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SK Meena

Department of Plant Pathology,
College of Agriculture, Vasantrya
Naik Marathwada Krishi
Vidhyapeeth Parbhani,
Maharashtra, India

RV Deshmukh

Department of Plant Pathology,
College of Agriculture, Vasantrya
Naik Marathwada Krishi
Vidhyapeeth Parbhani,
Maharashtra, India

VV Giri

Department of Plant Pathology,
College of Agriculture, Vasantrya
Naik Marathwada Krishi
Vidhyapeeth Parbhani,
Maharashtra, India

Efficacy of consequent, alternate and mix spraying of protectant and systemic fungicides against sigatoka leaf spot disease of banana

SK Meena, RV Deshmukh and VV Giri

Abstract

A field experiment was conducted during the year 2016-17 on farmer's field of village Barad, Tq. Mudkhed, District-Nanded in randomized block design, replicated four times with five treatments of fungicides spray viz., T1-single spray of Dithane M-45 75 WP @0.25%, T2- single spray of Azoxystrobin 25 EC @0.06%, T3-Spraying of Dithane M-45 @0.25% alternated with spraying of Azoxystrobin @0.06% (C→S→C→S→C→S six sprays at 15 days interval), T4- Spraying of Dithane M-45 @0.25% + Azoxystrobin @0.06% (C+S six sprays at 15 days interval), T5- Control. The spraying were started after six month after planting of the crop and were continued till flowering at 15 days interval. Significantly minimum percent disease severity index of sigatoka (16.67%) was recorded by the treatment T3 i.e. spraying of Dithane M-45 @0.25% alternated with spraying of Azoxystrobin @0.06% and significantly maximum banana yield (80.55Mt/ha) was recorded by the treatment T3 i.e. Spraying of Dithane M-45 @0.25% in alternation with the spraying of Azoxystrobin @0.06%. Total six sprayings were conducted at 15 days interval.

Keywords: banana, fungicides, sigatoka

Introduction

Banana belongs to family *Musaceae*, is the most important fruit crops of the world as well as India. It is known for its antiquity and has ancient history as old as Indian history grown from dawn of civilization. The banana crop determines the socio-economic status of the farmer's and called as 'Kalpataru' (Plant of heaven) due to its socio-economic and multiple uses. The currency note paper is prepared from banana fibre in Japan and in India at Navsari Agricultural University. The leaves of plants, bunches, flowers, fruits have religious importance. Fruit is soft, sweet, pleasantly flavoured. It is nutritious, cheap and known as "Poor man's apple". The fruit in unripe form is used as starchy food. Banana flour prepared from raw fruit is a highly nutritive baby food.

The largest area under banana cultivation in India is in Tamil Nadu followed by Maharashtra, Gujarat, Andhra Pradesh, Karnataka, Madhya Pradesh and Bihar. Maharashtra is the second highest banana producer state in India with 2.50 million metric tonnes production with an area 92.6 thousand hectare during 2009-10 with share of 19.26 percent of production of total banana production in India. The major banana growing districts of Maharashtra are Jalgaon, Dhule, Buldhana, Nanded and Parbhani (Anonymous, 2012) ^[1].

Diseases are among the most important limiting factor in banana production world wide (Simmonds, 1966) ^[14]. Among various diseases of banana, leaf spot or yellow sigatoka caused by *Mycosphaerella musicola* is a very serious disease in tropical banana growing areas (Stover, 1980) ^[12]. Sigatoka leaf spot affects not only the banana leaves, but also bunch weight and fruit quality. Leaf spot when severe reduces yield when less than six viable leaves remain at harvest. Leaf spot may also cause early maturity and premature ripening of fruits. Banana from leaf spot infected plants can ripen in the field. These field ripen bunches harbor fruit fly and are unmarketable. Even unripe fruits from affected bunches are unsaleable, because they are likely to ripen in transit to market (Mourichon *et al.*, 1997) ^[6].

Materials and Methods**Field experiment**

The field experiment was conducted during 2015-2016 on the farmer's field of village 'Barad,' Tq. Mudkhed, District Nanded, Maharashtra.

Correspondence**SK Meena**

Department of Plant Pathology,
College of Agriculture, Vasantrya
Naik Marathwada Krishi
Vidhyapeeth Parbhani,
Maharashtra, India

Treatment details

	Fungicides
1.	Protectant-Dithane M-45 75 WP @0.25%
2.	Systemic-Azoxystrobin 25 EC @0.06%
Treatments	Fungicidal spray schedule
T ₁	Spraying of Dithane M-45@0.25% at 15 days interval.
T ₂	Spraying of Azoxystrobin @0.06% at 15 days interval.
T ₃	Spraying of Dithane M-45@0.25% alternated with spraying of Azoxystrobin @0.06% at 15 days interval.
T ₄	Spraying of Dithane M-45@0.25% + spraying of Azoxystrobin @0.06% at 15 days interval.
T ₅	Control (No spray)
	Total no. of sprays = 6
Date of planting	10-09- 2015

Observations recorded

The five representative plants from each plot were selected for recording the observations. The observations on growth characters and intensity of sigatoka leaf spot disease of banana were recorded at 15 days interval and finally the observations on yield and yield attributing characters were recorded at harvest of the crop.

Disease assessment of sigatoka leaf spot

The total number of leaves per plant and the disease severity index were assessed on 5 banana plants of similar vegetative growth per plant using Gauhl's modification of Stover's severity scoring system (Stover and Dickson, 1970 and Gauhl *et al.*, 1993) [13, 31]. The observations on sigatoka leaf spot were recorded at 15 days interval starting from appearance of disease symptoms up to harvest of the crop at monthly interval. Disease severity index of sigatoka leaf spot was calculated by using following formula.

$$\text{Percent disease intensity (severity)} = \frac{\sum n X b}{(N-1) t} \times 100$$

Where,

n= number of leaves in each grade

b= grade

N= Number of grades used in the scale

t= Total number of leaves scored

Disease rating/scoring was done by applying 0 to 6 disease rating scale of Gauhl *et al.*, (1993) [31].

Scale

Score	Description	Disease rating
0	No symptoms	Immune
1	Less than 1% of lamina with symptoms	Resistant
2	Less than 1 to 5% of lamina with symptoms	Resistant
3	6 to 15% of lamina with symptoms	Moderately resistant
4	16 to 33% of lamina with symptoms	Moderately susceptible
5	34 to 50% of lamina with symptoms	Susceptible
6	54 to 100% of lamina with symptoms	Highly susceptible

Analysis of data

The observations on growth characters, disease severity index at 15 days interval and yield characters were analyzed in randomized block design as per procedure given by Panse and Sukhatme, (1967) [7].

Methodology

The present field experiment was conducted on the farmer's field of village 'Barad' Tq. Mudkhed, District Nanded. Spraying schedule of fungicides were started after 6 months of planting the crop. Total 6 sprayings were applied at 15 days interval. Recommended doses of fungicides (Mancozeb 25gm/10lit. of water and Azoxystrobin 6ml/10lit. of water) were used.

Five representative plants were selected from each plot for recording observations on growth characters, percent disease severity index of sigatoka at 15 days interval and yield and yield contributing characters at harvest of the crop.

Results and Discussion

Efficacy of consequent, alternate and mix spraying of protectant and systemic fungicides against sigatoka leaf spot disease of banana.

The data presented in Table-1 revealed that the effect of spraying of protectant and systemic fungicides alone, protectant fungicides in combination with systemic fungicide and protectant fungicides in alternation with systemic fungicides on height of plant and girth of stem was found non-significant, However, it was found significant in respect of number of leaves per plant.

Significantly maximum number of leaves (13.9) were retained at harvest by the treatment T3 i.e. Spraying of Dithane M-45 @0.25% alternated with spraying of Azoxystrobin @0.06% at 15 days interval, followed by the treatment T4 i.e. Spraying of Dithane M-45 @0.25% fungicide in combination with Azoxystrobin @0.06% fungicide at 15 days interval (13.1). Total six spraying were undertaken at 15 days interval. Minimum number of leaves (11.0) was retained by control treatment

Days to flowering and maturity

Significant differences were observed due to spraying of contact and systemic fungicides at 15 days interval on flowering and maturity of banana.

Significantly maximum days for flowering and maturity was observed in treatment T3 i.e. Spraying of Dithane M-45 @0.25% alternated with spraying of Azoxystrobin @0.06% at 15 days interval for six times (218.8 and 338.8 days respectively).

The control treatment matures 6 days earlier and produced small sized banana fruits (332.6 days) as compared with rest treatments.

Table 1: Efficacy of protectant and systemic fungicidal sprays when used as alone, in combination, and in alternation on growth characters, flowering and maturity of banana

Treatments		Height of plant (cm.)	Girth of stem (cm.)	Total no. of leaves/plant	Days to flowering	Days to maturity
T1	Spraying of Dithane M-45@0.25% at 15 days interval.	238.3	67.8	12.0	216.8	333.0
T2	Spraying of Azoxystrobin @0.06% at 15 days interval.	236.5	67.6	13.6	217.5	335.8
T3	Spraying of Dithane M-45@0.25% alternated with spraying of Azoxystrobin @0.06% at 15 days interval.	238.5	66.7	13.9	219.5	338.8
T4	Spraying of Dithane M-45@0.25% + spraying of Azoxystrobin @0.06% at 15 days interval.	243.6	66.5	13.1	219.0	337.3
T5	Control (No spray)	230.6	63.1	11.0	215.8	332.5
SE _±		4.880	1.430	0.480	0.975	0.559
CD at 5%		N/S	N/S	1.44	3.008	1.723

Percent disease index of sigatoka leaf spot disease of banana.

The data presented in Table-2 revealed that the significant differences were observed among the different spraying treatments of protectant and systemic fungicides on the percent disease index of sigatoka leaf spot disease of banana. Significantly minimum percent disease severity index (16.67%) of sigatoka was recorded by the treatment T3 i.e. spraying of Dithane M-45@0.25% alternated with spraying of

azoxystrobin @0.06% at 15 days interval and it was found at par with treatment T4 i.e. Spraying of Dithane M-45@0.25% used in combination with azoxystrobin @0.06% which showed PDI 18.69%, as compared with rest of the treatments under study and control treatment. Total six spraying were undertaken at 15 days interval. Control treatment recorded maximum percent disease severity index of sigatoka leaf spot (31.28%).

Table 2: Efficacy of protectant and systemic fungicidal sprays when used as alone, in combination, and in alternation on the percent disease index of sigatoka leaf spot disease of banana.

Treatments	PDI of sigatoka leaf spot						Average PDI of Sigatoka	
	Ist	IIInd	IIIrd	IVth	Vth	VIth		
	04-4-2016	20-4-2016	06-5-2016	22-5-2016	11-6-2016	26-6-2016		
T1	Spraying of Dithane M-45@0.25% at 15 days interval.	18.10 (25.16)	15.78 (23.37)	14.73 (22.53)	13.38 (21.43)	11.75 (20.02)	10.88 (19.23)	14.10 (21.95)
T2	Spraying of Azoxystrobin @0.06% at 15 days interval.	14.88 (22.65)	13.75 (21.37)	12.33 (20.53)	10.88 (19.24)	9.33 (17.76)	8.55 (16.96)	11.62 (19.75)
T3	Spraying of Dithane M-45@0.25% alternated with spraying of Azoxystrobin @0.06% at 15 days interval.	13.35 (21.41)	10.58 (18.95)	9.13 (17.56)	7.30 (15.65)	5.65 (13.74)	4.85 (12.70)	8.48 (16.67)
T4	Spraying of Dithane M-45@0.25% + spraying of Azoxystrobin @0.06% at 15 days interval.	14.10 (21.98)	12.43 (20.59)	11.00 (19.35)	9.25 (17.69)	8.30 (16.73)	7.48 (15.85)	10.43 (18.69)
T5	Control (No spray)	21.85 (27.82)	23.88 (29.21)	25.93 (30.58)	27.45 (31.56)	31.08 (33.86)	32.35 (34.65)	27.09 (31.28)
SE _±		0.862	0.790	0.594	0.613	0.383	0.424	0.611
C.D.at 5%		2.687	2.461	1.850	1.911	1.193	1.320	1.903

(Figure in parenthesis are angular values)

Yield contributing characters of banana as influenced by protectant and systemic fungicidal sprays.

The data presented in Table-3 revealed that the significant differences were observed due to the spraying of protectant and systemic fungicides alone, in combination and in alternation on the yield and yield contributing characters of banana.

Weight of bunch/ plant

Significantly maximum weight of bunch (18.13 kg/plant) was recorded by the treatment T3 i.e. Spraying of Dithane M-45 @0.25% alternated with spraying of azoxystrobin @0.06% at 15 days interval, and it was found at par with treatment T4 i.e. spraying of Dithane M-45 @0.25% used in combination with spraying of azoxystrobin @0.06% at 15 days interval (17.13 kg/plant), as compared with rest of the treatment and control under study. Total six spraying were undertaken at 15 days interval.

Number of hands/bunch

Significantly maximum number of hands/bunch (8.50) were observed in treatment T3 i.e. Spraying of Dithane M-45 @0.25% alternated with spraying of Azoxystrobin @0.06% at

15 days interval, and it was found at par with treatment T4 i.e. Spraying of Dithane M-45 @0.25% is used in combination with spraying of Azoxystrobin @0.06% at 15 days interval (8.25), as compared with rest of the treatments under study. Total six spraying were undertaken at 15 days interval.

Numbers of fingers/bunch

Significantly maximum number of fingers per bunch (134.70) was recorded by the treatment T3 i.e. spraying of Dithane M-45 @0.25% used in alternation with Azoxystrobin @0.06% at 15 days interval, and it was found at par with treatment T4 i.e. Spraying of Dithane M-45 @0.25% used in combination with Azoxystrobin @0.06% at 15 days interval which showed 128.88 fingers per bunch as compared with rest of the treatment and control. Total six spraying of protectant and systemic fungicides alone in combination and in alternation were undertaken at 15 days interval.

Banana yield (Mt/ha)

Significantly maximum banana yield (80.55 Mt/ha) was recorded by the treatment T3 i.e. Spraying of Dithane M-45@0.25% in alternation with the spraying of Azoxystrobin @0.06% at 15 days interval for six times and it was found at

par with treatment T4 i.e. Spraying of Dithane M-45 @0.25% were used in combination with Azoxystrobin @0.06% at 15 days interval for six times which gave 76.11 Mt/ha as compared with rest of the treatments and control.

Minimum yield of banana was recorded by the control treatment (66.33 Mt/ha).

Maximum yield of banana was recorded by the treatment, spraying of Dithane M-45 @0.25% used in alternation with the Azoxystrobin @0.06% at 15 days interval. Total six sprays were undertaken at 15 days interval.

Repeated use of contact fungicide or systemic fungicide may develop the resistance in pathogen and plant get more attacked by the pathogen as compared when these fungicides were used in alternation or in combination with other fungicides. Similar results on effect of different fungicidal sprays when used in alternation or in combination with other fungicides against for management of sigatoka leaf spot disease of banana and for estimation of yield losses were reported by several workers "Shinde *et al.*, (2015) [2], Kulkarni, N.O. (2004) [4] and Thammaiah *et al.*, (2005) [15].

Table 3: Efficacy of protectant and systemic fungicidal sprays when used as alone, in combination and in alternation on the yield and yield contributing characters of banana.

Treatments		Weight of bunch/Plant (kg)	Number of fingers/bunch	Number of hands/Bunch	Banana yield Mt/ha
T1	Spraying of Dithane M-45@0.25% at 15 days interval.	15.30	124.30	7.67	67.99
T2	Spraying of Azoxystrobin @0.06% at 15 days interval.	16.73	127.65	8.17	74.33
T3	Spraying of Dithane M-45@0.25% alternated with spraying of Azoxystrobin @0.06% at 15 days interval.	18.13	134.70	8.50	80.55
T4	Spraying of Dithane M-45@0.25% + spraying of Azoxystrobin @0.06% at 15 days interval.	17.13	128.88	8.25	76.11
T5	Control (No spray)	14.93	122.65	7.67	66.33
SE _±		0.484	2.420	0.216	2.152
C.D.at 5%		1.499	7.452	N/S	6.638

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