

## Effect of the product on soil quality

**HUMAC® Agro** with a **high content of natural humic acids (62%)** is a certified natural stimulator of soil fertility. The product is easy to apply and highly effective in increasing the biological activity of the soil. The preparation acts as a soil stimulator and its application modifies/improves the basic properties of the soil, mainly nutrient management (they release unused nutrients and thus reduce the need for technical fertilizers by 40%), ensure a change in the soil structure (by creating so-called peds, i.e. microcracks for the accumulation of water and air in the soil), increase the buffering capacity of the soil (water retention), reduce the leaching of nutrients, supply mainly trace elements to the soil and the like. All the positive aspects of the product work to increase the yields of agricultural production every year. **The high efficiency of the product is ensured by the activation of the raw material** - humic substances by our own technological procedure.



In 2013, an experiment was carried out in cooperation with LODR Końskowola in Poland (Annex Tóth, 2015), which monitored the **effect of HUMAC® Agro on the soil**. After the application of HUMAC® Agro in the amount of 500 kg/ha, **an increased content of humus in the soil** was recorded, as well as **increased values of the soil reaction** (buffering effect on pH) and the **contents of available forms of all monitored nutrients were also increased** (P, K, Mg, B, Mn, Cu, Zn and Fe) compared to the initial state determined at the beginning of the experiment as well as the control without HUMAC® Agro application (see table 1).

Table 1. State of soil properties before and after application of soil conditioner HUMAC® Agro

Parameter	Unit	Pred sejbou	After harvesting		
			Control	HUMAC® Agro 500 kg/ha	Change
Humus content	%	1,18	1,14	1,59	+ 39,47 %
pH/KCl	n/a	6,19	4,93	7,26	optimálne
phosphorus (P)	mg/kg	113,7	89,1	165,9	+ 86,20 %
potassium (K)	mg/kg	216,7	210,0	212,5	+ 1,19 %
magnesium (Mg)	mg/kg	71,0	58,0	100,0	+ 72,41 %

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<b>boron (B)</b>	mg/kg	1,08	0,62	2,00	<b>+ 222,58 %</b>
<b>manganese (Mn)</b>	mg/kg	150,0	184,0	237,0	<b>+ 28,80 %</b>
<b>copper (Cu)</b>	mg/kg	3,2	2,5	4,5	<b>+ 80,00 %</b>
<b>zinc (Zn)</b>	mg/kg	8,5	7,1	10,3	<b>+ 45,07 %</b>
<b>iron (Fe)</b>	mg/kg	1002	1142	1198	<b>+ 4,90 %</b>

Table 2. Monitoring of humus content from different experiments before and after application HUMAC® Agro

Place	Dose of HUMAC® Agro	Control	With the addition of HUMAC® Agro	Change
<b>Poland 2013</b>	500 kg/ha	1,14 %	1,59 %	<b>+ 39,47 %</b>
<b>Slovakia 2013</b> (1st harvesting)	225 kg/ha	2,27 %	2,54 %	<b>+ 11,89 %</b>
<b>Slovakia 2013</b> (2nd harvesting)	225 kg/ha	2,29 %	2,48 %	<b>+ 8,30 %</b>
<b>Farské 2012</b> (2nd year)	250 kg/ha	1,80 %	1,95 %	<b>+ 8,33 %</b>
<b>Farské 2013</b> (3rd year)	250 kg/ha	2,68 %	3,01 %	<b>+ 12,31 %</b>
<b>Majer 2012</b> (2nd year)	1190,5 kg/ha	2,48 %	2,62 %	<b>+ 5,65 %</b>

**Humic acids are also able to reduce the content of some metals in the soil**, in 2016 an experiment was carried out on soils contaminated with copper from the territory of central Spiš (Fazekaš, 2015). The results of the tests showed that the copper content in the aqueous solution originating from contaminated soils (25 mg/l) exceeded the permitted limits established by law 13 times. After the application of a natural stimulator (2% HUMAC Enviro solution), the copper content **significantly decreased by 40%** in a five-day interval, and the average value of Cu (15

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mg/l) exceeded the legal limit 8 times. Based on the testing of the HUMAC® Agro product at the Institute of Hydrology of the SAS in 2020 and 2021, **the full water capacity (retention capacity) was determined in the range of 560 - 720 liters of water per 1 m<sup>3</sup> of material** (or 310 - 390 l/kg). The results of chemical analysis of soil samples on the BLÁTA farm from 2011 (Tóth) show an increase in the values of accessible nutrients (see table 3).

Table 3. Comparison of the values of selected parameters without application and after application of HUMAC® Agro on the Blatá farm

Parameter	Control	HUMAC® Agro 200 kg/ha	Unit	Change
ammoniacal nitrogen (N - NH <sub>3</sub> )	8,9	9,0	mg/kg	+ 1,12 %
nitrate nitrogen (N - NO <sub>3</sub> <sup>-</sup> )	4,9	5,8	mg/kg	+ 18,37 %
inorganic nitrogen (N)	13,8	14,8	mg/kg	+ 7,25 %
available phosphorus (P)	4,8	19,2	mg/kg	+300 %
available potassium (K)	228,8	363,5	mg/kg	+ 58,87 %

<b>Recommended dosage of HUMAC® Agro for soils without topsoil and barren soils</b>	<b>1 - 3 kg / m<sup>2</sup></b>
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The activated natural humic acids in the product require some time to form humic complexes to ensure effective plant nutrition. HUMAC® Agro can be applied to the soil all year round. The preparation is simply worked into the upper layers of the soil, ideally near the roots of the plants, or it is sprinkled on the soil using conventional fertilizer spreaders. Repeated use is recommended after 3-4 years. Product without protection period. To revive the soil, a basic dose of HUMAC® Agro with artificial fertilizers and grass seeds is required repeatedly for 2-3 years.

**HUMAC® Agro is suitable for use in organic agriculture for the production of organic food**