

Assessment of the Level of Adoption of Fertilizer Application by Coconut Small Holders in *Chilaw* Area

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ABSTRACT

There is a need of increasing the coconut production due to the increased demand of the country. Coconut Research Institute (CRI) has developed and recommended number of technologies to increase the production of coconut. Out of the all technologies, fertilizer application plays a key role in increasing the coconut yield. Cultivation of coconut is dominated by small holders (< 8 ha) (313,124 ha). The contribution of small holders to the national coconut production is very significant. The objective of the study was to assess the knowledge level and factors associated with the level of adoption in manuring of coconut small holders.

This study was carried out among 80 farmers in eight Grama Naladari divisions of Chilaw Coconut development officer (CDO) range. The survey was confined to holdings less than 20 acres (8 hectares). The study determined the knowledge and adoption levels of fertilizer technology recommended by CRI. The socio-economic factors such as growers' education level, monthly income, extent of the holdings, farmers' residency, exposure to extension services and the grower type which affect the adoption of fertilizer application of CRI were studied.

As resulted by the survey, the average knowledge level (95%) is much higher than the average adoption level (44%). Farmers in the largest land category (10-20ac) showed the highest level of adoption while farmers in the smallest land category (0-2.5ac) showed the lowest knowledge and adoption levels. The income of the growers and exposure to extension contacts were highly associated with the adoption of manuring. As revealed by the survey, provision of fertilizer subsidy, technical advisory assistance could increase the level of adoption.

KEY WORDS: *Cocos Nucifera*, Fertilizer, Knowledge, Adoption, Small Holder

INTRODUCTION

Coconut (*Cocos nucifera* L.) being a monocotyledonous palm belongs to family palmaria. The crop is referred to as 'King of the tropical palms' as it is well adapted to hot and humid conditions in the tropics. Sri Lanka is the fourth largest coconut producing country accounting for average annual production of 2500 million nuts per year. The crop occupies 439,000 ha which represent 25 percent of the total cultivable land area (Anon. 2004 b). The major coconut producing areas are located in 'coconut triangle' which comprises the districts of Kurunegala, Gampaha and Puttalam.

Coconut industry plays an important role in contributing to the national economy. Its contribution is 2 percent to the Gross Domestic Production (GDP) (Anon, 2004 b). The palm is popularly known as "Tree of life" or "Kapruka" showing its wide variety of uses to people. Being a major source of food, it provides 22 percent calorie intake in the diet. The domestic consumption accounts for 70 percent of the total annual production and the rest is used for export (Anon, 2003).

The yield of coconut depends upon three major factors namely, the genetic make-up of the palm, the environment where they are grown and the agricultural techniques applied (Magat, 1978). It is possible to increase 40 percent nut yield by the adoption of CRI developed technologies (Liyanage, 1999). Fertilizer use is one of the most important cultural practices that affect the yield. Investigations have shown that 45 percent of the yield variation is caused by nutritional status of the palms. Coconut requires regular supply of plant nutrients to sustain its growth and yield through

its productive life. Since the removal of nuts and other parts of coconut palm, from the estate, substantial amount of NPK and Mg are depleted from the soil (Nathanael, 1961). So it is important to provide regular nutrients to palm to its better performance. In coconut, it has been found that significant increase in production could be realized (within a relatively short period of time) by the proper application of fertilizer (Nathanael, 1967). The coconut palm responds very satisfactorily and economically to fertilizer application (Abeywardena, 1975). CRI has recommended diversity of fertilizer mixtures and doses according to the age of the palms (Anon, 2004 a).

Cultivation of coconut is dominated by small holders (< 8 ha) covering 75% of the coconut growing area (313,124 ha). The contribution of small holders to the national coconut production is very significant. About 47 percent of the growers did not care about manuring (Anon, 1993). Therefore, it is important to assess the level of knowledge and adoption of small holders on fertilizer application recommended by CRI and the constraints for such acceptance. By improving the level of adoption of coconut small holders, the higher annual production of nuts could be obtained.

METHODOLOGY

Chilaw Coconut Development Officer (CDO) range under coconut triangle was purposively selected since similar survey has not been conducted in the area and to minimize the cost and time spent. This area consists of 49 Grama Niladari Divisions (GN divisions). Eight GN divisions were randomly selected for the survey. Selected GN divisions were Thimbilla, Ariyagama, Mugunuwatawana, Kakkapalliya,

North Mahagama, Marawala, Malwatte and Wilaththawa.

Sampling Method

In each GN division, coconut holdings with an extent up to 20 acres (8 hectares) including home gardens were selected for sampling. Ten holdings were selected randomly in each GN division to have a sample of 80 coconut growers.

Data collection

Detailed structured questionnaires based interviews were conducted to obtain primary data. Survey was carried out from January 2005 to April 2005. Secondary data were obtained from the libraries at CRI and the University of Wayamba.

Data analysis

Data, collected through the survey were coded and entered into computer. The analysis was done by using SAS Version 8. The Pearson's chi-square statistics were used to find the factors associated with fertilizer application.

RESULTS AND DISCUSSION

1. General information

1.1 Extent distribution of the sample

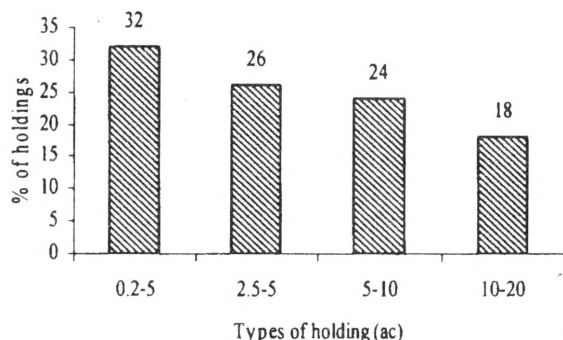


Figure 1. Distribution of the holdings (extent-wise)

Sample was categorized into four categories (H₁-H₄) according to the extent of the holding. Out of the sample the highest percentage belonged to 0-2.5 acres category and the lowest proportion was under 10-20 acres category (Figure 1).

1.2 Education level of the farmers

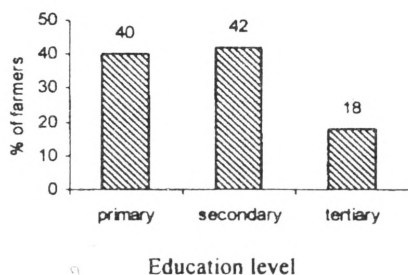


Figure 2. Distribution of growers' education level

Majority of the growers (42%) were under secondary education level while growers under primary and tertiary education levels were 40% and 18% respectively (Figure 2).

1.3 Type of the grower (occupation)

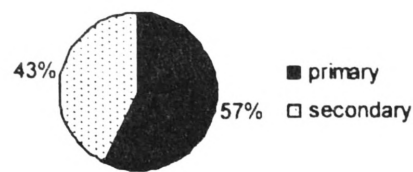


Figure 3. Distribution of type of grower

Two categories of growers were identified during the survey. The coconut growers whose main source of income was the coconut holding were considered as the primary growers and others who are having other income sources were considered as secondary growers. Out of the sample majority of growers (57%) were secondary growers (Figure 3)

1.4 Residency of growers

Out of the sample, 70% of the farmers resided in the holding itself while 30% of the farmers resided out of the coconut holdings.

1.5 Income level of the farmers

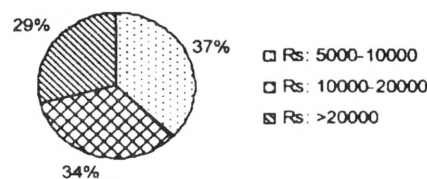


Figure 4. Distribution of grower's income level

Farmers' monthly income was categorized into three categories such as Rs: 5000-10000, Rs: 10000-20000, Rs: >20000. Majority of the farmers (37%) were found to be in the lowest level of income category whereas the lowest numbers of farmers were found to be in high income category (Figure 4).

2. Use of Fertilizer

2.1 Adoption of recommended fertilizers

In case of recommended fertilizer application, 46%, 52%, 38%, 40% and 33% of growers used to apply YPM, APM, Straight fertilizers, Dolomite and Organic Matter respectively (Table 1). Majority of farmers mentioned high prices of fertilizers, low nut prices as the reasons for non adoption while number of farmers mentioned scarcity of labour, high labour cost and lack of time. All farmers were aware of application of straight fertilizers and organic matter (Table 1). Almost all farmers mentioned that the fertilizer application would increase the yield and vigour of the palm.

The results indicated that as land extent increases, the knowledge and adoption level of farmers also increased (Table 2). Although the farmers have more than 89% knowledge on recommended fertilizers, the adoption of the first three land categories (0-2.5ac-5-10ac) are less than 50%. Only the largest extent owners adopted about 57% of the recommended fertilizers. It was obvious that the level of adoption was much less than the knowledge level

due to the constraints such as high prices of fertilizer and low nut prices. The average percentage of 95% shows that the knowledge level of growers regarding fertilizers was very high whereas the adoption was considerably less (44%) than the knowledge level.

Table 1: Knowledge and Adoption of Recommended Fertilizers.

| Fertilizer | Aware and adopted % | Aware and not adopted % | Unaware % |
|---------------------|---------------------|-------------------------|-----------|
| YPM | 46 | 45 | 9 |
| APM | 52 | 39 | 9 |
| Straight fertilizer | 38 | 62 | 0 |
| Dolomite | 40 | 47 | 13 |
| Organic matter | 33 | 67 | 0 |

YPM-Young Palm Mixture; APM-Adult Palm Mixture

Table 2: Knowledge and adoption of all recommended fertilizers in each category

| Extent (acres) | Knowledge % | Adoption % |
|----------------|-------------|------------|
| 0-2.5 | 89 | 35 |
| 2.5-5 | 90 | 36 |
| 5-10 | 100 | 46 |
| 10-20 | 100 | 57 |

The results revealed that there is an increasing trend of YPM application with the increase of extent (Table 3). Farmers who had the knowledge, yet abstain from YPM application was highest in 0-2.5ac category while the lowest was observed in the 10-20ac category. It was also observed that all growers with 5ac and above knew about YPM mixture. The average knowledge and adoption of YPM mixture were 93% and 49% respectively. The reasons for non adoption of YPM were low exposure to extension sources and high cost of labour. Results revealed that about 52% of farmers were adopted APM. Manuring of coconut with APM was relatively high. All farmers in 5-10ac and 10-20ac categories knew about APM due to higher exposure to extension sources. About 15% and 14% of farmers were unaware of APM in 0-2.5ac and 2.5-5ac categories respectively. The use of APM is more than YPM. In 5-10ac and 10-20ac categories, the application trend of APM was similar to that of YPM.

Table 4 shows manuring with organic matter was known to all farmers (100%) but only 33% of farmers applied organic matter and the reasons for not adoption was revealed as the scarcity of materials. The highest level of adoption was found in 2.5ac - 5ac 000000000category while the lowest level of adoption was found in 10ac - 20ac category because of the scarcity and the requirement of larger amount and high prices of materials. The results also showed that cow dung, goat manure, poultry manure and Gliricedia leaves were widely used as organic materials. 0-2.5ac - 2.5-5ac categories recorded the lowest level of awareness and adoption of Dolomite application as they were less exposure to extension sources whereas 10ac - 20ac category recorded the highest level of adoption (64%). Similar to the other fertilizers, dolomite application was known to all farmers in 5-

10ac - 10-20ac categories. Out of the sample the average adoption level was 40%. About 23% of farmers from 0-2.5ac and 19% of farmers from 2.5-5ac categories were not aware of Dolomite application due to low extension contacts.

Table 3: Distribution of farmers on the knowledge and adoption level of YPM and APM

| Extent (ac) | 0-2.5 | 2.5-5 | 5-10 | 10-20 |
|-----------------------|-------|-------|------|-------|
| Use of YPM (%) | | | | |
| Aware and adopted | 35 | 43 | 53 | 64 |
| Aware and not adopted | 50 | 43 | 47 | 36 |
| Unaware | 15 | 14 | 0 | 0 |
| Use of APM (%) | | | | |
| Aware and adopted | 50 | 48 | 53 | 64 |
| Aware and not adopted | 35 | 38 | 47 | 36 |
| Unaware | 15 | 14 | 0 | 0 |

Table 4: Distribution of growers on the Knowledge and adoption levels of Organic Matter and Dolomite application

| Extent (ac) | 0-2.5 | 2.5-5 | 5-10 | 10-20 |
|----------------------------------|-------|-------|------|-------|
| Use of Organic Matter (%) | | | | |
| Aware and adopted | 27 | 43 | 37 | 21 |
| Aware and not adopted | 73 | 57 | 63 | 79 |
| Unaware | 0 | 0 | 0 | 0 |
| Use of Dolomite (%) | | | | |
| Aware and adopted | 35 | 29 | 42 | 64 |
| Aware and not adopted | 42 | 52 | 58 | 36 |
| Unaware | 23 | 19 | 0 | 0 |

Irrespective of the frequency and method of application, majority of the farmers used only inorganic fertilizers (Figure 5). About 23 % of the sample used inorganic fertilizer with organic supplements while 10% of the farmers practiced only organic manure. The usage of organic fertilizers was limited because of the unavailability and requirement of higher quantity of materials. Around 15% of the farmers claimed that they could not fertilize for a long period of time.

Irrespective of the amount of fertilizer applied and frequency, out of the sample 70% of the farmers practiced incorrect method of application (Figure 6). The reasons for this malpractice were the inefficiency of dissemination of research findings and high labour cost on manuring.

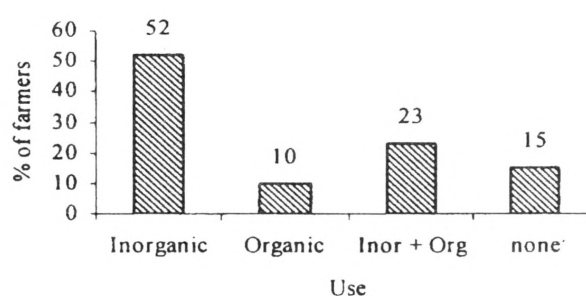


Figure 5. Application of fertilizer by types

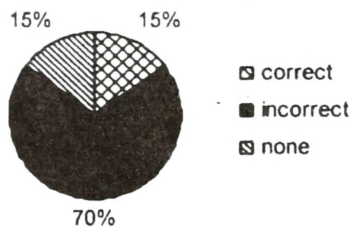


Figure 6. Method of application

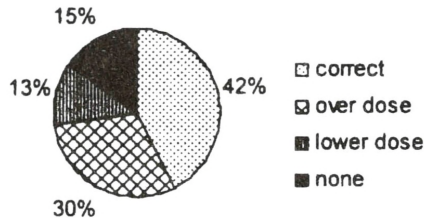


Figure 7. Distribution of growers using different dosages

The amount of fertilizer recommended by CRI is 3.0 kg per palm per year. More than 3 kg per palm per year was considered as over-dose and less than 2 kg per palm per year was considered as lower-dose. About 43% of the farmers practiced the incorrect amount of fertilizer *i.e.* over-dose or lower-dose (Figure 7). Irrespective of method of application and frequency, 42% of farmers knew about the correct dose. Few farmers who practiced over-dose mentioned that 3 kg of fertilizer was not enough per palm per year. Lack of knowledge of the farmers on the CRI research findings was the major reason for this situation.

2.2 The practice of mulching

It was obvious that the adoption of mulching was much less than the knowledge level (Figure 8). Many farmers were unaware of the benefits of this practice and on the other hand, majority of farmers claimed that the mulching materials were scarce as the reasons for non-adoption. Coconut fronds and husk were used as fire wood and some get income by selling them.

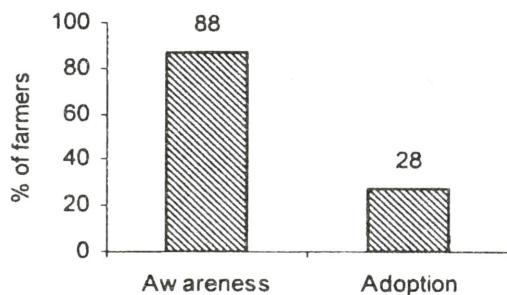


Figure 8. Distribution of farmers on knowledge and adoption of mulching

2.3 Factors associated with the application of fertilizer

Irrespective of the amount, type, and brand, application of fertilizers once or twice a year was considered as the "regular application". In general, regular application is higher in 10-20ac category than other categories mainly because of the better exposure

to extension services (Table 5). The 2.5-5ac category recorded the lowest percentage (48%) of regular users. Results indicated that regular fertilizer application was not associated with the extent of the holding (Table 5).

Table 5: Association between the extent and regular application of fertilizer

| Extent (ac) | Regular | % | Irregular or not applied | % | Total |
|--------------|-----------|-----------|--------------------------|-----------|-----------|
| 0-2.5 | 13 | 50 | 13 | 50 | 26 |
| 2.5-5 | 10 | 48 | 11 | 52 | 21 |
| 5-10 | 10 | 53 | 9 | 47 | 19 |
| 10-20 | 10 | 71 | 4 | 29 | 14 |
| Total | 43 | 54 | 37 | 46 | 80 |

$\chi^2 (3) = 2.2342, P = 0.5252$

The regular fertilizer use shows an increasing trend from lower income level to higher income level. The majority of respondents from highest income level were found to be the regular fertilizer users (Table 6). Above observations indicate that the growers' tendency to manure coconut palms regularly is highly associated with the income level. Irrespective of the extent of the holdings, the higher the income level, the higher the tendency for the growers to apply fertilizer was more.

Table 7 indicates that there was a significant association between the frequency of visiting CDO and the regular application of fertilizer. It was found that the farmers who never visit CDO and who visit CDO once in two years or more recorded the lowest regular application of fertilizer by 37% and 30% respectively. The results indicated that the more interaction farmers had with the CDO, more tendency was shown to practice fertilizer. This indicates the importance of the contact with the CDO on fertilizer application (Table 7).

Table 6: Association between the income level and the regular application of fertilizer

| Income level per month | Regular | % | Irregular or not applied | % | Total |
|------------------------|-----------|-----------|--------------------------|-----------|-----------|
| Rs: 5000-10000 | 9 | 30 | 21 | 70 | 30 |
| Rs: 10000-20000 | 15 | 56 | 12 | 44 | 27 |
| Rs: >20000 | 19 | 83 | 4 | 17 | 23 |
| Total | 43 | 54 | 37 | 46 | 80 |

$\chi^2 (2) = 14.5478, P = 0.0007^{**}$

Table 7: Association between the frequency of visiting CDO and regular manuring

| Frequency | Regular | % | Irregular or not applied | % | Total |
|-------------------------|-----------|-----------|--------------------------|-----------|-----------|
| Never | 11 | 37 | 19 | 63 | 30 |
| Once in 3 months | 10 | 83 | 2 | 17 | 12 |
| Once a year | 19 | 68 | 9 | 32 | 28 |
| Once in 2 years or more | 3 | 30 | 7 | 70 | 10 |
| Total | 43 | 54 | 37 | 46 | 80 |

$\chi^2 (3) = 12.257 P = 0.0066^{**}$

2.4 Knowledge on deficiency symptoms

Knowledge on identification of deficiency symptoms was very unsatisfactory (Figure 9). Most farmers were not aware that lack of what fertilizer causes the particular deficiency. This was mainly

because of lack of awareness programs on deficiency symptoms.

Table 8: Summary of chi-square test

| Independent Variable | DF | Calculated chi-square value | P Value |
|-----------------------------|----|-----------------------------|-------------|
| Income level | 2 | 14.5478 | 0.0007** |
| Frequency of visiting CDO | 3 | 12.257 | 0.0066** |
| Education level | 2 | 3.7729 | 0.1516 (ns) |
| Growers' residency | 1 | 2.3010 | 0.1293 (ns) |
| Type of grower (occupation) | 1 | 0.0241 | 0.8766 (ns) |
| Extent of the holding | 3 | 2.2342 | 0.5252 (ns) |
| Growers' interest | 2 | 0.7542 | 0.6858 (ns) |

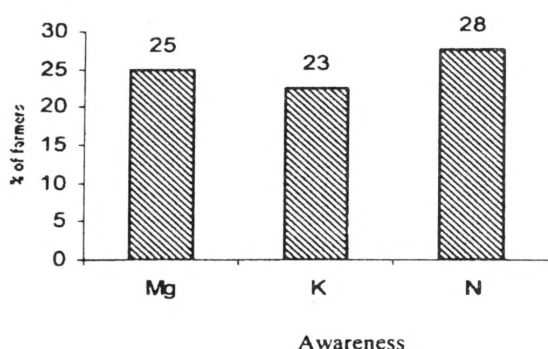


Figure 9. Distribution of knowledge on deficiency symptoms

2.5 Application of other materials.

Figure 10 indicates that relatively higher percentage of farmers applied salt. Many farmers were not aware of the effect of salt application. A few farmers mentioned that application of salt improves the vigour of the palm and to avoid termite attack and button nut fall. In case of application of ash, majority of farmers were unaware of what nutrient could be derived from ash and they do this by tradition. A few farmers mentioned that the application of ash would avoid leaf fall and button nut fall.

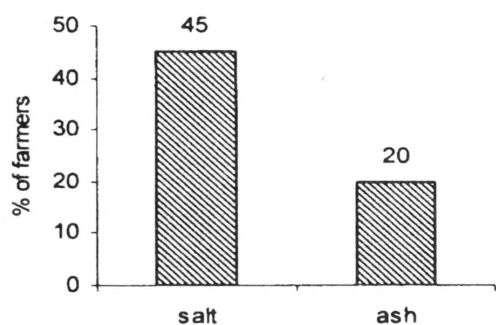
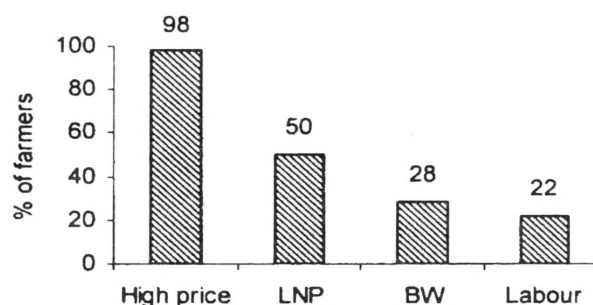


Figure 10. Distribution of farmers applying other materials

3. Constraints on Fertilizer Application

Almost all farmers mentioned that the price of fertilizer was high and they could not afford the price whereas half of the farmers said that they were unable to get a reasonable price for their nuts (Figure 11). To overcome this, majority of farmers seek fertilizer subsidy. About 28% of farmers mentioned that the bad weather was as their one of the constraints while 22%

of farmers said that scarcity of labour and high labour cost were major constraints faced by them, to suppress the fertilizer application.



LNP = low nut price; BW = bad weather

Figure 11. Constraints faced by growers

CONCLUSIONS

CRI has a mandate to increase the quality and quantity of coconut production and therefore has been involving in introducing new technologies to the growers for more than 75 years by now. The results of the survey revealed that knowledge of growers on different fertilizers/mixtures such as YPM, APM, Straight fertilizers, Dolomite and Organic manure was very high as indicated 91%, 91%, 100%, 87% and 100% respectively. However it was identified that the adoption of different fertilizers was much less than the knowledge level. In case of frequency of application, 54% of the growers were found to be the regular fertilizer users. Out of the sample 70% practiced incorrect method of application and 43% used incorrect amount.

Income level of the farmers and frequency of meeting CDO played a major role in the regular fertilizer use in coconut. High prices of fertilizers, lack of dissemination of research findings, low exposure to extension services, low nut prices, scarcity and high cost of labour and scarcity of materials (Organic) were stated by growers as the reasons for non-adoption.

In order to overcome the above mentioned barriers and to increase the dissemination of research findings of CRI, publications of CRI should be made available at Agrarian Service Centres at a low price or free of charge. CRI should also provide technical assistance through awareness programs such as field demonstrations and training programs to improve the efficiency of manuring as majority of farmers practiced incorrect method and amount of fertilizer, so that farmers would get maximum benefits. As almost all farmers mentioned that the price of fertilizers are high, the provision of fertilizer subsidy would increase the level of adoption and in turn increase the coconut production.

Proper manuring along with other improved management practices such as planting, irrigation, soil moisture conservation, intercropping and animal husbandry etc. could increase the production, so that the coconut small holders will be able to cater to the increasing demand of the country.

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