

Brand new polyfunctional biologics are the triggers in crop residues destruction

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Statement of the Problem: Natural crop residues biorecycling lasts 3–4 years. This is due to cellulose and lignin predominance in plant tissues, complex natural polymeric carbohydrates. Particularly slow plant residues biorecycling occurs in arid and sharply continental soil-climatic zones. The use of polyfunctional biologics with biodestructors and biopesticides properties leads to residues mineralization accelerating, phytosanitary stabilization, soil fertility improvement and crops' productivity increasing. The aim of this work is efficacy evaluating of new polyfunctional biologics with biodestructors and biopesticides properties in corn residues destruction.

Methodology & Theoretical Orientation: New biologics are developed on 2 *Trichoderma asperellum* producer strains, high active antagonists and cellulolytics, thermotolerant and psychrophilic, selected according to target characteristics. Biologics laboratory samples were obtained by liquid-solid-phase cultivation on inert peat carrier, as well as in substrate-associated preparative forms by spent mushroom substrates multibioconversion. The biologics experimental batches efficacy was evaluated in small plot trials under appropriate climatic conditions at 15 kg/ha consumption rate for 1 and 6 months with a single application and 12 months with a double one.

Findings: Revealed a general decrease in the plant residues biomass under the influence of all formulations by 1.2–1.4 times within 1 month, 3.5–3.8 times within 6 and 4–4.5 times within 12 months. The total cellulose content in crop residues decreased against the natural background over 6 and 12 months by 1.2 and 1.6 times, respectively, and under the biologics influence – by 2 and 4 times, respectively. The total lignin content decreased against the natural background for 6 and 12 months by 1.2 and 1.5 times, respectively, and under the biologics influence – by 1.5 and 2 times, respectively.

Conclusion & Significance: A 3–4-fold acceleration of the crop residues destruction processes under the influence of polyfunctional biologics with biodestructors and biopesticides properties has been shown.

Recent Publications

1. Novikova II, Titova JA, Boykova IV, Krasnobaeva IL (2019) Controlled breeding of the psychrophilic strain G-034 VIZR of *Trichoderma asperellum* for fast crop residues' polymer utilization and soil enhancement. Vavilov J Genetics and Breeding 23(3):228-236. doi: 10.18699/VJ19.497 (in Russian).
2. Titova JA, Novikova II, Boykova IV, Pavlyushin VA, Krasnobaeva IL (2019) Novel solid-phase multibiorecycled biologics based on *Bacillus subtilis* and *Trichoderma asperellum* as effective potato protectants against *Phytophthora* disease. Agricultural Biology 54(5):1002-1013. doi: 10.15389/

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agrobiology.2019.5.1002eng. (in Russian).

3. Titova JA., Novikova II, Krasnobaeva IL, Boykova IV (2020) Crop residues low-temperature biodestructor obtaining via waste multirecycling from mono-, double- and tripleculture of edible mushrooms. *Modern mycology in Russia* 8(5):384–386 (in Russian).
4. Pavlyusin VA, Novikova II, Boikova IV (2020) Microbiological control in phytosanitary optimization technologies for agroecosystems: research and practice (review). *Agricultural Biology* 55 (3):421-438. doi: 10.15389/agrobiology.2020.3.421eng.
5. Kolesnikov LE, Novikova II, Popova EV, Priyatkin NS, Zuev EV, Kolesnikova YR, Solodyannikov MD (2020) The effectiveness of biopreparations in soft wheat cultivation and the quality assessment of the grain by the digital x-ray imaging. *Agronomy Research* 18(4):2436–2448. doi:10.15159/AR.20.206.
6. Titova JA (2021) Spent mushroom substrates valorization via brand new multirecycled polyfunctional biologics producing on them. *Waste Biomass Valor.* doi: 10.1007/s12649-021-01552-5.

Biography

Julia A Titova graduated from Moscow State University. After postgraduate study had put over PhD Thesis "Biological basis to the control of cultivated mushroom *Agaricus bisporus* (Lange) Imbach mycodiseases". Research interests are mycology, phytopathology, plant diseases indoors and outdoors, plants and mushrooms diseases microbiocontrol, edible mushroom mono-, double and triple cultivation, diseases of cultivated mushrooms, waste-off technologies, waste management (from the point of fungi), mycobiota of weeds; biocontrol of weeds with pathogenic fungi; multistep wastes biorecycling. Special skills lie in identification, isolation and cultivation of plant pathogenic and mycophilic fungi, common, modern and special methods of mycology and phytopathology use. The researcher has developed brand new waste multibiorecycling technology, methodology and the know-hows for the brand new 15 multirecycled substrate-associated polyfunctional biologics (MSAPB) production. Biotechnologies for MSAPB use are under development.

Biography

Irina I Novikova heads the direction of the laboratory's research work related to the search for highly effective strains of microbes-antagonists of phytopathogenic fungi and bacteria and the creation of new biologics based on them to protect crops from fungal and bacterial diseases. I. I. Novikova defended her doctoral dissertation on the topic: "Biological justification of the creation and application of multifunctional biologics based on antagonist microbes for agroecosystems phytosanitary optimization ". Under her leadership, more than 10 new multifunctional biologics have been developed to protect vegetable, grain, fruit and berry crops, grapes and potatoes, effectively reducing plant disease infestation, increasing disease resistance, stress resistance and significantly increasing yield.