

Microbiological product helps straw degradation of winter wheat, and stabilizes soil NH₄ over winter

By: Dr. Jurate Aleinikoviene¹, Dr. Vaclovas Boguzas¹ and Dr. Ewald Sieverding²

¹ Department of Agronomy of the Agriculture Academy of Vytautas Magnus University, Akademia, Kauno,

² University of Hohenheim, Inst. of Agric. Sci. in the Tropics, Depart. of Agroecology, Germany.

SUMMARY

Two field experiments have shown that post harvest applied microbial mixture (BACTOLiVE AGRO of company UAB BIOVAGA, Lithuania) at 300 g/ha to straw and stubbles of winter wheat, resulted in

- accelerated degradation of wheat straw more and better than 25 kg N/ha applied as urea
- stabilized NH₄-mineralization over autumn, winter and spring 2017/2018, so, avoiding losses of N
- interrupted pathogen transfer by straw from winter wheat to next crop, spring wheat
- and increased grain yields of the follow crop, spring wheat, planted in April 2018, by more than 500 kg/ha
- cultivation with cultivator had better yield increases by BACTOLiVE® AGRO than disk harrowing, likely due to the better soil aeration effects after high rainfalls in autumn of 2017.

In a laboratory experiment, two microbial products (BACTOLiVE AGRO, BACTOMIX), one soil conditioner with herbal extracts, alginates and aminoacids (AMALGEROL) and two chemical fertilizers (UREA, NH₄SO₄) were tested in two soil:

- BACTOLiVE AGRO degraded straw best of the microbial products, and the soil conditioner, after 2 months; the effect of chemical fertilizers depended on the soil type, NH₄SO₄ was very good in sandy loam.
- BACTOLiVE AGRO caused, in both soils, highest dehydrogenase activity – this is a measurement of the microbial activity of soils – UREA inhibited these enzymes in silt loam. Again, the results showed that UREA (NH₂CO) is not good choice for straw degradation. BACTOLiVE AGRO should be used

RESULTS

In two field trials (ASU: experimental station of Agriculture Academy of VM University, and at Sakiai, at farmers field) the microbial product BACTOLiVE® AGRO was dissolved in water and was sprayed alone at 300 g/ha or in combination with UREA (CH₄N₂O) after harvest of winter wheat on the stubbles and on the shredded straw, on 20 Aug. 2017. UREA and KAS (NH₄SO₄) were sprayed at 25 kg N/ha. Treated straw was incorporated either with disk harrow (left foto) or with cultivator (right foto).



We found that **BACTOLiVE® AGRO alone had degraded 29% more of straw** within 6 weeks after treatment (until first week Oct) as compared to control, while UREA or the UREA + BACTOLiVE AGRO treatments had only 17 or 15% more degraded than controls (average of the two field sites). This was surprising as UREA, as relative inexpensive N source, is often recommended for the purpose of acceleration of post harvest straw degrading.

Treatment	ASU, at 45 DAT degraded straw (% more than in control)	Sakiai, at 41 DAT degraded straw (% more than in control)
Control	-	-
BACTOLiVE AGRO	17	40
UREA + BACTOLiVE AGRO	0	29
UREA	0	34

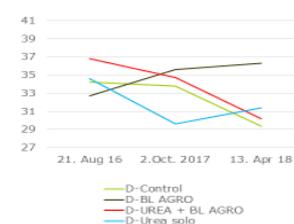
In an exact laboratory experiment straw was packed in nets and treated at recommended doses with different products before burring in a sandy loam and a silt loam. After two months, BACTOLiVE® AGRO of all biological products had degraded best the straw, while degradation improvement by chemical fertilizers depended on the soil; NH₄SO₄ was very good in sandy loams. UREA degraded only in silt loam. Dehydrogenase is a measurement of microbial activity in soil, and it was very clear that **after BACTOLiVE treatment the microbial activity was highest**, of all. UREA, in silt loams appears to inhibit microbial activity (see table)

Proposal for publication

Treatment	Sandy loam soil		Silt loam soil	
	Straw degradation (%)	Dehydrogenase activity ($\mu\text{g/g DW}$)	Straw degradation (%)	Dehydrogenase (activity $\mu\text{g/g DW}$)
Control (untreated)	24,8	5,31	27,2	14,05
Amalgerol (3 L/ha)	14,6	6,02	24,6	11,20
Bactomix (1 L/ha)	26,6	6,13	11,4	11,33
BACTOLiVE AGRO (500 g/ha)	28,0	9,73	37,6	15,42
UREA (80 kg/ha)	25,8	7,26	35,2	9,04
NH ₄ SO ₄ (100 kg/ha)	38,4	7,12	35,8	14,15

Biological stabilization of NH₄ concentration in soil from autumn to spring

NH₄ content (kg/ha) in soil at ASU



NH₄ content (kg/ha) in soil at Sakiai



BACTOLiVE® AGRO maintained high and stable NH₄ concentration in soil over winter until planting of next crop, while urea did not (see Figure below). BACTOLiVE AGRO should not be combined with UREA as this will not improve efficacy for straw degradation and NH₄ stabilisation.

Spring wheat was planted in April 2018, on same plots that were sprayed in autumn 2017. Fertilization and herbicide sprays to spring wheat were as usual; there was no fungicide spray. It was seen that the **BACTOLiVE® AGRO treatment tendentially decreased diseases, in particular *Septoria / Drechslera tritici* in the spring wheat over the first 2 months**; thereafter no differences were found with control in any treatment because spores of pathogens were flying in from neighbour crops. Hence, due to degradation of straw, and thus decrease of initial pathogen inoculum on straw, all treatments somewhat inhibited transfer of diseases to next crop.

*Urea calculated at 240-350 EUR/t; KAS calculated at 150-230 EUR/t; BACTOLiVE AGRO used at 300 g/ha

BACTOLiVE® AGRO increased grain yields of spring wheat, planted in 2018, after straw treatment with BACTOLiVE AGRO in 2017, by 490 kg/ha (Sakai) and 650 kg/ha (ASU) as compared to control (untreated), and **grain yields of BACTOLiVE® AGRO treatments were 490 kg and 170 kg/ha higher than the UREA treatment (see table)**. Combinations of BACTOLiVE® AGRO with mineral N-fertilizers are not recommended. It appears that BACTOLiVE AGRO is not compatible with UREA fertilizers, because the bacteria in BACTOLiVE AGRO may accelerate the transformation of urea to NH₄, and NH₄ to NO₃ that likely was washed out during the rainy autumn of 2017.

Treatment	Average yields of spring wheat in 2018 at Sakiai (t/ha), after straw degradation treatment in 2017	Average Yields of spring wheat in 2018 at ASU (t/ha), after straw degradation treatment in 2017	Product cost of treatments / ha One time after harvest – for straw degradation
Control (straw not treated)	4,31	5,34	0
BACTOLiVE AGRO alone	4,80	6,09	13,5 EUR /ha
25 kg/ha N fertilizer*	4,31	5,92	13,0-19,0 EUR / ha
N-fertilizer + BACTOLiVE	4,37	5,88	26,5-32,5 EUR / ha