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### Assessing perception of disease-free planting materials of citrus amongst farmers of Vidarbha region of Maharashtra, India

<sup>1</sup>Sangeeta Bhattacharyya, <sup>2</sup>Tannishtha Bardhan and <sup>3</sup>Samrat Sikdar

<sup>1</sup>Scientist, Agricultural Extension, ICAR-Central Citrus Research Institute, Amravati Road, Nagpur, Maharashtra, India

<sup>2</sup>Young Professional, International Cooperation Division, Ministry of Agriculture and Farmers' Welfare, New Delhi, India

<sup>3</sup>Ph.D Scholar, School of Human Sciences, College of Agriculture and Life Sciences, Mississippi State University, Starkville, MS, United States

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Corresponding Author: Sangeeta Bhattacharyya

#### Abstract

Farmers' perception of agricultural technology is an important factor in determining the adoption of that technology. As citrus fruit being an input intensive perennial crop, the technology of good quality disease-free planting material becomes a crucial factor in determining the longevity of citrus orchards. Hence the precursor to adoption of this technology, that is, farmers' perception of disease-free planting materials of citrus developed by the premiere research institute of citrus, ICAR-Central Citrus Research Institute (ICAR-CCRI), Nagpur was assessed by the authors in this study. The locale of study was Vidarbha region of Maharashtra, India with sample size of 150 (n=150). For measuring perception a 4 point Likert type scale was developed. Items related to the perceived attributes of a technology were incorporated. Mean Perception Score (MPS) and descriptive statistics were used to assess the perception. Farmers perceived CCRI planting material to be initially costly (Affordability) but of high quality developed through scientific protocols (MPS=3.65, Rank 1). According to their perception, the planting materials had no problem in adapting to the local environment (Compatibility) and farmers' field conditions (MPS=3.64, Rank 2), were relatively advantageous (Relative Advantage) (MPS=3.56, Rank 3) in terms of better yield, high quality and less recurring cost involved in controlling disease pest attack, were predictable and trustworthy (Predictability) in nature due to brand value of ICAR-CCRI (MPS=3.1, Rank 4) with 58.66% farmers agreeing to the statement. Complexity and trialability of CCRI planting materials ranked 5<sup>th</sup> and 6<sup>th</sup> in perception score.

However, they perceived that availability of CCRI planting materials was scarce and cost was slightly higher but the disease-free quality of planting material was the very reason they trusted the institute's technology and have adopted it. Government of India in similar line has launched the Clean Plant Program to provide a boost to the institute's disease-free planting material technology.

**Keywords:** Citrus, disease-free planting material, ICAR-CCRI, Vidarbha, perception, mean perception score

#### Introduction

India is an agrarian country and about 65% of our population are directly involved in agriculture and allied activities while 55% of the country's total workforce is engaged in this sector (PIB, 2023) [15]. As per clarion call of the Hon'ble Prime Minister of India, a doubling or enhancement in farmers' income can only come through technology adoption and scientific farming; given the decreasing size of land holding due to rapid urbanization and increased population. In this context, India's horticultural sector has immense potential in enhancing farmers' income (Chand, et.al., 2008; Chatterjee and Mukherjee, 2019) [3, 4]. Mitra and Panda (2020) [12], reported through their econometric analysis that horticultural production and GDP through do not have any short run relationship but in long run we cannot deny absence of any linear relationship between them. This can be backed up by several case studies from different parts of our country (Kashyap et.al., 2020; Roy and Thorat, 2008) [9, 17]. And fruit crops are an excellent option for farmers in ensuring not

only livelihood but nutritional security of farm household as well as the country. Citrus is the third most important fruit crop after banana and mango in India and is cultivated in almost every state of India given the wide biodiversity of the citrus family. Mandarins, sweet oranges, limes, lemons, grapefruits and pummelos are commercial cultivars of India. The annual production of citrus is 14.65 million tons (MoA&FW, GoI, 2023) [11].

However the key to enhanced production and income lies in adoption of advanced technology through scientific methods of farming. In this context, a favourable perception of farmers regarding an agricultural technology serves as an essential determinant of adoption of that technology (Yamano et.al., 2015; Mottaleb, 2018; Gorfad, 2012; Oladele and Fawole, 2007; Jha et.al., 2020) [21, 13, 5, 14, 7]. In citrus, Indian Council of Agricultural Research-Central Citrus Research Institute (ICAR-CCRI), Nagpur is the premiere institute conducting research and developing advanced technologies for citrus fruit crop. The institute develops technologies for overall improvement of productivity and

profitability of citrus farmers across India and provide sustainable solutions to the problems of citrus growers through extension and farm advisory services (ICAR-Central Citrus Research Institute, 2024)<sup>[6]</sup>. The institute was established in 1985 and since then it has been engaged in development of improved production technologies of citrus of which the production of disease free planting material production technology has become the most popular amongst citrus growers of India. since 2001, ICAR- Central Citrus Research Institute, Nagpur is actively involved in sale of containerized disease-free planting materials of citrus at a rather no-profit no-loss basis to farmers throughout the country by establishing mother block and undertaking rigorous indexing and screening of virus and other pathogens in the planting materials developed. ICAR-CCRI nursery has been awarded “5 star” rating by National Horticulture Board. Till date the institute has distributed more than 50 lakh plants across the country wide and generated revenue of more than 15 crores. Orchards encompassing more than 18050 ha have been planted by disease-free plants of ICAR-CCRI. The institute has commercialized this technology by licensing it with 9 private nurseries (Bhattacharyya *et al.*, 2023)<sup>[2]</sup>. Hence, a study was formulated at ICAR-CCRI to determine the perception of farmers of citrus growing districts of Maharashtra regarding disease-free planting materials through Mean Perception Score (MPS).

**Materials and Methods**

**Locale of Study**

Nagpur, Amravati and Wardha districts which are the popular Nagpur mandarin (*Citrus reticulata* Blanco)belts of Vidarbha region of Maharashtra were purposively selected for the study. Mandarin is the most popular citrus cultivar amongst all commercial cultivars of India. And these districts account for most of Nagpur mandarin production in the country by virtue of which Nagpur mandarin even received the GI tag in 2014. The Amravati and Nagpur districts of Maharashtra contribute about 80 per cent of the total area under mandarin orchards in Maharashtra state sharing 48.88 per cent and 31.45 per cent, respectively (Wankhede *et al.*, 2017)<sup>[20]</sup>.

**Sampling Plan and Data Collection**

A sample of 50 citrus growers who purchased ICAR-CCRI planting materials was selected as respondents for the study through stratified random sampling method from each of the 3 districts thus making a total sample size of 150 farmers (n=150). The research design followed was *ex post facto*. Semi structured interview schedule was developed and data was collected through personal interview method.

**Measuring the perception of farmers of disease-free planting material technology of ICAR-CCRI**

Farmers’ perception of a technology is crucial for the adoption of the technology. A positive or favourable perception can give rise to a positive attitude leading to adoption. For measuring perception a 4 point Likert type scale was developed. Items analysis was done. The data collected were subjected to descriptive statistical analysis such as frequency counts, percentage and mean derived from four-point Likert’s type scale as the following: 4 =strongly agree, 3 = agree, 2 = disagree, and 1 = strongly disagree. The Likert’s scale was done by asking some positive statements like CCRI technologies are affordable. To which the responses were rated according to their perceptions and the cut-off mean score was determined by adding the ratings up (4 + 3 + 2 + 1 = 10) and dividing the sum by 4 to give 2.5 as the cut-off mean score. For each statement, the total score was divided by the number of respondents, for instance a statement like "CCRI technologies are affordable" may have responses of strongly agree (f= 50); agree (f = 43); disagree (f = 31) and strongly disagree (f = 26). It will now be worked as 50 x 4 = 200, 43 x 3 = 129, 31 x 2 = 62 and 26 x 1 = 26. Then 200 + 129 + 62 + 26 = 417. The sum was divided by the total f thus, 417 / 150 = 2.78. In this case, 2.78is the Mean Perception Score (MPS) which is greater than the cut-off mean score of 2.50. The ranking was done according to the mean values, with the one with the highest mean ranking ‘1’.

**Results and Discussion**

**Perception of farmers of disease-free planting material technology of ICAR-CCRI**

The Mean Perception Scores were calculated of all perceived attributes of the technology (Table 1). The ones above cut-off score 2.5 was considered favourable and ones below were unfavourable perception.

**Table 1:** Perception of CCRI planting materials amongst farmers (n=150)

Statements	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)	Mean Perception Score (MPS)	Rank
<b>Availability/Accessibility</b>						
Planting materials of CCRI are easily available for purchase	65 [43.33%]	52 [34.66%]	33 [22%]	-	1.78	9 <sup>th</sup> (less than mean cut-off 2.5)
<b>Affordability</b>						
Planting materials of CCRI are affordable	50 [33.33]	43 [28.66]	31 [20.66]	26 [17.33]	2.22	8 <sup>th</sup> (less than mean cut-off 2.5)
Cultivation and management is cost effective	87 [58]	40 [26.66]	15 [10]	8 [5.33]	1.62	10 <sup>th</sup> (less than mean cut-off 2.5)
CCRI planting materials even though are initially costly, they are scientifically developed and of high quality	-	-	52 [34.66]	98 [65.33]	3.65	1 <sup>st</sup>
<b>Relative Advantage</b>						
Adoption of CCRI planting materials give better yield, high quality and less recurring cost on management	-	-	66 [44]	84 [56]	3.56	3 <sup>rd</sup>
<b>Complexity</b>						
Easy package of practices for cultivation	14	31 [20.66]	76	29 [19.33]	2.8	5 <sup>th</sup>

	[9.33]		[50.66]			
<b>Compatibility</b>						
Planting material easily adapt to microenvironment of farmers' field	-	-	53 [35.33]	97 [64.66]	3.64	2 <sup>nd</sup>
<b>Observability</b>						
CCRI planting materials are visibly healthy and produce more and better quality fruits	23 [15.33]	32 [21.33]	60 [40]	35 [23.33]	2.71	7 <sup>th</sup>
<b>Trialability</b>						
CCRI planting materials can be tried in a small scale before large scale adoption	21 [14]	34 [22.66]	57 [38]	38 [25.33]	2.74	6 <sup>th</sup>
<b>Predictability</b>						
CCRI has brand value hence its planting materials can be predicted to be of high quality and it for adoption	-	22 [14.66]	88 [58.66]	40 [26.66]	3.12	4 <sup>th</sup>

From Table 1, it is evident that farmers perceive CCRI planting material though initially costly, are developed by maintaining all scientific protocols and hence are of high quality (Mean=3.65, Rank 1). According to their perception, the planting materials had no problem in adapting to the local environment and farmers' field conditions (MPS=3.64, Rank 2). They considered the planting material to be relatively advantageous (MPS=3.56, Rank 3) in terms of better yield, high quality and less recurring cost involved in controlling disease pest attack because these varieties are lesser prone to diseases. The next highest perception score (MPS=3.12, Rank 4) was obtained by the predictable and trustworthy nature of CCRI developed planting materials. 58.66% farmers agreed that CCRI had brand value hence its varieties could be predicted to be of high quality and suitable for adoption. Complexity and trialability of CCRI planting materials ranked 5<sup>th</sup> and 6<sup>th</sup> in perception score. The

planting materials were also visibly healthy and produced more and better quality fruits after 4-5 years hence the observability parameter received the 7<sup>th</sup> rank (MPS=2.7). These parameters had MPS above cut-off 2.5 and can be considered favourable perception (Fig 1). However, the farmers perceived that planting materials were of higher cost (MPS=2.22, Rank 8) and hence the cost of cultivation (MPS=1.62, Rank 10) in initial years were higher coupled with gestation period where farmers had to wait for the trees to bear fruits. The planting materials were also not easily available and difficult to purchase from CCRI due to scarcity because of which 43.33% farmers strongly disagreed with ease of availability criteria and ranked it 9<sup>th</sup> (MPS=1.78) which was much lesser than mean cut-off score of 2.5. These parameters had MPS below cut-off 2.5 and can be considered unfavourable perception.

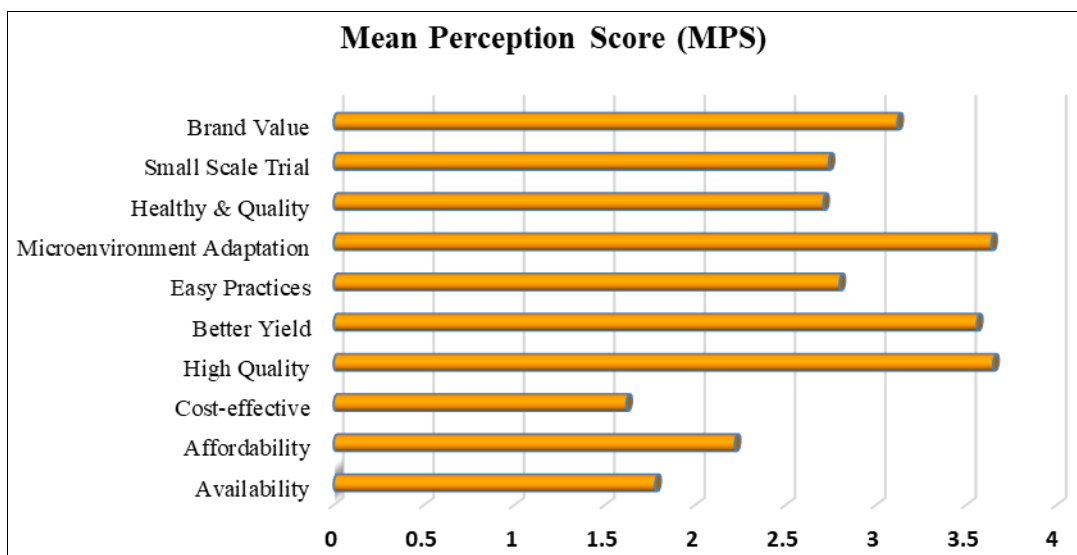


Fig 1: Graphical Representation of the Mean Perception Scores of the farmers

The perception of citrus growers regarding various technologies of citrus has been reported by authors across the world like Lahlali et.al. (2021) [10] about citrus farmers' perception of plant protection measures in Morocco, Astuti et.al. (2018) [11] about adoption of Gerga Lebong technology of citrus in Indonesia and Toessi et.al. (2024) [19] about management of fungal diseases in citrus amongst farmers of Benin. Sedhai et.al. (2022) [18] and Razzaghi Borkhani & Mohammadi (2019) [16] reported farmers' perception of Good Agriculture Practices (GAP) in citrus amongst farmers of Nepal and Iran respectively. A favourable perception was

a precursor to adoption of production and orchard management technologies in above mentioned studies.

**Conclusion**

The persistent problem of citrus growers of Vidarbha region of Maharashtra is lack of availability of good quality, or in other words, disease-free planting materials which has time and again emerged in field surveys and case studies (Bhattacharyya et al., 2023) [2]. Farmers often end up purchasing planting materials at low costs from private nurseries which often end up to be spurious and of low

quality. These when planted grow into orchards of low productivity and remain susceptible to diseases and pests and decline at an early age. As a result, the farmers suffer economic loss. Citrus being a perennial crop, the damage is irreversible after plantation of low quality plants. Hence, educating farmers, that, even though disease-free plants are slightly higher in cost but the investment once done, saves him from early decline of his citrus orchard; is the need of the hour. Right knowledge and favourable perception of farmers regarding adoption of clean planting materials is extremely crucial for enhancing longevity and productivity of citrus orchards. And ICAR-CCRI is effectively working in this direction through training and capacity building programmes of farmers. Recently, Government of India too has launched the Atmanirbhar Clean Plant Programme (CPP) in the 2023-24 Union Budget which seeks to produce disease-free and superior planting material for esteemed horticultural crops with citrus being one. The programme proposed to start 10 "Clean Plant Centres" across India with ICAR-CCRI having one centre. Total budget allocation is Rs. 2,200 crore spread over a period of 7 years for the CPP (Kar, 2024)<sup>[8]</sup>. These initiatives pave the way for further adoption of clean planting material technology in citrus by the farmers of our country and ultimately raise the horticultural production of India in global statistical charts.

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#### Conflict of Interest

The authors declare no conflict of interests

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