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A Scale to Measure the Adoption Level of Recommended Scientific Practices by Coffee Growers in India

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ABSTRACT. *Coffee (Coffea arabica L.) is an important crop cultivated in India over an area of 0.305 million ha by 0.14 million growers, with an average annual production of 0.2 million tonnes. Coffee industry has a gross turn over of Rs. 200 million besides providing daily employment to 0.4 million people. At present the national average yield is as low as 860 kg ha^{-1}, whereas the potential yield is 1500 kg ha^{-1}. Non-adoption of the practices recommended by the Indian Coffee Board was considered as the major reason for this yield gap. Thus, a study was conducted in Karnataka and Kerala States of India during 1997-98 to develop a scale to measure the adoption level of recommended scientific practices by the coffee growers. Forty eight technologies that were recommended by the Indian Coffee Board were identified for the study. Information on these technologies were circulated among 51 scientists/extension officers to identify relevant technologies which influence coffee yield and, 30 were short listed and included in the scale. The selected technologies were grouped under 7 main components. Information on these 7 components were circulated again among 26 scientists/extension officers and weightages were obtained for each component depending on its influence on yield. Each technology under main component was further split into specific recommended practices and allotted weightage score was distributed among them. Final adoption scale consisted of 99 practices with a score of 100. The scale was tested for reliability and validity and was found to be sound and is suitable to be used for Arabica and Robusta varieties. Due importance was given to usually neglected areas such as maintenance of farm machinery, record maintenance, labour management and mixed cropping. The scale is also an indicator of efficiency of the extension system and useful in designing an appropriate extension strategy for coffee.*

INTRODUCTION

Coffee (*Coffea arabica* L.) occupies a place of pride among plantation crops grown in India. Cultivation of this stimulating beverage crop is mainly confined to the Southern states of Karnataka, Kerala, Tamil

Nadu and Andhra Pradesh. Coffee is cultivated in an area of 0.31 million ha by 0.14 million growers producing an average of 0.2 million tonnes annually. Coffee industry has a gross turn over of Rs. 200 million besides providing daily employment to 0.4 million people.

At present India's contribution to world coffee production is 2.5 - 3.5% which is insignificant to make an impact in international market. However, by adopting all the recommended practices it is possible to almost double the yield, because the National average yield is 860 kg ha^{-1} whereas the potential yield is 1500 kg ha^{-1} (Radhakrishnan, 1997). Therefore, it is necessary to know the practices that are not adopted by growers, towards which research/extension efforts can be directed.

The Indian Coffee Board is evaluating the performance of extension officers based on the number of leaflets distributed, field visits made, group meetings and demonstrations conducted through a project called Multi Level Monitoring and Review System (MLMR). However, these parameters are only means in extension but not ends. The ratio between the coffee growers and the extension officers is very wide in India *i.e.*, 450:1. Further, liaisoning with demographically scattered, geographically isolated coffee growers under heavy rainfall areas is very difficult. Hence, extension officers should isolate the practices which are not adopted by coffee growers and selectively target at them in extension efforts using the available limited time, energy and resources.

Kantharaju (1989) and Nithyashree (1992) made an attempt to evaluate the adoption level of recommended practices by coffee growers but considered only 11 and 7 recommended practices, respectively. The total recommended practices were at least ten times more than the one's studied (Anonymous, 1997). Thus they provided a partial picture on the adoption status of coffee growers. This study attempts to overcome that deficiency.

It is of immense importance to assess whether all the practices that increase quality are adopted by coffee growers. Therefore, development of a scale to measure the adoption level of coffee growers with respect to the recommended practices is an urgent need. This would assist to isolate the practices which influence the quality of coffee, to study them and formulate research/extension strategies.

MATERIALS AND METHODS

This study was conducted during 1997–98 in Karnataka and Kerala, which are the two highest coffee growing states of India. Based on the available literature, and discussion with coffee scientists and extension officers, about 48 technologies recommended by the Indian Coffee Board were identified. A list of such 48 technologies was circulated among 51 coffee scientists/extension officers, who were working in Karnataka and Kerala states. The average experience of these officers in the field of coffee research/extension was 17 years. The scientists/extension officers were requested to indicate to what extent the technologies were relevant in determining coffee yield on a three point continuum namely, 'Highly important', 'Somewhat important' and 'Not important' with the scores of 2, 1 and 0, respectively. They were also requested to add new technologies which determined coffee yield for inclusion in the list. All the officers (100%) responded to the study and results were considered for the selection of technologies to be included in the scale. Thirty technologies which were of significant importance were finally selected through point biserial correlation method to measure the adoption level of coffee growers (Table 1).

The selected technologies were grouped under 7 main components namely, nursery practices, planting and aftercare practices, soil, water and weed management practices, nutrient management practices, plant protection practices, harvesting and post-harvesting practices, and farm management practices. These 7 components were again circulated among 26 scientists/extension officers with experience in the field of coffee in Karnataka and Kerala states. They were requested to indicate to what extent these components were important in deciding coffee yield with the maximum score of 100. All the 26 (100%) scientists/extension officers responded and the average of the weightage allotted to each component is indicated in Table 2.

Each technology under main components were further split into specific recommended practices in consultation with coffee scientists/extension officers and allotted weightage score was distributed among them. Finally, the scale consisted of 99 questions with 100 marks. The reliability of the score was established by split–half method. For this purpose the method was administered to 30 coffee growers on a random basis in a non–sample area. The reliability co–efficient found through Spearman's correlation co–efficient was 0.63, thus indicating that the method is reliable. A rigorous approach of consulting coffee scientists and extension officers at

Table 1. List of technologies and their significance levels (n = 51).

No.	Operation	'r' value	Significance level
I	**Nursery Practices**		
1.	Choice of varieties	0.315	*
2.	Seed coffee preparation	0.335	*
3.	Vegetative propagation	0.404	**
4.	Grafting	0.190	NS
II	**Planting and Aftercare Practices**		
5.	Selecting of suitable area	0.432	**
6.	Jungle clearing	0.015	NS
7.	Soil conservation measure	0.580	**
8.	Line marking	0.144	NS
9.	Spacing	0.285	*
10.	Pitting	0.482	**
11.	Planting, forking, staking, mulching and hutting	0.755	**
12.	Interplanting, replanting and underplanting	0.019	NS
13.	Training, pruning and rejuvenation	0.632	**
14.	Use of growth regulators	0.158	NS
15.	Choice of shade trees	0.603	**
16	Shade regulation	0.696	**
III	**Soil, Water and Weed Management Practices**		
17.	Scuffling	0.124	NS
18.	Cover digging	0.423	**
19.	Irrigation management	0.500	**
20.	Drought management	0.400	**
21.	Cradle pits	0.300	*
22.	Watershed management	0.265	NS
23.	Drainage measures	0.212	NS
24.	Manual weeding	0.099	NS
25.	Chemical weed control	0.218	NS
26.	Integrated weed management	0.440	**
IV	**Nutrient Management Practices**		
27.	Soil testing	0.880	**
28.	Application of bulk organic manures	0.144	NS
29.	On farm waste recycling	0.060	NS
30.	Lime application	0.910	**
31.	Fertilizer application	Infinite	**
32.	Foliar spray of nutrients	0.226	NS
33.	Micronutrient management	0.040	NS
34.	Integrated nutrient management	0.514	**

Table 1 : Cont'd.

No.	Operation	'r' value	Significance level
V.	**Plant Protection Practices**		
35.	Pest management	0.186	NS
36.	Nematode management	0.818	**
37.	Integrated pest management	0.732	**
38.	Disease management	0.211	NS
39.	Flowering/root/stem parasite management	0.259	NS
40.	Integrated disease management	0.794	**
VI	**Harvesting and Post Harvesting Practices**		
41.	Harvesting time and method	0.504	**
42.	Collection of gleanings	0.092	NS
43.	Processing methods	0.459	**
44.	Weightage specifications at the time of delivering coffee to the pool	0.510	**
VII	**Farm Management Practices**		
45.	Care and maintenance of machinery	0.334	*
46.	Record maintenance	0.451	*
47.	Labour management	0.295	*
48.	Mixed cropping	0.520	**

* Significant at p=0.05 ** Significant at p=0.01 NS Non-significant

Table 2. Weightage allotted to components based on their importance in influencing the coffee yield as perceived by coffee scientists/extension officers (n = 26).

No.	Components	Score
I	Nursery practices	10
ii	Planting and aftercare practices	15
iii	Soil, water and weed management practices	19
iv	Nutrient management practices	22
v	Plant protection practices	14
vi	Harvesting and post harvest practices	10
vii	Farm management practices	10
	Total	100

every stage in development of this scale ensured a good content validity. The developed scale was pre–tested with 10 coffee growers to know the suitability of the scale as well as to observe the difficulties of test administration. There was no difficulty or inadequacy in the test administration. The final format of the scale is given in Appendix 1.

RESULTS AND DISCUSSION

Table 1 indicates that out of 48 technologies proposed 30 (62.5%) were selected by the scientists/extension officers to include in the scale. Out of 30 technologies selected 7 (23.33%) were significant ($p<0.05$) and 23 (76.67%) were highly significant ($p<0.01$) in deciding the yield as perceived by the judges. Out of 30 technologies selected majority 8 practices (26.66%) were from soil, water and weed management components, 4 (13.33%) each from nutrient management and farm management components, and 3 (10%) each from nursery, plant protection and harvesting and post-harvesting practices. All the technologies selected by the scientists/extension officers have been recommended by the Indian Coffee Board (Anonymous, 1997). Extensive research and extension activities were carried out by the Indian Coffee Board (ICB) with respect to the technologies selected. The experience of the scientists/extension officers regarding the suitability of the technologies in the field may be the criteria in selecting the technologies to include in the scale.

Table 2 reveals that nutrient management (score 22) plays very important role in deciding the coffee yield followed by soil, water and weed management practices (score 19), planting and aftercare practices (score 15), plant protection practices (score 14), and nursery practices, harvesting and post-harvesting practices and farm management practices. These practices have a direct influence on yield (Anonymous, 1997) and may be the reason for the allocation of a higher weightage. Planting and after care practices are carried out only when the plantation is established, and plant protection is practised only when there is an incidence of pests and diseases. Therefore, these practices got relatively less weightages. Nursery practices are done only at the beginning of a plantation (or once in hundred years). Harvesting and post-harvesting practices determine mainly the quality of the yield and farm management practices indirectly influence the yield. Thus, these practices were allotted the least weightage.

Special features of the scale

1. The scale is suitable to apply in both the major varieties of coffee, namely, Robusta and Arabica which occupy 52 and 48 % of the total coffee cultivated area in India, respectively. The scale also includes all the recommended practices for cultivation of both varieties (Anonymous, 1997).

2. Due weightages are attached to the components which play important role in increasing coffee yield. Thus, possibility of a coffee grower becoming high adopter by adopting less important recommended practices has been eliminated.

3. The role of the practices such as maintenance of farm machinery and equipment, record maintenance, labour management and mixed cropping in increasing the profitability of coffee cultivation has been recognised.

4. The scale not only measures the adoption level of coffee grower but also indirectly indicates the efficiency of extension system.

CONCLUSIONS

The scale developed by the present study includes all the practices recommended by the Indian Coffee Board in order to obtain higher yields of coffee and have overcome the deficiencies of other scales available for the same purpose. Thus, the present scale could be used as an effective tool to measure the level of adoption of recommended practices by coffee growers. Application of this scale in a specific region would help the extension officers to identify the priority areas for extension work, and is also an indicator of the efficiency of the extension system.

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REFERENCES

Anonymous. (1997). Coffee Guide. Research Department, Coffee Board, Ministry of Commerce, Government of India.

Kantharaju, A. (1989). A study on adoption of improved practices of Coffee and Cardamom by small farmers in Hassan District of Karnataka. Unpublished MSc thesis, Univ. Agric. Sci., Bangalore.

Nithyashree, D.A. (1992). A study on yield gap and adoption of improved practices of coffee in Chikmaglur District. Unpublished MSc thesis, Univ. Agric. Sci., Bangalore.

Radhakrishnan, S. (1997). Fifty years of Indian Coffee Economy : A perspective. Indian Coffee. LXI: 3-6.

APPENDICES

Appendix 1. Scale to measure the level of adoption of recommended practices by coffee growers.

Please indicate your responses for the following statements regarding adoption of recommended scientific practices in coffee cultivation.

1.	**Nursery**	**10 statements - 10 scores**
1.1	Choice of varieties	
1.1.1	Recommended variety .	Adopted/Not
1.2	Seed Coffee preparation	
1.2.1	Selection of good mother plant	Adopted/Not
1.2.2	Harvesting of fruits at right stage	Adopted/Not
1.2.3	Wood ash treatment	Adopted/Not
1.2.4	Seed treatment with dressers like Bavistin/Vitavax	Adopted/Not
1.3	Vegetative propagation	
1.3.1	Good matter plant selected	Yes/No
1.3.2	Cuttings collected during June -August	Yes/No
1.3.3	Fungicide treatment for cuttings given	Yes/No
1.3.4	IBA treatment for cuttings	Provided/Not
1.3.5	Cuttings propagation through trench method	Adopted/Not
2.	**Planting and after care**	**30 statements - 15 scores**
2.1	Selection of suitable area	
2.1.1	Suitable altitude	Yes/No
2.1.2	Suitable aspect	Yes/No

Appendix 1: Cont'd

2.1.3	Optimum rainfall	Yes/No
2.1.4	Less exposure to wind	Yes/No
2.1.5	Transport facility	Good/Bad
2.1.6	Sufficient water source	Yes/No
2.1.7	Rich humus in soil	Yes/No
2.1.8	Gentle slope	Yes/No
2.1.9	Good drainage	Yes/No
2.2	Soil Conservation measures	
2.2.1	Terracing	Adopted/Not
2.2.2	Contour planting	Adopted/Not
2.2.3	Mulching	Adopted/Not
2.3	Spacing	
2.3.1	Line marking while planting	Adopted/Not
2.3.2	Recommended spacing	Adopted/Not
2.4	Pitting	
2.4.1	Pit size	Correct/Not
2.5	Planting, staking, mulching and hutting	
2.5.1	Scientific procedure of planting	Adopted/Not
2.5.2	Staking	Adopted/Not
2.5.3	Mulching	Adopted/Not
2.5.4	Hutting	Adopted/Not
2.6	Training, pruning and rejuvenation	
2.6.1	Training	Adopted/Not
2.6.2	Time of pruning	Adopted/Not
2.6.3	Method of pruning	Adopted/Not
2.6.4	Centering	Adopted/Not
2.6.5	Topping	Adopted/Not
2.6.6	Time of collar pruning during rejuvenation	Correct/Not
2.6.7	Method of rejuvenation	Yes/No
2.7	Choice of shade trees	
2.7.1	Recommended species of shade trees planted	Yes/No
2.7.2	Spacing for shade trees adopted	Yes/No
2.8	Shade regulation	
2.8.1	Time of shade regulation	Yes/No
2.8.2	Method of shade regulation	Yes/No

Appendix 1: Cont'd

3.	**Soil, water and weed management**	**19 statements - 19 scores**
3.1	Cover digging	
3.1.1	Time of cover digging is appropriate	Yes/No
3.1.2	Method of cover digging is appropriate	Yes/No
3.2	Irrigation management practices	
3.2.1	Blossom irrigation time is appropriate	Yes/No
3.2.2	Blossom irrigation quantity is optimum	Yes/No
3.2.3	Backing irrigation time is appropriate	Yes/No
3.2.4	Backing irrigation quantity is optimum	Yes/No
3.3	Drought management practices	
3.3.1	Irrigation at right time during drought period	Yes/No
3.3.2	Optimum quantity of irrigation during drought period	Yes/No
3.3.3	Planting of drought tolerant varieties	Yes/.No
3.3.4	Spraying of nutrient mixture	Adopted/Not
3.3.5	Spraying of anti-transparents	Adopted/Not
3.4	Cradle pits	
3.4.1	Pitting during right time	Yes/No
3.4.2	Taking pits of correct measurement	Yes/No
3.4.3	Renovation of pits	Adopted/Not
3.5	Integrated weed management practices	
3.5.1	Cover cropping practiced	Yes/No
3.5.2	Scuffling and mulching practiced	Yes/No
3.5.3	Slash weeding	Adopted/Not
3.5.4	Recommended dosage of weedicide used	Yes/No
3.5.5	Appropriate method of application of weedicide	Adopted/Not
4.	**Nutrient management**	**11 statements - 22 scores**
4.1	Soil testing	
4.1.1	Time of soil sampling	Correct/Not
4.1.2	Method of soil sampling	Adopted/ Not
4.2	Lime application	
4.2.1	Lime applied at appropriate time	Yes/No
4.2.2	Optimum quantity of lime applied	Yes/No
4.3	Fertilizer application	
4.3.1	Fertilizer applied at appropriate time	Yes/No

Appendix 1: Cont'd

4.3.2	Optimum quantity of fertilizer applied	Yes/No
4.3.3	Fertilizer applied through correct method	Yes/No
4.4	Integrated nutrient management	
4.4.1	Recommended dosage of fertilizer applied	Yes/No
4.4.2	FYM, compost and Biofertilizers applied	Yes/No
4.4.3	On farm waste recycling	Adopted/Not
4.4.4	Cover cropping practiced	Yes/No
5.	**Plant protection**	**14 statements - 14 scores**
5.1	Nematode management	
5.1.1	Integrated control measures at nursery and field level	Adopted/Not
5.2	Integrated pest management	
	White stem borer	
5.2.1	Identification of nature of damage	Possible/ Not
5.2.2	Control measures	Adopted/Not
	Coffee berry borer	
5.2.3	Identification of nature of damage	Possible/ Not
5.2.4	Control measures	Adopted/Not
	Shot hole borer	
5.2.5	Identification of nature of damage	Possible/Not
5.2.6	Control measures	Adopted/Not
	Mealy bug	
5.2.7	Identification of nature of damage	Possible/Not
5.2.8	Control measures	Adopted/Not
	Green scale	
5.2.9	Control measures	Adopted/Not
5.3	Integrated disease management	
	Leaf rust	
5.3.1	Identification of nature of damage	Possible/Not
5.3.2	Control measures	Adopted/Not

Appendix 1: Cont'd

	Black rot	
5.3.3	Identification of nature of damage	Possible/Not
5.3.4	Control measures	Adopted/Not
6.	**Harvesting and post harvesting**	**5 statements - 10 scores**
6.1	Harvesting	
6.1.1	Coffee harvested at right time	Yes/No
6.1.2	Correct method of harvesting	Adopted/Not
6.2	Processing methods	
	If dry processing	
6.2.1	Thickness and duration while drying	Yes/No
6.2.2	Dried at proper place	Yes/No
	If wet processing	
6.2.1	Fruits are properly pulped, demucilaged and washed	Yes/No
6.2.2	Beans are properly demucilaged and washed	Yes/No
6.3	Weightage specifications at the time of delivering coffee to the pool	
6.3.1	Test weight is correct	Yes/No
7	**Farm Management**	**10 statements - 10 scores**
7.1	Care and maintenance of machinery	
7.1.1	Care and maintenance of sprayers	Adopted/Not
7.1.2	Care and maintenance of pump sets	Adopted/Not
7.1.3.	Care and maintenance of pulper and huller	Adopted/Not
7.1.4	Care and maintenance of sprinkler and accessories	Adopted/Not
7.1.5	Care and maintenance of tractor	Adopted/Not
7.1.6	Care and maintenance of jeep	Adopted/Not
7.1.7	Care and maintenance of barrels, bushels & balances	Adopted/Not
7.2	Record maintenance	
7.2.1	Relevant records maintained properly	Yes/No
7.3	Labour management	
7.3.1	Labour management	Possible/Not
7.4	Mixed farming	
7.4.1	Mixed farming	Adopted/Not