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Good agricultural and good management practices in coconut cultivation: A critical integrated adoption index model

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Abstract
Good Agricultural and Management Practices in coconut cultivation not only helps to produce quality outputs, but also improves the soil condition, reduces cost resulting in improving the livelihood of the adopted farmers. Hence the objective of the study is to understand the adoption of Good Agricultural and Good Management Practices in coconut cultivation and the reasons for not adopting the practices. The details about Good Agricultural and Good Management Practices in coconut cultivation was collected from Central Plantation Crops Research Institute and FAO. Most of the farmers have adopted IPM and IDM to control the pest and disease. With respect to GMP, most of the farmers have adopted the harvest of matured nuts. The major reason for non-adoption of GAP and GMP was due to lack of technical knowledge.

Keywords: Adoption, adoption index, GAP, GMP

Introduction
Agriculture sector is constantly providing food and other resources to a growing world population are of crucial importance for human existence. However, there are numerous problems faced by the farmers results in low production and productivity. Similarly, coconut farmers in India are facing many problems in the production of coconuts (Vanamadevi 2017) [7], which leads to a decline in the production of quality nuts reflecting the competitive nature in the industry globally. Premkumar (2018) [6] in the study indicated that factors contributing to problems in cultivation and maintenance are power interruption, frequent attack of pests and diseases, monsoon failure, high cost of fertilizer and boosting chemicals, non-availability of quality fertilizer and boosting chemicals, depletion in ground water level and
non-availability of quality seedlings.
Sustainable agricultural practices have a vital role to play in sustaining the growth and development of agriculture (Kalidas, 2020) [4]. The concept of good agricultural practices (GAP), which, if properly applied, results in food products that are safe without contamination and wholesome for consumers or further processing. In addition, GAP contributes to the improved productivity, in particular for the small-scale farmers' (Shivakoti, 2019) [5]. Hence this article focuses on analysing the good agricultural practices and good management practices to be adopted in coconut cultivation. Also, the study focuses on adoption gap in GAP & GMP and reasons stated by the farmers for not adopting the practices.

Methodology
The adoption index (Divya, 2014) [2] was used to analyze the good agricultural practices and good management practices by collecting the responses of the sample farmers on three-point continuums full, partial and nil adoption with a numerical score of 3, 2, and 1 respectively. The average score for a given technology was obtained using the scaling technique and the adoption index was calculated by dividing the average score with the maximum obtainable score on a given practice and then multiplied by a hundred.

$$\text{Adoption Index} = \frac{\text{Respondents' Score}}{\text{Total Possible Score}} \times 100$$

Garret's Ranking Technique was used to rank the problems encountered by them in adopting good agricultural and management practices. The ranks were converted into percent position by using the formula,

$$\text{Per cent position} = \frac{100 \text{ x } (R_{ij} - 0.5)}{N_i} \text{ x } 100$$

Where

R_{ij} = Rank given to the i^{th} attribute by the j^{th} individual

N_j = number of attributes ranked by the j^{th} individual

By referring to Garret's table, the percent position estimated were converted into scores. Thus, for each problem, the mean score was estimated. The problem with the highest mean value was considered as the most important one, and the others followed in that order.

Results and Discussion

Adoption and Adoption GAP in Good Agricultural Practices in Coconut Cultivation

Good Agricultural Practices, as defined by FAO, are a "collection of principles to apply for on-farm production and post-production processes, resulting in safe and healthy food and non-food agricultural products, while taking into account economic, social and environmental sustainability. Awareness of the respondents about GAP was analysed and presented in tabular form. The results revealed that most of the respondents are aware of good agriculture practices.

Table 1: Adoption of Good Agricultural Practices in Coconut Cultivation

	Good Agricultural Practices	Adoption (%)	Adoption GAP (%)
1.	Selection of varieties	46.30	53.70
2.	Field Selection (Soil)	49.00	51.00
3.	Soil Testing before planting	47.30	52.70
4.	Water Testing	15.70	84.30
5.	Adoption of Proper Planting methods (Drenching, Spacing etc.,)	47.00	53.00
6.	Adoption of Modern Irrigation methods	49.00	51.00
7.	Fertilizer Application as per standards	49.30	50.70
8.	Integrated Pest and Disease Management	51.70	48.30
9.	Harvesting of coconuts (Age)	49.70	50.30
10.	Method of Harvesting	29.70	70.30

(Good Agricultural Practices in Coconut Cultivation by PCA, FAO and TNAU)

It is evident from the above table that 51.70 percent of the sample farmers were adopted integrated pest and disease management at the field level. Since, the pests and disease attack in the field results in loss in yield, and farmers were taking much care in adopting this practice. Followed by the age of harvesting the matured nuts, i.e., 49.70 percent of the farmers adopted this in the field. Fertilizer application and modern irrigation methods were adopted by 49.30 percent and 49.00 percent of the farmers. The method of harvesting of coconuts and water testing practices done by the farmers secured the least score of 29.70 and 15.70 percent.

There was a considerable gap in water testing practices (84.30 percent) of the sample farmers. They have not adopted water testing due to the non-availability of trusted source for water testing and lack of knowledge on the importance of water testing. Water testing practices was followed by the method of harvesting; About 70.30 percent of the farmers have not adopted this due to lack of labour for harvesting; hence farmers were unable to implement at the field level. In all the practices, more than 50 percent of the farmers have not adopted good agricultural practices.

Adoption and Adoption GAP of Good Management Practices in Coconut Cultivation

FAO defines "GMP as that part of a food control operation aimed at ensuring that products are consistently manufactured to a specified quality appropriate to their intended use". It has thus two complementary and interacting components; the manufacturing operation itself and the control system and procedures.

The knowledge of the good management practices of the sample respondents were analysed and presented in Table 5.22. It could be inferred that the majority of the farmers 54.70 percent are adopted of harvesting of coconut after maturity, 53.00 percent practiced the time lag between chemical spray and harvest of nuts, 51.00 percent practiced organic farming, followed by safe handling and application of chemicals. Value addition in coconut and potential market for selling coconuts stay at the least with 25.70 percent and 36.60 percent, respectively.

A gap of 74.30 percent in value addition technologies; the sample farmers were reluctant to do value addition because of risk in establishing the processing industries. They were followed by 63.40 percent gap in identifying a potential market for selling the coconuts and 63.20 percent gap in eco-friendly waste management practices. Dried leaves, dried spathe of coconut was burnt in the field itself, which led to decrease in the earthworm population. This waste could be managed by chopping and burial in the field itself, which is an excellent fertilizer for the coconut.

The details about various good management practices suggested by Central Plantation Crops Research Institute (CPCRI), FAO, PCA and APCC was documented and considered for analysis.

Table 2: Adoption & Adoption GAP of GMP in Coconut Cultivation

Sl. No.	GMP	Adoption (%)	Adoption GAP (%)
1.	Precision farming (Need based application of inputs)	43.00	57.00
2.	Time lag between chemical spray and harvest of nuts	53.00	47.00
3.	Safe handling and application of chemicals	49.30	50.70
4.	Organic farming in coconut	51.00	49.00
5.	Harvesting of coconut after maturity	54.70	45.30
6.	Value addition technologies	25.70	74.30
7.	Potential market for selling coconuts	36.60	63.40
8.	Eco-friendly waste management	36.80	63.20

Constraints faced by the farmers in adopting Good Agricultural and Good Management Practices in Coconut Cultivation

Farmers who were not adopting the GAP and GMPs were asked to rank the reasons for the non-adoption of practices. The responses were analyzed and presented in Table 3.

Table 3: Constraints faced by the farmers in adopting GAP and GMP

S. No.	Constraints	Non-Adopted farmers	
		Mean Score	Rank
1	Lack of technical know-how	72.31	I
2	High cost of adopting the technology	62.32	II
3	Lack of interest	52.40	III
4	Poor effect on yield during initial phase	42.88	IV
5	No support from institutions	39.37	V

It is inferred that the lack of proper technical know-how was the major reason for the non-adoption of good agricultural practices, followed by a higher cost of adopting the technology for non-adoption. Non-interest in adoption was ranked third because farmers felt that there was no much difference in adopting and non-adopting the technology. No support from institutions ranked at the least.

Conclusion

Adoption of Good Agricultural & Good Management practices improves the condition of soil, environment and nature, thus providing sustainable way of farming. Overall analysis of Good Agricultural and Good Management Practices in coconut cultivation, it was found that lack of technical know-how is the major reason for non-adoption of the practices. Producers may be trained by the concerned institutions to adopt the practices which provides a sustainable solution for profitable farming. Strategizing the promotion and adoption of Good Agricultural Practices standards for coconut cultivation by the concerned authorities, which helps to improve the scientific production and productivity. Suitable suggestions and trainings to be provided by the State Departments and concerned boards to promote GAP &GMP in the coconut orchard provide additional income and improves the livelihood of the coconut farmers.

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