Asian Journal of Agricultural Extension, Economics & Sociology
15(3): 1-12, 2017; Article no.AJAEES.31740
ISSN: 2320-7027

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Yield Gap Analysis in Adoption of Production Technology of Mango by the Farmers

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJAEES/2017/31740
Editor(s):
(1) Kwong Fai Andrew Lo, Agronomy and Soil Science, Chinese Culture University, Taipei, Taiwan.
Reviewers:
(1) José Alfredo Villagómez-Cortés, Universidad Veracruzana, Veracruz, Mexico.
(2) Oluyemi Adeleye, Development Resource Initiative (DRIVE), Space 2000 Complex, Barnawa, Kaduna, Nigeria.
(3) Ekenta Cornelius Michael, Ahmadu Bello University, Zaria, Nigeria.
Complete Peer review History: http://www.sciencedomain.org/review-history/18104

Original Research Article

Received 22nd January 2017
Accepted 24th February 2017
Published 9th March 2017

ABSTRACT

The study was conducted on yield gap analysis in adoption of production technology of mango by the farmers at Tumkuru district. Ten villages were selected and out of which twenty farmers were selected from each for the study, ten belong to big and small farmers category. Total 200 sample size were selected, the data were collected through personal interview, Frontline demonstration, Off-campus and On-campus training programme. Observation was recorded that 20 per cent of yield gap between demonstration plot and actual farmers plot in mango. The total yield gap between potential yield and actual yield was 50%. Majority of the big farmers (63%) and small farmers (50%) were at medium level of adoption. Majority of the big farmers (more than 80%) fully adopted the production practices like plant population per hectare and pit size, whereas more than 90 per cent of small and big farmers have not adopted production technology such as spraying with mango special as micronutrient, application of Paclobutrazol for regular bearing in Alphanso mango variety and using improved mango harvester for drudgery reduction. Significantly

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adopted by the big farmers in production technologies such as recommended farm yard manure application (55%), recommended quantity (730:180:680 NPK g/plant/year) of inorganic fertilizer application (58%) and powdery mildew management (46%). More than 70 per cent of small farmers have not adopted technologies such as selection of grafted seedlings (71%) and fruit fly management (70%). But significantly not adopted by the small farmers in production technology *viz*., selection of improved variety (62%), selection of grafted seedlings (71%), recommended quantity (730:180:680 NPK g/plant/year) of inorganic fertilizer application (72%) and powdery mildew management (63%). High cost and inadequate availability of labour, erratic supply of electricity, lack of knowledge regarding pest and disease management, unawareness about nutrient management and high cost of inputs were the major production constraints perceived by the Mango growers. A great majority of big and small farmers opined that providing crop insurance, availability and supply of improved seedlings and inputs at right time, research efforts for development of cost effective simple technologies for pest and disease management and conducting demonstration cum training programmes were necessary to overcome the constraints.

Keywords: Adoption; frontline demonstration; production constraint; mango and yield gap.

1. INTRODUCTION

Mango (*Mangifera indica* L) belongs to family Anacardiaceae. It is called “the king of fruits” on account of its nutritive value, taste, attractive fragrance and health promoting qualities [1]. It is commercially cultivated in more than 80 countries including Brazil, China, Egypt, India, Indonesia, Mexico, Pakistan, Phillipines, Thailand and Vietnam among these countries India is ranks number one in mango production. In India, the major mango growing states are Andhra Pradesh, Uttar Pradesh, Karnataka, Bihar, Gujarat and Tamil Nadu and it occupied about 46 per cent of the global area and 40 per cent of the global production [2]. Mango is cultivated over an area of 25 lakh hectares with an annual production of 180.02 lakh metric tones in India during 2012-13 [3].

The need of present era is to increase the productivity of each and every crop. This could be achieved by adopting improved production practice, high yield varieties and improved technologies on mango production Efforts are made by extension worker to disseminate these recommendations among mango growers. However, it has been observed that mango growers are still following their age old practices of mango cultivation. The practices followed by the mango growers of Tumkur district have not been systematically documented so far. Hence, the study was undertaken to make to analyse the yield gap in adoption of production technology of mango by the farmers at Tumkuru district of Karnataka state.

2. MATERIALS AND METHODS

Tumkur district is an important mango growing district of Karnataka comprising 10 taluks of which, Gubbi taluk was selected for the study, because it has the maximum area under mango compared to other taluks. From Gubbi taluk, 10 villages having maximum area under mango growers were selected randomly. From each village, 20 farmers were selected in which ten belong to big farmers category and ten belong to small farmers category. Thus, a total sample size of 200 were selected. An interview schedule was used to collect the data from the respondents. Data were collected through personal interview, Frontline demonstration, Off-campus and On-campus training programme during the year from 2010-11 to 2012-13. The information collected was tabulated, analysed and interpreted as per the objectives of the study.

Yield data of experiment was collected from Krishi Vigyan Kendra, Konehalli, Tiptur taluk, Tumkur district. Besides this, the demonstration plot yield was obtained using the data from the On farm trial and Frontline demonstrations conducted in the farmers field under the close supervision of scientists from Krishi Vigyan Kendra, Konehalli, Tiptur in different locations of the district. Further, information on actual yield obtained by the farmers on their farms under their own management practices was collected at the time of interaction with farmers. Using these data the differences between potential yield and demonstration plot yield (Yield gap-I), difference between demonstration plot yield and actual yield

(Yield gap- II) and difference between potential yield and actual yield (Total yield gap) were determined.

Potential yield - Demonstration plot yield = Technological gap (yield gap-I)

Demonstration plot yield - Actual yield = Extension gap (yield gap- II)

Potential yield - Actual yield = Total yield gap

3. RESULTS AND DISCUSSION

The realized yield and estimated yield gaps are presented in Table 1, the potential yield of mango was found 200 kg/tree and the demonstration plot yield obtained through frontline demonstrations was found to be 160 kg/tree [4]. The actual yield realized by the farmers on their farm with their own resources and management practices was 100 kg/tree. The magnitude of technological gap (yield gap-I) was 40 kg/tree, which was 20 per cent less than the maximum attributable yield [5]. Extension gap (yield gap-II) refers to the difference between demonstration plot yield and actual yield and it was 60 kg/tree. There was 30 per cent reduction in yield compared to demonstration plots yield. A sizable total yield gap of 100 kg/tree was observed and it accounted for 50 per cent. These findings [6].

Table 1. Yield gap identified in mango production

Particulars	Yield (kg / tree)	Percentage gap
Potential yield	200	--
Demonstration plot yield	160	--
Actual yield	100	--
Technological gap (Yield gap I)	40	20
Extension gap (Yield gap II)	60	30
Total yield gap	100	50

The causes for such a large total yield gap may be attributed to environmental differences between research stations, extension worker, farmer fields and non adoption of production technologies. It could be reduced through considerable co-ordination between researchers, extension workers and farmers.

3.1 Overall Adoption Level

The findings related to the overall adoption levels are presented in Table 2. Majority of the big farmers (63%) have medium level of overall adoption, whereas in the case of small farmers, half of the farmers (50%) have medium level of overall adoption. As it is seen in the table, one third (34%) of the small farmers have low level of adoption. The farm size and economic conditions were found to influence the adoption level of big farmers as compared to small farmers.

3.2 Adoption of Production Technology

The practice wise extent of adoption of production technologies by the mango growers were analysed and results are presented in Table 3. More than 90 per cent of small and big farmers have not adopted technology such as spraying with mango special as micronutrient, application of Paclobutrazol for regular bearing in Alphanso mango variety and using improved mango harvester for drudgery reduction. More than 80 per cent of small and big farmers have not applied herbicide in the mango garden for weed management and canopy management in mango orchard. It is evident from the table that, majority (more than 80%) of the big farmers fully adopted the practices like plant population per hectare and pit size. Significantly adopted by the big farmers in production technologies such as recommended farm yard manure application (55%), recommended dose of inorganic fertilizer application (58%) and powdery mildew management (46%). More than half of the big farmers have not adopted selection of grafted seedlings (54%), mango hopper management (60%) and fruit fly management (65%). These findings are in line with research findings [7] and [8].

The practices which were adopted fully by small farmers were pit size (86%) and plant population per hectare (76%). More than 70% of small farmers have not adopted technologies such as fruit fly management (70%). Significant percentage of small farmers have not adopted practices *viz*., selection of improved variety (62%), selection of grafted seedlings (71%), recommended dose of inorganic fertilizer application (72%) and powdery mildew management (63%). The study revealed that the simple technologies were adopted to a relatively greater extent as compared to complex technologies. Complexity of innovations may be

Table 2. Overall adoption level of recommended practices by Mango growers (n=100)

Extent of adoption	Big farmers		Small farmers	
	No	Percentage	No	Percentage
Low	18	18.00	34	34.00
Medium	63	63.00	50	50.00
high	19	19.00	16	16.00

Table 3. Adoption of production practice by mango growers

Production practices	Big farmers (n=100)						Small farmers (n=100)					
	Full adoption		Partial adoption		Non adoption		Full adoption		Partial adoption		Non adoption	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Improved variety	25	25	32	32	43	43	18	18	20	20	62	62
Selection of grafted seedlings	14	14	32	32	54	54	08	08	21	21	71	71
Plant population/ha	82	82	18	18	--	--	76	76	24	24	--	--
Pit size	85	85	--	--	15	15	86	86	14	14	--	--
Recommended quantity of FYM application	20	20	55	55	25	25	15	15	46	46	39	39
Recommended dose of inorganic fertilizer application	30	30	58	58	12	12	12	12	16	16	72	72
Drip irrigation followed	40	40	22	22	38	38	35	35	36	36	29	29
Spraying with Mango special (micronutrient)	--	--	09	09	91	91	--	--	06	06	94	94
Canopy management	08	08	08	08	84	84	07	07	05	05	88	88
Growing legumes as intercropping	28	28	26	26	46	46	21	21	24	24	55	55
Weedicide application	10	10	08	08	82	82	06	06	08	08	86	86
Application of Paclobutrazol	--	--	--	--	100	100	--	--	--	--	100	100
Mango hopper management	23	23	17	17	60	60	19	19	21	21	60	60
Fruit fly management	12	12	23	23	65	65	08	08	22	22	70	70
Stem borer management	16	16	36	36	48	48	13	13	32	32	55	55
Powdery mildew management	18	18	46	46	36	36	15	15	22	22	63	63
Using improved mango harvester	--	--	09	09	91	91	--	--	07	07	93	93

one of the reasons for non adoption of practices like spraying with mango special as micronutrient, application of Paclobutrazol for regular bearing in Alphanso mango variety, canopy management in mango orchard and using improved mango harvester [9] and [10].

3.3 Relationship between the Adoption Level and Socio-economic Characteristics of Mango Growers

The study included the correlation analysis to know the relationship between the adoption level and personal, socio-economic characteristics of mango growers. The results with respect to the correlates level are presented in Table 4. The results indicated that, out of 16 variables, ten variables had relationship with the adoption level of big farmers at varied level. The variables like farming experience, extension contact, social participation, risk orientation and scientific orientation were found to be highly significant at 0.01 per cent level with the adoption level. Whereas, the variables like education, level of aspiration, cosmopoliteness, economic motivation and innovative proneness showed lesser level of significance at 0.05 per cent level. However, in case of small farmer category, occupation, farming experience and level of aspiration were found to be highly significant at 0.01 per cent level with the adoption level of small farm mango growers. This may be due to the fact that the respondents having higher

education level with farming experience, extension and social participation and higher aspirations might be influenced in adopting the crop production technologies at higher rate. Further, motivation to maximize the profit, willingness to change, taking risk to try new ideas, scientific situation analysis, contact with resource persons of different institutions might be the possible reason for adopting improved technologies by mango growers [11].

Table 4. Relationship between the adoption level and personal, socio-economic characteristics of mango growers

Characteristics	Correlation co-efficient (r)	
	Big farmers (n=100)	Small farmers (n=100)
Age	-0.17	-0.14
Education	0.825**	0.351
Occupation	0.186	0.422*
Farming experience	0.419*	0.478*
Family size	0.218	0.246
Extension contact	0.472*	0.212
Social participation	0.516*	0.305
Opinion on agriculture	0.312	0.292
Level of aspiration	0.653**	0.464*
Cosmopoliteness	0.732**	0.233
Economic motivation	0.652**	0.318
Risk orientation	0.434*	0.294
Scientific orientation	0.497*	0.327
Innovative proneness	0.754**	0.306
Credit orientation	0.213	0.273
Annual income	0.315	0.295

** Significant at 0.01 per cent level*
*** Significant at 0.05 per cent level*

3.4 Production Constraints among Mango Growers

The findings related to production constraints are presented in Table 5. Big and small farmers opined that erratic supply of electricity (91% & 94%), lack of knowledge about application of Paclobutrazol, canopy management and use of improved mango harvester (82% & 91%) and Lack of knowledge regarding pest and disease management (81% & 84%) respectively as the major production constraints. This agrees with the findings [12] and [13]. Majority of the big farmers expressed that the major production constraints in mango cultivation were inadequate irrigation source (72%), unawareness about micro and macro-nutrient management (61%), low market rate for the produce (65%) and lack of adequate market information (60%). High cost of inputs (71%), inadequate irrigation source (81%), unawareness about micro and macro-nutrient management (73%), low market rate for the produce (78%) and lack of adequate market information (73%) were the major production constraints expressed by the small farmers. These findings are in line with research findings [14,15,16] and [17].

The aforesaid production constraints imply that there is an urgent need to strengthen the outreach activities of developmental departments. These constraints also provide inputs for the policy makers to formulate strategies to develop irrigation sources, continuous power supply and fixed price for the produce. Training programme, demonstrations and other extension efforts targeting the farmers' needs on production technologies of mango by the developmental departments will reduce the technological and extension gap and will improve the socio-economic status of mango growers.

3.5 Suggestions of the Mango Growers to Overcome the Production Constraints

Suggestions of the mango growers are presented in Table 6. A great majority of big and small farmers expressed that providing continuous power supply, research efforts are needed for development of cost effective simple technologies for production practices, fixed price for the produce and developing irrigation source were the solutions to overcome the production constraints. A significant percentage of big farmers opined that providing crop insurance (76%), availability and supply of grafted seedlings and inputs at right time at subsidized rates (74%), research efforts are needed for development of cost effective simple technologies for production practices (73%) and conducting demonstration cum training programmes (62%) were the suggestions to overcome the constraints [18,19] and [20].

Providing crop insurance (79%), availability and supply of grafted seedlings and inputs at right time at subsidized rates (79%), research efforts are needed for development of cost effective simple technologies for production practices (86%), conducting demonstration cum training programmes (78%) and providing good market price (62%) were the suggestions of small farmers to overcome the production constraints [21,22] and [23].

Table 5. Production constraints of mango growers

Production constraints	Big farmers (n=100)		Small farmers (n=100)	
	No.	Percentage	No.	Percentage
Non availability of inputs	26	26	34	34
Inadequate irrigation source	72	72	81	81
High cost of inputs	52	52	71	71
Erratic supply of electricity	91	91	94	94
Unawareness about micro and macro-nutrient management	61	61	73	73
Lack of knowledge about application of Paclobutrazol, canopy management and use of improved mango harvester	82	82	91	91
Lack of knowledge regarding pest and disease management	81	81	84	84
Low price for the produce	65	65	78	78
Lack of adequate market information	60	60	73	73

Table 6. Suggestions of the mango growers to overcome the constraints

Overcome the production constraints	Big farmers (n=100)		Small farmers (n=100)	
	No.	Percentage	No.	Percentage
Availability and supply grafted seedlings and inputs at right time at subsidized rates	74	74	79	79
Research efforts are needed for development of cost effective simple technologies for production practices including pest and disease management	73	73	86	86
Conducting demonstration cum training programmes	62	62	78	78
Providing crop insurance	76	76	79	79
Providing good market price	56	56	62	62
Providing continuous power supply	72	72	81	81
Developing irrigation source	81	81	93	93

4. CONCLUSION

It can be concluded that adoption of production practices can reduce the yield gap to a considerable extent, thus, leading to increased productivity of mango in the district. Hence, there is a need for reaching mango growers with different extension strategies like organizing capacity building activities for stakeholders, conducting demonstrations to show the worth of the technologies, organizing field visits to solve field problems, conducting exposure visits to successful farms to develop confidence about technologies and encouraging collaborative and group approaches may increase the production and productivity of mango in the district.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDIX

Fig. 1. Demonstration on mango spacial spray

Fig. 2. Demonstration on mango fruit fly trap

Fig. 3. Demonstration on improved mango harvester

Fig. 4. Demonstration on improved mango harvesting

Fig. 5. Demonstration on improved mango harvesting vs. Farmers method of harvesting

Fig. 6. Data collection in registration book with farmers

Fig. 7. Data collection in registration book with farmers signature

Fig. 8. Improved and farmers mango harvester

Fig. 9. Farmers method of harvesting

Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/18104