DIAPORTHE HELIANTHI : CURATIVE EFFECTS OF IPRODIONE-BASED FUNGICIDES.

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SUMMARY

In the greenhouse, iprodione-based fungicides showed curative effects when they are applied on the first leaf symptoms of *Diaporthe helianthi.*

On leaves, the necrosis progress is stopped by the formation of a barrier between diseased and healthy tissues. Later on, the development of the disease on stems is limited. The curative effect of the product "iprodione + carbendazim" was confirmed under practical conditions in the field.

INTRODUCTION

Diaporthe helianthi appeared in France first in 1984, but presently it is endemic in the south-west of the country.

Several studies have been carried out in two directions to control this disease : the research of tolerant varieties, and the development of a fungicidal protection of sensitive varieties.

At the present time, tolerant varieties are available and their cultivation is highly recommended in risky areas.

The fungicidal protection must be applied following warnings and when the first symptoms appear on leaves with products having if possible curative effects. The study of such products carried out under controlled conditions enabled us to give special preference to the product 'iprodione + carbendazim' (A.PERES, 1988). Complementary trials in the greenhouses and in the field defined more accurately the effects of this fungicide on the development of the disease.

MATERIAL AND METHODS

The trials in the greenhouses were carried out on sunflower plants, variety MIRASOL, cultivated in pots with water reserves. At the stage 'floral bud E2-E3', plants were contaminated artificially with 2 - 3 leaf sprayings of a suspension containing *D. helianthi* ascospores titrating 1.5 10e5 spores/ml every 24 hours (A. PERES et. al., 1986). Fungicides were applied with a hand sprayer on the basis of 350 l/ha at the very beginning, when symptoms appeared on leaves.

In the field, the trial was carried out on a sunflower crop, variety MIRASOL, under conditions of reinforced natural contamination. This contamination consisted in bringing fragments of contaminated stems, and then irrigating to bring about the development of *D. helianthi* ascospores. A fungicidal treatment was applied on the first leaf symptoms with a 12 m- spraying ramp (volume of 360 l/ha).

The efficiency of fungicidal treatments was estimated on leaves and on stems according to the evolution of the disease. The severity of attack on sunflower stems was evaluated according to the following scale :

0 = healthy
1 = spot on the stem surrounding the petiole up to 5 cm in diameter
2 = spot on the stem surrounding the petiole greater than 5 cm in diameter
3 = attack sleeves on the stem separated by green areas
4 = totally brown stem
5 = stem broken on the spot level.

RESULTS

In a first trial, the product 'iprodione + carbendazim' applied at the very beginning when symptoms appeared on leaves, reduced the apparition of new symptoms. The plants treated with this product had respectively twice and four times less diseased leaves than plants treated with 'maneb + thiophanate methyl' and untreated plants.

The fungicide 'iprodione + carbendazim' also slowed down the development of necroses. In between healthy and diseased tissues, we observed the formation of a well-pronounced margin which seems to stop the fungus progression in the leaf. One month following the treatment, necroses on leaves treated with 'iprodione + carbendazim' at a dosis of 4 l/ha only represented 11% of the total area of a leaf, while the necroses on leaves treated with 'maneb + thiophanate methyl' and on untreated leaves reached respectively 91% and 98% (Fig.1).

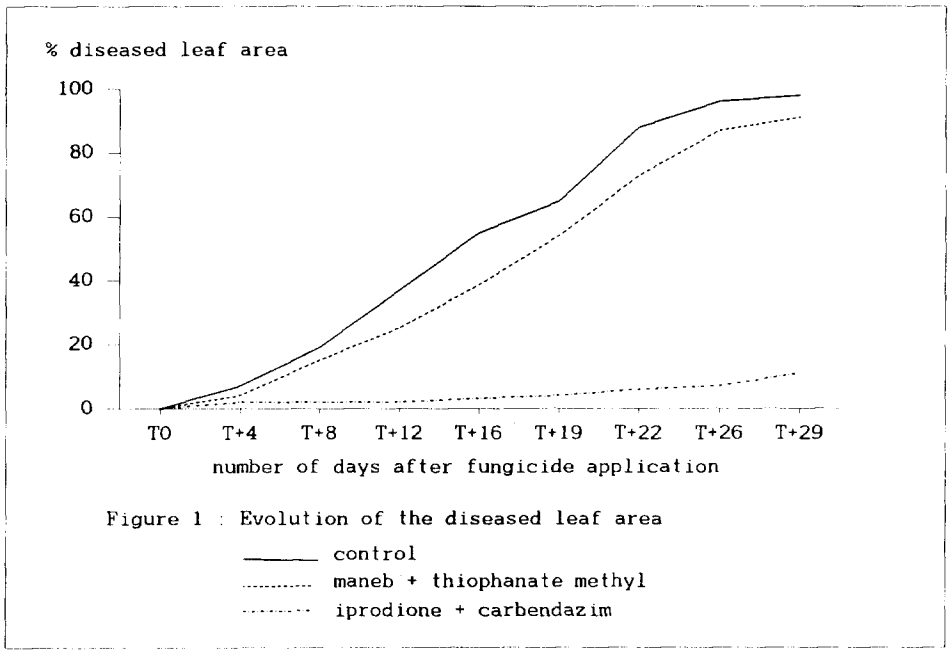

Figure 1 : Evolution of the diseased leaf area

While putting off the necrosis progression, the product 'iprodione + carbendazim' prevented the disease from reaching the stem. At maturity, we noted 4 to 5 times less diseased stems. The attack severity was also reduced and the spots on stems did not form infectious sleeves detrimental to a correct plant nutrition. (Table 1)

TREATMENTS	Quantity of formulated product per ha	Nu diseased leaves T+25 days	% of stems diseased at maturity	Severity of attack on stems at maturity
iprodione 175 g/l + carbendazim 87.5 g/l	4 l/ha	2.5	21	2
maneb 300 g/l + thiophanate methyl 150g/	7l/ha	4.6	95	3.4
UNTREATED CONTROL		8.7	100	4

Table 1 : Effects of two fungicides on the development of the disease brought about by *D. helianthi* under controlled conditions.

In a second trial in the greenhouse, the product 'iprodione + carbendazim' tested at the dosis of 3 l/ha did not lead to the formation of a clear margin between healthy and diseased tissues on leaves. On the other hand, this barrier was visible on the leaves treated with the fungicide 'diniconazole + iprodione + carbendazim'. Compared to other tested products, 'diniconazole + iprodione + carbendazim' appeared to be the fungicide reducing most the frequency and severity of attacks on sunflower stems. (Table 2).

TREATMENTS	Quantity of formulated product per hectare	Average nu. of diseased leaves per plant T+21 days	Average nu. of spots on stems at maturity	Severity of attack on stems at maturity
iprodione 175 g/l + carbendazim 87.5 g/l	3 l/ha	1 b	2.22 bc	1.89
diniconazole 24 g/l + iprodione 160 g/l + carbendazim 80 g/l	2.5 l/ha	2.33 b	0.67 c	1.1
prochloraz 300 g/l + carbendazim 80 g/l	1.5 l/ha	2 b	3.67 b	2.67
difenoconazole 62.5g/l + carbendazim 125 g/l	2 l/ha	1.44 b	3.89 b	2.44
fenpropimorphe 375 g/l + carbendazim 125 g/l	1.6 l/ha	1.44 b	2.67 bc	2.22
UNTREATED CONTROL		5.56 a	7 a	3.89

Table 2 : Effects of different fungicides on the development of the disease under controlled conditions.

In the field, the product 'iprodione + carbendazim' was applied at the dosis of 4 l/ha, three days before the first leaf symptoms appeared. We could not observe any clear delimitation between healthy and diseased tissues on leaves. However, a significative reduction in the percent of stem attacks was recorded a fortnight following the treatment (10 July), which means about a month after the contamination, and confirmed the curative effect of the product. Other tested fungicides under the same conditions were sensibly less performing (Table 3). A month after the treatment (21 July), the efficiency of products was highly reduced, certainly because of a lack of persistence.

TREATMENTS	Quantity of formulated product/ha	% of diseased stems	
		July 10	July 21
UNTREATED CONTROL		53.8 a	79.4
maneb 300 g/l + thiophanate methyl 150g/	7 l/ha	46.3 ab	77.5
iprodione 175 g/l + carbendazim 87.5 g/l	4 l/ha	25.0 b	73.8
prochloraz 300 g/l + carbendazim 80 g/l	2 l/ha	45.0 ab	65.0
flusilazole 250g/l + carbendazim 125 g/l	0.8 l/ha	47.5 ab	67.5
fenpropimorph 375 g/l + carbendazim 125 g/l	2 l/ha	33.8 ab	67.5

Table 3 : Effects of different fungicides on the development of the disease under conditions of open field.

DISCUSSION

All tested fungicides belonging to different chemical products (triazoles, imidazoles, morpholins and dicarboximids) reduced the attacks on leaves and stems when applied on the first visible leaf symptoms, therefore stressing out a curative effect.

However, only both products containing iprodione had a marked curative effect with the formation of a barrier between healthy tissues and diseased tissuees on leaves. Both fungicides could play a direct part on the mycelial growing of *Phomopsis helianthi*. In fact, *in vitro*, iprodione alone can reduce the mycelial development of a fungus like *Sclerotinia sclerotiorum* (M.E. MATHERON & J.C. MATEJSA, 1989). But an inhibition of the mycelial development is not enough to explain the presence of this barrier, which is probably of a physico-chemical nature between healthy and sick tissues. Such a barrier could traduce a defence reaction of the plant stimulated by fungicides.

In the greenhouse, the presence of this barrier between healthy and diseased tissues seems to be associated to a later reduction in stem attacks. In the field, this relationship seems to be more difficult to emphasize, the quick evolution of the disease being able to hide the effects very quickly.

In the greenhouse as well as in the field, the product 'iprodione + carbendazim' appeared to be efficient. In the greenhouse, a dosis reduction brought about an efficiency loss, but we did not think that it was necessary to prove it. In the field, the product applied at a normal dosis offered a persistence of action of about 3 weeks ; its application would gain by being renewed to control late contaminations of *D. helianthi* more efficiently.

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