Technological Impact of Phytopthora Management Practices in Mandarin

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ABSTRACT

The present study entitled "Technological Impact of Phytopthora Management Practices in Mandarin" was carried out as research review Committee Project in Nagpur district of Vidarbha region in Maharashtra state. A total sample of 120 respondents were selected (60 Beneficiary mandarin growers and 60 non beneficiary mandarin growers). The six villages from Narkhed, Katol and Higanatahsil namely Khapri (Kene) , Rohana, Ridhora, Khandala,Sawangi and Mandavghorad, respectively were selected for the present study.

Narkhed,Katoland Higana tahsil was purposively selected as there was maximum number of mandarin growers and under TOT RKVY project, beneficiary farmers were provided with the phytopthora control technology from the College of Agriculture, Nagpur. Phytotpthora management practices TOT RKVY project had significant technological impact of 29.31 per cent on beneficiary farmers in terms of per cent change tree canopy (27.74), gum oozing(29.82), fruiting (32.87),fruit drop(34.71), fruit quality (28.34)and yield (22.77) from mandarin crop over non beneficiary farmers which were significantly higher than the non-beneficiaries of TOT RKVY project. Z values of technological impact highly significant at the 0.01 level of probability

Keywords:Technological Impact, Phytopthora Management Practices, Mandarin

INTRODUCTION

Citrus fruits have a prominent place among popular and extensively grown tropical and subtropical fruits. This is occupying two-third of the world total area. Citrus possess greater adoptability to different climatic conditions. Among Citrus group, Mandarin (Citrus reticulata) is world's leading fruit crop. It is also known as fancy fruits and eaten as desert fruit. It was originated in China and has been cultivated in China and Japan over long period.

The Mandarin of 'Vidarbha region' is known as 'Nagpur Mandarin' throughout the India. There is historical background behind its name. At the end of 18th century, Maharaja Raghuji Bhosale brought few plants of lose skinned Oranges from Aurangabad and planted in his garden at Nagpur. These plants under the soil and water condition of Nagpur and other Vidarbha region like Nagpur, Amravati, Akola etc. grows very well and produces fruits of excellent quality. Since then Orange cultivation has earned an important place in horticultural economy of Vidarbha. Mandarin is a glorious natural gift to the Vidarbha region. The Nagpur Mandarin has earned fame and name in country for its exceptional quality. Hence, Nagpur has created its own status as 'Orange city' throughout the India.

Mandarin is one of the important fruit crop of MH state. The Mandarin is grown in humid tropical Vidarbha region of Maharashtra State where summer temperature reaches as high as 45°c to 46°c. It occupies 2nd position in terms of area and 3rd position in terms of production of fruit crops in India. It occupies an area of 107.32 thousand ha. The total production of Mandarin is 797.95 thousand MT and average yield is 7.43 MT per ha. At present the cultivation of the Orange is mostly concentrated in five districts namely Nagpur, Amravati, Wardha, Yavatmal, and Akola (Ministry of Agriculture, GOI 2017-18). In Vidarbha, the Nagpur district has 31.45 per cent area under Mandarin cultivation. The total area under Mandarin cultivation in Nagpur district is 25882.84 ha. and total production is 132553.85 MT.

But from last some years Mandarin growers struggles against the Phytopthora disease or Dinkya in local language. It results severe losses in the production and quality of Mandarin fruit. Phytopthora is the major disease in recent years in Nagpur district. This disease affects on the plants of Mandarin and due to this there were much more economical loss of Mandarin growers.

Phytopthorais most destructive pathogen of Mandarin trees. It had been causing severe crop losses to Mandarin orchards much before its discovery in real scientific terms. Anton de Bary discovered the fungus as Phytopthora means "plant destroyer". The first appearance of Phytopthoraepidemic was reported in Azore Island during 1832-1836. Then Phytopthoraepidemics of citrus were reported in 1841 from France and in 1845 from Portugal. An extensive survey of citrus orchards and citrus nurseries in India has been conducted under National Network Project on Phytopthporadisease of Horticulture crops (Citrus) funded by ICAR during 1997-2002. Citrus cultivation belt of Vidarbha and Marathwada region of Maharashtra, Punjab, Madhya Pradesh, Andhra Pradesh and NE states of India were surveyed to assess the impact of Phytopthoradiseases. In this survey, Phytopthora parasitica have been recorded from the orchards of Mandarin in Nagpur district.

Phytophthoraspp. is the causal agent of several serious diseases of citrus in India. Phytophthoraparasitica, P. citrophthora and P. palmivora have been mostly involved in causing damping off, collar rot and root rot in Mandarin. However, Phytophthora parasitica and P. palmivora are the most prevalent species in Mandarin orchards of Nagpur region. It remains a threat and a persistent problem wherever Mandarin is grown that can result in substantial tree loss particularly trees on susceptible rootstock. Supply of poor quality sampling may result in foot rot, root rot or gummosis in orchard. These are the most important soil borne diseases of Mandarin causing mortality of newly planted trees and a slow decline and yield loss of mature trees. Epidemics of Phytophthora on heavy black cotton soils play an important role in Mandarin root stock failure. Hence, Phytopthoradisease management is very important.

Keeping in this view, the present study is framed and conducted in Nagpurdistrict to assess the technological impact of Phytopthoramanagement practices on Mandarin growers.

Need and importance of the study

Mandarin is the major fruit crop of Vidarbha region in Maharashtra State and Nagpur is popular as name Orange city but in recent years Mandarin growers are faces criticism of Phytopthora disease.

To overcome the attack of Phytopthora, there was University recommended package of management practices which was given through the Extension Education Section, College of Agriculture, Nagpur under the TOT RKVY since 2016-17 and farmers were trained to adopt management practices to control of Phytopthora disease of Mandarin by University Scientists.

Thus, it is need to study the technological impact of Phytopthoramanagement practices on the Mandarin growers and ascertain the constraints faced by them during adoption and implementation of the Phytopthora management practices.

METHODOLOGY

The present study was conducted in Narkhed,Katoland Higanatahsil of Nagpur district in Maharashtra state. Six villages namely Khapri (Kene) and Rohana from Narkhedtahsil,Ridhora and Khandala from Katol tahsil and Sawangi and Mandavghorad from Higanatahsil were selected puposively. From these villages,60 Beneficiary mandarin growers and 60Non-beneficiary mandarin growers were selected purposively.

An experimental design of social research was used in the present study as Technological Impact of phytopthoraManagement practices in mandarin in Nagpur District was ascertain among beneficiary and non beneficiary Mandarin growers.

RESULTS AND DISCUSSION

The detail research report with all the relevant data have been furnished herewith.

Technological impact

As stated in preceding chapter of methodology that technological impact of Phytotpthoramanagement practices in Mandarin organized under the TOT RKVY project has been studied in different parameters i.e. change in tree canopy, change in gum oozing, change in fruiting/fruit drop change in fruit quality and change in yield of the Mandarin tree. The responses of the beneficiaries and non-beneficiaries were recorded. Findings of parameters of the technological impact were presented as follows.

1) Tree canopy

Due to Phytopthoramanagement improvement in growth observed in tree canopy of Mandarin tree in terms of growth in stems, leaves and branches are presented in Table 1.

Table 1
Distribution of the respondents according to tree canopy

Sl. No.	Particulars	Beneficiaries (N=60)			Non-beneficiaries (N=60)		
		GI	SI	NI	GI	SI	NI
a	Stem	39 (65.00)	18 (30.00)	03 (05.00)	27 (45.00)	22 (36.67)	11 (18.33)
b	Branches	40 (66.66)	19 (31.66)	01 (01.66)	29 (48.33)	19 (31.66)	12 (20.00)
c	Leaves	40 (66.66)	19 (31.66)	01 (01.66)	31 (51.67)	16 (36.67)	13 (21.66)
	Mean Index	**81.85**			**64.07**		

(Figures in parenthesis indicate percentage)

GI- Growth improvedSI- Started to improveNI- Not improved

From Table 1, it was observed that the majority of beneficiaries were found improvement in the growth of stems (65.00%), branches (66.66%) and leaves (66.66%) followed by nearly one third of the beneficiary respondents perceived that stems (30.00%), branches (31.66%) and leaves (31.66%) were started to improve as an effect of Phytopthora management treatments. While non beneficiaries whatever treatment conducted on their own found improvement in growth of leaves (51.67%), stem (45.00%), and branches (48.00%), while 36.67, 31.66 and 36.67 per cent non beneficiaries were found started in improvement of stem, branches and leaves of Mandarin crop, respectively.

From the findings it could be surely stated that, Phytopthoramanagement practices had greater influence on the tree canopy of Mandarin plant. Improvement in growth of stem, branches and leaves of Mandarin crop.

The application of FYM, NPK, micronutrients as per recommendations gives significant results to the Mandarin growers. The results as perceived by the beneficiaries of TOT RKVY, canopy volume increased significantly due to proper irrigation schedule, timely fertigation of micronutrients and fertilizer application.

Therefore, from the findings it was concluded that majority of beneficiaries acquired more growth improvement in tree canopy of Mandarin plants than non beneficiaries. Obtained results show positive impact of Phytopthora management demonstration on the orchards of beneficiaries as perceived by them.

2) Gum oozing

Control over the bleeding of gum which ooze out from the Mandarin tree due to implementation of Phytopthoramanagement practices under TOT RKVY project is presented in Table 2.

Table 2
Distribution of the respondents according to gum oozing

Sl. No.	Particular	Beneficiaries (N=60)			Non-beneficiaries (N=60)		
		FC	PC	NC	FC	PC	NC
a	Gum oozing	41 (68.34)	16 (26.66)	03 (05.00)	28 (46.67)	16 (26.67)	16 (26.66)
	Mean Index	**82.22**			**63.33**		

(Figures in parenthesis indicate percentage)

FC- Fully controlledPC- Partially controlledNC- Not controlled

It is shown in Table 2, that 68.34 per cent beneficiaries observed that their Mandarin crop get fully control over the gum oozing, followed by 26.66 per cent beneficiaries get partial control over gum oozing due to Phytopthoramanagement practices, while least number of beneficiaries (5.00%) couldn't found control over gum oozing in their Mandarin orchards. In case of non-beneficiaries it was found that 46.67 per cent respondents get full control over the gum oozing, followed by equal percentage (26.67% & 26.66%) of Mandarin growers get partial control and didn't get control over the gum oozing in their Mandarin orchards.

Efficacy of fosetyl-Al and metalaxyl was worked more effectively with the COC, Bordeaux mixture and Bordeaux paste for management of gum oozing in Mandarin. Pasting of metalaxyl and fosetyl-Al to the stem of Mandarin could have positive effect, and gum oozing found stopped. Next effective treatment to reduce the disease attack was spraying of metalaxyl and fosetyl-Al as per the recommendations; it imparts good results to the beneficiaries of TOT RKVY project. Treatment of these recommendations was imparted significant reduction in gum oozing index of Mandarin plants, accordingly reduction in disease index.

Under the TOT RKVY project full kit of management practices was provided to reduce attack of Phytopthoradisease and also the information about application schedule of these practices was given by the concerned authority to the beneficiaries of project through training and other extension activities.

From the results it was concluded that the gum oozing of beneficiaries Mandarin crop was significantly controlled over non beneficiaries crop as an effect of treatments provided through the demonstration of Phytopthora management.

3) Fruiting

Findings of fruiting and fruit drop in the Mandarin orchards were presented in Table3.

Table 3
Distribution of the respondents according to fruiting

Sl. No.	Particulars	Beneficiaries (N=60)			Non-beneficiaries (N=60)		
1	Fruiting	I	LBI	NI	I	LBI	NI
		40 (66.67)	17 (28.33)	03 (05.00)	26 (43.34)	21 (35.00)	13 (21.66)
	Mean Index	**80.83**			**60.83**		

(Figures in parenthesis indicate percentage)

I- Improved LBI- Little bit improved NI- Not improved

According to the data presented in Table 3, it is revealed that 66.67 per cent beneficiaries noted the improvement in fruiting. It was followed by 28.33 per cent beneficiaries who acquired little bit improvement in fruiting, only 5.00 per cent beneficiaries didn't acquired improvement in fruiting in their Mandarin orchards.

In the case of non-beneficiaries, it was found that the equal percentage (43.34 %) of Mandarin growers attained improvement in fruiting. While 35.00 per cent Mandarin growers attained little bit improvement in the fruiting, further it is noted that one fifth of the non beneficiaries (21.66%) didn't attained any improvement in fruiting in their Mandarin orchards.

It was concluded that majority of beneficiaries get significant increase in fruiting in Mandarin orchards over the non beneficiaries.

4) Fruit drop

Findings of fruiting and fruit drop in the Mandarin orchards were presented in Table 4.

Table 4
Distribution of the respondents according to fruit drop

Sl. No.	Particulars	Beneficiaries (n=60)			Non-beneficiaries (n=60)		
1	Fruit drop	**FC**	**PC**	**NC**	**FC**	**PC**	**NC**
		40 (66.67)	17 (28.33)	03 (05.00)	26 (43.34)	20 (33.33)	14 (23.33)
	Mean Index	**80.83**			**60.00**		

(Figures in parenthesis indicate percentage)
FC- Fully controlledPC- Partially controlledNC- Not controlled

According to the data presented in Table 4, it was revealed that 66.67 per cent beneficiaries obtained control over the fruit drop in their Mandarin orchards. It was followed by 28.33 per cent beneficiaries have partial control over the fruit drop, only 5.00 per cent beneficiaries didn't obtained control over the fruit drop in their Mandarin orchards.

In the case of non-beneficiaries, it was found that the 43.34 per cent of Mandarin growers attained improvement in fruiting and control over the fruit drop. While one third (33.33%) Mandarin growers obtained partial control over the fruit drop, further it is noted that above one fifth of the non beneficiaries (23.23%) non beneficiaries could not get control on the fruit drop in their Mandarin orchards.

To control the pre-harvest fruit drop in Mandarin, application of fungicides like benomyl is recommended to the Mandarin orchards. These fungicides have great influence on control of fruit drop. Beneficiaries of project applied these fungicides in their orchards and it was gives benefits in control of fruit drop, reducing disease attack and accordingly resulted in increasing the fruiting of Mandarin.

It was concluded that majority of beneficiaries get significant control of the fruit drop in Mandarin orchards over the non beneficiaries.

5) Fruit quality

Impact of Phytopthoramanagement practices on fruit quality of the Mandarin tree was described in terms of size of fruit increased, skin colour of fruit, keeping quality of fruit and juice. The findings of these parameters presented in Table 5.

Table 5
Distribution of respondents according to fruit quality acquired

Sl. No.	Particulars	Beneficiaries (N=60)			Non-beneficiaries (N=60)		
1	Size of fruit increased	Yes		No	Yes		No
		52 (86.66)		08 (13.34)	33 (55.00)		27 (45.00)
2	Skin colour of fruit	I	LBI	NI	I	LBI	NI
		44 (71.66)	13 (21.66)	03 (05.00)	29 (48.33)	21 (35.00)	07 (11.67)
3	Keeping quality of fruit	36 (60.00)	15 (25.00)	09 (15.00)	25 (41.66)	20 (33.34)	15 (25.00)
4	Juice Quantity	38 (63.34)	16 (26.66)	06 (10.00)	27 (46.67)	23 (37.77)	10 (15.56)
5	Juice Quality	36 (60.00)	17 (28.33)	07 (11.67)	24 (40.00)	24 (40.00)	12 (20.00)
	Mean Index	**78.27**			**60.98**		

(Figures in parenthesis indicate percentage)
I- ImprovedLBI- Little bit improvedNI- Not improved

Size of fruit

From the Table 5, it is revealed that the greater majority of beneficiaries (86.66 %) noted the increase in size of Mandarin fruit, however 13.34 per cent non-beneficiaries did not obtained increase in size of fruit. Whereas, 55.00 per cent non-beneficiaries obtained the increase in fruit size whatever they adopted the treatment on their own while 45.00 per cent non-beneficiaries did not obtained the increase in fruit size.

Skin colour of fruit

It is also indicated from Table 5, that near about three fourth of beneficiaries (71.66%) acquired the improvement in the skin colour of Mandarin fruits as an effect of demonstration, while in the orchards of 21.66 per cent beneficiaries skin colour of fruits was little bit improved and 5.00 per cent beneficiaries did not obtained improvement in skin colour of fruits. Nearly half of the non beneficiaries i.e. 48.33 per cent acquired the improvement in skin colour of fruits with their own efforts, while 35.00 per cent non-beneficiaries obtained little bit improvement in the skin colour of fruits and 11.67 per cent non-beneficiaries did not obtained improvement in skin colour of fruits.

Keeping quality of fruit

Table 5 also shows that 60.00 per cent beneficiary respondents could attained the improvement in keeping quality of fruits, while in the orchards of 25.00 per cent beneficiaries achieved little bit improvement of keeping quality of Mandarin fruits and remaining 15.00 per cent beneficiaries not found improvement in the keeping quality of fruit. In case of non beneficiaries 41.66 per cent respondents could improve the keeping quality of fruit on their own while, 33.34 per cent non-beneficiaries obtain little bit improvement in keeping quality of fruit and 25.00 per cent non-beneficiaries still unable to improve the keeping of affected Mandarin orchard.

Juice quantity of fruit

It was presented in Table 5, that quantity of juice was improved in orchards of 63.34 per cent beneficiaries. Juice quantity of Mandarin fruit was little bit improved in the orchards of 28.33 per cent beneficiaries. Whereas, 46.67 per cent non-beneficiaries obtained improvement in juice quantity with their own efforts followed by 37.77 per cent non beneficiary respondents found little bit improvement in the juice quantity while 15.56 per cent non beneficiaries unable to improve the juice quality.

Juice quality of fruit

In regards with the juice quality it was observed that 60.00 per cent beneficiaries able to improve the juice quality of Mandarin fruits after the treatment provided under the project and more than one fourth of the beneficiary respondents (28.88%) obtained little bit improvement in the juice quality of fruits. Least proportion of the beneficiaries (11.12%) didn't found improvement in the juice quality. Regarding non beneficiary equal percentage of respondents (40.00%) obtained expected improvement and little bit improvement in juice quality on their own efforts, respectively and 20.00 per cent non-beneficiaries did not obtained improvement in quality of juice.

Application of recommended practices in Mandarin orchards as per recommendations gives significant results in concern with fruit quality. Results showed that, Phytopthoramanagement practices helps in increase in fruit size, improvement in the skin colour of fruit, improvement in keeping quality of fruit and improvement in quality and quantity of fruit juice after getting recovered from the damages of Phytopthora. These management practices were useful to increase fruit firmness, imparting attractive skin colour of fruit, improvement in nutritional quality of fruit, TSS of fruit, and acidity level in fruit of Mandarin. From the findings drawn as above, we can conclude that the Phytopthoramanagement practices along with application of fungicides and other treatments enhance the fruit quality. It could be helpful in imparting the improvement of internal as well as external quality of Mandarin fruit.

Table 6
Yield obtained by the respondents due to adoption of recommended Phytopthoramanagement practices

Sl. No.	Particulars	Beneficiaries (N=60)	Non-beneficiaries (N=60)
1	Mean Yield (ton/ha)	12.13	9.88

It is observed from the Table 6 that yield rate (12.13 ton/ha.) was more in beneficiary mandarin growers as compared to the yield rate (9.88 ton/ha.)of non beneficiary mandarin growers under TOT RKVY project. It might be due to the use of recommended Phytopthora Management practices by the beneficiaries of the TOT RKVY project.

Overall technological Impact

Overall technological impact of Phytopthora Management practices was amplified largely under the tree canopy, gum oozing, fruiting/fruit drop, fruit quality by enumerating the per cent change between beneficiaries and non-beneficiaries, thus results obtained presented in Table 7.

Testing the significance of the difference in the means

In order to test the variability of means of tree canopy, gum oozing, fruiting/fruit drop, fruit quality, yield and overall technological impact of beneficiaries over the non-beneficiaries, the data were subjected to 'Z test' and the results thus obtained have been presented in Table 7.

Table 7
Technological impact of Phytopthoramanagement practicesdemonstrated under TOT RKVY project

Sl. No.	Impact parameters	Mean Index		% change	Z value
		Beneficiaries	Non-beneficiaries		
1	Tree canopy	81.85	64.07	27.74	4.30**
2	Gum oozing	82.22	63.33	29.82	2.92**
3	Fruiting	80.83	60.83	32.87	3.38**
4	Fruit drop	80.83	60.00	34.71	3.47**
5	Fruit quality	78.27	60.98	28.34	4.98**
6	Yield (ton/ha)	12.13	09.88	22.77	2.37**
	Overall technological impact	**69.35**	**53.18**	**30.40**	**5.83****

** *Significant at 0.01 level of probability*

It was observed from the Table 7 that the mean indices of various parameters of technological impact viz. tree canopy (81.85), gum oozing (82.22), fruiting (80.83)and fruit drop (80.83), fruit quality (78.27), yield (12.13 ton/ha) and overall technological impact (69.35) of beneficiaries were higher than mean indices of tree canopy (64.07), gum oozing (63.33), fruiting (61.66), fruit drop (60.00), fruit quality (60.98), yield (09.88 ton/ha) and overall technological impact (53.18) of the non-beneficiaries.

The per cent change occurred after the application of Phytopthoramanagement practices in tree canopy, gum oozing, fruiting, fruit drop and fruit quality and yield of Mandarin orchards of beneficiaries was 27.74 per cent, 29.82 per cent, 32.87 per cent,34.71 per cent, 28.34 per cent and 22.77 per cent respectively over the non-beneficiaries of the project. The per cent change in overall technological impact of Phytopthoramanagement practices on the beneficiaries was 30.40 per cent over the non-beneficiaries.

A mere quantitative superiority of the mean index of the beneficiaries over the mean index of the non-beneficiaries is not conclusive proof of its superiority. Hence, the ratio between observed differences was computed as indicated by 'Z' values.

The 'z' values of tree canopy (4.30), gum oozing (2.92), fruiting (3.38) and fruit drop (3.47), fruit quality (4.98), yield (2.37) and overall technological impact (5.82) were found highly significant at 0.01 level of probability.

It could be therefore, be inferred that the beneficiaries differed highly significant over non-beneficiaries in tree canopy, gum oozing, fruiting and fruit drop, fruit quality, yield and overall technological impact. Therefore, be explicitly stated that there was definite increase in tree canopy, definite control over the gum oozing, definite increase in fruiting and control on the fruit drop and definite increase in fruit quality of Mandarin and increase in yield among beneficiaries over non-beneficiaries as result of technological impact of Phytopthoramanagement practices in Mandarin organized demonstrated under TOT RKVY project.

By the end large, it could definitely be stated that the Impact of Phytopthoramanagement practices in Mandarin organized under the TOT RKVY project have positive and significant technological impact on the beneficiaries.

Hence, it could be stated that developmental projects have significant impact on farmers, hence in future concerned authorities should need to organize the developmental projects like TOT RKVY to increase the participation of farmers more prominently and help to increase the horizontal impact on socio-psychological and technological parameters.

Similar findings supported by Waman (2010) revealed that, a more than half (54.28 per cent)

of the respondent beneficiaries were under the category of medium impact group; while considerable proportion of them (45.72 per cent) were belonged to high impact group category.

Jayashree (2012) indicated that 10.61 per cent over the impact of agricultural technology information center on beneficiaries.

Gaghare (2018) found that total mean impact of seed production training programme organized under RKVY project on trainee farmers over non-trainee farmers was found 36.24 per cent.

More (2020) overall technological impact per cent change was 29.08 which were significantly higher than the non-beneficiaries of TOT RKVY project. Z values of technological impact highly significant at the 0.01 level of probability.

CONCLUSIONS

The findings of the present study conclude thatPhytotpthora management practices TOT RKVY project had significant technological impact of 29.31 per cent on beneficiary farmers in terms of per cent change tree canopy (27.74), gum oozing(29.82), fruiting (32.87),fruitdrop(34.71), fruit quality (28.34)and yield (22.77) from mandarin crop over non beneficiary farmers which were significantly higher than the non-beneficiaries of TOT RKVY project. Z values of technological impact highly significant at the 0.01 level of probability.

Thus,Phytotpthora management practices TOT RKVY projectis highly beneficial programme for control of Phytotpthorain Mandarin crop. It is therefore suggested that, if thenon beneficiary farmers may get advantages of Phytotpthora management practicesTOT RKVY projectit will help to increase their yield and annual income.

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