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Participatory demonstration of integrated root (wilt) disease management practices in farmers' gardens – an impact study

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Abstract

Integrated root (wilt) disease management practices are recommended by CPCRI for improving the health and productivity of coconut palms in root (wilt) affected areas. The recommended practices were adopted in 25 ha plots of 208 coconut farmers consisting of 5000 palms during 1999-2000 to 2002-2003. The result was demonstrated in a participatory mode involving farmers, members of households, farm women, scientists, extension workers and local leaders. The impact analysis indicated a remarkable reduction in root (wilt) disease intensity with an increase in average yield from 24.17 to 46.30 nuts/palm/year, i.e. 91.4% increase. The B: C ratio improved from 1.03 to 1.77. Leaf rot disease found to be superimposed in root (wilt) affected palms could be managed very effectively (47.9% to 1.5% incidence). Effectiveness of rhinoceros beetle control and eriophyid mite management was also recorded. The technology demonstration was done with an appropriate extension methodology support. PRA techniques, recording of individual palm profile, informal group meetings, scientist-farmer interaction, research station visit, method demonstration/training programmes for knowledge and skill upgradation were the major extension components adopted.

Key words: Farmer participatory demonstration, root (wilt) management practices, impact analysis

Introduction

Coconut (*Cocos nucifera* L.) is one of the most important and useful tree species cultivated in more than 80 countries in the humid tropics. In India it is grown in 17 States and three union territories. India ranks first in the world in coconut production and productivity (7779 nuts / ha) and the production is about 13,968 million nuts annually from an area of 1.79 million hectares. (Singh, 2000). About 10 million people in the country are engaged in coconut cultivation, processing, marketing and trade related activities. Coconut contributes over Rs.700 crores annually to the GDP of the country. The nation earns foreign exchange to the tune of Rs. 239 crores by way of export of coir and coir products.

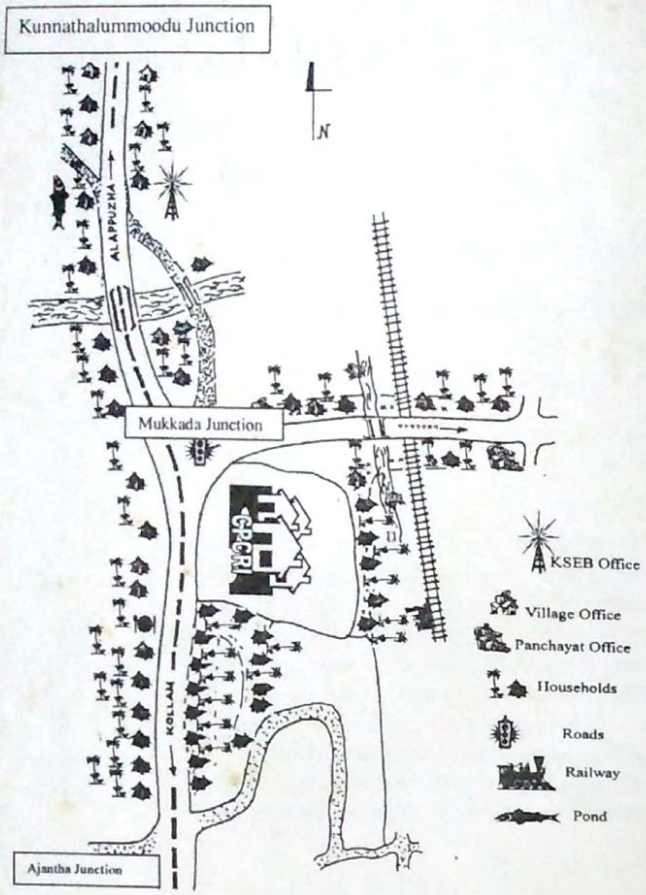
However, the productivity of coconut in Kerala, the largest coconut producing State in the country is dismally low. This is mainly attributed to the prevalence of the root (wilt) disease of coconut, a debilitating malady that occurs in a contiguous manner in eight of the southern districts of the State and also in isolated pockets in the northern districts of the State. The annual monetary loss due to the disease was estimated to be around Rs. 3000 million (CPCRI, 1985).

For sustaining the production and improving the health and productivity of root (wilt) affected palms, a package of integrated management practices is being recommended by CPCRI. Even though this package was assessed and proved in farmers' fields, the adoption by farmers was found to be very low. Hence, it was felt essential that the package of technologies be demonstrated over a large area of 25 ha, simultaneously analyzing the socio- economic impact. The results of this study are presented in this paper.

Materials and Methods

The demonstration site was 25 ha of contiguous area. The locations were on both sides of the National Highway 47 from Kunnathalummoodu junction to Ajantha junction on one side and from Mukkada to Krishnapuram Panchayat office on the other side and the area around CPCRI (RS) Kayangulam. (Fig.1) Total number of farmers who participated in the demonstration programme was 208 with average land holdings of 0.11

ha under rain-fed conditions. The programme was implemented in a participatory mode during 1999 November to 2003 July.



ig. 1. Map of the project area

The package of practices adopted was :

Application of balanced fertilizers – 500gN: 300gP_2O_5: 1000g K_2O per palm per year (1.1 kg Urea, 1.7 kg each of Rajphos and Muriate of Potash twice a year- 1/3 during May-June and 2/3 during August-September)

Application of Magnesium Sulphate - 1 kg per palm per year

Application of lime @ 1 kg per palm per year

Apply 50 kg organic manure every year in the form of compost, Farm yard manure and green leaves/ loppings.

Sow green manure seeds like cowpea in the coconut basin during April – May and incorporate during August – September.

Plant only good quality coconut seedlings to ensure increased yield and health of palms.

Adoption of moisture conservation measures like mulching, cropping systems and organic recycling.

- Control of leaf rot disease: Remove rotten portion of the spindle and adjacent leaves and pour 300 ml of fungicidal solution consisting of 2ml Hexaconazole or 3g Mancozeb in the spindle axils. (Koshy *et al.*, 2002). As an integrated prophylactic measure against pests, along with this a mixture of 200 g sand with equal quantity of Marotti/ Neem cake or 30 g Carbofuran in the spindle axis was applied. This has to be done twice a year during April –May and October –November.
- Treating the manure pits and other breeding sites of rhinoceros beetle with *Metarrhizium* culture and *Clerodendron* and use of naphthalene balls in leaf axils.
- Against Eriophyid mite infestation, neem oil-garlic-soap emulsion (2 per cent) or Wettable Sulphur 4 per cent, was sprayed twice a year along with other plant protection operations. For managing this pest, wettable sulphur (4%) was sprayed first. Even though the attack was reduced, the problem of coried bug attack emerged. Hence, spraying with neem-oil-garlic-soap emulsion was followed.
- Adopt coconut based cropping systems for recycling of organic residues, improving soil properties and to increase the total income.
- In case of boron deficiency, apply borax @ 500 g per adult palm in two splits per year and 300 g per seedling per year as a corrective measure.
- Removal of senile and uneconomical palms (yielding less than 10 nuts per palm per year).
- Adoption of other need-based plant protection measures for red palm weevil, coried bug and stem bleeding were carried out.

Farmer participatory demonstration of the integrated management of the root (wilt) affected coconut gardens was found to be imperative in view of the field level observations such as low level of awareness, knowledge and adoption of the recommendations, perennial nature and the morphology of the crop, low level of adoption of improved technology, poor perception of the farmers about the impact of the recommendations and the incidence of a complex group of pests and diseases in root(wilt) affected palms.

The following extension components were implemented for ensuring the participation of major stake holders. A Participatory Rural Appraisal (PRA) of the area by a multi-disciplinary expert team including key informant farmers, recording of individual palm profile

using a structured schedule involving the individual farmers, holding of informal group meetings in farmers fields, scientist-farmer interaction in the research station and method demonstration of skill oriented technologies, training programmes for farmers, farm women and at house-hold level, building intense rapport through frequent field visits / involving farmers in every stage of implementation, supervision, monitoring and evaluation. The recording of the observations on individual palms were done before the demonstrations (October – January 1999) and after the demonstration programme (October-December 2002; January- February 2003). For further triangulations of the observations, transect walks by the multidisciplinary team was conducted at six monthly intervals.

Results and Discussion

The root (wilt) affected palms were categorised as disease advanced, disease middle, disease early and apparently healthy, based on the disease severity scores. The impact of the management practices in reducing the disease intensity and regaining the general health of the palms is evident from the data presented in Table I.

Table I. Impact of the technology on the disease status of palms

Root(wilt)disease intensity category	Pre-demonstration (1999)	During demonstration (2001)	Post demonstration (2003)
DA (Disease Advanced)	23.5%	14.4%	7.8%
DM (Disease Middle)	32.2%	27.9%	35.7%
DE (Disease Early)	31.7 %	41.0%	37.7%
AH (Apparently Healthy)	12.6 %	16.7%	18.8%

The percentage of palms in the disease advanced category (disease intensity score >50) was reduced remarkably to 7.8 from 23.5 after technology adoption. The palms in the disease early category (disease intensity score <20) increased to 37.7% from 31.7% before demonstration, whereas the disease middle category palms (disease intensity score 20-39) increased from 32.2 to 35.7% which may be due to the shift from disease advanced palms. Moreover, when new spindles emerged every month, they were found to be either free from infection or only very mildly infected. Remarkable improvement of palms was noted in the apparently healthy category from 12.6% to 18.8% after the demonstration (Table. I). Earlier studies (Anithakumari and Remabai, 2002) had also indicated that 60 to 90% yield improvement was possible except in the case of disease advanced palms by adopting the integrated management practices. The above observations emphasise the feasibility of the technology in bridging the yield gap due to the disease.

Leaf rot disease occurs superimposed on 65% of the root (wilt) affected palms. Loss of green photosynthetic area due to extensive leaf rot causes decline in yield and vigour of palms. Appearance of the root (wilt) affected palms is visibly due to the incidence of leaf rot disease. More over, majority of the farmers realised the impact of root (wilt) disease only after the incidence of leaf rot. The data presented in Table 2 convincingly showed the effectiveness of the control measures recommended by CPCRI. At the pre-demonstration stage, about half of the (47.9%) palms of the demonstration area were severely affected with leaf rot. In severely affected palms, adoption of leaf rot control measures helped in reducing the intensity to a low level (1.5%) resulting in improvement of the over all appearance of the palms.

Another serious problem encountered during the implementation of the demonstration programme was the Eriophyid mite attack. The practice of using neem oil garlic soap emulsion not only reduced the mite attack, but also the coried bug infestation significantly. Spraying of neem oil garlic soap emulsion was found to be superior to wettable sulphur in managing the Eriophyid mite menace. During the pre-demonstration period, it was noted (Table 2) that there was severe infestation in 68% of the bearing palms in the area. After the application of the control measures, it was found that 11.31% were free from mite attack and only 23.0% recorded severe infestation. At the end of three years, there was a remarkable improvement in the 'no infestation' category to 34.3% indicating the effectiveness of the technology. At present only 15.3% of the palms are having severe infestation.

Table 2. Impact of the technology on leaf rot disease and Eriophyid mite

Root(wilt)disease intensity category	Pre-demonstration (1999)	During demonstration (2001)	Post demonstration (2003)
Leaf rot disease	47.9% (Severe)	21.3% (Severe)	1.5% (Severe) 1.0% (75% leaves) 2.8% (50% leaves) 2.9% (25% leaves) 0.8% (5-10% leaves)
Eriophyid mite	68.0% (Severe)	11.31% (Noinfestation) 24.8% (low infestation) 40.89% (medium infestation) 23.00% (Severe infestation)	34.3% (No infestation) 33.5% (low infestation) 16.8% (medium infestation) 15.3% (Severe infestation)

It was noted that about 25% of the palms in the demonstration area were found to be infested by rhinoceros beetle at the beginning of the programme (Table.3). The interventions adopted against the pest were biological control measures like the application of *Metarrhizium* and incorporation of Clerodendron in the manure pits and other breeding sites. Since the infestation was found to be higher in seedlings and juvenile palms, interactive demonstrations were conducted to educate the farmers on the mode of application of naphthalene balls and sand mixture. As a result of the described measures and the co-operation and participation of the farmers, the reduction in the incidence of the pest was convincing and observable.

Table 3. Effect of management practices on Rhinoceros beetle incidence and recovery of palms affected by boron deficiency

Period	Rhinoceros beetle incidence	Boron deficiency
Pre Demonstration (1999)	25.5%	5.3%
During Demonstration(2001)	2.1%	10.2%
Post Demonstration (2003)	1.8%	8.6%

During the pre–demonstration stage, the incidence of boron deficiency was observed in 5.3 per cent of the total palms of the area. The application of borax was adopted in the first year, only for the palms with visual symptom expression. The treated palms recovered from the malady, but fresh incidence was noticed in the second year and the recommended dose of borax was applied. With the application of Borax, there was reduction in the incidence after three years (Table 3). The application of borax for correcting the symptoms should be continued until complete recovery.

Improvement in the average yield of palms

The adoption of the integrated root (wilt) management practices was effective in improving the average yield of the 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. Similar impact in yield was recorded in various demonstration fields. (Muralidharan *et al.*, 1996). The management of coconut during the initial stages acquires importance in reducing the risk, realising 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 per cent 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 (>50/palm/year). The high yielding palms increased to 20.7 per cent from 7.5 per cent due to the adoption of the management practices (Table 4). Increase was recorded in the case of medium yielding palms also from 19 per cent to 31.3 per cent. Both very low and low yielding palms decreased almost 50 per cent compared to pre-demonstration stage. Out of the total palms of the project area, 61 per cent of palms were in the bearing stage during the pre-demonstration period. During the post-demonstration period, 82.1 per cent of the 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.

Table 4. 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 categorisation		**Pre demonstration**	**Post demonstration**
Started flowering		2%	12.2%
Very low (<10nuts/palm/year)		6.5%	4.3%
Low (10-20 nuts/palm/year)		26.0%	13.6%
Medium (20-50 nuts/palm/year)		19.0%	31.3%
High (>50/palm/year)		7.5%	20.7%
Non bearing palms			
Disease advanced uneconomic		39 %	12.7%
Palms cut and removed			5.2%

The pre-demonstration observations showed that 19 percent of the total palms were in the non yielding category even after the bearing age. Expenditure in the form of inputs was incurred on these palms also which results in reduced returns and lower cost benefit ratio. The data indicated the need for adoption of integrated management practices in the root (wilt) affected area for improving the productivity and net returns.

The impact could be summarised as follows:

Integrated root (wilt) management practices improved the average yield of disease affected palms by 91 per cent in rainfed situation under farmers' conditions. The health of the disease affected palms improved resulting in the reduction of root (wilt) disease intensity scores. The demonstration also emphasised the need for

adopting non-chemical or environment friendly approaches developed by CPCRI in combating pests and diseases of coconut in farmers' conditions. Leaf rot disease could be effectively controlled by adopting recommended measures. Eriophyid mite could be managed by spraying low cost botanicals like neem oil-garlic-soap mixture twice a year along with the integrated management. Rhinoceros beetle infestation was reduced remarkably to 1.8 per cent through the use of neem cake/ marotti cake- sand mixture and use of Metarrhizium and Clerodendron in breeding sites of the beetle in farmers' fields.

Moreover, the need for efficient extension methodologies to support, supplement, establishing linkages, popularising, improving feedback 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 emphasised through this field oriented participatory transfer of technology approach.

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References

Anithakumari, P. and Remabai, S. 2002. Integrated Management in Root (wilt) affected Garden - A Success Story. *Indian Coconut Journal* 33 (3): 12-15.

CPCRI. 1985. Coconut Root (wilt) Disease- Intensity, Production loss and Future strategy. Survey report, CPCRI, Kasaragod.

Koshy, P.K., Yogesh kumar, D., Jayasree,D., Udaya Joseph and Sosamma, V.K. 2002. Integrated management of leaf rot disease and insect pests on coconut, *Indian Phytopathology*, 55(1):45-50.

Muralidharan, A., Jayasankar, N.P., Antony, K.J. and Rethinam, P. 1996. Management. In: M.K.Nair, K.K.N.Nambiar, P.K.Koshy and N.P.Jayasankar (Eds). *Coconut root (wilt) disease. Monograph Series. No.3.* pp. 73-78. Central Plantation Crops Research Institute, Kasaragod.

Singh, H. P. 2000. Information sharing and technology transfer in coconut. *Indian Coconut J.* 31(5): 1-11.