

Concentrated chelate
microfertilizer with
biostimulant complex



ISSUE URGENCY

The extraordinary importance of plant nutrition with micronutrients lacking in the soil is generally recognized in the world practice and does not give rise to doubt. Micronutrients as well as vitamins provide for 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 Europe shows that the content of some essential micronutrients has decreased in tens to hundreds of times in recent years of land use! The effect of use of traditional (NPK) macrofertilizers significantly reduces against this background.

The problem of reduction of land fertility has become a global threat. Biomass of cultivated plants does not return to the circulation of elements in this landscape by 60-80%. The content of humus in the famous Ukrainian black earth soil has dropped by a quarter: annual losses on the average amount to 0.62 t/ha. Nearly 1.5 million hectares of Ukrainian lands are in urgent need of fertility restoration and 625,000 hectares of former black earth soil are irrevocably lost for farming. Today, Ukraine preserved less than one percent of lands, the fertility of which is maintained at an appropriate level!

55% of the formerly fertile lands in the USA are not suitable for agriculture anymore. This figure is even higher in Europe and it increases drastically! Not to confirm the sinister “Law of diminishing soil fertility”, formulated in 1798 by Thomas Malthus, the British scientist and priest, it is necessary to severe the measures all over the world which ensure the reproduction of soil fertility through the regular application of “organic fertilizers” to the soil and the use of harmless chelated micronutrient preparations of the last generation, soaked by the entire surface of plants.

In addition, the significant climate change in some regions of Europe in the direction of sharply continental, the extreme weather conditions in recent years, the reduction of the yield of many traditional crops require the development of adaptogenic preparations that increase the resistance of plants to adverse environmental factors.

COMPOSITION OF NANOAGRICOLE PREPARATIONS

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, apple acid, tartaric acid, racemic tartaric acid, aspartic acid, ethanedioic acid, citric acid) and their biologically active derivatives (succinate, malate, tartrate, asparaginate, oxalate and citrate). The growth factor HV (“Heliovector”), developed and patented by the Scientific and Production Agricultural Association NanoAgricole, greatly increases the resistance of plants to aggressive environmental impact and in addition it is powerful biostimulant. The original component TFV (“Transfoliovector” accelerates the penetration of nutrients through epidermis and cuticular layer of plants. Variations for pre-sowing seed treatment are enhanced by the growth stimulants – auxins.

The chelated antidotes (antidotes in case of poisoning by heavy metals): ethylene diamine disuccinic acid, ethylene diamine tetracetic acid and hydroxyl ethylidene diphosphonic acid, which are widely used in medicine, are used as additional complexing compounds to reduce the toxicity of penetrating micronutrients and to increase their bioavailability.

NOVELTY AND ADVANTAGES OF NANOAGRICOLE

- Confirmed by patents;
- The preparation has the most complete formulation of essential micronutrients, including cobalt, molybdenum and boron in bioavailable complex form;
- The balanced set of chelating agents (ethylene diamine disuccinic acid, succinic acid, apple acid, tartaric acid, racemic tartaric acid, aspartic acid, ethanedioic acid and citric acid) makes the complexes with micronutrients stable in a wide range of pH, enabling the effective use of microfertilizer on acidic, neutral and even weakly basic soils;
- The preparation is resistant in calcinated media; it is not destroyed in hard water;
- Amphoteric micronutrients of the preparation, molybdenum (Mo) and boron (B) to a lesser extent are in the form of complexes of accelerated absorption;
- The presence of chelated micronutrient cobalt (Co), (powerful stimulant of nitrogen metabolism, component of vitamin B12 and nitroreductase enzyme, activator of nitrifying bacteria that bind the atmospheric nitrogen in soil), contribute to the proper transformation of nitro compounds into amine containing and increased accumulation of amino acids and protein in the treated plants;
- Natural chelating agents stimulants-adaptogenes on the basis of poly-carboxylic acids take part in the most important energetic transformations of organism, enhance the oxygenation (oxygen supply) of tissues, increase the production of the main energy substance ATP (adenosine triphosphate), contribute to the accumulation of nutrients, stimulate the protective properties of plants and drastically inhibit the toxicity of the preparation;
- The low stability constant of these complexes contributes to their rapid metabolism in the organism and manifestation of biostimulating action;
- The complex biochemical composition of derivatives of gluconeogenesis (Heliovector) greatly increases the adaptability of plants to adverse conditions, stimulates their growth and increases productivity;
- The preparation for seed treatment contains the powerful stimulant of root system growth – heteroauxin in the form of β -indoleacetic acid and β -indolebutyric acid;
- Due to the specific chelate structure and special transfactor “Foliovector” the preparation is absorbed through epidermis and cuticular layer of plants ten times faster, it is less washed out with rain and dew, allowing its effective use for foliar treatment of vegetative plants and considerable reduction of the working concentration to 2l/ha, and, consequently, the toxic effect.

ACTION MECHANISM

Invaluable natural poly-carboxylic acids in NANOAGRICOLE act as native chelating agents (which have an affinity to living cell) covering the micronutrients with fixed natural organic layer, masking their penetration through the stomata, significantly raising the rate of absorption and facilitating the movement in plant tissues.

Derivatives of succinic acid, hydroxy-succinic acid, aminosuccinic acid, ethylene diamine disuccinic acid (apple acid, tartaric acid, racemic tartaric acid, aspartic acid), ethanedioic acid, citric acid, isocitric acid and ketoglutaric acid, which are the components of NANOAGRICOLE, as well as patented factors “Heliovector” and “Foliovector” participate in very important oxidative cycles of substance transformation in organism (Krebs, Roberts, Barro cycles, gluconeogenesis and neo glycolysis), act as activators of energetic processes, contributing to production of the main energetic substance ATP (adenosine triphosphate) in cells, significantly increase the resistance and adaptability of plants to adverse environmental conditions.

The electron transfer and energetic transformation stop without going into the next phase in case of absence of any of these acids in mitochondria of cells, and the organism dies. It is not for nothing, the healthy cells try to accumulate these substances in a stressful situation and concentration of succinic acid derivatives in them increases sharply.

Remember amber – hardened to stone tears of trees formed in the period of mass destruction of plants. Exactly this crushed stone saved the lives of Crusaders who worked the way through the harsh desert to the Holy Sepulchre. The preparation has pronounced antibacterial, fungicidal and antiviral properties due to the content of copper, zinc, molybdenum and boron.

Heteroauxin in form of β -indoleacetic acid and β -indolebutyric acid, which is the part of compositions for seed treatment, promotes the accelerated root formation.

DISADVANTAGES OF EXISTING ANALOGUES

Micronutrients of majority of such fertilizers are represented either by common salt-like forms and have an effect only in higher concentration which is hazardous for soil, or chelated only by ethylene diamine tetracidic acid, but this complexing agent does not react with amphoteric elements. Therefore, boron and molybdenum are present in them in salt-like but not chelated form and practically not absorbed by plants in the proposed concentration. Micronutrients chelated by this complexing are stable only in a narrow pH range and inactive in neutral and basic soil.

The majority of such micronutrients do not contain chelates of cobalt which are expensive but extremely important for the metabolism. They are not balanced according to the content of mesophilic elements: magnesium, calcium and sulfur. Magnesium and calcium are almost not chelated in order to reduce the cost of the product. However, such form leads to rapid degradation of essential chelate complexes with other micronutrients and their transfer to the ordinary salts and thereby to reduction of their bioavailability.

Actual concentration of micronutrients in the majority of phosphorus-containing fertilizers is hundred times lower than the standard, as phosphates of all metals except alkali metals, are water-insoluble!

Such micronutrient fertilizers do not contain adaptogenic components which increase the survival rate in extreme conditions! Many micronutrient fertilizers are represented by dry forms and require additional procedure of weighing, dissolution and filtration.

BIOLOGICAL EFFECT

NANOAGRICOLE takes complex combined effect:

- Increases the seed germination energy and viability;
- Accelerates root formation;
- Increases resistance to adverse environmental factors (overcooling or overheating, lack or excess of light and moisture);
- Optimizes photosynthesis, eliminates plant chlorosis;
- Strengthens the immunity system and resistance to disease;
- Increases the content of vitamins and sugars in fruits;
- Accelerates the intracellular conversion of nitrates to easily digestible amine components and amino acids;
- Contributes to the accumulation of fibrin (protein) in cereal crops;
- Increases the fat content in oil crop;
- Enhances productivity of the soil nitrifying bacteria and fixation of atmospheric nitrogen;
- Improves the efficiency of macrofertilizers, enhances the nutrient uptake;
- Contributes to the flowering and acceleration of plant ripening;
- Increases the number of grains per spike (ear, pod, calathium);
- Statistically significantly increases the crop yields;
- Improves the taste and nutritional value of fruit and vegetable crops.

ASSORTMENT

NANOAGRICOLE is adapted for different types of agricultural crop; it is produced for pre-sowing treatment of seeds and foliar (leaf) nutrition of plants depending on the component contents.

REVOLUTIONARY TECHNOLOGY

Production of NANOAGRICOLE is based on the original use of cavitation effect in blender-mixers of RPE type, developed and patented by the Interregional Scientific and Production Agricultural Association "NanoAgricole" for the preparation of solutions for agricultural purposes. The plants of this principle use the effect of hydrodynamic cavitation of rotary pulsating action. Crushing, dissolving, mixing of processed substances and synthesis of specific reagents takes place without direct mechanical contact and heating under the active influence of exploding micro-bubbles in cavitation field of the blender.

This has significantly improved the quality of the product and had beneficial effect on its pricing.

METHODS OF APPLICATION

The potential of NANOAGRICOLE is manifested the most effectively in pre-sowing treatment of seeds followed by foliar nutrition.

Pre-sowing treatment of seeds. Seeds are treated with NANOAGRICOLE (possibly with protectants) on units of Mobitox, ПСС-5 (PSSH-5), КПС-10 (KPS-10) or ПС-10 (PS-10) type at the rate of (3l of concentrate) of fertilizer per ton of seeds. If necessary, the preparation is three times diluted with water or protectant solution. Compatibility test is performed before the introduction of protectant. There shall be no precipitate in mixed solutions (turbidity is possible).

Foliar nutrition of crops (spraying) is carried out on vegetative plant, better together with the nitrogen-potash fertilizers and plant-protecting agents after the compatibility test. NANOAGRICOLE removes the stress from the influence of agrochemicals taking adaptogenic effect. The preparation is well combined with urea solution, the majority of herbicides and insecticides. NANOAGRICOLE forms the precipitate with the soluble salts of orthophosphoric acid and in alkaline medium!

Any standard equipment is used for spraying of crops. The spray material is prepared before use by pouring the canister of NANOAGRICOLE (20 l) to 2 m³ of urea solution per 10 ha of crops (2 l/ha), i.e. microfertilizer is diluted 1:100 to a concentration of 1%.

The optimal temperature of spray material use is +15-20°C, but not less than +10°C, at air temperature of +10-25°C and average daily temperature of at least +5°C. Nutrition is carried out 2-3 times at intervals of 2 weeks early in the morning or evening, avoiding the bright sun, rain and strong winds.

Convenient packaging of the preparation in canisters of 5 liters and 20 liters capacity facilitates its use in traditional agricultural equipment and designed for the hectare standard (2l) or ton (3l) of treated seeds.

HARMLESSNESS

The tests at the Institute of Occupational Medicine of the Academy of Medical Sciences of Ukraine revealed that NANOAGRICOLE does not contain salts of lead, mercury, thallium, arsenic and cadmium, natural [radium (236Ra), technetium (232Th), potassium (40K)] and technogenic [cesium (137Cs), strontium (90Sr)] radionuclides.

The parameters of acute toxicity LD₅₀ in intragastric seeding of bred Wistar rats of both sexes treated by method of V.B. Prozorovsky were not determined, since even at a dose of 5000 mg/kg for 14 days, there were no lethal cases.

Percutaneous action of NANOAGRICOLE is mild and does not exceed the acceptable parameters.

Thus, microfertilizer belongs to almost nontoxic preparations according to the classification of K.K. Sidorov and to the fourth class of substances – “Low hazardous” according to GOST 12.1.007.

EFFICIENCY OF USE

The efficiency of NANOAGRICOLE is supported by years of researches on the experimental fields of the scientific institutions of the Academy of Agricultural Sciences and well-known agricultural companies in Ukraine, Russia, the Baltic States, Poland, Italy, Syria, Lebanon and South Africa.

NANOAGRICOLE has proved to be effective almost for all treated agricultural crops, including garden crop, fruit and berry crops and even ornamental floriculture.

Concentration and physical and chemical indicators of variations of NANOAGRICOLE and their control methods

Indicator name	Standard	Control method*
Mass fraction of chelate Fe, %	0,27-1,52	Determination of ferrum in chelate form by ion-pair chromatography EN 15451:2008 and reverse-phase high performance liquid chromatography EN 15452:2008
Mass fraction of chelate Fe, g/l	3,2-18,2	
Mass fraction of chelate Mn, %	0,25-1,35	Fertilizer with micronutrients. Determination of manganese ST CMEA 3366-81
Mass fraction of chelate Mn, g/l	3,1-15,8	
Mass fraction of chelate Zn, %	0,17-0,73	Fertilizer with micronutrients. Determination of zinc ST CMEA 3368-81
Mass fraction of chelate Zn, g/l	2,0-8,45	
Mass fraction of chelate Cu, %	0,05-1,2	Fertilizer with micronutrients. Determination of cuprum ST CMEA 3365-81
Mass fraction of chelate Cu, g/l	0,6-12,6	
Mass fraction of chelate Co, %	0,004-0,05	Fertilizer with micronutrients. Determination of cobalt ST CMEA 3364-81
Mass fraction of chelate Co, g/l	0,05-0,65	
Mass fraction of compl. B, %	0,2-0,9	Fertilizer with micronutrients. Determination of boron ST CMEA 3363-81
Mass fraction of compl. B, g/l	2,2-1,0	
Mass fraction of chelate Mo, %	0,01-0,07	Fertilizer with micronutrients. Determination of molybdenum ST CMEA 3367-81
Mass fraction of chelate Mo, g/l	0,1-0,8	
Mass fraction of chelate Mg, %	0,8-0,9	Determination of magnesium by spectrometric method of atomic absorption EN 12947:2000
Mass fraction of chelate Mg, g/l	9,6-10,2	
Mass fraction of chelate Ca, %	0-1,1	Determination of calcium by atomic absorption EN 12947:2000 and CINAO GOST 26487
Mass fraction of chelate Ca, g/l	0-13	
Mass fraction of S, %	2,3-3,7	Determination of free sulphur GOST 26490
Mass fraction of S, g/l	25,3-48,0	
Mass fraction of K ₂ O, %	0,5-3,5	Determination of total potassium GOST 26718-85. Flame photometry
Mass fraction of K ₂ O, g/l	6,5-28,9	
Mass fraction of N (amide), %	1,2-6,0	Determination of total nitrogen GOST 26715-85 and according to Deward Method EN 15476:2009
Mass fraction of N (amide), g/l	13,2-67,5	
Succinate, %	0,05-0,50	Determination of chelating agents by ion, ion-pair, high performance liquid chromatography and chromatography-mass spectrometry: EN 13368-1:2001, EN 13368-2:2007, CEN/TR 15106:2005
Succinate, g/l	0,55-5,85	
Malate, %	0,05-0,50	
Malate, g/l	0,55-5,85	
Citrate, %	1,1-1,4	
Citrate, g/l	12,1-15,6	
Tartrate, %	0,02	
Tartrate, g/l	0,25	
Asparaginate, %	0,02	
Asparaginate, g/l	0,25	
Oxalate, %	0,02	
Oxalate, g/l	0,25	
β-indoleacetic acid, %	0-0,005	Determination of auxins by high performance liquid chromatography and mass spectroscopy EN 13368-2:2007, CEN/TR 15106:2005
β-indoleacetic acid, g/l	0-0,06	
β-indolebutyric acid, %	0-0,002	
β-indolebutyric acid, g/l	0-0,03	
pH value	5,9±1,1	Potentiometry GOST 26483, 26484
Density at 200C, g/ml	1,1-1,3	Densimetry GOST 18995.1-73, ST CMEA 1504-79

CONTROL METHODS

The content of active components of NANOAGRICOLE (TS U 20.1-37999502-001:2012) is assessed by combination of standard methods: atomic absorption spectrophotometry (AAS), including direct electro thermal atomization of samples together with the plasma photometry, ion, ion-pair, reversed-phase and high performance liquid chromatography (HPLC) and chromatography-mass spectrometry.

Chelated micronutrients are determined by atomic absorption spectrophotometry (AAS) (GOST 30178-96, RD 52.18.191-89 and RD 52.286-91), including direct electro thermal atomization of samples (RD 52.24.377-2008) together with the flame photometry (M-02Vd/2001).

WARNING

NANOAGRICOLE is well combined with the majority of agricultural chemicals. NANOAGRICOLE forms precipitate with the soluble salts of orthophosphoric acid and alkaline products, which in some cases may be eliminated by the addition of citric acid!

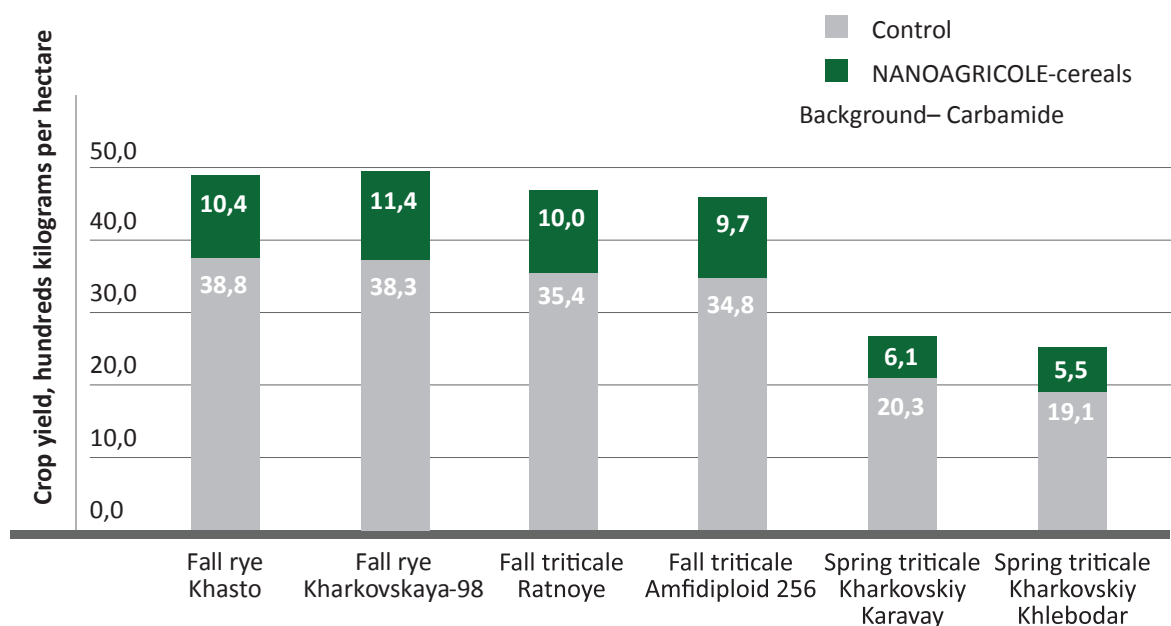
Highly effective preparation, overdose is not permitted!

STORAGE OF NANOAGRICOLE

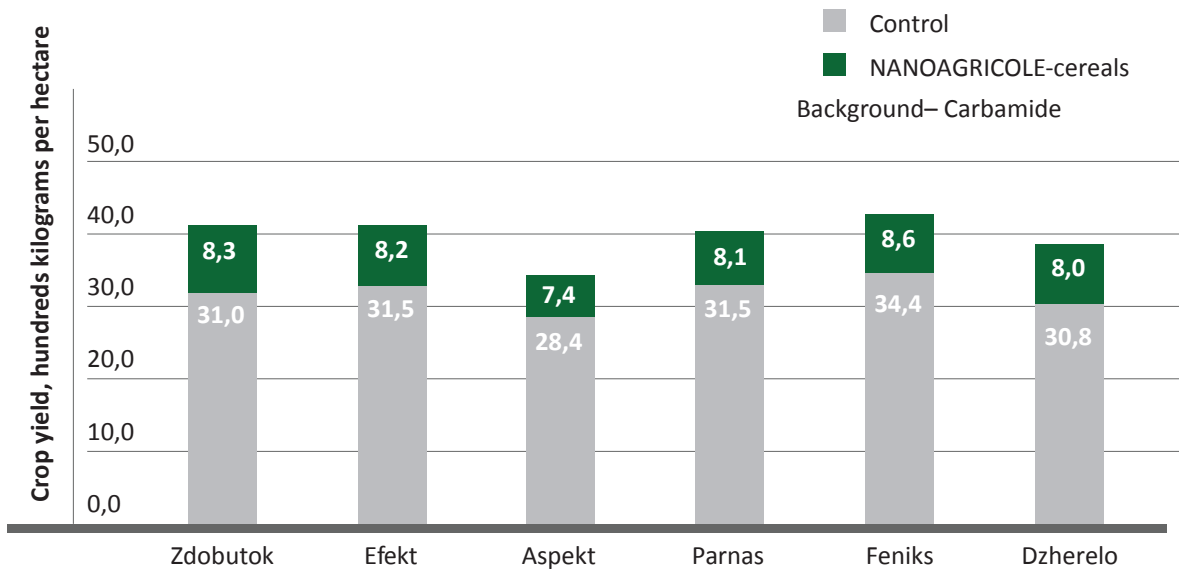
Store in closed original packing at temperature from 0 to 30°C, avoiding direct sunlight. Shelf life is 2 years.

Increase of crop yield after the treatment of seeds and foliar fertilizing with “NANOAGRICOLE-cereals”

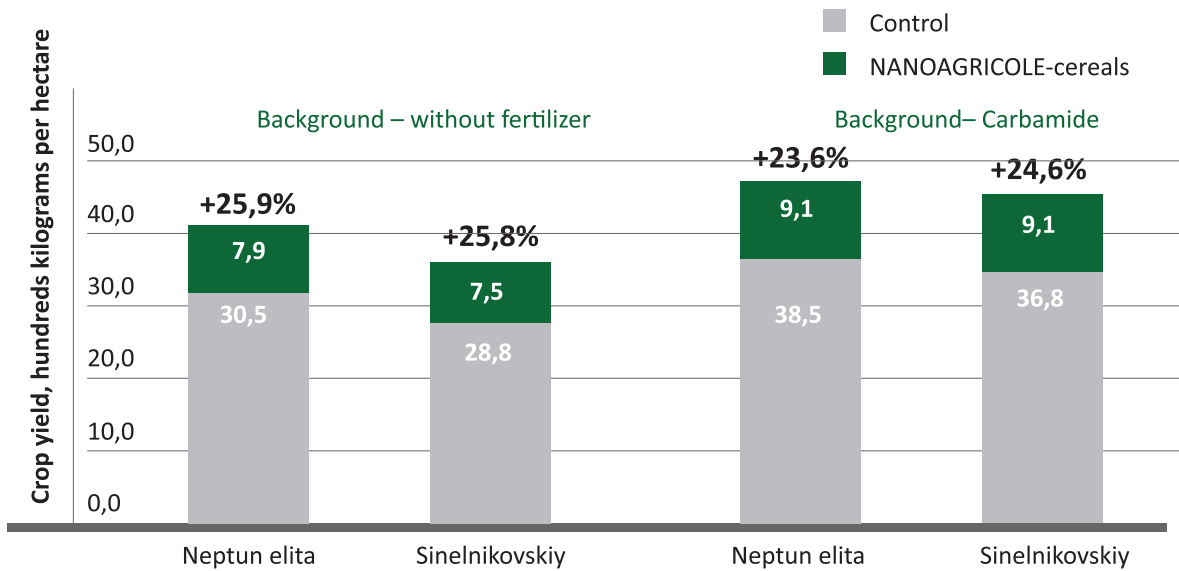
Rye and triticale



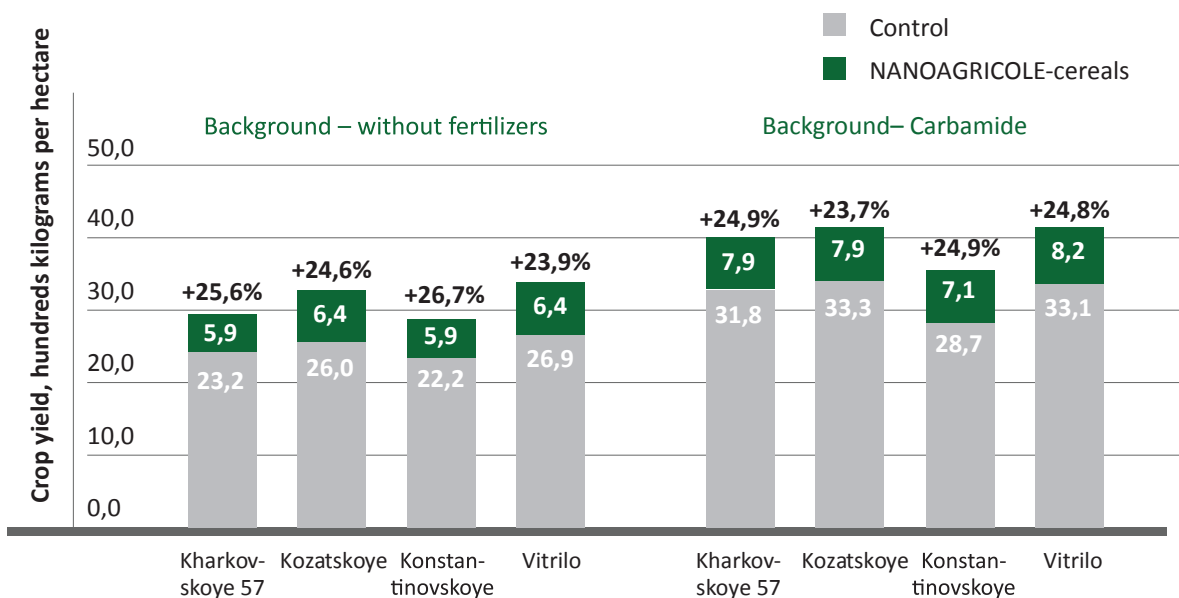
Barley



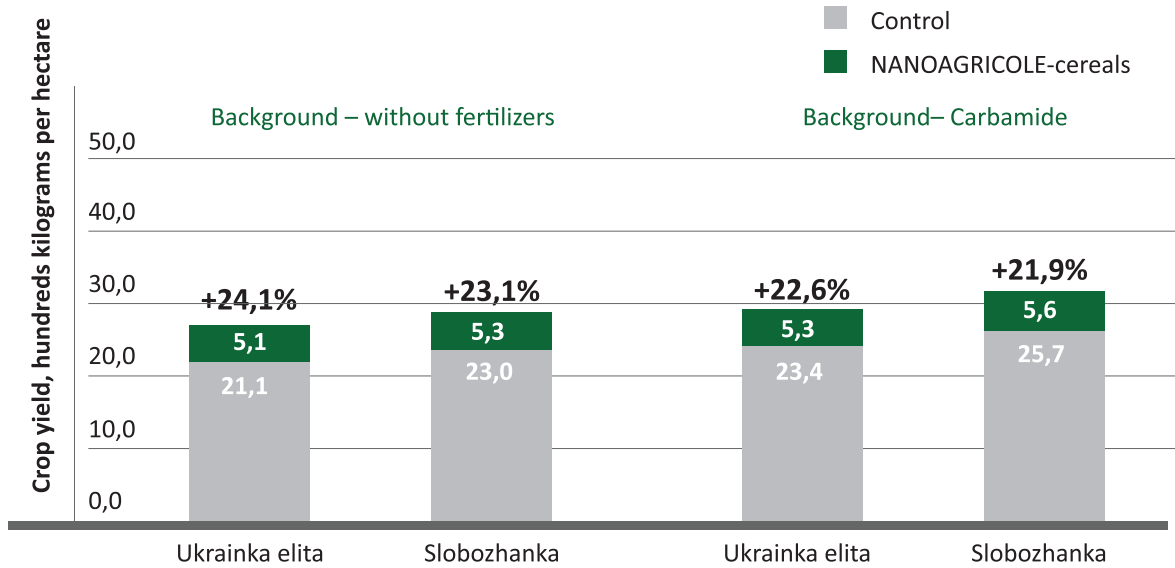
Oats



Millet

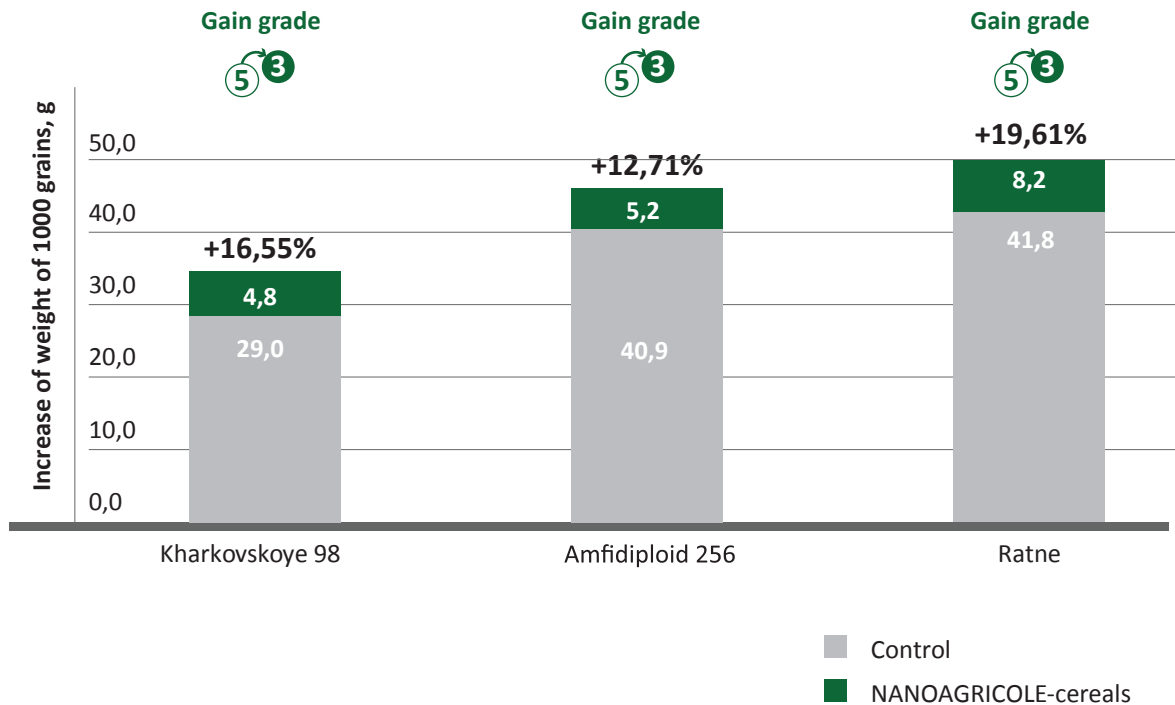


Buckwheat



Increase of weight of 1000 grains after the treatment of seeds and foliar fertilizing with “NANOAGRICOLE-cereals”

Rye and triticale



Increase of crop yield after the treatment of seeds and foliar fertilizing with “NANOAGRICOLE-legumes”

