Effect of Metconazole on plant morphology and formation of yield in *Brassica napus*

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ABSTRACT

Triazole fungicides are used in practice of winter oilseed rape production for more than 15 years.

It is well accepted that those substances can regulate plant growth and plant development and thus stabilise and even increase yield when applied even without the need of the fungicidal effects. The reason for these effects are thought to be due to increased root system, plant fitness, increased stress tolerance and decreased senescence.

The aim of the study presented was to monitor the effects of the triazole metconazole (a.i. of Caramba®) in a three year field study, established in 1998 at the experimental farm of the Department of Agriculture in Merklingsen. Caramba was applied in three different concentrations (100 %, 75 % and 50 % relative to the product prescription of 1,5 l/ha) in 10 application variants differing in application time (early autumn, late autumn, early spring, late spring) and number of applications (one / two applications). At the growth stages 1.0, 1.5 (before winter), 1.10 (early spring), 5.0, 6.3, 6.7 (maturity) plant reaction was estimated according to the parameters plant height, leaf position and colour, diameter hypocotyl, fresh and dry matter, root length and resistance to lodging. The effects of the treatments are discussed and weighed with regard to their potential to influence formation of yield.

A good correlation was found between product concentration and application time. Best results were seen with the early autumn treatment with an assessment rate of 3.0 – 3.8 versus 6.8 of the control. Also a combination of late autumn and early spring application tended to stand better than the control and other applications. Yield was higher than the untreated control regardless to the treatment.

It is yet important to note, that the positive effects of Caramba (a.i. 60 g/l metconazole) correlate with the oilseed rape cultivar, the location, yield expectation and climate.

Key words: triazole fungicide/winter oilseed rape/yield/plant morphology

INTRODUCTION

In practice Triazoles are known to stabilise and even improve yield for more than 20 years. These effects are even significant in culture years without the occurrence of any fungal disease. The reasons for this fact are numerous and often hard to determine precisely. Normally the effects are due to an overall increased fitness of plants against stress combined with reduced aging.

The intention of this study was to monitor the effects of metconazole (active ingredient (a.i.) of Caramba®) on the morphology of winter oilseed rape and its impact on the formation of yield. For this in a four year field study, established in 1998 at the experimental farm of the Department of Agriculture in Merklingsen, winter oilseed rape was cultivated according to local practice and conditions of location. As a positive side effect there was no significant disease occurrence to threaten formation of yield except for some attack of *Sclerotinia sclerotiorum* in 2000. A selection of the results from the field trials is presented in the following.

MATERIALS AND METHODS

The field trial was sown with the cultivar Lirajet on 22.08.1998, 04.09.1999 (late due to drought) and 25.08.2000. It was arranged in blocks with 5 replicates and 9 variants plus untreated control at the experimental farm of the Department of Agriculture in Merklingsen. The size of each block was 13,5 m² (2,25 x 6 m). Four of the five replicates were used to estimate disease occurrence and morphology in the field, the fifth block was used to draw plant material from the field for laboratory analysis. The 10 variants (Table 1) were treated at four different stages of plant development (two in autumn and two in spring) using three 3 application concentrations (see table 1). Yield was estimated on basis of a core harvest of 2 x 5 m of each block.

The assessment parameters to determine plant morphology are given in table 2.

Table 1: Treatments, concentrations and application times

Variant	Concentration [l/ha]	Application time
1	1,5	autumn 1*
2	1,0	autumn 1
3	0,7	autumn 1
4	1,5 / 1,5	autumn 2/spring 1
5	1,0 / 1,0	autumn 2/ spring 1
6	0,7 / 0,7	autumn 2/ spring 1
7	1,5 / 1,5	autumn 2/ spring 2
8	1,0 / 1,0	autumn 2/ spring 2
9	0,7 / 0,7 / 1,0	autumn 2/ spring 1/ spring 2
10	- (control)	-

*autumn 1 = BBCH 13-14 (1.0); autumn 2 = BBCH 16-18 (1.5); spring 1 = BBCH 39-59 (3.1-3.7); spring 2 = BBCH 65 (5)

Table 2: Assessment parameters

Parameter no.	Morphological criteria	Scale
1	root length	[cm]
2	fresh-/ dry-matter of the roots	[g]
3	hypocotyl diameter	[mm]
4	fresh-/ dry-matter of the plants	[g]
5	leaf position and colour	score from 1 - 9*
6	plant height	[cm]
7	tendency to lodging	score from 1 - 9*
8	yield	[dt/ha]

*score 1=very good / no lodging; score 9=very bad / plants completely down

RESULTS

It is to see that especially early autumn treatment with metconazole using the advised concentration of 1.5 l/ha resulted in significantly reduced plant growth before winter. At flowering these effects diminished and appeared only to be significant when an additional early spring treatment was applied. Late autumn and late spring treatments seemed to have no effect (figures 1 and 2).

The hypocotyl diameter tended to increase with metconazole treatment, yet significant results were not to obtain (figure 3).

Concerning yield a clear tendency to increased yield due to metconazole application was evident regardless what application time and concentration. Though significant increase in yield was only to achieve with multiple applications (applications 4, 6 and 9, figure 4).

Figure 1: Average plant height of three vegetation periods before winter (98/99, 99/00, 00/01)

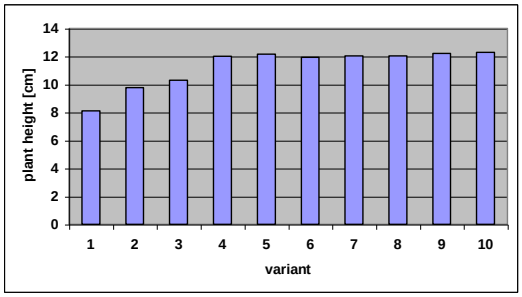


Figure 2: Average plant height at early flowering of three vegetation periods (98/99, 99/00, 00/01)

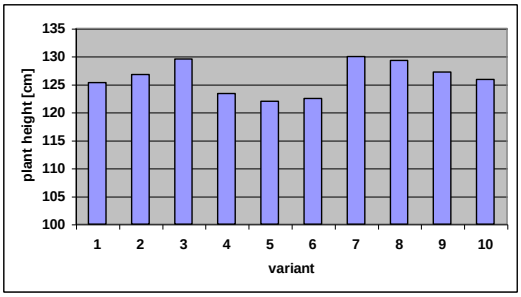


Figure 3: Average hypocotyl diameter at flowering of three vegetation periods (98/99, 99/00, 00/01)

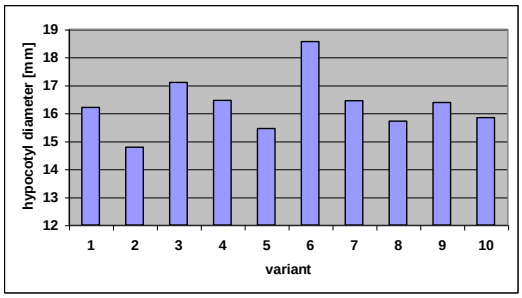
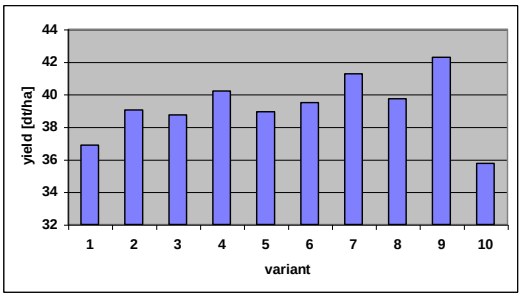


Figure 4: Average yield of three vegetation periods (98/99, 99/00, 00/01)



DISCUSSION

As the results of this three year field study show, triazole application results in an increase of yield. If this yield increase also results in higher profit depends on the individual costs that accumulate due to the price of the product, labour time and application concentration and frequency.

From our results it was not clearly to determine what effect of metconazole on plant morphology were the main reason for yield increase. It is to assume that especially the growth reducing effect in autumn and thus better frost resistance, the increase in hypocotyl diameter and thus less tendency to lodging and the higher root biomass and thus better nutrient absorption were the main reasons for higher yield.

In addition to the effect on plant morphology also the fungicidal effect of metconazole plays an important role in practice. Data from recent studies show that the combination of both effects guarantee significant yield increase also by increasing the thousand seed weight.

Consequently our results show that one early autumn treatment and depending on the weather in spring maybe a second early spring treatment using the standard concentration of Caramba (a.i. metconazole) results in the best effects leading to a healthy, homogenous and lodging resistant stand of winter oilseed rape. It is yet important to note, that the positive effects of metconazole correlate with the oilseed rape cultivar, the location, yield expectation and climate.

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