QUESTIONNAIRE ON COVER CROPS AND GREEN MANURES

(IN RELATION TO COCONUT CULTIVATION)

M. L. M. SALGADO, Ph.D. (Cantab.), B.Sc. (Lond.), Dip. Agric. (Cantab.)

SOIL CHEMIST, COCONUT RESEARCH SCHEME (CEYLON)

INTRODUCTION

THE practice of growing green manures, particularly cover crops, has not been undertaken on coconut estates in a systematic manner. In 1929, the Department of Agriculture published a leaflet entitled "Green Manuring with Particular Reference to Coconuts" by Joachim; but since then little progress has been made and the practice is yet far from general. It has been alleged that on certain estates the establishment of cover crops has adversely affected the crop yield, and owing to this belief a consequent prejudice against cover crops has arisen. It may, however, be stated that the practice has not been given a fair trial. There has recently been a general re-awakening regarding the subject, as shown by a newspaper controversy that took place in 1933. The subject was discussed before the Chilaw Planters' Association in a paper prepared by the writer read before that body in June 1935, and in view of the diversity of opinion regarding this agricultural practice a questionnaire on the subject was issued by the Coconut Research Scheme in order to ascertain the experience of planters. The replies to the questionnaire would indicate the lines along which further experiments have to be carried out.

Details of the questionnaire are given below :

Name of Estate and Locality.

Name of Proprietor.

1a. Which of the following soil types occur on the estate : cabook, loam, clay ; and lay of land (Undulating, flat, hilly) ?

1b. Rainfall.

2. Do you grow green manures ? If so, please mention the varieties you grow
   (*a*) Erect varieties
   (*b*) Cover crops

3. How do you get your green manures established ? Please give details, such as planting by broadcasting or in rows. Seed rate, single or mixed stands of green manure (such as mixture of *Centrosema* and *Calopogonium*), alternate rows or entire field, and whether cuttings are used.

4. How long do you find it takes to establish a cover of (*a*) *Centrosema* (*b*) *Calopogonium* (*c*) *Pueraria javanica ?*

5. Do your covers die-back during drought : and do they recover after rains ?

6. Have you experienced a set-back in the trees immediately after establishing covers ? Please give crop records of such fields if available.

7. Have you observed an improvement in the health of palms after covers were established ?

8. How do you utilise your cover crops ?
   (*a*) Do you plough in your cover : how often ?
   (*b*) Do you harrow : how often ?
   (*c*) Do you bury in trenches ?
   (*d*) As fodder ?

9. In your experience what is the best green manure crop, (erect and cover) for your soil ?

10. What is your experience with covers on young plantations ?

11. Have you found it difficult to re-establish Pueraria on the same soil after ploughing or harrowing this cover ?

12. Have you ever observed beetles in fields where green manures alone were harrowed, ploughed or buried in trenches ?

13. What system of manuring do you adopt on land under cover crops and green manures ? If artificial

manures are used, state the composition of mixtures and the quantities applied.

14. Are you able to utilise covers as fodder for cattle ?

15. How many acres do you have under uniform cover crops and are you prepared to allow the Coconut Research Scheme to lay down an experiment on cover crops on your estate ?

61 copies of the questionnaire were sent, but only 32 replies were received. The following bodies were consulted in making the list of estates as comprehensive as possible:—

Chilaw Planters' Association,
Kurunegala Planters' Association,
Southern Province Planters' Association, and the
Low-Country Products Association

to whom thanks are due. The questionnaire was first issued in October 1935, but as additions were made to the list of estates where cover crops were grown, further copies were sent in April and May 1936.

In spite of the fact that all of the Planters' Associations interested in coconut cultivation and also the Low-Country Products Association were consulted, there are doubtless many Estate Proprietors and Superintendents interested who were not approached for their views. To these apologies are tendered, and the Coconut Research Scheme would welcome further correspondence from them.

A classification of replies received according to districts is as follows :

Chilaw	10
Colombo	6
Galle	1
Kandy	1
Kurunegala	11
Negombo	1
Puttalam	2
Total ..	32

The 32 estates represent an extent of 17,400 acres of which 7,750 acres (*i.e.*, about 45 per cent.) are under cover crops.

Visits were paid to a number of estates from which replies to the questionnaire were received, and points arising out of the replies were discussed.

It is not proposed to give here the full details of the replies received from each estate owing to lack of space, but it would be useful to discuss briefly the subject under review in the light of the information gathered from the practical experience of estates.

DISCUSSION

Though the questionnaire referred to the subject of green manures in general, the information gathered has been mainly regarding cover crops. Hence the following discussion is mainly concerned with this aspect of green manures.

1. *Soil type and rainfall.*—Cover crops have been established under a variety of soil and climatic conditions in Ceylon. In spite of the belief that it would be difficult to grow covers under conditions of very low rainfall, these have been established even in the Puttalam District. One of the estates at Mundel, with an average rainfall of 45 inches, has been visited by the writer and the good growth of covers noted.

2. *Varieties grown.*—Of the erect green manures *Tephrosia candida* (Boga medeloa), the *Crotalarias* and *Gliricidia* are the only types grown on coconut estates.

Among cover crops *Calopogonium mucunoides*, *Centrosema pubescens* and *Pueraria javanica* are popular, while in a few cases Vigna is occasionally grown. Probably Vigna was the first cover to be introduced to coconut estates, but in general it may be said that it is now grown to a negligible extent.

3. *Method of establishing cover.*—The land is first ploughed and harrowed, seed is broadcast and lightly raked in. In a few cases a small dose of artificials or cattle manure is broadcast before ploughing. In some cases covers are planted on coconut husk trenches.

Centrosema is invariably planted mixed with *Calopogonium*. Seed rates used have been very variable from 8 to 45 lb. per acre. Where heavier seed rates were used a cover was established in a short time—even as short a time as four months.

In the case of *Pueraria*, in view of the high cost of seeds, cuttings have been used with success. Economy in seeds has also been effected by germinating seeds on coconut husks and planting in the field at a very small seed rate.

4. *Time taken to establish a cover.*—The time taken to establish a cover also seems variable. *Calopogonium* is the quickest and establishes itself in six to eight months. *Centrosema* and *Pueraria* take nearly one and half years to form a complete cover.

Though the growth of *Calopogonium* is very rapid it thins down at the seeding season and lets in grass before the shed seed germinates. Grown with *Centrosema*, the latter grows continuously and though the start is slow it spreads over the *Calopogonium* at the seeding season and subsequently almost completely blankets it.

5. *Die-back.—Calopogonium* is the earliest to die-back during a drought and even during ordinary dry weather, as also after seeding. *Pueraria* too shows a tendency to die-back, but recovers. *Centrosema* is more resistant. All these varieties recover with the rains. In the case of *Centrosema—Calopogonium* mixtures *Centrosema* takes the place of *Calopogonium* after die-back.

Calopogonium seeds seem to remain viable for a number of years. When a *Centrosema* cover that has replaced the *Calopogonium*, is ploughed after several years, the *Calopogonium* seeds that had remained dormant for a number of years, regenerate themselves.

6. *Set-back after establishing covers.*—Except in three isolated cases where a set-back was experienced for 2 or 3 years, there is an emphatic and definite belief that there is no set-back whatever that can be attributed to the cover crop.

7. *Improvement of health of palms after covers were established.*—There is a general agreement that the health of the palms as judged by the green colour of the foliage shows distinct improvement. The contrast is always seen between adjacent fields with cover and no cover.

8. *Utilisation of cover.*—The method of treating the cover seems to differ, but there is a distinct consensus of opinion against leaving covers permanently untreated and allowing rank growth.

The various methods practised on different estates are as follows :

(*a*) Ploughing once in two years. It is reported that ploughing in a thick cover is difficult, particularly in the case of *Pueraria.*

(*b*) Harrowing once a year and even twice a year when the cover is thick. Harrowing is done during the end of the rainy season.

(*c*) Digging with mamotty forks once in 2 years in wet weather seems to be a very effective method.

(*d*) In a few cases the cover is envelope-forked. This seems to be the practice on some estates in the Kurunegala District.

(*e*) The cover from alternate rows is pulled out and buried in shallow trenches between palms, with or without manure. This practice is reported to have caused the breeding of the coconut black beetle in the trenches in four estates.

Sometimes the cover is buried in trenches along with coconut husk.

(*f*) Slashing the cover seems to be little practised.

(*g*) A few estates treat the cover by controlled grazing, especially in the case of *Centrosema* which is relished by cattle.

(*h*) A manure mixture is broadcast on the cover, which is scorched by the manure.

(*i*) Coconut husk is thrown on the cover.

9. *Best green manure.*—Here opinion differs considerably. Most estates grow *Calopogonium, Centrosema* and *Pueraria,* and are not restricted to one crop.

10. *Covers on young plantations.*—There seems to be a general agreement that cover is particularly useful in young plantations, especially in reducing the weeding bill. Care should be taken to prevent the creepers (especially *Pueraria*)

from climbing young palms. The area immediately round the palms up to a distance of about six feet is kept clean weeded.

It has been also stated that in young plantations covers favour the breeding of rats and bandicoots. On the other hand it may be stated that these pests breed equally well among the usual weed growth of young plantations.

11. *Difficulty of establishing Pueraria on the same soil after ploughing or harrowing.*—Difficulty was experienced in a few isolated cases. If harrowing is done when the cover is thick so that the discs do not reach the soil, the cover is not eradicated. Many estates do not seem to have sufficient experience of this cover.

12. *Black beetle where cover has been ploughed, harrowed or buried.*—In four estates the coconut black beetle (*Oryctes rhinoceros*) was reported to have been found where cover was buried. In one estate where cover was buried nearly 30,000 adult beetles and grubs were collected and destroyed from May to October 1934.

In the case of one estate it was alleged that the black beetle breeds in the cover among the mixture of decaying fronds and leaf mould.

Where ploughed or harrowed black beetle has not been found.

13. *Systems of manuring adopted where land is under cover.*—These may be summarised as follows :

(*a*) The cover is cut back in the centre along a row, manure is broadcast on the bare land, which is then ploughed and harrowed and the cover replaced.

(*b*) The manure mixture is broadcast on the cover and then harrowed.

(*c*) Manure mixture is broadcast on the cover and the cover not further disturbed. The cover is scorched by the manure, which is subsequently washed down by rain.

(*d*) The cover is buried in trenches with manure round the palms or between the rows.

(*e*) Envelope-fork covers with manure mixtures. This method seems to be practised on some estates of the Kurunegala District.

(*f*) The cover is grazed down by cattle, which in turn are used for manuring the palms.

The manure mixtures, where applied, contain a preponderance of potash and phosphoric acid. Several estates have used no artificials with cover.

14. *Cover as fodder.—Centrosema* is relished by cattle. *Calopogonium* and *Pueraria* seem to be less favoured, but buffaloes are indifferent and eat all these varieties with preference for *Centrosema.* Most estates do not utilise the cover as fodder. Where the cover is thick, controlled grazing is practised without damage to the cover.

FUTURE EXPERIMENTS

The replies to the questionnaire indicate that there is a general belief, as the result of experience, that the growing of cover crops has definite advantages such as reducing the cost of weeding and maintaining the healthy appearance of the palms. While there seems also to be no set-back that can be attributed to cover crops, what has to be determined is whether the growing of covers bring about a definite increase in crop yield, and also how this can be attained by the different methods of utilising the cover combined with the most economical system of manuring. Field experiments that are contemplated by the Coconut Research Scheme will aim at the elucidation of these points.