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Technology utilization among coconut farmers of root (wilt) disease affected areas

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Abstract

The study was conducted in Alappuzha district, Kerala during 2010-11 among 150 coconut farmers randomly selected from 30 panchayaths. The adoption and knowledge of the farmers were studied in respect of seedling and adult palm management. In case of coconut seedlings application of chemical fertilizers, organic manure and prophylactic measure against rhinoceros beetle attack (leaf axil filling) were adopted by majority of farmers. The management of adult palms recorded fairly good adoption level regarding basin opening, basin management with green manures and organic manure/ lime/salt/chemical fertilizer application. Kuttanad region of Alappuzha district recorded significant level of knowledge and adoption of coconut farming technologies compared to other regions of the district. Farmers' knowledge and adoption indicated statistically significant relationship with area under cultivation, training participation, membership in groups, frequent attendance in group meetings and enterprise diversification. The knowledge and adoption of plant protection aspects including bio-control measures, soil and water conservation were far below optimum which needs participatory community based extension interventions. Compared to the adoption and knowledge level during 2001, this study recorded improvement in both knowledge and adoption of recommended technologies except plant protection and soil/ moisture conservation technologies.

Keywords: Adoption, coconut seedling, knowledge, management, plant protection

Introduction

Coconut is one of the most important crop, which is unique as a homestead as well as commercial crop, of the country. Kerala state holds the prime position in area (7.87 lakh hectares) and production (5802 million nuts) in coconut, but lags much behind in productivity compared to other major coconut growing states in India. Coconut sector contributes around 21 per cent of the total agricultural GDP of Kerala, thus closely linked to the agricultural economy of the State. Several reasons could be attributed to the low productivity of the crop, such as wide spread incidence of root (wilt) disease, pests and diseases, fragmented holdings, social changes, unstable prices, volatile markets *etc*. The small and marginal holders cultivating coconut should improve technology utilization, ensure effective use of natural resources and value addition, all of which needs knowledge and capital. Ohler (1999) observed that educating coconut small holders to become good managers using appropriate techniques and materials is the most difficult part of the problem. He asserts that extension and training are as important as new technologies. It was widely reported that most small holders apply inadequate production techniques resulting in low yield and income. Fowler and Teskey (1985) commented that small holders tend to be risk averse and hence change their methods and crops only in small steps, thus minimizing uncertainties and risk of capital loss. However, technology adoption is a pre-requisite in improving the development of coconut sector as well as

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increasing the impact of research output, thus contributing to the welfare of coconut communities. In this background, a study was taken up among coconut farmers of Alleppey district, Kerala, India with the following objectives.

To assess the knowledge and adoption of technologies recommended for scientific management of coconut in root (wilt) affected area, to find out the correlation between knowledge, adoption and socio-economic variables and to analyze spatial and temporal dimensions in adoption of coconut technologies.

Materials and Methods

The study was conducted among the randomly selected coconut farmers in Alleppey district in Kerala, India during 2010-11. This district faces the highest production loss of 271 million nuts per year in the state (Rawther and Pillai, 1995) due to the debilitating root (wilt) disease. Multi stage random sampling design was engaged by selecting 10 development blocks of the district and a total of 30 panchayaths in the second stage of sampling. Data were collected from a total of 150 coconut farmers randomly selected from the list of farmers provided by the Krishibhavans. Krishibhavans are the panchayath level agricultural extension units headed by an agriculture expert under the Kerala State Department of Agriculture. They are responsible to formulate, co-ordinate, collaborate and implement location specific farming programmes in participation mode. Pre-tested interview schedule was used for data collection. The respective field situations like pest incidence, adoption of cropping systems, identification of symptoms by farmers *etc.* could be verified during the interview in farmers' plots itself. The knowledge of the farmers was summarized to a knowledge score *i.e.,* 100 * (k1 + ... + k n)/n where, k is the knowledge of each technology/practice of the sample respondents. Similarly the adoption score was also computed for analysis. Appropriate measures such as contingency coefficient, Phi, Spearman's rank correlation and point-bi serial correlation were used to analyze the association between variables depending upon their type. Data were analyzed using SAS and Microsoft Excel software.

Results and Discussion

The results on knowledge and field level technology utilization in management of coconut seedlings/pre-bearing palms and adult palms along with the correlation of various socio-economic factors with knowledge and adoption of coconut farming technologies are furnished. The spatial and temporal dimensions of technology adoption was also analyzed and furnished.

Technology utilization management of pre-bearing coconut palms

Scientific management of field planted coconut seedlings attains importance in the root (wilt) disease affected area, especially in the context of massive replanting scheme being implemented by the Government of Kerala. Quality seedlings will perform better, only if the required management practices are adopted. The knowledge and adoption of recommended practices such as varieties, spacing, pit size, mother palm selection, seedling selection, leaf axil filling with sand, ash and salt mixture, leaf axil filling with naphthalene balls, *Metarhizium* fungus treatment in manure pits, fungicide application against leaf rot, organic manure and chemical fertilizer application were studied.

The percentage of farmers having knowledge and adoption on the practices for managing field planted coconut seedlings are shown in Table 1. In this context we could observe that traditional practices evolved through generations of farmers' experiences and technologies from research institutions serve as multiple knowledge sources in a perennial crop like coconut. The practices such as leaf axil filling with sand, salt and ash mixture as prophylactic measure against rhinoceros beetle attack and application of chemical fertilizers were being followed by one third of the farmers, whereas more than eighty per cent of the farmers apply organic manures to seedlings.

While almost all farmers who had knowledge on the technological components also adopted the same, the case was not so with attributes having low knowledge level (5 to 20%). It could be seen that less than half the number of farmers acquired knowledge on those technological components adopted them. Knowledge on placement of naphthalene balls and

Table 1. Knowledge level and adoption of management practices of field planted seedlings/ pre-bearing coconut palms (n=150)

Sl.No	Technology components	Knowledge (%)	Adoption (%)	Have knowledge but not adopted (%)	Measures of association	
					Contingency coefficient	Phi
1.	Varieties	5.84	2.60	55.5	0.548	0.655
2.	Spacing	12.99	7.14	45.0	0.583	0.718
3	Pit size	14.29	7.79	45.4	0.580	0.712
4.	Mother palm selection	17.53	5.84	66.7	0.475	0.540
5.	Seedling selection	16.23	5.84	64.0	0.493	0.566
6.	Leaf axil filling (sand, ash & salt)	34.42	33.77	5.6	0.680	0.928
7.	Leaf axil filling (naphthalene balls)	0.65	0.65	0.0	0.707	1.000
8.	Fungicide against leaf rot disease	2.60	1.30	50.0	0.575	0.702
9.	Organic manure application	82.47	81.82	0.78	0.699	0.978
10	Chemical fertilizer application	35.06	34.42	1.85	0.702	0.986

use of bio-control agent *Metarhizium anisopliae* (green muscardine fungus) for control of rhinoceros beetle were found to be almost nil. The data indicated coordinated efforts in reaching out to the farming community with low or no cost technologies like bio-control of pests/diseases, mother palm and seedling selection, importance of scientific pit taking for planting seedlings in correct spacing in community basis. Participatory training programmes for building necessary awareness and skill as well as motivating them by convincing the need and benefits of technology utilization involving stakeholders are highly needed for the rejuvenation of this crop.

Technology awareness among the farmers is very important for its successful adoption in the field but it is being influenced by many other factors. The association of knowledge and adoption with respect to management of coconut seedlings was expressed in terms of contingency coefficient and 'Phi'is also provided in the Table 1. The degree of association was more distinctively expressed by the coefficient 'Phi'. Higher the value of Phi indicated stronger association and also higher percentage of adoption by the farmers having knowledge on that technology. The value of Cramer's 'V', another measure of association, was found to be the same as 'Phi' for this data.The knowledge and adoption of recommended practices for adult palms showed different picture compared to the knowledge and adoption in case of coconut seedling management.

Integrated nutrient management is one the most important operation in the management of adult coconut palms in root (wilt) affected areas for improving health and productivity. The level of knowledge and adoption of different operations with regard to basin management is shown in Table 2. The level of knowledge and adoption of chemical fertilizers, encompass the requirement of the three major nutrients which were considered separately. They were combined because the response by any farmer to these three components was the same. Unlike seedling management, almost all the farmers put into practice their knowledge for managing the adult palms, which is also reflected with high values for 'Phi'. This may be because the farm family had to meet the consumption need as well as a part of farm income from adult coconut palms. The lowest value for 'Phi' was obtained as 0.971 corresponding to knowledge and adoption of organics. The major source of green manure was the trees in the homestead and only 11 per cent farmers cultivating *Glyricidia* for green manure. Farmers were not aware of growing cover crops but they grow cowpea and sun hemp in coconut basins as recommended.

Table 2. Knowledge level and adoption of cultivation practices for adult coconut palms (n=150)

Sl. No.	Technology components	Knowledge (%)	Adoption (%)
1	Basin opening of palms- yearly basis	68.8	68.8
2	Green manure - basin management	40.3	40.3
4	Application of organics	68.8	67.5
5	Application of lime	27.3	26.6
6	Application of chemical fertilizers	36.4	36.4
7	Application of magnesium sulphate	21.4	20.8
9	Application of salt	48.7	48.0
10	Mulching in basins	14.3	14.0
11	Husk burial	1.9	0.0
12	Drainage provision in water logging areas	1.9	0.6
13	Irrigation during summer months	26.6	26.0
14	Cropping systems	87.3	66.4

The sole source of organics was FYM and only two farmers were reported to make vermicompost during the representative survey. The appropriate technologies for meeting organic matter requirement in coconut based farming systems through organic recycling have to be popularized among farmers. Knowledge and adoption of micro-nutrients and cover crops were not responded in the survey. There was good response among the farmers in adopting lime (26.6%), magnesium sulphate (20.8%), chemical fertilizer application (36.4 %), salt (48%) and multi-cropping systems (66%). This indicated that farmers are willing to adopt new technologies if suitable supports are being given. The data provided areas where the extension programmes in coconut to be concentrated. More awareness has to be given for improving adoption rate of convinced technologies or practices through field demonstrations, trainings and participatory programmes especially to promote practices like husk burial, mulching, irrigation and drainage. It is proven that, inter/mixed cropping of compatible crops in coconut gardens increased the yield of coconut as well as better returns to the farmer. But field observations during the survey reiterated the need for educating the farmers in selection and combinations of intercrops in coconut gardens and organic recycling practices for better efficiency and maximizing the farm income.

Knowledge and adoption of plant protection aspects was found to be very low (1.95%). The reasons could be the inadequate level of training the farmers, lack of exclusive participatory large area demonstrations of pests/disease management with intense monitoring and documenting the responses; along with the difficulties in getting skilled climbers for timely operations. The adoption of integrated pest management (IPM) practices was almost meager in the case of rhinoceros beetle, red palm weevil, eriophyid mite and coried bug, even though they were adopting technology components in piecemeal basis. The knowledge and adoption regarding the chemical control of leaf rot disease was 5.19 per cent and 4.55 per cent respectively, whereas that of bio-control of leaf rot disease was less than one per cent and no adoption. This area needs special attention in view of the ban of chemicals and the shift towards organic practices. Regarding stem bleeding disease, around five per cent of the farmers were aware of the recommended management practices. Regarding the pests, the knowledge as well as adoption of practices recommended was very low, except for rhinoceros beetle, and this needs further reorientation of technologies to suit community based recommendations and approaches along with appropriate extension strategies. Knowledge and adoption of micronutrients was absent among the farmers surveyed. This will have long term implication since micro-nutrient deficiencies are being reported as field problem by extension officials. Hence, the farmers are to be made aware about the symptoms, remedial measures and integrated nutrient strategy with special emphasis to micro-nutrient management in coconut gardens with the help of the extension officials, mass media and the farming community.

Thippesamy *et al.* (2008), Mahadik *et al.* (2009) and Anithakumari and Kalavathi (2001) also reported low level of knowledge and adoption of hybrids and plant protection measures in coconut.

Spatial difference in technology utilization among coconut farmers

The Alappuzha district is distinct with the areas below sea level *i.e.* Kuttanad region with paddy fields and coconut, Onattukara region with sandy loam soil and crop specificity, northern Alappuzha dominated with sandy soil along the coastal areas and region bordering Kollam and Pathanamthitta districts with laterite soil, all having coconut cultivation.

Regional differences on knowledge level and adoption of technologies were analyzed based on the scores computed for each holding included in the sample. It was found that Kuttanad region had a significant edge (Table 3) over other three regions in knowledge and adoption of coconut farming technologies. This may be because of the active presence and activities of various public and private agencies in the area concentrating among the farmers mainly for paddy. This orientation would have helped in the adoption of coconut farming technologies by the farmers. This analysis showed strategic approaches for area specific interventions for improving the technology utilization in coconut,

Table 3. Average score of knowledge and adoption in the four regions of Alappuzha district (n=150)

Region	Average knowledge score	Average adoption score
Kuttanad	36.36	31.40
Onattukara	16.13[a]	12.75[b]
Alappuzha North	19.15[a]	12.66[b]
Alappuzha Laterite	18.40[a]	16.67[b]

Figures with same alphabet as superscript are not significantly different

instead of blanket implementation or project formulations.

Correlation between socio-economic variable with knowledge and adoption

The association of socio-economic variable on the adoption and knowledge scores is shown in Table 4. Statistically significant correlation was observed with area under farming, annual yield of coconut, number of palms and enterprise diversification. Social factors like participation in training, membership in groups and frequency in attending group meetings were also significantly correlated with the knowledge and adoption of coconut farming technologies.

The results in Table 4 indicated that area under coconut cultivation and numbers of coconut palms are positively and significantly correlated with knowledge and adoption of technologies, since they provide resources to the farmer for investing in coconut cultivation. Nagabhushan and Guruprasad (1994) and Thippesamy *et al.* (2008) observed positive and significant association of land holding with knowledge and adoption level of coconut farmers. This result also indirectly points to the lack of scale neutrality of the technologies recommended. Hence group/cluster approaches could enable and motivate farming community for availing credit, savings and pooling human resources for better investment and adoption of technologies. The age and education level of the farmers were not significantly correlated with the adoption or knowledge scores and showed negative relationship with adoption and knowledge of adult palm management and adoption of seedling management. This may be an indication of the low level of involvement and motivation of educated persons in the coconut cultivation. Yogananda (1992) also reported no significant relationship of age of coconut farmers with knowledge or adoption of technologies. But none of the studies reviewed reported non-significance between education and knowledge/ adoption level of coconut farmers. As there was no significant association between the three enterprise diversification variables *viz*., inter cropping, mixed cropping and livestock, these three variables were combined as enterprise diversification. Enterprise diversification improves unit income, productivity and better resource utilization in small and marginal holdings. But scientific choice and combinations of enterprise to suit farmers' situational specificity and capacity building of the community for better management was required for realizing the impact. The participation of the farmers in extension programmes clearly indicated influencing the knowledge acquirement and technology utilization. Thippesamy *et al.* (2008) and Yogananda (1992) reported positive and significant relationship of adoption and knowledge of coconut farmers with extension and social participation. Hence, concerted planning and interventions required for motivating farming community and enabling extension officials in augmenting such programmes for improving knowledge, skill and attitude towards coconut farming, besides focusing on income improvement

Table 4. Correlation between socio-economic variables with knowledge and adoption of the respondents (n=150)

Variables	Seedling Management		Adult palm management	
	Knowledge	Adoption	Knowledge	Adoption
Area under farming	0.390 **	0. 516 **	0.422 **	0.260 **
No. of palms#	0.245 **	0.334 **	0.267 **	0.170
Age of farmer	0. 079	0.027	0.030	- 0.028
Education level	- 0.026	0.109	- 0.02	-0.018
Participation in training	0. 331 **	0. 365 **	0.391 **	0.422 **
Membership in groups	0. 149	0. 058	0.155 **	0.233 **
Frequency of attending group meetings	0. 538 **	0. 477 **	0.589 **	0.530 **
Enterprise diversification	0. 360 **	0. 324 **	0.384 **	0.430 **

Pearson's correlation coefficient # Number of juvenile/adult palms in order ** Significant at 0.01 level

from the crop through appropriate technology choices. This is particularly important in view of the fluctuation of the price of the produce as well as the input prices in root (wilt) diseased areas. Resource poor farmers require constant technology facilitation for decision making and it will be a challenge in the case of perennial crop like coconut which requires regular management practices to sustain the productivity.

Improvement in knowledge and adoption over 10 years

The knowledge and adoption of the coconut farming community was reported to be very low except in the case of traditional practices by Anithakumari and Kalavathi (2001) in a study from Alappuzha district. The items in the low adoption categories like fertilizer application for seedlings, basin management, application of chemical fertilizers including magnesium sulphate and organic manure application recorded above 30 per cent adoption (Anithakumari *et al*., 2012). Similar was the case with plant protection in coconut seedlings, lime application, mulching basins and chemical fertilizer application for seedlings. The knowledge regarding the root (wilt) disease symptoms identification and management was only 24 per cent as reported during 2001 which was improved by 55 per cent as per data from this study. The continuing grey areas were integrated pests/disease management, specially bio-control aspects and soil and moisture conservation measures. The awareness and adoption of these technologies are vital in root (wilt) disease affected areas. Policy support and project planning should give emphasis to these aspects to be implemented in a participatory community based mode converging social resources.

The study indicated better knowledge and adoption of coconut technologies with regard to integrated nutrient management of coconut seedlings and adult palms and very strong relationship between knowledge level and adoption at field level for adult palms, where as for seedlings around half of the farmers with knowledge was not found to adopt the technologies. This needs further investigations and interventions among coconut communities. Region wise significant difference was observed in knowledge and adoption of farmers with highest in Kuttanad region. The knowledge and adoption of plant protection, bio-control aspects, micro-nutrient management and soil/moisture conservation were very low. Programme planning and implementation both in research and development, to focus these areas needed for the revival of the coconut in root (wilt) affected areas for improving health of palms and productivity.

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