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Adoption of Improved Technologies Among Nagpur Mandarin Growers in Vidarbha

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ABSTRACT

Nagpur mandarin (*Citrus reticulata* Blanco) popularly known as '*Nagpur Orange*' has got a Geographical Indication (GI) tag identity. Besides the Vidarbha region of Maharashtra, it is grown in the three districts of Rajasthan and Madhya Pradesh. Being a cash crop, mandarin cultivation in Maharashtra increased upto 1,35,000 ha and occupies top position in terms of area. However, the average productivity of 9-10 tons/ha point at the dismal status of Nagpur mandarin industry especially in Vidarbha. Hence, to ascertain the causes of technology non-adoption leading to low productivity, the study was undertaken in the Nagpur mandarin growing area of Central India comprising 300 respondents in a stratified random sampling. The study revealed that, growers with land large holdings were better adopters due to increased scientific orientation and better extension contacts. Overall, the reason of non-adoption differed with the perceived importance of technology by the respondents. However, lack of information was one of the major handicaps and the growers need to be equipped with required information for accelerating the improved technology adoption process.

Key words: Adoption, constraints, Nagpur mandarin

INTRODUCTION

Nagpur mandarin (*Citrus reticulata* Blanco) popularly known as '*Nagpur Orange*' has got a Geographical Indication (GI) tag identity. Besides the Vidarbha region of Maharashtra it is widely grown in three districts of Rajasthan and Madhya Pradesh each. The entire Nagpur mandarin industry in Central India is on budded plants and starts bearing after 5-6 years. The 65-70 per cent Nagpur mandarin orchardists lacking assured sources of irrigation prefer monsoon dependent *mrig* bahar whereas the *ambia* bahar is favored by only 30-35 per cent farmers having assured source of irrigation. Being a cash crop, mandarin cultivation in Maharashtra increased upto 1, 35,000 ha and occupies top position in terms of area. However, the average productivity of 9-10 tons/ha point toward the dismal health of Nagpur mandarin industry. The variety of reasons directly or indirectly affects the production and productivity. The average size of land holding and low resource base are some of the limiting factors constraining the growers in managing the resources optimally. The legacy of socio-economic disparity coupled with the age-old fatalistic notions also acts as a barrier in improved technology adoption. Added to it, is climatic change that puts the growers into an array of uncertainty. During 2012, due to high temperature and high humidity 44,000 acres area in Amravati district alone was seriously affected and losses were upto the tune of 80 per cent. Hence, considering the imperatives and institutional set up, finding out the extent of technology awareness, reasons of partial or non-adoption of the technology formed the basis of present study.

METHODOLOGY

The study was carried out in Vidarbha region of the Maharashtra State in India. The following citrus growing four districts were purposively selected considering the large acreage under Nagpur mandarin (*Citrus reticulata* Blanco) cultivation.

Name of the district	Talukas/ Blocks
Nagpur	Katol, Kalmeshwar, Bhiwapur, Ramtek and Saoner
Wardha	Arvi, Karanja (Ghatge), Ashti
Yawatmal	Ralegaon, Kalamb, Babhulgaon, Pusad , Digras
Amravati	Morshi, Paratwada , Warud and Chandur Rly

Three hundred, Nagpur mandarin growers were contacted having representation from the specified districts and four to five villages from each talukas as per probability proportion to size technique. Pertinent information based on the objectives of the study was collected with the help of well structured pretested interview schedule. The respondents included Nagpur mandarin growers whose orchards were in bearing stage. To delineate the factors of non-adoption in different strata of society, the data (N=300) was divided into three broad categories based on the land holding of the respondents' *viz*.(i). Upto 10 acre, (ii). >10 & < = 20 acres and (iii). > 20 acres.

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RESULTS AND DISCUSSION

The data in Table 1 presents the response of independent variables pertaining to respondent Nagpur mandarin growers in the sample area. The coefficient of correlation in first category of respondents (N=118) established positive relationship (r =0.44) between extension contact and adoption. The study conducted by C.Thamban *et. al.* (2006) on micro-irrigation technology in coconut revealed similar results. It implied that, through regular extension contacts, the farmers were better informed about the improved technology that ultimately led to better adoption. However, the yield did not commensurate with the irrigated land holding hence, it was negatively correlated. Thus, the cumulative effect of extension contact and increased knowledge contributed in overall adoption of the technology. Similarly in second category of respondents (N=112), the correlation coefficient indicated similar relationship between extension contact and adoption, but there was no proportionate increase in yield in relation to irrigated land holding. It indicated that, scientific orientation contributed towards increase in knowledge and its application in the field led to increased production from the orchard. In the third category (N=70) encompassing large farmers were found to be better adopters due to regular extension contacts and increased scientific orientation. However, the adoption did not commensurate with the large holdings as it is generally believed.

Table 1: Correlation analysis between independent variables and adoption

n=300

	Category of Respondents		
	1 to 10 acres (n=118)	>10 acres but < =15 acres (n=112)	15 acres and above (n=70)
Variables	**Correlation coefficient(r)**	**Correlation coefficient(r)**	**Correlation coefficient(r)**
Irrigated land holding	-0.08	0.07	0.14
Income from citrus orchard	-0.06	0.03	0.32**
Extension contact	0.44*	0.59*	0.27**
Scientific orientation	0.09	0.21**	0.24**
Knowledge	0.22**	0.31**	0.28**

*Significant at 1% level of significance

** Significant at 5% level of significance

The data in Table 2 indicated the extent of awareness and adoption of improved technologies/recommended package of practices. The 60.66 per cent farmers were unaware of the necessity of soil suitability testing before taking up citrus plantation, whereas 29.66 per cent respondents perceived it as unnecessary, theirs being the traditional area of citrus cultivation. Similarly, only 59.66 per cent farmers followed the recommended spacing and 5.33 per cent farmers modified it as per their own assumptions. Surprisingly, 51 per cent farmers were not aware of the double ring irrigation system that was very much needed as the water stagnation near tree trunk acts as a pre disposing factor for the proliferation of *phytophthora* fungi causing root-rot and gummosis. Only 63 per cent respondents were aware of the recommended doses of fertilizers of which only 24.33 per cent could follow it in full and 37.66 per cent partially. After harvesting, the regular practice of dead wood pruning with secateur followed by spraying of 1 per cent carbendazim was not known to 58.33 per cent farmers and only 8 per cent followed it fully whereas 25.33 per cent partially. As a prophylactic measure, spraying of 1 % Bordeaux mixture before and after monsoon was not known to 34.33 per cent farmers and 20.66 per cent respondents followed it fully whereas only 40.00 per cent adopted it partially.

The bark eating caterpillar (*Inderbella spp.*) although a minor pest becomes major when neglected. Its control measure was not known to as many as 73.33 per cent respondents. Similarly 89.66 per cent farmers did not know the control measure for mite that affects the marketability of fruits on maturity. The fruit drop that can otherwise be managed effectively with simple treatment if not controlled at right stage, it directly affects the production. Yet 81.66 per cent farmers expressed their ignorance about the technology whereas, 13.33 per cent farmers did not encounter such problem in their orchard. The practice of using pesticides though known to 79.33 per cent farmers only 25.33 per cent followed it in total and 42.66 per cent partially. Similarly to reduce the drop of mature fruits, pre-harvest treatment of 1 per cent carbendazim spray 45 days before harvest was not known to 90.00 per cent respondents. Use of grass or plastic mulch as a moisture conservation measure was not known to 50.66 per cent farmers and 32.33 per cent were ignorant about the importance of drip irrigation system for efficient & productive use of water. The use of micronutrients was followed fully by only 12.00 per cent respondents and 7.00 per cent partially although known to 76.66 per cent farmers.

The use of Metalaxyl MZ-72 paste after scrapping infected gum oozing out of bark was not known 81.66 per cent farmers and only 14.33 per cent farmers followed it fully. For root-rot treatment using the same fungicidal spray was not known to 86.66 per cent whereas only 5.33 per cent farmers did not require it. The use of herbicides is not known to 93.66 per cent and 89.33 per cent farmers for pre and post emergence weeds respectively. Similarly 98.66 per cent farmers did not know about the fertilizers application based on leaf testing.

Table 2: Extent of Awareness and Adoption of improved technology

n=300

	Awareness		Adoption		
Technology	**YES**	**NO**	**Full**	**Partial**	**Not Needed**
Soil suitability testing before taking up Nagpur mandarin cultivation	118 (39.33)	182 (60.66)	11 (3.66)	0 (0.00)	89 (29.66)
Plant to plant spacing (6x6 mt)	266 (88.66)	34 (11.33)	179 (59.66)	68 (22.66)	16 (5.33)
Double Ring irrigation in case of non installation of drip irrigation system	147 (49)	153 (51.00)	62 (20.66)	24 (8.00)	49 (16.33)
NPK application as per schedule and recommended doses	195 (63)	105 (35.00)	73 (24.33)	113 (37.66)	43 (14.33)
Pruning of dead wood with secateur followed by 1% spray of Carbendazim	125 (41.66)	175 (58.33)	24 (8.00)	76 (25.33)	16 (5.33)
1% Bordeaux paste application before and after monsoon	197 (65.66)	103 (34.33)	62 (20.66)	120 (40.00)	11 (3.66)
Dichlorvos @ 3-4 ml/ litre for control of bark eating caterpillar (*Indebella spp.*)	80 (26.66)	220 (73.33)	40 (13.33)	23 (7.66)	62 (20.66)
Light trap for the fruit sucking moth	47 (15.66)	253 (84.33)	15 (5.00)	4 (1.33)	108 (36.00)
Dicofol or Wettable Sulphur for control of mite	31 (10.33)	269 (89.66)	8 (2.66)	6 (2.00)	105 (35.00)
For fruit drop 1.5 gm 2-4 D or GA_3 + 1%Urea +1 % Carbendazim in 100 litre water	65 (21.66)	245 (81.66)	23 (7.66)	31 (10.33)	40 (13.33)
Use of pesticides for the control of insect pests	238 (79.33)	62 (20.66)	76 (25.33)	128 (42.66)	16 (5.33)
Three sprays of 1% Carbendazim 45 days before harvest at 15 days interval	30 (10)	270 (90.00)	9 (3.00)	15 (5.00)	104 (34.66)
Grass/Plastic Mulch for moisture conservation in summer	148 (49.33)	152 (50.66)	17 (5.66)	44 (14.66)	123 (41.00)
Drip irrigation for efficient & productive use of water	203 (67.66)	97 (32.33)	44 (14.66)	104 (34.66)	29 (9.66)
Use of micronutrients as per requirement.	230 (76.66)	70 (23.33)	36 (12.00)	21 (7.00)	62 (20.66)
Scrapping the gum oozing bark & applying Metalaxyl MZ-72 paste thereon	65 (21.66)	245 (81.66)	43 (14.33)	17 (5.66)	11 (3.66)
For root rot, spray of Metalaxyl MZ-72@2.75 gm/ lit or Fosetyl Al @ 2.5 gm/lit water(2 sprays) at 15 days interval	40 (13.32)	260 (86.66)	19 (6.33)	9 (3.00)	16 (5.33)
Use of Diuron @ 2 kg a.i. or Simazine @4 kg a.i. per ha as a pre-emergence herbicide	19 (6.33)	281 (93.66)	5 (1.66)	0 (0.00)	132 (44.00)
Application of Glyphosate 4 lit /ha as a post emergence herbicide	32 (10.66)	268 (89.33)	13 (4.33)	0 (0.00)	152 (50.66)
Fertilizer application based on leaf testing	10 (3.33)	290 (96.66)	5 (1.66)	1 (0.33)	44 (14.66)

The Table 3 depicts the constraints in non-adoption of recommended technology. For not attempting the soil suitability testing before taking up citrus plantation, lack of information was cited as the main reason by 75.00 per cent respondents. For not adhering to the recommended spacing 65.71 per cent farmers perceived it as non-feasible whereas for double ring irrigation system, 64.55 per cent farmers expressed their ignorance as a main constraint. These findings were in agreement with those of M. Kumaran and K. Vijayaragawan (2005) who reported educating the farmers about water related problems are to be taken care by the extension system. This may improve farmers' knowledge and their level of satisfaction which in turn contribute to adoption. For recommended doses of NPK application, the constraints emerged out to be financial and lack of information. The dead wood pruning after harvesting using secateur followed by 1per cent carbendazim spray was perceived as difficult to adopt by 11.53 per cent and 25.38 perceived it non-feasible. Overall, the reason of non-adoption differed with the perceived importance of technology by the respondents. However, lack of information was one of the major handicaps and thus the growers need to be equipped with required information for accelerating the technology adoption process.

Table 3: Reasons of non-adoption of recommended package of practices

n=300

		CONSTRAINTS IN ADOPTION				
Technology	**Non-adoption Out of (n=300)**	**Financial**	**Lack of information**	**Difficult to adopt**	**Not feasible**	**Any other**
Soil suitability testing before taking up Nagpur mandarin cultivation	200 (66.66)	5 (2.50)	150 (75.00)	9 (4.50)	5 (2.50)	31 (15.50)
Plant to plant spacing (6x6 mt)	37 (12.33)	0 (0.00)	7 (6.66)	0 (0.00)	69 (65.71)	26 (24.76)
Double Ring irrigation in case of non installation of drip irrigation system	165 (55.00)	28 (14.81)	122 (64.55)	2 (1.05)	23 (12.16)	14 (7.40)
NPK application as per schedule and recommended doses	75 (25.00)	65 (34.57)	45 (23.93)	0 (0.00)	33 (17.55)	45 (23.93)
Pruning of dead wood with secateur followed by 1% spray of Carbendazim	184 (61.33)	41 (15.76)	103 (39.61)	30 (11.53)	66 (25.38)	20 (7.69)
1% Bordeaux paste application before and after monsoon	107 (35.66)	62 (27.31)	80 (35.24)	1 (0.44)	60 (26.43)	24 (10.57)
Dichlorvos @ 3-4 ml/ litre for control of bark eating caterpillar (*Indebella spp.*)	175 (58.33)	17 (8.58)	146 (73.73)	3 (1.51)	6 (30.03)	26 (13.13)
Light trap for the fruit sucking moth	171 (57.00)	14 (8.00)	120 (68.57)	7 (4.00)	6 (3.42)	28 (16.00)

Dicofol or Wettable Sulphur for control of mite	181 (60.33)	6 (3.20)	147 (78.60)	1 (0.53)	1 (0.53)	32 (17.11)
For fruit drop 1.5 gm 2-4 D or GA_3 + 1%Urea +1 % Carbendazim in 100 litre water	206 (68.66)	6 (2.53)	215 (90.71)	3 (1.26)	2 (0.84)	11 (4.64)
Use of pesticides for the control of insect pests	80 (26.66)	140 (67.30)	8 (3.840	0 (0.00)	8 (3.84)	52 (25.00)
Three sprays of 1% Carbendazim 45 days before harvest at 15 days interval	172 (57.33)	27 (14.43)	143 (76.47)	0 (0.00)	17 (9.09)	0 (0.00)
Grass/Plastic Mulch for moisture conservation in summer	116 (38.66)	5 (3.12)	31 (19.37)	3 (1.87)	40 (25.00)	81 (50.62)
Drip irrigation for efficient & productive use of water	113 (37.66)	64 (29.49)	37 (17.05)	19 (8.75)	35 (16.12)	62 (28.57)
Use of micronutrients as per requirement.	123 (41.00)	60 (41.66)	10 (6.94)	15 (10.41)	41 (28.47)	18 (12.5)
Scrapping the gum oozing bark & applying Metalaxyl MZ-72 paste thereon	229 (76.33)	29 (11.78)	188 (76.42)	0 (0.00)	20 (8.13)	9 (3.65)
For root rot, spray of Metalaxyl MZ-72@2.75 gm/ lit or Fosetyl Al @ 2.5 gm/lit water(2 sprays) at 15 days interval	256 (85.33)	28 (10.56)	220 (83.01)	4 (1.50)	1 (0.37)	12 (4.52)
Use of Diuron @ 2 kg a.i. or Simazine @4 kg a.i. per ha as a pre-emergence herbicide	163 (54.33)	19 (11.65)	55 (33.74)	0 (0.00)	88 (53.98)	1 (0.61)
Application of Glyphosate 4 lit /ha as a post emergence herbicide	135 (45.00)	23 (17.03)	54 (40.00)	1 (0.74)	56 (41.48)	1 (0.61)
Fertilizer application based on leaf testing	250 (83.33)	9 (3.58)	206 (82.07)	3 (1.19)	13 (5.17)	20 (7.96)

CONCLUSION

The farmers having marginal and small land holding in view of the financial crunch found to be seriously constrained to adopt the recommended technology package. Therefore, It led to gradual negligence and in turn adversely affected the orchard health thereby the production and productivity. However, better scientific orientation increased the acceptability of improved technology adoption. It is an indication that, there exists lot of scope for increasing the adoption levels and the growers need to be constantly updated on technology and persuaded to follow it for increasing profitability. It also dispelled the myth that, the farmers with large land holding have better awareness as well as adoption. The finding contravened the popular notion as large chunk of them were found to be the absentee landlords mostly reliant on their farm managers for technology implementation.

Their technology adoption levels as well as average production levels were found to be lower than the medium landholders. Therefore, to accelerate the process of technology dissemination among citrus growers, the approach has to be multi-pronged and need based.

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