

## ANTIFUNGAL ACTION OF ORGANIC APLICABLE FERTILIZERS TOWARDS PLANT PATHOGENS

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### Abstract

An antifungal action of novel organic agriculture applicable fertilizers manufactured on base of mixture of rock meal, produced from natural Austrian minerals was established in conducted *in vitro* trials towards economic important for the region of Bulgaria plant pathogens as *Monilia fructigena*, *Alternaria solani* and *Phytophthora infestans*. The tests reveal that even though these products are fertilizers, they can effectively act as protective fungicides. Additionally real field tests for phytotoxicity were conducted with different cultural and decorative plants and results show that there is absolutely no toxic action of these products even is 10 folds higher doses than labels recommended.

**Key words:** organic fertilizers, antifungal, plant pathogens.

### INTRODUCTION

Panamin fertilizers for organic agriculture are mixtures of rock meal, produced from natural Austrian minerals, with major components calcium, magnesium, silicon plus additional microelements like iron, phosphates and potassium (Panamin Co, 2017).

During recent years, this fertilizers became popular as in the commercial as in the organic agriculture. However it was founded that this products can express and ISR (Induced System Resistance) effect on plant i.e. can significantly reduce the attacks on treated plants caused by fungus and bacteria pathogens and provide resistance to frost and drought (Valchev and Valcheva, 2019; Kovacevik and Mitrev, 2019). In this study, conducted *in vitro* tests reveal that they can have also direct antifungal action towards some of the most economical important for the region of Bulgaria plant pathogens as *Monilia fructigena*, *Alternaria solani* and *Phytophthora infestans*.

The fact that such fertilizers can manifest ISR properties actually is not something unusual for the novel present day's fertilizer products.

Also even though ISR elicitors (promoters) usually do not have direct pesticidal properties, some of them may manifest such, especially in the higher concentrations (doses) (Reuveni and Reuveni, 1998).

### MATERIALS AND METHODS

Cultures of *Monilia fructigena*, *Alternaria solani* and *Phytophthora infestans* were isolated from infected fruits quince tree (for *Monilia fructigena*), tomato leaves (for *Alternaria solani*) and potato leaves (for *Phytophthora infestans*). Germ tube inhibition tests were conducted for determination of possible protective activity of the tested fertilizers. Fresh infected with inspected pathogen plant parts were collected and were incubated in a humid chamber for the purpose of stimulation the conidial sporulation of the phytopathogens. Conidial suspensions were prepared with the density  $3 \times 10^4$  spores/ml. Microscopic slides kind "handing drop" were sprayed with tested solutions and after drying, 20  $\mu$ l of conidial suspension was applied. The slides were incubated in a humid chamber, in thermostat and after 24-48 h. the number of germinated conidia was counted with a light microscope (Nikolov and Ganchev, 2011).

The possibility of evaluated fertilizers to inhibit the development of the mycelium of the tested phytopathogens was determined according to Thornberry methods (radial growth assays). For this purpose a potato dextrose agar (PDA) was used. The observation of mycelium growth was conducted on the 3rd, 7th, and 14th day (Secor and Rivera, 2012). The effectiveness was determined with formula of Abbott (Abbott,

1925). Statistical manipulation of the results was made with R Program Language for Statistical Computing (Team, 2013). In this study five different products were evaluated: Panamin Agro, Panamin Suspension, Panamin ImunoActive, Panamin ImunoActive Plus and Panamin ImunoSafe

## RESULTS AND DISCUSSIONS

Trials with conidia spores reveal that products: Panamin ImunoActive and Panamin ImunoActive Plus can completely inhibit the germination of conidia spores of the all tested plant pathogens completely at 1 % (v/v) concentration. The rest of the products do not manifest such activity.

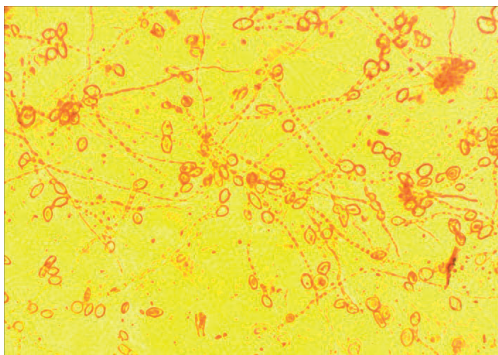


Figure 1. Conidial suspension of *Monilia fructigena* – control variant

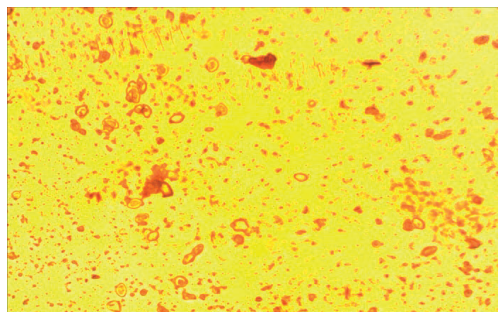


Figure 2. Conidial suspension of *Monilia fructigena* – Panamin ImunoActive – 1 % (v/v)

The conducted *in vitro* radial growth assays show also that both products: Panamin ImunoActive and Panamin ImunoActive Plus can express antifungal action towards tested plant pathogens at different degree. Panamin ImunoSafe at registered 0.3 % (v/v)

concentration do not show any pesticidal activity but in the 1 % and 3 % (v/v) was able to suppress the development of mycelium of testes pathogens.

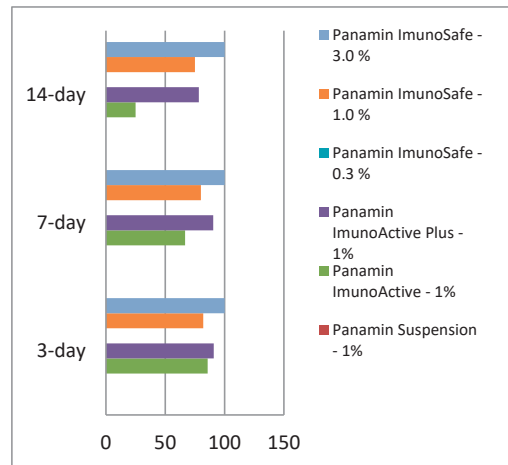


Figure 3. *Alternaria solani* radial growth assays

The figure above clearly show the ability of Panamin ImunoSafe completely to block the development of the mycelium at 3 % (v/v) concentration. The same product at 1 % (v/v) has a little bit less effectiveness while at registered 0.3 % (v/v) – zero effectiveness. Panamin ImunoActive has good level effectiveness only in 3 days after treatment, after that the effectiveness drop significantly. Panamin ImunoActivePlus however can provide satisfactory level of protection towards tested pathogen.

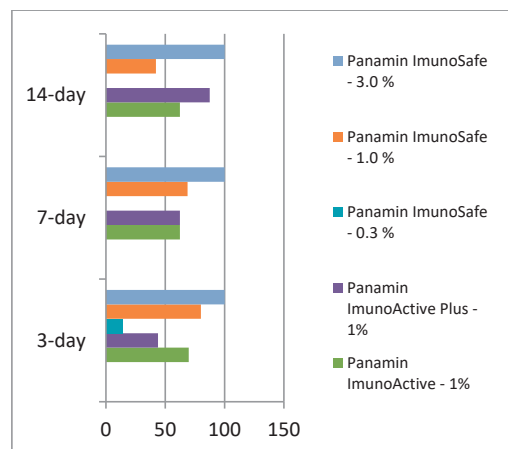


Figure 4. *Phytophthora infestans* radial growth assays

The results show that effectiveness of Panamin fertilizers towards *Phytophthora infestans* is significantly less than *Alternaria solani*. However Panamin ImunoSafe again at 3 % (v/v) concentration was able completely to inhibit the development of mycelium. The same product at 1 % (v/v) concentration show good effectiveness only 3 days after start of the test, after that the effectiveness drop significantly. Panamin ImunoActive also was not able to provide satisfactory level of effectiveness while Panamin ImunoActive Plus achieved approximately 87 % effectiveness 14 days after start of the test.

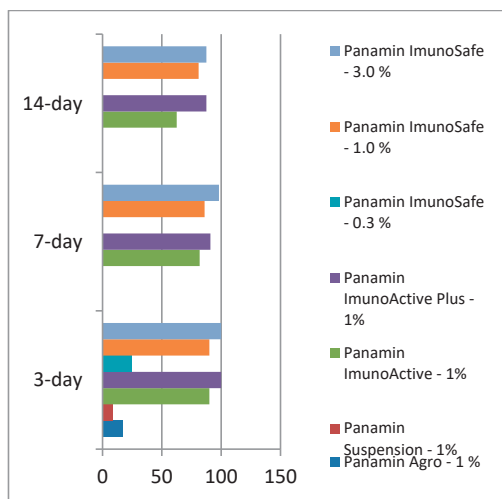


Figure 5. *Monilia fructigena* radial growth assays

According to the given tested plant pathogen, Panamin ImunoSafe together with Panamin ImunoActive Plus has higher level of effectiveness – over 87 % at the end of the test. Panamin ImunoActive have high effectiveness at the beginning of test but it drop to the 60 % at the end. Panamin ImunoSafe at 1 % (v/v) concentration also achieves good level of effectiveness. Surprisingly Panamin Agro,

Panamin Suspension and Panamin ImunoSafe at 0.3 % (v/v) concentration also express (although very low) effectiveness towards *Monilia fructigena* at the beginning of the test.

## CONCLUSIONS

The conducted trials reveal that some of Panamin fertilizers can express a excellent level of effectiveness towards some economic important plant pathogens. This is additional option for use of such kind products with can simulate the growth of the plants and can provide plant protection action simultaneously. The conducted phytotoxicity tests reveal that even in 10 folds higher doses than labels recommended, these products do not manifest any symptoms of phytotoxicity on plants.

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