APPENDICES:

APPENDIX A

Appendix to the Decision of the Minister of Agriculture and Rural Development No. G-1758/25

INSTRUCTION MANUAL FOR THE USE AND STORAGE OF THE ORGANIC AGENT SUPPORTING PLANT GROWTH – SOIL CONDITIONER **„HUMIBAKT"**

Scope of application

HUMIBAKT is designated for application on all types of soils, in field cultivation of plants. It is particularly recommended for use on light, low-humic soils. It is also dedicated for use in the cultivation of vegetables and ornamental plants, lawns, and in orchardry.

Effects of application

HUMIBAKT rebuilds the humic layer of soil and enhances its sorption capacity. The application of the soil conditioner restores microbiological balance, which, in turn, improves the condition of agricultural crops, orchard plants, ornamental plants, and vegetables. Proper mineralisation of organic matter residue that is left in soil after agrotechnical treatments, by introducing bacteria of a targeted action, to the substrate, has a positive influence on the circulation of the following elements: phosphorus (P), potassium (K), and sulphur (S), and optimises nitrogen (N) management. It also increases the accessibility of micro-and macroelements in forms that are accessible for plants. The increased microbiological activity contributes to the improvement of the cloddiness of soil, which, in turn, enhances the accessibility of nutrients, resulting in increased yield. The desirable cloddy structure of layers of arable soil offers beneficial conditions for the germination of seeds and fosters the proper, optimum development of the root system of plants in the arable layer. The clods form a spatial, spongy complex which, thanks to its porous structure, absorbs and retains water and nutrients, thus improving water retention capacity and reducing the stress caused by water deficit in soil. The addition of humic acids improves the tolerance of plants to salt, frost, and heat and the buffer capacity and cation-exchange capacity of soils. Apart from that, it improves the activity of soil microorganisms and biodiversity.

Dosage, time, and manner of application

Crop cultivation:

HUMIBAKT is applied on soil or on leaves, in form of spraying at the rate of 200 grams of the product per 1 ha soil surface.

HUMIBAKT is best applied in the form of:

- Post-harvest application: Mix 200 grams of the product with 200 – 300 litres of water.
- Pre-sowing application: Mix 200 grams of the product with 200 – 300 litres of water.
- Intervention application at the early stage of plant development: Mix 200 grams of the product with at least 400 litres of water.

The solution should be applied immediately after preparing the mixture. At least 2 applications per year are recommended.

Vegetables:

The soil conditioner should be applied before sowing or planting seedlings, onto prepared soil, in form of spraying water solution at the ratio of 200 g of the conditioner per 1 ha/400 litres of water. After applying, the soil conditioner may be mixed with the 5-10 cm thick top layer of soil with the use of cultivation tools. The soil conditioner may also be applied as intervention at the early stage of plant growth, at the ratio of 200g/ha/400 l of water.

Orchard plants:

Before planting an orchard/plantation: The soil conditioner may be applied in form of aqueous solution prepared by mixing 200 g of the conditioner with 400-700 l of water per 1 ha (10 000 m2).The prepared solution should be sprayed evenly onto the whole surface of the field or onto 1 m wide belts, where trees/seedlings will be planted, and then it should be mixed with the superficial layer of soil to the depth of 5-10 cm. The prepared solution should be sprayed evenly onto the whole surface of the field or onto 1 m wide belts, where trees/seedlings will be planted, and then it should be mixed with the superficial layer of soil to the depth of 5-10 cm.

In an existing orchard/plantation: Aqueous solution of the conditioner, prepared in the same way as described above, should be poured in early spring onto the surface of weed strips/mechanical belts along the rows of plants, with the use of an herbicide bar.

Ornamental plants and lawns:

Before planting: apply on prepared soil in form of aqueous solution prepared by mixing 200 g of the conditioner with 200-300 l of water per 1 ha. Then it may be mixed with the superficial layer of soil to the depth of 5-10 cm with the use of available cultivation tools.

Existing plants/plantations: apply in early spring (before start of vegetation) or as intervention by spreading the aqueous solution evenly over the surface of the plantation (solution: 200 g of the conditioner mixed with 200-300 l of water per 1 ha for ornamental plants, 200 g of the conditioner mixed with 500-700 l of water per 1 ha for lawns). If possible, mix with the superficial layer of soil to the depth of approx. 5 cm.

Application by means of fertigation:

HUMIBAKT may be applied by means of fertigation in the cultivation of field crops, vegetables, flowers, and soft fruit, in the dose of 200 gram of the product per 1 ha of soil, using a 0.02% solution. This ratio is obtained by mixing 200 grams of the product with 1000 litres of water.

Preparation of the liquid

Before preparing the liquid, make sure to determine the required amount. It is recommended to place the conditioner on the sieve of the sprayer that is filled to at least 1/3 of the calculated volume, and then supplement water to reach the target volume and mix thoroughly until completely solved. Sediment in the suspension occurs

naturally. The solution should be applied as soon as possible after preparing the mixture. After spraying, clean the sprayer.

Note:

- Avoid strong sunlight during application. The product should be applied on cloudy days or in the evening.
- Do not use simultaneously with plant protection agents and other chemically synthesised products.
- It is forbidden to apply the soil conditioner on soils that are frozen, flooded with water, or covered by snow.
- The conditioner may be applied together with other fertilizers. In such event, HUMIBAKT should be added at the last stage of preparing the spraying liquid.

Safety precautions and storage:

Do not eat or drink during application. Avoid contact with the soil conditioner. Follow the rules of personal hygiene: after finishing work with the soil conditioner, thoroughly wash the body parts that are exposed to the soil conditioner. Keep away from children. Store in the sealed original packaging, at room temperature, in a dry, properly ventilated room, away from food and drink products. Do not expose to direct sunlight. Do not store in unmarked containers.

Use only in compliance with the instruction manual printed on the label.

[Stamp]

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Institute of Soil Science
and Plant Cultivation
State Research Institute

Test report

"Assessment of suitability of the soil conditioner HUMIBAKT"

Tests performed for JMS - GLOBAL SŁAWOMIR HRUSZKA

under Agreement No. 414.29.2023

Signature Not Verified

Document signed by Anna Podleśna
Date: 2025.04.28 14:10:29 CEST

Puławy, April 2025

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1. TEST OBJECTIVE

The objective of the tests was to determine the influence of the soil conditioner HUMIBAKT on shaping the water retention capacity of soil and on the accumulation of organic carbon in the arable layer of light soil.

2. METHODOLOGY

Upon the order of JMS – GLOBAL SŁAWOMIR HRUSZKA, ul. Graniczna 43, 93-428 Łódź, a field experiment on the soil conditioner HUMIBAKT was carried out in the vegetation season 2023/2024. The aim of the test was to grant marketing authorisation for the product. The experiment was conducted on the experimental fields of the Agricultural Experimental Station of the Institute of Soil Science and Plant Cultivation – State Research Institute in Grabowo nad Wisłą, in the Masovian Voivodeship.

Samples of the product for agricultural tests were collected by the sample collector from the Chemical and Agricultural Research Laboratory in Łódź, Mr. Jacek Michalak, on the 19.07.2023 (sample collection report No. 06/07/9/N/23) and on the 04.09.2023 (sample collection report No. 01/09/9/N/23). Samples of fertilizers and agents supporting plant growth and substances designated for tests to grant marketing authorisation.

The experiment was established on luvisols formed on light clay, belonging to good wheat complex. The soil under the maize was characterised by slightly acidic pH, high content of phosphorus, and very high content of accessible magnesium. The experimental field was drained, with drainage in good condition, and the soil had well-regulated water and air relationship. The basic properties of the soil are provided in Table 1.

Tables 2 and 3 present data concerning the sowing material, forecrops, and fertilization in the last 3 years.

Table 1. Properties of the soil on the experimental maize field

Plant	Type and class of the soil	Agricultural bonitation complex	mg in 100 g of soil			pH $_{KCl}$
			Egner		Mg accessible Schachtschabel	
			P_2O_5	K_2O		
maize	Luvisol formed on light clay	Good wheat	18.9	19.9	6.1	5.6

Table 2. Assessment of the sowing material used in the experiment

Plant /variety/	Cultivation year	Origin	Sowing quantity [kg/ha]
Maize **BAOBI**	2024	LIDEA-SEEDS	Approx. 30.0

Table 3. Forecrops of maize in the previous three years

Year	Forecrop	Yield [t/ha]	Organic fertilization [t/ha]	Mineral fertilization [kg/ha]				Chemical agent
				N	P_2O_5	K_2O	CaO	
2021	Maize for silage	49.6	32.0	151.8	79.0	84.0	-	Maister Power 42.5 OD – 1.5 l
2022	Spring barley	3.61	-	74.0	48.0	78.0	520	Mustang Forte 195 SE – 0.8 l
2023	Winter wheat	7.53	-	136.8	56.0	84.0	-	Pontos – 0.5 l Sempra – 0.2 l

The experiment tested the effects of application of the soil conditioner HUMIBAKT. The conditioner was applied in the dose of 0.2 kg/ha, twice: on the stubble after the harvest of winter wheat in 2023 and in the spring, after sowing maize cultivated on the same field, in the subsequent year, with a control field, according to the scheme:

A – control site (without the application of soil conditioner HUMIBAKT)

B – application of soil conditioner HUMIBAKT

The whole experiment site was fertilized with mineral fertilizer according to the technology of maize cultivation for green forage as adopted at the Agricultural Experimental Station in Grabowo.

The field experiment was carried out with the use of the long-strip method. The fields for harvesting had a surface area of 15.0 m^2 (10 m long and 1.5 m wide).

The dates of application of the soil conditioner HUMIBAKT are presented in Table 4, and the site plan of the experiment is shown in Figure 1.

	A Control	**B HUMIBAKT**
Repetition	IV	IV
	III	III
	II	II

	I	I

Fig. 1. Site plan of the experiment

Table 4. Mineral fertilization and chemical agents applied in the experiment

Site designation	Type of fertilizer or chemical agent	Dose of pure substance (kg/ha)	Dose of the fertilizer/preparation	Date of application
A, B	Polifoska 6	N - 15 P_2O_5 - 50 K_2O - 75	250 kg/ha	24.04.2024 r.
A, B	Potassium salt	K_2O - 48	80 kg/ha	24.04.2024 r.
A, B	RSM S 28	N - 47	200 l/ha (dose I)	24.04.2024 r.
A, B	Ammonium phosphate	N- 9 P_2O_5 - 23	50 kg/ha	29.04.2024 r.
A, B	Urea	N - 46	100 kg (dose II)	29.05.2024 r.
B	HUMIBAKT	0.2 kg/ha	Pre-sowing	25.04.2024 r.
B	HUMIBAKT	0.2 kg/ha	Top dressing	28.05.2024 r.
A, B	Maister Power 42,5 OD	1.5 l/ha	-	23.05.2024 r.

3. CULTIVATION TREATMENTS IN THE VEGETATION SEASON

The experiment was carried out in compliance with the valid technology of cultivation of maize for green forage. Chemical protection of plants against illnesses, weeds, and pests was performed in compliance with the recommendations for maize protection. The list of cultivation treatments is provided in Table 5, and the periods of selected development stages of maize are presented in Table 6.

The dates and manner of application of the tested soil conditioner were adapted to comply with the instructions of the Ordering Party.

Table 5. Cultivation from the harvest of forecrops and treatment during the vegetation period,

Type of treatment	Date
Threshing of winter barley with cutting straw	13.08.2023.
Spraying the field with soil conditioner – HUMIBAKT at the dose of 0.2 kg/ha (site B)	31.08.2023.
Cultivation of the field with disc harrow and cultipacker	01.09.2023.
Spring ploughing with rotating plough	19.03.2024.

Cultivation of the field with brake harrow	28.03.2024.
Application of phosphorus and potassium fertilizers: Polifoska 6 – 250 kg/ha + potassium salt 80 kg/ha with fertilizer spreader, and application of one dose of nitrogen in form of RSM S 28 at the dose of 200 l/ha with an attachable sprayer	24.04.2024.
Application of soil conditioner HUMIBAKT at the dose of 0.2 kg/ha (site B)	25.04.2024.
Cultivation with the set: Disc harrow + V-ring pressing roller	29.04.2024.
Sowing BAOBI variety of maize with a point seeder, in the amount of 88.9 thousand seeds/ha with the application of fertilizer: ammonium phosphate at the dose of 50 kg/ha	29.04.2024.
Spraying the maize with herbicide Maister Power 42.5 OD at the dose of 1.5 l/ha + 250 litres of water	23.05.2024.
Application of dose II of nitrogen in form of urea with fertilizer spreader in the amount of 100 kg/ha	29.05.2024.
Harvesting the maize: cutting, weighing and collecting plant samples	02-03.09.2024.

Table 6. Development phases of maize according to the BBCH scale

Code	Development phase	Date
00	Dry seed (caryopsis)	29.04.2024.
01	Beginning of seed imbibition	30.04.2024.
05	Radicle emerged from caryopsis	03.05.2024.
07	Coleptile emerged from caryopsis	05.05.2024.
10	First leaf through coleoptile	07.05.2024.
11	First leaf unfolded	08.05.2024.
13	Three leaves unfolded	12.05.2024.
15	Five leaves unfolded	23.05.2024.
31	First node detectable	14.06.2024.
33	Three nodes detectable	20.06.2024.
51	Beginning of tassel emergence	02.07.2024.

55	Middle of tassel emergence: middle of tassel begins to separate	04.07.2024.
59	End of tassel emergence: tassel fully emerged and separated	06.07.2024.
63	Male: beginning of pollen shedding Female: tips of stigmata visible	08.07.2024.
67	Male: flowering completed Female: stigmata drying	13.07.2024.
69	End of flowering	16.07.2024.
71	Beginning of grain development: kernels at blister stage, about 16% dry matter	23.07.2024.
73	Early milk	27.07.2024.
75	Kernels in middle of cob yellowish-white (variety-dependent), content milky, approx. 40% dry matter	30.07.2024.
85	Dough stage: kernels yellowish to yellow (variety dependent), about 55% dry matter, harvest	09.08.2024.

4. THE COURSE OF WEATHER CONDITIONS

Water deficits and periods of droughts that usually occur in the region of the Agricultural Experimental Station of the Institute of Soil Science and Plant Cultivation - State Research Institute at the turn of June and July occurred significantly earlier in the 2024 vegetation season. In April, the recorded level of precipitation was less than 28 litres of water. Moreover, precipitation occurred mainly in the first half of the month. In the end of May, the level of precipitation was 14.3 mm. Due to late sowing of maize, the period of drought did not affect the plants. During that time, the maize developed 6-7 leaves. In the period that is critical due to the plants' demand for water, i.e. in the phases of tassel emergence, flowering, and forming kernels, the moisture conditions were very favourable for the plants. Such beneficial conditions for the growth and thriving of plants resulted in a high yield of maize.

5. TEST RESULTS

5.1. Total water capacity (TWC) and field capacity (FC)

Soil samples for testing were collected from the arable and humic layers, i.e. 0-25, while

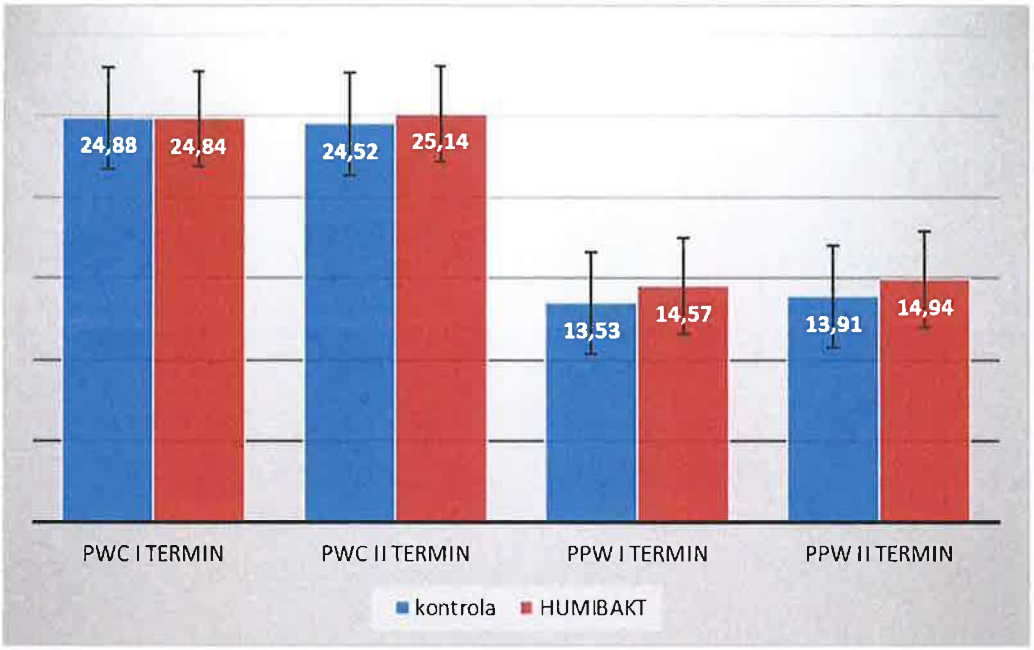
maintaining the natural structure of soil.

In order to achieve it, four samples were collected from each site (the control site and the site where soil conditioner HUMIBAKT was applied). Samples for the determination of the organic carbon content were collected from the same places. This approach enabled to conduct all analyses on the same soil formations. Samples were collected two months after the post-harvest application of the soil conditioner and 6 weeks after spring application. Samples were collected to lockable steel Kopecky cylinders of the capacity of 100 cm^3 to ensure that the natural structure of soil would be maintained. Laboratory tests of the physical properties of soils were conducted at the laboratory of the Department of Soil Science and Environmental Analyses of the Institute of Soil Science and Plant Cultivation – State Research Institute in Puławy.

The water capacity of the analysed soils was determined with the use of the apparatus for testing the water characteristics of soil on a sand block (manufactured by Eijkelkamp, the Netherlands). Total water capacity was determined at soil suction pressure 0 hPa, while field capacity was determined at soil suction pressure of 100 hPa. The analysis consisted in placing the soil samples collected to cylinders in a sand block. Then the soil samples were brought to full saturation through capillary ascension. At the moment when the maximum saturation of the soil sample with water and the suction pressure value of 0 hPa had been reached, the samples were weighed and dried at the temperature of 105°C for 24 hours. Then they were weighed again and the water content in the sample was calculated.

The field capacity was determined in the same way, although here the samples were removed from the sand block when the soil suction pressure reached the value of 100 hPa.

The laboratory analyses conducted in the first series demonstrated that the total water capacity on the site where HUMIBAKT had been applied was practically on the same level as on the control site. The levels were, respectively, 24.88% for the control site and 24.84% for the site with HUMIBAKT (Fig. 2). In the second series of tests, a slightly larger value of TWC (25.14%) was noted on the site with HUMIBAKT, in comparison to the control site (24,52%). However, the difference was not statistically significant. As for field capacity, the contents of water found on sites where HUMIBAKT had been applied were higher than on control sites both in the first and second round of tests. However, this difference was also statistically insignificant. 2).



[TWC Round I, TWC Round II, FC Round I, FC Round II

Blue: Control, red: HUMIBAKT]

Fig. 2. Percentage of water content corresponding to total water capacity (TWC) and field capacity (FC) on sites with HUMIBAKT soil conditioner ad on control sites.

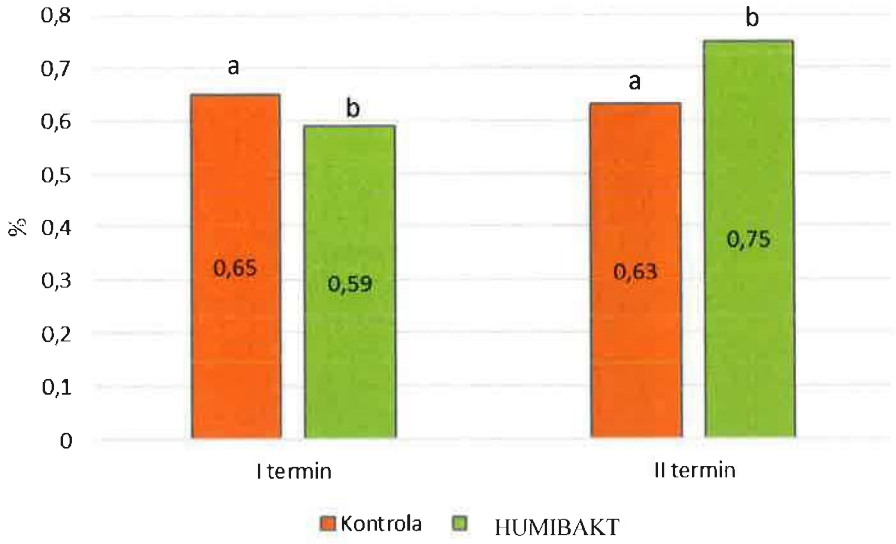
The conducted tests of the influence of HUMIBAKT on water capacity point to certain trends that might, in the future, lead to positive changes in the water capacity of soil. However, the short duration of the experiment does not allow us to draw clear conclusions.

5.2. Content of organic carbon in the arable layer of soil

Pursuant to the guidelines of the Ordering Party, soil samples for the determination of the content of organic carbon (Corg) were collected from the 0 – 30 cm layer twice: 2 months after spraying the field after the harvest of maize with the HUMIBAKT soil conditioner (round I) and 6 weeks after the application of soil conditioner in the spring, after sowing maize (round II). Soil samples were sifted through a sieve with a 2 mm mesh. The content of organic carbon was determined at the Main Laboratory of Chemical Analyses of the Institute of Soil Science and Plant Cultivation - State Research Institute with the Tyurin method (PB 021-rev.IV.28.08.2020).

As a result of the application of soil conditioner HUMIBAKT, the content of organic carbon in the field of maize in the spring increased from 0.63% to 0.75%. The content of organic matter (calculated as %Corg x 1.724) in the arable layer of soil on the site where HUMIBAKT had been applied increased by 14% in comparison to the content of organic matter in the soil

where the tested soil conditioner had not been applied (Fig. 3).

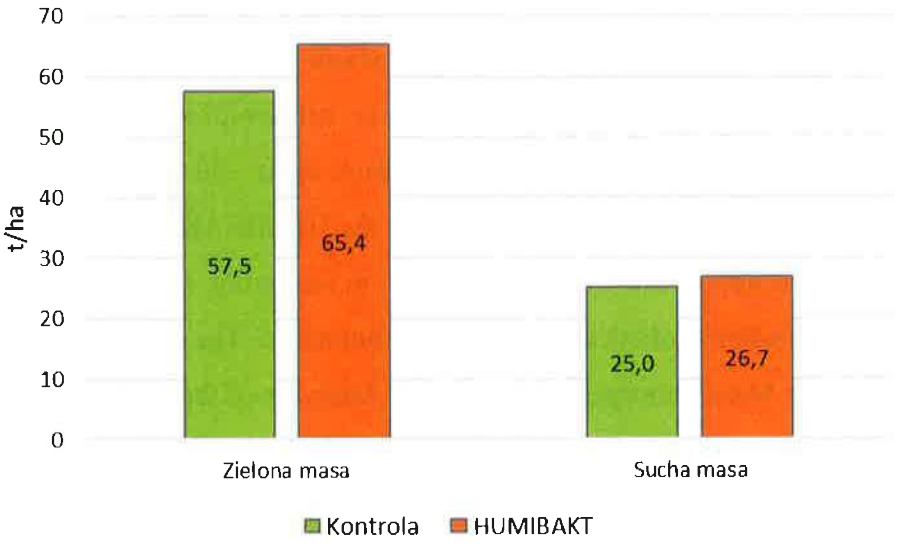


[Round I Round II
orange: Control green: HUMIBAKT]

Fig. 3. Content of organic carbon (Corg) in the 0-30 cm soil layer in the experiment

5.3. Yield of maize

In 2024, the yield of maize was high. The average yield of maize was 61 t/ha for green weight and 26 t/ha for dry weight. The application of soil conditioner HUMIBAKT increased the crops by 12% and dry weight by 6% in comparison to the yield on the control site (Fig. 4).



[Green weight Dry weight
orange: Control green: HUMIBAKT]

Fig. 4. The influence of the application of soil conditioner HUMIBAKT on the yield of maize

6. Conclusions

1. Soil conditioner HUMIBAKT had a positive influence on the accumulation of organic carbon in the arable layer of soil in the spring.
2. After the application of HUMIBAKT in the spring, the content of Corg on the control site amounted to 0.63%, and on the site where the tested soil conditioner had been applied twice it reached 0.75%.
3. As for field capacity, the values of water content on sites where HUMIBAKT had been applied were higher than on control sites both in the first and second round of tests.
4. The yield of green weight of corn on the site where HUMIBAKT had been applied were 12% larger than in the control site, while the yield of dry weight was 6% larger.
5. Based on the conducted analyses, one may confirm that HUMIBAKT soil conditioner is suitable for use in the cultivation of field crops.

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