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Technology Transfer of integrated root (wilt) management package- Experiences from the participatory programme on coconut

P.Anithakumari and S. Manoj

Central Plantation Crops Research Institute (Regional Station), Kayamkulam, Kerala

Abstract

Coconut is a social crop for lakhs of small and marginal farmers. Root (wilt) disease caused by phytoplasma is estimated to cause annual loss of 968 million nuts. CPCRI developed a package of integrated root (wilt) management practices for improving the health and yield of disease affected palms. A large area participatory demonstration of the technology package was conducted in a contiguous area of 25 ha with the participation of 208 farm families for three years. The impact of the technology indicated 91.4 percent improvement in the average yield and reduction in the root (wilt) disease intensity. A shift in the paradigm for demonstration of technology packages in coconut and innovative 'participatory technology transfer approach' (PTT) was the outcome of the programme. Data indicated significant improvement in the awareness, knowledge and adoption of the technology package.

Key words: Root (wilt), Participatory demonstration, farmers' perception

Introduction

Coconut, a social crop for millions of small and marginal farmers, occupies an area of 12 million hectares with a total production of about 56 billion nuts. India, Indonesia, Philippines and Sri Lanka are the major coconut growing countries of Asia Pacific regions contributing 78 per cent of the world production. In Kerala state whose name itself is derived from 'kera' meaning coconut palm, this crop attains utmost importance as a livelihood crop touching the personal, cultural, social, religious and cultural scenarios. Even though Kerala occupies the major status in production and area of coconut compared to several other coconut growing states of India, the productivity is only 5870 nuts/hectare, which is far below the national productivity. i.e., 6891 nuts/ha. (CDB, 2000). Many constraints like incidence of root (wilt) disease, fluctuating price situation, socio economic changes, fragmentation of holdings etc had been reported. Root (wilt) disease, the debilitating one, leads to low productivity and is estimated to be causing an annual loss of 968 million nuts. (CPCRI, 1985). It was also reported that the knowledge as well as the adoption of scientific coconut cultivation practices are very low adding to the situation. (Anithakumari and Kalavathy, 2001).

Central Plantation Crops Research Institute (CPCRI) established the phytoplasmal etiology and the insect transmission of the root (wilt) disease as well as developed the package of integrated management practices for improving the health and productivity of such palms. Since root (wilt) disease had no effective and economical therapeutic control measures, integrated management is the best option for adoption by the small and marginal coconut farmers of the disease-affected areas.

Extension interventions included demonstration plots in farmers' plots, training programmes, extension literatures, seminars, institute visit by client groups, kisan melas etc., to disseminate the research results/potential of the existing technologies of CPCRI in enhancing the productivity and health of disease affected palms to the farming community. But it was found that the impacts were not as convincing as expected and this led to the need for an alternative extension strategy in the root (wilt) affected areas. CPCRI (RS), Kayamkulam under these circumstances, took up the participatory programme. The features of the programme and the paradigm shift in demonstrating the technology package were as follows:

- The result demonstration was taken up in a contiguous area which is a hot spot of root (wilt) disease of 25 hectares of coconut plots with 5000 palms.
- The participation, involvement and partnership of 208 farmers /farm families were ensured through systematic and scientific extension interventions and technologies transferred with appropriate extension backup.
- The technology demonstrated included a package ranging from quality seedlings, management and plant protection aspects, which required efforts and cooperation of stakeholders in learning, analyzing, adopting and assessing the process.
- The crop is perennial in nature and the observability of technologies adopted will take 2-3 years in terms of yield and other attributes. Furthermore the demonstration involves large number of farmers, existing crop stand which challenges the extension approaches.
- Partnership of other agencies like Coconut Development Board, Department of Agriculture, Kerala, Farmers organizations and local gram panchayats.
- Strong researcher-farmer-extension interaction, sharing of experiences and mutual learning developed
- Participating farmers were given opportunities for choice of technologies to suit their resource base and to evaluate/assess the impact of technologies in field situation through direct observation and continuous monitoring.

The programme was implemented in the field conditions to demonstrate the integrated root (wilt) disease management technologies in the farmers' garden to increase the productivity of the root (wilt) affected gardens and to create awareness about root (wilt) management technologies and to popularize them among the farming community and extension workers.

Methodology

The project was implemented in a period of three years from December 1999 to July 2003. Various data collection procedures were employed so as to document the qualitative and quantitative aspects.

- Participatory Rural Appraisal method - Transect walk in the project area, interactive group sessions at the research institute/farmers fields
- Regular field visits, visit of multidisciplinary team visits, rapport building small group sessions
- Participation of research institute staff to maintain regular contacts/monitoring technology or skill needs and planning
- Capacity building of farmers in carrying out the technology implementation and effective sharing
- On farm demonstration of root (wilt) management technologies recommended by CPCRI with the paradigm shift from the early methodology
- Recording individual palm profile before, during and after the programme
- Pre tested interview schedule for data collection from the farmers. Awareness was measured using scoring technique of Salunke (1978) with modifications. Knowledge was measured using teacher made knowledge test. Attitude scale was developed using equal appearing interval method. Adoption index for the practices were calculated. Percentage, t test and average were used for analysis.
- Perception of the technology and implementation using questionnaires developed.

Results

The entire households were surveyed after serially numbering the palms. The data were analysed which was supported by the documentation of transect diagram. The data indicating the holding size of farmers is presented in Table 1.

Table 1. Distribution of respondents according to their area under coconut

Area	Number	Per cent	Cumulative per cent
<0.10 ha	137	66.50	66.50
1.01 -0.20 ha	45	21.84	88.34
0.21 - 0.40 ha	20	9.70	98.04
>0.40 ha	4	1.94	100.00

Majority of the farm holdings falls under the category of less than 0.01 ha. Only four respondents (2%) had above 0.40 ha of land under coconut. This data stresses the need of alternative strategies of extension and research suiting resource base of marginal holdings.

Spacing of coconut palms

The average number of palms per hectare was found to be 247 against the recommended 175. Spacing is a non-monetary investment required for obtaining

sustainable yield utilizing natural resources effectively. The palm population was found to be similar irrespective of holding size. This indicates that the farmers are adopting an average spacing of 6.3 m only. This may also be a factor in reducing the optimum productivity of holdings particularly cropping systems in the homesteads. This factor could not be altered in a given field situation of technology demonstration. The paradigm of demonstration of technologies was shifted in terms of farmer context (individual/scattered to contiguous area), crop context (choice of plots to actual field situation), approach (individual to participation), implementation (top down to multidirectional), partnership (marginal to intense), demonstration components, monitoring and evaluation and adoption strategies.

Impact of technologies on productivity and income

The adoption of the integrated root (wilt) management practices was effective in improving the average yield of root (wilt) affected palms in farmers' fields. Since the management practices helped in regaining the health, it was reflected in the yield also. The average yield of the palms increased from 24.17 to 46.3 nuts/palm/year after three years, recording an improvement of 91.4 per cent. The management of coconut during the initial stages acquires importance in reducing the risk, realizing early income, sustaining of future performance of palms and maintaining steady health and yield. The improvement in the initiation of flowering of coconut from 2.0 to 12.2 per cent indicates the need for management in root (wilt) affected areas.

The participating farmers themselves after group discussion at the pre demonstration stage opined to classify the yielding palms mainly into four categories such as started flowering, very low yield (<10 nuts/palm/year), low yield (10-20 nuts/palm/year), medium yield (20-50 nuts/palm/year) and high yield (>50 nuts/palm/year). Considering the yield performance in the locality, the high yielding palms increased to 20.70 from 7.5 per cent due to the adoption of the management practices (Table 2). Increase was recorded in the case of medium yield palms also from 19.0 to 31.3 per cent. Both very low and low yielding palms decreased almost 50.0 per cent compared to pre-demonstration stage. Out of the total palms of the project area, 61.0 per cent were in the bearing stage during the pre demonstration period. During the post demonstration period, 82.1 per cent of the total palms came under the yielding category. The shift occurred due to the cut and removal of severely disease affected uneconomic palms (5.2 per cent) as well as 12.7 per cent of the non bearing palms came to the flowering stage due to the impact of integrated management practices.

The pre demonstration observations showed that 19.0 per cent of the total palms were in the category of 'not yielding even after the bearing age'. Expenditure in the form of inputs was incurred on these palms also which results in reduced returns and lower benefit cost ratio to the farm families. The data indicated the need for adoption of integrated management practices in the root (wilt) affected areas for improving the productivity and net returns.

Impact of Participatory Technology Transfer (PTT) approach

The impact of recommended technology package demonstrated in the farmers' field situation could be sustained only through the building up of awareness, knowledge, attitude towards the technology and the adoption of the practices. The role of PTT in improving the awareness, knowledge, attitude and adoption of

Table 2. Impact in yield due to management practices.

	Pre- demonstration(1999)	During demonstration(2001)	Post demonstration(2003)
Average yield (nuts/palm/year)	24.17 nuts	32.5 nuts (34.3% increase)	46.3 nuts (91.4 % increase)
BC Ratio	1.03	1.38	1.77
Yield categorization		**Pre demonstration**	**Post demonstration**
1. Started flowering		2%	12.2%
2. Very low (<10nuts/palm/year)		6.5%	4.3%
3. Low (10-20 nuts/palm/year)		26.0%	13.6%
4. Medium (20-50 nuts/palm/year)		19.0%	31.3%
5. High (>50/palm/year)		7.5%	20.7%
Non bearing palms		39 %	12.7%
Disease advanced uneconomic palms cut and removed			5.2%

recommended root (wilt) management practices among the farmers was found to be significant when the awareness, knowledge, attitude and adoption level of farmers' before and after PTT was compared and the results are given in the Table 3.

Table 3. Impact of PTT in the awareness, knowledge, attitude and adoption of recommended coconut root (wilt) management practice

Variables	Average scores		't' value
	Before PTT	After PTT	
Awareness	14.11	32.53	14.35**
Knowledge	18.84	59.47	08.05**
Attitude	22.56	36.58	04.38**
Adoption	16.32	45.58	06.90**

** Significant at 0.01 levels

The data indicates that there is significant improvement in the awareness, knowledge, attitude and adoption of the recommended coconut root (wilt) management practices among the farmers of the participatory technology transfer approach. The change in the awareness is high indicating the lack of required technology transfer efforts at field level. This itself will create the necessary grounds for the better knowledge acquisition and further utilization of the technologies. This also paved the path for erasing misconception about technologies such as incidence of boron deficiency, etiology of root (wilt) disease, root (wilt) as a manageable disease and low cost technologies from research system and improving the attitude towards the technology package. But regarding the knowledge about the practices and its adoption, the improvement is not as in the case of awareness since it requires decision making according to the resources available, attitude of farmer, socio-psychological variables etc. The adoption of the practices may improve with time after suitable adaptations by farming community. The data clearly shows the impact of PTT approach in empowering the farmers as good decision makers in farming. The change in high level of awareness, knowledge and adoption after the intervention was significant among the farmers. Also indicated the success of PTT in changing the time old misconceptions and lack of awareness among the coconut farmers for better acceptance research systems' utility.

The PTT approach significantly enhanced the practice wise awareness, knowledge and adoption of integrated root (wilt) management practices and the improvement recorded among the respondents after is us shows in Table 4.

Table 4. Practice wise gain in awareness, knowledge and adoption after PTT

Technologies/ Variables	Before PTT (per cent)	After PTT (per cent)	Chi square value	Improvement (per cent)
Nursery management practices				
Awareness	73. 06	99.46	0.94NS	26.40
Knowledge	58.43	92.66	4.18*	34.23
Adoption	52.41	87.81	11.22**	35.40
Planting in main field and management				
Awareness	70.00	88.00	1.19NS	18.00
Knowledge	47.00	82.00	5.02*	35.00
Adoption	43.80	76.33	4.79*	32.53
Management of adult palms				
Awareness	67.50	99.46	3.49*	32.46
Knowledge	44.93	85.76	7.69**	40.83
Adoption	30.42	65.75	6.29*	35.33
IPM of coconut				
Awareness	41.38	82.88	26.81**	41.50
Knowledge	29.70	66.50	7.08**	36.80
Adoption	38.00	55.50	0.97NS	17.50
IDM of coconut				
Awareness	12.00	82.00	26.81**	70.00
Knowledge	4.92	71.71	29.70**	66.79
Adoption	4.40	55.15	20.54**	50.75

The table 4 indicates that the knowledge improvement was to the tune of 74.78 per cent regarding the integrated root (wilt) management practices after the PTT approach implementation for three years. The maximum improvement was recorded in improvement of awareness (70.00 per cent), knowledge (66.79 per cent) and adoption (47.46 per cent) in the integrated disease management practices which includes identification of symptoms, management practices, dosage and methods and time of application of fungicides etc, of root (wilt) disease, leaf rot, stem bleeding and boron deficiency in coconut. The awareness improvement in the case of nursery management and planting in main field management was found to be low which may be due to the high awareness level already among the farmers. Majority of the practices were traditional/indigenous and practiced over hundreds of years by the farmers. Awareness of only a few technologies like polybag seedlings and lack of awareness about the prevalence and skill in identifying root (wilt) disease tolerant/resistant mother palms in the disease tract was found lacking. More than 40 per cent improvement was found in the awareness on recommended IPM practices (41.50 per cent) and knowledge in adult palm management practices (40.83 per cent). The changes in the awareness, knowledge and adoption among the farmers on the technology items were significant except IPM adoption, awareness on main field management and nursery management. The utility of PTT approach in improving the awareness, knowledge and adoption of recommended practices was

evident from this table. The need for formulating appropriate extension methodologies or approaches after analyzing field and farmers situations according to detailed inventory on individual practices/technologies advocated for utilization was also brought out from the study.

These results were supported by impacts of action researches in tree crops like reduction of coffee berry borer attack through adoption of organic methods of pest management among small coffee growers as reported by Williamson(2002). Thrupp (1996) reported that impact assessment of project on biologically integrated orchard systems (BIOS) in USA showed use of organo phosphorous compounds had dropped from around 32 per cent to under 10 per cent while biological control users increased from 4 per cent. Average synthetic nitrogen inputs had decreased by 42 per cent.

The perception of the farmers regarding the implementation of the technologies/practices was also recorded inorder to improve upon and drawing lessons of the procedures. Since it was a participatory effort, the criteria for assessing the technologies were derived after thorough discussion by the key informant farmers based on their experience as partners in the project. The data were compiled and presented in the table 5.

The farmers rated green manure seed sowing, quality seedlings and application of lime as the I, II and III ranks. The data clearly reflects the field level considerations of farmers in utilizing any technology even though the important criterion which the research system always consider the most important such as need of the technology(8-8.5), impact on adoption in yield (7.50)and observability of results(6.8-6.75). But the scores were in the range of 6.5 to 8.5, which is rather high scores, but adoption is less. The reasons were reflected in the average scores of cost (5.66), simplicity (5.40) and labour requirement (5.25) for adopting each of these practices. Hence weighing the varied situations of small and marginal homesteads and the farming practices adopted these three factors are the most critical and research and development efforts should be

Table 5. Perception of the farmers about the technologies/practices implemented in the project

Practices	Cost	Labour requirement	Simplicity	Result	Yield	Eco-friendly	Need/ interest	Total/ Rank
Leaf rot								
➢ Contaf/Dithane + phorate	2	3	4	7	7	2	7	**2 X**
➢ Contaf/Dithane + marotti cake	2	3	4	7	8	4	8	**336 IX**
Chemical fertilizer	4	5	6	5	7	6	8	**41 VII**
Magnesium sulphate	4	5	5	7	7	7	9	**44 VI**
Organic manure/FYM/green leaves/ash/salt	7	5	6	8	9	9	10	**54 IV**
Lime	6	7	7	8	8	9	10	**55 III**
Green manure seeds (cowpea/sunnhemp)	8	8	9	8	8	8	10	**59 I**
Basin opening	6	5	8	7	7	8	7	**48 V**
Spraying against mite								
➢ Wettable sulfur								
➢ Garlic neem soap mixture	7	4	4	56	6	78	6	**39 VIII41 VII**
Red weevil control								
➢ Pheromone Trap	4	6	4	46	6	24	36	**29 XI36 IX**
➢ Monocrotophos								
Traditional practices smoking/crown cleaning/ salt ash application	8	4	7	7	8	6	8	**48 V**
Quality seedlings	10	8	2	9	9	10	9	**57 II**
Total 68	***63***	***65***	***8582***	***90***	***7881***	***96102***		
Average scores	***5.7***	***5.3***	***5.4***	***7.16.8***	***7.5***	***6.56.8***	***8***	***8.5***

channeled in bridging these gap. The need for R&D different from medium to large holding farmers versus small and marginal holdings is also reflected in this data.

This result was supported by the findings of Snapp *et al.*, (2002) that some of the research programmes, however, fail to understand or take into account of farmers' real priorities. Farmers' production priorities are often assumed to focus on maximizing yields or financial returns while in reality they may be concentrating on gaining the best returns from a very small cash investment, or on maximizing food security. The most significant blocks to farmers' acceptance seem to be the high labour requirement, the need for skilled management and the total profitability in the short term.

Moreover, the need for efficient extension methodologies to support, supplement, establishing linkages, popularizing, improving feed back for adaptations, unpacking the technology packages for better adoption through transfer of technology interventions and the participatory mode for transfer of technology especially for perennial crops like coconut was emphasized through this field oriented participatory transfer of technology approach. This is supported by the findings of Snapp *et al.*, (2002) who opined that the most effective methods among the participatory research methods to develop and disseminate technologies are demonstration trails, farmer participatory research and extension, farmer empowerment, mass media and brochures.

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