

USE OF HERBICIDES UNDER MIXED COCONUT AND COCOA STANDS IN NEW IRELAND

By J.S. Ballard*

One of the problems in mixed coconut and cocoa stands is the growth of weeds, especially in areas which get a lot of sun. In some areas the ground may be completely covered with weeds.

Each month before the nuts are collected, it is worthwhile cutting the ground cover to make it easier to find the fallen nuts. Tall grass and weeds make it hard for the harvester to find nuts, so that the total number of nuts collected is less than it should be and uncollected nuts germinate where they have fallen.

Short grass also aids the collection of cocoa pods after they have been cut from the tree.

This paper describes a test using herbicides to kill weeds.

The purpose of the test was to see if weeding costs could be reduced using herbicides and to make collection of all fallen coconuts and cut cocoa pods easier. Better growth of the cocoa trees and coconut palms was also expected.

Methods and materials

The weeds found in the area used for this test were as follows:

Main weeds—

- Thurston grass (*Paspalum conjugatum*)
- Centrosema pubescens*
- Pueraria phaseoloides*

Other weeds—

- Kunai (*Imperata* species)
- Crowsfoot grass (*Eleusine indica*)
- Carpet grass (*Axonopus compressus*)
- Paspalum paniculatum*
- Leucaena seedlings with stems up to 12 mm across
- Lantana camara*
- Broomstick (*Sida rhombifolia*)
- Mimosa pudica*

Unidentified ferns

Various glossy-leaved creepers at ground level

Yams (*Dioscorea* species) growing up some cocoa trees

Spraying mixtures

First of all a blanket spraying was done.

The term blanket spraying means that all the ground areas have spray put on them. The aim is to kill off all unwanted plants in the area; any regrowth is spot sprayed to keep the area free from these plants.

About six months later, spraying was done to weeds that had grown up again.

Six months after this, another spraying was done.

Several different chemicals were used each time spraying was done, so as to kill a range of weeds. The following chemicals were used during the programme.

Gramoxone

Sodium chlorate

Ansar 529

Amoxone 50

Butoxone 80

Dowpon

Wetting agents Lissapol and Agral

Various formulations were tried. The effectiveness of Gramoxone alone was compared with a "cocktail spray" containing several chemicals. The formulations tried are given in the Appendix. The most effective and economical formulations are given in the Recommendations.

The first spraying was carried out 14 to 28 days after weeds in the area had been cut. The area contained mature coconuts underplanted with mature cocoa. Some parts of the area had no coconut palms or cocoa trees on them for one reason or another. Comparisons could therefore be made between light shade, medium shade and dark shade conditions.

No damage or sickness was noticed in the coconut palms and cocoa trees as a result of

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Cost of chemical control of weeds under coconut and cocoa stands may in some cases be less than the cost of cutting weeds by hands.

spraying herbicides. However, care should be taken so that the chemicals do not get sprayed on to any green parts of the plants, especially the cocoa trees.

Results

Effects of different chemicals

First spraying—Gramoxone alone. Gramoxone is a contact herbicide that gives rapid kill of green plant tissue. In strong sunlight, the kill is quick but not very lasting. However, in dark shade the kill is not as quick, but it is better.

Because Gramoxone kills weeds quickly it can be sprayed an hour before it rains and the rain will not wash it off before it has killed the weeds.

Where Gramoxone was sprayed, all plants died back within 3 days. After 6 weeks, leucaena, lantana and other woody plants had grown again. Kunai recovered quickly and flourished. Centrosema recovered and spread

quickly, especially where there was light shade.

Average control from Gramoxone was 62 % at 6 weeks and 38 % at 8 weeks after the first spraying.

It was noticeable that the weeds grew again much more quickly after Gramoxone spray than after the "cocktail spray" (see below). This is because Thurston grass (*Paspalum conjugatum*) is not killed properly with Gramoxone and it was the dominant grass.

First spraying—cocktail spray. Sodium chlorate and Ansar 529, which were included in this spray, are both contact herbicides having slight movement with the plant. Both are general herbicides but Ansar 529 is very good for controlling Thurston grass (*P. conjugatum*) which was present in large amounts.

Amoxone 50 was also included. This chemical is moved within the plant and kills many broad-leaved plants and some

germinating grass seedlings. However, it is risky to spray Amoxone 50, which contains 2,4-D, where young cocoa is growing because it can kill the cocoa.

It has also been reported that MSMA (in Ansar 529) has caused temporary zinc deficiency symptoms in young cocoa.

Where the "cocktail" was sprayed, all green leaf was killed within 3 days. At 6 weeks, leucaena and lantana had grown again and kunai had reappeared. Mimosa was killed under shade, but not in open areas. Centrosema was growing again in open areas and so were grasses, although not as strongly as in the open areas where Gramoxone only had been sprayed.

Because the chemicals in the "cocktail" are slower to kill than Gramoxone, they can be more easily washed off the leaves by rain. The makers of Ansar state that MSMA will not work as well if it rains within 4 hours of applying. The makers of Amoxone 50 say that kill may be less if rain falls within 6 hours of application. It was noted in the trial that when it rained soon after applying the "cocktail" the kill was less than when it did not rain.

The average control at 6 weeks after the first spraying with the cocktail was 83 % and at 8 weeks 64 %.

Spot spraying. Some weeds in the trial were not controlled by the first spraying and needed spot spraying. These weeds were leucaena and kunai, which were treated with Butoxone 80 and Dowpon respectively.

Second spraying. The second spraying was done about 6 months after the first spraying. Because of the weed height, it was necessary to cut some of the area before spraying.

Plant growth over the ground at the time of the second spraying was between 20 and 100 %. As a comparison, 91 % of the area previously sprayed with Gramoxone was covered with weeds, whereas only 57 % of the area sprayed previously with the "cocktail" was covered with weeds.

Although there was still more pueraria, centrosema and Thurston grass than other weeds they were still not growing as strongly as before except in large open patches where there was no shade. *Euphorbia geniculata* began to appear.

Average control at 6 weeks after the second spraying with Gramoxone was 85 % and 68 % at 8 weeks, and with the "cocktail", was 67 % and 56 %.

Third spraying. For the third spraying,

Ansar was not available, so a mixture of Gramoxone and Amoxone 50 was used instead of the "cocktail".

This round was done about 6 months after the second spraying, but it was more of a spot spray than before, although ground covered ranged from 5 to 100 %.

Average control at 6 weeks after the third spraying, for Gramoxone only, was 67 % and at 8 weeks 57 %.

After the third spraying was finished, the main weeds remaining were as follows:

| | |
|-----------------------------|----------------------|
| <i>Imperata</i> species |) Patches of weeds |
| <i>Euphorbia geniculata</i> |) in light shade and |
| <i>Leucaena</i> |) open areas. |

| | |
|--------------------------------|-----------------|
| <i>Paspalum conjugatum</i>) | |
| <i>Centrosema pubescens</i>) | In shady areas. |
| <i>Pueraria phaseoloides</i>) | |
| <i>Peperomia pellucida</i>) | |

Other weeds becoming more noticeable were:

Dioscorea species

Ipomoea species

Eleusine indica

Paspalum paniculatum

with *Sida rhombifolia*, *Lantana camara*, *Mimosa pudica*, *Chloris barbata* and *Axonopus compressus* also found occasionally.

In Gramoxone-sprayed areas there was an increase of centrosema and pueraria in the lightly shaded areas. Although the legumes centrosema and pueraria are desirable because they fix nitrogen, grass is preferred under coconuts because nuts are easier to collect in grass. However, in open areas, a centrosema or pueraria cover-crop is useful in preventing other weeds, such as kunai, from growing.

Since the spraying, no serious problems have arisen through trying to control weeds, although a minor case of erosion was noticed.

Conclusions

Much better control occurred where the cocktail was applied. This is because the cocktail controls Thurston grass better than Gramoxone, and Thurston grass was the worst weed.

There has been a change in the kind of weeds growing in the area over the year, especially in areas where the same chemical was used throughout. There were some weeds that were not killed by the chemicals sprayed

because they are resistant to those chemicals. These weeds became the main weeds. Other herbicide mixtures must be used to control them.

Cost comparison

A cost comparison was made between costs of labour for cutting weeds monthly, and the six-monthly spraying programme with intermediate spot spraying.

The number of man-days for manual slashing, on the control plots, was 20 m-d per ha per year. The average labour for each slashing round was 1.7 m-d per ha.

The number of man-days for chemical control averaged 4.8 m-d per ha per year.

This was made up of—

- 2.6 m-d per ha for the first spraying;
- 1.5 m-d per ha for the second spraying;
- 2.1 m-d per ha for the third spraying.

The cost of chemicals had to be added to the cost of labour for the spraying rounds.

Although in the first year chemical weeding costs were greater than the cost of manual slashing, the author feels that chemical costs in following years would be much less because there are fewer weeds.

Since the test was carried out in 1972 and 1973, labour and chemical costs have increased - labour costs by 80 % and chemical costs by about 9 % only. This means that chemical control is far more competitive with manual control now that it was three years ago.

RECOMMENDATIONS

No two spray situations are the same. Before any spraying is done the general condition of the area should be considered and the following questions asked.

What is the amount of shade given by the crop? What is the amount of weeds? What kind of weeds? Are they growing strongly? Is the crop at a stage of growth when it could be damaged by the chemicals? What kind of chemical is need to kill the weeds?

There are many kinds of herbicides on the market that kill different kinds of weeds. Your local agricultural officer can advise you on the best kind to use.

The following chemical mixtures were found to give satisfactory control of weeds in mixed coconut and cocoa stands. An average of about 208 l per ha was used through the whole trial.

First spraying. Use "cocktail" spray.

- 2.3 kg sodium chlorate
- 2 840 ml Ansar 529
- 570 ml Amoxone 50
- 140 ml Agral
- 200 l water

Second spraying. Six months after first spraying

- 850 to 1 140 ml Gramoxone
- 230 ml Agral
- 200 l water

Third spraying. Six months after second spraying.

- 850 ml Gramoxone
- 280 ml Amoxone 50
- 230 ml Agral
- 200 l water

Spot spraying. The following spot spray mixes were found to be effective.

Kunai (*Imperata species*). Spot spray 6 to 8 weeks after the general spray application. If necessary spray again 8 weeks later with the same mix.

- 2.7 kg Dowpon
- 60 ml Agral
- 200 l water

Leucaena seedlings. Slash seedlings first to 15 mm. Then allow to grow again up to 45 mm in height, then spot spray. If necessary spray again 12 weeks later with the same mix.

- 570 ml Butoxone 80
- 60 ml Agral
- 200 l water

The mixtures are made in 200 litre drums by adding the chemicals to 200 l of clean water (not salt water). Dirty water can cause some chemicals to lose their power to kill. Each chemical in turn should be well mixed with the water, especially mixtures containing Amoxone 50 (2,4-D), otherwise the action of all the chemicals is likely to be affected and the kill not good.

The mixtures are applied using knapsack sprayers. In our test we used Anchor brand knapsack sprayers that hold 18 l of liquid. 0.4-E Agri-Jet nozzles were used.

The spray operators should wet the leaves to a point just before the chemical runs off to the ground. Therefore, more chemical will be used where there are a lot of tall weeds.

Care should be taken, so that the chemicals do not get sprayed on to any green parts of the

coconut or cocoa trees, especially the cocoa trees.

If the weeds are tall, it is best to cut them 2 to 4 weeks before the first spraying.

The best results are obtained when the grass and weeds are sprayed when they are between 150 and 360 mm high. If higher than this, spraying costs will increase, because more spray will be needed.

Spraying can be done twice in the first year. This is usually enough.

In open areas, where the sunshine allows a lot of weeds to grow, it is best to spray about every 18 weeks. However, in areas of dark shade with a good stand of coconuts and cocoa, an interval of 29 weeks is reasonable during the first year.

After the first year, there will be fewer weeds, so that spot sprays only will be needed in the second year.

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APPENDIX

Chemicals used:

- Gramoxone (200 g paraquat ion per litre)
- Sodium chlorate
- Ansar 529 (399 g of monosodium methanearsonate per litre)
- Amoxone 50 (2,4-D amine at 499 g per litre)

Butoxone 80 (2,4,5-T butyl ester 798 g a.i per litre)

Dowpon (85 % w/w dalapon as sodium salt)

Lissapol

Agral

Mixtures tried:

| Gramoxone | Cocktail |
|------------------------|-------------------------|
| <i>First spraying</i> | <i>First spraying</i> |
| 1 136 ml Gramoxone | 2 268 g sodium chlorate |
| 284 ml Lissapol or | 2 941 ml Ansar 529 |
| 142 to 227 ml Agral | 568 ml Amoxone 50 |
| 200 l water | 142 ml Agral |
| | 200 l water |
| <i>Second spraying</i> | <i>Second spraying</i> |
| Same as above | 2 268 g sodium chlorate |
| | 1 136 ml Ansar 529 |
| | 568 ml Amoxone 50 |
| | 142 to 227 ml Agral |
| | 200 l water |
| <i>Third spraying</i> | <i>Third spraying</i> |
| Same as above | 852 ml Gramoxone |
| | 284 ml Amoxone 50 |
| | 142 to 227 ml Agral |
| | 200 l water |

Spot spraying—

| | |
|-----------|--------------------|
| Leucaena: | 568 ml Butoxone 80 |
| | 57 ml Agral |
| | 200 l water |
| Kunai: | 2 722 g Dowpon |
| | 57 ml Agral |
| | 200 l water |

HANDBOOK ON WEED CONTROL

Weed Control in the South Pacific, edited by M. Lambert. Southern Pacific Commission, Noumea, Handbook No. 10, 1973: 119 pages.

This handbook, edited by South Pacific Commission agronomist Michel Lambert, is available for \$A 1.00, post free, from—

SPC Publications Bureau
PO Box 306
Haymarket NSW 2000
Australia.

The handbook is written in relatively simple English, and is well illustrated. It will be very useful for Papua New Guinea application.

It describes all the most important

herbicides which are available in the South Pacific countries. It goes on into calibration and application of herbicides. There is a big section on the use of herbicides in different crops, including pineapples, bananas, pastures, coffee, coconuts, cocoa, taro and so on.

There is a bibliography at the back which is very useful. An appendix with the chemical names of herbicides and the trade names which are used in the South Pacific is also useful.

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