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Constraints in adoption of integrated management for root (wilt) disease affected coconut areas - An analysis of Alleppey district

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Abstract

Analysis of the constraints faced by the farming community in root (wilt) affected area was done during 2010-2011 at Alleppey district, Kerala, India. It was found that irrespective of the holding size only 50 percent of the coconut trees were in bearing stage whereas around one third were seedlings and one fifth pre bearing stage. Adoption of recommended practices were statistically significant with the area under coconut cultivation. The farmers identified 30 major constraints which were categorized as technical, input, economic, social and biophysical constraints in order of importance. Participation of the coconut farmers in meetings related to farming was only 18.9 percent and participation in training programmes was meager and only 10 percent of the sample respondents were members in any farmer groups. The results indicated need for coconut farmers' clusters/ societies for improving technology adoption in community basis.

Keywords: Adoption, coconut, constraint analysis, root (wilt)

Introduction

India is one of the major producers of coconut with highest productivity among the major coconut growing countries of the world. Coconut is cultivated in 1.89 million hectares spread over 18 States/Union Territories of India. The four southern states Kerala, Tamil Nadu, Karnataka and Andhra Pradesh account for 89.7 percent of area and 91 percent of the country's production of 15.73 billion nuts in the year 2008-09. The productivity of coconut in these four states vary between 5193 (Karnataka) to 13771 nuts/ha (Tamil Nadu). The productivity of coconut in Kerala which accounts for 41.6 percent area was only 7365 nuts/ha compared to the national level productivity of 8303 nuts/ha. (CDB website). The productivity in the research stations even under rainfed cultivation was over 12000 nuts/ha. There may be several factors hindering the farmers to achieve higher productivity, but to meet the growing demand of coconut (expected to be more than 20 billion nuts by the year 2025), a higher productivity has to be achieved as the scope for area expansion is almost nil. It is also important that the efforts to increase productivity should be cost effective as the crop in the recent years failed to fetch attractive returns to the farmers and a substantial area under the crop is replaced with other cash crops like rubber. One of the major limiting factors of coconut production in Kerala state is the wide spread occurrence of the root (wilt) disease in the eight southern districts. Though it was demonstrated that yield can be improved by adopting integrated disease management practices in the disease affected region, majority of the farmers are not following the complete package of technologies. It is necessary to document and analyze the constraints faced by the farmers while adopting the technologies as it will help various stakeholders involved in coconut research and development in realizing the field level problems and bridge the gaps for improving the technology utilization and income of coconut

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farmers. It is well known that coconut farmers face several constraints in production and marketing of coconut. However, very few attempts were made for quantifying field level constraints perceieved by the farming community, paricularly in the root(wilt) disease affected area. Keeping this as background, a study was undertaken in the Alappuzha district of Kerala with the objectives to analyze the constraints faced by the coconut community in the root (wilt) disease affected region, to study the socio economic profile of the coconut farmers and the level of adoption of technologies in the district.

Materials and Methods

The study was conducted in Alleppey district during September 2010 to February 2011. The district constitutes 3.64 percent of the total state area with 1414 sq.km of size. The total area under coconut in the district was 34859 hectares with total production of 275 million nuts and productivity of 7087 nuts per hectare (Farm guide, 2010). Rawther and Pillai (1991) reported highest incidence of root (wilt) disease of coconut in Kottayam district followed by Alappuzha district *i.e*.70.69 per cent. The report also revealed that the production loss was highest in Alappuzha district to the tune of 271.02 million nuts per annum compared to other districts of Kerala. Coconut occupies more than one third of the total cropped area of the district and historically had an important role in the livelihood of the population of the Alappuzha district and still provides valuable export products. Coir making and diversification still continues to be one of the mainstays of economy of the district.

The respondents for the study were selected by following a multistage sampling design. In the first stage 10 blocks where coconut is a predominant crop in the district were selected. A total of 31 panchayaths were selected from these blocks in the second stage. Two wards from each panchayath were randomly selected and from the list of coconut farmers collected from the Krishibhavan, 5 farmers were selected at random for data collection. Data were collected by way of interview and farm visits. The interview schedule was semi structured type, pre tested and adjusted prior to its full administration. The questionnaire covered details of demographic characters, land area, knowledge on coconut cultivation practices, adoption of technologies and constraints. The constraints were measured as per the methodology followed by Meena and Sharma (2002). To distinguish the severity of constraints discretely, a score of 3 was given to the most important constraint, 2 for important and 1 for least important as per the farmers perceptions. The scores were multiplied with the number of farmers recorded constraints as per their perceived importance of the constraints. The cumulative total was divided with the total respondents and the mean score was calculated. The inventory of the coconut technologies practiced in the homesteads was as per the methodology adopted by Mekonnen *et al.* (2010). Data were analyzed using SPSS and Microsoft Excel software.

Results and Discussion

Socio economic profile of selected farmers

The profile of the coconut farmers under study revealed that all the respondents were literates, out of which 64.7 percent had education level up to primary level, 13.70 percent high school education, 17.60 percent senior secondary and 3.90 percent with qualification graduation or above. This indicated that comparatively low interest exists among higher educated people for engaging in farming. Regarding occupation, only 11.03 percent of farmers were engaged in farming as a major livelihood source. In Kerala it may be presumed that farming is becoming a part time job due to the several socio economic changes. The highest proportion of the respondents (33.12 percent) were those engaged in skilled or semiskilled jobs like labourers, housewives, part time job in private shops *etc*. The other categories were retired officials (22.73 per cent), private jobs/ small business (21.43 percent), gulf returnees (6.49 percent) and government officials (5.20 percent). This is indication of the education level possessed by the farmers, which is to be duly exploited in knowledge dissemination and utilization.

Participation in meetings by farmers enables them for experience sharing and exposure to information and knowledge. It was recorded that 81.8 percent of the respondents did not attend any meetings related to the crop. Among those participated in meetings indicated that 2.6 percent

attended regularly and 7.8 percent each attended sometimes or occasionally. Similarly only 10.4 percent of the sample respondents were member in some group/organization related to coconut development. Social participation by the farmers surely will enhance their awareness and capacity to facilitate community based problem solving. The implementation of coconut cluster programme may influence the farmers in solidifying the group activities and bargaining powers of the coconut communities.

Training imparts knowledge and skill in technologies and was proved to enable farmers to adopt technologies and improve their income efficiently. But it was observed that 19.5 percent of the farmers participated in agricultural trainings and few on coconut. They opined that they need intensive training programmes in their locality on plant protection aspects and low cost management of coconut palms for better yield.

Regarding the land holding size, 35.2 percent of the respondents possessed area up to 0.1ha, 31 percent between 0.1 and 0.2 ha, 20.8 percent between 0.2 and 0.4, and 13 percent possessed land holding size above 0.4 ha in the study area under coconut cultivation. It was also noted in the survey that 22.5 percent of the sample farmers adopted animal husbandry units in their coconut based homesteads. Alleppey district is having the highest population density per unit area in Kerala with lowest per capita land availability. Hence animal husbandry units are a better option to enhance income from marginal holdings since it offers opportunities to reduce external inputs and scope for integrated farming systems for more income per unit area.

Characteristics of holdings

The data in table1 indicated that around 50 percent of the total coconut palms were in the bearing stage providing yield. On an average it was found that coconut based homesteads/households had 22 adult or bearing palms along with 6 pre bearing palms and 11 coconut seedlings planted in the field. The incidence of other diseases like leaf rot, pests like rhinoceros beetle, red palm weevil *etc*. were also high in the root (wilt) disease affected areas. This prompts the farming community to under plant coconut in a regular manner. This also indicated that the farmers have to invest in the management/care of about 50 per cent of palms with no income. The data showed that almost similar pattern of planting followed irrespective of the size of coconut plots. This also may be one of the limiting factors leading to low level of technology utilization which needs investment by the farmer. Moreover non adoption of proper spacing in field hinders efficient use of natural resources also. Hence, technology options for economically managing the coconut palms of various stages in root (wilt) disease affected areas along with development/policy support in augmenting utilization of scientific practices for yield enhancement attains importance based on this situational constraint

Table 1. Average number of palms/household (n=155)

Holding size (ha)	Adult palms	Pre bearing	Seedlings
Below 0.1	5.63 (55.96)	1.86 (18.48)	2.57 (25.55)
0.1 to 0.2	10.87 (44.30)	4.8 (19.59)	8.87 (36.34)
0.2 to 0.4	34.09 (56.00)	8.17 (13.42)	18.61 (30.54)
Above 0.4	68.11 (56.76)	18.22 (15.18)	33.67 (28.06)

(Figures in parenthesis: percentage of palms)

Technology adoption in coconut homesteads

Most of the recommended technologies were adopted by farmers with more area under coconut, indicated by the positive and significant correlation of adoption of technologies and the area under cultivation (Table 2). However technologies like intercropping in coconut gardens, organic manuring, basin management, green manuring and farming systems were adopted by marginal land holders as well. Mathew (2009) also reported the lack of scale of economy in operation and market exploitation of small and marginal coconut holdings. Surendran and Thomas (2009) in their study found that the present income generated from coconut based agriculture was not sufficient enough to meet their living expenses. Farmers with marginal or sub marginal land holdings found to prefer adoption of no cost or low cost technologies/practices in coconut, where as those with higher holding size adopted technologies which require external inputs like fertilizers, lime, salt *etc*. This constraint could be overcome by effective awareness creation among

Table 2. Correlation between area under coconut cultivation and technology adoption (n=155)

Sl. No.	Technologies adopted	"r" values
1	Farm Yard manure application	-0.0114 NS
2	Plant protection in seedlings	0.376 **
3	Recommended Spacing	0.322 **
4	Organic manuring	0.076 NS
5	Chemical fertilizer (seedlings)	0.200 **
6	Lime application	0.252 *
7	Green manuring, Vermicomposting	0.073 NS, 0.024 NS
8	NPK fertilizers and Magnesium sulphate application for adult palms	0.189*, 0.176*, 0.1876 *, 0.178*
9	Salt application 0.157 *	
10	Irrigation	0.191 *
11	Mixed cropping , Intercropping	0.06649NS, 0.0117NS, 0.0121 NS
12	Recommended cultivars/varieties	0.444**

**Significant at 1% *Significant at 5% NS: Not Significant

farming community regarding technology options, group approaches and efficient resource utilization.

The coconut technologies practiced by farmers of the root (wilt) disease affected area is given in Table 3. The extent of practice of the traditional technologies/ practices was the highest among the coconut growers. Basin management, green manuring, leaf axil filling of seedlings and salt applicationalso was adopted by more than 50 percent of farmers. Integrated pest and disease management are very crucial in root (wilt) affected areas, but found to be practiced by less than 10 per cent of the farmers. It was found that adoption of technologies on bio-control aspects of pests and diseases of coconut as well as micro nutrient deficiencies and their management was almost absent among the farmers. This may be mainly due to the non-availability of critical inputs and low knowledge level. This was also reported by Thampan and Remani (2010). Hence focused measures needed for appropriate interventions to overcome the management gap among farmers.

Table 3. Coconut technologies inventoried from homesteads in Alleppey district, Kerala, India (n=155)

Technologies/practices recommended	Practiced by coconut farmers
Use of resistant/tolerant varieties, Use of naphthalene balls for leaf axil filling, Integrated Disease management, Integrated pest management, Provision of drainage, Husk burial	<10%
Recommended spacing, Pit size of planting, Mother palm/ Seedling selection, Magnesium sulphate application, Irrigation, Mulching, integrated Animal husbandry units	11- 25%
Chemical fertilizer - seedlings, Lime application, Chemical fertilizer application (NPK)	26-50%
Basin management, Green manure application, Salt application, Leaf axil filling - seedlings,	51-75%
Basin opening , Cropping system, Farm yard manure application, local varieties	>75%

Mathew (2009) also opined that abandonment of regular care and management of palms leads to stress and many are leaving coconut gardens neglected in a study conducted in Trivandrum and Alleppey districts of Kerala. Thampan and Remani (2010) found that coconut farmers prefer organic management practices rather than chemical intensive technologies. Mahadik *et al.* (2009) reported that 100 percent of the farmers studied in Ratnagiri district adopted local varieties and 21 percent adopted high yielding varieties also along with them where as adoption of organic manure application (16 percent), split doses of chemical fertilizers (12 percent), Integrated Pest Management (less than 10 percent), indicated low to medium level of adoption among coconut farmers.

Another positive indication in the present study was the improvement in the knowledge (52.82 percent) of the farmers in the identification of the root (wilt) disease symptoms which is almost double to the data reported by Anithakumari and Kalavathy (2001) from Alappuzha district. This could be attributed to the participatory technology transfer efforts of CPCRI, Technology mission/coconut cluster programme of Coconut Development Board and Department of Agriculture, Kerala, indicating the impact of coordinated efforts.

Constraints perceived by farmers in coconut cultivation in root (wilt) disease affected areas

The constraints perceived by the farmers in adopting the recommended practices were categorized into input, technical/extension, social, economic and biophysical constraints. The constraints under each category were ranked based on the mean score obtained as per the farmers' perception of importance and is furnished in Table 4.

Table 4. Constraints perceived by coconut farmers in root (wilt) disease affected areas

Constraints perceived by farmers	Mean score	Rank
Input constraints		
Non availability of root (wilt) tolerant seedlings as per demand	2.52	I
High cost of inputs	2.45	II
Non availability of bio control agents adequately	2.46	III
Plant protection chemicals not available in time/ convenient locations	2.45	IV
Inadequate availability of organic manures	1.97	V
Technical/extension constraints		
Difficultyin early identification of red palm weevil incidence	2.95	I
Low level of knowledge/adoption on plant protection and management	2.81	II
Unscientific use of chemicals	2.61	III
Lack of appropriate coconut palm climbing machines	2.46	IV
Inadequate extension contact for information provision	2.39	V
Lack of sufficient training at field level	2.16	VI
Social constraints		
Labour problems- high charges, inadequate availability, low output	2.74	I
Low level of participation/involvement of youth and women	2.25	II
Fragmented holdings, very low investment in coconut, low risk taking ability	2.21	III
Need for more integration among various agencies in coconut R&D	2.17	IV
Lack of bargaining capacity of coconut community	2.15	V
Diminishing motivation/inspiration towards coconut cultivation	2.10	VI
General apathy towards managing coconut - low remunerative crop	2.10	VII
Conversion to more remunerative crop like rubber	1.61	VIII
Economic constraints		
Declining yield/income from coconut	2.46	I
Fluctuating price of coconut	2.32	II
Lack of regular policy support/incentives for coconut farmers	2.29	III
Low awareness on credit/insurance availability	2.22	IV
Marketing restricted to middle men, erosion of traditional marketing channels	2.17	V
Bio Physical constraints		
High level of incidence of red palm weevil - destructive pest	2.62	I
Low organic content of soil	2.13	II
Delayed flowering, difficult to maintaining palms up to bearing stage	2.12	III
Leaving coconut gardens neglected	2.04	IV
Micro nutrient deficiencies (low knowledge)	1.94	V
Button shedding due to multiple reasons which farmers could not identify	1.90	VI

The pre-requisite for the technology utilization for the farming community is the timely availability of inputs in required quantity and quality. In root (wilt) disease affected area, availability of disease tolerant varieties/hybrids, plant protection chemicals and bio control agents play vital role for improving the productivity of palms. The results clearly indicated the importance attached to these technologies by the farming community. The study of Anithakumari *et al.* (2003) among the extension officials of the Kerala state also reported the importance of the above mentioned input constraints in technology adoption. Decentralized farm level production and distribution of bio control agents and quality seedlings may be taken up by coconut clusters with technical facilitation of research and extension/ development agencies. To overcome the high cost and local availability of plant protection chemicals, cluster based procurement of chemicals and need based application may be adopted.

The major technology need recorded by the farmers was on plant protection aspects, particularly the early diagnosis of red palm weevil infestation. The decision making process by the farmers requires adequate knowledge, information and skill. The data strongly points to the need for effective extension strategies and training programmes in this area. To overcome these constraints, the activities of various stake holders such as research, extension, development agencies and media has to be converged. Even though the farmers ranked insufficient field level training at a low priority, it could be inferred that some of the indicated constraints could be overcome with capacity building programmes for farm labourers, farmers including women and youth. Bindlish and Evenson (1997) reported that frequent visit of extension workers increased the efficiency and productivity of the farmers. Yogananda (1992) and Thimmaraju (1989), Anithakumari *et al. (*2003), Thippeswamy (2007), Mahadik *et al.* (2009) and Thampan and Remani (2010), also reported low level of knowledge and technical guidance as important constraints faced by majority of coconut growers.

Social constraints like labour problem, especially for the highly skilled job of coconut climbing, apathy of youth towards farming and

fragmentation of holdings were important constraints perceived by the farmers. Social mobilization and motivation along with technological combinations ensuring adequate income to the farmers are required to improve the coordination and linkage of several actors. In a study conducted in Tanzania by Madulu and Chalamila (2007) found that the impact of lethal disease of coconut has been reflected in the expected income of small holder farmers by 50 percent per year and farmers were not investing in coconut there because they do not feel secured; instead they are promoting alternate tree crops. Prakash (1989) and Thampan and Remani (2010) also reported similar constraints along with non-attractive profit margin from coconut cultivation among coconut farmers. Mani and Santhakumar (2011) observed that in coconut, unlike in natural rubber, was characterized by lack of cohesiveness with a multiplicity of actors operating at sub-optimal scales. The provision of subsidies by the Department of Agriculture was not linked to technology adoption.

The coconut farmers were very much concerned about the declining yield/income and fluctuating price of coconut. Similar results were reported by Subburaj (2007) and Surendran and Thomas (2009). Besides reduction in yield, the income from coconut also declined due to the lack of scale of economy in operation and market exploitation (Mathew, 2009). As mentioned in a study by Mani and Santhakumar (2011), the coconut producers are small farmers and mostly unorganized while the consumers are divided somewhat equally between a large number of households and industrial consumers. These factors could be overcome through strong organizations of coconut farmers involving from production to processing and marketing.

The bio-physical constraints indicated the reasons for yield decline like high pest incidence, management gaps in maintaining soil quality and delayed flowering of palms in root (wilt) disease affected areas. Prakash (1989), Thampan and Remani (2010) Anithakumari *et al.* (2003), and Mathew (2009) also reported the high incidence of pests and diseases and neglect in management of coconut as constraints. In root (wilt) affected area the incidence of red palm weevil and leaf rot disease are related and hence community interventions in managing them needs high priority. Strengthening participatory demonstration programmes and opportunities for appraisal and evaluation by community along with support for group based adoption could bridge the gaps in technology awareness and utilization.

Among the categories of constraints the most perceived was that under technical/extension (Fig. 1). Further look into the data showed that lack of technology for early identification of red palm weevil incidence and its increasing level of incidence, low level of knowledge and adoption of plant protection and management aspects, unscientific use of chemicals and labour problems (high wage rates, inadequate availability, low output) were perceived as the most important constraints which are being experienced by the farmers at present and had immediate impact on income and yield. Some of the important constraints such as inadequate availability of root(wilt) disease tolerant seedlings and bio control agents, high cost of inputs, declining trend in yield, micro nutrient deficiencies *etc*. may have long term impact in the root(wilt) affected area.

The farmer respondents in the Alleppey district having highest level of root(wilt) disease incidence perceived 30 major constraints covering input, technical, social, economic and biophysical aspects fromproduction to marketing of coconut. The constraints or field level problems faced by the small and marginal holding coconut farmers in the root (wilt) affected area were multifaceted and needs interventions at research, extension, development, social and policy levels. The local self Government bodies and extension /development agencies may

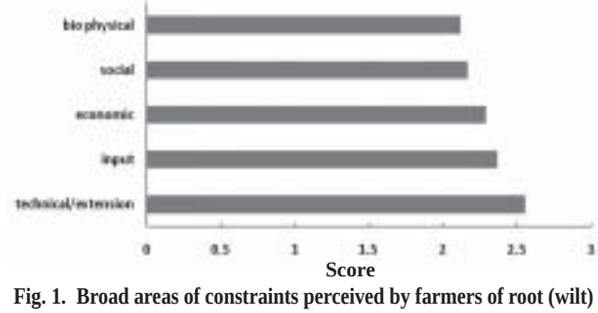

Fig. 1. Broad areas of constraints perceived by farmers of root (wilt) affected area

prioritize the problems and derive programmes for implementation in participatory mode. The constraints could also be overcome through strengthening the cluster approach with provision for adequate and timely information and input provision as well intensification of use of mass media and ICT among the community and ensuring price stability through policy, value addition of coconut and market interventions. A ready market will encourage farmers to produce more and for that they need to adopt appropriate technologies.

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