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Extent of Adoption of Available Components in the IFS Units of Kerala

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ABSTRACT

Integrated Farming Systems (IFS) have shown to be an important way to improve the intake of safe and micro nutrient rich foods, particularly for households of Kerala. The productivity and profitability from a unit directly depends on the components adopted. Keeping this in mind, the present study was carried out with an objective to measure the extent of adoption of various components among the existing integrated farming system units of Kerala during 2021-22. Three districts Kollam, Thrissur and Kannur were selected randomly. From each district four panchayat were randomly selected and fifteen IFS units were selected randomly from each identified panchayat, thus making the total sample size 180 integrated farming system units. To measure the extent of adoption of available components in the IFS units, a composite index was developed. The result revealed that majority of the IFS farmers exhibited low level adoption of available components in their units and among the components, dairy and crop component had the highest adoption rate.

INTRODUCTION

Kerala is known for its richness of and biodiversity. The varied agro ecosystems have enabled Kerala to host large number of crops and allied enterprises. However, unfortunately, the conventional agricultural systems are currently facing tremendous pressure in terms of new agrarian structure, land reforms and increasing impacts of climate change (Viswanathan, 2014). This has adversely affected the food security and generic resource base of the state compelling the households to increase their dependence on markets for their everyday needs. Majority of the farmers in Kerala are either marginal and small or even landless with fragmented land holdings (GOK, 2019). Attaining self-sufficiency in food production in this peculiar condition is indeed a challenge and it can be achieved only through a noble, sustainable approach and Integrated Farming Systems (IFS) shows a way forward. Integrated Farming System is broadly defined as a system comprising of several mutually cohesive and complementary agro based enterprises. It ensures maximum productivity from unit area and enables to reap maximum profit, without disturbing the ecological and socio economic balance (Mamatha et al., 2019). These enterprises not only supplement the income of the farm families but also provide year round employment for the family members (Behera et al., 2001). Integrated farming system also reduces the cost of production by recycling the residues in the field and helps to conserve water, soil health and other nutrients (Singh & Riar, 2014). Even though these systems are made up of integration of various components, which are complementary to each other, in terms of adoption and profitability of various crops and other components, area wise variations can be noted among each unit. So that, no common model can be suitable for all the conditions. The optimization of each component is crucial for increasing overall productivity and profitability of the system. Hence for designing an IFS unit in a profitable and sustainable way, selection of the components plays a crucial role. The selection of different components in a unit is primarily based on its complementarity to each other and the ability to meet the diverse needs of the growers (Sheikh et al., 2021). It must be ensuring that the interactions among them are as compatible as possible with minimum competition. Understanding the interconnections and

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dependences among existing components, will aid in the development of a unit, as it gives a clear idea about how the output from one component is more productively utilized as an input in another. Keeping this in view, the present investigation was formulated to reveal the facts about extent of adoption of identified components in the IFS units of Kerala. It will explore the possibilities for developing new models and examine whether existing models could be scaled up. This further reflects into the structural and functional dynamics of Integrated Farming Systems, which enables the research and extension systems to set or modify their priorities and select proper and specific delivery mechanisms.

METHODOLOGY

Kerala state was purposively selected and three districts (Kollam district from Southern Kerala, Thrissur district from Central Kerala and Kannur district from Northern Kerala) were selected randomly. From each district, 2 Agro Ecological Units (AEU) were randomly selected. A list of panchayats in each AEUs of study was prepared and two panchayats with potentially active IFS units were selected randomly from each AEU. A comprehensive list of farmers those who had adopted Integrated Farming System, was prepared separately for each panchayts. On the basis of the lists, 15 Integrated Farming System units were selected randomly from each identified panchayat, thus making the total sample size 180 IFS units.

Integrated Farming System is an effective fusion of several agro based enterprises such as crops, aquaculture and animal husbandry and so on. To get an idea about the structure and functioning of the existing unit, various components available in each unit should be analyzed thoroughly. For that a final composite index was developed using the indicators for measuring rate of adoption.

Through reviewing the literatures and discussion with experts, various components prevailing in the study area were identified. In order to ascertain the extent of adoption of these enlisted components, a composite index was developed with help of selected indicators. Based on the availability, nine components were identified in the study area. The identified components were: Crop, Dairy, Poultry, Fisheries, Apiculture, Mushroom, Composting, Biogas and Azolla. Under each selected components appropriate indicators were chosen by referring relevant literatures and expert's opinion. The indicators chosen under each dimension were thought to make a significant contribution in measuring the adoption of various components in the IFS units. The development of a valid and reliable index necessitates careful examination of each indicator. Thus, these indicators were distributed to scientists and experts via Google forms as well as direct methods and they were requested to rate the relevancy of each indicator on a three-point scale, i.e. 'Most relevant,' 'Relevant,' and 'Least relevant,' with scores of 3, 2, and 1 respectively. The relevancy weightage (RW) was calculated for each indicator by using the following formula:

$$\text{Relevancy weightage} = \frac{\text{Most Relevant Responses} * 3 + \text{Relevant Responses} * 2 + \text{Least Relevant Responses} * 1}{\text{Maximum Possible Score}}$$

By using the above formula, the indicators with Relevancy Weightage (RW) of > 0.75 were considered for inclusion in developing the final index. Finally, a total of 25 indicators were retained for the data collection. To bring the values of indicators to a comparable range, normalization was done using maxi- min methodology suggested by UNDP (2006). Post normalization, separate Principal Component Analysis (PCA), as suggested by Dunteman (1989), was done considering 25 selected indicators and using IBM SPSS 26 version software.

Principal Component Analysis (PCA) method was used to construct indices for the selected indicators. It was used for grouping variables that were highly correlated into principal components (Gupta et al., 2020). Principal components were described as the part of multivariate procedures wherein linear combinations of correlated indicators are involved to maximize the variance accounted for in the original set of indicators (Chakravarty, 2017). Twenty five indicators for developing the adoption index were subjected to Principal Component Analysis and first nine principal components were selected with eigen values greater than 1. The eigen value for the selected nine principal components were 4.30, 3.13, 2.35, 2.05, 1.87, 1.47, 1.36, 1.16, 1.07. The values of first principal component in the rotational component matrix were taken as final weightage. The normalized values of each indicator were multiplied with its respective weightage. The multiplied values of indicators were summated for each respondent to obtain the final composite index.

RESULTS AND DISCUSSION

Categorization of IFS farmers based on extent of adoption of available components

The respondents were finally categorized, based on composite index values obtained into low, medium and high adoption levels using the cumulative square root frequency method as follows:

Table 1. Distribution of respondents based on extent of adoption of available components

Categories of adoption (Adoption Index Score)	Kollam (%)	Thrissur (%)	Kannur (%)	Total (%)
Low (<0.32)	36.67	40.00	43.33	40.00
Medium (0.32 – 0.60)	41.67	33.33	36.67	37.22
High (>0.60)	21.66	26.67	20.00	22.78
Total	100	100	100	100

According to the preceding Table 1, most (40 %) of the IFS farmers exhibited low level adoption of available components in their units, followed by medium level adoption (37.22%). Only less than one fourth (22.78%) had shown high level adoption. Same trend was noticed in Thrissur and Kannur district also. Nearly two fifth of the respondents in both in Thrissur (40%) and Kannur district (43.33%) were had low level adoption followed by medium with respective percentages 33.33 per cent and 36.67 per cent. A slight change was noticed from the general trend in Kollam district, as most (41.67%) showed medium level adoption followed by low level (36.67 %). Across all districts, less than three ten of total respondents (21.66% in Kollam, 26.67% in

Thrissur and 20% in Kannur) only exhibited high level adoption of available components. According to the findings of Ghouse & Hassan (2020), distance to the market, economic motivation, risk orientation, family size, innovativeness and scientific orientation, were the factor that influencing crop diversification. Lacks of resources, less demand, difficulty in time management for multiple activities were also attributed to the low adoption of certain components. These findings were at odds with that of Akshitha & Dolli (2020), who found that nearly half of the respondents from each selected districts (46.67% Belagavi and 40% for Vijyapur) belonged to medium level of adoption

Component wise extent of adoption in IFS units

An adoption index score was derived based on the extent of adoption of specified components in each dairy based IFS unit. The selected components were ranked based on their score. The component wise extent of adoption among IFS units is shown in Table 2.

Table 2. Component wise extent of adoption among IFS units

S.No.	Components	Total no. of units with specific component (n=180)	Adoption index score	Rank
1	Crop	180	1	1
2	Dairy	180	1	1
3	Poultry	158	0.87	3
4	Fisheries	95	0.53	5
5	Apiculture	55	0.31	7
6	Mushroom	11	0.06	8
7	Biogas	62	0.34	6
8	Compost	115	0.64	4
9	Azolla	159	0.88	2
	Mean score	0.62		

The Table 2 showed that among the selected agricultural components, dairy (1) and crop (1) component had the highest adoption rate. Following that, greater adoption was observed in azolla (0.88), poultry (0.87) and compost (0.64). Least adoption was noticed for mushroom (0.06), apiculture (0.31), biogas (0.34) and fisheries (0.53). Crop, azolla, poultry and compost were the most widely used components in dairy based IFS units. These componets were inextricably linked to dairy, both in terms of feed and waste management. In Kerala, majority of the farmers were marginal and using their homesteads for various agricultural activities,usually prefer components which requires less space, care and investment and multiple use. Small farming families, landless labourers and people with income below the poverty line rear chickens with low inputs and harvest the benefits like egg and meat via scavenged feed resources (Sonaiya, 2004). In addition to being a good source of human nutrition, poultry is a dependable source of regular cash income also. Poultry manure provides vital input for sustainable organic farming. Crop residues and grains provide the feed for the poultry (Roy & Kadian, 2013). Thus, the direct and strong linkage of azolla and compost with both crop, dairy and poultry sectors, may be the reason for its higher adoption rate. It was also critical to highlight that none of the existing IFS units in the study area possessed all selected components.

Possible reasons for non adoption was enlisted through discussion with farmers and experts and scored based on their responses. The mean score for each reason was calculated and ranked in such a way that one with the highest mean score being the most important reason.

Table 3. Reasons for non adoption of identified components in IFS units

S.No.	Reasons	Mean score
1	More financial investment needed	2.78
2	Not profitable	2.56
3	Marketing difficulties	2.48
4	Difficulty in time management	2.29
5	Lack of resources	2.14
6	Less demanding	2.06
7	Lack of awareness	1.94
8	Prejudice of the respondents	1.51

Need of more financial investment (2.78) was ranked as the main reason for non-adoption followed by not profitable (2.56). Table 3, denoted the least adopted components in IFS. By comparing these two observations, it may be concluded that the high initial investment needed to set up a component hinders the majority of farmers from adopting it. As an impact of COVID-19, just like other sector, agriculture sector was also hit and the financial situation of farmers remained precarious. A study conducted by Habanyati et al., (2022) reported that as part of COVID-19 lockdown farmers in Kerala were faced a lot of difficulties such as farm labor shortages, input shortages, machinery shortages, poor access to credit as well as consultancy and movement restrictions and this affected the financial condition of farmers. As a result, most of them were hesitant to implement new programmes or technology unless they received financial assistance from the government. For crop and dairy component, Government procurement centres were there like Vipani, VFPCK, Supplyco and MILMA. However, for other components farmers themselves needed to find out the market. Next important reason noted was difficulties in time management (2.29). Due to labour shortage and high wage rate which existed in Kerala, majority of the farm operations in the IFS units were carried out by the farmer himself or with the assistance of family members, farmers may have faced difficulty in managing all activities due to a lack of sufficient workers. Some componets necessitate a strong resource base such as water resources, nector yielding cropping systems and appropriate infrastructure, such as clean and sanitary production and processing units. This indicated that lack of resources (2.14) limited the applicability of some components in some areas. The other possible reasons were found to be less demanding (2.06), lack of awareness (1.94) and prejudice of the respondents (1.51). A study conducted by Mishra et al., (2020) among the apiculture farmers of Arunachal Pradesh, highlighted the need of more extension activities in the form of training and other advisory services for the adoption of improved apiculture practices. Since the adoption of some components were found to be low, more Government support should be provided in terms of financial and technological assistance to enhance the adoption of those components.

CONCLUSION

Integrated Faming System is a viable option for ensuring nutritional as well as livelihood security of Kerala. Along with the benefits of sustainability and livelihood security, IFS also helps to mitigate the risks associated with mono cropping system. From this study, it can be summarized that, most (40%) of the IFS farmers in the study area exhibited low level adoption of identified components in their units, followed by medium level adoption (37.22%). Among the selected agricultural components, dairy and crop component had the highest adoption rate. Following that, greater adoption was observed in azolla (0.88), poultry (0.87) and compost (0.64). The reasons like high initial investment, marketing difficulties, lack of sufficient resources, less demand, difficulty in time management for multiple activities etc., can be attributed to the low adoption of certain components.

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