

## Effect of inoculum levels of *Fusarium solani* on the development of wilt in potato

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**Abstract:** An investigation was carried out to evaluate the effect of different inoculum levels of *Fusarium solani* var. *eumartii* on the development of wilt diseases and plant growth of potato. Soil was inoculated by mixing oat grains colonized by the fungus at 0, 0.1, 0.5 and 1% (w/w) and its PDA culture at 0, 1, 5 and 10 blocks (10 mm)/pot. The highest level of inocula caused maximum reduction in plant growth and tuber weight, and the highest infection. Colonized oat grains at 1% and PDA culture at 10 blocks/pot reduced potato tuber weight by 69.22% and 40.06%, respectively.

**Key words:** Potato, Inoculum levels, *Fusarium solani*

### Introduction

Potato suffers from various kinds of diseases. So far 34 diseases have been recorded in Bangladesh (Rashid *et al.*, 1986). Fusarial wilt caused by *Fusarium solani* var. *eumartii* is very important and caused serious damage to the crop. It produced the most severe type of wilt which affected up to 50% of potato plants (Lean and Walker, 1941; Hoshino 1949; Goss, 1938). Under the soil conditions of Bangladesh, the disease is destructive in most of the cultivars. Every year seed tubers of different potato cultivars are being imported in Bangladesh without proper testing due to lack of standard methods for inoculation and disease development which are prerequisite for checking potato cultivars against *Fusarium* wilt. With this view in mind an investigation was conducted to evaluate the effect of four levels of inoculum of *F. solani* var. *eumartii* on wilt development, and growth and yield of potato.

### Materials and Methods

*Fusarium solani* var. *eumartii* was isolated from diseased potato plants collected from experimental Farm of Bangladesh Agricultural University using potato dextrose agar (PDA) medium. It was purified by hyphal tip culture method (Tuite, 1969) and stored in PDA slants at 10±1°C as stock culture. The soil of the investigation was sterilized with 2% formaldehyde and poured into earthen pots (30 cm x 25 cm).

The isolate was grown on sterilized oat grains and PDA. Oat grains colonized by *F. solani* var. *eumartii* were air dried and used as inoculum. The colonized oat grains were mixed with soil in the pots maintaining inoculum levels of 0, 0.1, 0.5 and 1% (w/w). Blocks at 7 days old PDA culture of the fungus were cut with a 10 mm cork borer and used as inocula. PDA culture were mixed with pot soil at 0, 1, 5 and 10 blocks/pot. The design of experiment was completely randomized with 4 replications (pots). The seed tubers of cultivar Diamant, weighing 100g, were cut into two equal pieces and surface sterilized with 1% formalin solution by swabbing the tuber surface one day before planting.

Seventy days after planting potato plants were removed from the pot and washed with tap water. Data on infection of stem, stolon and tuber; stem height, number and weight of stem, tuber and stolon were recorded. The data were

analyzed statistically and means were compared following Duncan's Multiple Range Test.

### Results and Discussion

The effect of *Fusarium solani* var. *eumartii* at various levels of inoculation on diseases development, plant growth and yield of tubers were presented in the Tables 1&2. There was gradual decrease in stem numbers, with higher inoculum levels although there was no statistical significant difference among the treatments. In case of stem height, the 1% treatment produced lowest stem height (23 cm). There was no significant difference between treatment levels 0.1% and 0.5% in stem height. The treatment 0.5% was significantly different from 1% level. Similar results were observed in case of stem weight. The lowest number of tuber was found in treatment 1% level. There was no significant difference in stolon number, but reduction was observed in treatment 1% level (Table 1).

No infection of stem/plant was observed at 0.1% level of inoculum and in control. Stems infected per plant were 2.3 at 0.5% and 2.7 at 1% level of inoculum. In case of infected stolon/plant there was significant difference among the treatments. Maximum stolon infection was observed in 1% inoculum level.

In case of tuber infected and weight showed significant difference at 1% inoculum level. The lowest weight and the highest infection of tubers/plant was observed at 1% inoculum level. Reduction of tuber weight/plant was the highest (69%) at 1% level of inoculum (Table 2).

The results in Tables 3&4 sowing the effect of three levels of inoculum potential used on the basis of number of PDA blocks for inoculation. In this method there was no significant difference in tuber and stem number/plant in all treatments. In case of stem height/plant the height of the plants gradually decreased with the increase of inoculum levels. Significant difference was found among the treatments and stem weight/plant decreased gradually with the increase of inoculum level. The lowest stolon number/plant was found in 10 blocks level of inoculum (Table 3).

In case of stem infection, there was significant different among the treatment and produced the highest stem infection/plant in 10 block inoculum. No infection was observed in stolon at 1 block inoculum levels but stolon infection at 10 blocks treatment was the highest. Inoculation with 10 blocks gave the highest number of

tuber infection. The lowest tuber weight/plant was observed when treated with the highest inoculum level (10 blocks) and was significant at 5% level. Percentage of

reduction of tuber weight/plant was the highest (40%) at 10 blocks inoculum level (Table 4).

**Table 1.** Effect of inoculation by *Fusarium solani* var *eumartii* at different inoculum levels on the growth of potato

| Level of inoculum (%) | Stem number /plant | Stem height (cm) | Stem weight(g)/ plant | Tuber number /plant | Stolon number /plant |
|-----------------------|--------------------|------------------|-----------------------|---------------------|----------------------|
| 0                     | 4.3                | 68.3             | 88.5                  | 5.3                 | 9.7                  |
| 0.1                   | 4.0                | 56.6             | 66.3                  | 4.0                 | 9.3                  |
| 0.5                   | 3.7                | 55.0             | 55.0                  | 4.0                 | 9.7                  |
| 1.0                   | 2.7                | 23.3             | 23.3                  | 3.3                 | 5.3                  |
| LSD (P=0.05)          | -                  | 13.1             | 15.3                  | -                   | -                    |

Data represent the means of four replications. LSD = Least significant difference.

**Table 2.** Effect of inoculation by *Fusarium solani* var. *eumartii* at different inoculum levels on the infection and tuber weight of potato

| Level of inoculum (%) | Stem infected/ plant | Stolon infected /plant | Tuber infected/ plant | Tuber weight/ plant | % reduction of tuber weight/plant |
|-----------------------|----------------------|------------------------|-----------------------|---------------------|-----------------------------------|
| 0                     | 0.0                  | 0.0                    | 0.0                   | 65.0                | 0.0                               |
| 0.1                   | 0.0                  | 0.0                    | 0.3                   | 56.7                | 12.8                              |
| 0.5                   | 2.3                  | 1.0                    | 1.0                   | 53.3                | 17.0                              |
| 1.0                   | 2.7                  | 3.7                    | 3.3                   | 20.0                | 69.2                              |
| LSD (P=0.05)          | 1.71                 | 0.72                   | 10.13                 | 10.13               | 11.73                             |

Data represent the means of four replications, LSD = Least significant difference.

**Table 3.** Effect of inoculation by *Fusarium solani* var *eumartii* at different inoculum levels on the growth of potato

| Level of inoculum | Tuber number/plant | Stem number /plant | Stem height (cm) | Stem weight (g)/plant | Stolon number/plant |
|-------------------|--------------------|--------------------|------------------|-----------------------|---------------------|
| 0                 | 5.67               | 4.33               | 70.0             | 75.0                  | 10.67               |
| 1                 | 4.67               | 3.67               | 51.67            | 53.33                 | 8.00                |
| 5                 | 4.33               | 3.33               | 41.67            | 51.67                 | 7.67                |
| 10                | 4.33               | 3.67               | 39.67            | 43.33                 | 7.0                 |
| LSD(P=0.05)       | -                  | -                  | 14.73            | 15.31                 | -                   |

Data represent the means of four replications, LSD = Least significant difference.

**Table 4.** Effect of inoculation by *Fusarium solani* var *eumartii* at different inoculum levels on the infection and tuber weight of potato

| Level of inoculum | Stem infected /plant | Stolon infected /plant | Tuber infected/ plant | Tuber weight(g)/ plant | % reduction of tuber weight/plant |
|-------------------|----------------------|------------------------|-----------------------|------------------------|-----------------------------------|
| 0                 | 0.0                  | 0.0                    | 0.0                   | 66.67                  | 0.0                               |
| 1                 | 0.0                  | 0.0                    | 0.0                   | 48.33                  | 27.5                              |
| 5                 | 0.67                 | 0.67                   | 0.67                  | 41.67                  | 39.5                              |
| 10                | 2.0                  | 1.67                   | 2.33                  | 40.06                  | 40.0                              |
| LSD (P=0.05)      | 1.12                 | 0.63                   | 0.91                  | 17.2                   | 11.3                              |

Data represent the means of four replications, LSD = Least significant difference.

In both inoculation methods, the potato plants started wilting at 45 days of planting. Maximum wilting of plants observed at 55 days to 65 days. Severe wilting occurred at 1.0% inoculum level. Wilting started from the tip of the plant and became thin and dull in compared to control. Similar result was observed by Shrivastava (1970). In a comparative inoculation study with three *Fusarium* spp. Lean and walker (1941) observed that most severe type of wilting produced by *Fusarium solani* var *eumartii*. In 1% inoculum level the tuber surface was found discoloration.

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