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# SEASONAL INFLUENCE ON THE OCCURRENCE AND MANAGEMENT OF BLAST OF FINGER MILLET (*ELEUSINE CORACANA* (L.) GAERTN.) UNDER FIELD CONDITION

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***ABSTRACT:*** ***Blast (Pyricularia grisea) is one of the most destructive diseases of finger millet. In this investigation, an attempt was made to know the seasonal influence (Kharif and Rabi) responsible for high and low blast disease development in the cropping period of finger millet and to get higher yields with sustainable disease management practices. The integrated approach (fungicides and biocontrol agents) is the novel idea to manage crop diseases as it involves minimum fungicidal load in nature. Field experiments conducted in two different seasons (Kharif and Rabi 2014) revealed that the lowest blast disease incidence was recorded in the rabi season crop. Among the different treatments tested, seed treatment with combination of Pseudomonas fluorescens @10g/kg and Trichoderma viride @4g/kg and foliar application of new fungicide molecule Tricyclazole +Mancozeb @2g/lit at maximum tillering and heading phase ($T_{10}$) recorded minimum leaf blast and neck blast incidence ( PDI 8.8%& 0.33% ) with the maximum grain yield of 3741 kg/ha.***

***Key words: Bioagents; blast; finger millet; fungicide; integrated disease management,.***

## 1. Introduction

Finger millet (*Eleusine coracana* (L.) Gaertn.) is one of the important millet crops of India. It is indispensable to Indian Agriculture as a source of grain and straw in a vast dry land area. This small millet is rich in protein, iron and calcium. The fodder is fed to cattle; the malted grain is used as food for infants. The protein of finger millet has been reported to possess a fairly high biological value, which is needed for the maintenance of nitrogen equilibrium of the body. In India, it occupies an area of 1,138.1 thousand hectares with an average production of 1,688.2 thousand tons (Anan 2014).

Finger millet is affected by several diseases *viz*., blast, brown leaf spot, foot rot and viral diseases. Among the various diseases that affect finger millet, blast disease affects adversely the

 

crop from economic point of view, whenever it occurs. In fact the impact of the disease on growth and grain yield of the crop is so high. Under favourable environmental conditions yield reduction upto 100 per cent was recorded at Rampur, Nepal (Batsa and Tamang, 1983 and Getachew et al., 2003). The leaf and neck blast severity varies within the season and also from one season to other. Mc Rae (1922) reported this disease for the first time from India and gave an estimate of loss due to the impact of the disease. Ramappa, *et al.*, (2002) recorded up to 50 per cent neck blast and 70 per cent finger blast incidence during Kharif 2000 in Mandya and Mysore districts. Vishwanath *et al*., (1986) recorded 30 per cent of yield losses in finger millet due to blast incidence. Blast disease is considered as number one in the form of yield loss in Andhra Pradesh, Haryana, Madhya Pradesh, Maharashtra and Mysore. The ultimate loss in grain yield is due to the cumulative effect of reduction in grain number and weight as well as enhanced spikelet sterility (Nagaraja et al., 2007). The adverse effect of the disease on finger millet could be in many ways. It starts from nursery where seed germination is reduced, seedlings are killed affecting the seedling stand, may cause extensive damage to foliage affecting adversely the transplantable seedlings. In main field the disease affects the plant growth and tillering. Further the knowledge on the effect of interaction of host variety with weather, pathogenic strain and of course in any situation is an essential component in integrated disease management strategy. These factors are more relevant with a polycyclic, airborne pathogen like *Pyricularia* sp. In this investigation, an attempt was made to know the seasonal influence (Kharif and Rabi) responsible for high and low blast disease development in the cropping period and to get higher yields with disease management practices.

## 2. METHODOLOGY

### Field Experiments

Field experiment on use of bioagents (*Pseudomonas fluorescens & Trichoderma viride* talc formulations) and fungicide (Tricyclazole + Mancozeb) individually and their integration as seed treatment and foliar spray was conducted during 2013-14 (Season I &II) for the management of blast disease of finger millet in randomized block design with 3 replications using local susceptible variety Paiyur 2 at Regional Research Station Paiyur, Tamil Nadu, India

 

with the following 11 treatments. $T_1$- Seed treatment with *P. fluorescens* @ 10g/kg of seed, $T_2$ - Foliar application of *P. fluorescens* @ 2g/li , $T_3$- Seed treatment + foliar application of *P. fluorescens* ($T_1$+$T_2$), $T_4$- Seed treatment with *Trichoderma viride* @ 4g/kg of seed, $T_5$- Foliar application of *T. viride* @ 4g/lit , $T_6$- Seed treatment + foliar application of *T. viride* ($T_4$+$T_5$), $T_7$- Seed treatment with Tricyclazole + Mancozeb @ 2g/kg, $T_8$-Foliar application of Tricyclazole + Mancozeb @ 2g/ lit, $T_9$-Seed treatment + foliar application of Tricyclazole + Mancozeb ($T_7$+$T_8$), $T_{10}$- Seed treatment with combination of *P. fluorescens* 10g/kg + *T. viride*@ 4g/kg + Foliar application of Tricyclazole + Mancozeb @ 2g/ lit and $T_{11}$- Untreated control.

**Preparation of Bioagents**

The bioagent formulations were prepared at the biocontrol laboratory of Regional Research Station, Paiyur. In order to prepare bioagent formulations, the pure culture of *T. viride* was multiplied on overnight, soaked and autoclaved Molasses yeast medium at 26 ± 1 $^0$C for 5 days. And then the liquid culture was mixed with talcum powder in 1:2 ratio. However, the culture of *P. fluorescens* was multiplied on King's B broth medium at 26 ± 1 $^0$C for 3 days and mixed in talcum powder in 1:2 ratio (Radjacommare *et al.*, 2004 &Vidhyasekaran, *et al* 1999).The seed and spray treatment were given as above said doses either per kg of seed or per liter of water. That is seed treatment with bioagents and fungicides were given 24 hours before sowing. Foliar spray with above treatments was given at maximum tillering and heading stages of the crop. An untreated control plot was also maintained. The recommended agronomical practices with 60 N: 30 P: 30 K in kg/ha were adopted for better crop growth in both the seasons and other standard packages of practices were followed at the time of crop growth period (Anon., 1997).

**Disease Scoring and statistical analysis**

Occurrence of leaf blast was recorded by visual observation following 0-5 scale at the time of crop vegetative stage. Neck blast incidence is recorded at dough stage of the crop. Neck blast incidence was calculated by counting the number of infected peduncles in a selected population of hundred plants and calculated as per cent incidence. Observation on growth

 

characteristics, yield attributes and grain yield also were recorded, economics worked out and statistical analysis was done.

## 3. RESULTS AND DISCUSSION

**Season I(Kharif)**

All the treatments tested were effective against blast (leaf and neck blast) except control. Among the treated plots a significant difference in blast incidence was observed in the plot ($T_{10}$) seed treatment with combination of *P. fluorescens* @ 10g/kg and *T. viride* @ 4g /kg of seed followed by foliar application of new fungicide molecule Tricyclazole + Mancozeb @2g/lit at maximum tillering and heading phase (10.9% & 0.67%) but this is on par with seed treatment (10g/kg of seed) and foliar application (2g/lit) of P. *fluorescens* at maximum tillering and heading phase ($T_3$) respectively (Leaf blast 12.3% & Neck blast1.0%). Untreated control recorded maximum disease incidence of 29.4% & 6.7% (Leaf and neck blast incidence).

A significant difference with respect to number of tillers, leaf length, finger length and grain yield was observed in the treatment ($T_{10}$) seed *i.e* treatment with combination of *P. fluorescens* @ 10g/kg and *T. viride* @ 4g /kg of seed followed by foliar application new fungicide molecule Tricyclazole + Mancozeb @2g/lit at maximum tillering and heading phase (Number of tillers 4.0, leaf length 59.5 cm, finger length 6.0 cm and maximum grain yield of 3688kg/ha with B:C ratio of 3.5) and seed treatment (10g/kg of seed) + foliar application (2g/lit) of *P. fluorescens* at maximum tillering and heading phase ($T_3$) (Number of tillers of 3.7, leaf length 56.9 cm, finger length 5.9cm and grain yield of 3533kg/ha). Untreated control ($T_{11}$) recorded minimum number of tillers (2.9/hill), shorter leaf length (46.8cm), earhead length (5.2cm) and minimum grain yield of 2031 kg/ ha respectively (Table 1).

**Season II (Rabi)**

The results of rabi season experiment confirmed the findings of the kharif season experiment. Here also the seed treatment with combination of *P. fluorescens* @ 10g/kg and *T. viride* @ 4g/kg of seed followed by foliar application of new fungicide molecule Tricyclazole + Mancozeb @ 2g/lit at maximum tillering and heading phase ($T_{10}$) recorded minimum leaf and neck blast

 

disease incidence of 6.8% and 0.0 % respectively. This was followed by seed treatment @10g/kg of seed and foliar application of *P. fluorescens* @ 2g/lit at maximum tillering and heading phase ($T_3$). The fungal antagonist *T. viride* used plots showed slightly higher percentage (9.7% &3.67%) of blast disease incidence. Maximum disease incidence of 20.8% & 8.3% of leaf and neck blast respectively were recorded in the control plot ($T_{11}$) (Table 2). In case of rabi season crop the leaf and neck blast incidence was found to be minimum, when compared with the first season crop. This may be due to the change in the climatic condition during November to March in this region. Similar results were reported by Krishnamurthy et al., (1998) and Kumar & Kumar (2011).

Analysis of rabi season data on the growth of finger millet crop showed the same trend of results. Among the treatments tested, the treatment $T_{10}$ (seed treatment with combination of *P. fluorescens* @ 10g/kg and *T. viride* @ 4g /kg of seed followed by foliar application of new fungicide molecule Tricyclazole + Mancozeb @2g/lit at maximum tillering and heading phase) and $T_3$ (seed treatment @10g/kg of seed and foliar application of *P. fluorescens* @ 2g/lit at maximum tillering and heading phase) recorded maximum number of tillers /hill (6.5&5.7), higher plant height (98.7 &94.8 cm), more number of leaves/tiller (11.3&10.5), maximum leaf length (57.7&54.5cm), more number fingers/earhead (7.1&6.8) and maximum finger length (5&5.4cm). The untreated control ($T_{11}$) recorded minimum number tillers ( 4.7/hill), lower plant height (83.8cm), minimum leaves (9.8/tiller), lower leaf length (44.8.cm), minimum finger length (4.4cm) and minimum fingers (6.5/ earhead) (Table 2).The significantly highest grain yield of 3794 kg/ha was registered in the treatment $T_{10}$ *i.e* – seed treatment with combination of *P. fluorescens* @ 10g/kg and *T. viride* @4g /kg of seed followed by foliar application of new fungicide molecule Tricyclazole + Mancozeb @2g/lit at maximum tillering and heading phase and in $T_3$ *i.e* - seed treatment @10g/kg of seed and foliar application of *P. fluorescens* @ 2g/lit at maximum tillering and heading phase (3591kg/ha). The lowest grain yield of 2516kg/ha was recorded in the untreated control treatment ($T_{11}$) (Table 2).

The mean performance of the treatments on blast disease incidence revealed that $T_{10}$ - seed treatment with combination of P. *fluorescens* @10g/kg and *T.viride*@4g/kg and foliar

 

application of new fungicide molecule Tricyclazole + Mancozeb @2g/lit at maximum tillering and heading phase recorded lowest leaf blast and neck blast incidence of 8.8% and 3.3 % respectively. This was followed by the treatment $T_3$- seed treatment with *P. fluorescens* @10g/kg and its two foliar applications (2g/lit) at maximum tillering and heading phase which registered 10.3 % &0.83% of leaf and neck blast incidence respectively. Whereas, the untreated control registered highest leaf and neck blast incidence of 25.1% & 9.5% (Table 3).

**Pooled analysis**

The pooled analysis data on grain yield reveled that among different treatments, $T_{10}$ -seed treatment with combination of *P. fluorescens* @10g/kg and *T. viride* @4g/kg and foliar application of new fungicide molecule Tricyclazole +Mancozeb @2g/lit at maximum tillering and heading phase ($T_{10}$) had registered highest mean grain yield of 3741kg/ ha with the yield increase of 44% over control ($T_{11}$). This was followed by the treatment $T_3$- seed treatment with *P. fluorescens* @ 10g/kg and foliar application of *P. fluorescens* @2g/lit at maximum tillering and heading phase which recorded a mean grain yield of 3562kg/ha. The lowest grain yield of 2274kg/ was recorded in the untreated control plot ($T_{11}$) (Table 3).

## 4. Conclusion

Collectively these data suggests that seed treatment with combination of *P. fluorescens* @10g/kg and *T. viride* @4g/kg and foliar application of new fungicide molecule Tricyclazole +Mancozeb @2g/lit at maximum tillering and heading phase ($T_{10}$) and seed treatment with *P. fluorescens* @10g/kg and its two foliar sprays at maximum tillering and heading stages ($T_3$) can be effectively exploited for the management of blast disease in finger millet during karif and rabi season.

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Table 1: Effect of bioagents and fungicide on blast disease incidence, growth and yield of finger millet under field condition (Season I) Kharif

| Trts | Leaf Blast (PDI)* | Neck Blast (PDI)* | No. of tillers/ Hill* | Plant height (cm) * | No. of leaves /tiller* | Leaf length (cm) * | No. of fingers /ear head* | Length of finger (cm) * | Grain Yield kg/ha* | B:C ratio |
|---|---|---|---|---|---|---|---|---|---|---|
| $T_1$ | 13.8 | 3.67 | 3.5 | 106.3 | 15.7 | 51.4 | 8.1 | 5.6 | 3401 | 3.4 |
| $T_2$ | 16.8 | 3.00 | 3.2 | 94.9 | 14.9 | 48.1 | 7.8 | 5.7 | 3158 | 3.0 |
| $T_3$ | 12.3 | 1.00 | 3.7 | 111.7 | 16.5 | 56.9 | 8.7 | 5.9 | 3533 | 3.4 |
| $T_4$ | 16.7 | 6.33 | 3.3 | 96.1 | 15.6 | 50.5 | 7.7 | 5.7 | 2981 | 2.9 |
| $T_5$ | 17.4 | 4.67 | 3.1 | 93.2 | 14.6 | 48.7 | 7.9 | 5.4 | 2849 | 2.7 |
| $T_6$ | 15.8 | 4.33 | 3.6 | 102.7 | 15.7 | 55.4 | 8.1 | 5.8 | 3333 | 3.2 |
| $T_7$ | 16.7 | 3.67 | 3.3 | 99.7 | 15.5 | 48.6 | 7.6 | 5.6 | 3202 | 3.1 |
| $T_8$ | 18.1 | 2.67 | 3.2 | 95.0 | 15.2 | 51.6 | 7.8 | 5.5 | 3003 | 2.9 |
| $T_9$ | 15.1 | 1.00 | 3.4 | 107.4 | 16.1 | 56.4 | 7.0 | 5.8 | 3312 | 3.1 |
| $T_{10}$ | 10.9 | 0.67 | 4.0 | 113.0 | 16.7 | 59.5 | 8.9 | 6.0 | 3688 | 3.5 |
| $T_{11}$ | 29.4 | 6.7 | 2.9 | 74.8 | 14.3 | 46.8 | 6.4 | 5.2 | 2031 | 2.1 |
| SEd | 1.31 | 1.02 | 0.13 | 9.90 | NS | 3.50 | NS | 0.13 | 240.1 | - |
| CD (p=0.05) | 2.74 | 2.12 | 0.28 | 20.36 | NS | 7.20 | NS | 0.28 | 500.9 | - |

*-- Values are mean of three replication

Table 2: Effect of bioagents and fungicide on blast disease incidence, growth and yield of finger millet under field condition (Season II) Rabi

| Trts | Leaf Blast (PDI)* | Neck Blast (PDI)* | No. of tillers/ Hill* | Plant height (cm) * | No. of leaves /tiller* | Leaf length (cm) * | No. of fingers /ear head* | Length of finger (cm) * | Grain Yield kg/ha* | B:C ratio |
|---|---|---|---|---|---|---|---|---|---|---|
| $T_1$ | 9.4 | 2.33 | 5.5 | 92.1 | 10.3 | 48.1 | 6.7 | 4.8 | 3455 | 3.5 |
| $T_2$ | 10.6 | 2.00 | 5.3 | 91.6 | 10.1 | 46.3 | 6.3 | 4.7 | 3225 | 3.1 |
| $T_3$ | 8.3 | 0.67 | 5.7 | 94.8 | 10.5 | 54.5 | 6.8 | 5.0 | 3591 | 3.4 |
| $T_4$ | 10.5 | 4.00 | 5.5 | 91.8 | 10.2 | 48.4 | 6.6 | 4.8 | 3032 | 3.0 |
| $T_5$ | 13.4 | 3.00 | 5.3 | 89.8 | 10.1 | 47.5 | 6.3 | 4.5 | 2989 | 3.0 |
| $T_6$ | 9.7 | 3.67 | 5.7 | 93.6 | 10.3 | 52.9 | 6.7 | 4.9 | 3376 | 3.3 |
| $T_7$ | 13.3 | 2.67 | 5.6 | 88.7 | 10.1 | 46.7 | 6.5 | 4.5 | 3289 | 3.1 |
| $T_8$ | 15.2 | 2.00 | 5.5 | 84.2 | 9.9 | 49.9 | 6.3 | 4.8 | 3106 | 3.0 |
| $T_9$ | 11.2 | 0.67 | 5.6 | 89.2 | 10.1 | 53.0 | 6.5 | 5.0 | 3374 | 3.1 |
| $T_{10}$ | 6.8 | 0.00 | 6.5 | 98.7 | 11.3 | 57.7 | 7.1 | 5.4 | 3794 | 3.6 |
| $T_{11}$ | 20.8 | 8.33 | 4.7 | 83.8 | 9.8 | 44.8 | 6.5 | 4.4 | 2516 | 2.7 |
| SEd | 0.52 | 0.23 | 0.56 | 5.96 | - | 3.35 | - | 0.25 | 270.0 | - |
| CD (p=0.05) | 1.10 | 0.46 | 1.17 | 12.45 | - | 6.99 | - | 0.52 | 563.4 | - |

*-- Values are mean of three replication

 

Table 3: Effect of bioagents and fungicide on blast disease incidence, growth and yield of finger millet under field condition (Pooled)

| Trts | Leaf Blast (PDI)* | Neck Blast (PDI)* | No. of tillers/ Hill* | Plant height (cm)* | No. of leaves/ tiller* | Leaf length (cm) * | No. of fingers /ear head* | Length of finger (cm) * | Grain Yield kg/ha* | B:C ratio |
|---|---|---|---|---|---|---|---|---|---|---|
| $T_1$ | 11.6 | 3.00 | 4.5 | 99.2 | 13.0 | 49.8 | 7.4 | 5.2 | 3428 | 3.5 |
| $T_2$ | 13.7 | 2.50 | 4.3 | 93.3 | 12.5 | 47.2 | 7.0 | 5.2 | 3192 | 3.1 |
| $T_3$ | 10.3 | 0.83 | 4.7 | 103.3 | 13.5 | 55.7 | 7.8 | 5.4 | 3562 | 3.4 |
| $T_4$ | 13.6 | 5.17 | 4.4 | 94.0 | 12.9 | 49.5 | 7.1 | 5.3 | 3006 | 3.0 |
| $T_5$ | 15.4 | 3.83 | 4.2 | 91.5 | 12.4 | 48.1 | 7.1 | 5.0 | 2919 | 2.9 |
| $T_6$ | 12.9 | 4.00 | 4.6 | 98.2 | 13.0 | 54.1 | 7.4 | 5.4 | 3355 | 3.3 |
| $T_7$ | 14.9 | 3.17 | 4.5 | 94.2 | 12.8 | 47.6 | 7.1 | 5.0 | 3246 | 3.1 |
| $T_8$ | 16.6 | 2.33 | 4.3 | 89.6 | 12.6 | 50.8 | 7.1 | 5.2 | 3055 | 3.0 |
| $T_9$ | 13.1 | 0.83 | 4.5 | 98.3 | 13.1 | 54.7 | 6.7 | 5.4 | 3343 | 3.1 |
| $T_{10}$ | 8.8 | 0.33 | 4.9 | 105.9 | 14.0 | 58.6 | 8.0 | 5.7 | 3741 | 3.6 |
| $T_{11}$ | 25.1 | 9.50 | 4.0 | 79.3 | 12.1 | 45.8 | 6.4 | 4.8 | 2274 | 2.4 |
| SEd | 0.70 | 0.75 | 0.31 | 5.22 | 0.50 | 2.42 | 0.40 | 0.14 | 180.0 | - |
| CD (0.05) | 1.42 | 1.54 | 0.63 | 10.44 | 1.00 | 4.87 | 0.82 | 0.28 | 363.0 | - |

*-- Values are mean of three replication

 