Research Paper :

Effect of *Pseudomonas fluorescens* Pf1 talc-based formulation under different storage periods against late leaf spot of groundnut

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SUMMARY

In groundnut, late leaf spot caused by *Cercosporidium personatum* is the serious disease. The effect of storage of *Pseudomonas fluorescens* Pf1 talc-based formulation for different periods in the management of late leaf spot disease was assessed. Groundnut seeds were treated with Pf1 formulation (100 g/kg seed) and sprayed with Pf1 formulation (1 kg/ha) at different days of storage and challenge inoculated with pathogen. The disease intensity and population of *P. fluorescens* in the formulation at different days of storage were recorded. The results revealed that effective protection against the disease was observed only up to 30 days after seed treatment with Pf1 formulation and foliar application of Pf1 formulation was able to offer protection only up to 15 days.

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Late leaf spot caused by *Cercosporidium personatum* is the destructive foliar disease in groundnut. The most obvious effect of this disease is the loss of photosynthetic tissue, which leads to premature defoliation (Kaur *et al*., 1992). Late leaf spot is almost co-existent with the crop and contributes to significant loss in yield throughout the world (Wells *et al.,* 1994). Among a range of rhizobacteria including *Azotobacter, Bacillus* and other genera with the ability to promote plant growth through biocontrol or other mechanisms, the fluorescent Pseudomonads have received much attention as the most effective bacteria for biological control of soil and foliar pathogens.

Fluoresent Pseudomonads belong to a major group of rhizosphere dwelling bacteria known as plant growth promoting rhizobacteria (PGPR) (Leeman *et al*., 1995; Liu *et al*., 1995). Several fluorescent Pseudomonads are known to control soil borne fungal pathogens like *Pythium, Fusarium, Rhizoctonia* in a wide range of crops (Vidhyasekaran *et al*., 1997). They survive and multiply well in the phyllosphere and induce resistance in the host (Wilson *et al*., 1992).

MATERIALS AND METHODS

Groundnut seeds were treated with Pf1 talc-based formulation (100 g kg^{-1} seed) at different days of storage *viz*., 0, 15, 30, 45, 60, 75, 90, 105 and 120 days of storage. The plants were inoculated with *Cercosporidium personatum* at 45 days after sowing. The plant height and disease intensity were recorded at 60 and 90 days after sowing. The population of *P. fluorescens* in the talc-based formulation at different days of storage and pod yield per plant were also recorded.

In another set of experiment, groundnut plants (45 days old) were sprayed with Pf1 talc-based formulation (1 kg ha^{-1}) at different days of storage *viz.,* 0, 15, 30, 45, 60, 75, 90, 105 and 120 days of storage. The plants were inoculated with pathogen two days after foliar spray. Disease intensity was scored at 90 days after sowing. The population of *P. fluorescens* in the formulation at different days of storage and pod yield per plant were also recorded.

RESULTS AND DISCUSSION

Effective protection against the disease was observed only up to 30 days after seed treatment with Pf1 formulation (38% disease

Table 1 : Effect of seed treatment with Pf1 talc formulation under different storage periods on late leaf spot

Days of storage	Plant height (cm) (60 DAS)	Disease intensity (grade) (90 DAS)	Population of *P. fluorescens* (cfu x 10^8 g^{-1}) in the formulation	Pod yield $plant^{-1}$ (g)
0	37.1^{bc}	5.0^{a}	20.0^{a} (9.3)	4.2^{b}
15	38.4^{b}	4.8^{a}	14.7^{b} (9.1)	5.1^{a}
30	38.6^{ab}	4.6^{a}	12.0^{bc} (9.0)	5.4^{a}
45	40.2^{a}	4.6^{a}	11.3^{c} (9.0)	4.2^{b}
60	36.5^{c}	5.1^{a}	10.0^{cd} (9.0)	4.0^{b}
75	33.6^{d}	6.2^{b}	9.0^{d} (8.9)	4.0^{b}
90	33.2^{d}	6.4^{b}	9.0^{d} (8.9)	3.8^{b}
105	32.9^{d}	7.0^{bc}	5.0^{e} (8.6)	3.8^{b}
120	32.7^{d}	7.1^{c}	3.3^{c} (8.5)	3.5^{bc}
Carbendazim @ 2 g kg^{-1} seed	34.1^{d}	4.6^{a}	-	4.4^{ab}
Control – Pathogen inoculated	28.1^{e}	7.8^{c}	-	2.8^{c}
Control – Pathogen uninoculated	28.3^{e}	4.6^{a}	-	3.5^{bc}

Data represent mean of three replications
Data followed by the same letter in a column are not significantly different (p=0.05) by DMRT
Figures in the parentheses are log transformed values

reduction). Pf1 talc based formulation when used as seed treatment reduced the disease effectively up to 60 days of storage. Pf1 formulation was ineffective in reducing the disease intensity when the formulation was stored for 120 days. Pf1 formulation when stored for 30 and 45 days recorded the lowest disease intensity. Survival of *P. fluorescens* in the formulation decreased with increase in days of storage. Pf1 formulation stored up to 120 days and used for seed treatment gave the lowest pod yield. The pod yield per plant was found to be reduced due to storage of Pf1 formulation for longer periods of 120 days (Table 1).

The foliar application of Pf1 formulation was able to offer protection only up to 15 days (20% disease reduction). At 30 days after foliar application there was no protection against the disease and severe disease symptoms similar to untreated control plants were observed. Foliar application of Pf1 formulation was ineffective after 75 days of storage. The pod yield per plant was maximum when Pf1 formulation was applied at 15 and 30 days of storage. Pf1 formulation (120 days old) gave the lowest pod yield per plant (Table 2).

The induced systemic resistance appeared to be transient and at 30 days after foliar application and 60

Table 2 : Effect of foliar spray with Pf1 talc formulation under different storage periods on late leaf spot

Days of storage	Disease intensity (grade) (90 DAS)	Population of *P. fluorescens* (cfu x 10^8 g^{-1}) in the formulation	Pod yield $plant^{-1}$ (g)
0	4.6^{c}	19.0^{a} (9.2)	4.0^{b}
15	3.4^{a}	15.3^{b} (9.1)	5.4^{a}
30	3.4^{a}	12.0^{c} (9.0)	5.4^{a}
45	4.2^{bc}	11.0^{cd} (9.0)	4.4^{ab}
60	4.5^{c}	11.0^{cd} (9.0)	4.0^{b}
75	6.2^{d}	9.0^{d} (8.9)	4.0^{b}
90	6.2^{d}	9.0^{d} (8.9)	3.6^{b}
105	6.4^{d}	5.3^{e} (8.7)	3.6^{b}
120	6.8^{de}	4.0^{e} (8.6)	3.4^{bc}
Carbendazim (500 g ha^{-1}) + Mancozeb (1 kg ha^{-1})	3.8^{ab}	-	4.8^{a}
Control – Pathogen inoculated	7.4^{e}	-	2.6^{c}
Control – Pathogen uninoculated	4.3^{c}	-	3.6^{b}

Data represent mean of three replications
Data followed by the same letter in a column are not significantly different (p=0.05) by DMRT
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days after seed treatment no induction of disease resistance by *P. fluorescens* was detected. Several other studies had also indicated that induced systemic resistance might be only transient. Effect of seed treatment with *P. fluorescens* was lost within 14 days in bean (Zdor and Anderson, 1992) and 45 days in rice (Vidhyasekaran, 1997).

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