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Tales from the trees: A study on the adoption of production technologies of mango growers in the eastern dry zone of Karnataka

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Abstract

India leads global mango production, accounting for 44.01% of the world's output, cultivating over 2 crore MT across 23.46 lakh hectares. Karnataka plays a key role, with major productions in Kolar and Ramanagar, driven by its diverse climate and expanding value chain. The study was conducted among 120 mango growers in Kolar and Chikkabalapur districts of Karnataka. The study indicated that exactly two fifths (40.00%) of the mango growers belonged to the medium adoption category, followed by low (33.33%) and high (26.67%) adoption categories. The majority of the farmers had full adoption on selection of regular varieties (97.50%), planting season and planting techniques (100.00%), no adoption in the use of growth regulators (83.33%), drip irrigation (85.83%), weed management (95.83%), fertilizer management (93.33%). It was also found that the variables such as education, annual income, extension participation, cosmopolitaness extension contact, mass media exposure, social participation, and level of aspiration were found to have a significant relationship with the adoption of production technologies of mango growers. The adoption patterns of farming practices among mango growers suggested the need for targeted strategies to improve agricultural outcomes.

Keywords: Adoption, production technologies, mango growers, correlation

Introduction

A strong value chain is being established across India owing to mango production, which leverages the potential of horticulture for increased unit productivity and substantial value addition. This industry, rapidly expanding throughout the country is impacting the agricultural sector and transforming the agricultural environment.

Mangos, the national fruit of India, have an impressive production profile. According to 2023 data, the nation produces 2,08,72,000 MT of mangos, which are grown across an expansive 23.46 lakh hectares. Among the top ten countries in the world for mango production, India ranks first, contributing a significant 44.01 per cent of total production. (Source: National Horticulture Board)

Karnataka holds a significant position on the nation's horticultural map. Mango occupies an area of 1,48,380 hectares with the production of 14,62,250 MT. The predominant mango-growing districts are Kolar, Ramanagar, Tumkur, Chikkabalapur, Bangalore Rural, Mysore, Hassan, Dharwad, and Belagavi. In Karnataka, Kolar and Ramanagar are the largest mango-growing districts with an area of 50,259 and 33,005 hectares, producing 4,29,185 and 3,29,603 tons respectively. Karnataka's mango industry thrives due to its geographically diverse climate.

Keeping in view the importance of mango cultivation to the

study area as well as to the country, it is necessary to know about the efficiency of mango growers in adopting the production technology. The current study intends to investigate the use of production technologies by mango growers in Karnataka's Eastern Dry Zone.

Methodology

The study was conducted in Srinivasapura taluk of Kolar district and Chintamani taluk of Chikkabalapur district of Karnataka during 2023-2024. The study sample consisted of 120 mango growers, with six villages selected from each taluk and ten growers, comprising 5 big farmers and 5 small farmers chosen from each village. *Ex-post facto* research design was used. Adoption of production technologies is operationally defined as the extent to which respondents use the recommended production technologies of mango.

Results and Discussion

The Data presented in Table 1 indicate that exactly two fifths (40.00%) of the mango growers belonged to the medium adoption category, followed by low (33.33%) and high (26.67%) adoption categories. Among small farmers, more than two-fifths (46.66%) belonged to the low adoption category, followed by medium (36.67%) and high (16.67%) adoption categories. Among big farmers, more than two-fifths (41.67%) belonged to the medium adoption category,

with high (38.33%) and low (20.00%) adoption categories coming in second and third, respectively. The fact that small farmers make up a larger portion of the low adoption group raises the possibility that they are dealing with more significant obstacles to adopting more productive farming methods, such as restricted access to funding, technology, and technical knowledge. Large farmers, who make up the

majority of those in the medium and high adoption categories, appear to have benefited from easier access to infrastructure, technology, and resources, which has made it easier for them to implement better practices. They are probably able to invest in innovations and technologies that increase productivity because of their larger operation.

Table 1: Overall Adoption of production technologies by mango growers

Adoption level	Small farmers (n1=60)		Big farmers (n2=60)		Overall (n=120)	
	f	%	f	%	f	%
Low (<26.47)	28	46.66	12	20.00	40	33.33
Medium (26.47-31.55)	22	36.67	25	41.67	48	40.00
High (>31.55)	10	16.67	23	38.33	32	26.67

Mean=29.016, SD=5.07

Distribution of mango growers according to the adoption of production technologies

Results of the distribution of mango growers as per the adoption of production technologies are presented in Table 2. Regarding the selection of early varieties, more than half (53.33%) of the farmers had full adoption. Among small farmers, more than two-fifths (46.66%) of the mango growers had full adoption, and among big farmers, 60 per cent of the farmers had full adoption. Regarding the selection of regular varieties, the majority (97.50%) of the farmers had full adoption. Among small farmers, the majority (95.00%) of the farmers had full adoption. Among big farmers, all (100.00%) farmers had full adoption. Regarding the selection of high-yielding varieties, more than half (58.34%) of the farmers had full adoption. Exactly half (50.00%) of small farms showed full adoption. Among big farmers, more than two-thirds (66.66%) of the farmers had full adoption. According to the study, small and large farmers have adopted improved mango varieties to differing degrees. In general, the selection of regular, early, and high-yielding varieties has been fully embraced by a sizable portion of farmers, especially large farmers. This showed that farmers are starting to adopt improved varieties into their farming practices after realizing their advantages, particularly those with greater financial means. Big farmers' higher adoption rates could be explained by their easier access to resources, knowledge, and extension services, which allowed them to adopt technology with greater knowledge.

With respect to planting season and planting technique, all (100.00%) the farmers had full adoption, which included all small and big farmers. The study reveals that all farmers, regardless of their farm size, have fully adopted the recommended planting season and planting technique for mango cultivation. This revealed that farmers have recognized the importance of planting at the optimal time to ensure proper growth, yield, and quality of mangoes.

Regarding spacing, all (100.00%) mango growers have adopted the conventional system of planting, whereas a greater majority (98.33%) of the mango growers have not adopted high density planting (HDP). This is likely due to a lack of awareness, traditional practices, initial investment, and technical expertise required for HDP, which highlights the need for targeted extension services and training

programs to promote HDP benefits and feasibility.

Regarding the FYM application, more than half (55.00%) of the farmers had partial adoption, followed by full adoption (45.00%). Among small farmers, more than two third (68.33%) of the mango growers had partial adoption, followed by full adoption (31.67%). Among big farmers, more than half (58.33%) of the farmers had full adoption, followed by partial adoption (41.67%). The greater percentage of partial adoption among small farmers would suggest that they are incorporating FYM into their farming methods gradually, perhaps as a result of limited resources or a small herd size. On the other hand, large farmers show a preference for complete adoption, most likely as a result of their larger herd size, greater access to resources, and capacity to apply more thorough techniques. According to the data, FYM is generally acknowledged as a worthwhile technique, and if more assistance and training are given, especially to small farmers, there is a chance that its full adoption will expand.

With respect to fertilizer management, the majority (93.33%) of the mango growers had no adoption, which includes the majority (91.66%) of small farmers and the majority (95.00%) of big mango growers had no adoption. Farmers might be constrained by factors such as cost and may not prefer to apply fertilizers for long duration tree crops.

With respect to the use of growth regulators to induce flowering and fruit set, the majority (88.33%) of the farmers had no adoption, including ninety per cent and 86.66 per cent of the small farmers and big farmers respectively. There are a number of reasons for the low growth regulator adoption rate. It's possible that farmers are worried about the safety, expense, or efficacy of growth regulators. The high percentage of non-adopters may also be due to a lack of awareness or knowledge regarding the appropriate use of these substances. The practice may not have been seen as necessary or beneficial, or it may indicate difficulties in accessing or affording growth regulators, as evidenced by the low adoption rate among both large and small farmers. Future adoption may be boosted by additional instruction, proof of the practice's advantages, and removal of any obstacles to access.

With respect to the application of mango special, more than half (52.50%) of the mango growers had no adoption, which

included the majority (63.33%) of the small mango farmers, and more than two fifth (41.66%) of the big farmers had. The relatively low adoption of Mango Special, particularly among small farmers, suggested that its use may be constrained by elements like cost, awareness, or perceived benefits. Larger farmers appear more likely to embrace it, probably because they have greater access to resources, while small farms can encounter obstacles that keep full adoption from happening. Adoption rates may increase if these obstacles are removed, for example, by offering more information, offering incentives, or proving its efficacy.

With regard to drip irrigation, the majority (85.83%) of the mango growers have no adoption, including the majority (91.67%) of small farmers and big farmers, and (80.00%) have no adoption. This indicates a significant gap in water conservation and efficient irrigation practices. This is likely due to factors such as non-availability of water under rainfed situations, high initial investment costs, and a lack of awareness about drip irrigation benefits.

Regarding soil conservation practices, nearly half (49.17%) of the mango growers had partial adoption, including exactly half (50.00%) of the small farmers and nearly half (48.33%) of the big farmers. The high rate of partial adoption of soil conservation practices among mango growers can be attributed to limited resources, lack of knowledge, and gradual implementation.

Regarding intercropping, the majority (65.00%) of the farmers had full adoption. Among small farmers, two third (66.67%) of the mango growers had full adoption and among big farmers, 63.34 per cent of the mango growers had full adoption. This revealed that intercropping is a widely accepted and beneficial practice among mango farmers, likely due to its ability to increase crop diversity, reduce pests and diseases, provide additional income and improve soil health. The high adoption rate across all farm sizes indicates that intercropping is a feasible and attractive option for farmers, regardless of their resource base. Another reason could be the wide spacing followed by farmers, which gives scope for intercropping.

Regarding weed management, the majority (97.50%) of the farmers had no adoption, followed by partial adoption (2.50%). Among small farmers, all (100.00%) farmers had no adoption. Among big farmers, the majority (95.00%) of the mango growers had no adoption, followed by partial adoption (3.33%) and full adoption (1.67%). This indicated that farmers may be relying on traditional or manual methods of weed control, which can be labor-intensive and expensive practices. The lack of adoption of improved weed management practices may be due to limited access to information, lack of awareness about the benefits, or unavailability of necessary inputs or equipment and cost.

With respect to pruning, nearly half (48.33%) of the mango growers had full adoption, followed by partial adoption (41.67%) and no adoption (10.00%). Just 50% of mango

producers who were small farmers had partial adoption, whereas the majority of large farmers (63.34%) had full adoption. The relatively high adoption rate, particularly full adoption among big farmers, indicates that pruning is viewed as a beneficial practice for mango cultivation. The slightly lower adoption among small farmers may be due to factors such as limited resources, lack of knowledge, or labor, which could hinder full implementation. However, the widespread partial adoption revealed that farmers recognized the benefits of pruning and are gradually incorporating into their farming practices.

Regarding powdery mildew disease management, majority (38.33%) of the mango growers had no adoption, followed by partial adoption (34.17%) and full adoption (27.50%). Among small farmers, more than two fifth (43.33%) of the mango and among big farmers, more than one third (35.00%) of the farmers had full adoption. Regarding anthracnose disease management, more than two fifth (45.00%) of the farmers had partial adoption including small and big farmers falling into the same category. Regarding mango malformation, more than two fifth (41.66%) of the mango growers had partial adoption, including nearly half (48.34%) of the small farmers and more than two fifth (45.00%) of the big farmers. With regard to blossom blight management, more than half (51.67%) of the mango growers had partial adoption, including both small and big farmers. The varying adoption rates can be attributed to differences in resources, knowledge, and the perceived severity of each disease. Big farmers, with better access to resources and information, showed higher adoption rates. Small farmers, however, often faced limitations such as financial constraints, knowledge gaps, or lack of access to effective treatments, leading to higher partial or no adoption rates.

With regard to management of hoppers, nearly half (49.17%) of the mango growers had full adoption. Among small farmers, more than two fifth (48.33%) of the mango growers fell into the partial adoption category and among big farmers, 63.33 per cent of the mango growers belonged to full adoption category. This indicated that big farmers may have better access to information, training, and resources, enabling them to effectively manage hoppers and reduce pest damage. In contrast, small farmers may face constraints such as limited knowledge, labor, or inputs, leading to lower adoption rates and potentially experiencing greater pest-related losses.

Regarding harvesting all (100.00%) mango growers had full adoption of manual harvest. With regard to mechanical harvest all (100.00%) mango growers had no adoption,. However, all (100.00%) mango growers had full adoption on the correct time of harvest. The result indicates that mango growers generally follow the manual method of harvest and have less awareness regarding mechanical harvesting methods

Table 3: Adoption of production technologies of mango cultivation by Small and Big mango growers

Sl. No	Recommended technologies	Small farmers (n1=60)						Big farmers (n2=60)						Mango growers (n=120)					
		Full adoption		Partial adoption		No adoption		Full adoption		Partial adoption		No adoption		Full adoption		Partial adoption		No adoption	
		f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
1.	Selection variety *																		
	a. Early varieties (Amrapali, Raspuri, Langra)	28	46.66	07	11.67	25	41.67	36	60.00	05	8.33	19	31.67	64	53.33	12	10.00	44	36.67
	b. Regular varieties (Alphanso, Kesar, Dasehari, Totapuri, Neelam)	57	95.00	00	0.00	03	5.00	60	100.00	0	0.00	0	0	117	97.50	0	0	03	2.50
	c. High yielding varieties (Amrapalli, Mallika)	30	50.00	03	5.00	27	45.00	40	66.66	01	1.67	19	31.67	70	58.34	04	3.33	46	38.33
2.	Planting season (July- August)	60	100.00	0	0.00	0	0.00	60	100.00	0	0.00	0	0.00	120	100.00	0	0.00	0	0.00
3.	Planting techniques (Pit size of 90 x 90 x 90 cm)	60	100.00	0	0.00	0	0.00	60	100.00	0	0.00	0	0.00	120	100.00	0	0.00	0	0.00
4.	Spacing																		
a.	Conventional system (10m x 10m, 8 m x 8 m)	60	100.00	0	0.00	0	0.00	60	100.00	0	0	0	0	120	100.00	0	0.00	0	0.00
b.	High Density Planting (5 m x 5 m, 3 m x 3 m, 2.5 m x 2.5 m)	0	0.00	0	0.00	60	100.0	0	0.00	02	3.33	58	96.67	0	0.00	02	1.67	118	98.33
5.	FYM Application (25kg/Plant/year)	19	31.67	41	68.33	0	0	35	58.33	25	41.67	0	0	54	45.00	66	55.00	0	0.00
6.	Fertilizer management (From 1 st to 9 th year: 75:20:70 g/plant, From 10 th onwards: 730:180:680 g)	01	1.67	04	6.67	55	91.66	0	0.00	03	5.00	57	95.00	01	0.83	07	5.84	112	93.33
7.	Use of growth regulators to induce flowering and fruit set (NAA@20PPM, 0.5%Urea, 1%KNO ₃)	0	0.00	06	10.00	54	90.00	01	1.67	07	11.67	52	86.66	01	0.83	13	10.84	106	88.33
8.	Application of Mango special (2-3 g/l, 3 sprays/year)	13	21.67	09	15.00	38	63.33	24	40.00	11	18.33	25	41.67	37	30.83	20	16.67	63	52.50
9.	Drip irrigation	03	5.00	02	3.33	55	91.67	10	16.67	02	3.33	48	80.00	13	10.83	04	3.34	103	85.83
10.	Soil conservation method Mulching, contour bunding)	16	26.67	30	50.00	14	23.33	21	35.00	29	48.33	10	16.67	37	30.83	59	49.17	24	20.00
11.	Inter-cultivation																		
a.	Inter cropping (sunhemp, cowpea, dhaincha)	40	66.67	11	18.33	9	15	38	63.34	17	28.33	05	8.33	78	65.00	28	23.33	14	11.67
b.	Weed management (Atrazine 2.0 kg/ha)	0	0	0	0	60	100.00	01	1.67	02	3.33	57	95.00	00	0.00	01	2.50	117	97.50
c.	Pruning (June- July)	20	33.33	30	50.00	10	16.67	38	63.34	20	33.33	02	3.33	58	48.33	50	41.67	12	10.00
12.	Disease management																		
a.	Powdery mildew (Hexacenazole: 1g/l, Sulphur: 3g, Carbendazim: 1g)	12	20.00	22	36.67	26	43.33	21	35.00	19	31.67	20	33.33	33	27.50	41	34.17	46	38.33
b.	Anthracoze (1% Bordeaux mixture/ 1 g carbendazim/ Chlorothalonil 2g/l)	13	21.67	27	45.00	20	33.33	25	41.67	27	45.00	08	13.33	38	31.67	54	45.00	28	23.33
c.	Mango malformation (Carbendazim 0.1%, Bordeaux paste)	08	13.34	23	38.33	29	48.33	13	21.67	27	45.00	20	33.33	21	17.50	50	41.67	49	40.83
d.	Blossom blight (Mancozeb 2g/l, Thiophonate 2g/l, carbendazim 1g/l)	20	33.33	31	51.67	09	15.00	26	43.33	31	51.67	03	5.00	46	38.33	62	51.67	12	10.00
13.	Pest management																		
a.	Hopper (Imidacloprid 0.25 ml/l, thiomethoxam 3 ml/l, cyhalothrin 2ml/l)	21	35.00	29	48.33	10	16.67	38	63.33	12	20.00	10	16.67	59	49.17	41	34.17	20	16.66
b.	Aphids (Dimethoate 1ml/l, methyl demeton 1ml/l)	17	28.33	23	38.33	20	33.34	26	43.34	11	18.33	23	38.33	43	35.83	34	28.34	43	35.83
c.	Flower Webber (Acephate 1.5g/l)	05	8.33	28	46.67	27	45.00	08	13.34	23	38.33	29	48.33	13	10.83	51	42.50	56	46.67
d.	Stem borer	10	16.67	33	55.00	17	28.33	17	28.33	29	48.33	14	23.34	27	22.50	62	51.67	31	25.83
e.	Fruit fly	15	25.00	25	41.67	20	33.33	18	30.00	28	46.67	14	23.33	33	27.50	53	44.17	34	28.33
14.	Harvesting																		
a.	Manual harvest	60	100.00	0	0.00	0	0.00	60	100.00	0	0.00	0	0.00	120	100.00	0	0.00	0	0.00
b.	Mechanical method	0	0.00	0	0.00	60	100.00	0	0.00	0	0.00	60	100.00	0	0.00	0	0.00	120	100.00
c.	Correct time	60	100.00	0	0.00	0	0.00	60	100.00	0	0.00	0	0	120	100.00	0	0.00	0	0.00

*= Farmers are growing multiple varieties as indicated in the table.

Relationship between profile characteristics and Adoption of production technologies of mango growers

Table 3 indicates that the variables such as education, annual income, extension participation and cosmopolitaness were found to have significant relationship with adoption of production technologies of mango growers at one per cent level whereas the variables extension contact, mass media

exposure, social participation and level of aspiration were found to have significant at 5 per cent level. However, the variables such as age, family size and farming experience were found to be non-significant.

With regard to small farmers, the variables namely, annual income, extension contact, extension participation, mass media exposure, cosmopolitaness, social participation and

level of aspiration were found to have significant relationship with their adoption of production technologies at one per cent level significance whereas, education was found to have significant at 5 per cent level of significance with adoption of production technologies. The remaining variables, such as age, family size and farming experience, had a non-significant relation with the adoption of production technologies of mango growers.

With respect to big farmers, the variables such as education, annual income, extension contact, extension participation, mass media exposure, cosmopolitanism and level of aspiration had significance at 1 per cent level. The variables such as farming experience and social participation were found to have significance at 5 per cent level. The variables such as age and family size were found to be non significant.

Table 11: Relationship between profile characteristics and Adoption of production technologies of mango growers

Sl. No.	Characteristics	Correlation co-efficient		
		Small farmers (n1=60)	Big farmers (n2=60)	Overall (n=120)
1	Age	0.103 ^{NS}	0.125 ^{NS}	0.143 ^{NS}
2	Education	0.604 ^{**}	0.755 ^{**}	0.677 ^{**}
3	Annual income	0.544 ^{**}	0.412 [*]	0.556 ^{**}
4	Family size	0.139 ^{NS}	0.198 ^{NS}	0.178 ^{NS}
5	Farming experience	0.020 ^{NS}	0.053 ^{NS}	0.061 ^{NS}
6	Extension contact	0.310 [*]	0.420 [*]	0.396 [*]
7	Extension participation	0.476 [*]	0.540 [*]	0.589 ^{**}
8	Mass media exposure	0.419 [*]	0.379 [*]	0.482 [*]
9	Cosmopolitanism	0.544 ^{**}	0.542 ^{**}	0.671 ^{**}
10	Social participation	0.463 [*]	0.384 [*]	0.364 [*]
11	Level of aspiration	0.339 [*]	0.364 [*]	0.463 [*]

Conclusion

From the results, it can be concluded that the overall majority of the farmers belonged to the medium adoption category, however, small farmers majorly belonged to the low adoption category. There was full adoption regarding selection of variety, planting season, planting technique, conventional system of spacing, manual harvesting and correct time of harvesting. However, lower adoption. However majority of the farmers had no adoption on high-density planting, weed management, fertilizer management, drip irrigation, mechanical method of mango harvest, pests and disease management. The adoption patterns of farming practices among mango growers suggested the need for targeted strategies to improve agricultural outcomes. Policy interventions should focus on providing financial support, subsidies and easier access to credit for farmers, while also promoting knowledge exchange between big and small farmers through collaborative platforms like training programmes. Such initiatives would help bridge the adoption gap, ensuring that all categories of farmers move towards more sustainable and profitable farming practices.

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