Proceedings of Placrosym XV (2002): 723-731

FARMERS' RECEPTIVITY TO COCONUT PRODUCTION TECHNOLOGIES: A STUDY ACROSS DIFFERENT ROOT (WILT) DISEASE INTENSITY REGIONS OF KERALA STATE

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ABSTRACT

Contribution of Kerala State to the production of coconut at national level is on the decline. The productivity level remained low in the state compared to many other states. Low level of technology utilization is often attributed for the low productivity. The incidence of root(wilt) disease, a debilitating disease which inflicts considerable economic loss to coconut growers is observed in varying degrees of intensity across various regions in the State. A study was carried out to assess the extent of utilization of coconut production technologies by farmers across different disease intensity regions in Kerala State. The study was conducted among 600 coconut growers in three districts of Kerala State, viz., Kozhikode, Ernakulam and Thiruvananthapuram which represent the disease free, high disease intensity and mild disease intensity regions. A three stage random sampling design was adopted for the study.

The results revealed that the extent of utilization of recommended technologies by coconut growers vary between different disease intensity regions. Farmers' receptivity to coconut production technologies ranged from low to medium level. Technologies such as basin opening and application of organic manures were the most commonly adopted practices. Plant protection, spacing for optimum plant density and cultivation of hybrid/high yielding varieties were the items of low level of adoption. Applications of chemical fertilizers, irrigation, intercultural operations, inter/mixed cropping and mixed farming were having medium level of adoption. The present level of farmers' response to coconut production technologies thus calls for streamlining strategies to initiate farmer participatory research/extension programmes for evolving technologies appropriate to different agroclimatic regions.

INTRODUCTION

There is a declining trend observed in the contribution of Kerala State to the production of coconut at national level. Though the State has the largest area under coconut cultivation and is the largest producer of coconuts in the country, the productivity level remained low in the state compared to many other states. Low level of technology utilization by the cultivators is often cited as one of the important reasons for the low productivity. (Bastine *et al.*, (1991), Jnanadevan and Prakash, (1994), Thampan (1999) and Rajagopal *et al.*, (2001). Coconut is cultivated under a wide range of agroclimatic situations in the state. Farmers experience several technological and socio-economical constraints in adopting the recommended production technologies of coconut. Root (wilt) disease, which is a debilitating disease, inflicts considerable economic loss to coconut growers. The incidence of the same is observed in varying degrees of intensity across various regions in the State. It is worthwhile to analyse farmers' receptivity to coconut production technologies in different disease intensity zones of Kerala State in terms of the extent of adoption of recommended practices so that appropriate strategies can be envisaged for enhancing technology utilization by farmers for improving coconut scenario. Though few earlier studies were undertaken to analyse the extent of adoption of coconut cultivation technologies, they were primarily confined to single district only. A large scale study to compare the technology utilization scenario in coconut farming between different zones to provide an overall picture was lacking. Hence, a study was carried out to assess the extent of utilization of coconut production technologies by farmers across different disease intensity regions in Kerala State.

METHODOLOGY

Study site : The study was conducted in three districts of Kerala State, viz., Kozhikode, Ernakulam and Thiruvananthapuram. The per cent share of area under coconut cultivation in Kozhikode, Ernakulam and Thiruvananthapuram districts is 14, 7 and 10 respectively with 17, 8 and

11 per cent share to the State's coconut production. These districts represent the disease free, high disease intensity and mild disease intensity regions of the State respectively with respect to the intensity of incidence of root(wilt) disease.

Selection of respondents: A three stage random sampling design was adopted for the study. The first stage units were community development blocks. From Kozhikode district four blocks were selected and from other two districts five each. The second stage sampling units were the panchayats. From each selected block, two panchayats were randomly selected except in two blocks of Kozhikode district from where three panchayats each were selected. Thus a total of 30 panchayats were included in the study. The coconut holdings with an area more than 0.05 ha and having at least 10 coconut trees formed the third stage sampling units. The sampling frame was constructed by enumerating the house holdings (approximately 50 per cent) in the selected panchayats. Proportional to the number of households in each holding size class (i.e. small, medium, and large), 20 farmers each were selected from selected panchayats. Thus a total of 600 farmers were selected as respondents of the study.

Data collection: Data were collected from the respondents at four quarterly intervals during the year 2001 using pre-tested interview schedules specifically developed for the study. Out of 600 respondents, data from three farmers could not be obtained for all the four quarters and hence analysis was restricted to the data from 597 farmers only.

Measurement of variables: A list of ten major items of production technologies of coconut was prepared and extent of adoption of these items was studied. Selected profile characteristics of farmers such as age, occupation and size of holding were also documented.

RESULTS AND DISCUSSION

1. Profile characteristics of coconut farmers

A profile of the socio-personal characteristics of the farmers under the study is presented in the Table 1.

i) Age

From the results it is clear that majority (78.7 per cent) of the coconut farmers were above 40 years of age. Only 21.3 per cent of the farmers were

Table 1. Profile characteristics of coconut farmers

Socio-personal variable		Disease free region		High disease intensity region		Mild disease intensity region		Overall	
		Frequency	Per cent	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
Age	< 40 years	35	17.6	30	15.2	62	31.0	127	21.3
	40-60 years	99	49.7	93	47.2	95	47.5	287	48.2
	>60 years	65	32.7	74	37.6	43	21.5	182	30.5
Education									
	Farming alone	106	53.3	108	54.5	85	42.5	299	50.0
	F. +Ag.labour	30	15.1	9	4.5	16	8.0	55	9.2
	F.+ Govt.job	25	12.6	31	15.7	31	15.5	87	14.6
	F.+ Pvt.job	8	4.0	20	10.1	18	9.0	46	7.7
	F.+ Business	15	7.5	15	7.6	22	11.0	52	8.7
	Others	15	7.5	15	7.6	28	14.0	58	9.7
Size of holding									
	Small	105	52.8	110	55.6	124	62.0	339	56.8
	Medium	69	34.7	68	34.3	60	30.0	197	33.0
	Large	25	12.6	20	10.1	16	8.0	61	10.2

below 40 years. This is in line with the general trend observed in Kerala state where the younger generation keeps away from farming. Number of young farmers was comparatively high in Thiruvananthapuram district than the other two.

ii) Occupation

Among the coconut farmers, 50 per cent of the respondents were depending on farming alone as their source of livelihood. The remaining was engaged in other avenues, besides farming, for income earning. About 15 per cent farmers were government employees. There was no significant difference in the distribution of respondents according to occupation status across different disease intensity zones. This result is also in line with the general trend observed in Kerala state. As farming is not the sole source of income for livelihood to many of the farmers, they may not make serious efforts in putting into practice the available technological options for enhancing production and productivity of crops; perhaps little time only might be devoted for farming by such majority of farmers.

iii) Size of holding

Majority of the coconut farmers (56.8 per cent) were belonging to small holding category. About one third of the holdings were of medium size while only 10.2 per cent only were large holdings. It is a generally observed trend that the extent of adoption of improved farming technologies is higher in the case of farmers having more acreage than small and marginal farmers. Hence, the predominance of fragmented holdings might be one of the reasons for the low level of farm technology use in general.

2. Extent of adoption of coconut production technologies in different root (wilt) disease intensity regions

The extent of technology utilization by coconut growers in different root (wilt) disease intensity are summarized in table 2. Basin opening and application of organic manures were the most commonly practiced items of production technologies. Plant protection, spacing for optimum plant density and cultivation of hybrid/ high yielding varieties were the items of low level

Table 2. Extent of adoption of coconut production technologies in different root (wilt) disease intensity regions

Sl. No.	Production technology	Disease free region		High disease intensity region		Mild disease intensity region		Overall	
		Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
1.	Hybrids/High Yielding Varieties	17	8.54	36	23.23	46	23.00	99	16.58
2.	Spacing for optimum palm density	32	16.08	16	5.56	11	5.50	59	9.88
3.	Basin opening	115	57.79	172	83.84	166	83.00	453	75.88
4.	Application of organic manures	128	64.32	168	79.29	157	78.50	453	75.88
5.	Application of chemical fertilizers	39	19.60	74	34.85	69	34.50	182	30.49
6.	Irrigation	17	8.54	141	71.21	50	25.00	208	34.84
7.	Intercultivation	89	44.72	125	51.01	101	50.50	315	52.76
8.	Inter/mixed cropping	26	13.07	72	23.23	46	23.00	144	24.12
9.	Mixed farming	77	38.89	66	24.75	49	24.62	192	32.27
10.	Plant protection	7	3.54	28	14.07	10	5.00	45	7.54

of adoption. Applications of chemical fertilizers, irrigation, intercultural operations, inter/mixed cropping and mixed farming were having medium level of adoption. From Table 2, it is evident that technology utilization varied between different disease intensity zones.

3. The item wise extent of adoption of recommended production technologies

i) Hybrids/high yielding varieties

Different varieties of coconut hybrids have been released by research institutions and made available to farmers. Compared to local cultivars, the hybrids are high yielding and early bearers. In spite of the relative advantages, farmers' response to these hybrid varieties was not that enthusiastic as revealed by the results of the present study. From table 2, it is evident that the extent of adoption of hybrids was more in disease mild and disease severe zone compared to disease free zone. This might be due to the implementation of scheme for removal of root (wilt) affected palms and replanting with hybrids by the Coconut Development Board and State Department of Agriculture.

Even in the coconut holdings having hybrids, majority (57 per cent) had only five or less number of hybrid palms; 6 to 10 hybrids in 8 per cent of the holdings; 10 to 49 hybrid palms in 27 per cent of the holdings and more than 50 hybrids in eight per cent of the holdings.

Lack of availability of planting materials of hybrids was often cited as a major constraint in adopting coconut hybrids (Thampan, 1999). Coconut farmers, in general, perceived that hybrids required more care and management including proper manuring and irrigation for their better performance and under average management conditions local tall variety would be a better choice. Further, they also believed that hybrid varieties were more susceptible to pests and diseases.

ii) Spacing for optimum plant density

Systematic planting of seedlings is essential for better establishment and performance of the coconut palms. The extent of adoption of proper spacing for optimum palm density (165 to 185 palms per hectare) was comparatively high in disease free zone (16.08 per cent) when compared

Table 3. Number of hybrid palms per hectare coconut holding

Disease intensity region	No. of palms per ha in the region	No. of palms per ha in the adopted garden
Disease free region	4.5	52.5
High disease intensity region	5.6	31.1
Mild disease intensity region	9.9	42.9
Overall	6.7	40.3

Table 4. Average number of palms per hectare and percentage bearing palms across holding categories

Disease intensity region	Small		Medium		Large		Overall	
	Density	% bearing	Density	% bearing	Density	% bearing	Density	% bearing
Disease free region	220.6	73.6	169.3	78.7	176.6	80.2	197.3	76.2
High disease intensity region	216.4	78.0	178.1	78.6	135.8	85.8	195.1	79.0
Mild disease intensity region	260.5	77.3	242.6	73.0	220.1	86.1	251.9	76.7
Overall	233.8	76.3	194.6	76.9	174.6	83.6	214.8	77.3

to disease severe (5.56 per cent) and disease mild (5.50 per cent) regions.

The data presented in table 4 showed that small holdings had higher palm density compared to medium and large holdings. The average per ha palm densities were 233.8, 194.6 and 174.6 respectively for small, medium and large holdings.

The results of the study (table 5) also showed that a considerable proportion of the palms in the coconut holdings in the State were senile and unproductive. The percentages of senile palms were 5.7, 8.5 and 7.3 in disease free, disease high and disease mild zones respectively. The results of the study indicate the need for implementing programmes to restructure the existing coconut gardens for optimum plant density and for systematic under planting/ replanting for enhancing coconut productivity in the state.

Table 5. Percentage senile palms

Disease intensity region	Percentage of senile palms
Disease free region	5.7
High disease intensity region	8.5
Mild disease intensity region	7.3

Availability of quality planting materials is to be ensured, if such systematic garden restructuring programmes are to be undertaken. A glance at the table 6 below indicate that about half of the farmers (48 per cent) depend on own seedlings for planting. Next important source of seedlings was market/ private vendors visiting village (14 per cent). Neighboring farmers was reported as source of seedlings by 14 per cent of coconut growers. It may be noted that only 12 per cent farmers depend on Krishibhavan and other governmental agencies for coconut seedlings. 8.3 per cent procured seedlings from private nurseries. The above results showed that farmers depend considerably on private sector for the supply of coconut seedlings. Research Stations and other government farms may not be able to supply seedlings in sufficient quantity to meet the demand (Rethinam, 1991). Hence, there should be some arrangements to ensure quality seedling production by the private sector agencies. It is also important to initiate programmes for decentralized coconut nurseries utilizing the local elite coconut palms as mother palms.

Table 6. Sources of coconut seedlings

Source	Number of holdings	Percentage
Own	110	48
Krishi Bhavan / other government agencies	28	12
Neighboring farmers	32	14
Market / Vendors visiting village	40	17
Private nursery	19	8.3

iii) Basin opening

Farmers traditionally adopted the practice of basin opening primarily to facilitate application of manures and also for irrigating the palms. It is a labour intensive cultural operation. The results indicated that more than three fourth of the farmers resorted to the practice of basin opening. In Kozhikode, the disease free zone, the extent of adoption of this practice was comparatively low (table 2).

iv) Application of organic manures

Organic manure application is an integral part of sustainable farming practices, for which farmers traditionally attach much significance. It was observed that majority (75.88 per cent) of the coconut cultivators applied organic manures (table 2) to coconut palms. The extent of adoption of organic manures was low in disease free zone i.e., in Kozhikode district, compared to other two zones. The educational efforts of various extension agencies to popularize integrated nutrient management in root(wilt) affected coconut gardens might be one of the reasons for comparatively higher adoption rate in disease sever and mild zones.

The details of types and quantity of organic manures applied are furnished in table 7. Farm yard manure was the most commonly applied organic manure (64.8 per cent holdings). Green leaves and ash were applied in more than one-third

of the holdings. Many of the cultivators perceived that they experience difficulty in the availability of organic manures in the recent times. It is observed that few farmers obtained branded organic manures from some private agencies and there were problems with regard to the quality of the products being supplied.

The results revealed that farmers were applying organic manures well below the recommended quantity (Table 7). This situation points to the need of popularizing production and use of organic manures including vermicompost among the growers and also encouraging the cultivation of green manure crops in coconut garden. This becomes all the more important in the context of growing awareness among coconut farmers about the concept of organic farming. There is a tremendous potential for on farm recycling of coconut leaves through vermicomposting, for which viable technology is available.

v) Application of chemical fertilizers

Application of chemical fertilizers in the recommended dose, appropriate time and through suitable method is important in the integrated nutrient management practices for sustainable coconut production. As in the case of adoption of organic manures, the extent of adoption of chemical fertilizers was low in disease free zone, i.e., in Kozhikode district, compared to other two zones. Only 19.60 per cent farmers applied chemical fertilizers in the disease free zone, while the figures were 34.85 per cent and 34.50 per cent for disease severe and disease mild zones respectively.

The details of types and quantity of chemical fertilizers applied are furnished in table 8. Nearly half of the farmers applying chemical fertilizers were using coconut mixture, but in lower quantities than the recommended doze. The quantity of urea and potash applied per palm was near to the recommended levels. A considerable number of farmers applied factomphos, the complex fertilizer. High cost of fertilizers, high wage rate and lack of availability of labour were the constraints experienced by farmers in proper fertilizer application to coconut palms. Lack of knowledge about the correct dose and frequency of application also limits the adoption of integrated

Table 7. Type and quantity of organic manures applied in coconut holdings

Type of organic manure	No. of holdings	Percentage to the total adopted holdings	Average quantity applied (Kg/palm)
FYM/cow dung	387	85.4	20.8
Green leaves	236	52.1	18.4
Ash	232	51.2	4.6
Compost	17	3.8	17.0
Branded organics	14	3.1	6.1
Neem cake	64	14.1	2.6

Table 8. Type and quantity of chemical fertilizers applied in coconut holdings

Type of chemical fertilizer	No. of holdings	Percentage to the total adopted holdings	Average quantity applied (Kg/palm/year)
Urea	37	20.3	1.03
Factomphos	70	38.5	1.44
Mussoori/Rajphos	14	7.7	1.41
Muriate of Potash	87	47.8	1.50
Coconut mixture (10:5:20)	79	43.4	2.04
Other fertilizers	37	20.3	1.83

nutrient management practices. Integrated nutrient management is an important component of the crop production technology package for coconut and farmers are to be exposed to the same on a regular basis along with suitable incentives for enhancing the productivity of the crop.

vi) Irrigation

Data presented in table 2 revealed that overall only one third (34.84 per cent) of the coconut holdings received irrigation. Further analysis as presented in table 9 showed that there existed a significant difference in the extent of adoption of irrigation between different disease intensity zones. 71.21 per cent of coconut holdings in the disease severe zone received irrigation, while only 25 per cent of the cultivators followed irrigation in the disease mild zone. Only a meagre 8.54 per cent of the coconut holdings in the disease free zone received irrigation.

Table 10 provides the data on the methods of irrigation followed by coconut farmers. It is clear from the above table that most of the adopters of irrigation (93.75 per cent) follow basin irrigation method and only few farmers resort to modern water saving irrigation methods such as drip irrigation. Taking into account the importance of irrigation in enhancing productivity of coconut, it could be inferred that programmes for development of irrigation facilities and popularizing scientific methods of soil and water conservation among coconut growers are to be given emphasis in the coconut development programmes being implemented in the state, especially in the disease free zone in the north Kerala for improving the coconut scenario.

vii) Intercultivation

Intercultivation is recommended in coconut garden as a means of weed management and also for soil and moisture conservation. Research has proved that intercultural operations alone twice in a year, one at the starting of monsoon and second at the fag end of monsoon increase the coconut yield by 30-35 nuts/palm/year as compared to the neglected plots (27 nuts/palm/year) (Nampoothiri *et al.*, 2000). The results of the study revealed that overall 52.76 per cent of the coconut holdings had received intercultivation practices (table2). Further, analyses also indicated that no significant difference exist between different disease intensity zones in respect of the extent of adoption of intercultivation. Some of the farmers who participated in the study expressed their apprehension about the desirability of regular intercultivation practice in coconut gardens in the context of the gradual acceptance being gained among the farmers for the concept of organic / natural farming practices for sustainable production. This situation provides scope for refining the technological recommendation on intercultivation practices for coconut. Any technology which involves less use of labour is sure to gain more acceptance among coconut growers of Kerala State who often experience the constraints of labour scarcity and high wage rate.

viii) Inter/mixed cropping

It has been amply proved that a number of inter/mixed crops can be accommodated in the unutilized area in coconut gardens thus enabling better use of natural resources. Growing other crops under coconut brings additional income and employment opportunities. It can also cushion the fluctuating income from coconut because of market fluctuations. Growing other crops in the interspace of coconut garden has been a traditional practice in Kerala, especially under homestead situation. The results showed that overall only 24.12 per cent of the farmers adopted inter/mixed cropping in their coconut holdings (table2). The

Table 9. Percentage distributaion of holdings under irrigation

Disease intensity region	No. of holdings	Per cent
Disease free region	18	9.0
High disease intensity region	144	72.7
Mild disease intensity region	50	25.0
Overall	212	35.5

Table 10. Methods of irrigation adopted in coconut holdings

Sl. No.	Method	Number of holdings	Per cent
1.	Basin irrigation	195	93.75
3.	Drip	8	3.80
4	Flooding	5	2.45

extent of adoption of inter/mixed cropping was low (13.07 per cent) in disease free zone compared to disease severe (23.23 per cent) and disease mild (23 per cent).

The major intercrops cultivated were banana, tapioca, yam, ginger and vegetables. In mixed cropping, perennial crops like pepper, mango, jack, arecanut etc were included. In general, it was observed that most of the inter/mixed cropping methods practiced by the growers were not done in a systematic way. It could be due to the fact that majority of the coconut gardens were not properly laid out and optimum plant density could not be maintained which was acting as a barrier for correct multiple cropping practices. Lack of availability of irrigation facilities was another reason for low extent of inter/mixed cropping. To enhance the profitability of coconut cultivation especially in the present context of wide fluctuation in coconut prices, it is necessary to have programmes for popularizing optimum methods of inter/mixed cropping in coconut gardens. Suitable crop combinations are to be suggested depending on the farmers' preferences, his resource endowment and prevailing agro ecological features of the locality. The results of the present study indicate the need for initiating on farm trials with the active participation of coconut growers for evolving appropriate inter/mixed cropping practices for different regions in the State. Farmer participatory approaches in research/extension are more important in root (wilt) affected coconut areas because it has been amply demonstrated that multiple cropping in disease affected gardens can sustain the productivity of coconut palms.

ix) Mixed farming

Mixed farming in coconut garden involves cultivation of shade tolerant fodder crops in the interspaces of coconut and integrating animal enterprises like dairy, poultry, fisheries etc. and recycling the byproducts obtained. The results of the study indicated that in 32.27 percent of the holdings, mixed farming was practiced with integration of animal husbandry with coconut cultivation (Table 2). In these holdings, farmers adopted recycling of cattle manure in the coconut garden through composting. In the disease free zone the extent of adoption of mixed farming practices was 38.89 per cent, while it was 24.75 per cent in the disease severe and 24.62 in disease mild zone. As discussed under inter/mixed cropping, the results clearly points towards the need for organising farmer participatory technology transfer programmes for popularizing mixed farming practices in coconut holdings.

x) Plant protection

Various pests and diseases affecting coconut palms account for substantial loss in its production. Integrated management practices have been

Table 11. Extent of adoption of plant protection measures in coconut holdings

Pest/Disease	Disease Free zone		Disease Severe zone		Disease Mild zone	
	No.of holdings	%	No.of holdings	%	No.of holdings	%
Eriophyid mite	0	0.0	1	0.5	2	1.0
Rhinoceros beetle	0	0.0	0	0.0	0	0.0
Bud rot	5	2.5	14	7.1	6	3.0
Leaf rot	0	0.0	13	7.0	2	1.0
Stem bleeding	2	1.01	0	0.0	0	0.0

recommended against most of the pests and diseases of coconut. But the results of the present study showed that only 5.86 per cent of the farmers adopt any kind of plant protection measures for coconut. This is in line with the earlier studies indicating that the extent of adoption of recommended practices for the management of pests and diseases was very low (Thampan,1999). Even those who adopted the control measures were not following all the recommended practices.

Analysis indicated that the extent of adoption was low (1.51 per cent) in disease free zone compared to disease severe (6.06 per cent) and disease mild (6 per cent) zones (table 2). Lack of labour for climbing trees for plant protection measures, lack of knowledge about the recommended control measures, difficulty in identifying the symptoms of infestation, high cost of inputs like insecticides and fungicides were the major constraints hindering the proper adoption of integrated pest and disease management in coconut. In the light of the results of the present study, it can be very well inferred that farmer participatory extension approaches are to be employed to ensure the adoption of integrated management practices against pests and diseases in coconut along with implementation of location specific schemes to provide incentives for the need based plant protection measures. Such efforts will augment the front line extension programmes being carried out by research institution like CPCRI in the field of plant protection in coconut.

IMPLICATIONS

The study revealed that farmers' receptivity to coconut production technologies ranged from low to medium level. Technologies such as basin opening and application of organic manures were the most commonly adopted practices. Plant protection, spacing for optimum plant density and cultivation of hybrid/high yielding varieties were the items of low level of adoption. Applications of chemical fertilizers, irrigation, intercultural operations, inter/mixed cropping and mixed farming were having medium level of adoption.

The extent of utilization of recommended technologies by coconut growers vary between different disease intensity regions. The present level of farmers' response to coconut production technologies thus calls for streamlining strategies to initiate farmer participatory technology assessment programmes for evolving technologies appropriate to different agroclimatic regions. Further, efforts are also required for organizing participatory technology transfer programmes with emphasis on group approach. For the effective implementation of such strategies, co-ordination between various research, extension and development agencies involved in the improvement of coconut sector is to be ensured.

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