

RESEARCH ARTICLE

Field evaluation of *Rot-fix* for management of root rot disease of mulberry (*Morus* sp.)

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SUMMARY

Mulberry is cultivated throughout India as a host plant of silkworm (*Bombyx mori* L.) reared for commercial production of silk. The quality of silk produced depends largely on the quality of leaf fed to silkworm. Various mulberry diseases limit quality and quantity of silk production affecting the economic return to the farmers. Among these, root rot caused by a group of fungi is a severe threat for mulberry leaf production, especially in southern states of India due to large scale mortality and enormous crop loss. Though many fungi are isolated from the infected root, *Fusarium solani* is the one frequently found associated with the disease. Chemical control with fungicides is not advisable due to the environmental concern and toxicity to the soil and silkworm. Thus, recently a broad spectrum environment friendly formulation viz., *Rot-fix* has been developed by the Central Sericultural Research & Training Institute, Mysore and recommended after limited on-farm and field trials. However its efficiency has not been evaluated at the farmers' level in large scale. The present study has been conducted to evaluate the effect of *Rot-fix* in large scale in four southern states of India. The *Rot-fix* has been applied to the infected plants and their recovery has been studied. There was a high recovery (86.76-91.96%) of the infected plants after application of *Rot-fix*. Though the leaf yield was significantly ($P < 0.01$) lower (2.48%) in the recovered plants in first crop, by the second crop the plants were recovered completely and started giving yield the statistically on par with untreated healthy plants. The study therefore recommends the use of *Rot-fix* in large scale for control of root rot disease of mulberry.

Key Words : Field evaluation, Mulberry, *Rot-fix*, Root rot management

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Root rot is a serious disease of mulberry, occurs throughout the year in all kind of soils. The disease appears in isolated patches in the garden, spread

gradually leads to complete destruction of the plants causing huge crop loss (Pratheesh Kumar *et al.*, 2012). The disease incidence is 10 to 16% in hotspot areas of Karnataka (Philip *et al.*, 1997) with 15 % loss (Mallikarjuna *et al.*, 2010 and Qadri *et al.*, 2005). Maximum root rot incidence of 55.00% and 24.33% was reported in V₁ and MR₂, respectively (Rajeswari and

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Angappan, 2018). Though *Fusarium solani* (Philip *et al.*, 1995, Sharma *et al.*, 2003 and Manomohan and Govindaiah, 2012), *Fusarium oxysporum* (Beevi and Qadri, 2010 and Mallikarjuna *et al.*, 2010) *Macrophomina phaseolina* (= *Rhizoctonia bataticola*) Muthuswamy, 2011) are reported to be associated with the disease *F. solani* is the one frequently isolated. Though several methods by use of chemicals and plant based products are available, for management of the disease, growing concerns about health and environmental safety, the use of toxic, environmentally damaging chemicals are being discouraged. Thus, recently a broad spectrum environment friendly formulation *viz.*, *Rot-fix* has been developed by Central sericultural Research and Training Institute, Mysore with limited farm and on-farm trials (Pratheesh Kumar, 2019) and recommended for control of the disease. However the formulation has not been evaluated across mulberry growing areas of southern India. The present study has been conducted to evaluate the effectiveness of *Rot-fix* to control root rot disease in four mulberry growing states of Southern India and also assess the impact of application of *Rot-fix* on the leaf yield of mulberry.

MATERIAL AND METHODS

The experiment was conducted during the years 2017-2019 at four southern states of India *viz.*, Karnataka, Tamil Nadu, Andhra Pradesh and Telangana. The farmers were selected in consultation with the Sericulture Extension Officer of concerned area. A total of 538 farmers were covered under this study were selected from 32 villages of 4 states. Of these 126 farmers were from 7 villages of Karnataka, 209 farmers were from 11 villages of Tamil Nadu and 128 farmers of 9 villages from Andhra Pradesh and 75 farmers were from 5 villages of Telangana. The root rot infected mulberry plants showed different degree of infection.

The *Rot-fix* a plant based powder formulation has been prepared in the laboratory following standard procedures. The application of *Rot-fix* for infected plants was done following recommended procedure (Pratheesh Kumar *et al.*, 2017). The infected plants were cut one foot above the ground level. The soil around collar region is removed up to a depth of 15-20 cm. The *Rot-fix* was added in water @10 g per 2 liter of water and mixed well. The mixture is then poured on the cut stump so as to completely drench the stump. Immediately the soil was put in place and pressed firmly. The *Rot-fix* applied

plants were then tagged for further observation. The data on recovery of mulberry plants was taken one month after application of the *Rot-fix*. Total number of plants recovered among total number of infected plants applied with *Rot-fix* was observed and percentage was calculated.

The yield data was recorded from selected three villages from each state. Similarly three mulberry gardens from each selected villages was considered. A total of 10 mulberry plants were earmarked from each selected mulberry garden. The standing crop during the application of *Rot-fix* was not considered for collection of yield data as the infected plants are pruned for *Rot-fix* application. The data was collected from the immediate next two crops. For collection of yield data the plants applied with *Rot-fix* were tagged and also an equal number of healthy plants were also tagged. The yield data was recorded 60 days after pruning of the plants. The number of leaves leaving first four tender leaves was counted from each branch. The leaves were harvested and total leaf weight was recorded. The data on number of leaves and leaf yield from recovered and healthy plants as well as difference in leaf yield in the first and second crop of recovered plants and healthy plants were subjected for paired *t*-test and the means were compared for significance.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Effect of *Rot-fix* on disease control

A total of 538 farmers from 32 villages of 4 states were covered in this study. Of these 126 farmers from 7 villages were of Karnataka, 209 farmers from 11 villages of Tamil Nadu, 128 farmers from 9 villages of Andhra Pradesh and 75 farmers from 5 villages of Telangana. The total area covered was 2224 acre. Of this 4.8 acre was from Karnataka, 7.75 acre from Tamil Nadu, 5.89 acre from Andhra Pradesh and 3.8 acre from Telangana. A total of 2234 plants with an average of 319.14 plants per village were treated in Karnataka, 3274 with an average of 297.63 plants per village in Tamil Nadu, 2607 plants with an average of 289.66 plants per village and 1450 plants with an average of 290 plants were treated with *Rot-fix* in Telangana.

In various villages of Karnataka, among 2234 plants

treated 1976 (91.96%) plants were recovered. In case of Tamil Nadu, of 3274 plants treated, 2929 plants were recovered with an average recovery of 89.34%. Similarly in case of Andhra Pradesh, of the 2607 plants treated, 2282 plants were recovered with average recovery of 86.76%. Likewise in Telangana of 1450 plants treated,

1263 plants were recovered with an average disease control of 87.06% (Table 1).

Impact of *Rot-fix* application on yield of mulberry:

The data was collected from selected three villages of each state and three farmers from each village. A

Table 1: Effect of *Rot-fix* for control of root rot disease of mulberry in various states

Name of the state	Village	Farmers covered (No.)	Avg area covered (acre)	Total plants treated (No.)	Avg. plants treated/ farmer (No.)	Plants recovered (No.)	Disease control (%)
Karnataka	Lingasugur	21	0.72	332	15.81	304	91.57
	Sahapur	21	0.74	348	16.57	301	86.49
	Doddalahalli	16	0.56	341	21.31	309	90.62
	Thoreshattahalli	14	0.81	361	25.79	316	87.4
	Bidurkottai	18	0.51	324	18.00	286	88.27
	Bevoor	16	0.82	250	15.63	216	86.40
	KM Doddi	20	0.64	278	13.90	244	87.77
	Total/ average	126	4.80	319.14	20.73	286	91.96
Tamil Nadu	Udumalaipettai	18	0.56	321	17.83	302	94.08
	Dhamapuram	21	0.86	316	15.05	296	93.67
	Pollachi	18	0.74	288	16.00	256	88.89
	Madathukulam	17	0.54	301	17.71	283	94.02
	Gopichettipalayam	16	0.62	320	20.00	268	83.75
	Samayanallur	21	0.68	252	12.00	219	86.90
	Avinashi	21	0.72	332	15.81	304	91.57
	Berigai	19	0.71	321	16.89	276	85.98
	Trichy	22	0.69	288	13.09	264	91.67
	Srivilliputhur	17	0.72	274	16.12	243	88.69
	Alangayam	19	0.91	261	13.74	218	83.52
	Total/ average	209	7.75	3274	15.840	2929	89.34
	Andhra Pradesh	Palamnar	16	0.56	382	23.88	364
Kadappa		16	0.45	399	24.94	361	90.48
Eluru		14	0.86	285	20.36	246	86.32
Penukonda		12	0.51	240	20.00	189	78.75
Madakasira		16	0.82	288	18.00	242	84.03
Anantapur		12	0.92	240	20.00	204	85.00
Rayachotty		12	0.56	217	18.08	198	91.24
V.Kota		18	0.72	360	20.00	319	88.61
Markapur		12	0.49	196	16.33	159	81.12
Total/ average		128	5.89	2607	20.176	2282	86.76
Telangana	Vikarabad	18	0.96	324	18.00	304	93.83
	Nalkonda	16	0.92	318	19.88	268	84.28
	Metpally	14	0.58	321	22.93	276	85.98
	Suryapet	11	0.72	219	19.91	196	89.50
	Shadnagar	16	0.62	268	16.75	219	81.72
	Total/ average	75	3.8	1450	19.493	1263	87.06

total of 10 mulberry plants were selected and earmarked from each selected farmers' field. The yield data in terms of number of leaves and total leaf yield (g) were collected in each case and also similar observation was made in case of healthy plants of same mulberry garden. This observation was made in two consecutive crops after application of *Rot-fix*. The number of leaves was found significantly ($P<0.01$) higher on the healthy plants than the plants recovered after application of *Rot-fix* in all the states 1st crop with an average of 202.99 leaves per healthy plants against 187.08 in plants revived after *Rot-fix* application. Similarly, in case of leaf yield/ plant in 1st crop, there was significant ($P<0.01$) difference between yield in healthy plants and recovered plants with significantly higher with average of 717.93g against 699.67g in case of plants recovered after application of *Rot-fix*. Data collected in the 2nd crop from the same plants did not show significant difference in number of leaves or the leaf yield. In the second crop, average number of leaves per plant was found 199.8 in case of healthy plants were statistically on par with the average number of leaves obtained (195.95) in plants recovered after application of *Rot-fix*. Similarly, there was no significant difference observed between the yield obtained from the healthy plants and plants recovered after application of *Rot-fix*. The average yield of the healthy plants in the second crop was 715.62 g/plant was statistically on par with the average yield 709.87g per

plants obtained from plants recovered after application of *Rot-fix* (Table 2).

The average yield difference between healthy plant and plants recovered after application of *Rot-fix* was 18.26 in the 1st crop was significant ($P<0.01$) with 2.48% less yield in recovered plants. However, the yield difference (5.96 g/ plant) between healthy plants and recovered plants in the 2nd crop was statistically on par with deduction of only 0.76% in recovered plants (Fig.1 and 2).

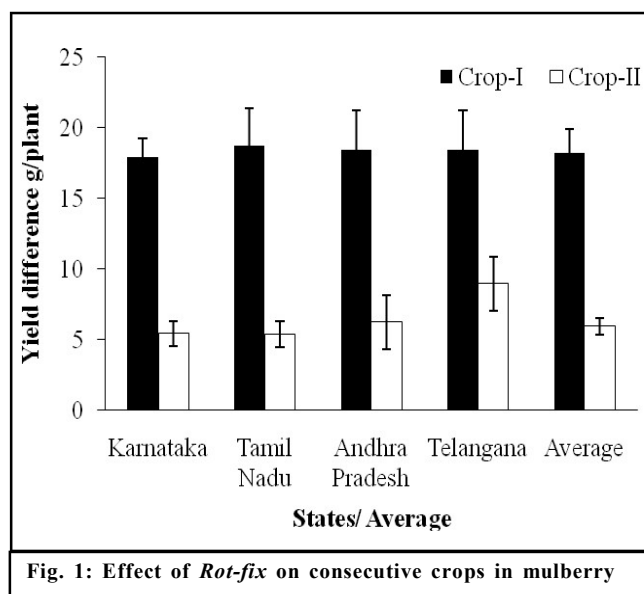


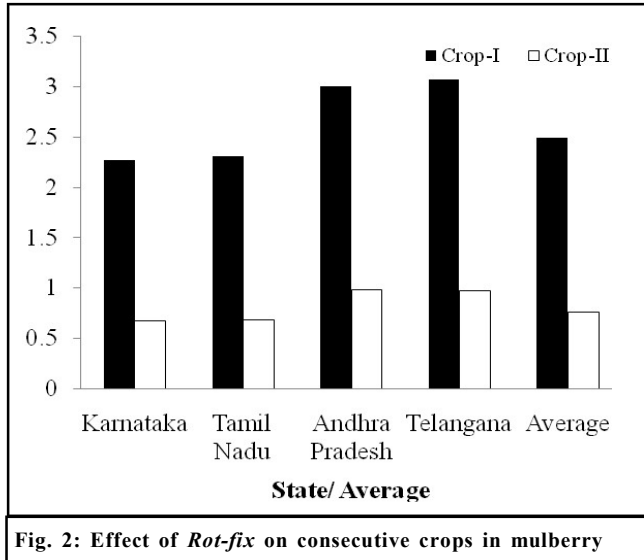
Fig. 1: Effect of *Rot-fix* on consecutive crops in mulberry

Table 2: Effect of application of *Rot-fix* on yield of mulberry

States		Crop-I				Crop-II			
		Leaves/ plant (No.)	Leaf yield/plant (g)	Leaves/ plant (No.)	Leaf yield/plant (g)	Leaves/ plant (No.)	Leaf yield/plant (g)	Leaves/ plant (No.)	Leaf yield/plant (g)
Karnataka	Mean	211.74	196.15	810.38	792.45	209.86	206.17	808.07	802.66
	t value		4.10		32.48		0.71		16.13
	P<0.01		**		**		NS		NS
Tamil Nadu	Mean	202.97	186.78	795.07	777.16	201.10	197.22	792.75	787.36
	t value		32.42		42.94		0.70		0.31
	P<0.01		**		**		NS		NS
Andhra Pradesh	Mean	201.75	186.09	644.53	625.78	197.02	192.93	642.22	635.98
	t value		29.68		22.53		0.96		0.46
	P<0.01		**		**		NS		NS
Telangana	Mean	195.48	179.29	621.75	603.28	191.22	187.49	619.44	613.48
	t value		32.42		21.19		0.69		0.33
	P<0.01		**		**		NS		NS
Pooled Average	Mean	202.99	187.08	717.93	699.67	199.8	195.95	715.62	709.87
	t value		20.58		62.99		63.74		30.25
	P<0.01		**		**		**		**

NS- Not significant, Mean of 10 farmers from each state

** indicate significance of value at P=0.01



The root rot is one of the major diseases of mulberry causing colossal loss. *Rot-fix* developed for control of root rot disease was found highly effective to recover the infected plants. Though the yield in the recovered plants is significantly less compared with the healthy plants in the 1st crop after application of the *Rot-fix*, the plants showed leaf yield similar on par with the healthy plants by 2nd second crop. This shows that the plants could completely recover due to the application of *Rot-fix* within 2 crops. The plants took certain time after application to repair the root system and to perform its normal function. The *Rot-fix* is therefore found highly effective and could be used widely in southern India against the root rot disease of mulberry.

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