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Research Article

Efficacy of Fungitoxicants in the Management of Leaf Blight (*Phytophthora colocasiae* Raciborski) of Taro (*Colocasia esculenta* (L.) Schott.) in Uttar Kannada, Karnataka, India

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Abstract

Taro (*Colocasia esculenta* (L.) Schott. is an important tuber crop of Uttara Kannada District of Karnataka, India. It is a rich source of carbohydrate, protein, minerals and vitamins. Leaf blight of taro (*Phytophthora colocasiae* Raciborski) is a major biotic stress in the cultivation of taro during monsoon and is widely spread in India. A field trial was conducted to manage the disease with fungitoxicants during 2009-2010 to 2011-2012. Among the six fungitoxicants evaluated against leaf blight of taro, fenamidone 10% + mancozeb 50% (Sectin) @ 0.1% (5.85 PDI) and metalaxyl 4% + mancozeb 64% (Metalaxyl M gold 68 WP) @ 0.25% (9.27 PDI) application twice at 15 days interval were highly effective in control of leaf blight of taro. These two fungicides were statistically on par in their efficacy to control the disease. Bordeaux mixture @ 1% (12.71 PDI) and potassium phosphonate @ 0.3% (13.58 PDI) were on par in reducing the incidence of leaf blight. The maximum disease incidence was noticed in the control (51.28 PDI).
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Keywords: Taro leaf blight, *Phytophthora colocasie*, Fenamidone, mancozeb, Metalaxyl, mancozeb fungicides

Introduction

Taro (*Colocasia esculenta* (L.) Schott), a traditional tuber crop of the tropics is grown for its edible cormels and leaves and is a member of the Araceae family. It is believed to be one of the earliest cultivated tuber crops in the world. According to Food and Agriculture Organisation (FAO) taro production has doubled over the past decades and taro is now the fifth most-consumed tuberous vegetable worldwide (FAOSTAT 2000). Taro is an important tuber crop of Uttara Kannada District of Karnataka, India. The crop is grown for its cormels and leaves in arecanut gardens as mixed crop, kitchen gardens and also in water logged low land areas. Taro leaves are used in preparations of patrode and as vegetable or cormels. It is a rich source of carbohydrate, protein, minerals and vitamins.

Taro leaf blight is caused by *Phytophthora colocasiae* Raciborski, a oomycetous pathogen. Taro leaf blight, the most destructive disease was first reported from Java in 1900 and this disease brought about 30-50% decline in taro cultivation in Solomon Islands, Papua, New Guinea, Philippines, Indonesia, China, Malaysia, Japan, India and countries of Africa and Caribbean islands. In India, taro leaf blight is more prominent in Northern and Eastern

parts, which are potential areas for taro production. Leaf blight has become a limiting factor for taro production in all taro growing countries including India causing yield loss of 25-30% (Misra and Chowdhury, 1997). Pathogen perennates through the mycelium present in seed corms and crop residues and the secondary spread in the fields takes place mainly through sporangia carried to the healthy plants by wind or rain splashes. Small circular brown lesions, brown on the upper surface of leaf, are the first symptoms of the disease. With the advancement of the disease, lesions enlarge and become irregular in shape and dark brown in colour with yellow margin. The infected leaves die within 20 days and yield losses of 30-50% are common during favorable conditions of intermittent rain and cloudy weather (Gadre and Joshi, 2003, Misra et. al., 2007). Management of the disease with the use of non systemic fungicides did not give satisfactory control of the disease which was due to congenial environmental conditions for the disease and peculiar shape and waxy coating of the leaf. Hence, an attempt was made to manage the disease with use of systemic fungicides and bioagent.

Materials and Methods

A field trial was carried out at Horticulture Research Station, University of Horticultural Sciences, Bagalkot, Sirsi, Uttara Kannada District of Karnataka during 2009-2010, 2010-2011 and 2011-2012 for three consecutive years. The region is situated at 516 m above mean seal level. The variety used for the trial was Makkalakesa, a popular variety of the region and it is highly susceptible to the disease. The soil was lateritic with 5.5 to 6.5 pH range. The average rainfall of the region is 2500 mm with 108 rainy days and major monsoon was observed during the months of June, July, August and September which coincides with growth stage of the crop. The relative humidity during the rainy days was ranged from 82% to 100% with temperature around 20^{O}C to 22^{O}C. The climatic conditions were highly conducive for infection, development and spread of the pathogen.

The trial was laid out with eight treatments replicated thrice with RBD design. Size of each plot was 3×1 m with 14 plants. The fungicides applied as spray against *P. colocasiae* were Bordeaux mixture @ 1%, fenamidone (10%) + mancozeb (50%) (Sectin) @ 0.1% , metalaxyl 4% + mancozeb 64% (Metalaxyl M gold 68 WP) @ 0.25%, copper oxychloride (Blitox 50 WP) @ 0.25%, potassium phosphonate @ 0.3%, copper sulphate @ 0.05% and bioagent *Pseudomonas fluorescens* @ 1%. The control was maintained with application of water to affected taro plants. The first spray was given two months after planting with initiation of the disease as leaf spots. The treatments were repeated at 15 days interval. A scale from 0 to 5 was used for assessing the per cent disease index (PDI) for estimation of leaf blight based on the area of lesions covered in the infected leaves, where in 0 grade – No disease, grade 1 -1-10 % disease, grade 2 -11-25% disease, grade 3 -26-50% disease, grade 4 -51-75% disease, grade 5 ->75% disease. A large scale demonstration was conducted further to verify the efficacy of effective systemic fungicide for the management of the disease. Large scale demonstration for management of leaf blight of taro was conducted in an area of 0.5 acres area during 2012-2013 at Horticulture Research Station, Sirsi, Uttara Kannada District, Karnataka, India for conformity of effective fungitoxicants with comparison to recommended check. Two treatments were compared, fenamidone 10% + mancozeb 50% (Sectin) @ 0.1% and mancozeb @ 0.2% which was recommended in package of practice as check with two sprays during monsoon. Standard statistical procedure was followed for the analysis of data (Gomez and Gomez, 1984).

Results and Discussion

All the fungitoxicants and bioagents could check the disease incidence in all three years. During the year 2009-2010, the systemic fungicide fenamidone 10% + mancozeb 50% (Sectin) @ 0.1% as spraying twice at 15 days interval from initiation of the disease resulted in significantly least leaf blight (5.00 PDI) (Table1). This was followed by the metalaxyl 4% + mancozeb 64% (Metalaxyl M gold 68 WP) @ 0.25% and potassium phosphonate @ 0.3% spray(6.33 PDI and 10.33 PDI) respectively. Spraying of 1% Bordeaux mixture and 0.25% of copper oxychloride were on par with each other. Unprotected plants exhibited maximum disease incidence (47.00 PDI) in control.

The same effect was noted in 2010-2011, and 2011-2012 also. Fenamidone 10% + mancozeb 50% (Sectin) continued to show least PDI (6.82 and 5.74) in subsequent years also. This was followed by metalaxyl 4% + Mancozeb 64% (11.07 and 10.40 PDI). Among the contact fungicides 1% Bordeaux mixture was effective in reducing leaf blight incidence. Copper oxychloride @ 0.25%, and copper sulphate @ 0.05% were less effective, in combating the disease. Bioagent *Pseudomonas fluorescens* @ 1% spray twice also reduced the disease incidence (20.83 PDI) as compared to the control where the maximum disease incidence was observed.

Table 1. Management of leaf blight of taro (Pooled 2009-2010, 2010-2011 and 2011-2012)

Treatments No.	Treatments	Per cent disease Index (PDI)			Pooled
		2009-2010	2010-2011	2011-2012	
T1	Bordeaux mixture @ 1% spray	12.00 (20.26)*	13.20 (21.25)	12.93 (20.84)	12.71 (20.88)
T2	Fenamidone (10%) + mancozeb (50 %) (Sectin) @ 0.1% spraying	5.00 (12.88)	6.82 (15.06)	5.74 (12.96)	5.85 (13.97)
T3	Metalaxyl 4% + mancozeb 64% (Metalaxyl gold 68 WP) @ 0.25% spray	6.33 (14.51)	11.07 (19.41)	10.40 (18.61)	9.27 (17.61)
T4	Copper oxychloride (Blitox 50 WP) @ 0.25% spray	15.33 (23.04)	20.55 (26.88)	19.77 (26.33)	18.55 (25.47)
T5	Potassium phosphonate @ 0.3% spray	10.33 (18.69)	13.57 (21.52)	16.85 (23.97)	13.58 (21.53)
T6	*Pseudomonas fluorescens* @ 1% spray	24.67 (29.77)	20.83 (27.10)	20.02 (26.39)	21.84 (27.84)
T7	Copper sulphate @ 0.05% spray	22.00 (27.95)	28.47 (32.22)	22.27 (27.85)	24.25 (29.46)
T8	Control	47.00 (43.27)	55.55 (48.40)	51.30 (45.87)	51.28 (45.74)
	CD (0.05)	**4.10**	**7.32**	**4.73**	**2.99**

*arc sin transformed values

Table 2 Large scale demonstration for management of leaf blight of colocasia during 2012-13

Treatments	Per cent Disease index (PDI)	Yield t/ha	% increase over control
T1 - Fenamidone 10%+ Mancozeb 50% (Sectin) @0.1%	6.23	18.52	61.18
T2- Mancozeb @ 0.2%	22.50	11.49	

Area 0.5 acres

The pooled data of three years indicated that fenamidone 10% + mancozeb 50% (Sectin) @ 0.1% and metalaxyl 4% + mancozeb 64% (Metalaxyl M gold 68 WP) @ 0.25% application twice at 15 days interval were highly effective in managing of leaf blight of taro. The treatment, fenamidone 10% + mancozeb 50% @ 0.1% was superior to all other treatments. potassium phosphonate @ 0.3% and Bordeaux mixture @ 1% were on par in reducing leaf blight incidence. Copper oxychloride @ 0.25% and bioagent *Pseudomonas fluorescens* @ 1% spray twice were statistically on par and less effective in reducing the disease. Copper sulphate @ 0.05% was least effective in checking the disease.

In the large scale demonstration for the management of the leaf blight of taro showed that performance of fenamidone 10% + mancozeb 50% (Sectin) @ 0.1% was superior in reducing leaf blight (6.23 PDI) with yield of 18.52 t^{-ha} as compared to mancozeb @ 0.2% with per cent disease index of 22.50 and yield of 11.49 t^{-ha}. There was 61.18% increasing in yield with systemic fungicide fenamidone 10% + mancozeb 50% (Sectin) @ 0.1% when compared to non systemic fungicide mancozeb @ 0.2% as control.

Scot et al. (2011) reported that taro leaf blight pathogen was managed with applications of fenamidone, metalaxyl and potassium phosphonate as sprays. Maheswari et al. (2001) obtained the best control of *Phytophthora* leaf blight of taro by application of metalaxyl 4% + mancozeb 64% (Metalaxyl M gold 68 WP) @ 0.25% with corresponding increase in corm/cormel yield in taro. Usha Rana et.al. (2007) reported that one hour corm dip in Ridomil MZ (metalaxyl 8% + mancozeb 64%) @ 0.3% before sowing resulted in 46.9 - 50.1% disease control with higher (6.8 t^{-ha}) cormel yield. Further, they confirmed that apart from corm treatment additional three sprays of Ridomil MZ fortnightly resulted in maximum disease control (54.6%) with higher (7.4 t^{-ha}) cormel yield in taro.

From the present investigation it is evident that systemic fungicides viz., fenamidone (10%) + mancozeb (50%) (Sectin) @ 0.1% and metalaxyl 4% + mancozeb 64% (Metalaxyl M gold 68 WP) @ 0.25% application twice as foliar sprays at 15 days intervals were highly effective in the management of taro leaf blight disease.

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