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IATROGENIC EFFECT OF CITRUS DISEASE MANAGEMENT WITH SYSTEMIC FUNGICIDE

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ABSTRACT

Citrus species are affected by a number of diseases in north eastern hilly (NEH) region, which affect the vegetative growth adversely resulting in low yields. An experiment was laid out with 2 years old khasi mandarin *(C. reticulata)* and rough lemon *(C. jambhiri)* seedlings, to study the effect of citrus disease management on growth parameters under protected and unprotected conditions. Protected plants were given foliar sprays of captafol @ 0.2% a.i. during the first year and carbendazim @ 0.05% a.i. during second year. Application was made twice at 15 days interval coinciding with the emergence of new flushes. Results indicated significant increase in the stem girth, stem height, plant canopy, branch length, twig length, and number of twigs over the unprotected plants both in khasi mandarin and rough lemon during the first year. The intensity of citrus scab which is the most predominant foliar disease in the region remained negligible 0.4% and 1.2 % in protected as compared to 38.5% and 45.7% in unprotected Khasi mandarin and rough lemon plants respectively. However, during the second year no significant difference in growth parameters was recorded between protected and unprotected rough lemon plants. The protected plants of both the species remained almost free from scab, powdery mildew and anthracnose but severe infection of leaf spot caused by *Alternaria citri* was observed on protected rough lemon plants resulting in severe defoliation and die back. Leaf spot severity and twig die-back was found much higher in protected (24.5% and 58.3%) than in unprotected (9.3% and 29.0%) rough lemon plants. However, this leaf spot was not recorded in Khasi mandarins.

INTRODUCTION

Citrus species are affected by number of diseases in NEH region due to conducive weather affecting the vegetative growth adversely resulting in low yields. Amongst the fungal foliar diseases, citrus scab *(Elsinoe fawcettii)*, powdery mildew *(Acrosporium tingitaninum = Oidium tingitaninum)*, anthracnose / twig die back *(Colletotrichum gloeosporioides)* are most

prominent diseases on Khasi mandarins *(Citrus reticulata)* and rough lemon *(C. jambhiri)*. For the management of different foliar diseases, efficacy of systemic carbendazim fungicide alone and alternate sprays of carbendazim and captafol was assessed for the growth rate of Khasi mandarin and rough lemon seedlings.

MATERIALS AND METHODS

Two year old seedlings of Khasi mandarin and rough lemon were maintained under two sets of conditions viz., protected and unprotected. During first year studies under protected conditions seedlings were protected by spraying carbendazim @ 0.05% followed by captafol @ 0.2% after 15 days on new flushes, (March, June and September) where as in second set, two sprays of carbendazim @ 0.05% were given at 15 days interval. No fungicidal application was given to the unprotected plants.

Growth parameters viz., stem girth, stem height, plant spread (width in NS & E-W direction) were recorded. Four branches in each direction were marked to record the observation on branch length. Two twigs in each branch were selected to observe the twig growth and number of leaves on each twig. Total number of twigs on each branch were also recorded. Growth increase with respect to girth, height, plant spread, branch and twig length were calculated with the following formula.

$$\text{Growth increase (\%)} = \frac{\text{Final measurement} - \text{initial measurement}}{\text{Initial measurement}} \times 100$$

RESULTS AND DISCUSSION

Results indicated that growth rate with respect to different parameters in protected plants of khasi mandarin and rough lemon was much higher than unprotected plants of both the citrus species during the first year when carbendazim was applied with alternate sprays of captafol (Table 1). Growth rate in Khasi mandarin varied from 93.7 to 231.3 which exhibited better effect of disease management than rough lemon where growth rate varied from 82.6 to 238.5. However, number of twigs in unprotected seedlings of both the citrus species were much more than protected plants. It may be attributed to the death of growing tips of shoots leading to the emergence of numerous lateral shoots resulting in russetting bunching type of appearance. The intensity of scab *(Elsinoe fawcettii)* and powdery mildew was found negligible in protected as compared to unprotected plants of both the species. In case of rough lemon, disease intensity was slightly higher than Khasi mandarin.

During second year, Khasi mandarin plants exhibited higher growth rate in protected than the unprotected plants, though the growth rate was of lower order than the previous year. But in case of rough lemon, no difference in growth rate was recorded between protected and unprotected sets of plants (Table 2). Stem girth and plant spread were higher in the unprotected plants than the protected plants which necessiated the comparison of disease severity to find out the reasons.

The comparison of disease severity revealed that protected plants of both the species remained almost free from scab, powdery mildew and anthracnose, but a severe infection of

leaf spot caused by *Alternaria citri* was observed on rough lemon plants. The intensity of disease as leaf spot on leaves and die back of twigs was almost two times higher in protected (24.5% and 58.35%) than in unprotected (9.3% and 29.0%) rough lemon plants. However, Khasi mandarin plants remained free from this disease. Higher disease severity of *Alternaria* blight on carbendazim protected plants as compared to unprotected plants indicating iatrogenic effect of disease management with selective systemic fungicide against pathogens not effective against other groups of fungi like *Alternaria* which attained higher disease severity in protected plants. Such iatrogenic effects have also been reported either in resistant varieties bread against a serious disease but exhibiting susceptibility to other pathogens otherwise of minor importance in the crop. Apple variety Liberty has been produced to possess multiple disease resistance against apple scab, fire blight and rust, but new growth flushes have been observed highly susceptible to *Alternaria* blight under Himachal conditions (personal observation). The use of Ridomil (metalaxyl) as spray or seed treatment for the control of downy mildew and white rust have been found to increase the severity of *Alternaria* leaf blight disease on toria, yellow sarson and mustard. It has been further reported that *Alternaria brassicola* and *A. brassicae* grew luxuriantly and sporulated profusely on the metalaxyl amended medium exhibiting an iatrogenic effect of disease management with metalaxyl (Sawant and Kolte, 1985). Soil application of benomyl have been reported to increase the severity of non sensitive *Alternaria* leaf spot of carnation (Smith *et. al*, 1970). Steeping of sugar cane setts for 15 minutes in 0.1% Bavistin stimulated the infection of Sclerotium rolfsii causing bud rot (Singh *et. al.*, 1984).

Plant protection schedule for citrus species should include broad spectrum fungicides besides effective systemic fungicides, to avoid the resurgence of minor pathogens like *Alternaria* due to iatrogenic effect. Continuous monitoring of pathogenic population should be considered before recommendation of plant protection schedule for orchard disease management.

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Table 1. Effect of disease management on growth parameters of Khasi mandarin and Rough lemon

Growth	Khasi mandarin						Rough lemon					
Parameter	Protected			Unprotected			Protected			Unprotected		
	Initial Measure Ment	Final measurem ent	Increase (%)	Initial measurem ent	Final measurem ent	Increase (%)	Initial measurem ent	Final measurem ent	Increase (%)	Initial measurem ent	Final measurem ent	Increase (%)
Stem girth (cm)	7.3	15.2	109.4	7.3	12.7	73.4	8.5	17.7	107.3	8.5	17.1	100.9
Stem height (cm)	96.9	207.0	113.6	105.4	163.0	54.6	83.4	182.8	121.8	86.8	191.6	20.7
Canopy width (cm)	51.1	99.0	93.7	56.8	84.6	48.8	79.4	145.0	82.6	87.5	129.5	48.0
Number of twigs	18.6	144.8	-	15.6	206.4	-	25.2	120.4	-	19.8	163.0	-
Branch length	31.9	69.9	118.0	33.2	71.1	114.4	39.2	86.1	119.4	33.8	72.7	114.8
twig length	13.1	43.5	231.3	15.4	32.7	113.1	14.2	48.0	238.5	14.1	40.3	186.1
No. of Leaves/twig	8.6	70.9	-	9.3	47.6	-	7.1	39.5	-	6.7	30.9	-
Scab (PDI)		0.4			38.5			1.2			45.7	

Table 2. Comparison of growth parameters in protected (carbendazim) and unprotected on Khasi mandarin and Rough lemon plants

Growth parameters	Khasi mandarin		Rough lemon	
	Protected	unprotected	Protected	Unprotected
Stem girth*	86.5	73.6	40.3	46.3
Stem height*	58.4	51.4	42.7	36.7
Canopy width*	48.6	33.9	23.7	42.3
Branch length*	87.1	74.5	28.3	26.8
Twig length*	61.5	47.5	18.2	15.4
Number of twigs	21.8	29.4	38.0	42.0
No. of leaves/twig	128.7	65.1	24.0	19.0

* Percent increase over the previous growth

Table 3. Comparison of disease severity in protected (carbendazim) and unprotected rough lemon plants.

Disease	Protected	Unprotected
Leaf spot *(Alternaria citri)*	24.5%	9.3%
Shoot infection *(Alternaria citri)*	58.3%	29.0%
Scab *(Elsinoe fawcettii)*	2.8%	52.6%
Powdery mildew *(Oidium tingitaninum)*	1.8%	56.0%