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Agreement with TOV MPA

“Nanoagricole”

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30 August 2010.

THE REPORT
ON THE SCIENTIFIC AND RESEARCH WORK
«Trials of the micronutrient fertilizer of “Nanoagricole” »
(BIOLOGICAL RESEARCHES)

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Head of Laboratory of
Crop and Plant Variety Study
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Kharkiv 2010

SUMMARY

The report comprises 41 pages, 16 tables, 1 figure(picture).

The object of study: the solution «Nanoagricole», winter wheat, spring barley, corn, sunflower, winter radish, soy, pea, sugar beets, varieties, hybrids, technologies of cultivation.

The goal of research: to study effect of the solution «Nanoagricole», to boost crop yields, to make better quality of products, to provide the preservation of soil fertility.

The results and their novelty: studing of effect of the solution «Nanoagricole» on varieties of winter wheat, spring barley, corn, sunflower, winter radish, soybeans, pea and sugar beets.

The effective doze of the preparation «Nanoagricole» is elaborated for pre-sowing seed treatment and foliar nutrition of plants.

The positive impact of «Nanoagricole» on productivity of crops and improving the quality of yield has been proved.

The main indicators: increase of productivity, improvement of quality indicators of harvest, preservation of soil fertility.

Offers on elaborations: to recommend the chelated micronutrient fertilizer with biostimulant complex «Nanoagrciole» for introduction it in the List of agrochemicals allowed to use in Ukraine.

NANOAGRICOLE, FERTILIZERS, VARIETY, HYBRID, WINTER WHEAT, SPRING BARLEY, CORN, SUNFLOWER, WINTER BARLEY, SOY, PEA, SUGAR BEET, SEEDS, PRODUCTIVITY, SEED QUALITY, TECHNOLOGY OF CULTIVATION.

INTRODUCTION

The extraordinary importance of plant nutrition with micronutrients lacking in the soil is generally recognized in the world practice now and does not give rise to doubt. Micronutrients as well as vitamins provide the most important processes of intracellular metabolism. No enzymes are formed without them, oxidation processes stop, photosynthesis as well as the formation of sugary and protein substances are not possible. Life is impossible without them.

The selective analysis of soils in farms shows that the content of some essential micronutrients has decreased till critical value during years of land exploitation! Against this background the effect of the usage of traditional (NPK) macrofertilizers repeatedly reduces.

Liquid concentrate NANOAGRICOLE is the water-soluble complex of chelated (organically bound) micronutrients Fe, Mn, Zn, Cu, Co, Mo, (B, Mg, Ca, S) with natural “energetic” acids (succinic acid, malic acid, tartaric acid, racemic tartaric acid, asparticacid, oxalic acid, citric acid) and their biologically active derivatives (succinate,malate, tartrate, asparaginate, oxalate and citrate). Variations for pre-sowing seed treatment are enhanced by the growth stimulants –getheroauxins.

To reduce the toxicity of incoming trace elements and enhance their bioavailability in microfertilizer "Nanoagricole" there are introduced widely used in medicine chelating antidotes. Among them, Trilon B or EDTA (etilendiamintetra acetic acid), OEDP (gidroksietilidendi phosphonic acid), EDDY (etilendiamindi succinic acid), as well as natural dicarboxylic and tricarboxylic acids.

Rich range of used complexing agents increases the chemical stability and mobility of chelated micronutrients "Nanoagricole" in environments with a wide pH range. Trace elements Iron Fe, Manganese Mn, Zinc Zn, Copper Cu, Cobalt Co are in the organically bound chelated form. Amphoteric elements Molybdenum Mo and Boron B are chelated by OEDP. Mesophilic elements Mg Magnesium and Sulfur S are present in the form of chelates of EDDY, succinates, malates, tartrates and citrates.

Penetration speed of chelated trace elements through the epidermis and the cuticular layer of plants increases by 12-15 times. It allows to efficiently use the drug "Nanoagricole" for foliar nutrition of vegetative plants and repeatedly reduce its operating concentration.

Derivatives of succinic acid, oxy-succinic acid, (malic and tartaric acids), oxalic acid and citric acid, participate in very important oxidative cycles of substance transformation in organism (Krebs, Roberts and Barro cycles), performing on different stages as an activators of energetic processes, contributing to accumulation of the main energetic substance ATP (adenosine triphosphate) in cells, and enhancing oxygen delivery. They increase the resistance and adaptability of plants to adverse environmental conditions.

These valuable natural polyacids in the preparation "Nanoagricole act as complexing agents, covering trace elements with fixed organic layer, facilitating their moving in plant tissues.

Heteroauxins for seed treatment in the form of β- Indoleacetic acid and β-Indolebutyric acid promotes the accelerated formation of roots.

The solution "Nanoagricole" is adapted for use on different cultures(crops), taking into account their need for trace elements.

SCHEME OF ESTABLISHMENT AND METHODICS OF PERFORMING THE RESEARCH .

In 2008-2010 in the Laboratory of Crop and Plant Variety Study of the V.Ya. Yuryeva Plant Production Institute of UAAN carried out research work on the effect of the drug "Nanoagricole" for the next farming winter wheat, barley, maize, sunflower, canola, winter wheat, soybeans, peas, and sugar beets.

According to this there were established the next researches (table 1):

Table 1

Scheme of a field study of effect of the «Nanoagricole» solution

№	Treatment option for seed and plants	
1	Control	
2	Pre-sowing seed treatment with the Nanoagricole solution, 4 l/t	
3	Foliar nutrition with the Nanoagricole preparation	in the phase of sprouting-tillering, 2 l/ha
4		in the phase of budding-flowering, 2 l/ha
5		in the phase of sprouting-tillering, 2 l/ha + during budding-flowering, 2 l/ha

The reaserches were established in accordance with the methods of State Variety Testing (Kiev, 2002) and were performed according to the demands of the methods of field research (B.O.Dospehov, 1985).

Soil of the research plot is the typical powerful medium black earth which is characterised as following: humus content in the plowing layer is 5,0 — 5,25%; pH of salt extract is 6,0 — 6,5. Before establishing the experiments levels of nitrogen in the soil was 14,5; mobile phosphorus — 13,8; exchangeable potassium — 13,5 mg/eq per 100 g of soil, in the soil at the experimental site with varieties of spring barley — 13,2, 11,1 and 13,0 mg/eq per 100 g soil, respectively; in the soil at the experimental site with rape varieties and hybrids — 14,0, 9,3 and 12,2 mg/eq per 100 g soil, respectively.

The main soil treatment consisted of plowing at once after wripening the preceding crop to a depth of 20-22 cm with the plow PLN-3-35.

The chemichals fertilizers were added under the main soil treatment(plowing.

In early spring period with the onset of physical maturity there was conducted soil harrowing with harrows BZTS — 1,0 in order to close the moisture. After that there was run pre-sowing seed treatment to the depth of seeding.

Within the research several nutritional backgrounds were established:

1. without adding fertilizers;
2. manure under plowing of 30 t/ha;

3. mineral fertilizers under plowing in a dose $N_{30}P_{30}K_{30}$, $N_{45}P_{45}K_{45}$ та $N_{60}P_{60}K_{60}$ in form of «Superagro»;

4. chisel tillage of soil with mineral fertilizers.

The experiments were performed in the laboratory of crop rotations stationary pledged under multifactorial schemes.

The researches were conducted in the stationary laboratory of crop rotations, which are set under multifactorial schemes.

Repetition in the experiments is threefold, the area of the record plot of 25 м^2.

Seeding was conducted with the drill CH-16M, SUPN-6, SPS-12, followed by seed rolling with rollers ZKKSH-6.

Harvesting was performed by plots combine "Sampo 130" or combine harvester "Winterstager" (Austria), followed by weighing and re-counting for standard moisture content and 100% purity.

Chemical means for crop protection that were used: protectant Vitavaks 200 FF (3 kg/t), herbicides - Butizan 400 (2.5 l/ha), Harnes (2,5 l / ha), Pivot (0,7 l / ha) ; insecticides – Karate - 0,15 l/ha, Decis profi - 40 g/ha, Biskaya – 0,4 l/ha.

Surveys and observation in the experiments were carried out according to an agreed program.

WEATHER CONDITIONS DURING PERIOD OF THE RESEARCHES PERFORMANCE

Table 2

Main meteorological parameters of weather conditions at the experimental fields of the Yuriev Plant Institute of UAAN during the vegetation period of research 2008 — 2010.

Decade	Середньобагаторічні				Current				
	Daily temperature	Daily temperature	°C Сума v температур,	The amount of precipitation	Air temperature, °C			The	amou
					Average daily	maximal	minimal		

1	2	3	4	5	6	7	8	9	10
August 2008.									
1	21,9			11,1	19,3	31,3	10,4	93,1	13,8
2	20,8			19,0	25,5	36,8	14,9	155,3	0,0
3	19,1			16,8	20,8	33,9	9,9	118,8	7,8
For a month	20,6	638,6	282	46,9	21,9	36,8	9,9	367,2	21,6
September 2008.									
1	17,2			15,7	19,3	31,8	5,0	93,1	0,8
2	14,3			14,1	11,2	18,0	7,0	13,2	25,3
3	12,0			13,7	10,9	18,2	2,7	12,0	8,4
For a month	14,5	439	117,2	43,5	13,8	31,8	2,7	118,3	34,5
October 2008.									
1	9,8			12,2	13,6	20,8	1,6	38,3	15,8
2	8,3			13,2	10,7	19,4	2,3	15,9	7,1
3	4,5			13,8	7,1	14,2	0,2	0	0
For a month	7,5			39,2	10,5	208	02	54,2	22,9
November 2008.									
1	2,1			7,0	4,0	13,8	-6,4		1,0
2	0,6			18,1	3,6	12,1	-5,0		9,0
3	-0,9			17,9	1,9	11,4	-3,1		17,7
For a month	0,6			43,0	3,2	13,8	-6,4		27,7
December 2008.									
1	-2,9			11,7	4,7	10,4	-1,5		3,2
2	-3,7			18,3	-5,4	-2,0	-10,2		0,3
3	-4,6			13,5	-7,0	-2,4	-12,6		18,1
For a month	-3,7			43,5	-2,6	10,4	-12,6		21,6
1	2	3	4	5	6	7	8	9	10
January 2009.									
1	-5,5			11,9	-11,7	-2,5	-24,8		5,5
2	-7,3			12,7	-3,1	2,8	-13,0		24,6
3	-6,8			13,7	-0,2	3,0	-5,2		0,2
For a month	-6,5			38,3	-5,0				30,3
February 2009.									
1	-6,6			9,0	-1,0	5,2	-10,6		29,4
2	-6,0			13,1	0,9	5,3	-7,3		30,4
3	-4,7			8,4	-5,4	2,0	-15,0		7,2

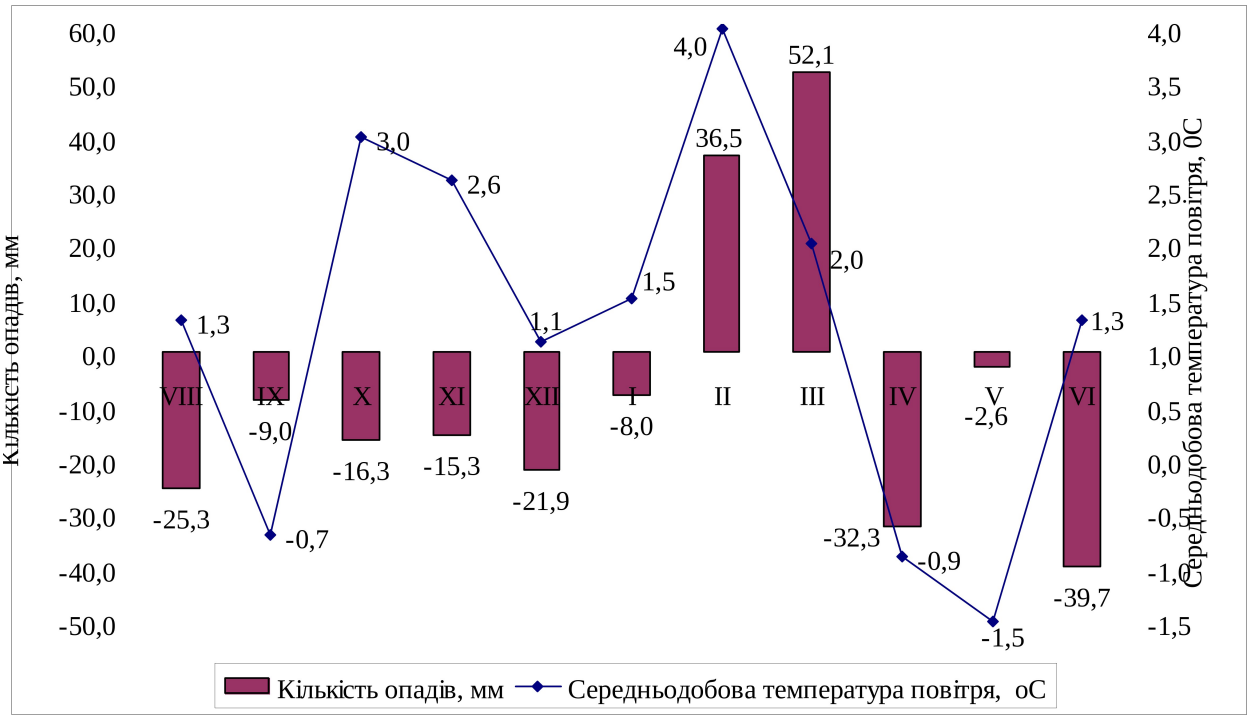
For a month	-5,8			30,5	-1,8	5,3	-15,0		67,0
March 2009.									
1	-2,7			7,8	-0,7	5,8	-10,3		21,7
2	0,4			9,3	1,8	8,6	-6,7		31,8
3	2,7			11,2	4,1	12,5	-4,4		26,9
For a month	-0,3			28,3	1,7	12,5	-10,3		80,4
April 2009.									
1	7,4			14,2	6,0	19,0	-2,3	1,9	1,5
2	9,0			12,4	8,6	19,2	-4,9	5,0	1,7
3	12,3			8,9	11,5	25,7	-3,3	34,2	0,0
For a month	9,6	287	42,2	35,5	8,7	25,7	-4,9	41,1	3,2
May 2009.									
1	14,9			13,2	13,7	22,7	6,3	36,5	16,0
2	16,6			11,7	13,5	23,8	4,0	35,1	13,1
3	16,7			18,8	16,5	26,0	8,5	72,0	12,0
For a month	16,1	482	142,8	43,7	14,6	26,0	4,0	143,6	41,1
June 2009.									
1	19,8			13,4	20,8	33,5	10,3	108,0	1,3
2	20,0			25,1	19,0	31,0	8,0	90,4	20,2
3	20,7			24,8	24,7	34,0	15,0	147,3	2,1
For a month	20,2	605	275,0	63,3	21,5	34,0	8,0	345,7	23,6
July 2009.									
1	21,0			19,5	20,6	31,6	10,1	105,7	15,3
2	21,6			25,0	25,8	36,0	16,4	158,4	34,6
3	21,5			27,2	21,6	33,2	13,5	127,2	45,7
For a month	21,4	641	346,7	71,7	22,7	36,0	10,1	391,3	95,6
For March – July	13,1	2015	806,7	242,5	13,8	36,0	-10,3	921,7	243,9
August 2009.									
1	21,9			11,1	20,2	29,4	8,1	92,0	8,3
2	20,8			19,0	25,6	35,2	14,1	150,2	3,5
3	19,1			16,8	20,9	34,9	14,0	115,1	0,0
For a month	20,6	638,6	282	46,9	22,0	35,2	8,1	357,6	11,8
1	2	3	4	5	6	7	8	9	10
September 2009.									
1	17,2			15,7	19,3	32,6	5,0	93,1	0,8

2	14,3			14,1	15,6	21,0	7,0	13,2	20,3
3	12,0			13,7	13,9	18,1	2,7	12,0	8,3
For a month	14,5	439	117,2	43,5	16,3	32,6	2,7	118,3	29,4
October 2009.									
1	9,8			12,2	15,2	20,9	1,6	38,3	8,8
2	8,3			13,2	11,7	19,8	2,3	15,9	7,1
3	4,5			13,8	7,1	14,9	0,2	0	2,0
For a month	7,5			39,2	11,3	20,9	02	54,2	17,9
November 2009.									
1	2,1			7,0	4,1	13,9	-6,4		1,0
2	0,6			18,1	3,9	12,1	-5,0		9,0
3	-0,9			17,9	1,9	11,4	-3,1		16,1
For a month	0,6			43,0	3,3	13,9	-6,4		26,1
December 2009.									
1	-2,9			11,7	1,7	8,4	-1,5		3,1
2	-3,7			18,3	-5,5	-2,1	-10,2		1,3
3	-4,6			13,5	-7,3	-2,9	-12,6		17,1
For a month	-3,7			43,5	-3,7	8,4	-12,6		21,5
January 2010.									
1	-5,5			11,9	-15,7	-5,1	-24,9		5,3
2	-7,3			12,7	-11,1	-6,8	-13,0		24,5
3	-6,8			13,7	-5,1	-1,0	-5,2		7,5
For a month	-6,5			38,3	-10,6	-1,0	-24,9		37,3
February 2010.									
1	-6,6			9,0	-10,0	-4,2	-13,5		21,4
2	-6,0			13,1	-6,2	-5,3	-7,2		30,9
3	-4,7			8,4	-9,4	-1,0	-15,8		17,2
For a month	-5,8			30,5	-8,5	-1,0	-15,8		69,5
March 2010.									
1	-2,7			7,8	-3,7	5,1	-11,2		22,7
2	0,4			9,3	-0,8	5,6	-6,7		32,5
3	2,7			11,2	4,1	9,5	-4,4		25,9
For a month	-0,3			28,3	-0,4	9,5	-11,2		81,1
April 2010.									
1	7,4			14,2	6,1	17,0	-2,3	1,9	4,5
2	9,0			12,4	8,9	18,2	-4,8	5,0	7,7

3	12,3			8,9	12,5	20,2	-3,3	34,2	10,0
For a month	9,6	287	42,2	35,5	9,2	20,2	-4,8	41,1	23,2
1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10
May 2010.									
1	14,9			13,2	13,5	21,7	6,3	36,5	10,1
2	16,6			11,7	16,5	23,8	6,1	35,1	11,0
3	16,7			18,8	24,5	29,0	8,5	72,0	12,1
For a month	16,1	482	142,8	43,7	18,2	29,0	6,1	143,6	33,2
June 2010.									
1	19,8			13,4	29,0	34,5	12,3	108,0	0,5
2	20,0			25,1	27,0	34,1	14,0	90,4	10,2
3	20,7			24,8	20,7	33,0	15,0	147,3	12,1
For a month	20,2	605	275,0	63,3	25,6	34,5	12,3	345,7	22,8

Weather conditions in autumn 2008 were warm and dry. Thus, the average air temperature in September was 13,8ºC, at a norm 14,5ºC, in October and November, the air temperature was above the norm by 3,0ºC and 2,6ºC, respectively. The amount of precipitation was less than the average annual by 9,0, 16,3 and 15,3 mm, or by 21, 42 and 36%, according to the months (Fig. 1).

Figure 1. Deviation from the average annual precipitation and temperature indicators during the growing season of winter wheat of 2008-2009. (data from the Meteopost Dokuchaev HNAU).



The average daily air temperature of the winter months was also by 1,1-4,0°C more than the norm. Rainfall in December 2008 and January 2009 was below the norm by 21,9 and 8,0 mm, or by 50 and 21%, respectively. Rainfall in February exceeded the average annual figures by 36,5 mm, or 120%.

The begining of the spring of 2009 was quite humid and warm. Thus, the amount of precipitation in March was above normal by 52,1 mm, or by 184%, and the average-daily air temperature above normal 2,0°C (1,7°C against -0,3°C). However, in April and May can be described as cool with low humidity. Thus, the average daily temperature was below the norm by 0,9°C and 1,5°C, and the amount of precipitation by 32,3 and 2,6 mm, or by 91 and 6%, according to the months.

The most drought summer terms of 2009 were noted in June. The average air temperature was above the norm by 1,3°C and quantity of precipitation was less by 39,7 mm, or 63%, compared with long-time average annual norm, that negatively influecnced the formation of the grain during plants blooming, formation and maturing of grain.

The first decade of July 2009 was close to the long-time average annual indicators of daily air temperature (20,6°C, at a norm of 21,0°C) and amoint of precipitation (15,3 mm at a norm of 19,5 mm).

In general, the autumn (September - November) and spring-summer (March - and the first decade of July) periods of the growing season 2008-2009, can be described as dry, with amount of rainfall by 32% and 14% respectively lower than normal, and the warm average daily air temperature above the norm by 1,6°C and 0,1°C, respectively.

For winter crops of the region the weather terms fo 2009-2010 happened to be very unsuccessful. The fall 2009 has was dry. Thus, the average air temperature in September, October and November exceeded the norm by 1,8°C, 3,8°C and 2,7°C respectively. Amount of rainfall during this period dropped to 14,1 mm (32%), 21,3 mm (54%) and 16,9 mm (39%) in the equation with the long-time average annual standards.

The average daily air temperature winter months of 2010 was below normal by -2,7-4,1°C. Rainfall in December 2009 was less than the norm of 22 mm in January in the normal range of 37,3 mm, and in February by 39 mm higher than long-term rates. Due to adverse weather conditions winter fields were covered with ice.

Spring warmth of 2010 came a little late, but in general the weather during this period did not differ much from the average for the given area.

The last ten days of May and early June brought to the experimental fields of the Institute abnormal heatwave (29,0-34,5°C against the norm of 16,1-20,2°C) and drought (33,2 mm of rain against the 43,7 mm and 22,8 mm against 63,3 mm normal, respectively).

Adverse weather conditions of 2009-2010 had very bad impact on the productivity of the research crops.

RESEARCH RESULTS

WINTER WHEAT

In the experiment with winter wheat and the efficiency of the use of the preparation "Nanoagricole-Cereals" in the different phases of the development of crops. Predeceeding crops are for variaties Astet, Alliance, Doskonala, Vasylyna- pea and grain.

The norm of seeding is 5 million pcs/ha. From the chemical protectors used are herbicide Calibre — 60 g/ha, insecticide Karate-zeon — 0,150 g/ha and fungicide Alto-super — 0,4 l/ha.

Foliar nutrition of winter wheat with the preparation «Nanoagricole-Cereals» was performed twice: when starting the early booting stage and earing at a dose of 2 l/ha per treatment at a dilution of 1:100.

The research results are shown in Table 3. These pieces of data were statistically proved and according to the results of threefold measurements are significantly exceeding scatter of the experiments error.

Depending on the background of mineral nutrion the level of productivity of crops that were not traeted with «Nanoagricole» is ranging in the limits from 3,53

t/ha (the average on the background in the control without fertilizers) up to 6,16 t/ha (the average while using mineral nutrition background of $N_{90}P_{60}K_{60}$).

Among the options of usinf the solution «Nanoagricole-Cereals» at average in the research the most efficient was twice sprying in the booting strage and ear formation at a application rate 2 l/ha, that gave ability to get extra 0,7-1,5 t/ha of grain.

Depending on the mineral nutrition background and wheat variety the total yield increment of twice treated crops ranged from 18,5% to 27,1%.

Significant yield increment is found from all the treated with "Nanoagricole" winter wheat varieties. Herewith the most significant increase of productivity is observed on the varieties Vasylysa (at average 23,5%) where control level on all of the parameters of mineral background was a little bit below than the second researched varieties. This fact reconciles well with the adaptogenic effect from the derivatives of succinic acid, included in the "Nanoagricole" composition.

In all the studied varieties of winter wheat is a general trend of enhancing of productivity with increased mineral background. This is consistent with the literature data: the chelating agents based on natural polycarboxylic acids and the chelated trace elements that are included in the preparation "Nanoagricole-Cereals" repeatedly accelerate the absorption and assimilation of nitrogen, phosphorus and potassium, activate metabolism, increase the degree of assimilation of macronutrients.

In terms of system of fertilizer application the highest efficiency of the «Nanoagricole-Cereals" is marked during cultivation of winter wheat using mineral nutrition $N_{60}P_{60}K_{60} + N_{30}$ with middle grain productivity rate of 7,62 t/ha. As a result in these conditions he variety Alliance gave harvest of 7,81 t/ha.

Table 3

Productivity of winter wheat depending on the nutritional background and application rate and term of foliar nutrition with the solution «Nanoagricole-Cereals», t/ha, 2009

Treatment option (B)	**Nutritiolan background (A)**				
	Plowing			**Chisel**	**Average**
	Without	**30 h/ha of**	**$N_{90}P_{60}K_{60}$**	**$N_{90}P_{60}K_{60}$**	

		fertilizers	manure			
1		**2**	**3**	**4**	**5**	**6**
Variety Astet, preceeding crop– pea on grain						
Control		3,81	5,21	6,26	6,14	**5,36**
Nanoagricole-Cereals 2 t/ha, booting		4,02	5,64	6,78	6,64	**5,77**
Nanoagricole-Cereals 2 l/ha, ear formation		4,35	5,89	7,25	7,13	**6,16**
Nanoagricole-Cereals, (2+2) l/ha, booting +earing		4,56	6,29	7,71	7,68	**6,56**
Yield increment (2+2) l/ha compare to control)	**t/ha**	**0,75**	**1,08**	**1,45**	**1,54**	**1,21**
	%	**19,7**	**20,8**	**23,2**	**25,0**	**22,2**
HIP_{05} A-0,20; B-0,19; AB-0,45						
Variety Alliance, preceding crop – pea on grain						
Control		3,13	4,57	6,32	6,24	**5,07**
Nanoagricole-Cereals 2 l/ha, booting		3,57	4,94	6,88	6,80	**5,55**
Nanoagricole-Cereals 2 l/ha, earing		3,65	5,15	7,32	7,22	**5,84**
Nanoagricole-Cereals, (2+2) l/ha, booting + earing		3,82	5,46	7,81	7,74	**6,21**
Yield increment (2+2) l/ha compare to control	**t/ha**	**0,68**	**0,89**	**1,49**	**1,50**	**1,14**
	%	**21,6**	**19,5**	**23,6**	**24,1**	**22,2**
HIP_{05} A-0,23; B-0,20; AB-0,48						

Продовження таблиці 3

Treatment status (B)		Nutritional background(A)				
		Plowing			Chisel	Average
		Without fertilization	30 t/ha of manure	$N_{90}P_{60}K_{60}$	$N_{90}P_{60}K_{60}$	
1		2	3	4	5	6
Variety Doskonala, preceeding crop – pea on grain						
Control		3,50	4,72	6,23	6,21	**5,09**
Nanoagricole-Cereals 2 l/ha, booting		3,86	5,18	6,94	6,89	**5,72**
Nanoagricole-Cereals 2 л/га, earing		4,01	5,47	7,33	7,25	**6,02**
Nanoagricole-Cereals, (2+2) l/ha, booting + earing		4,19	5,71	7,78	7,71	**6,35**
Yield increment (2+2) l/ha compare to control	**t/ha**	**0,69**	**0,99**	**1,55**	**1,50**	**1,18**
	%	**19,8**	**20,9**	**24,8**	**24,1**	**22,4**
HIP_{05} A-0,24; B-0,19; AB-0,47						
Variety Vasylyna, preceding crop – pea on grain						
Control		3,67	4,55	5,99	5,87	**5,02**
Nanoagricole-Cereals 2 l/ha, booting		3,99	5,02	6,85	6,80	**5,67**
Nanoagricole-Cereals 2 л/га, earing		4,16	5,17	7,22	7,25	**5,95**
Nanoagricole-Cereals, (2+2) l/ha, booting + earing		4,35	5,56	7,58	7,46	**6,24**

Yield increment (2+2) l/ha compare to control	**t/ha**	**0,68**	**1,01**	**1,59**	**1,59**	**1,22**
	%	**18,5**	**22,0**	**26,5**	**27,1**	**23,5**
HIP_{05} A-0,21; B-0,20; AB-0,48						

It is noted that the yield of winter wheat in the terms of experiment using traditional plowing was higher (average 7,72 t/ha) than using chisel plowing (averaging 7,53 t/ha) with the same level of mineral background $N_{90}P_{60}K_{60}$. However, the yield increment of wheat treated with chisel is the highest in test conditions. This fact is consistent with adaptogenic properties of the solution "Nanoagricole".

The stimulatory effect of the solution "Nanoagrciole-Ceraels" and a favourable effect on grain quality are confirmed by estimation of the mass of 1000 grains, number of grains per ear and the class of grain (tab. 4).

Table 4

Improvement of qualitive characteristics of grain of winter wheat varieties under the influence of foliar nutrition with "Nanoagricole-Cereals"

Varietuies	Nutritional background						Nanoagricole-cereals, (2+2)l/ha+$N_{90}P_{60}K_{60}$			± before control $N_{60}P_{60}K_{60}$	
	Without fertilizers			$N_{90}P_{60}K_{60}$						П	
	Weights of 1000 grains, g	Number of grains per ear	Class of grain	Weights of 1000 grains, g	Кількість зерен в колосі	Клас зерна	Маса 1000 зерен, г	Кількість зерен в колосі	Клас зерна	1000 зерен, г ирість маси	Приріст кількості зерен в колосі, шт.
Astet	40,5	34,2	4	41,2	34,4	4	45,1	39,8	3	**3,9**	**5,4**
Alliance	41,9	34,0	4	42,0	34,2	4	46,3	40,9	3	**4,3**	**6,7**
Doskonala	36,7	32,8	5	37,2	33,0	5	41,9	37,1	3	**4,7**	**4,1**
Vasylyna	37,1	32,2	5	37,4	34,2	5	42,3	38,2	3	**4,9**	**4,0**
Average	**39,1**	**33,3**		**39,4**	**33,9**		**43,9**	**39,0**		**4,5**	**5,1**
HIP_{05} A-0,20; B-0,18; AB-0,45											

It was defined that the mass of 1000 grains of studied varieties of winter wheat comprises at average 39,1 g on the nutritional background without fertilizers and 39,4 g with mineral fertilizers $N_{90}P_{60}K_{60}$. The average weight of 1000 grains of wheat treated with the drug "Nanoagricole-Cereals" was increased by 4,5 g (11,4%) and comprised up to 43,9 g.

The average number of grains per ear of the tested wheat varieties due to the use of the drug "Nanoagricole-Cereals" was increased by 15,0% from 33,9 pieces in the control to 39,0 peices after foliar nutrition.

The most important indicator of improving the quality of grain is its class, which determines the content of protein and gluten. For all four varieties tested after processing wheat "Nanoagricole" grain estimated as the third class, whereas in the control the quality remains at the fourth to fifth class.

SPRING BARLY

The study of the effect of the solution «Nanoagricole-Cereals» on spring barley varieties were conducted on the varietiesParnas and Vyklyk, according tothe full scheme of the field experience as shown in Table 1.

From means of chemical protection used: herbicide Calibre - 60 g/ha in the tillering phase, to protect against pests - insecticide Karate-zeon - 0,150 l/ha and fungicide Alto-super — 0,4 l/ha. The application rate of seeding- 4,5 million pcs of seeds/ha. Before sowing the seeds were treated with the solution Vitavaks 200 FF — 2,5 l/t. The main soil processing - tillage compared with chisel.

The control systems of nutrition supply included aftereffect of 30 t/ha of manure and mineral fertilizer application in a dose $N_{30}P_{30}K_{30}$ and $N_{60}P_{60}K_{60}$ under plowing or subsurface tillage (chisel plowing). Preceding crops - sugar beet and soybean.

Pre-sowing seed treatment was carried out with the solution "Nanoagricole-Cereals" at a dose of 4 l/t in the day before sowing(seeding). Foliar nutrition of barley carried out with the drug "Nanoagricole-Cereals" was performed twice: in tillering phase in phase of booting at a dose of 2 l/ha per treatment in a dilution of 1: 100.

In 2009 there was a negative weather conditions for the cultivation of spring barley, as from the period of germination till booting were drought and plants have evolved badly as a result formed the low level of productivity.

In the course of the research it was defined that pre-sowing seed treatment with the drug "Nanoagricole-Cereals" significant influenced the development and yield of barley varieties tested (tab. 5). Thus, the average yield of the variety Parnas (preceding crop - sugar beet) increased from 2,25 t/ha in the control to 2,54 t/ha. The yield increment of the crop coprised at average 0,29 t/ha (12,6%).

Table 5

Productivity of spring barley wheat depending on the nutritional background and presowing seed treatment with the solution «Nanoagricole-Cereals», t/ha, 2009

Treatment option (B)		Nutritional background (A)				
		Plowing			Chisel	Average
		Without fertilizers	30t/ha of manure	$N_{30}P_{30}K_{30}$	$N_{60}P_{60}K_{60}$	
1		2	3	4	5	6
Variety Parnas, preceding crop – sugar beets						
Control (without treatment)		1,50	2,18	2,65	2,68	**2,25**
Seed gtreatment, 4 l/t,		1,67	2,43	3,02	3,05	**2,54**
Yield increment	**t/ha**	**0,17**	**0,25**	**0,37**	**0,37**	**0,29**
	%	**11,2**	**11,6**	**13,9**	**13,7**	**12,6**
$HIP_{0,05}$ according to the factors: A (nutritiolan background) – 0,10 t/ha, B (Agrozahid)– 0,07 t/ha, AB (Interaction)– 0,14 t/ha,						
Variety Vyklyk, preceding crop - soy						
Control (without fertilizers)		2,87	3,03	3,33	3,42	**3,16**
Seed treatment, 4 l/t, Nanoagricole-Cereals		3,14	3,34	3,79	3,85	**3,53**

Yield increment	**t/ha**	**0,27**	**0,30**	**0,46**	**0,43**	**0,37**
	%	**9,4**	**9,8**	**13,7**	**12,6**	**11,4**
$HIP_{0,05}$ according to factors: A (Nutritional background) – 0,10 t/ha, B (Agrozahid)– 0,08 t/ha, AB (interaction)– 0,15 t/ha,						

Table 6

Yields of spring barley depending on the nutritional background and a dose and duration of foliar nutrition with "Nanoagricole-Cereals", t/ha, 2009.

Treatment option (B)		**Nutritional background (A)**					
		Plowing				**Chisel**	**Average**
		Without fertilizers	**30t/ha of manure**	**$N_{30}P_{30}K_{30}$**	**$N_{60}P_{60}K_{60}$**	**$N_{60}P_{60}K_{60}$**	
1		**2**	**3**	**4**	**5**	**6**	**7**
Variety Parnas, preceding crop – sugar beets							
Control		1,50	2,18	2,65	2,68	2,75	**2,35**
Nanoagricole-Cereals 2 l/ha, booting		1,61	2,41	2,74	2,81	3,09	**2,53**
Nanoagricole-Cereals 2 л/га, earing		1,70	2,51	3,01	3,13	3,20	**2,71**
Nanoagricole-Cereals, (2+2) l/ha, booting + earing		1,81	2,60	3,33	3,36	3,38	**2,90**
Yield increment (2+2) l/ha compare to control	**t/ha**	**0,31**	**0,42**	**0,68**	**0,68**	**0,63**	**0,54**
	%	**20,7**	**19,3**	**25,6**	**25,2**	**22,8**	**22,7**
HIP_{05} A-0,21; B-0,19; AB-0,48							
Variety Vyklyk, preceding crop - soy							
Control		2,31	2,66	3,16	3,26	3,20	**2,92**

Nanoagricole-Cereals 2 l/ha, booting		2,49	2,89	3,44	3,55	3,51	**3,17**
Nanoagricole-Cereals 2 л/га, earing		2,53	2,97	3,69	3,78	3,74	**3,34**
Nanoagricole-Cereals, (2+2) l/ha, booting + earing		2,77	3,24	3,94	4,09	4,01	**3,61**
Yield increment (2+2) l/ha compare to control	**т/га**	**0,46**	**0,58**	**0,78**	**0,83**	**0,81**	**0,69**
	%	**19,8**	**21,8**	**24,8**	**25,5**	**25,3**	**23,4**
HIP_{05} A-0,20; B-0,21; AB-0,47							

Even better yield was observed on the variety Vyklyk (preceding crop - soy). Productivity has increased at average from 3,16 t/ha in the control up to 3,53 t/ha, and grain increment was 0,37 t/ha (11,4%).

In these experiments, a significant impact on the yield of spring barley varieties had mineral nutrition background. Additional fertilizing of plants with macrofertilizers $N_{30}P_{30}K_{30}$ and $N_{60}P_{60}K_{60}$ in a form of "Nitroammophoska"(NPK) contributed to the maximum manifestation of the effect. Under these conditions, it was possible to increase the yield of barley varieties Parnas up to 3,02-3,05 t/ha, raising the yield by 13,7-13,9% and of the variety Vyklyk up to 3,79-3,85 t/ha, reliable increase of yields which was 0,43-0,46 t/ha (12,6-13,7%).

More significant impact manifestated foliar nutrition of vegetative plants (tab. 6). So after a double treatment with the drug "Nanoagricole-Cereals" yields of barley of both varieties was grown at average by 0,54-0,69 t/ha (22,7-23,4%), peaking at 25,2-25,5% provided the mineral nutritional background $N_{60}P_{60}K_{60}$. Under these conditions, the yield of winter barley varieties Parnas was 3,36-3,38 t/ha, and of the variety Vyklyk — 4,01-4,09 t/ha.

An important indicator of the quality of spring barley grain is protein content, particularly when using it in the brewing industry.

When testing the drug "Nanoagricole-Cereals" on crops of spring barley varieties Parnas it`s been defined that all treatment options statistically evidentally contributed to the growth of this indicator compared with the control (Table. 7). When growing spring barley with a complete cycle of processing of seeds and nutrition of vegetative mass with "Nanoagricole-Cereals" the protein content increased in the control without fertilizers by 2,16% and with additional nutrition $N_{60}P_{60}K_{60}$ - by 1,09%.

This confirms the property of micronutrient preparations activate metabolism of amino acids, protein and gluten increasing the class of grain.

Table 7

The protein content in grain of spring barley varietiy Parnas depending on the nutritional background and dose and duration of foliar treatment with the drug "Nanaogricole-Cereals", 2009,%.

№	Treatment option	Nutritional background		
		Without fertilizers	Background + $N_{60}P_{60}K_{60}$	Average
1	Control	10,73	14,51	**12,62**
2	Nanoagricole-Cereals, seed treatment, 4 l/ha	11,79	14,86	**13,33**
3	Nanoagricole-Cereals, 2 l/ha, booting	11,85	14,99	**13,42**
4	Nanoagricole-Cereals, 2 l/ha, ear formation	12,10	15,14	**13,62**
5	Nanoagricole-Cereals, (2+2) l/ha, booting + earing	12,78	15,31	**14,05**
6	Nanoagricole-Cereals, seed treatment+ Nanoagricole-Cereals, (2+2) l/ha, b ooting + earing	12,89	15,60	**14,25**
7	**± before control compare to the treatment №6**	**2,16**	**1,09**	**1,63**

MAIZE

Study of influence of the drug "Nanoagricole-Maize" on corn performed on the medium early hybrid Varta MW (FAO - 280) and medium early hybrid Zlagoda MB (FAO — 310).

Sowing was carried out with the drills SUPN-6. Harvesting of corn wass carried out with the combine "Winterstager" (Austria). Repeatition of experiments was threehold, each record plot was of 50 м^2.

Chemical protection means for corn used: herbicides - Harnes, Primextra Gold, Titus + Trend. Farming equipment for growing corn was common for areas of the the Eastern steppes of Ukraine except those techniques, which were studied. The density of seeding of both corn hybrids was 60 thousand pcs/ha.

The studies were conducted in the stationary steam-tilled corn seed rotation. Crop rotation scheme: black fallow - winter wheat - sugar beet - spring cereals - peas - winter wheat - maize - spring cereals - sunflower.

Corn seed treatment with the drug "Nanoagricole-Maize" was performed at the application rate of 4 liters of drug per tonne seed material.

Analysis of the results of the research of pre-sowing treatment of corn seed with the "Nanoagricole" shows that the grain yield depending on fertilizer use was statistically accuratly increasing (Table. 8). Thus, at average according to the experiment productivity of hybrid Varta increased from 6,77 t/ha in the control without treatment up to 7,58 t/ha and yield incerement of this crop was 0,81t/ha (11,9%). The average yield of hybrid Zlagoda increased after treatment of seeds from 5,82 t/ha in control up to 6,58 t/ha and yield increment was 0,75 t/ha (12,8%).

The most significant effect of treatment of seed corn with the "Nanoagricole" was manifestated within the mineral nutrition background $N_{60}P_{60}K_{60}$, especially in the traditional plowing. Under these conditions, the grain yield of maize hybrid Varta was 7,95-7,99 t/ha, and the hybrid Zlagoda — 7,08-7,10 t/ha. Yield increment of these crops increased by 12,7-13,7% and 14,5-15,5% respectively.

The twofold foliar nutrition of studied hybrids with the drug "Nanoagricole-Maize" in phases os sprouts and 6-8 leaves helped to reveal their potential opportunities and further increase the yield (Table. 9). In these circumstances, the

average yield of hybrid Varta was 8,08 t/ha, which is 1,33 t/ha or 19,7% higher than control. Increment of grain of the hybrid Zlagoda was at average 1,32 t/ha or 22,5%, and the yield reached 7,13 t/ha.

Table 8

Yields of maize hybrids depending on nutritional background and pre-sowing seed treatment (inlay) with the drug "Nanoagricole-Maize", t/ha, 2009

Treatment option (B)		Nutritional background(A)				
		Plowing			Chisel	Average
		Without fertilizers	30t/ha of manure	$N_{60}P_{60}K_{60}$	$N_{60}P_{60}K_{60}$	
1		2	3	4	5	6
Hybrid Varta MV (FAO — 280) (C), preceding crop – winter wheat						
Control (without treatment)		6,10	6,91	7,03	7,05	**6,77**
Seed treatment 4l/t, Nanoagricole-Maize		6,74	7,65	7,99	7,95	**7,58**
Yield increment	**t/ha**	**0,64**	**0,75**	**0,96**	**0,90**	**0,81**
	%	**10,5**	**10,8**	**13,7**	**12,7**	**11,9**
$HIP_{0,05}$ according to the factors: A (Nutritional background) – 0,11 t/ha, B (Agrozahid)– 0,07 t/ha, AB (Interaction)– 0,14 t/ha,						
Hybrid Zlagoda MV (FAO — 310) (C), preceding crop – winter wheat						
Control (without treatment)		5,24	5,71	6,20	6,13	**5,82**
Seed trreatment 4 l/t, Ncanoagricole-Maize		5,75	6,37	7,10	7,08	**6,58**
Yield increment	**τtha**	**0,51**	**0,66**	**0,89**	**0,95**	**0,75**
	%	**9,8**	**11,5**	**14,5**	**15,5**	**12,8**
$HIP_{0,05}$ according to the factors: A (Nutritional background) – 0,10 t/ha, B (Agrozahid)– 0,09 t/ha, AB						

(Interaction)– 0,15 t/ha,

The best mineral nutrition background was $N_{60}P_{60}K_{60}$. Yields of maize reached 8,40-8,44 t/ha for the hybrid Varta, 7,63-7,67 t/ha for the hybrid Zlagoda. Increase in yield compared with the control in the experiment was raised by 19,1-20,1% and 24,9-25,1% respectively.

Table 9

Yields of maize hybrids depending on nutritional background and dose and duration of foliar treatment with the drug "Nanoagricole-Maize", t/ha, 2009

Treatment option (B)		**Nutritional background (A)**				
		Plowing			**Chisel**	**Average**
		Without fertilizers	**30 t/ha of manure**	**$N_{60}P_{60}K_{60}$**	**$N_{60}P_{60}K_{60}$**	
1		**2**	**3**	**4**	**5**	**6**
Hybrid Varta MV (FAO — 280) (C), preceding crop — black fallow						
Control		6,10	6,85	7,03	7,05	**6,77**
Nanoagricole-Maize 2 l/ha, sprouts		6,38	6,99	7,39	7,57	**7,08**
Nanoagricole-Maize 2 l/ha, 6-8 leaves		6,74	7,26	7,85	8,11	**7,49**
Nanoagricole-Maize (2+2) l/ha, sprouts + 6-8 leaves		7,32	8,18	8,44	8,40	**8,09**
Yield increment (2+2) l/ha to control)	**t/ha**	**1,22**	**1,33**	**1,41**	**1,35**	**1,33**
	%	**20,2**	**19,5**	**20,1**	**19,1**	**19,7**
HIP_{05} A-0,23; B-0,19; AB-0,48						
Hybrid Zlagoda MB (FAO — 310) (C), preceding crop — black fallow						
Control		5,24	5,71	6,20	6,13	**5,82**
Nanoagricole-Maize 2 l/ha, sprouts		5,65	6,15	6,92	6,88	**6,40**
Nanoagricole-Maize 2 l/ha, 6-8 leaves		5,87	6,31	7,27	7,41	**6,72**

Nanoagricole-Maize (2+2) l/ha, sprouts + 6-8 leaves		6,23	6,91	7,76	7,63	**7,13**
Yield increment (2+2) l/ha to control)	**t/ha**	**0,99**	**1,20**	**1,56**	**1,53**	**1,32**
	%	**18,9**	**21,0**	**25,1**	**24,9**	**22,5**
$HIP_{0,05}$ interaction of factors A – 0,12 t/ha; B – 0,17 t/ha; AB – 0,34 t/ha						

SUNFLOWER

The effect of "Nanoagricole-Sunflower" for tested crops was carried out on hybrids of the first generation Yason and Oskil. Sowing of sunflower seeds were performed with the drill SUPN-6, harvesting was conducted in sections with the combine "Sampo 130" followed by weighing and converted to standard moisture content and 100% purity.

Chemical protection products used: Disinfectant Vitavaks 200 FF (3 kg/t), herbicide Harnesses (2,5 l/ha), insecticides - Karate — 0,15 l/ha.

Seeding rate was 50 thausand pcs/ha. Preceding crop - spring barley. The scheme of crop rotation: peas - winter wheat - sugar beet - barley - sunflower.

Sowing was carried out in the best period for sunflower.

Repeatition of the experiments was threefold, record plot area of 50 $м^2$.

Tests have testified that foliar nutrition of sunflower with the drug "Nanoagricole-Sunflower" at all stages of processing results in a statistically significant increase in yield (Table 10). Double treatment of plants in the stage of sprouts and 8-10 leaves facilitated to increased harvest of sunflower Oskil at average up to 2,56 t/ha in comparison with control 2,03 t/ha. In terms of processing with the "Nanoagricole" average yield of hybrid Yason rose to 2,64 t/ha. Average yield increment of these hybrids was 0,53 t/ha (25,9%) and 0,48 t/ha (21,6%), respectively.

Among mineral nutrition backgrounds the most effective was usage of the solution "Nanoagricole-Sunflower" during growing this crop with the background $N_{30}P_{30}K_{30}$ within nutrition. Under these conditions the level of productivity of the

the hybrid Oskil rose by 28,3-29,9%, and of the hybrid Yason — 23,6% in comparison with the control.

Table 10

Yields of sunflower hybrids depending on nutritional background and dose and duration of foliar treatment with drug "Nanoagricole-Sunflower", t/ha, in 2009

Treatment option (B)		**Nutritional background (A)**			
		Without fertilizers	**$N_{30}P_{30}K_{30}$**	**$N_{30}P_{30}K_{30}$ +N_{30}**	**Average**
1		**2**	**3**	**4**	**5**
Hybrid Oskil F_1, preceding crop – spring barley					
Control		1,84	2,01	2,23	**2,03**
Nanoagricole-Sunflower 2 l/ha, sprouts		1,90	2,17	2,58	**2,22**
Nanoagricole-Sunflower 2 l/ha, 8-10 leaves		1,97	2,21	2,77	**2,32**
Nanoagricole-Sunflower (2+2) l/ha, sprouts + 8-10 leaves		2,20	2,61	2,86	**2,56**
Yield increment (2+2) l/ha to control)	**t/ha**	**0,36**	**0,60**	**0,63**	**0,53**
	%	**19,5**	**29,9**	**28,3**	**25,9**
HIP_{05} A-0,20; B-0,19; AB-0,46					
Hybrid Yason F_1, preceding crop – spring barley					
Control		2,03	2,20	2,37	**2,20**
Nanoagricole-Sunflower 2 l/ha, sprouts		2,11	2,30	2,59	**2,33**
Nanoagricole-Sunflower 2 l/ha, 8-10 leaves		2,12	2,33	2,77	**2,41**

Nanoagricole-Sunflower (2+2) l/ha, sprouts + 8-10 leaves		2,44	2,66	2,93	**2,68**
Yield increment (2+2) l/ha to control)	**t/ha**	**0,41**	**0,46**	**0,56**	**0,48**
	%	**20,2**	**20,9**	**23,6**	**21,6**
HIP_{05} A-0,21; B-0,18; AB-0,47					

WINTER RAPE

In the experiment with winter rape varieties Exotic and Exgold effectiveness of the drug "Nanoagricole-Rape" in different phases of the crop development was studied.

Seeding of winter rape was carried 9.09.2008. Preceding crop was winter wheat. Tillage include: disking, plowing, pre-sowing cultivation. In double disking fertilizers were introduced at a dose of $N_{45}P_{45}K_{45}$. Seeding rate - 5 kg/ha.

After germination, in phase of two pairs of actual leaves the herbicide Butizan 400 — 2,5 l/ha was used, against pests it was used the Karate-zeon — 0,2 l/ha in phases of sprouts and budding.

The average yield of winter rape without fertilizers in the course of the experiment was 1,42 t/ha for the variety Exotic and 1,49 t/ha for the variety Excold. On the background of mineral nutrients in a dose $N_{45}P_{45}K_{45}$ grain productivity increased up to 2,07 t/ha and 2,04 t/ha, respectively (tabl.11).

Foliar nutrition with the preparation "Nanoagricole-Rape" contributed to the maximum manifestation of potential of the studied rape crops. Thus, when twofold processing of plants average yield of the variety Exotic rose to 2,21 t/ha, and of the variety Exgold — up to 2,20 t/ha.

Under the influence of the drug "Nanoagricole-Rape" yield increment of winter rape of the hybrid Exotic comprised to control without fertilizer 0,36 t/ha (25,3%) and 0,57 t/ha (27,6%) against the mineral nutrition background of $N_{45}P_{45}K_{45}$. The similar increase of yield using "Nanoagricole" was observed on the hybrid Excold:

0,35 t/ha (23,8%) before control without fertilizers and 0,52 t/ha (25.4%) when using them.

It should be also noted that the solution "Nanoagricole-Rape" promotes faster drying of mature crops and they do not need desiccation. Grain moisture of the treated plants of both hybrids for all nutritional backgrounds reduces by almost double: 6,9-7,0% from 12,1-13,7% in the control without fertilizer and 4,3-4,4% with 8.3-9 0% with mineral nutition (tab. 11).

Table 11

Yields of winter rape depending on nutritiolan background and dose and duration of foliar treatment with the drug "Nanoagricole-Rape", t/ha, in 2009.

Trereatment option (B)		**Nutritiolan background (A)**				**Average productivity**
		Without fertilizers		**$N_{45}P_{45}K_{45}$**		
		t/ha	**Humidity of grains,%**	**t/ha**	**Humidity of grains,%**	
Variety Exotic, preceding crop – winter wheat						
Control		1,42	13,7	2,07	8,3	**1,75**
Nanoagricole-Rape 2 l/ha, sprout		1,59	8,6	2,31	6,2	**1,95**
Nanoagricole-Rape 2 l/ha, budding		1,66	7,9	2.45	5,4	**2,06**
Nanoagricole-Rape (2+2) l/ha, sprouts + buddinbg		1,78	7,0	2,64	4,3	**2,21**
Yield increment (2+2) l/ha to control)	**t/ha**	**0,36**		**0,57**		
	%	**25,3**		**27,6**		
HIP_{05} A = 0,12 t/ha, B = 0,07 t/ha, AB = 0,17 t/ha						
Variety Eksgold, preceding crop – winter wheat						
Control		1,49	12,1	2,04	9,0	**3,53**
Nanoagtricole-Rape 2 l/ha, sprouts		1,67	8,2	2,29	7,2	**1,98**

Nanoagtricole-Rape 2 l/ha, budding		1,73	7,6	2,37	5,7	**2,05**
Nanoagtricole-Rape, (2+2) l/ha, sprouts +budding		1,84	6,9	2,56	4,4	**2,20**
Yield increment (2+2) l/ha to control)	**t/ha**	**0,35**		**0,52**		
	%	**23,8**		**25,4**		
HIP_{05} A = 0,13 t/ha, B = 0,07 t/ha, AB = 0,18 t/ha						

SOY

Growth and development of soybean in place of estyablishing the field trials during the growing season in 2009 was held in dry weather conditions compared to the long-term average annual. This is typical for such measure as soil moisture and amount of precipitation in the critical period (bloom-forming and pouring the grain).

Table 12

Yield of soybean varieties depending on nutritional background and pre-sowing seed treatment (inlay) with the drug "Nanoagricole-Legumes", t/ha, 2009.

Treatment option (B)		**Nutritional background (A)**				
		Plowing			**Chisel**	**Average**
		Without fertilizers	**30 t/ha of manure**	**$N_{60}P_{60}K_{60}$**	**$N_{60}P_{60}K_{60}$**	
1		**2**	**3**	**4**	**5**	**6**
Variety Romantyka, preceding crop - winter wheat						
Control (without treatment)		2,12	2,39	2,43	2,16	**2,28**
Seed treatment 4l/t, Nanoagricole-Legumes		2,33	2,65	2,72	2,48	**2,55**
Yield increment	**t/ha**	**0,21**	**0,26**	**0,29**	**0,32**	**0,27**
	%	**9,8**	**10,7**	**12,0**	**14,7**	**11,8**
$HIP_{0,05}$ according to the factors: A (Nutritional background) – 0,11 t/ha, B (Agrozahid)– 0,09 t/ha, AB (Interaction)– 0,16 t/ha,						
Variety Annushka, preceding crop — winter wheat						

Control (without treatment)		1,63	1,82	2,03	1,91	**1,85**
Seed treatment 4l/t, Nanoagricole-Legumes		1,79	2,00	2,26	2,20	**2,06**
Yield increment	**t/ha**	**0,16**	**0,18**	**0,23**	**0,29**	**0,22**
	%	**10,1**	**9,9**	**11,4**	**15,2**	**11,7**
HIP $_{0,05}$ according to the factors: A (nutritional background) – 0,10 t/ha, B (Agrozahid)– 0,08 t/ha, AB (Interaction)– 0,15 t/ha,						

Table 13

Yield of soybean varieties depending on nutritional background and pre-sowing seed treatment with the drug "Nanoagricole-Legumes",t/ha.

Treatment option (B)		**Nutritional background (A)**				
		Plowing			**Chisel**	**Average**
		Without fertilizers	**30 t/ha of manure**	**$N_{60}P_{60}K_{60}$**	**$N_{60}P_{60}K_{60}$**	
1		**2**	**3**	**4**	**5**	**6**
Variety Romantyka superelita, preceding crop - winter wheat						
Control		2,12	2,39	2,43	2,36	2,32
Nanoagricole-Legumes 2 l/ha, sprouts		2,30	2,50	2,61	2,61	2,51
Nanoagricole-Legumes 2 l/ha, budding		2,37	2,69	2,89	2,81	2,69
Nanoagricole-Legumes, (2+2) l/ha, sprouts + budding		2,47	2,81	2,99	2,97	2,81
Yield increment (2+2) l/ha to control)	**t/ha**	**0,35**	**0,42**	**0,56**	**0,62**	**0,49**
	%	**16,5**	**17,5**	**23,0**	**26,4**	**20,9**
HIP$_{05}$ A-0,23; B-0,18; AB-0,49						
Variety Annushka, preceding crop — winter wheat						

Control		1,63	1,82	2,03	1,91	1,85
Nanoagricole-Legumes 2 l/ha, sprouts		1,75	1,95	2,35	2,32	2,09
Nanoagricole-Legumes 2 l/ha, budding		1, 79	2,02	2,43	2,40	2,16
Nanoagricole-Legumes, (2+2) l/ha, sprouts + budding		1,85	2,11	2,53	2,44	2,23
Yield increment (2+2) l/ha to control)	**t/ha**	**0,22**	**0,29**	**0,50**	**0,53**	**0,39**
	%	**14,0**	**16,2**	**24,7**	**27,7**	**20,7**
HIP_{05} A-0,21; B-0,17; AB-0,46						

Was noted significantly low level of productivity ultra-early maturing soybean varieties as the Annushka. This can be explained by the fact that the critical phase of their growth and development happened at very severe drought of air and soil.

In experiments with soy the following scheme of crop rotation was used: black fallow - winter wheat - sugar beet - spring cereals - pea - winter wheat - maize for grain and soybean - spring cereals — sunflower.

The results of the experiments on the influence of the preparation "Nanoagricole-Legumes" on stage pre-sowing seed treatment of soybeans once again revealed quite high efficiency of the fertilizer (tab. 12). The verage yield of soybean varieties Romantyka was 2,55 t/ha against control 2,28 t/ha. Its yield increment reached 0,27 t/ha (11,8%).

In spite of stressful coditions and low crop yield of the ultra-early maturing variety Annushka in control 1,85 t/ha, seed treatment helped to increase yield by 0,22 t/ha (11,7%).

On the background of mineral nutrition $N_{60}P_{60}K_{60}$ the yield increment of soybean when seed treatment with the "Nanoagricole" increased: in 12,0-14,7% for the variety Romantyka and by 11,4-15,2% for the variety Annushka.

When using the solution "Nanoagricole-Legumes" on vegetating plants with spraying in a phase of sprouts and budding, yield increment on the control fertilized background with chisel cultivation was 0,62 t/ha (26,4%) for the variety and Romantyka and 0,53 t/ha (27,7%) for the variety Annushka (tab. 13).

This research confirms adaptogenic properties of the solution "Nanoagricole". The effect of its actions increases in stressful situations.

PEA

Scheme of the field experiments of studing the effect of the solution "Nanoagricole-Legumes" on peas did not differ from the typical tasks (Table 1)

Before sowing of pea seeds were dressed with the mixture of preparations Royal Flo + Taboo. Fungicide Royal Flo (3 l/t) protects pea plants in the early vegetation from root rot and phomosis and insecticide Taboo (1 l/t) - from soil pests, wireworms, cockchafers and weevils till the budding phase.

While dry weather conditions in 2009 varieties of pea Tzarevych and Impuls formed the largest yield — 2,33 t/ha and 2,32 t/ha, respectively. Method of the main tillage did not significantly affect the level of productivity.

Seed treatment of pea seeds with the solution "Nanoagricole-Legumes", seed dressing, led to statistically significant increase in productivity: for the Tzarevych 0,30 t/ha (12,6%) and for the Impuls 0,27 t/ha (11,6%). The effect was significantly higher in the background with mineral fertilizers: 0,35-0,38 t/ha (14,3-16,6%) and 0,32-0,33 t/ha (13,1-13,4 %), respectively (tabl.14).

Foliar nutrition with “Nano Agricole-legumes” manifested the most effective influence on the pea crop (table.15) . Yield increment increased in all the experiments, and the scater of results did not exceed the maximum allowable indexes. When two-fold processing of plants the crops productivity increased by an average by 0,45 t/ha (19,2%) for the variety Tzarevych and 0,50 t/ha (21,1%) for the variety Impuls.

As in the previous experiments, mineral nutrition of vegetative plants at a dose $N_{60}P_{60}K_{60}$ contributed to the maximum manifestation of pea yield. At that this level of productivity of pea variety Prince grown by 0,55-0,61t/ha (22,5-26,5%) and of the

Impuls — by 0,60-0,65 t/ha (25,2-22 8%). The yield of these varieties of peas reached 2,91-2,99 t/ha and 2,98-3,16 t/ha, respectively.

Table 14

Yield of pea varieties depending on nutritional background and pre-sowing seed treatment (inlay) with the drug "Nanoagricole-Legumes", t/ha, 2009.

Treatment option (B)		Nutritional background (A)				
		Plowing			Chisel	Average
		Without fertilizers	30 t/ha of manure	$N_{60}P_{60}K_{60}$	$N_{60}P_{60}K_{60}$	
1		2	3	4	5	6
Variety Tzarevych P-2, superelita, preceding crop — black fallow						
Control (without treatment)		2,17	2,40	2,44	2,30	**2,33**
Seed treatment 4l/t, Nanoagricole-Legumes		2,38	2,64	2,79	2,68	**2,62**
Yield increment	**t/ha**	**0,21**	**0,24**	**0,35**	**0,38**	**0,30**
	%	**9,5**	**10,1**	**14,3**	**16,6**	**12,6**
$HIP_{0,05}$ according to the factors: A (nutritional background) – 0,11 t/ha, B (Agrozahid)– 0,09 t/ha, AB (Interaction)– 0,14 t/ha,						
Variety Impuls, precedeing crop — blak fallow						
Control (without treatment)		2,09	2,31	2,51	2,38	**2,32**
Seed treatment 3l/t, Nanoagricole-Legumes		2,30	2,54	2,84	2,70	**2,60**
Yield increment	**t/ha**	**0,21**	**0,23**	**0,33**	**0,32**	**0,27**
	%	**10,0**	**9,8**	**13,1**	**13,4**	**11,6**
$HIP_{0,05}$ according to the factors: A (nutritional background) – 0,10 t/ha, B (Agrozahid)– 0,08 t/ha, AB (Interaction)– 0,13 t/ha,						

Table 15

Yield of pea varieties depending on nutritional background, dose and foliar nutrition with the drug "Nanoagricole-Legumes", t/ha.

Treatment option (B)		Nutritional background (A)				
		Plowing			Chisel	Average
		Without fertilizers	30 t/ha of manure	$N_{60}P_{60}K_{60}$	$N_{60}P_{60}K_{60}$	
1		2	3	4	5	6
Variety Tzarevych P-2, superelita, preceding crop — black fallow						
Control		2,17	2,40	2,44	2,30	**2,33**
Nanoagricole-Legumes 2 l/ha, sprouts		2,29	2,51	2,63	2,59	**2,51**
Nanoagricole-Legumes 2 l/ha, budding		2,32	2,59	2,78	2,75	**2,61**
Nanoagricole-Legumes, (2+2) l/ha, sprouts + budding		2,45	2,75	2,99	2,91	**2,78**
Yield increment (2+2) l/ha to control)	**t/ha**	**0,29**	**0,35**	**0,55**	**0,61**	**0,45**
	%	**13,3**	**14,6**	**22,5**	**26,5**	**19,2**
HIP_{05} A-0,19; B-0,19; AB-0,45						
Variety Impuls, precedeing crop — blak fallow						
Control		2,09	2,31	2,51	2,38	**2,32**
Nanoagricole-Legumes 2 l/ha, sprouts		2,17	2,43	2,80	2,74	**2,54**
Nanoagricole-Legumes 2 l/ha, budding		2,25	2,54	2,88	2,81	**2,62**
Nanoagricole-Legumes, (2+2) l/ha, sprouts + budding		2,42	2,72	3,16	2,98	**2,82**
Yield increment (2+2) l/ha to control)	**t/ha**	**0,33**	**0,41**	**0,65**	**0,60**	**0,50**
	%	**15,7**	**17,7**	**25,8**	**25,2**	**21,1**

HIP_{05} A-0,22; B-0,18; AB-0,47

SUGAR BEET

Sugar beet crop is very sensitive to the content of some trace elements in soil, especially boron, molybdenum and cobalt. Therefore, micronutrient preparation Nanoagricole-Beet could fasilitate to increase the productivity of this crop.

As an objects of the study the diploid genetic hybrid with one sprout Boruta (N-type, Rz-Cr) company "SYNGENTA Seeds AB" Sweden were chosen.

Among the options of using the drug "Nanoagricole-Beet", at average in the most efficient experiment was twofold spraying in the early phases of sprouts and early closing of inter-row spacing at a rate 2 l/ha, which made it possible to get 40,47 t/ha against 35,58 t/ha in control for the hybrid Boruta (Table 16).

Thus, the yield increment of beet increased by an average by 4,89 t/ha (13,7%) for the hybrid Boruta.

In the terms of the application of mineral fertilizers the highest efficacy of the solution "Nanoagricole-Beet" was marked when growing sugar beets using a dose of fertilizer $N_{60}P_{60}K_{60}$. A method for processing of plots didn`t not significantly affect the result. Performance of sugar beet grown in these conditions increased up to 41,86-41,89 t/ha.

Productivity increment of the crop on the background of mineral nutrition $N_{60}P_{60}K_{60}$ comprised 5,52-5,67 t/ha (15,2-15,7).

These results are consistent with the positive influence of the solution "Nanoagricole" on other crops.

The level of impact of the drug "Nanoagricole-Beet" on sugar beet yield allows to suppose that for a more rational opening the potential of this crop probably there is a need to increase the dose of treatment. This task can be solved in future rresearches.

Table 16

Yield of sugar beet varieties depending on nutritional background, dose and foliar nutrition with the drug "Nanoagricole-Beet", t/ha, 2009.

Treatment option(B)		Nutritional background (A)					
		Plowing				Chisel	Average
		Without fertilizers	30 t/ha of manure	$N_{30}P_{30}K_{30}$	$N_{60}P_{60}K_{60}$	$N_{60}P_{60}K_{60}$	
Hybrid Boruta (N-type, R_z-C_r), preceding crop – winter wheat							
Control		34,20	35,01	36,13	36,34	36,22	**35,58**
Nanoagricole-Beet 2 l/ha, sprouts		34,98	35,87	37,55	38,32	37,43	**36,83**
Nanoagricole-Beet 2 l/ha, start of closing of inter-row spacing		36,04	37,15	39,08	39,43	38,87	**38,11**
Nanoagricole-Beet, (2+2) l/ha, sprouts+ closure of inter-row spacing		38,31	39,13	41,15	41,86	41,89	**40,47**
Yield increment (2+2) l/ha to control)	**t/ha**	**4,11**	**4,12**	**5,02**	**5,52**	**5,67**	**4,89**
	%	**12,0**	**11,8**	**13,9**	**15,2**	**15,7**	**13,7**
HIP_{05} A-0,24; B-0,19; AB-0,49							

CONCLUSIONS

1. It`s established that while the double treatment with spraying of the drug "Nanoagricole-Cereals" of winter wheat crops varieties Astet, Alians, Doskonals and Vasylyna in phases of booting and earing there was following increase in productivity: on the untreated background - 0,68-0,75 t/ha (18,5-21,6%), and when using mineral fertilizers in a dose $N_{90}P_{60}K_{60}$ - 1,50-1,59 t/ha (25,0-27,1%) to the level of productivity for control variant.
2. It`s revealed that the mass of 1000 grains of winter wheat of the studied varieties comprises at average 39,1 g on the background without fertilizers and 39,4 g with mineral fertilizers $N_{90}P_{60}K_{60}$. The average weight of 1000 grains of wheat treated with the drug "Nanoagricole-Ceraels" has increased by 4,5 g (11,4%) and comprised 43,9 g.
3. It `s determined that the average number of grains per ear of the tested wheat as the result from use of the drug "Nanoagricole-Cereals" increased by 15,0% from 33,9 units in controle to 39,0 units after foliar nutrition.
4. The most important indicator of improving of grain quality is its class, which determine the content of protein and gluten. For all the tested varieties of winter wheat Astet, Alians, Doskonala and Vasylyna after treatming with "Nanoagricole" grain is estimated as the third class, while in the control its quality remained at the fourth-fifth class.
5. It`s established that pre-sowing seed treatment with the drug "Nanoagricole-Cereals for seed dressing" significantly affected the yield of the studied barley varieties. The average productivity of the varieties Parnas and Vyklyk increased from 2,25 t/ha and 3,16 t/ha in control to 2,54 t/ha and 3,53 t/ha, respectively. The yield increment comprises at average 0,29 t/ha (12,6%) and 0,37 t/ha (11,4%).
6. It`s determined that against the background of mineral nutrition the harvest of barley with seed treatment grown for the variety Parnas to 0,37 t/ha (13,7-13,9%) and for the Vyklyk 0,43-0,46 t/ha (12,6-13,7%).

7. It`s proved that after double foliar nutrition of vegetative plants with the drug "Nanoagricole-Cereals" yield of barley of both varieties grown by an average of 0,54-0,69 t/ha (22,7-23,4%), reaching a maximum 25,2-25,5% provided the mineral nutrition background $N_{60}P_{60}K_{60}$. In these conditions the yield of spring barley varieties Parnas comprised 3,36-3,38 t/ha, and a variety Vyklyk - 4,01-4,09 t/ha.
8. It`s established that when growing spring barley with a complete cycle of seed treatment and foliar nutrition with the solution "Nanoagricole-Cereals", protein content in grain increased in comparison with the control without fertilizer at 2,16%, and with additional nutrition with $N_{60}P_{60}K_{60}$ - at 1,09% .
9. It`s been established that after pre-sowing seed treatment of corn with the drug "Nanoagricole-Corn for seed dressing", grain yield depending on fertilizer use was significantly increased. At average within the experiment yield of hybrid Varta increased from 6,77 t/ha in the control without treatment to 7,58 t/ha and yield increment of this crop was 0,81t/ha (11,9%). The average yield of hybrid Zlagoda increased after seed treatment from 5,82 t/ha in control to 6,58 t/ha, and yield increment was 0,75 t/ha (12,8%).
10. The most significant impact of seed dressing of corn with the "Nanoagricole" was observed on the mineral nutrition background $N_{60}P_{60}K_{60}$: yield of corn grain of hybrid Varta was 7,95-7,99 t/ha, and the hybrid Zlagoda - 7,08-7,10 t/ha. Yield increment of these crops increased by 12,7-13,7% and 14,5-15,5% respectively.
11. Double foliar nutrition of the studied hybrids with the drug "Nanoagricole-Corn" in phases of sprouts and budding helped more to reveal their potential: the average yield of hybrid Varta was 8,08 t/ha, which is 1,33 t/ha (19,7%) higher than in the control. Increase of grain on the hybrid Zlagoda averaged from 1,32 t/ha (22,5%), and yield reached 7,13 t/ha.
12. It was determined that yield on the mineral nutrition background corn yield which had been treated twice with the "Nanoagricole" achieved 8,40-8,44 t/ha for hybrid Varta and 7,63-7,67 t/ha for the hybrid Zlagoda. Yield increment of these crops

compared with the control within the experiment grew to 19,1-20,1% and 24,9-25,1% respectively.

13. It has been proved that the double treatment with the drug "Nanoagricole-Sunflower" of growing plants in stage of sprouts and budding helped to increase harvest of sunflower Oskil at average by 2,56 t/ha compared with the control 2,03 t/ha. The average yield of hybrid Yason also increased to 2,64 t/ha. Yield increment of these hybrids was 0,53 t/ha (25,9%) and 0,48 t/ha (21,6%), respectively.
14. It`s found that application of the drug "Nanoagricole-Sunflower" is the most effective against the mineral nutrition background at a dose $N_{30}P_{30}K_{30}$. In these circumstances, the level of performance of the hybrid Oskil was 28,3-29,9%, and hybrid Yason — 23,6%.
15. It`s established that the impact of the drug "Nanoagricole-Rape" yield increment of winter rape variety Exotic comprised to the control without fertilizer 0,36 t/ha (25,3%) and 0,57 t/ha (27,6%) in mineral nutrition background $N_{45}P_{45}K_{45}$. Similar increase of yield of winter rape using "Nanoagricole" was observed on the variety Eksgold: 0,35 t/ha (23,8%) for the control without fertilizers and 0,52 t/ha (25,4%) when using them.
16. It has been proved that the drug "Nanoagricole-Rape" promotes rapid drying of mature rape crops and they do not need desiccation. Grain moisture of treated plants of both varieties at all nutritional backgrounds is reduced almost by two times: 6,9-7,0% of 12,1-13,7% in the control without fertilizers and 4,3-4,4% of 8,3-9,0% of mineral feeding.
17. It`s revealed that pre-sowing seed treatment of soybeans with the drug "Nanoagricoel-Legumes for seed dressing" led to increase in yield of soybean varieties Romantyka at average by 0,27 t/ha (11,8%), and of ultra-early maturing variety Annushkas up to 0,22 t/ha (11,7%).
18. On the mineral nutrition background $N_{60}P_{60}K_{60}$ the yield increment of soybeans when seed treatment with "Nanoagaricole" increased: by 12,0-14,7% for the class Romantyka and by 11,4-15,2% for Annushka.

19. It has been proved that the yield increment when using the drug "Nanoagricole-Legumes" on vegetative plants was 0,62 t/ha (26,4%) for soybean varieties Romantyka and 0,53 t/ha (27,7%) for Annushka.
20. It`s revealed that pre-sowing seed treatment of pea with the drug "Nanoagricoel-Legumes for seed dressing" led to increase of productivity: for the variety Tzarevych 0,30 t/ha (12,6%) and for the Impuls 0,27 t/ha (11,6 %). The effect was significantly higher on the mineral fertilizers background: 0,35-0,38 t/ha (14,3-16,6%) and 0,32-0,33 t/ha (13,1-13,4 %), respectively.
21. It is noted that yield increment of pea crop with foliar double feeding with 'Nanoagricoel-Legumes" increased at average by 0,45 t/ha (19,2%) for the variety Tzarevych and 0,50 t/ha (21,1%) for the variety Impuls.
22. It`s revealed that on the mineral nutrition background of vegetative crops at a dose $N_{60}P_{60}K_{60}$ level of performance of pea varieties Tzarevych under the impact of "Nanoagricoel-Legumes" grew by0,55-0,61t/ha (22,5-26,5%) and the variety Impulse — up to 0,60-0,65 t/ha (25,2-22,8%).
23. It was established as a result of feeding sugar beet with "Nanoagricole-Legumes" increase the crop yield has raised at average by 4,89 t/ha (13,7%) for the hybrid Boruta. It is important to add that yield incrrement on the mineral nutrition background at a dose $N_{60}P_{60}K_{60}$ comprised 5,52-5,67 t/ha (15,2-15,7%).
24. A useful range of biological effects allows to recommend the chelated micronutrient fertilizers with bio-stimulant complex "Nanoagricole" for putting it into the List of chemicals approved for use in Ukraine.