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Evaluation of Pyraclostrobin 20% WG against Sigatoka Leaf Spot Disease of Banana caused by *Mycosphaerella musicola*

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ABSTRACT: *A field experiment was conducted during 2011-12 at Zonal Agriculture Research Station, Khargone (M.P.) to evaluate efficacy of Pyraclostrobin 20% WG against Sigatoka Leaf Spot Disease of banana cultivar Grand Naine at different doses viz., 0.5g/L, 1g/L, 1.5 g/ L. The efficacy of Pyraclostrobin was compared with commonly used chemicals viz., Propiconazole 25% EC @ 1 ml/L, Mancozeb 75% WP @ 1.5 g/L, Carbendazim 50% WP @ 1g/L and untreated control. Phytotoxicity effect of Pyraclostrobin was evaluated using a single spray, at 1.5g/L and 3g/L. All these treatments were found statistically significant in reducing the disease intensity of banana over control. Minimum PDI (Percent Disease intensity) observed was in the treatment of Pyraclostrobin 20 % WG @ 1.5 g/L (20.35 %). The next most effective treatment was Pyraclostrobin 20 % WG @ 1.0 g/L (21.12 %). The Pyraclostrobin 20 % WG @ 0.5 g/L recorded 24.06 PDI while Propiconazole 25% EC @ 1.0 ml/L recorded 28.11 PDI. The standard products Carbendazim 50% WP @ 1.0 g/L and Mancozeb 75 % WP @ 1.5 g/L recorded the PDI of 25.20 % and 26.48 % respectively. PDI recorded in control plot was 32.19 %. Pyraclostrobin at 1.5g/L and 3g/L did not cause any phytotoxicity symptoms in terms of chlorosis, necrosis, wilting, scorching, hyponasty and epinasty.*

Keywords: *Efficacy, Banana, Sigatoka Leaf Spot, Mycosphaerella musicola, Pyraclostrobin*

INTRODUCTION

Bananas (*Musa* sp.) are among the most widely consumed food crop across the globe. The crop is grown in more than 100 countries throughout the tropics and sub-tropics, with an annual world production of around 101.99 million MT during 2012 (FAOSTAT-2014). In India, banana is grown on 776 thousand hectares, producing 26509 thousand MT during 2012-13 (Indian Horticulture Database 2013). According to the FAO statistics India became the largest producer of banana in the world in 2011 contributing 27.68% to the total global production. The leading banana growing states are Tamil Nadu, Maharashtra, Gujarat, Andhra Pradesh, Karnataka, Madhya Pradesh and Bihar.

The crop can be grown in a range of environments and production systems, and provides a nutritious staple food and a significant source of revenue round the year. Growing populations in many of the countries where bananas provide a vital food source mean that productivity increases are essential. However, such increases in production must be brought about in the face of growing pest and disease pressure. The crop suffers mainly Sigatoka leaf spot disease caused by *Mycosphaerella musicola*. It was first reported from Java in 1902 (Zimmermann 1902). Although it is spread over short distances by conidia and ascospores, over long distances it is the movement of infected germplasm such as diseased leaves and suckers that is likely to be responsible. The first sign of disease is the appearance of small yellow streaks on the upper side of leaves. These streaks enlarge and coalesce forming necrotic lesions with light grey centres and yellow perimeters. Large areas of leaf can be damaged causing a lowering of photosynthetic ability, a reduction in crop yield and premature ripening of the fruit.

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Therefore, a need of suitable and effective fungicide is important for the management of the Sigatoka leaf spot disease to get maximum yield. With these view an experiment was undertaken to evaluate the efficacy of Pyraclostrobin 20% WG against Sigatoka Leaf Spot Disease of banana.

Pyraclostrobin (Chemical name (IUPAC) : methyl N-(2-{[1-(4-chlorophenyl)-1H-pyrazol-3-yl]oxymethyl}phenyl) N-methoxy carbamate) is a broad-spectrum fungicide of the strobilurin group that moves through the cell layers of a leaf but is not redistributed throughout the plant like a true systemic fungicide (Bardinelli *et al*. 2001).The fungicide has protective, curative, eradicative, translaminar and locosystemic properties. It is taken up rapidly by the plant and is largely retained by the waxes in the leaf cuticle. It demonstrates good translaminar movement through the leaf, resulting in disease control on both leaf surfaces.

MATERIALS AND METHODS

Experimental Site and Season

The experiment was conducted at Zonal Agriculture Research Station, RVSKVV, Khargone (M.P.) during 2011-12. The station is situated at an altitude of 240 MSL, 22°N Latitude and 75°E Longitude. Maximum temperature ranges from 25° C to 47 °C while minimum temperature ranges from 7°C to 27° C and rarely drops below 7° C. The rains usually start in the month of June and ceases in September. It rarely continues up to mid of October. The total rainfall ranges between 700 - 900 mm. The stable rainfall period is about 3 month with 30 to 40 active rainy days. The soil is low in available nitrogen, medium in phosphorus and high in potash with pH of 8.5. During the Kharif season 2012 the rain received was recorded 820.8 mm June 2012 onward, which was well distributed in the month of June to September 2012. There was normal variation in temperature and relative humidity (Fig. 1).

Experiment Design and Treatments

The experiment was laid out in a randomized block design with three replications. For this the healthy tissue cultured plants of the cultivar "Grand Naine" were planted to 13.5 meter^2 experimental plots, maintaining a row spacing of 1.5 meter with 1.5 meter between plants in a row. The NPK and FYM were incorporated to the soil as per soil test value (STV) and all the recommended agronomic practices were followed to grow a successful crop. The fungicides treatments evaluated included Pyraclostrobin 20% WG @ 0.5, 1, 1.5 g/ L, Propiconazole 25% EC @ 1 ml/ L, Mancozeb 75% WP @ 1.5 g/L, Carbendazim 50% WP @ 1g/L and untreated control. Details of the treatments are given in table-1. Two sprays of each treatment were applied first immediately after the first symptom of disease and second after its 15 days, using a knapsack sprayer with 500 litre spray volume/ ha.

Disease and Yield Assessment

Disease severity observations were recorded before spraying, and final observation was recorded at 10 days after final spray. Plants were scored on a scale ranging from 0-9, where 0 denotes healthy plant and 9 denotes severe disease incidence and was converted into Percent Disease Intensity (PDI) based on the severity of attack on all the leaves of five plants per plot.

The Percent disease intensity (PDI) was worked out using below formula described by Wheeler (1969).

$$PDI = \frac{Sum\ of\ numerical\ grading}{No.\ of\ leaves\ examined \times Maximum\ disease\ grade} \times 100$$

Yield data were pooled from all the harvests of each plot and expressed as kg/plant. The percent disease intensity (PDI) was worked out and thus data obtained were subjected to arcsine transformation before analysis of variance.

Phytotoxicity Observations

The observations of Phytotoxicity (Chlorosis, necrosis, wilting, scorching, hyponasty and epinasty) were recorded at 1, 3, 5, 7 and 10 days after application by visual observations based on 0 – 10 scale as given below.

Scale	*Phytotoxicity (%)*
0	No phytotoxicity
1	1 – 10
2	11 – 20
3	21 – 30
4	31 – 40
5	41 – 50
6	51 – 60
7	61 – 70
8	71 – 80
9	81 – 90
10	91 – 100

RESULTS AND DISCUSSION

The data presented in Table 1 revealed that, all these treatments were found statistically significant in

Table 1
Efficacy of Pyraclostrobin 20 % WG against sigatoka leaf spot disease in banana

Treatment No.	*Treatment*	*PDI (Pre-treatment)*	*PDI (10 days after final spray)*	*Percent reduction over control*	*Yield (kg/ plant)*
1.	Pyraclostrobin 20% WG (0.5 g/L)	32.18 (34.56)*	24.06 (29.35)	25.01	26.34
2.	Pyraclostrobin 20% WG (1.0 g/L)	32.72 (34.89)	21.12 (27.36)	34.26	27.94
3.	Pyraclostrobin 20% WG (1.5 g/L)	31.38 (34.07)	20.35 (26.81)	36.69	29.26
4.	Propiconazole 25% EC (1.0 ml/L)	32.87 (34.98)	28.11 (32.01)	12.64	24.58
5.	Mancozeb 75% WP (1.5 g/L)	32.63 (34.83)	26.48 (30.97)	17.67	24.37
6.	Carbendazim 50% WP (1.0 g/L)	32.62 (34.82)	25.20 (30.13)	21.56	26.11
7.	Control	33.09 (35.11)	32.19 (34.56)	0.00	21.45
S.E. +		(0.16)	(0.30)	-	0.18
C.D. at 5%		(0.49)	(0.91)	-	0.56

*The parenthesis values are arc sine transformed values.

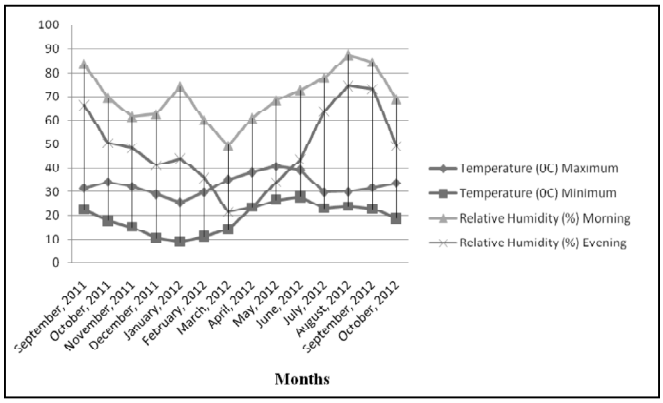

Figure 1: Weather data for the year 2011-12

reducing the disease intensity of banana over control. Minimum PDI (Percent Disease intensity) observed was in the treatment of Pyraclostrobin 20% WG @ 1.5 g/L (20.35%). The next most effective treatment was Pyraclostrobin 20% WG @ 1.0 g/L (21.12%). The previously results had showed that Pyraclostrobin often controlled early and late leaf spot on peanut better than most other recommended fungicides (Portillo *et al.* 2001), (Culbreath *et al.* 2002) and (Hagan *et al.* 2004).

The Pyraclostrobin 20 % WG @ 0.5 g/L recorded 24.06 PDI while Propiconazole 25% EC @ 1.0 ml/L recorded 28.11 PDI. The standard products Carbendazim 50% WP @ 1.0 g/L and Mancozeb 75 % WP @ 1.5 g/L recorded the PDI of 25.20 % and 26.48 % respectively and PDI recorded in control plot was 32.19 % (Fig 2).The treatment Pyraclostrobin 20 % WG @ 1.5 g/L was the most effective treatment giving 36.69 percent reduction over control followed by Pyraclostrobin 20 % WG @ 1.0 g/L giving 34.26 % reduction over control. Among the standard products Carbendazim 50% WP @ 1.0 g/L and Mancozeb 75 % WP @ 1.5 g/L recorded the per cent reduction over control of 21.56 % and 17.67 % respectively (Fig 3). The Disease can weaken crop by robbing nutrients and reducing photosynthetic leaf area. Pyraclostrobin controls disease and improves the photosynthetic efficiency of plants. Healthy plants with more efficient photosynthesis stay green longer and have more energy available for fruit development. The use of

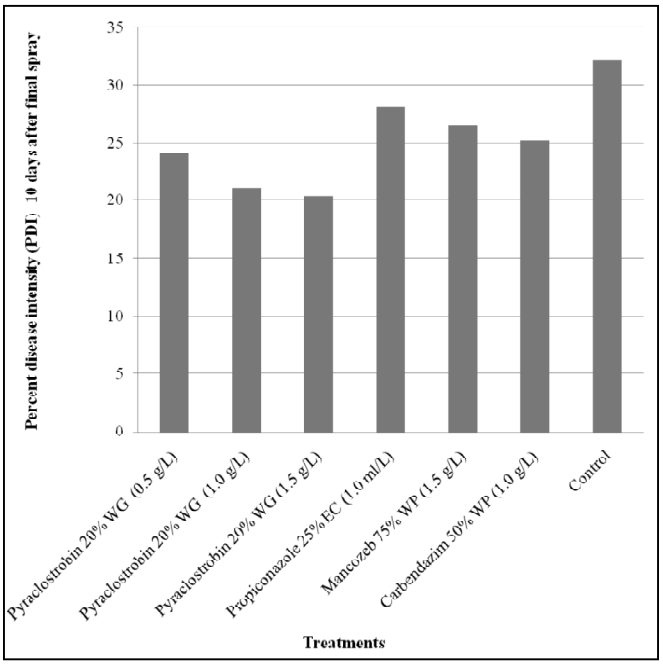

Figure 2: Efficacy of fungicides on percent disease intensity (PDI) 10 days after final spray

Pyraclostrobin in the management of anthracnose fruit rot of bell pepper was previously reported by (Ivey *et al.* 2004).

The highest yield was recorded in the treatment of Pyraclostrobin 20% WG @ 1.5 g/L (29.26 kg/plant) followed by Pyraclostrobin 20% WG @ 1.0 g/L (27.94 kg/plant). Yield observed in the treatment of Pyraclostrobin 20% WG @ 1.5 g/L and 1.0 g/L was significantly superior than the individual treatments of Carbendazim 50% WP @ 1.0 g/L (26.11 kg/plant), Propiconazole 25% EC @ 1.0 ml/L (24.58 kg/plant) and Mancozeb 75% WP @ 1.5 g/L (24.34 kg/plant). All the treatments were significantly superior in yield as compared to control plot (21.45 kg/ plant) (Fig 4). Pyraclostrobin not only controls disease, but also impacts the physiology of plants, enabling the plants to better handle yield-robbing environmental stresses such as drought, heat, cold temperatures, and ozone damage. The combination of disease control and these Plant Health benefits often translate to improved performance of Pyraclostrobin in the field producing greater yields at harvest.

Phytotoxicity

There was no adverse effect observed on the plants due to application of Pyraclostrobin 20% WG at any of the doses tested. The crop growth was uniform in all treatments. None of the treatments of Pyraclostrobin 20% WG, showed any type of phytotoxicity symptoms on banana.

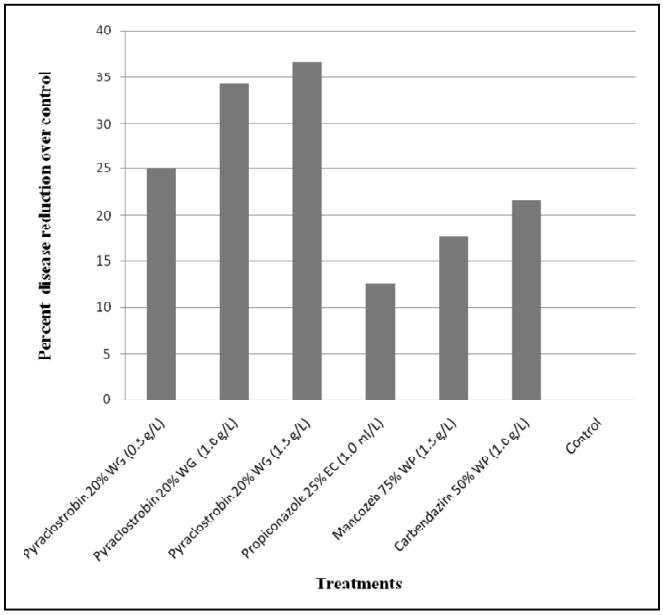

Figure 3: Efficacy of fungicides on percent disease reduction over control

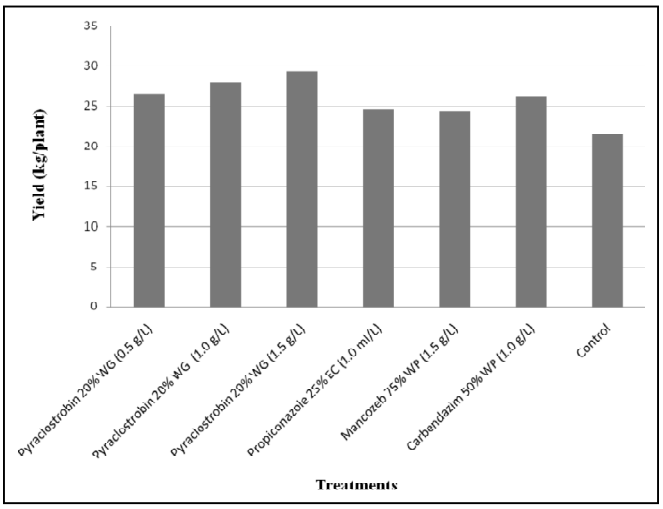

Figure 4: Efficacy of fungicides on yield of banana (kg/plant)

CONCLUSION

It is concluded that Pyraclostrobin 20% WG at all concentrations tested, were found significant at 5% level in reducing the disease intensity and in increasing yield of banana as compared to standard checks and control. Among the different concentrations evaluated 1.5 g/L was found best. At higher concentrations the chemical did not cause any phytotoxicity to banana crop cv. Grand Naine.

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