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Master-Arbeit

Zur Wirksamkeit verschiedener Fungizide gegenüber *Fusarium solani* in vitro und zur Bekämpfung von *Fusarium solani* im Tomatenanbaugebiet des Zwaysees in Äthiopien

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12 Summary

In the year 2004 a new fungal disease was observed in the tomato growing area around Lake Zway in Ethiopia. The symptoms are small brown to black lesions which sometimes show concentric rings. Around these lesions a light yellow ring is noticed that becomes more visible after a few days. By time both symptoms (lesions and yellowing around the lesions) are spread all over the leaves and the disease ends in a die back of the plants within 7 to 8 days. The appearance of die back disease begins when the first fruits start to mature, so that most of the fruits left green on the tomato plant or flowers don`t set fruits.

In the laboratory of the institute of Phytomedicine at the University of Hohenheim mainly two fungal spieces were isolated from infected leaves of tomato, *Datura* spp. and *Solanum* spp.. These fungi were *Alternaria alternata* (Fr.:Fr.) Keissel. f. sp. *lycopersici* and *Fusarium solani* (Mart.) f. sp. *solani*. According to the leafspots with its concentric rings it first seems that *Alternaria alternata* causes the lesion. The trials in Ethiopia showed good results following the application of Folpan 80 WDG (folpet) with Kocide® (copper hydroxid), Cantus® (boscalid), Ortiva® (azoxystrobin) and Rovral® 50 WP (iprodion). Applications with the same fungicides arranged after the trial showed no or only little response to the fungus. In summer 2005 also *Fusarium solani* was isolated in absence of *Alternaria alternata* from the leaves of *Capsicum annuum* L. It seems that *Fusarium solani* causes the leaf spots on tomato.

Three different field trials were conducted in Ethiopia at the city of Meki in the Rift Valley. Two trials without replications were conducted to follow the disease development and the control of *Alternaria alternata.* For this reason 3 new tomato varieties were introduced to Ethiopia and also the tomato varieties Ercole and Ulisse already established on the farm were tested. The new varieties were Rebecca,

Volume and Dart. In the first trial, that was performed without replications, the effectiveness of already infected tomato plants was proofed. The application should be started 2 weeks before the fruits start to mature. The fungicides which were kept by the custom caused that the application was delayed for 10 days.

The second trial was repeated 4 times with all 5 tomato varieties and three different applications showed by table 1. The applications differ in fungicides and intervals. Treatment 1 was applied every 10 days, treatment 2 every 10 days and treatment 3 every 7 days.

In the third trial, that also included no replications, the 5 tomato varieties were planted in 4 different distances to 40, 50, 60 and 70 cm. The fungicides and treatments were the same like in trail 2. Only Cantus® (boscalid) was substituted by iprodion and treatment 1 was abandoned (Table 2).

The results of the first trial showed that the infection of all plots were affected by a later application of the fungicides. So with earlier treatments of fungicides better results could be expected. Trial 2 demonstrates a predominance of the fungicides of Var. 2 and Var. 3 by a longer vitality of the tomatoplants for one week, but this can be a natural variability. Within these 2 treatments no differences were apparent. The few differences are based on the fungicides that were chosen for control of *Alternaria alternata* and couldn't have a strong impact on *Fusarium solani*. As *Fusarium solani* is a soilborne fungus, trial 3 showed no interference by different distances. The yield analyses made in trial 2 and 3 also showed no effect by any treatment.

Based on this stand of affairs *Fusarium solani* was observed closer and a test of the pathogenity of *Fusarium solani* and *Alternaria alternata* was carried out. In this tests only the first infected plants showed leaf spots like in Ethiopia but the characteristic course of the disease. To fullfill the 'Koch's postulate' the *Fusarium solani* conidia isolated from the lesions were used to inoculate new plants. These plants showed no infection by the fungus.

For the *in vitro* trial new active fungicides were tested that are based on the experiences of tomato growers in South America. The new fungicides with a protective character are Folpan® 80 WDG (folpet), Flint® (trifloxystrobin), Euparen® M WG (tolylfluanid) and Bravo® 500 (chlorothalonil). Systemic compounds are metalaxyl-m (Ridomil® Gold MZ), tebuconazol (Folicur® EM) and azoxystrobin (Ortiva®) with a translaminare and local systemic mode of action. Based on the results of the trial in Ethiopia the combination of Folpan 80 WDG (folpet) and Funguran (copper hydroxid), which are also protective fungicides were also tested.

Ridomil® Gold MZ (mancozeb and metalaxyl-m) were also included in the tests. The first one has protective characteristics and the second is a systemic component, but the combination should be used protectively.

All components were tested in combinations and in different concentrations. Some of the active compounds that showed good responses were also tested alone to identify the active components with the higher efficiency. The results are shown in the figures 7 to 20.

Compared to the single tested substances the *in vitro* trial showed clearly the effectiveness of combinations to control *Fusarium solani.* Especially, the phthalimids Bravo® 500 and Folpan® 80 WDG in combination with Funguran showed good a strong inhibition on the mycelium growth of *Fusarium solani*, caused by synergistic interactions of the different mode of actions according to the active components.

Ridomil® Gold MZ (metalaxyl-m and mancozeb) with Funguran® (copper oxychloride) in higher concentration also showed high activity to control *Fusarium solani*, but the concentration is to high to advise the application. The strongest inhibition on the mycelium growth exhibited Folicur® EM (tebuconazol with tolylfluanid) in combination with Folpan® 80 WDG (folpet) (Table 3). Especially, the long term effect with almost no mycelium growth over 43 days showed the effectiveness of this combination. Because there is almost no differences between

the growth of mycelia by the various concentrations of Folicur EM (tebuconazol and tolylfuanid) with Folpan® 80 WDG (folpet), Folicur® EM (tebuconazol and tolylfuanid) and Bravo® 500 (chlorothanlonil) and Funguran® (copper hydroxid) can be applied in lower concentrations at lower infection pressure and rise the dose with a higher infection pressure.

Another problem is the emergence of resistance to tebuconazol, which should be used only three times per growing period. Most active components tested *in vitro* are protective fungicides they can only applied before *Fusarium solani* infects tomato plants. After a infection has taken place the systemic combinations with systemic compounds like tebuconazol with tolylfluanid (Folicur® EM) should be used.

At lower infection pressure also the combination of Ortiva® (azoxystrobin), with a translaminar and locally systemic mode of action and Funguran® (copper oxychloride) can be applied. Nevertheless all fungicide treatments will show only limited efficiency without introducing crop rotation and eradication of the hostweedplants *Datura* spp. and *Solanum* spp. from the fields. For this case a special trainee program should be offered to the farmers. To prevent resistance to tebuconazol and other active components with a high risk to resistance the programs should also develop an appropriate management of fungicides.