Efficacy of microbiological treatments and trap crop against pests of winter oilseed rape

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Abstract

Winter oilseed rape was cultivated in monoculture or in combination with turnip rape as trap crop sown in trap strip. Preventative microbiological treatments for diseases control in winter oilseed rape were tested using Trichoderma asperellum and product based on effective microorganisms. Microorganisms were effective to protect of oilseed rape and allowed to obtain higher yield comparing to untreated plants. No effect of turnip rape as trap crop stripe on infestation by insect pest was observed. There was no statistically significant influence of presence B. rapa on total yield. Statistically higher percentage of infected pods collected from area with turnip rape compared to monoculture area was noted.

Introduction

Winter oilseed rape (WOSR) is mainly grown with the use of conventional farming technology (in particular fertilizers and pesticides). The amount of organic oilseed rape planted in Poland is relatively small. This is due to the demanding requirements associated with rape nutrition and its protection. In the conventional farming many problems can be eliminated by the preventive and curative treatments. Insect pest and pathogens cause in organic crops substantial yield losses. Effective organic strategies to control them are still insufficient (Ludwig et al., 2011). Oilseed rape pests like pollen beetle (*Meligethes aeneus*), rape stem weevil (*Ceutorhynchus napi*) and cabbage stem weevil (*C. pallidactylus*) are very difficult to control. Some effects of natural insecticides and flower oil against these insects pests in the literature are available (Weiher at al., 2007; Ludwig et al., 2011). Unfortunately, these environmentally compatible control measures for pest management did not achieve satisfactory effects. Beneficial microorganisms like *Trichoderma* spp. are known as biocontrol fungal agent and were tried in protection of many crops (Harman et al., 2004, Kowalska 2011). The objective of this project is to develop environmentally-friendly system with methods to regulate pest infestation in WOSR by creating border strips combined with microbiological–preventive treatments of direct control.

Material and methods

The field experiments were carried in the experimental station of the Institute of Plant Protection-NRI in Poland, in the district Poznan. Effects of plant protection preparations have been tested separately. One year before WOSR on experimental area was grown phacelia. During vegetation of WOSR, in the spring, the mineral fertilization NPK has been delivered as trade product Plantos (0-8-18) in dose 150 kg·ha^{-1} where soil nutrient supplied: P_{P2O} 12 kg·ha^{-1}, K_{K2O} 27 kg·ha^{-1}, Mg_{MgO} 12 kg·ha^{-1} and S 18 kg·ha^{-1}. In cultivation method included sowing in wide row distance (25 cm) and mechanical weed control. Monoculture of winter oilseed rape (line var. Californium) was laid on 0.23 ha. Next to this area was another one, where this same variety rape was sown in monoculture and it was surrounded by a strip of turnip rape (var. Brachina, width of strip 2 m). Both experimental surfaces were divided into three equal parts, with three different microbiological treatments: 1) EM - plant strengthener in a dose of 10 l·ha^{-1}, 300 l water·ha^{-1}, 2) Trifender – plant strengthener with *T. asperellum.* It was used at a dose of 200 g product·ha^{-1}, 300 l water·ha^{-1}. Both products have been used as plant spraying-three times (one treatment was performed in autumn in BBCH 46 of maturity of WOSR, the second in BBCH 55 and the third in BBCH 61 of WOSR in the following year). The efficacy of treatments was determined by measuring percentage of the affected surface of pods of 50 plants randomly selected and collected from two localizations in each part. The symptoms of dark pod spot (DPS) caused by complex pathogens such as *Alternata brassicae, A. brassicola* and *A. alternata* were observed.
"Efective Microorganisms" (EM) is recommended for many crops to applying to the soil and to the plants. The main purpose of them is improved soil fertility, plant quality and health. Unfortunately, in the literature can we find many ambiguous data on efficacy of EM. Papers either indicated its benefits (especially from tropic countries) or ineffectiveness (Sangakkara et al., 2011; Mayer et al., 2008). Agricultural producers (especially

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amateurs) indicated the positive impact of effective microorganisms on crops. However, the effects of EM are not clear and reproducible. Trade product EM (ProBiotics Polska) is an example of such preparation. “Trifender” it is the product of Biovéd Co., Hungary, where one gram contains $5x10^8$ of conidium isolate T1 (NCAIM 68/2006) of the fungus *T. asperellum.* Influence of protective strip of turnip-rape was assessed as a trap for some insect-pests of WOSR. Against *M. aeneus* two treatments with spinosad as foliar spraying (trade product Biospin 120 SC) at dose 200 $ml \cdot ha^{-1}$at BBCH 53-59 of WOSR were made. The results were statistically analyzed by the variance analysis method using the Statistica 10.0 software. Significant difference were verified using the Tukey’s test at significance level P = 0.05. Data expressed in percentages were arc sin transformed.

Results

In general, we concluded that on the field with the strip trap of turnip-rape a percentage of infested pods by DPS was higher compared to the pods collected from the site experiment without *B. rapa* (Fig. 1). A statistically significantly higher was the percentage of infected surface of pods from the plants treated with *Trichoderma* and with *B. rapa* in comparing to the this same treatment on the area without the protective strip (10.07 and 2.46%, respectively). Statistically higher infection pods collected from area with turnip rape compared to monoculture from untreated experimental area was observed.

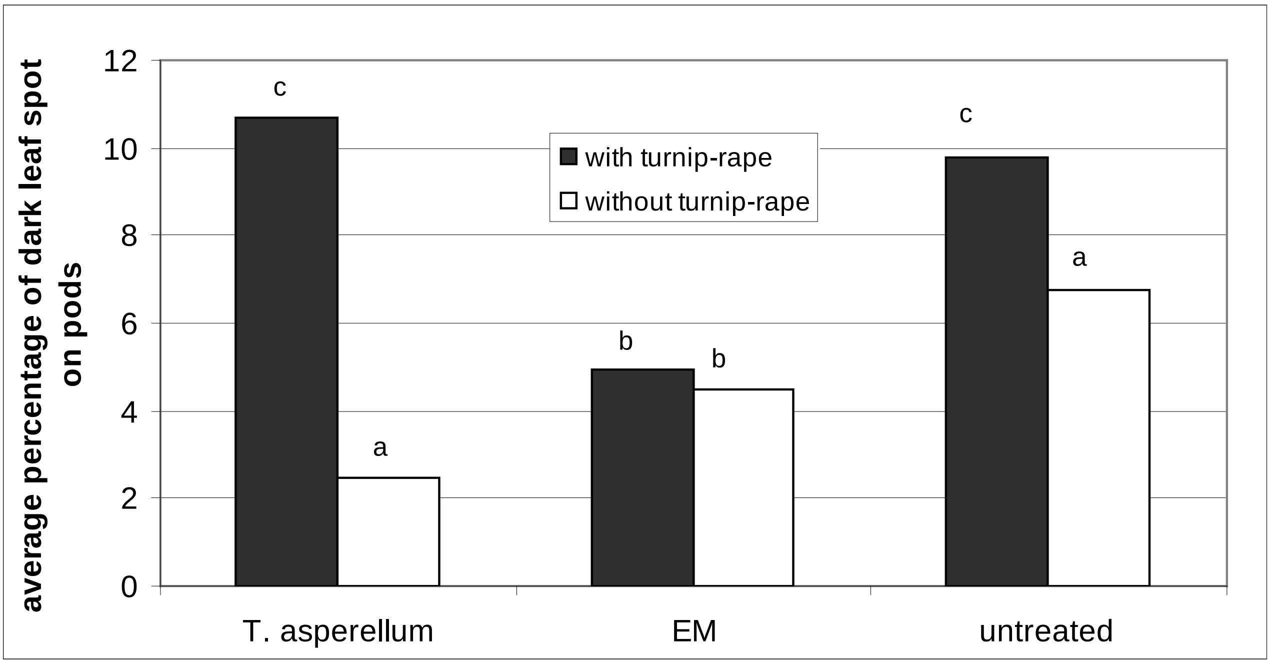

Figure 1. Effects of microbial treatments variants on symptoms of dark pod spot on pods in relation to presence and absence of strips with turnip-rape

Turnip rape as trap crop did not result on yield increase or in limitation of losses caused by insect pests on treated parts of the field. Treatments with *Trichoderma* caused statistically important increase the yield obtained comparing to untreated area, 3.0 t $ha \cdot^{-1}$ and 3.2 $ha \cdot^{-1}$, respectively for presence and absence of turnip-rape.(Fig. 2). In the case of treatments with EM was found the trend increase in harvested yield from the area with trap crop compared to pure WOSR (3.3 and 2.9 t $ha \cdot^{-1}$, respectively). The lowest yield was obtained from untreated plants with and without turnip-rape, 2.6 and 2.4 t $ha \cdot^{-1}$, respectively)

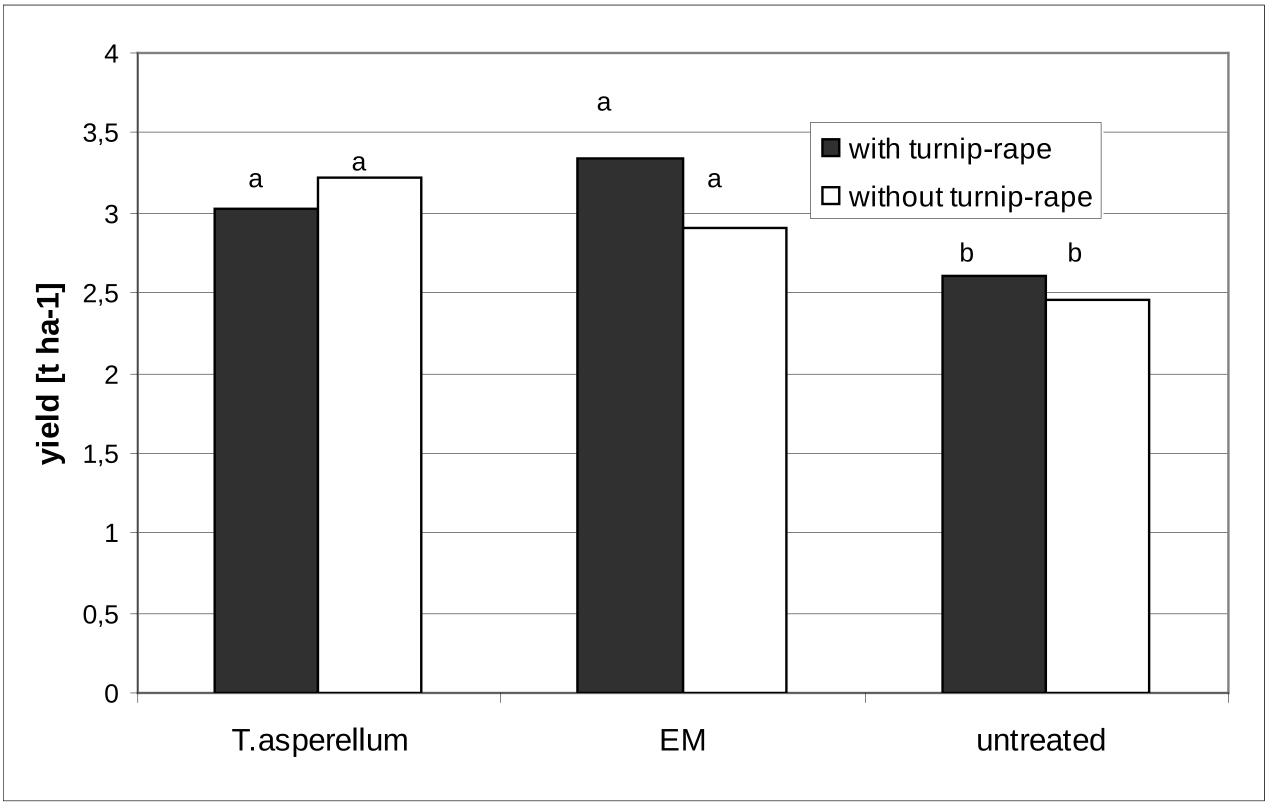

Figure 2. Effects oh microbial treatments variants on total seed yield of winter oilseed rape in relation to presence and absence of strips with turnip-rape

Discussion

Oilseed rape is a plant that requires intensive fertilization, this problem tried to solve by intercropping of oilseed and faba beans (Kießling and Köpke, 2008). Yield of organically cultivated varieties of winter rape from trials represent up to 70 % of yields achieved by winter rape cultivated conventionally, most however about 50%. This is in line with our obtained yield ranged from 2.4 to 3.3 t·ha^{-1}, generally (Fig.2). The lowest yield was harvested from untreated area compared to *Trichoderma* and EM treatments and we can conclude that performed microbiological treatments were useful. Unfortunately the border strip did not influence on infestation by insect pest, in the case of presence of pathogens was observed higher percentage of infected pods compared to pods collected from WOSR without trap strip. Turnip rape probably could be the first host for pathogens, which I next time, can be infesting the plants of oilseed rape. In other studies where monoculture of WOSR was mixed with turnip rape and cereals also not obtained satisfactory results (Ludwig et al. 2011). Additionally, rapeseed yields were reduced significantly when was sown together with cereals in (Paulsen 2011). The preferential infestation of *B. rapa* by stem weevils and pollen beetles was observed only up to 10 days, when the phenology of turnip rape was advanced relative to oilseed rape. After this period not differences in infestation by both pest species were observed. This situation has forced us the use of spraying with spinosad, which was effective against pollen beetle. This effect is in line with the findings of another study (Ludwig et al., 2011).

Acknowledgements

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