Effects of the fungicides Caramba (metconazole) and Cantus (boscalid) on oilseed rape diseases

Paul, V.H. [1] ; Liu, Yong [1,2], Dapprich, P. D. [1], and Rose, S. [1]
[1]Laboratory for Biotechnology and Quality Assurance, Department of Agriculture,
Fachhochschule Südwestfalen / University of Applied Sciences. 59494 Soest, Germany
Tel: 0049 2921 378242 Fax: 0049 2921 378200 paul@fh-swf.de, biolab@fh-swf.de
[2] Institute of Plant Protection, Sichuan Academy of Agricultural Sciences,
610066, No 20 Jing Ji Si Road, Chengdu, Sichuan, P.R. China liuyong65@hotmail.com

ABSTRACT

The mode of action of the fungicides Caramba (a.i. 60 g/l metconazole) and Cantus (a.i. 500 g/l boscalid) on stem rot (*Sclerotinia sclerotiorum*), stem canker (*Phoma lingam*), powdery mildew (*Erysiphe cruciferarum*), damping off (*Rhizoctonia solani*), grey mould (*Botrytis cinerea*), verticillium wilt (*Verticillium longisporum*), light leaf spot (*Cylindrosporium concentricum*) and dark leaf and pod spot (*Alternaria brassicae*) on oilseed rape (*Brassica napus*) were studied in climate chamber experiments. Caramba at the rate of 3 dosages of 1.5 l/ha (officially recommended) , 1.125 l/ha and 0.75 l/ha, and Cantus at 1 dosage of 0.5 kg/ha (officially recommended) were applied respectively, to test the protective, curative effects and its efficiency. Inoculation methods were used depending on the diseases including mycelial suspension dropping on detached leaves, spore suspension dropping on cotyledons and soaking into wound roots, spore suspension spraying onto plants and soil mycelia mixture.

The results indicated that both Caramba and Cantus performed very good protective and curative effects, and high efficiency as well. Recommended full concentration 1,5 l/ha of Caramba performed highest efficiency. There was a positive correlation between fungicides application time and disease control effects. Compared to untreated control, both Caramba and Cantus inhibited significantly ($p<0.01$) to the lesion extension of stem rot after 8 days inoculated. After application of Caramba, the severity of stem canker, grey mould, light leaf spot and damping off was significantly lower ($p<0.01$) than its control. So far, from these first results Cantus is a very powerful fungicide to control stem rot, light leaf spot and the other diseases.

Key words: mode of action, metconazole, boscalid, oilseed rape, fungal pathogens

INTRODUCTION

Triazole fungicides have been used in plant production for more than 20 years and are known to stabilise or increase the yields even without the presence of fungal diseases. There are a multitude of reasons for this and they are not easy to differentiate. Generally the fungicide induces a better fitness against stress combined with reduced aging.

Beside the triazole fungicides which are already established in oilseed rape production, a new fungicide with the active ingredient boscalid is now on the market. This fungicide is said to heve a wide spectrum of activity against various fungal pathogens as well protective and curative.

It was the goal of this study two compare metconazole with the established triazole tebuconazole (a.i. of the product Folicur) and to assess the potential of boscalid under different conditions in laboratory studies. The pathogens tested were *Sclerotinia sclerotiorum* (stem rot), *Powdery mildew* (*Erysiphe cruciferarum*), and *Rhizoctonia*-Damping off (*Rhizoctonia solani*). *Cylindrosporium concentricum* (light leaf spot) was only tested with the fungicide Cantus.

MATERIALS AND METHODS

The fungicides were applied either prior to or after inoculation with Caramba using 3 dosages of 1.5 l/ha (officially recommended) , 1.125 l/ha and 0.75 l/ha, and Cantus at 1 dosage of 0.5 kg/ha (officially recommended)

Inoculation with stem rot

For inoculation with the pathogen of stem rot *Sclerotinia sclerotiorum* true leaves of *Brassica napus* were cut of the plants and then contact-inoculated with 25 µl drops of a mycelial suspension and placed in a humid chamber (approximately 100 % rel. humidity). To study the curative effects the leafs were treated with metconazole and boscalid 24, 48, 96 and 144 hours after inoculation. For the study

of protective effects the leafs were treated with metconazole and boscalid 24, 48, 96 and 120 hours prior to inoculation. The assessment (measurement of the diameter of the lesions) was accomplished 8 days after inoculation.

Inoculation with powdery mildew

The inoculation with the pathogen of powdery mildew *Erysiphe cruciferarum* was accomplished using a spray inoculation (conidia concentration 10^4 conidia/ml). To study of the curative effects the plants were treated with the full concentration (100 %) of metconazole and the comparative product 120 and 240 hours after inoculation. To study of protective effects plants were treated with the full concentration (100 %) and reduced concentrations (75 % and 50 %) of metconazole and the comparative product 120 hours prior to inoculation. The assessments for the curative and protective effects were carried out 33 days after inoculation.

Inoculation with *Cylindrosporium concentricum*

5 excised segments (1.7 mm diameter) of the third true leaf were put on a benzimidazole-agar in plastic petri-dishes. Inoculation occurred by putting a drop of 25 µl of mycelial suspension of C. concentricum in the centre of each segment. The fungicide was sprayed (according to the various concentrations) either prior (protective) or post (curative) inoculation. After 6 weeks incubation at 17° C in a climate chamber disease incidence was measured via the number of acervuli produced.

Inoculation with Rhizoctonia-Damping off

To study the effect of metconazole on *Rhizoctonia* damping off, this pathogen was mixed (in petri dishes (PDA, Merck)) with substrate (20g Agar/kg soil). Oilseed rape seeds were sown into this substrate after an incubation period of 48 h.

For the study of the curative effects each seed was treated with 25 µl of full concentration (100 %) and reduced concentrations (75 % and 50 %) of metconazole and the comparative product (seed coating) 96 and 168 h after sowing. The two fungicides were placed on the seeds in form of drops.

For the study of protective effects each seed was treated with 25 µl of the above mentioned solutions of metconazole and the comparative product (seed coating) directly on the seeds. The assessments for the curative effects were carried out 15 days after substrate inoculation (13 days after sowing) and for the protective effects 19 days after substrate inoculation (17 days after sowing).

RESULTS

Stem rot

A protective application of metconazole (C) generally reduced the extent of lesions of stem rot (*Sclerotinia sclerotiorum*). A treatment with metconazole reduced the lesions from between 6,9 and 8,1 cm in the control (co) to between 0,2 and 2,8 cm (Figure 1). Best results were obtained when the time between application of metconazole and inoculation was short. When the inoculation was carried out 96 to 144 h after the protective application of metconazole the positive effects were reduced. Similar results were obtained with tebuconazole (F). Here the lesions were reduced to between 0,5 and 0,9 cm. Additionally, the positive reductive effect lasted longer than with metconazole.

A curative application of metconazole (C) and tebuconazole (F) also reduced the extend of stem rot lesions. A treatment with 100 % metconazole reduced the lesions from 10 cm in the control to between 0,1 and 5,6 cm (Figure 2). Best results were obtained when application of metconazole was shortly after the inoculation with stem rot. Similar results were obtained with tebuconazole (F). Here the lesions were reduced to between 0,2 and 5,7 cm. In the curative treatment no differences in the two products with regard to the duration of the positive effects could be observed. The best positive effects were obtained when the treatment with each product were carried out 24 to 48 h after inoculation with stem rot.

Powdery mildew

Both protective and curative applications of metconazole (C) and tebuconazole (F) reduced powdery mildew (*Erysiphe cruciferarum*). In the protective treatments the assessment rates were reduced from 8,7 in the control to between 1,4 and 2,6 in the metconazole and between 1,7 and 2,5 in the tebuconazole treated variants (figure 3).

In the curative treatments the assessment rates were reduced from between 7,8 and 8,1 in the control to between 1,2 to 1,5 for both products (figure 4). In addition the infection frequency 33 days after inoculation was reduced. Approximately 70 % of the treated and 100 % of the control plants were infected. Furthermore it was observed that the production of conidia started 20 days later than in the control.

Rhizoctonia damping off

Metconazole (C) and tebuconazole (F) showed positive effects against *Rhizoctonia* damping off (*Rhizoctonia solani*). With a protective application the infection intensity was reduced from assessment rate 6,7 in the control to between 1,4 to 2,2 in the Metconazole and between 1,7 and 2,2 in the VGM treated variants (figure 5).

The effects of the curative applications depended on the application date (figure 6). The application of metconazole (C) and tebuconazole (F) 96 h after inoculation lead to a higher reduction of disease symptoms than a later application. The assessment rate of the metconazole treated variants were reduced from 4,4 in the control to between 2,4 and 2,6 96 h after inoculation and to between 3,1 and 3,7 168 h after inoculation. The tebuconazole treated variants were reduced from 4,4 in the control to between 2,0 and 2,8 96 h after inoculation and to between 2,8 and 3,4 168 h after inoculation. Furthermore, a reduction of effectiveness at both applications could be observed for tebuconazole when lower concentrations (75 and 50 % of registered doses) were used. When tebuconazole was applied 96 h after inoculation the efficiency was reduced from an assessment rate of 2,0 at 100 % dosage to 2,7 (75 %) and 2,8 (50 %), and in the treatment 168 h after inoculation from 2,8 (100 %) to 3,3 (75%) and 3,4 (50 %).

In the metconazole treatments a similar reduction with decreasing concentrations was not observed. A reduction of efficiency was only observed in the combination of the later applications with lower concentrations (3,1 at 100% and 3,7 and 3,3 at 75 and 50 % respectively).

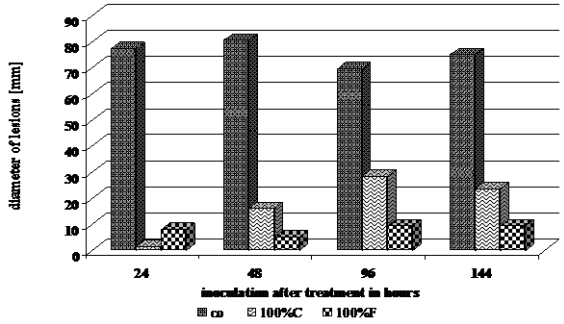

Fig. 1: Protective effects of metconazole/tebuconazole on stem rot (*Sclerotinia sclerotiorum*); detached leaf test

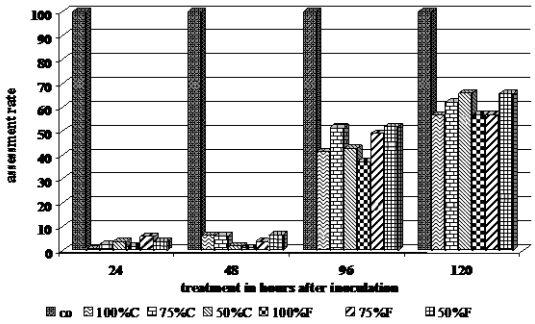

Fig. 2. Curative effects of metconazole/tebuconazole on stem rot (*Sclerotinia sclerotiorum*); detached leaf test

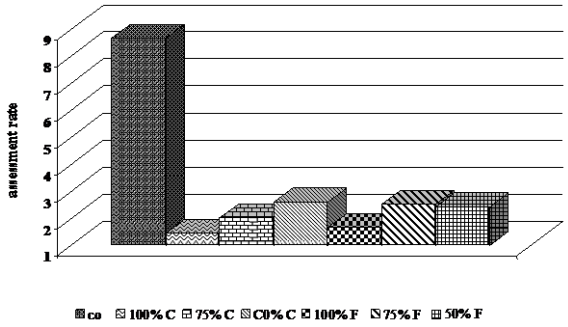

Fig. 3. Protective effects of metconazole/tebuconazole on powdery mildew (*Erysiphe cruciferarum*), treatment 5 days before inoculation, first symptoms appeared after 12 days; assessment 33 days after inoculation

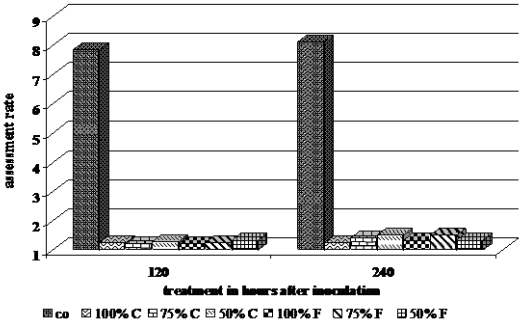

Fig. 4. Curative effects of metconazole/tebuconazole on powdery mildew (*Erysiphe cruciferarum*); assessment 33 days after inoculation

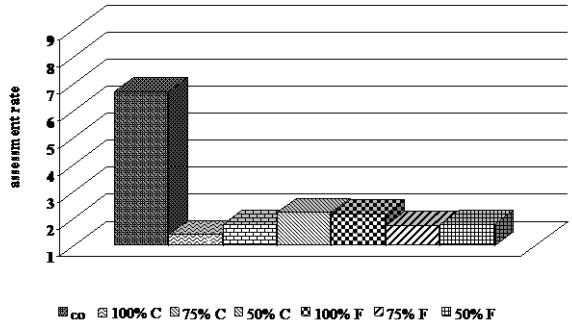

Fig. 5. Protective effects of metconazole/tebuconazole on Rhizoctonia-Damping off (*Rhizoctonia solani*); treatment as seed coating; assessment 18 days after substrate inoculation

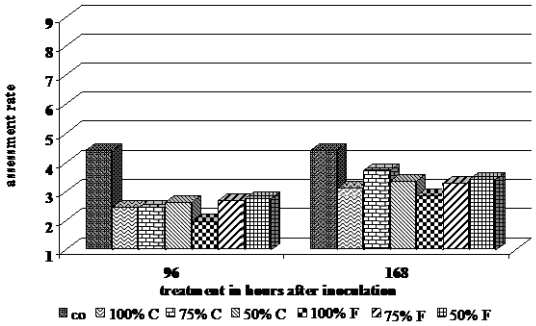

Fig. 6. Curative effects of metconazole/tebuconazole on Rhizoctonia-Damping off (*Rhizoctonia solani*)

Figures 7 and 8 show the protective and curative effects of boscalid against light leaf spot. For the two cultivars selected no infection even with an application 6 days prior to inoculation was found (figure 7). Similar were the results from the curative applications. 10 days after inoculation significantly less new acervuli were produced compared to the untreated control (figure 8).

Untreated control (average no. acervuli/leaf*)	Treatment 1 day prior to inoculation	Treatment 6 days prior to inoculation
Artus	0	0
Express	0	0

*average from 20 leaf segments

Fig. 7. Protective effect of boscalid against light leaf spot at 5 leaf stage

Cultivar	No. acervuli at day of treatment	No. acervuli 10 days after boscalid traetment
Artus	199 untreated	360 untreated
Artus	160 untreated	89 boscalid treated
Express	73 untreated	155 untreated
Express	78 untreated	36 boscalid treated

Fig. 8. Curative effect of boscalid against light leaf spot

DISCUSSION

Metconazole proved to be a very potential fungicide. Effects were convincing as well for protective as for curative applications. From our result it was evident that metconazole performed better than tebuconazole, especially with regard to protective application. If one takes the positive regulating effect of the triazole fungicides in general into consideration metconazole appears to be a very good tool for yield protection and increase.

Boscalid as a new fungicidal substance appeared to be of very good effect in protective and curative application against light leaf spot. From our research so far it seems even better that metconazole with regard to fungicidal and protective aspects. Further research in other oilseed rape pathogens and field trials is necessary to assess the full performance of this new fungicidal substance.

REFERENCES

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