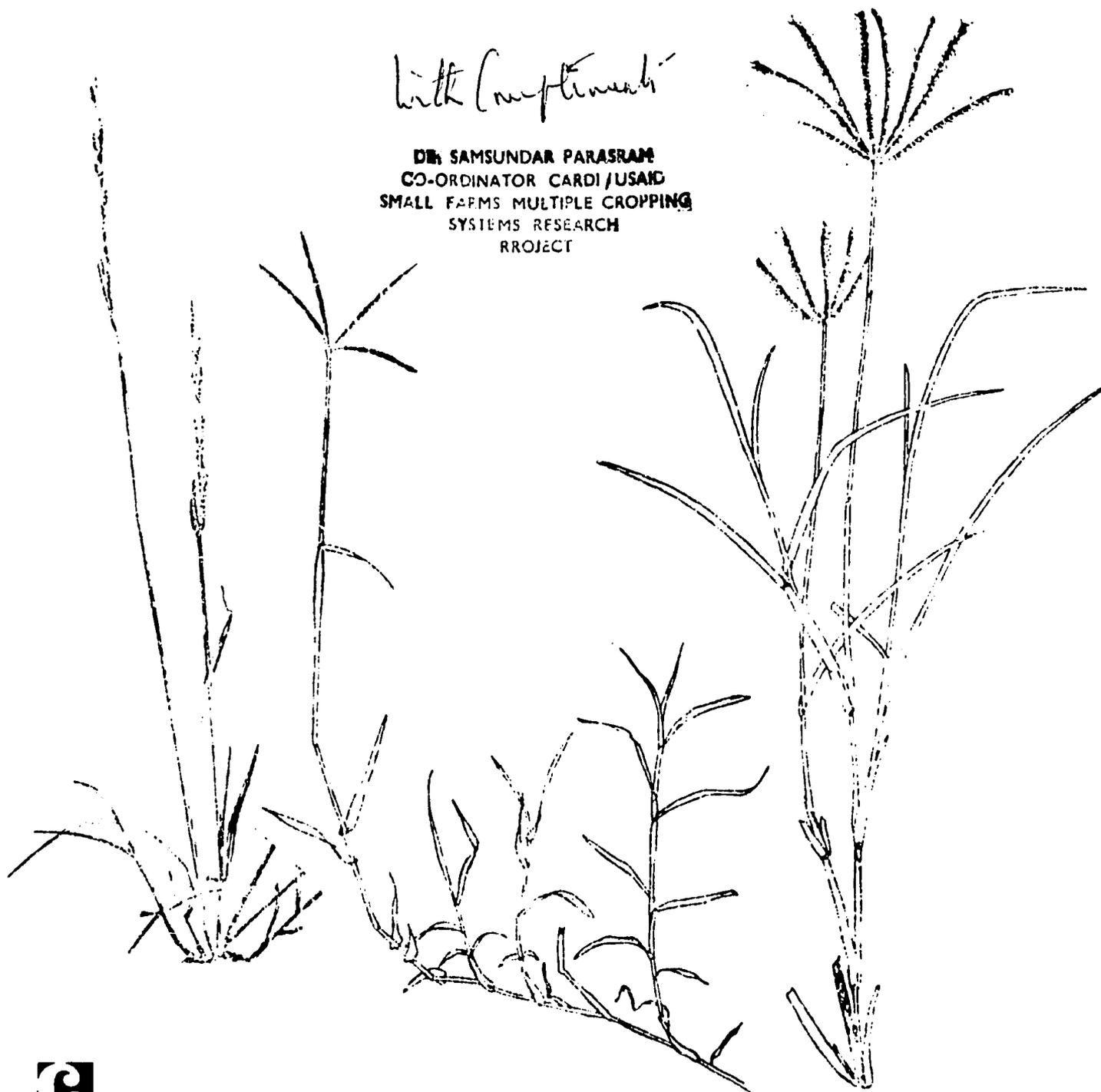


# WEED CONTROL IN THE CARIBBEAN PROBLEMS AND RECOMMENDATIONS

Report on Two Workshops, April/May, 1980

*With Compliments*

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SYSTEMS RESEARCH  
PROJECT



CARIBBEAN AGRICULTURAL RESEARCH AND DEVELOPMENT INSTITUTE

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CARIBBEAN AGRICULTURAL RESEARCH AND DEVELOPMENT INSTITUTE

Weed Control in the Caribbean -

Problems and Recommendations:

Report on Two Workshops, April/May, 1980

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## INTRODUCTION

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As part of CARDI's USAID funded Small Farm Multiple Cropping Systems Research Project (538-0015), two Weed Control Workshops were held in April-May 1980. These two Workshops form part of CARDI's ongoing training programme.

Assistance with these Workshops was provided by the USAID Bureau of Development Support/Agriculture in the person of Mr. Myron Shenk as Consultant.

Mr. Shenk is a Weed Scientist with the International Plant Protection Centre (IPPC), Oregon State University, but based at Centro Agronomico Tropical de Investigacion y Enseñanza (CATIE) at Turrialba in Costa Rica. The Workshops were led by Mr. Shenk and Dr. John Hammerton, CARDI's Chief of Programmes, who is a Weed Scientist by training.

Mr. Shenk arrived in Barbados on April 13th to discuss and plan the programme with Dr. Hammerton. A brief visit to St. Lucia en route to Grenada, where the first Workshop was held, enabled Mr. Shenk to see something of St. Lucian agriculture.

The Grenada Workshop catered to CARDI staff from Guyana, Trinidad and Tobago, Barbados, St. Vincent and St. Lucia, as well as from Grenada, and Ministry of Agriculture staff members from the latter three territories.

The Antigua Workshop drew CARDI staff from Belize, Jamaica, Montserrat, St. Kitts/Nevis and Dominica as well as from Antigua, and Ministry (or Department) of Agriculture staff members from the latter four territories. Participants are listed on pages 48 - 50.

The format comprised a series of informal lectures, illustrated by overhead projection and, where appropriate, by slides, with questions and answers and discussions. Early in each Workshop, participants presented a series of Country Papers which are summarised on pages 4 - 18.

Certain sessions dealt with 'Specific Herbicides', 'Specific Weed Problems' and 'Specific Crop Problems' as identified and requested by participants. These sessions are summarised on pages 19 - 35. The programmes for each workshop are given on pages 39 - 44.

IPPC provided folders containing a number of useful publications and other literature, and CARDI acknowledges with gratitude this contribution. Other material was prepared by Dr. Hammerton. Pages 45 - 47 list the material and publications distributed.

SUMMARY OF "COUNTRY PAPERS" ON WEED CONTROL PROBLEMS

Grenada

1. Major Weeds.

Scleria spp - Razor grass

Rhynchospora nervosa - Star grass

Andropogon aristatus - Finger grass

Moghania strobilifera - Wild hop

Mimosa pudica - Ti Marie

Commelina diffusa - Watergrass

Blechnum pyramidatum - John bush

Hyptis capitata - Bachelor's buttons

Pseudelephantopus spicatus - Dog's tongue

Lantana camara - Black sage.

2. Weed Control. Little attention to continuing control, rely on periodic clearance. Poor understanding of weed/crop relationships. Some farmers want to maintain weeds in cocoa 'to keep soil moist', 'to keep soil cool'. Vegetable growers recognise need for control, but practice inadequate.
3. Methods. Cutlass universal, hoe only in certain areas. hand-pulling widely used. Inversion of soil by forking or mechanical cultivation. Some burning. Cutlassing may be to bare the soil (no debris left), cut to a stubble, or cut to a high stubble (merely top over to facilitate access for reaping cocoa etc).
4. Herbicides. Gramoxone and Reglone, but few others available or used.

5. Problem crops etc. Tannias, tomatoes and cabbage.

St. Vincent

1. Major Weeds

- Cyperus rotundus - Nutgrass
- Cynodon dactylon - Devil grass
- Commelina spp - Water grass
- Amaranthus spp - Callaloo
- Portulaca oleracea - Purslane
- Solanum spp
- Cleome spp
- Bidens pilosa
- Eleusine indica - Fowl foot
- Phyllanthus amarus - Seed-under-leaf
- Setaria poiretiana - Gamalot
- Argemone mexicana - Poppy
- Euphorbia spp
- Sporobolus indicus - Hay grass
- Vinca rosea - Old maid
- Mormodica charantia - Cerasee
- Digitaria spp
- Drymaria cordata -
- Panicum fasciculatum - Bamboo grass
- Chloris barbata - Purple top
- Leonotis nepetifolia - Lion's tail

2. Weed Control. Only banana farmers use chemicals, but even these more conscious of pest and disease problems than of weeds. Some weeds used as medicine and so left. Farmers may selectively thin weeds.

3. Methods. Hoeing used both in land preparation and post-planting  
Hand pulling used, but expensive in time. Cutlassing widely  
used for perennials. Chemicals - Gramoxone mainly - only used  
in bananas. Burning used for land clearing. Residuals not much  
used.
  
4. Herbicides. Gramoxone, 2,4-D, 2,4,5-T, Atrazine, Dacthal and  
Tok E available. Gramoxone most widely used and farmers like to  
see its effects. Some mixing of 2,4-D and Gramoxone.
  
5. Problem Crops etc. Arrowroot now appearing in cane as a weed.  
Research needed on rotation and control in multicrop systems.  
Chemical costs excessive.

## St. Lucia

### 1. Major Weeds

Commelina spp - Watergrass  
Paspalum fasciculatum - Bamboo grass  
Panicum muticum - Para grass  
Ipomoea spp - Wild slip  
Cyperus rotundus - Nutgrass  
Achyranthes indica - Devil's horse whip  
Mimosa pudica - Sensitive plant  
Cleome spp  
Axonopus compressus - Savannah grass  
Parthenium hysterophorus - White tops  
Sporobolus indicus - Hay grass

2. Weed Control. Crops often spaced so as to allow weeding. Cleome spp serious for vegetables because harbours caterpillars. Farmers weed crops to which they attach most value, others weeded only if labour available. Rotation would improve weed control.
  
3. Methods. Handweeding, machete, hoe and push hoes, (particularly in pineapples). Not much use of chemicals for weed control. Extension recommendations poor. Farmers often almost illiterate (use patois) and unaware of toxicity problems.
  
4. Herbicides. Gramoxone, Dalapon, Gesapax, Maloran (in bananas), 2,4-D, Dacthal, Simazine, Gesaprim.
  
5. Problem crops etc. Some research underway in WINBAN. CARDI starting some work in carrots.

### Barbados

#### Major Weeds

Cyperus rotundus - Nutgrass  
Cynodon dactylon - Devil's grass  
Brachiaria cruciforma -  
Portulaca oleracea - Purslane  
Amarathus spp - Callaloo  
Euphorbia spp  
Phyllanthus amarus - Seed-under-leaf  
Teramnus labialis - Rabbit vine

2. Weed Control. Few small farmers use herbicides except Gramoxone. Larger estates use more herbicides.
3. Methods. Hand weeding and hoeing commonest among small farmers, with some use of Gramoxone.
4. Herbicides. Gramoxone, Dalapon, Roundup, 2,4-D/2,4,5-T, Dacthal, Dymid, Gesaprim, Alanap, Gesagard, Patoran, Kerb, Ramrod, Tok, Preforan, Pyramin, Asulox. Wide range available for use in a wide range of crops.
5. Problem crops etc. Onions, cabbage, tomatoes and cucurbits are crops in which control is difficult. Preforan recommended for beans, Pyramin for beets, Asulox in cucurbits and some other vegetables, Dymid in Solanaceae, Dacthal in cucurbits, onions, and crucifers. etc.

## Guyana

### 1. Major Weeds

Pastures - brush and scrub spp.

Coastal Area -

Cyperus rotundus - Nutgrass

Scleria spp - Razor grass

Digitaria spp - Crab grass

Cyperaceae - Sedges

Rottboelia exaltata - Corn grass

- 2 & 3. Weed Control and Methods. Weeds in pastures controlled by brush cutting. Manual control used in small farmer rice and vegetables. Herbicides for rice are subsidised, propanil is main material used. Gramoxone used in citrus and pineapples and elsewhere. Atrazine/ametryne used in sugar cane. In coconuts use burning. Foreign exchange restrictions limit quantity and range of herbicides available.
4. Herbicides. Gramoxone, Propanil, Ametryne/Atrazine
5. Problem crops. Vegetables and rice.

### Trinidad and Tobago

#### 1. Major Weeds

Rottboelia exaltata - Corn grass  
Paspalum fasciculatum - Bamboo grass  
Cynodon dactylon - Devil grass  
Parthenium hysterphorus - White tops  
Portulaca oleracea - Purslane  
Cyperus rotundus - Nutgrass

2. Weed Control. In vegetables, P. fasciculatum and P. hysterphorus serious, hoeing, hand-pulling, cutlassing common. Gramoxone, Roundup and pre-emergence herbicides. In citrus brush cutting and Gramoxone used. In cane pre-emergence herbicides and in field crops, pre-em, post-emergence herbicides and inter-row

cultivations. Farmers consider weeds a major constraint. Vegetable growers aim for high profits even with weeds as major problem.

3. Methods. Cutlassing, hoeing and spraying all used.
4. herbicides. Agroxone, Actril, Asulox, Diuron, Dowpon, Eptam, Reglone, Tordon and Amiben available. Gramoxone and Roundup the most widely used.
5. Problem crops etc. Research being undertaken by U.W.I. (corn-grass and vegetables) , by CARDI (forage seed crops, particularly legumes), by Ministry of Agriculture and by Caroni (sugar cane).

## Antigua

### 1. Major Weeds

Cyperus rotundus - Nutgrass  
Cynodon dactylon - Devil grass  
Parthenium hysterophorus - Whitehead  
Andropogon pertusus - Seymour grass  
Chloris barbata - Purple top  
Cenchrus spp - Bur grass  
Echinochloa colonum - Junglerice  
Desmanthus virgatus -  
Beorhavia spp - Hogweeds  
Portulaca oleracea - Purslane  
Euphorbia spp - Milkweeds

Panicum macimum - Guinea grass  
Lagascea mollis - Velvet bush  
Cleome spp - Consumption weed  
Eleusine indica - Fowl foot grass  
Leonotis nepetifolia - Lion's tail

2. Weed Control. Farmers using manual methods view weeds as a major constraint to crop protection, particularly in the rainy season.
3. Methods. Gramoxone or Reglone used before and/or after land preparation, but pre-planting. Some use of pre-em residual herbicides, but most farmers use manual methods particularly in vegetables. There is some inter-row spraying with Gramoxone and/or Reglone, and with Glyphosate. Onions, carrots, beetroots and other vegetables, yams, cotton and corn normally receive substantial amounts of weed control. Hoes, cutlass and knapsack sprayers are the normal tools used.
4. Herbicides. Gramoxone, Reglone, Roundup, Dalapon, Eptam, Daconate, Diuron, Lorox, Tok, Caparol (prometryne), Dacthal, Venzar and Dymid are available.
5. Problem crops etc. C. dactylon and C. rotundus are particularly difficult to control. P. nysterophorus is a frequent weed in many crops. Weed control in pineapples and pastures is often poor. Crop sanitation and crop rotation could help. CARDI and the Department of Agriculture are involved in some research in weed control: Mrs Anthony is conducting observation trials in orchard crops.

Dominica

1. Major Weeds

Commelina spp - Watergrass

Ipomoea tiliacea - Capi

Panicum muticum - Paragrass

Mikania micranthra - Volcan

Solanum ficifolium - Susumber, Wild Eggplant

Cyperus rotundus - Nutgrass

Heliotropium spp - Scorpion Weed

Stenotaphrum spp - St. Augustine grass

Wedelia trilobata - Marigold

2. Weed Control. In vegetables pests are considered to be more important than weeds, but weeds probably constitute a very major constraint to production.
3. Methods. Manual methods widespread. Apart from Gramoxone, herbicides are hardly used.
4. Herbicides. Gramoxone, Reglone, Karmex, 2,4-D, 2,4,5,-T, Hyvar X and Dowpon available.
5. Problem crops etc. Commelina appears to be resistant to Gramoxone, or recovers from treatment. This also appears true of I. tiliacea, P. muticum and S. ficifolium. The latter recovers rapidly from chopping. No research in progress.

Jamaica

1. Major Weeds

Cyperus rotundus - Nutgrass  
Parthenium hysterophorus - White top  
Echinochloa spp - Junglerice  
Cynodon dactylon - Purslane  
Euphorbia spp - Milkweeds  
Eleusine indica - Yard grass  
Sida acuta - Ballier savanne  
Sorghum halepense - Johnson grass  
Amaranthus spp - Calalu

2. Weed Control. Large farmers growing export and high value crops consider weeds a major constraint. Many small farmers regard pests and diseases as more important. Some farmers may opt to sustain some loss from weeds and use their time more profitably elsewhere.
3. Methods. Common among small farmers are macheting, hoe and hand pulling. Spraying with Gramoxone is quite popular. On larger farms and estates herbicides and inter-row cultivations are more frequent. Sugar cane, bananas, citrus, vegetables grown on a large scale, root crops and legumes normally receive substantial amounts of weed control. Wheel hoes, boom sprayers and inter-row cultivators are used as well as smaller tools and knapsack sprayers. Improved tools could help.
4. Herbicides. Gramoxone (and other paraquat formulations) 2,4-D, Gesapax, Gesapax Combi, Karmex, Dowpon (and other dalapon formulations), Dacthal, Actril D, Tok, Gesagard, Hyvar-X, Gesatop, Treflan,

Round-up, Eptam, Daconate (and other organo-arsenical formulations), Lorox, Bladex, 2,4,5-T, Tordon, TCA, Stam, Balan, Paarlan, Perflan, Probe, Dowfume are available. Foreign exchange limitations may restrict availability from time to time.

5. Problem crops etc. Rottboelia exaltata can be a problem in sugar cane and legumes. C. rotundus is a problem in many crops, especially vegetables. S. nalepense is serious in citrus, and in sugar cane. Research on weed control is in progress in the Ministry of Agriculture (Mr. Eric Watt) and in the Sugar Industry Research Institute (Mr. Reg Burgess and Mrs. Thelma McCathy). CARDI (Adet Thomas) has work in progress with peanuts, onions, red beans and in sugar cane intercropping.

### Montserrat

#### 1. Major Weeds

Cyperus rotundus - Nutgrass  
Cynodon dactylon - Bermuda grass  
Cenchrus echinatus - Bur grass  
Commelina elegans - water grass  
Parthenium hysterophorus - White head  
Leonotis nepetifolia - Candle stick  
Portulaca oleracea - Purslane  
Cleome viscosa - Sambo  
Amaranthus spp - Spinach  
Desmodium canum - Sweetheart  
Stachytarpheta jamaicensis - Vervain  
Chloris barbata - Purple top  
Achyranthes indica - Devil's horse whip  
Mucuna pruriens - Cow itch  
Sporobolus indica - Wire grass  
Eleusine indica - Fowl foot grass

2. Weed Control. Weeds appear to to be considered a major constraint. CARDATS estimates 25% of money spent on crop production is spent on labour for weeding.
  
3. Methods. Cutting by cutlass and mattock and stumping followed by burning practiced for brush<sup>control</sup> in land preparation. Gramoxone or 2,4-D etc., used for weed control before ploughing. Hoe-fork also used. Many crops grown on ridges which may be partly broken down to control weeds, once crop is growing. Some use of herbicides.
  
4. Herbicides. Gramoxone, Round-up, 2,4-D, 2,4,5-T, Hyvar X, Gesagard, Gesprim, Dymid, Dacthal, Lorox, Kerosene.
  
5. Problem Crops etc. Wide rows (ridges) predispose to weed growth and closer spacing or bedding could help suppress weeds. Disappointing results have been achieved with Hyvar-X in pineapples: may be incorrect rate. Watergrass is a problem in hot peppers in some areas. Ministry is involved in work on weed control in peanuts, (closer planting), pineapples and corn. CARDATS is working with farmers including use of herbicides in onions, carrots and cotton.

St. Kitts/Nevis

1. Major Weeds

Cyperus rotundus - Nut grass

Chloris barbata - Purple top

Paspalum spp

Parthenium hysterophorus - White top

Cleome viscosa - Caia  
Commelina elegans - Watergrass  
Sida acuta - Wallier savanne  
Vernonia cinerea - Iron weed  
Euphorbia spp - Milk weed  
Leonotus nepetifolia - Lion's tail  
Acacia spp -

2. Weed Control. Most of the cultivable land in St. Kitts is owned by NACO, and most of this is in cane. Nevis has small farms on which manual means of weed control are universal. Government tractor used for primary land preparation and this is often delayed.
  
3. Methods. Machetes and hoes are widely used. In St. Kitts herbicides are used in cane and to some extent in other NACO-grown crops. Improved cultivations and better timing to kill germinating weed seedlings would help. Closer spacing of some crops could also help suppress weeds.
  
4. Herbicides. Gramoxone, Round-up, Eptam, Actril D, Tok, Gesagard, 2,4-D and 2,4,5-T. No herbicides are available in Nevis.
  
5. Problem crops etc. C. rotundus, C. viscosa and P. nysterothorus are important under extension cultivation. No research in progress, but much practical experience has been gained at the CARDI field station (Mr. C. Quashie).

Belize

1. Major Weeds

Cyperus rotundus - Nut grass

Cynodon dactylon - Bahama grass

Echinochloa spp - Jungle rice etc.,

Momordica charantia - Serasee

Ipomoea spp - wild slip

Amaranthus spp - Wild spinach

Synedrella nodiflora - Porter bush

Solanum spp

Many woody spp.

2. Weed Control. In slash-and-burn agriculture, no weed control is practiced in corn. M. charantia is a common pioneer and regenerating woody spp., eventually leads to abandonment of the site after one or two crops. A small area may be weeded by machete, removing all vegetation, for planting beans. Large scale farming would use tractor cultivation and sprays for weed control in corn, sugar cane etc. Weeds in citrus and bananas controlled by macheting and herbicides.
3. Methods. See above. Hand tools are used by small farmers and by labour in citrus and bananas. Little weed control practiced in pastures, except by grazing; this in many cases may encourage certain weedy species.
4. Herbicides. Gramoxone, 2,4-D, 2,4,5-T, Gesapax, Gesagard, Karmex, Stam and probably some others.

5. Problem crops etc. Rice on mechanically cleared land appears to become very weedy in the second crop, leading sometimes to abandonment of the land. Parasitic weeds and lianas in citrus are troublesome.

## NOTES ON SPECIFIC HERBICIDES

Notes on the Herbicides discussed in response to Requests from Participants at the Two Workshops.

### Alachlor (Lasso)

A soil acting herbicide controlling many annual grasses, seedlings of some perennials, some broadleaved weeds, and with some effect on nutgrass.

Selective in corn, peanuts, soyabean and dry beans. Usually applied pre-em but can be used p.p.i.

Rates:- 1½ - 3 lb/ac. a.i. Absorbed by shoots and maybe by roots and translocated.

Absorbed by soil colloids and broken down by microbes. Persistence 6-10 weeks. Compatible with other herbicides - with atrazine in corn (1½+1½ lb/ac a.i.), and prometryne in peanuts (2+1 lb/ac a.i.).

### Bromacil (Hyvar-X, Hyvar-XL: Krovar contains bromacil plus diuron)

Non-crop uses at rates up to 20 lb/ac a.i., for general vegetation control. Selective for annual and perennials in citrus and pineapples at rates of 1.5 to 5 lb/ac a.i. Not very effective on some established weeds, and best applied to clean land. Controls some hard to kill weeds such as Johnson grass, Devil grass and Nutgrass.

Root absorbed and a photosynthetic inhibitor. Persistent in soil for many months or years depending on rate etc.

Dalapon (Dowpon, Basfapon, Gramevin and Dalapon)

A soluble chlorine - substituted aliphatic acid developed many years ago.

Selective in broad-leaved crops for annual and perennial grasses. Can be used as directed or spot treatments in corn and cane.

Rates 4-20 lb/ac a.i. Absorbed by shoots and roots, readily washed off into the soil and leaches easily. Also rapidly broken down in soil and persists only a few weeks at rates of 4-8 lb/ac.

Relatively low toxicity but can irritate eyes and skin, not absorbed in significant amounts through skin.

DCPA (Dacthal)

Selective for annual grasses and certain broad-leaved weeds in cabbages, onions, solanaceous vegetables, beans and cucurbits. Kills germinating seedlings by unknown mechanism.

Rates 4-10 lb/ac a.i. pre-em to crop and weeds. Can mix with diphenamid (Dymid) at approx., 2-2½ lb/ac a.i., each.

Does not leach and appears to breakdown in soil by microbial and chemical activity. Relatively non-toxic.

Damage to black-eye reported.

Dicamba (Banvel and other formulations some with 2,4-D etc.)

Pre-em and post-em for annual broad-leaved weeds including 2,4-D - resistant species. Selective in corn, sorghum, grasses and sugar cane.

Rates 0.5 lb/ac a.i., upward. Auxin like symptoms but mechanism speculative. Root and shoot absorbed. Mobile in soils but biodegraded and persistent for only a few weeks. Can cause damage by spray drift to vegetables, bananas etc. Compatible in mixes with atrazine and alachlor.

Dinoseb (Dow Selective Weedkiller, Premerge)

A yellow dyestuff contact herbicide for control mainly of broadleaved weeds in grasses. Poor on established perennials. Somewhat temperature sensitive - can cause damage at high temperatures to resistant crops. Pre-plant, pre-em or post-em application to weed seedlings. Rates 0.75-12.0 lb/ac., higher rates for non-crop use.

Highly toxic to mammals and fish. Rapidly absorbed by skin and causes staining. Use all caution in handling. Can leach in soil and microbially broken down.

Used at 'cracking' in peanuts.

EPTC (Eptam, Eradicane (with antidote))

For control of annual grasses, seedlings of perennial grasses, nutgrass and many broad-leaved weeds.

Selective in potatoes, beans, forage legumes, sweet potatoes, corn. For some crops an interval between application and planting may be necessary.

Must be incorporated immediately by disc, rotavator or irrigation. Granular formulation can be incorporated by hand hoes. Volatilisation losses high, apply sprays to dry soil surfaces preferably.

Rates 2-6 lb/ac a.i.. Readily absorbed by roots. Not persistent in soil - half life about a week - but damage has been reported seemingly from residues several weeks after treatment.

Eradicane contains an antidote and can be used at high rates in corn with safety.

There are a range of similar compounds which are selective in other crops: vernolate (Vernam) in legumes, butylate (Sutan) in corn, molinate (Ordram) in rice and cycloate (Ro-neet) in beet.

Glyphosate (Round-up)

A phosphonated amino acid - glycine. broad spectrum, relatively non-selective. Readily translocated so gives excellent control of perennials including nutgrass and grasses.

Rates 0.5 - 1.0 lb/ac a.e. Sulphate of ammonia (ca. 4 lb/ac) appear to be<sup>a</sup> synergist and should be tried with lower rates of glyphosate.

Requires some 5-6 hours fine dry weather for effectiveness. Effects usually not seen for several days. In soil adsorbed and broken down by micro-organisms. No soil activity or persistence.

Nitrofan (Tok E25, Tok WP50)

For the control of annual grasses and broad leaved weeds in brassicas, carrots, onions, peas, beans, peanuts, cotton, sunflower, either pre-em or post-em. Application rate should be moderately high volume - 60-75 Imp. gal/ac.

Rate 4-6 lb/ac a.i., and most effective against small weed seedlings. Tok E25 may be more toxic to some crops than Tok WP50. Adsorbed by most soils and biodegraded (eventually) to CO<sub>2</sub>. Tok E25 can injure skin and leave oily deposit in sprayers.

Organic arsenicals (Daconate, Ansar, Broadside etc.)

Based on MAA (methanearsonic acid), usually either MSMA (monosodium methanearsonate) or DSMA (disodium).

Shows selectivity in grasses, and used for control of grass weeds in Zoysia. Cotton shows some tolerance and often used as directed sprays in cotton. Also non-crop uses for Johnson grass, nutgrass and other weeds. Requires some 5-6 hours fine weather to be effective. Rates 2 lb/ac a.i., upwards.

Less toxic to mammals than inorganic arsenicals, but requires full caution in handling etc.

Reported that Sorrel shows some tolerance.

Paraquat (Gramoxone)

Water soluble contact herbicide for non-crop use or as pre-em contact or directed post-em use, or as desiccant/defoliant and for no-till systems.

Rates 0.5 lb/ac ion. Can use nonionic or cationic surfactant. Rapidly absorbed and resistant to removal by rain. Very rapid action in bright sunlight. Rapidly and completely inactivated in the soil and cannot be removed from soil by washing.

Concentrate extremely toxic if ingested - must exercise greatest caution. Avoid contact with skin and finger- and toe-nails as may lose these.

Broad-spectrum, but many perennial will regenerate since

little translocation. In general should not use in mixtures but in sequential sprays (paraquat - dalapon on regrowth - paraquat on regrowth etc.).

Other formulations of paraquat reportedly less effective.

Picloram (Tordon, also in mixtures with 2,4-D, 2,4,5-T)

For control of woody plants, annual and perennial broad-leaved weeds. Grasses resistant.

Rates 2-8 lb/ac a.e., pellets for brush control, depending on density and age of stand, 2-3 lb/ac as sprays and 1-2 lb/ac for non-woody perennial weeds. Rates of picloram can be reduced if 2,4-D or 2,4,5-T mixtures are used.

Absorbed by soil colloids but leached in sandy soil and very persistent. Use sparingly and if possible as spot treatments.

2,4,5-T (Many Trade-names, some with 2,4-D, these often called Brushkiller).

For control of woody plants. Selective in pastures, rice, corn and other graminaceous crops.

Absorbed through foliage, bark and roots. Can treat stumps (in oil carrier) or use frill treatment of standing trees. Oil-based sprays better for bark absorption.

Rates range widely from 0.5 lb/ac a.e., in pastures up to 15 or 16 lb/ac for brush and tree control. Can use in land clearance.

Broken down in soil, persistence depends on rate. More persistent than 2,4-D.

NOTES ON CONTROL OF  
SPECIFIC WEED PROBLEMS

Notes on the Weeds discussed in Response to Requests from  
Participants at the Two Workshops

Achyranthes indica (Devil's Horse Whip)

General or localised sprays of 2,4-D or dicamba were suggested where this could be done in fallow, corn or sorghum or in pastures. Damage to pasture legumes would result from overall sprays.

Amaranthus spp (Wild spinach, callaloo, Bhajee etc)

Several species occur as weeds, one of which (A. spinosus) is spiny. Most herbicides control Amaranthus spp., though cyanazine (Bladex) is poor. Very susceptible to 2,4-D or dicamba post-em.

Andropogon bicornis (Foxtail grass)

Perennial pasture weed with a fibrous root system. Cultivation will probably eliminate it in time. In pastures spot treatment with glyphosate.

Antigonon leptopus (Coralita, Coralilla)

Has tubers or nutlets? Persistent and difficult to control, recovers from paraquat treatment. Cultivation in the dry season, and treatment with 2,4-D, 2,4,5-T or glyphosate should prove effective.

Aquatic Weeds (Eichhornia crassipes, Pistia stratiotes,  
Nymphaea spp.)

Water weeds increase water loss by evapotranspiration. If fish are present and important must not spray the entire area at one time, else decaying weeds will deoxygenate the water. In such a case should spray in strips. Diquat (Reglone) effective, also 2,4-D, neither should pose residue hazards from water use for domestic or agricultural purpose after a week or so. Certain residual herbicides can be used but will persist for some months. Consider use of weeds as feed?

Commelina spp (water grass)

Common in wet areas and in bananas. Paraquat reportedly ineffective, diquat or paraquat/diquat mixture may be better. 2,4-D amine or glyphosate effective.

Cynodon dactylon (Devil's grass, bahama grass)

Variable weed. Must kill stolons. Cultivation during dry season can desiccate. Dalapon and dalapon/paraquat sequences and glyphosate effective.

Cyperus rotundus (Nutgrass)

Use shading crops, desiccation of tubers during fallow. Fumigate seed beds with MeBr, metham or dazomet. Thiocarbamates (EPTC, vernolate, butylate etc.) will kill some and induce dormancy in tubers. Must incorporate, may need to allow interval between treatment and planting. Can use Eradicane (EPTC plus antidote) for corn with no damage. Triazines in oil or as emulsion may have some effectiveness. Alachlor at high rates give some

control. 2,4-D and dicamba both give some control. Organo-arsenicals can be effective if repeated. Glyphosate is excellent and will kill tubers with shoots.

Avoid spread from localised infestations. Use corn as cleaning crop.

Digitaria spp (Crab grass, Finger grass etc)

As weeds of cultivated land can be controlled by alachlor in corn or peanuts etc. Atrazine gives poor control. Simazine and/or diuron are both good for Digitaria control in, for example bananas. Diuron could be used in corn also, or in aroids. Diuron/simazine mixture shown to be useful in ginger.

Kallstroemia spp.(Police macca)

Spreading usually prostrate plant, probably most serious in vegetables. EPTC (p.p.i) or DCPA (pre-em) or amiben (pre-em) should be effective. Nitrofen may not be effective post-em unless seedlings small.

Maranta arundinacea (Arrowroot)

Has become a weed problem in sugar cane planted on old arrowroot land. Suggested glyphosate or picloram/2,4,5-T as spot treatment and possible as treatment to cut stumps.

Mucuna pruriens (Cow Itch)

A twining vine with irritant hairs. A problem in Montserrat

where it over-runs old lime groves. 2,4-D suggested, plus surfactant to improve wetting because of the hairy leaves.

Parthenium hysterophorus (Whiteheads, white tops)

Allergenic in India and possibly in West Indies although seldom reported. In many places the dominant weed, due probably to its resistance to paraquat. Very plastic.

Diquat, organo-arsenicals, glyphosate effective, latter may kill developing seeds. 2,4-D and/or 2,4,5-T could be tried.

Paspalum fasciculatum (Bamboo grass)

Paraquat ineffective, recovery rapid. Cultivations, repeated to exhaust reserves, dalapon (sequential sprays) or glyphosate are effective.

Portulaca oleracea (Purslane, Pursley)

Common in vegetables; apparently responds to fertilisers. Difficult to control by hoeing; does not desiccate easily and re-roots at nodes. Should aim to prevent seeding. No selective herbicide for use in vegetables: DCPA appears to be ineffective but nitrofen post-em on seedlings may be effective. Amiben worth trying. In corn atrazine or alachlor or EPTC (p.p.i) should control purslane.

Rottboelia exaltata (Corn grass, itchgrass)

Reduces tillering of cane, yields of crops etc. Produces

many seeds with limited dormancy. Resistant to atrazine.

Frequent cultivation encourages germination - destroy seedlings and prevent seed production. Use crop and herbicide rotation. Susceptible to dinitroaniline herbicides (trifluralin, benfluralin, dinitramine etc). Rogue with herbicide glove and glyphosate.

Ruellia tuberosa (Duppy gun, Monkey gun, heart bush etc)

Should be controlled in pastures by 2,4-D and/or 2,4,5-T. Also glyphosate should be effective against underground parts if the former herbicides not effective.

Scleria spp (Razor grass)

Root system difficult. Try 2,4-D/2,4,5-T, glyphosate, picloram. Probably need large volume.

Solanum spp (Nightshades etc)

Large bushy weeds, often spiny, found in pastures and waste places. Should be controllable by 2,4-D, 2,4,5-T, dicamba or picloram. Some species may be able to regenerate from roots or rhizomes (?).

Sorghum halepense (Johnson grass)

This species is rhizomatous. Somewhat similar non-rhizomatous spp., may be present in some territories. Organo-arsenicals and dalapon should be effective as overall or directed sprays.

Glyphosate also effective, and could be used for spot treatment to clean-up a few plants.

Synedrella nodiflora (Fatten barrow, Porter bush)

Can be serious in corn or peanuts. In corn controllable by atrazine (pre-em) or 2,4-D or dicamba (post-em). In peanuts can control with prometryne.

## NOTES ON WEED CONTROL IN SPECIFIC CROPS

### Notes on the Crops discussed in response to requests from Participants at the Two Workshops

#### Aroids and Aroid/Banana Combinations

Prometryne (Gesagard) at 2-3 lb/ac a.i., before crop emergence. Some Gramoxone (1 pint/ac) can be added if weeds have already emerged. Diuron (Karmex) and atrazine (Gesaprim) which are recommended for bananas are liable to damage aroids. Shielded Gramoxone can be used between plants.

#### Cabbage.

Tok E25 or Tok WP50 pre-em or after transplanting at about 3 lb/ac a.i. Can repeat later. Relatively high volume sprays may be more effective. Tok WP50 may be safer to cabbage seedlings. Dacthal (DCPA) at 5-8 lb/ac a.i., pre-em should be safe. Will normally require some hand hoeing and hand pulling. Close spacing in beds can help suppress weeds.

#### Corn

An abundance of herbicides can be used. Atrazine, cyanazine (Bladex), alachlor (Lasso) or mixtures of atrazine and alachlor, all pre-em are standard treatments. Eradicane (EPTC & antidote) p.p.i., alone or with atrazine is very effective in very weedy situations. Oicamba (Banvel) can be used pre-em with atrazine or alachlor or cyanazine. Post-em for broadleaved weeds, 2,4-D or

dicamba can be used, but not when corn is 'shooting'. Interrow cultivation can be used for control of weed seedlings. Spot treatment of Johnson grass or itch grass with glyphosate may be justified. Shielded or directed sprays of dalapon can be used for other grass weeds. but not if soil is very wet.

### Onions

Dacthal (DCPA) at 6-8 lb/ac a.i., pre-em and Tok E25 or Tok WP50 (nitrofen) at 1-3 lb/ac a.i., post-em to seedling weeds, preferably at volume rates of 60 gal/ac or more. Weed susceptibility diminishes with time, but too early a spray will miss any weeds not yet emerged. Nitrofen sprays can be repeated. Hand weeding will almost certainly be required at least once. Onions should not be grown on land infested with nutgrass, nor on land known to be weedy.

### Pastures

For control of broad-leaved weeds, 2,4-D, 2,4,5-T and dicamba can be used. For woody weeds, Tordon (picloram) may be used as spot treatments, but with extreme care because of its persistence. All these treatments will harm - but not necessarily kill - desirable forage legumes.

Undesirable grasses can be killed by spot treatment with dalapon or Round-up.

In establishing pastures, mob-stocking will often suppress or kill weeds, while enabling legumes and desirable grasses to recover rapidly and establish. Mowing or brush-cutting regularly will also

control many woody species. Regular and repeated cutting with a machete will weaken and eventually kill many woody weeds.

### Peanuts

Premerge (DNBP) at 1 lb/ac a.i., or Ancrack (a mixture of naptalam and DNBP) at about 4 lb/ac total a.i., at cracking time will control many emerged broadleaved weeds. Dalan (benefin) or Vernam (vernoiate) p.p.i., have proved effective in Jamaica. Alachlor pre-em has given good control, particularly with narrow rows. Combinations of vernoiate ppi plus alachlor pre-em has proved very effective. Hoeing or any cultivation once pegging has started can cause yield reductions.

### Sugar cane

Many herbicides are available for pre-em use. These include atrazine, ametryne (and mixtures of the two), diuron (but some cane varieties have proved susceptible) and asulam (Asulox). Sencor (metribuzin) might be worth testing in cane.

Post-em 2,4-D is effective for broad-leaved weeds. Fenac and dicamba should be safe and effective for 2,4-D resistant or tolerant weeds. Spot or directed treatments with glyphosate and dalapon can be used for grasses such as itchgrass, Johnson grass, guinea grass and others. Interrow cultivations and banking will help control many weeds.

### Sweet Potato

Dacthal plus Dymid or Enide (diphenamid) at about 2 lb/ac a.i.,

of each can be applied at transplanting time. EPTC ppi., applied a week before ridging, would be worth testing. Maloran (chlorbromuron) may be worth testing also. Some hand-hoeing and hand-pulling is usually needed, often done when 'turning' the vines.

### Tomatoes

Dymid or Enide at about 4 lb/ac a.i., after transplanting is generally safe. Worth testing are Treflan (trifluralin) and Paarlán (isopropalin) at rates of about  $\frac{1}{2}$ -1 lb/ac a.i., and 1-1 $\frac{1}{2}$  lb/ac a.i., respectively pre-plant incorporated. Devrinol (napropamide) pre-planting is also worth evaluation. Normally hoeing and hand-pulling and shielded sprays of Gramoxone or Reglone are needed.

## INFORMATION NEEDS

### As perceived by Participants

It was agreed that the following 'types' of information were needed.

- A replacement for Kasasian and Seeyave's 'Weedkillers for Caribbean Agriculture' which was now out-of-date. (This was published in 1968 by R.R.C., U.W.I., Jamaica and Trinidad).
- A revision of Hammerton's 'The Biology and Control of Nutgrass' (Published by Department of Agriculture Extension, U.W.I., St. Augustine, Trinidad, as Extension Bulletin No. 10., August 1974).
- A revision of Hammerton's 'Herbicides, A guide to Terminology, properties and uses'. (Published by Department of Agriculture Extension, U.W.I., St. Augustine, Trinidad as Extension Bulletin No. 9, April 1974).
- A revision of Adams, Kasasian and Seeyave's 'Common Weeds of the West Indies'. (Published by U.W.I., St. Augustine, Trinidad 1970).
- A glossary of terms used in weed control, possibly incorporated into a crop protection glossary.
- Information on sprayer care and maintenance, mixing, choice and range of equipment etc.
- A listing of local names for weeds against the botanical names.
- A listing of herbicides available in the region, local agents and prices.

It was also agreed that a Crop Protection Manual, covering pests, diseases and weeds, was highly desirable and would contribute substantially to improving crop protection in the region.

It was suggested that this be put out in the form of a small (octavo) size 3-ring folder, so that material could be added and/or amended. Sections could be on different-coloured paper which should be heavy enough to stand up to field handling. A two volume format was suggested: the first volume would contain basic information (sprayer maintenance, handling and storage of chemicals a glossary of terms etc.,) while the second volume would contain recommendations crop-by-crop. It was suggested that 'tentative' recommendations or 'treatments worth trying' should be included. However, this was only worthwhile if CARDI and Ministry or Department staff communicated their experiences and findings to the 'editors' of the Manual.

RECOMMENDED FUTURE ACTION

- Produce a Crop Protection Manual (see page ) as soon as possible for field testing by CARDI field staff and Ministry or Department of Agriculture staff.
- Establish channels of communication for relaying information on crop protection between CARDI specialist staff and CARDI's and Ministry's or Department's field staff. This must include communication of experiences, experimental findings etc., so that crop protection recommendations can be qualified, modified, updated, etc.
- Develop extension materials for farmers, in collaboration with Ministries or Departments of Agriculture, which integrate weed, pest and disease control into crop production systems.
- Hold regular Workshops (possibly biennially ?) in Crop Protection for CARDI, Ministry or Department staff.



15.45 Calibration of sprayers and calculation of  
Volume and application rates - Hammerton

17.30 Finish

Wednesday, 23rd April

08.00 Minimum Tillage - M. Shenk  
Note: Power supply failures disrupted the planned  
programme and led to several modifications.

09.00 Discussion and Review of Weed Problems - J. Hammerton  
Country Papers: Barbados (D. Norgrove), Guyana (W.  
Massiah and Trinidad and Tobago (B. Ahmed & C. Devers)

10.15 Experimental Methodology - M. Shenk

11.15 Discussion and Review - J. Hammerton

LUNCH

13.30 Specific herbicides - response to Workshop - Hammerton

15.45 New Techniques - M. Shenk

17.00 Finish

Thursday, 24th April

08.00 System Approach - M. Shenk

09.00 Discussion

10.15 Specific Weed Problems - response to Workshop -  
J. Hammerton

11.15 Specific crop and crop combination problems -  
response to Workshop - J. Hammerton

Closing - J. Hammerton and Participants.

13.30

Field Trip - Mardi Gras UNDP-FAO Watershed Development Project - Mr. Charles Frances and nearby estate of Mr. Roy Defreitas (to look at weed problems).

PROGRAMME OF ANTIGUA WEED CONTROL WORKSHOP

April 29-May 2, 1980

Tuesday 29th April, 1980

- 08.30            Opening. Welcome (Dr. C. Walter). Purpose of Workshop (Dr. J. Hammerton). Address and Opening (Mr. D. Michael, P.S. Ministry of Agriculture and Supplies).
- 09.00            The Role of Weeds in Society - M. Shenk
- 10.00            Break
- 10.15            Weed Interference - J. Hammerton
- 11.15            Socio-economic Aspects of New Technologies - M. Shenk
- 12.15            LUNCH
- 13.45            Weed Control Methods - J. Hammerton
- 14.45            Country Papers - Antigua (V. Barkley), Dominica (L. Nicholas), Jamaica (A. Thomas), Montserrat (J. Adam), St. Kitts/Nevis (J. Lowery), Belize (A. Castaneda).
- 17.30            Finish

Wednesday 30th April

- 08.15            Herbicides: Principles of Selectivity - M. Shenk
- 09.15            Toxicity and Proper Handling of Pesticides - J. Hammerton.
- 10.15            Break
- 10.30            Factors affecting the Performance of Herbicides applied to Foliage - M. Shenk

- 11.30            Equipment: Selection, Use and Maintenance -  
                 J. Hammerton
- 12.30            LUNCH
- 14.00            Factors affecting the Performance of Herbicides  
                 applied to the soil - M. Shenk
- 15.15            Break
- 15.30            Literature: Calibration of Sprayers and Calcula-  
                 tions - J. Hammerton
- 17.00            Finish

Thursday 1st May

- 08.15            Minimum Tillage - M. Shenk
- 09.15            Experimental Methodology - J. Hammerton
- 10.15            Break
- 10.30            Biological Control of Weeds - M. Shenk
- 11.30            Discussion and Review of Problems and Needs -  
                 J. Hammerton and Participants.
- 12.00            LUNCH
- 13.30            Field Trip

Friday 2nd May

- 08.15            The Systems Approach to Weed Control - M. Shenk
- 09.15            Specific Herbicide - response to Workshop - J.  
                 Hammerton
- 10.30            Break
- 10.45            Continuation
- 11.45            Plant Protection Manual: format etc/information  
                 needed - J. Hammerton

12.15	LUNCH
13.45	New techniques - M. Shenk
15.00	Specific Weed Problems - response to Workshop J. Hammerton
16.00	Break
16.15	Closing
16.25	Finish

PUBLICATIONS AND INFORMATION  
DISTRIBUTED AT THE WORKSHOPS

Glossary of terms used in Weed Control (8 pp)\*

Sprayer Calibration (5 pp)\*

Application Rates (3 pp)\*

Weights, Measures and Conversion (4 pp)\*

Problems (in Calibration and Calculation of rates etc) and  
Solutions (15 pp)\*

Field Manual for Weed Control Research (1976), by L.C. Burrill,  
J. Cardenas, E. Locatelli and Edited and designed by A.E. Deutsch.  
International Plant Protection Centre (IPPC) (Oregon State Univer-  
sity, Corvallis, OR. 97331, U.S.A (59 pp)

Factors affecting Herbicide Performance starring Herbert I. Cide  
(1975 ) by R.L. Zindahl. Bulletin 563S, Colorado State University,  
Fort Collins, Colorado, USA. (23 pp).

Knapsack Sprayers: Use, Maintenance, Accessories (1979) by F. Fraser  
and L.C. Burrill, IPPC. (33 pp).

Diagnosis and Prevention of Herbicide Injury (1978) by R.H. Lockerman  
A.R. Putnam, R.P. Rice and W.F. Meggitt. Extension Bulletin E-809  
Michigan State University. (19 pp).

A list of Suggested Equipment and Facilities to Support a Weed  
Research Programme (1978). Document 25-A-78, IPPC. (4 pp).

Tropical Weed Seeds 1. Monocots by J. Doll, C. Reyes, D. Navia,  
H. Fisher and J. Cardenas, IPPC (4 pp).

Tropical Weed Seeds 11. Dicots by J. Doll, C. Reyes, H. Fisher, J. Cardenas, IPPC (4 pp).

Factors Influencing Herbicide Performance by Monsanto (4 pp).

From Agronomic Data to Farmer Recommendations. An Economics Training Manual. (1976) by R.K. Perrin, D.L. Winklemann, E.R. Moscardi and J.R. Anderson. Information Bulletin 27, Centro International de Mejoramiento de Maiz y Trigo, Mexico (51 pp).

Practical Characteristics for the Recognition of Some Important Weed Families of the Lowland and Highland Tropics (1979). H.H. Fisher. (Paper presented at the PCARR/NCPC/UPLB/WSSP/IPPC/USAID Workshop at Laguna, Philippines. (20 pp).

Prospects for the Biological Control of Weeds with Insects, by R.D. Goeden, Division of Biological Control, University of California, Riverside. (10 pp).

Crop-Weed Competition (1979) by K. Moody. (Lecture to course at NCPC at Laguna, Philippines). (20 pp)

Selective Action of Herbicides (1980) by Beatriz L. Mercado. (Lecture to course at NCPC at Laguna, Philippines). (5 pp).

Herbicide Classification. IPPC. (10 pp)

Factors Influencing Soil Applied Herbicides. IPPC (6 pp).

Factors Influencing Foliage-Applied Herbicides. IPPC (8 pp).

Herbicide Families. IPPC (17 pp)

Pesticide Formulation. IPPC (7 pp)

\* Papers so marked written and provided by Dr. John L. Hammerton of CARDI. Copies are available from CARDI (see below).

The remaining papers and bulletins were generously provided by IPPC as course material. If requested, CARDI will attempt to obtain additional copies from IPPC: write to CARDI Information Unit, Box 51B, Brittons Hill, St. Michael, Barbados.

PARTICIPANTS IN GRENADA WORKSHOP ON WEED CONTROL (April 21-24)

1. CARDI

John L. Hammerton	Barbados	Chief of Programmes
David Norgrove	Barbados	Agronomist
Reynold Benjamin	Grenada	Technician, CARDI/USAID
Golden Julien	Grenada	Counterpart, CARDI/USAID
Ken Buckmire	Grenada	Country Team Leader, CARDI/ USAID
Arthur James	St. Lucia	Technician, CARDI/USAID
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Lenford Sampson	St. Vincent	Technician. CARDI/USAID
Norbert Ferris	St. Vincent	Technician. CARDI/USAID
Bill Massiah	Guvana	Agronomist
Belal Ahmed	Trinidad	Agronomist
Clive Devers	Trinidad	Agronomist

2. Ministries of Agriculture

Neville Burris	Grenada
Raphael Brathwaite	Grenada
David Rennie	Grenada
Cosmos Joseph	Grenada
Carlyle Hope	Grenada
Orgias Campbell	Grenada
Clive Alexander	Grenada
Sydney Law	Grenada
George Ogilvie	Grenada
Flores Griffith	St. Lucia
Glenroy Browne	St. Vincent

3. Garth Baker Grenada 'Free West Indian'

PARTICIPANTS IN ANTIGUA WORKSHOP ON WEED CONTROL (April 29-May 21)

1. CARDI

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E.A. Burleigh	Antigua	Irrigation Agronomist
John Keoghan	Antigua	Forage Legume Agronomist
Richard Pearon	Antigua	Forage Legume Agronomist
Perry Philip	Antigua	Forage Legume Technician
Darryl Roberts	Antigua	Technician
Anselmo Castaneda	Belize	Agronomist
Adet Thomas	Jamaica	Agronomist
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Jasmeed Adam	Montserrat	Country Team Leader, CARDI/USAID
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Kelvin Swanston	St. Kitts/ Nevis	Counterpart, CARDI/USAID
Ashraf Ali	St. Lucia	Economist (May 2 only)

2. Ministries/Departments of Agriculture

Hilroy Willet	Antigua
Elliott Schonten	Antigua
Keith Joseph	Antigua
Ralston Edwards	Antigua
James Spencer	Antigua
Robertta Anthony	Antigua
George Joseph	Antigua
T. Joseph	Antigua
Sereno Benjamin	Antigua
Beatrice Turner	Antigua

Mackenzie Harper	Antigua
Mackenzie Edwards	Antigua
Elloy deFreitas	Antigua
E. Bennett	Antigua
Francis Henry	Antigua
Albert Fleming	Antigua

Naomi Aaron	Antigua
Carlton Hampson	Antigua
Luke Prevost	Dominica
Franklyn Michael	Montserrat
J. Farrell	Montserrat
Charles Williams	St. Kitts/Nevis

3. Other

Carlton L Samuel	CMC Antigua
Conrad Thomas	ADC Diamond Project
Lazman Webson	Antigua Sugar Industry
James Sedlacek	Ministry of Education, Antigua
Alfred Gardner	Farmer, Parham Antigua
Ethel Burton	Farmer, Antigua
Jaspar Small	ADC Cotton
Wavell Gardner	Farmer, Antigua

EVALUATION OF GRENADA WORKSHOP ON WEED CONTROL

April 21-24, 1980

1. How relevant was the Workshop?  
Very 10      Moderately 5      Irrelevant 0
  
2. Was the Workshop valuable in terms of new information and ideas?  
Yes 12      Moderately 3      No 0
  
3. What topics were inadequately covered?  
None 6  
'Socio-economic aspects of new technologies'  
'Legislation to monitor herbicide use/misuse'  
'Minimum tillage'  
'All - more time needed for all topics'  
'Biological control'  
'Specific crop combination'
  
4. Were any topics irrelevant?  
Yes 0      No 15
  
5. What new topics do you think should have been included?  
'Weed Control on roadside/non-crop areas'  
'Land clearing of forest/brush vegetation'  
'Chemical control in multicropping systems'  
'Arrowroot as a weed and its control'  
'Time of herbicide treatments'
  
6. Were the sessions  
Too long 5      Too short 1      About right 9

7. Could the format have been improved?

'More handouts'

'Need two weeks'

'More participation'

'More practicals inc., identification, and

'More Caribbean experience'

8. Other comments?

'Workshop created awareness, importance, limitations and dangers of herbicides'

'Principles of weed control handbook needed'

'Explain control vs eradication'

'Could not take rates from some overlays'

'Ask what 2 or 3 sessions were least or most useful'

'More locally relevant slides and information needed'

'Practical demonstrations'.

EVALUATION OF ANTIGUA WORKSHOP ON WEED CONTROL  
April 29th to May 2nd, 1980

1. How relevant was the workshop?  
Very 13      Moderately 6      Irrelevant 0
  
2. Was the workshop valuable in terms of new information and ideas?  
Yes 12      Moderately 7      No 0
  
3. What topics were inadequately covered?  
None 11  
'Timing of weed control'  
'Herbicide classification'  
'Land classification'
  
4. Were any topics irrelevant?  
Yes 0      No 19
  
5. What new topics do you think should have been included?  
'Mechanical/Cultural weed control'  
'Equipment/implements for weed control'  
'Extension methods'  
'Weed control in orchards'
  
6. Were the sessions  
Too long 4      Too short 0      About right 15
  
7. Could the format have been improved?  
'More field trips for weed identification'  
'Practicals on spraying, drift etc.'  
'Discussion of specific weed control trials'

'More handouts'

'Small discussion groups'

8. Other comments

'Too long a day'

'More time needed'

'Opening formalities a waste of time'

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Illustrations on cover were obtained from the U.W.I. Herbarium  
St. Augustine, Trinidad.

Names of weeds on cover from left to right:

1. Sporobolus Indicus
2. Cloris Barbata
3. Cynodon Dactylon

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