J Krishi Vigyan 2019, 8 (1) : 174-177 DOI : 10.5958/2349-4433.2019.00092.8

Integrated Management of Panama Wilt Disease in Banana

Sudha A[1], Kavitha P S[2] and Sriram N[3]

Krishi Vigyan Kendra, Sandhiyur, Salem 636 001 (Tamil Nadu)

ABSTRACT

Panama disease is caused by the soil borne hyphomycete, *Fusarium oxysporum* Schlect. The aim of the study was to identify suitable management practices from the beginning stage of the crop. Fungicide carbendazim was first treatment. Biocontrol agents were used as second treatment regularly at a monthly interval. As per the observation, disease incidence was less in bioagents used plots (100sq.m) . It was found that the disease incidence of 12.5 per cent and recorded yield by 42.75 t/ha with a net return of Rs.4,05,000 and 19kg/bunch was recorded in fungicide treated plots. In Bioagents used as a integrated approach disease incidence of 60.5 per cent and yield of 35.50 t/ha. and net return of Rs.2,99,500, 15 kg/ bunch. The conclusion was that, application of bioagents, integrated with cultural and mechanical practices like cutting and burning of diseased leaf to avoid aerial spread, sucker treatment to avoid nematode problem, selection of healthy suckers for planting will manage the disease and also less expensive.

Key Words: Banana, Biocontrol, Corm injection, Fusarium wilt, *Fusarium oxysporum, Paecilomyces lilacinus, Trichoderma viride.*

INTRODUCTION

Fusarium wilt caused by *Fusarium oxysporum* is one of the most destructive diseases of banana worldwide. The pathogen is soil-borne and remains viable up to 30 yr. Breeding banana for resistance against fusarium wilt is difficult because of the sterile and polyploid nature of the plant and the saprophytic and pathogenic habits of the pathogen. Several disease managementstrategies such as crop rotation with rice, application of carbendazim (0.2%) as soil drenching or injection of rhizomes with 2 per cent carbendazim (Thangavelu *et al*, 2001), have limited success and the application of synthetic fungicides result in undesirable effects on the environment. A complementary approach for managing fusarium wilt is biological control and the search for antagonistic microorganisms has allowed for several antagonistic fungi and bacteria with high activity to be identified.

Tamil Nadu has occupied an area of 1.3 lakh sq.km with an overall area of around 63 lakh hectare for plantation. About 70 per cent of India's banana production of 29-30 Mt comes from five states - Tamil Nadu, Maharashtra, Gujarat, Andhra Pradesh and Karnataka. In Salem district, banana is cultivated in an area of nearly 2379 ha. Bananas are produced as a primary staple food crop among the most important food cops in the world. The Total area under Banana is 1,13,681 ha in Tamil Nadu with Production of 48,87,841 t with yield of 42,996 kg/ha. The area under banana was declining due to biotic stress like wilt disease. Panama disease, also known as Fusarium wilt of banana (Musa spp.), is one of the most notorious of all plant diseases.

Fusarium wilt symptoms and damages

Fusarium wilt or Panama disease of banana produces two types of external symptoms: "yellow leaf syndrome" and "green leaf syndrome" (Stover, 1962; Pérez-Vicente, 2004). Yellow leaf syndrome: this is the most conspicuous and classic symptom of Fusarium wilt on banana. It is characterized by the yellowing border on older leaves that can at times

Corresponding Author's Email: sudhaa1981@gmail.com

[1]Millet Breeding station, TNAU, Coimbatoor. [2]Tapioca and Castor Research Station, Yethapur, Salem.

[3]Krishi Vigyan Kndra, Salem, Tamil Nadu.

be confused with potassium deficiency, especially in drought and cold environment. The yellowing of the leaves progresses from older to younger leaves. The leaves collapse gradually, bending at the petiole, commonly close to the midrib and hang down, forming a "skirt" of death leaves around the pseudostem (Fig.1). Green leaf syndrome: In contrast to the yellow leaf syndrome, the leaves of affected plants in some cultivars eventually remain predominantly green until the petioles bend and collapse. In general, younger leaves are the last to show symptoms, frequently remaining unusually erect, giving a bristle-like appearance. Growth does not stop in an infected plant and emerging leaves are of pale colour. The lamina of the emerging leaf can be markedly reduced, shrivelled and distorted. The pseudostem eventually splits longitudinally at the plant base. There is no evidence of symptoms in the fruits. A susceptible banana plant infected with Fusarium wilt will rarely recover. While it can occur, the growth is poor and the mother plant produces many infected suckers before it dies. Internal symptoms are characterized by vascular discoloration: this begins with a yellowing of the root and rhizome vascular tissue, which progresses to develop continuous yellow, red or 8 brownish strands in the pseudostem (Fig.2). In susceptible cultivars, reddish coloured vessels can also be observed in petioles (Akila *et al*, 2011).

Fig 1. Symptom on the live plant

Fig 2. Disease affected pseudostem and sucker

The yield loss was up to 60 per cent in these crops. Most of the farmers find difficult to purchase the fungicides due to high cost. Hence the effectiveness of different treatments along *Paecilomyces lilacinus* and *Trichoderma viride* NRCB-1 @ 10 g/pit along with 10 kg of farm yard manure with chemical fungicides was shown to the farmers through trainings and on farm trials.

MATERIALS AND METHODS

Technology

The following technologies were intervened through KVK with the farmers of kammalapatty village.

- Rhizome treatment with bioagents and chemicals to protect from nematode
- Soil application of*Paecilomyce slilacinus* and *Trichoderma viride* NRCB-1 1 @ 10 g/pit along with FYM at the time of planting
- Application of biocontrol agents in soil, drenching of bioagents to protect the rhizome from wilt incidence
- Corm injection with 3ml of 2 per cent carbendazim at 4th, and 6th month of planting and application of carbofuran @ 40gm/corm
- Drip fertigation of liquid pseudomonas to protect the rhizome from wilt
- Several intensive On and Off campus trainings with method demonstrations on use of *T. viride* and *P.fluorescens* were given through the KV K, Sandhiyur, Salem

Treatments

TO1- Use of fungicides after the disease was occurred (carbofuran (40g/pit), Copper oxy chloride (0.25%))

TO2- Corm injection with 3 ml of 2% carbendazim on 4th and 6th month after planting and application of carbofuran @40 g/corm

TO3- Application of *Paecilomyceslilacinus and Trichoderma viride* NRCB-1 @ 10 g/pit along with

Table 1.Effect of bioagents and chemicals against Panama wilt of Banana under field condition.

Treatment	% disease incidence 3rd m	% disease incidence 5th m	% disease incidence 7th m	No. of leaves affected	Bunch weight (kg/pt	Production (t/ha)	Net return (lakh)	BCR
To1	11.5 (19.82)	14.7 (22.54)	21.5 (27.62)	3	15[c]	35.50[c]	1.98	2.98
To2	2.5 (9.10)	4.5 (12.25)	5.8 (13.94)	1	19[a]	52.75[a]	3.15	3.42
To3	5.5 (13.56)	8.5 (16.95)	11.8 (20.09)	2	17[b]	48.25[b]	3.05	3.35
Control	20.0 (26.57)	25.0 (30.00)	31.55 (34.17)	5	11.5[d]	32.5[d]	1.75	2.55
CD(0.05 %)				0.11	0.36	1.14		
SEd				0.041	0.16	0.50		
CV (%)				2.51	1.48	1.70		

10 kg of FYM on planting time and 4th month after planting

An area of 0.4 ha was selected witha plot of size, 16 x 10m for each treatment. Four treatments, each replicated four timesin a randomized block design were evaluated (Table 1). The highly susceptibleThe observations on wilt incidence wererecorded five, seven and nine months after planting.

RESULTS AND DISCUSSION

The results revealed that sucker treatment with Corm injection with carbendazim and application of carbofuran @40g/corm was equally effective to sucker treatment with *P. lilacinus* and *T. viride* NRCB-1 @ 10 g/pit along with 10 kg of FYM in reducing wilt incidence even from fifth month onwards. These two treatments were significantly different from other treatments and were on par with each other. At an early stage of planting, sucker treatment with carbendazim was equally effective in reducing the disease incidence but not in later stages. Least wilt incidence was noticed in the corm injected suckers (5.8 %) followed by *P. lilacinus* and *T. viride* NRCB-1 @ 10 g/pit along with 10 kg of FYM treated suckers (11.8%) whereas control recorded 31.55 per cent wilt incidence.

Highest yield was recorded as 52.75 t/ha, and an average yield of 61 t/ha in precision farming technology practiced plots. Among the various fungicides, carbofuran treated corms and corm injection with carbendazim treated plants resulted in low disease incidence of 12.5 % and performed better in the field. Application of fertilizers, irrigation methods, sucker treatment, weed management, harvesting and marketing is suggested as an effective strategy to get higher yield. Though it is a highly remunerative crop, they can adapt the corm injection with recommended dose of fungicide in different stages in early period. Though fungicides can controlled the disease but it is not recommended for long term process which is hazardous to soil health and expensive. The present study revealed that *P. lilacinus* and *T. viride* were equally effective not only in reducing the wilt incidence but also significantly increasing the yield Raguchander *et al* (1997).

Eco friendly IPDM practices will be more effective when it is being followed by the whole community in a particular region than an individual

grower. The measurable results were increase in yield level and income of the farmers, their knowledge and skill on using biocontrol agents had been improved as a result of KVK intervention. Since, pesticide usage is a major grudge to agriculture operations, the ecofriendly management technologies reduced pesticides usage resulting in less disease incidence and enhanced yield and quality produces.

Due to the impact of planting material on disease dissemination, use of healthy planting material is a key component of any management system of Fusarium wilt of banana. Development of certified healthy planting material program that can be accessed by growers is important, together with adoption of other control measures.

ACKNOWLEDGEMENT

The authors want to thank all their colleagues and farmers for their assistance in the research for this paper .

REFERENCES

Akila R, Rajendran L, Harish S, Saveeth K, Raguchander T, Samiyappan, R (2011).Combined application of botanical formulations and biocontrol agents for the management of *Fusarium oxysporum* f. sp**.** *cubense* (Foc) causing Fusarium wilt in banana. *Biological Control* **57(3)** : 175-183

Pérez-Vicente L (2004). Fusarium wilt (Panama disease) of bananas: an updating review of the current knowledge on the disease and its causal agent. In. *Memorias de XV Reunion Internacional de ACORBAT (Oaxaca, MX)*. Pp: 1-14.

Raguchander T, Jayashree K and Samiyappan R (1997) .Management of *Fusarium* wilt of banana using antagonistic microorganisms *J Biol Control* **11**: 101-105

Stover R H (1962).Fusarium wilt (Panama disease) of bananas and other Musa species. Kew, UK. *Commonwealth Mycological Institute* 177 p.

Thangavelu R, Sundararaju P, Sathiamoorthy S, Raghuchander T, Velazhahan R, Nakkeeran S, Palaniswami A (2001). Status of Fusarium wilt of banana in India. In: Molina, A.B., Nikmasdek, N.H., Liew, K.W. (Eds.), Banana Fusarium Wilt Management: Towards Sustainable Cultivation. *INIBAP-ASPNET*, Los Banos, Laguna, Philippines, pp. 58– 63.

Received on 15/06/2019 *Accepted on 22/09/2019*