reproduction in the soil, weather conditions in spring and early summer. In the forest-steppe, the main problem weeds in crop crops are pink thistle (Cirsium arvense L.) and yellow (Sonchus arvensis L.), white quince (Chenopodium album L.), field mustard (Sinapis arvensis L.), common butterbur (Amaranthus). retroflexus L.), amaranthus blitoides L., wild radish (Raphanus raphanistrum L.), odorless chamomile (Matricaria inodora L.), field thistle (Thlaspi arvense L.), field birch (Convolvulus arvensis L.), as well as monocotyledonous (cereal weeds), including chicken millet (Echinochloa crus-galli L.), mouse blue (Setaria glauca L.).

Our research has shown that soybean crops have formed a mixed type of weed, which is dominated by dicotyledonous species of weeds: quinoa white (Chenopodium album L.), butterbur (Amaranthus retroflexus L.), talaban field (Thlaspi arvensis L.), sprats (Poligonum scabrum Moench.), wild radish (Raphanus raphanistrum), pink thistle (Cirsium arvense (L.) Scop.). They differ significantly in biological and morphological features and belong to different botanical families.

Among cereals were present: mouse blue (Setaria glauca (L.) Pal. Beauv.), Chicken millet (Echinochloa cruss-galli (L.) Pal. Beauv.).

Thus, the structure of weed agrocenosis weeding was as follows: there were a total of 102 units/m^2, including cereals - 39 and dicotyledons 63 units/m^2. Among cereal species, blue mouse species dominated - 16 pieces/m^2, chicken millet - 15 pieces/m^2 and oats 6 pieces/m^2. Among the dicotyledonous species of white quince - 16 pcs./m^2, common quince - 14 pcs./m^2, talaban field - 12 pcs./m^2, bitters - 8 pcs./m^2, there were perennial species - thistles 2 pcs./m^2.

Soybeans grow relatively slowly at the beginning of the growing season and weeds compete with them for moisture, nutrients and light. This makes it less competitive than weeds. Yield losses from weeds can range from 30 to 50%. Therefore, integrated weed control is essential for successful soybean cultivation. The critical period for weed control is the phase of 1 to 3 true leaves of the crop. Harmfulness of weeds to soybeans depends on their species composition, moisture conditions, early maturity of the variety, sowing power, potential weediness of the arable layer, techniques and methods of care for soybean crops.

Weeds are one of the main factors limiting the production of agricultural products, including soybeans. They reduce crop productivity through competition, allelopathy, serve as a center for the development of pests, pathogens and other pathogens. Weeds complicate the collection and post-harvest processing of grain, which significantly increases the overhead costs of cultivation. Timely and complete release of crops from competition with weeds for living space, light, moisture, nutrients is a key component of obtaining high yields of crops, including soybeans.

The chemical method of weed control in crops is shifted towards reducing the herbicide press on crops and the environment. The appropriateness of the use of herbicides should depend on the level of weediness of crops, the phase of crop development and should vary according to economic thresholds of harmfulness and taking into account the regulated norms of their use.

The importance of herbicides in agriculture has increased due to both increasing the technical efficiency of chemicals and increasing the volume of their use. The level of phytotoxic effects of combined preparations, mixtures and technological combinations caused a significant weakening of weed resistance, which ensured the destruction or deep suppression of weeds (89-94%) in the case of spraying crops. The group of priority and most common herbicides should include: harness, primextra, basis, task, master, estrone, primo, granstar, which, along with purely phytotoxic properties have provided significant technological progress, easy to use formulations, high solubility, low dependence from external factors, a wide range of terms of processing, the increased level of ecological safety [14].

Subject to treatment with herbicides with one active substance or mechanism of action, we obtain a larger number of resistant species that re-form seeds and have increased resistance. With long-term such use, there is a complete replacement of susceptible species with resistant ones.

Soil and post-emergence herbicides are successfully used on soybean crops. The latter have a number of significant advantages. Until recently, soil herbicides were used on soybean crops, providing: a clear field for the period of early crop development; relative cheapness of field cultivation operations; low cost of drugs; saving the use of sprayers.

In this sense, soil herbicides provide farmers with time. However, such herbicides have enough significant disadvantages that reduce the effectiveness of their use. Let's name these shortcomings: dependence on presence of moisture, optimum temperatures, necessity of mechanical earnings in soil; variety of action on different types of soils, due to which it is necessary to conduct a thorough analysis of the soil for the degree of weeding, the amount of humus and organic matter; the possibility of stressful conditions for young crops.

Due to a number of disadvantages of soil herbicides, farmers prefer post-emergence preparations.

The use of post-emergence herbicides over soil has the following advantages: the ability to assess the extent of weeding, which will allow you to choose a drug with high technical efficiency; the use of post-emergence herbicides completely replaces mechanical tillage, which significantly reduces labor costs and reduces the possibility of wind and other types of soil erosion.

When using post-emergence herbicides, it is important to determine the phase of crop development. To this end, an alternate list of operations was developed: to establish the time of emergence of weeds and stages of crop development; determine the types of weeds and their number at the time of application; reduce the width of soybean rows, which will reduce the competitiveness of weeds.

The degree of crop contamination and harmfulness in our experiments was high. Phytocenosis of weeds in soybean crops due to high competitiveness absorbed much of the productive moisture and nutrients from the soil. Therefore, any methods against weeds can be safely attributed to the most effective measures to regulate water and nutrient regimes and in general the potential of soil fertility.

During the research, soybean crops accounted for 98-102 pieces/m^2 of weed plants, 38% of the total number were perennial cereal weeds, namely: mouse blue, common plaice, chicken millet.

The other part was occupied by dicotyledonous weeds: odorless chamomile, white quince, common buckthorn, bitter gourd. From soil herbicides, we investigated the effect of the drug Frontier® Optima, which was applied to soybean crops at a rate of 1,0 l/ha. Studies have shown high herbicide and cost-effectiveness of the drug Frontier® Optima. Thirty days after the application of Frontier® Optima herbicide, the normal consumption rate of 1,0 l/ha in soybean crops was only 11 pieces/m^2 of weed plants. Cereal weeds were completely absent, only stable dicotyledons remained, in particular quinoa, bitters. This amount of weed vegetation is 79% lower compared to the weed control version, where no herbicides were applied. The efficiency of destruction of annual dicotyledonous and cereal weeds 60 days after application of Frontier® Optima was 75% compared to the control. Before harvesting, the weediness of soybean crops increased slightly and was in the range of 26 pcs/m^2. This figure is 72% lower compared to weeds in the control version, where at the time of harvest there were 94 pieces/m^2 of weed plants (Table 1).

The greatest damage is caused by weeds that appear before or at the same time as soybean seedlings. Due to its biological characteristics, soybeans can not compete with such plants. They should be destroyed no later than 25 days after emergence. Delay in destruction measures reduces the yield by 10% every day. These losses can no longer be offset by any other crop care measures at later stages of soybean growth and development. In areas where weeds were not weeded before soybean harvest, soybean seed yield losses were 64%.

The application of Frontier® Optima herbicide helped to reduce both annual cereals and some dicotyledonous weeds. From the results of research it can be concluded that the application of soil herbicide Frontier® Optima reliably protects soybean crops during most of the growing season.

Since the degree of contamination of agrophytocenoses in the farm was quite high, especially dicotyledonous weeds, we decided in addition to the soil herbicide Frontier® Optima, to apply additional post-emergence herbicide Corum pk, 1,5 l/ha + surfactant Metholate, 10, l/ha.

There are two sides to a plant protection system: the object of protection and the pest, and the difficulty is that they respond differently to climate change.

Table 1

Influence of herbicides on weed infestation of soybean agrocenosis (average for 2019-2020)

Options	Technological type of herbicide	Accounting	Weed rates	
			Quantity, pcs/m^2	Reduction of % to control
Control (without processing)	--	1	102	--
		2	96	--
		3	94	--
Frontier® Optima k.e., 1,0 l/ha	soil	1	21	79
		2	24	75
		3	26	72
Corum p. K., 1,5 l/ha + South Africa Metholate, 1,0 l/ha	insurance	1	102	-
		2	11	89
		3	7	93
Frontier® Optima k.e., 1,0 l/ha + Corum p.k., 1,5 l/ha + surfactant Metholate, 1,0 l/ha	soil + insurance	1	20	80
		2	3	97
		3	1	99
Frontier® Optima k.e., 1,0 l/ha + Corum p.k., 1,5 l/ha + surfactant Metholate, 1,0 l/ha + Quantum - Molybdenum Chelate (Mo), 0,5 l/ha	soil + insurance + microfertilizer	1	19	81
		2	2	98
		3	1	99

For example: soy is difficult to cope with stressful conditions, reduces yields and resistance to disease. Pests, on the contrary, become more aggressive, diseases affect it more and more often, pests pass their development cycle faster, give more generations, and so on. Weeds do not lag behind when living in their territory, they are better adapted to temperature fluctuations and lack of moisture. One of the trends of the last few years in the protection of soybeans has been to reduce the effectiveness of herbicides. Today, few soybeans do without two treatments against dicotyledonous weeds.

The application rate of Korum® herbicide is from 1,25 to 2,0 l/ha, depending on how difficult the situation is in the field. Corum® should be used in a tank mixture with surfactant Metholate in a ratio of 2:1 - for two units of Corum® should be added one unit of Metholate. The consumption rate of the working solution is 200-250 l/ha. Metholate is a drug that opens the entrance to the internal systems of quinoa, allowing the active components of the product Corum® to effectively destroy it.

Metolats contains substances that reduce the surface tension of the working solution, allowing it to adhere firmly to the sheet. Another feature of Metolate is its ability to dissolve wax and facilitate the penetration of the active ingredients of the herbicide into the leaf. The combination of the special formulation Corum® with surfactant Metholate has a high buffering capacity, which allows you to keep the pH of the solution within optimal limits sufficient to dissolve cuticular waxes and penetrate into the tissues of the leaf Corum® effectively fights not only white quinoa, it has a very wide range of controlled weeds, including such malicious as ragweed, species of birch, birch, bitters, poppy, yellow and garden thistle, chamomile, cruciferous bur ' and dozens of less common species.

It should be noted that many weeds are able to grow after exposure to the herbicide, so you should act not only effectively but also quickly to prevent them from doing so. The unique combination of the active ingredients of the herbicide Korum® with highly effective surfactant Metholate allows you to completely destroy weeds in 5-7 days.

Due to the high selectivity and soft action, the Corum® application window is very wide - from one to five trifoliate leaves. But the main factor is not the phase of crop development, but the phase of weed development, and we should focus on the most problematic weeds. Dozens of studies across Europe have shown that even a double dose of Corum®, administered with or without Metholate, did not reduce yields. So soybean and pea crops will be safe even on the floors. Keep in mind that imazamox, which is contained in the herbicide Corum®, is part of the Clearfield® system, the products of which should not be used more than once every three years. Care should also be taken to organize crop rotation, as some crops, such as sugar beets and vegetables, may be sensitive to imazamox residues in the soil. Other crops, such as cereals, sunflower and corn, can be sown without restrictions.

According to prof. O.O. Ivashchenko, the sensitivity of white quince to the action of herbicides in the cotyledon phase reaches more than 99%, and in phase 4 pairs of true leaves only 38,5%. That is why the recommendations for the use of Corum® on soybean and pea crops should be divided into two parts [5].

The first crop in the early stages of development, weeds are not overgrown (in the cotyledon phase - the first pair of true leaves). For such conditions the norm of Corum® 1,5 l/hectare + surfactant Metholate of 0,75 l/hectare will be sufficient. The second - problem weeds, in particular quinoa, overgrow (3 pairs of leaves - the beginning of branching). In this case, the maximum rate of Corum® 2,0 l/ha + surfactant Metholate 1,0 l/ha should be applied.

BASF monitors trends in the plant protection market around the world. The group's specialists respond quickly to the urgent needs of agricultural producers, implementing new solutions and helping to make agricultural production more stable and efficient. The new powerful herbicide Corum® is another tool in the agronomist's arsenal to achieve new soybean yield records.

Numerous studies have established the high efficiency of application of post-emergence drugs on soybean crops. Weed mortality reaches 90% or more with a significant reduction in their raw weight, which has a positive effect on crop development, provides high yields of soybeans. According to the recommendations of I. Storchous, it is necessary to take into account the aftereffects of herbicides on subsequent crop rotations. In view of this, selective herbicides should be used, with a shorter detoxification period in the soil and with a more effective effect on different types of weeds [11].

Our studies showed that the herbicide Korum® 1,5 l/ha, which is used in the experiment, significantly reduced the weediness of soybean crops compared to growing without herbicides and manual weeding. Korum® herbicide 1,5 l/ha was applied to phase 5 of trifoliate soybean leaves (early phases of weed growth). After applying the herbicide for a week was dry cool weather. Weed accounting has shown that when using the drug on vegetative plants, its phytotoxicity depends to a lesser extent on the species composition of weeds.

Accounting conducted 30 days after spraying the crops showed that the effectiveness of Corum® 1,5 l/ha against the weed complex in soybean crops was 89% compared to the original weed.

This drug effectively destroyed cereal weeds (92-97%). The total number of weeds decreased at the time of harvest by 93% compared to the original, which proves the high efficiency of the drug to eliminate weeds in soybean crops (Table 2).

The development of highly effective weed protection systems depends largely on the completeness of the study of weed crops, ie identifying the composition of weeds in different crops with the analysis of the groups they form and the correctness of the generalization of the results.

Given the agri-environmental requirements and the high level of weed infestation of many weed species, it is almost impossible to destroy them in soybean crops with a single herbicide. Therefore, the fight against them must be carried out comprehensively, in a combination of agronomic and chemical measures, both on the predecessors in crop rotation and during the main and pre-sowing tillage. When soybeans are sown, weeds have a negative effect, which in various ways contribute to the reduction of crop productivity. The losses are mainly due to competition between weeds and cultivated plants. Weeds not only reduce the yield of the main crop, but also degrade its quality. The change in quality indicators in weedy fields is due primarily to the fact that weeds remove from the soil the most valuable nutrients, use largely groundwater, affect the properties soil. Selective herbicides do not show a negative effect on crops to which selectivity is directed and do not worsen the quality of the crop, provided that the regulations of their application are strictly observed.

Table 2

The effect of herbicides on the main species of weeds soybean agrocenosis (average for 2019-2020)

Options	Acc-ount.	Cereal weeds		Loboda is white		Shchyrytsia ordinary	
		pcs/m^2	Decrease in% to control	pcs/m^2	Decrease in% to control	pcs/m^2	Decrease in% to control
Control (without processing)	1. 2. 3.	36 32 31	- - -	16 16 16	- - -	14 14 14	- - -
Frontier® Optima k.e., 1,0 l/ha	1. 2. 3.	1 2 2	97 94 94	9 9 9	44 44 44	8 8 8	43 43 43
Corum p. K., 1,5 l/ha + South Africa Metholate, 1,0 l/ha	1. 2. 3.	36 3 1	- 92 97	16 3 2	- 81 88	14 2 1	- 86 93
Frontier® Optima k.e., 1,0 l/ha + Corum p.k., 1,5 l/ha + surfactant Metholate, 1,0 l/ha	1. 2. 3.	1 - -	97 100 100	9 1 1	44 94 94	6 1 1	57 93 93
Frontier® Optima k.e., 1,0 l/ha + Corum p.k., 1,5 l/ha + surfactant Metholate, 1,0 l/ha + Quantum - Molybdenum Chelate (Mo), 0,5 l/ha	1. 2. 3.	1 - -	97 100 100	9 1 1	44 94 94	6 1 -	57 93 100

The effectiveness of the combined use of soil and post-emergence drugs in our experiment was quite high. Thus, the accounting was carried out after the use of the soil preparation Frontier® Optima k.e. showed that its use reduced weed infestation by cereal weeds by 94% compared to controls. After application of the herbicide Corum + surfactant Metholate, the number of cereal weeds in soybean crops decreased to 1 piece/m^2, which is 97% less than the original. The use of this method of weed control has allowed to get rid of them almost completely - in soybean crops at harvest time. The combination of pre-emergence and post-emergence use of the studied drugs had a greater phytotoxic effect on the main weed species in soybean crops. Thus, cereal weeds were destroyed by 100%, butterbur by 93%, and quince by 94%. It should be noted in areas where the composition was introduced Frontier® Optima k.e. + Corum pk + South Africa Metholate + Quantum - Chelate Molybdenum phytotoxic effect on weeds increased, and soybean plants later grew and developed better. The rates of weed control in soybean crops compared to control plots for the period of soybean seed harvest were 94-100% (Table 2).

The level of soybean seed yield and its stability largely depend on extreme environmental factors. In our experiments, a significant increase in soybean seed yield was obtained with the application of soil and post-emergence herbicides. Selective herbicides kill and inhibit weed growth, which improves the growth and development of the crop.

The yield of soybean seeds, where herbicides were applied in comparison with the control was on average: when using the herbicide Frontier® Optima k.e., 1,0 l/ha – 2,09 t/ha, Corum p. к., 1,5 l/ha + surfactant Metholate, 1,0 l/ha - respectively 2,57 t/ha., and when applying Frontier® Optima k.e. + Corum p. к. + South Africa Metholate – 2,78 t/ha. As can be seen from the above data, the highest soybean yield was in the variant with the application of soil herbicide Frontier® Optima k.e., 1,0 l/ha – 2,09 t/ha, Korum p. к., 1,5 l/ha + South Africa Metholate, 1,0 l/ha + Quantum - Molybdenum Chelate (Mo), 0,5 l/ha - the level of soybean seed yield was on average over two years – 2,94 t/ha, which is more than in control areas on 1,92 t/ha or 188% (Table 3).

Therefore, these drugs are quite effective in soybean crops, as they increase yields and reduce weeds.

Table 3

Soybean yields depend on exposure herbicides and microfertilizers, t/ha

Options	Seed yield, t / ha			Increase in control	
	2019	2020	aver-age	t/ha	+/-
Control (without processing)	1,21	0,82	1,02	-	-
Frontier® Optima k.e., 1,0 l/ha	2,52	1,65	2,09	+ 1,07	105
Corum p. K., 1,5 l/ha + South Africa Metholate, 1,0 l/ha	3,06	2,08	2,57	+ 1,55	152
Frontier® Optima k.e., 1,0 l/ha + Corum p.k., 1,5 l/ha + surfactant Metholate, 1,0 l/ha	3,20	2,35	2,78	+ 1,76	173
Frontier® Optima k.e., 1,0 l/ha + Corum p.k., 1,5 l/ha + surfactant Metholate, 1,0 l/ha + Quantum - Molybdenum Chelate (Mo), 0,5 l/ha	3,34	2,54	2,94	+ 1,92	88
NIR_{05}	0,17 0,18				

Thus, in order to maintain and increase the yield of soybean seeds, it is important to eliminate all possible causes of its loss. Among the main reasons for the loss of soybean seed yield is the negative effect of weediness of agrocenoses, which is not only to reduce the seed yield but also to deteriorate its quality. Therefore, for the successful cultivation of soybeans in technological measures, much attention should be paid to the introduction of herbicides and their compositions.

Conclusions

1. The structure of weeding of soybean agrocenosis was as follows: there were a total of 102 units/m^2, among them cereals - 39 and dicotyledons 63 units/m^2. Among cereal species, blue mouse species dominated - 16 pieces/m^2, chicken millet - 15 pieces/m^2 and oats 6 pieces/m^2. Among the dicotyledonous species of white quince - 16 pcs./m^2, common quince - 14 pcs./m^2, talaban field - 12 pcs./m^2, bitters - 8 pcs./m^2, there were perennial species - thistles 2 pcs./m^2.

2. The efficiency of destruction of annual dicotyledonous and cereal weeds 60 days after application of Frontier® Optima was 75% compared to the control. Before harvesting, the weediness of soybean crops increased slightly and was in the range of 26 pcs/m^2. This figure is 72% lower compared to weeds in the control version, where at the time of harvest there were 94 pieces/m^2 of weed plants.

3. Accounting conducted 30 days after spraying the crops showed that the effectiveness of Korum® 1,5 l/ha against the weed complex in soybean crops was 89% compared to the original weed. This drug effectively destroyed cereal weeds (92-97%). The total number of weeds decreased by 93% at harvest time compared to the original, which proves the high effectiveness of the drug to eliminate weeds in soybean crops.

4. The combination of pre-emergence and post-emergence application of the studied drugs had a greater phytotoxic effect on the main weed species in soybean crops. Thus, cereal weeds were destroyed by 100%, butterbur by 93%, and quince by 94%. It should be noted in areas where the composition was introduced Frontier® Optima k.e. + Corum pk + South Africa Metholate + Quantum - Chelate Molybdenum phytotoxic effect on weeds increased, and soybean plants later grew and developed better. Weed control rates for soybean weeds were 94-100% compared to control plots during the soybean harvest period.

5. The highest soybean yield was in the variant with the application of soil herbicide Frontier® Optima k.e., 1,0 l/ha – 2,09 t/ha, Corum p. к., 1,5 l/ha + surfactant Metholate, 1,0 l/ha + Quantum - Molybdenum Chelate (Mo), 0,5 l/ha - the level of soybean seed yield averaged 2,94 t/ha over two years, which is 1,92 more than in the control plots t/ha or 188%.

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