REPORT ON THE FIRST NATIONAL SURVEY OF COMMUNAL AREAS OF ZIMBABWE, BY CROP PROTECTIONISTS FROM THE PLANT PROTECTION RESEARCH INSTITUTE IN THE DEPARTMENT OF RESEARCH AND SPECIALIST SERVICES, HARARE, DURING THE 1984/85 GROWING SEASON.

BY SAM L.J. PAGE Ph.D.*
CAMES M. MGUNI M.Sc. (PATHOLOGIST)
SIMON Z. SITHOLE M.Sc. (ENTOMOLOGIST)

*BASED AT THE TROPICAL PLANT NEMATOLOGY ADVISORY AND RESEARCH UNIT,
CAB INTERNATIONAL INSTITUTE OF PARASITOLOGY,
ST. ALBANS, AL4 OXU, ENGLAND

SUMMARY

A total of 33 communal areas were surveyed for pests and diseases during the 1984/85 growing season. These communal areas were selected on the basis of soil-type, altitude and crop diversity and a number of communal areas were chosen from each of the five natural Farming Regions.

From a total of 186 root and soil samples that were collected from stunted or chlorotic plants, 88% were found to contain plant-parasitic nematodes. The results showed that several genera of plant-parasitic nematodes are associated with serious yield-losses (sometimes in excess of 30%) in maize, sorghum, finger millet, bulrush millet, sunflower and tobacco. The most important nematode pests identified during the survey were the root-lesion, migratory endoparasitic nematodes, Pratylenchus zeae and P. brachyurus, a semi-endoparasite, Rotylenchulus parvus and the macroscopic, ectoparasitic, root-tip feeding nematodes, Xiphinema spp. and Paralongidorus sp.. Pratylenchus spp. and R. parvus are each capable of causing losses of 30%. These two nematode pests were often found infesting the same plants. Xiphinema spp. and Paralongidorus ?n.sp. were associated with severe stunting of cereal crops, particularly maize and yield-losses in affected fields were estimated to be more than 50%. This is a completely new record of a species of Paralongidorus being associated with damage to maize. This nematode appears to be indigenous to savannah areas, being more common in the low-veld of Farming Regions IV and V - the most

remote and hitherto most neglected parts of the country, as far as agricultural research is concerned.

The most widespread disease that was discovered during the survey was the maize streak virus, while the most devastating insect pest was the armoured cricket. Other insect pests causing serious damage to crops in communal areas were stem-borers and termites. Witch-weed was also a problem in some areas.

Ninety-four percent of the maize fields that were sampled were infested with plant-parasitic nematodes and the highest (and, therefore, potentially most destructive) populations of both nematode and insect pests were found either under continuous maize or where maize was being rotated with sorghum and/or millet. All of these cereal crops were found to be susceptible to the same nematode and often the same insect pests. None of the farmers questioned during the survey ever fallowed their land (a practise that is common in commercial farming areas) although many of them complained of declining yields. Most communal farmers are obliged to devote the greater part of their land to the main food staple, maize, in order to sustain themselves and their families, other crops only being grown in narrow strips. It is, therefore, extremely difficult for these farmers to rotate their crops effectively and fallowing is impossible. Communal farmers that live in farming regions IV and V (75% of the rural population) face a more difficult task, as the high temperatures and unreliable nature of the rainfall further restrict their

choice of crops and cropping patterns. Groundnut proved to be a poor host for most of the pests and diseases that were adversely affecting cereals, therefore, farmers with sufficient land should be encouraged to incorporate groundnut into their crop-rotations.

All the village vegetable gardens that were sampled were infested with root-knot nematodes, Meloidogyne spp., sometimes to the extent of causing premature death of the plants. This ubiquitous soil pest is often responsible for yield losses in excess of 50% in a wide range of vegetable crops. Research into vegetable production should be given a much higher priority.

This survey has established that research is urgently needed into cultural methods of controlling pests and diseases in communal areas of Zimbabwe - especially those in Farming Regions IV and V. Methods for controlling pests and diseases which are currently used by commercial farmers are not always appropriate for subsistence farmers in the communal areas.

The overwhelming problem facing farmers in communal areas of Zimbabwe remains that of land distribution: while the commercial farming sector occupies the largest share of the most productive land and claims to have a land surplus, more than 4 million people (53% of the total population) subsist on 42% of the land, much of it in low rainfall areas, suited only to extensive cattle ranching. Although it is appreciated that the commercial farming sector provides a vital part of Zimbabwe's economy, being

responsible for 40% of total exports, this years bumper harvests in the communal sector, is ample proof of the growing confidence among communal farmers. With additional land, increased crop diversity, efficient crop rotation, improved seed and the correct inputs, communal farmers would not only be able to subsist but also produce substantial surpluses for export.

ACKNOWLEDGEMENTS

Special thanks are owed to Ms. Ntombi Mugabe who skillfully dealt with the logistics of this survey. Thanks are also due to Mr. Sithole, Mr. Cames Mguni, Mr. Paul Muchena, Mr. Solomon Mpeti, Mr. Zitsanza, Mr. Sebastian Mawere, Mr. Doba, Mr. Patrick Mandivenyi, Mr. George Chidodo, Mr. George Chidodo junior and Mrs. Carol Magumuye, whose hard work contributed greatly to this survey.

The assistance received from Agritex staff in the field and in particular the generous hospitality given to me by Mr. G. Tsododo, Mr. F. Mashayamombe, Mr. C.E.B. Chuma and colleagues at Chiredi Research Station was much appreciated.

I am grateful for the co-operation afforded me by members of the British High Commission in Harare. I am also indebted to my colleagues Dr. David Hunt and Mrs. Audrey Godman at the Commonwealth Institute of Parasitology, for their professional assistance in the identification of nematode species as part of the service offered to contributing member states.

CONTENTS

LIST OF TABLES

INTRODUCTION

Zimbabwe can be divided into five different natural regions according to climate and altitude. These regions are closely linked to the type of farming system that they can support. Thus Regions I, II and III, which receive more than 650 mm of rainfall per annum, support varying degrees of intensive farming, based on both crop and livestock production; while the hot, low-lying Regions IV and V are only suited to extensive livestock ranching, because rainfall never exceeds 500 mm and prolonged dry spells or periods of complete drought make crop production a very unreliable occupation, (Fig. 1).

Land distribution in Zimbabwe is a result of pre-Independence legislation. For example the Land Apportionment Act of 1930 confined Africans to "reserves", which later became known as "Tribal Trustlands" and occupied less than half the area of the country, much of it in Farming Regions IV and V. The Land Husbandry Act of 1951 restricted each African family to 8 acres (3.2 ha) of land within the Tribal Trustlands. Since Independence these Tribal Trustlands have been re-named "Communal Lands" and today provide land for more than 4 million people, with those in Farming Regions IV and V still supporting 74% of the rural population. Despite the harsh environment these people are attempting to produce subsistence food crops, in addition to livestock in order to survive.

There is increasing land pressure in all communal areas, although our survey showed that the average holding in some places is still 3.1 ha, supporting an average family of 10, including 7 children. Widows form the most impoverished group, as far as land holdings are concerned. Many of them cultivate as little as 0.5 ha, despite having to provide for a number of children. As a result they are often forced to undertake additional work, such as beer-brewing or labouring, to supplement their incomes. A resettlement programme is in progress and to date almost 38,000 families have been resettled on land vacated by white farmers.

Women and children constitute the majority in the permanent rural population, the younger men folk being obliged to migrate to urban centres in search of paid employment. This means that most of the day-to-day agricultural work is done by women. Many of these women are enthusiastic participants of local 'Master Farmer' training programmes which are run by Agritex, the national extension service.

Maize is the predominant crop as it provides the staple food in all areas, except where rainfall is too low. Sorghum or bulrush millet are the main food crops in these arid areas. Cereal crops are usually monocropped where land is limited, other crops being grown only in thin strips around the edges of the main crop. Fallow periods, which are a feature of the commercial farming system practised on the high veld, are never implemented

by communal farmers. Again this is probably due to land pressure as shifting cultivation was the traditional farming practice in pre-colonial days. Cash crops include cotton, tobacco and sunflower. Horticultural produce is grown in communal areas situated close to towns.

Prices paid to farmers for agricultural produce are determined by the government and purchases are made by the various marketing boards. These prices are revised each year giving the farmer plenty of time to plan the following season's cropping pattern. The Agricultural Finance Corporation provides credit for the purchase of seeds and other inputs for some small scale farmers. Such incentives have led to the large increases in output from the communal farming sector. This is in line with the government's plan for rural development, which has given all communal areas a high priority since Independence.

The survey of communal areas for pests and diseases of important crops was conducted at the request of the Zimbabwe government. It fulfilled the initial part of a 3-year programme to determine pre- and post-harvest losses in communal areas of the country. This programme is being funded by the World Bank, with additional funding from the British Overseas Development Administration for some laboratory equipment and for the technical services of Dr. Sam Page for six months. The purpose of the survey was to contribute to government policies which assist in the development of rural areas by:

1. improving crop production so that self-sufficiency in food is achieved
2. supporting women in their important role as food producers
3. raising the living standards of the rural population, thereby discouraging their rural-to-urban drift
4. improving the local diet in an effort to reduce disease, especially in children
5. educating communal farmers in cultural pest control, enabling them to be independent of costly inputs.

Specific objectives of the survey were:

1. assess the importance of nematode pests, in relation to other pests and diseases, as limiting factors in the production of crops in communal areas.
2. initiate appropriate and acceptable, low cost pest control methods.
3. encourage the introduction of new crops which will help to control nematode pests, as well as to improve the diet of local people.
4. plan a research programme to investigate the level of damage caused by any "new" nematode pests, by means of field trials, pot experiments and through the gathering of information from local people.

The survey team included local scientists who were specialists in plant nematology, plant pathology or entomology. The survey itself covered irrigation and resettlement schemes and as many communal areas as was possible in the time available.

The 1984/85 growing season was very good in terms of rainfall and in most areas communal farmers were able to harvest their first crop for 3 years. Exceptions to this were parts of Matebeleland South Province and the Hwange area where it was expected that "Food-for-Work" programmes would have to be re-introduced. Other problems highlighted during the survey were extensive soil erosion due to over grazing, shortages of fuel for cooking and poor access to water, with some women having to walk up to 4 km to the nearest well. Farmers also complained of inadequate transport facilities, late delivery of inputs and baboon raids on their crops. Nevertheless, communal farmers managed to produce almost half of this year's maize surplus - ten times more than the maximum surplus that they ever achieved prior to Independence.

FIG. 1.

MAP OF ZIMBABWE; SHOWING NATURAL FARMING REGIONS, COMMUNAL AREAS AND SAMPLE SITES

Reference

Farming Regions

I - Specialised diversified farming region

IIa & II b - Intensive farming region

III - Semi-intensive farming region

IV - Semi-extensive farming region

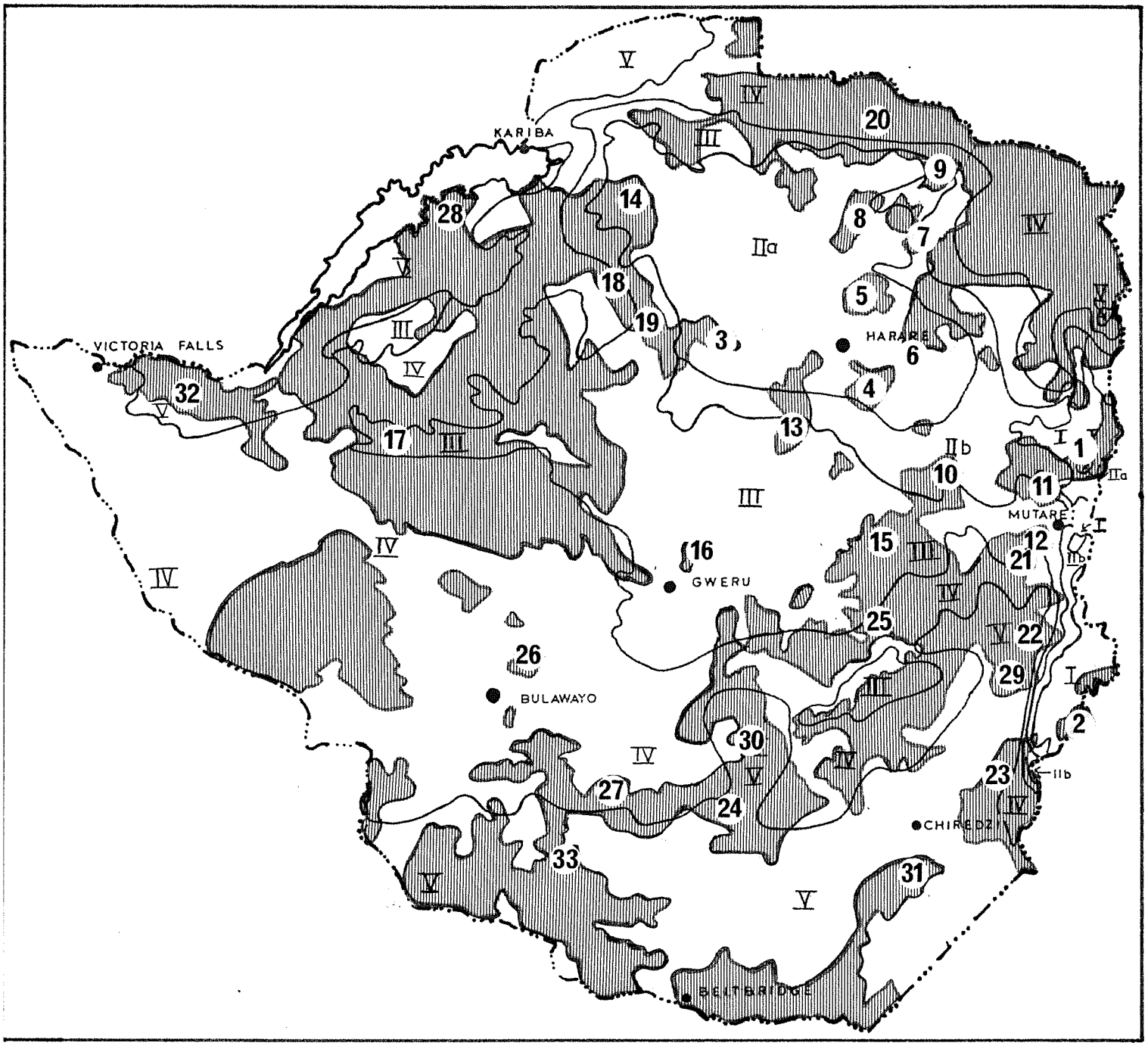
V - Extensive farming region

 - Communal areas

Sample Sites

1. Manga	12. Zimunya	23. Ndowoyo
2. Tamandayi	13. Ngezi	24. Mberengwe
3. Zvimba	14. Urungwe	25. Gutu
4. Chiota	15. Sabi North	26. Ntabazinduna
5. Chinamora	16. Chiwundura	27. Glassblock
6. Kunzwi	17. Mzola	28. Omay
7. Bushu	18. Piriwiri	29. Mutema
8. Chiweshe	19. Umfuli	30. Mazvihwa
9. Kandeya	20. Mzarabani	31. Matibi 2
10. Chiduku	21. Chinyauwhere	32. Hwange
11. Mutasa South	22. Muwushu	33. Gwaranyemba

ZIMBABWE.


KARIBA
VICTORIA FALLS
HARARE
MUTARE
GWERU
BULAWAYO
CHIREDZI
BEITBRIDGE
I
IIa
IIb
III
IIIb
IV
V
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33

B. SAMPLING METHODS

Samples were collected from 33 different communal areas during the first three months of 1985. These areas were selected according to soil-type, altitude and rainfall pattern so that a representative number of them were visited in each of the five natural farming regions.

All sampling was done with the full co-operation of Agritex (the National Extensive Service). Provincial Officers were informed of the dates when any of their communal areas were to be visited so that the relevant regional officers who put their extension workers at our disposal when necessary. The local extension workers were asked to take us to fields where crop growth was poor and samples were then collected from the affected plants. These samples consisted of soil and roots in the case of nematode pests; soil and various types of plant material in the case of fungal and virus diseases. Insect pests were captured and fixed in alcohol directly.

Sampling for Nematode Pests

Samples were taken from fields where farmers were experiencing unexplained patches of "poor growth" in their crops, plants that were not expected to reach their yield potential due to stunting and chlorosis or where there was a lack of response to fertilizer applications. Specific symptoms of nematode damage included

stunting, wilting and nutrient deficient leaves; necrotic, distorted or galled roots; delayed flowering or premature senescence; reduced yield of poor quality fruits or grains. These symptoms usually occurred in clearly defined patches within the field. The farmer concerned was questioned about the cropping history of the land, fertilizer applications and possible reasons for the "poor growth". This information was used as a basis for working out the host ranges of various nematode pests and appropriate methods for control.

Root and soil samples were collected from stunted plants at depths below 10 cm. Fine feeder roots were taken in preference to thicker, tougher ones and moist soil rather than dry surface soil was removed by means of a trowel or hoe and placed inside a plastic bag. These bags were sealed and labelled then stored in an insulated box for up to a week when their contents could be processed in the laboratory at the Plant Protection Research Institute in Harare.

(i) Extraction and Processing of Nematodes from soil samples

Nematodes were extracted from the soil samples using a modified tray extraction method. Thirty plastic-coated, wire, office trays, which each fitted into a 45 x 30 cm plastic "canteen" tray, were lined with plastic mosquito netting, over which was placed a single-ply layer of absorbant paper tissue. A 200 ml measure of soil was taken from each sample bag and crumbled evenly over the surface of the tissue. The wire tray was then placed inside one of the "canteen" trays, on a level

surface and water was slowly poured into this lower tray until the soil above became saturated, but not flooded. The trays were then left undisturbed for 24 hours at ambient temperatures in a shady room, after which time the upper tray plus its contents was removed and the water, which by now contained a suspension of nematodes, was poured into a tall glass bottle, then carefully sieved through a 38 u sieve. The nematodes caught on this sieve were re-suspended in approximately 100 ml water contained in a small glass bottle. This glass bottle was placed in a refrigerator for 12 hours to relax the nematodes before they were fixed in a few drops of formalin to await microscopic examination.

When large plant-parasitic nematodes (>2 mm long) were suspected of being present in a sample a sieving technique was used to retrieve them. For this a 200 ml soil sample was crumbled into a litre of water and left to soak for 1 hour, stirring intermittently. The resulting suspension was washed through a 4 mm aperture sieve (to remove course debris) into a 5 L plastic bucket, almost filled to the brim with water and stirred vigorourly with the hand to suspend all particles. After standing for 25 seconds the supernatant was decanted through a bank of three 150 μ-aperture sieves and the residues on each sieve washed with a gentle jet of water before being collected in a beaker. The bucket was refilled with water, stirred again and this time left to stand for 15 seconds before decanting through the same bank of sieves. All the residues from these sieves were poured through a 90 μ-aperture 7 cm diameter nylon sieve. This

sieve, plus its residue, was immersed in a Petri dish of water for 24 hours. This allowed time for the nematodes to swim through the sieve and collect in the water below, where they could be viewed through a microscope, (Flegg, 1967).

(ii) Processing of Nematodes in Root samples

Each root sample was first gently washed and roughly chopped before a random sample of 0.5 g was weighed and wrapped in a muslin bag that was secured with a length of string. The bags of roots were then stained for three minutes in a boiling mixture of 0.1% acid fuchsion dissolved in a solution of lactic acid and glycerol (1:1:1). The bags of roots were then cleared for an hour in cold water, the roots removed and placed in 50% glycerol to await scrutiny through a low power microscope.

All plant-parasitic nematodes that were extracted using the above methods were each stained in cotton blue/lactophenol and mounted in lactophenol on glass slides. These nematodes were identified to genus then sent to the Commonwealth Institute of Parasitology, U.K. to be identified down to species.

Sampling for Diseases

Diseased plants were sampled alongside the zig-zag path that was being traced through the field, by the collector. Twenty plants were selected at random along the row, then another twenty were selected, at a 60° angle across the rows. Samples of diseased tissue (roots, stems, leaves, grain or fruit) were taken

from any of these plants that were showing symptoms. The specimens were placed in absorbant paper bags, labelled with the collection date, host name, farmer's name and notes explaining the cropping history of the field concerned. These specimens were identified in the laboratory at P.P.R.I., Harare.

C PESTS AND DISEASES OF CROPS IN COMMUNAL AREAS

1. COMMUNAL AREAS IN INTENSIVE FARMING REGION I

This region covers much of the Eastern Highlands (Fig.1) between 1,200 and 2,200 m above sea level and defined as an area of high rainfall. Over 900 mm of rain is spread throughout the year making the region suited to a specialized diversified farming system. In frost-free areas, plantation crops such as tea, coffee and macadamia can be grown. Communal farms occupy 21% of the land in this region and support a population of approximately 50,000 people. The survey team visited two communal lands in this region, both in the Manicaland Province.

(i) Tamandayi

This communal area provides land for 1,230 farming families. The soil-type is a clay loam and covers a number of steep slopes, close to the border with Mozambique. Bandit activities have forced many people to move away from their farms where they were adjacent to the border and this has resulted in serious over-crowding with some farmers having only 0.5 ha of land. Maize was being grown by most farmers and other crops included finger millet, sweet potato, cassava, pumpkin, melon, groundnut and tomato. Witchweed, Striga asiatica, was causing serious damage in some maize fields (Plate 2f). Three farms were sampled in this area.

Nematode Pests

Pratylenchus spp. (either *P. zeae* or *P. brachyurus*) were found in high numbers in both roots and soil of stunted and chlorotic maize plants at all three sites. In addition *Rotylenchulus parvus* was found (9,600 juveniles per litre of soil) infesting maize and finger millet at two sites. *Xiphinema* sp., *Meloidogyne* sp., and *Criconemella sphaerocephala* were also recovered from the soil from these crops. Unthrifty banana plants were found to be suffering from root-knot nematode infection at one site.

Diseases

Maize streak virus was extremely widespread on maize and finger millet, causing the typical short broken, pale greenish-yellow streaks and spots which interrupted the normal green colouration of the leaves. Infection rates between 80 and 100% were recorded in some fields and the yield loss was expected to be at least 60%. *Puccinia* sp. was found causing pustules on chlorotic maize leaves. Other minor diseases recorded on maize were leaf blight, *Helminthosporium turcicum* and cob rot (*Diplodia* sp.). *Cercospora* sp. was isolated from pale to dark brown circular spots on groundnut leaves. No control measures were being taken by any of the affected farmers.

Insect Pests

The stalk-borers *Busseola fusca*, *Sesamia calamistis* and *Chilo partellus* were collected from stunted, wilting maize plants,

which were found to have dead hearts. The leaf hopper Cicadulina mbila was common, being responsible for the transmission of maize streak virus. Hilda patruelis was recovered from around the roots of dying groundnut plants. The elegant grasshopper, Zonocerus elegans was found feeding on maize leaves.

(ii) Manga

This communal area provides land for 1,591 farming families. The soil type is mainly deep clays or coarse grained sandy loams and covers an area made up of fairly steep slopes. Maize is grown by the vast majority of farmers who have sufficient access to fertilizers. Other crops included cotton, groundnut, sunflower, coffee and finger millet. Five farms were sampled in this area.

Nematode Pests

High numbers of Pratylenchus sp. were recovered from roots of stunted cotton, with Pratylenchus sp., Scutellonema magniphasmum and Helicotylenchus sp. being present in the soil. S. brachyurum was found in soil around stunted coffee trees but no parasitic nematodes were extracted from the roots of these trees. Rotylenchulus ? parvus, Xiphinema sp. and Scutellonema sp. were found in soil surrounding stunted maize plants at one site and Pratylenchus sp. and Helicotylenchus sp. were associated with patchy growth of maize at another. Soil from stunted finger millet was found to be infested with R. parvus, Scutellonema sp. and Helicotylenchus sp.

Diseases

A 55% infection by maize streak virus was recorded in this area. *Puccinia* sp. was isolated from small rusty raised spots on maize leaves. *Colletotrichum* sp. was causing dark brown lesions and angular spots on the veins of the underside of leaves and stems of beans. Diseased tomatoes were found to be suffering from an infection of late blight, *Phytopthora infestans*. Attempts were being made to control this disease with Dithane M45.

Insect Pests

There was a high incidence of stalk-borer. We found only one farmer who was using the recommended rate of Dipterex and Thidan to control this pest. The american bollworm, *Heliothis armigera* was observed infesting cotton bolls at one site. The cotton stainer, *Dysdercus intermedius* was collected, but not thought to be causing damage. Other less important pests collected were aphids feeding on maize tassels, snout beetles nibbling maize leaves and elegant grasshoppers feeding on maize and coffee leaves.

2. COMMUNAL AREAS IN INTENSIVE FARMING REGION II

This region receives moderately high rainfall (750 to 1000 mm) (Fig. 1) which is confined to the summer months and allows an intensive farming system, involving both crops and livestock, to be practised. Only 17% of this land is reserved for communal farmers and supports approximately 500,000 people. Eleven communal areas in this region, which are covered by four different provinces, were included in the survey.

Mashonaland West Province

(i) Zvimba

This communal area is divided into 6,500 farms and is covered entirely with coarse grained sand. Maize was the dominant cereal crop with tobacco, sunflower and cotton all being grown for cash. *Striga asiatica* was a problem in some maize fields, especially in the absence of crop rotation. Five farms were sampled in this area.

Nematode Pests

Pratylenchus brachyurus was found in high numbers in both roots and soil of stunted, chlorotic maize and sorghum in all four fields sampled. *Rotylenchulus parvus*, *Trichodrous* sp. and *Scutellonema unum* were present in addition to *Pratylenchus* spp. at some sites. Farmers who had applied fertilizer were particularly worried about the patches of poor growth in their maize crops. Maize that had followed tobacco was found to be

infested with root-knot nematodes, Meloidogyne sp. This nematode was causing damage to sunflower, ensuring a low yield and was also found in the roots of sorghum which was being intercropped in the same field. Meloidogyne sp. was extracted from cotton roots in the fields. The affected plants were severely stunted. None of the above nematodes was found to be impairing the growth of groundnut even when it was following a crop of maize.

Diseases

Maize streak virus, was a major problem in this area. A second disease affecting maize was the rust fungus, Puccinia sorghi. Cercospora sp. was isolated from the light or dark brown circular lesions on groundnut leaves. Phoma arachidicola and Rosette virus were also found causing damage to groundnut.

Insect Pests

The most important insect pests found on maize were termites and stem-borers. The maize streak virus vector Cicadulina spp., the american bollworm, Heliothis armigera and grasshoppers were also encountered on maize. The red bollworm Diparosis castanea and red spider mite, Tetranychus spp. were both serious pests of cotton. Aphis craccivora, the Rosette virus vector, was observed feeding on groundnut. Whitegrubs, Eulepida mashona and termites were also important pests of groundnut.

Mashonaland East Province

(ii) Chiota

A total of 9,256 farming families occupy this communal area. The soil-type is mainly coarse-grained sands. Maize predominated with finger millet and cotton, groundnut and sunflower being grown as cash crops. A degree of crop-rotation was being practised. Four farms were sampled in this area.

Nematode Pests

Roots of severely stunted maize were found to be infested with 100 Pratylenchus zeae per gram at one site. Significant numbers of P.zeae and Rotylenchulus sp. with a smaller population of Scutellonema unum were present in the soil. P. brachyurus and S. unum were associated with stunted maize at another site. Severe damage was being caused to finger millet by Meloidogyne sp. which was present in the roots and by Xiphinema sp., Paralongidorus sp. and S. brachyurum, which were present in the surrounding soil. Poor growth in groundnut was associated with Pratylenchus spp., Helicotylenchus sp. and S. unum.

(iii) Chinamora

This communal area is farmed by 7,615 families. Sandy soils cover most of the area, rainfall had been plentiful and good harvests were expected. The local farmers benefitted from the close proximity of Harare which provides a ready market for their horticultural produce, especially tomatoes. Subsistance crops included maize, finger millet, groundnut, banana, rape, with

soybean and tobacco often being grown as cash crops. Clearly defined crop-rotations were not being practised. Lack of firewood was a problem in some areas and other general problems included poor transport facilities and baboon attacks. The presence of Striga asiatica was noted in a number of fields. Samples were collected from three farms in this area.

Nematode Pests

Rotylenchulus parvus and Scutellonema unum were together causing streaked chlorosis with stunting of maize. In the case of R. parvus more than 2,000 juveniles were present in each litre of soil. One farmer, who was growing tobacco for the first time, was concerned about the poor quantity of his crop. His stunted, wilting and chlorotic plants were found to be severly infested with Meloidogyne javanica, despite the fact that the tobacco had followed a crop of maize. The uneven distribution of affected plants indicated the tobacco seed-beds had been the source of the infection. This suspicion was confirmed when it was found that the tobacco seedlings had been raised in a vegetable garden. A population of M. javanica equivalent to 3,800 juveniles per litre of soil was extracted from seed-beds in this garden. The farmer concerned was intending to rotate his tobacco with soybean. This practise should also be avoided as soybean is equally susceptible to Meloidogyne spp. Soil from the roots of groundnut displaying variable growth was found to contain Scutellonema sp. At another site tomatoes that were being grown following maize and a short period of fallow, were not affected by root-knot nematodes and

consequently the farmer was expecting a good harvest which he was planning to sell in Harare.

Diseases

Cercospora arachidicola was extracted from pale brown spots on groundnut leaves. Rust damage due to Puccinia sorghi, was found on maize. Septoria lycopersici was causing leaf spot and Phytophthora infestans late blight on tomato. These latter two diseases were being controlled with Dithane M45.

Insect Pests

Pest attack was generally not serious in this communal area. Aphid, Aphis craccivora attack was too low to warrant spraying. Although maize stalk-borer was present, yields were not expected to be affected. The elegant grasshopper was observed causing insignificant damage to finger millet.

(iv) Kunzwi

This is one of the smallest communal areas and provides land for 1,148 farming families. The soil type is deep, coarse-grained sand. Most farmers here were growing maize with the full range of inputs and other crops including finger millet, groundnut, sunflower and edible bean. Just one farm was sampled in this area.

Nematode Pests

Severely stunted maize was infested with large numbers of

Pratylenchus sp. and Helicotylenchus sp. was also present. Groundnuts that were stunted and had galled roots were found to be infested with Meloidogyne sp. Meloidogyne sp. juveniles and Pratylenchus sp. were extracted from the surrounding soil.

Mashonaland Central Province

(v) Bushu

This communal area is occupied by 630 farming families. The soils are composed of both kaolinitic clay and sandy loams. Samples were collected from five farms both in Bushu and the adjoining Sanyi Resettlement scheme, where serious soil erosion was noted. Maize was the dominant crop and was being grown continuously by those farmers with insufficient land. The main cash crops were tobacco, cotton and groundnut. Many farmers complained of poor transport facilities.

Nematode Pests

Maize growing in sandy soil was found to be infested with large numbers of Pratylenchus zeae (1,000/L of soil), low numbers of Paralongidorus sp. and Scutellonema sp. were also present. These nematodes were causing large patches of stunted chlorotic maize plants, despite the fact that adequate fertilizer had been applied. At Ndabua, a tobacco farmer was experiencing stunting, chlorosis and wilting in his tobacco plants due to severe root-knot. Again this was due to the fact that the tobacco seedlings had been raised in a vegetable garden. The farmer had applied EDB using a home-made soil injector gun prior to planting

his tobacco seedlings. Despite this, a population of 2,500 juveniles of Meloidogyne javanica was found per litre of seed-bed soil. The chemical application had, therefore, been completely ineffective. Banana plants that were bordering this garden were also found to be infested with root-knot nematodes.

Insect Pests

Aphis gossypii was a major pest of cotton in the early stages of growth. One of the farmers questioned had been spraying with dimethoate to control this pest. Damage due to maize stalk-borer was minor. The laceworm, Spodoptera littoralis, was reported to have been a problem a few weeks prior to our visit. At one site the reduced tobacco stand was attributed to cutworm, Agrostis spp. attack shortly after germination.

(vi) Chiweshe

This communal area supports 10,500 farming families and is covered mainly by coarse grained sandy soils. Maize, finger millet, sweet potato, pumpkin, groundnut, cotton and tobacco were the main crops grown. Local farmers complained of land shortages, poor transport facilities and baboon attacks on their crops. Many farmers were growing maize continuously on the same land. Samples were collected from four farms in this area.

Nematode Pests

Rotylenchulus parvus was present in moderately high numbers in soil from around the roots of all the stunted and chlorotic maize

plants that were sampled. In addition Pratylenchus zeae was found in high numbers in both the roots and soil of severly stunted maize at two sites. All the farmers who were found to have these nematode problems had been growing maize continuously on the same land and were complaining of a lack of response to fertilizer applications. R. parvus was associated with poor growth of cotton at Rosa and Scutellonema brachyurum and S. unum were extracted from soil around the roots of cotton and maize respectively, at two sites.

(vii) Kandeya

This communal area provides land for 11,800 farming families. The soil-type ranges from medium-grained sandy loams to coarse-grained sands. Maize, sorhum and millet are all important cereal crops in Kandeya. Groundnut, pumpkin and a range of vegetables are also grown with cotton and soybean serving as cash crops. Many farmers were rotating their maize with cotton. Their main complaints were poor transport facilities, lack of firewood and late delivery of inputs. Ten farms from this area were included in the survey.

Nematode Pests

Pratylenchus spp. (mainly zeae) was extracted, often together with Scutellonema unum, from the roots and soil of stunted and chlorotic maize plants. In Chibara district, severly stunted maize (cv. R201) that was suffering from a streaked form of chlorosis (which resembled magnesium defficiency), was found to

be growing in soil containing large numbers of Rotylenchulus parvus plus S. maginphasmum and S. unum. One of the farmers concerned was extremely worried about this stunted maize and had threatened to stop using fertilizer, as he said it was having no effect on his crop (Plate 1b). P. zeae, S. maginphasmum and S. unum were also associated with stunted cotton plants at two sites.

Insect Pests

The main pest problem was Aphis gossypii which was affecting young cotton plants. One of the farmers questioned was spraying with dimethoate. Termites were noted feeding on groundnut. Maize stalk-borer was observed but infestation levels were low. Other less important pests were jassids, Empoasca spp., and whitegrubs, Eulepida mashona, both affecting maize.

Manicaland Province

(viii) Chiduku

17,400 farming families inhabit this communal area where the soil-type varies from silty sand loams to coarse-grained sands. About 70% of the farmers in this area had used fertilizer on their maize crop. Other crops included finger millet, bulrush millet, groundnut and sunflower. Five farms were sampled in this area.

Nematode Pests

Severe stunting and chlorosis of maize was found to be due to

high populations of Pratylenchus sp. (106 per gram of root) and Rotylenchulus sp. in roots and soil of one field where fertilizer had not been used. Similarly high populations of these two nematodes produced less severe stunting in another field of maize where fertilizer had been applied. Pratylenchus sp. and Rotylenchulus sp. were also associated with stunted maize and sorghum where they each occurred in separate fields. Meloidogyne sp. was found to be reducing the growth of finger millet which had followed maize at one site and causing severe stunting of sunflower at another. In the latter case a population of Meloidogyne juveniles as high as 3,100 per litre of soil was recorded.

(ix) Mutasa South

This communal area provides land for 7,053 farming families. The soil type is mainly coarse grained sands or sandy loams. Fifty percent of the farmers had used fertilizer, while others preferred to use animal manure. Maize, groundnut, edible bean, finger millet and cotton were the main crops being grown. Three farms were sampled in this area.

Nematode Pests

All three farms had stunted crops of maize with varying degrees of chlorosis. Rotylenchulus sp. was found in moderately high numbers at all three sites. Pratylenchus sp., Scutellonema unum and Helicotylenchus sp. were found in addition to Rotylenchulus sp. at the first site. Here the farmer had been

growing continuous maize and had not used fertilizer. At the second site S. unum and Helicotylenchus sp. were also present in the soil and again maize had been grown continuously for at least three years. The stunted maize which was sampled at the third site was infested with Rotylenchulus sp. only. The farmer concerned had been rotating with groundnut and had managed to reduce the apparent level of nematode damage by applying fertilizer.

Insect Pests

Stalk borer was found infesting maize on two farms. Aphids were observed on maize leaves, tassels and cobs and snout beetle feeding marks were noted on maize leaves. Coreid bugs, Anoplocnemis curvipes, were reported on groundnuts but damage was minimal. Elegant grasshopper, Zonocerus elegans damage on maize, beans and cowpea was not serious.

(x) Zimunya

1,694 families, whose average holding is less than 4 ha, farm this area which is composed of coarse-grained sands and sandy loams. Many farmers were using fertilizers and pesticides and several 'master farmers' were expecting yields which would compare favourably with those obtained by commercial farmers. Maize, soybean, sunflower, cotton and groundnut were the most popular field crops, while cabbage, okra, tomatoes and edible beans were being cultivated in vegetable gardens. Three farms were sampled in this area.

Nematode Pests

Stunted growth of maize was noted on two farms, at one site 1,100 Rotylenchulus sp. per litre of soil was extracted, in addition to Pratylenchus zeae and Scutellonema brachyurum, while at the other, P. zeae, Rotylenchulus sp. and S. unum were all extracted from the soil surrounding the affected plants. Soybeans were found to be seriously infested with root-knot nematodes (200 mature females of Meloidogyne sp. per gram of root). Pratylenchus sp. and Scutellonema sp. were also present in the roots and soil of these soybean plants. It is unclear why such a damaging level of root-knot nematodes were present in the soil, as the farmer stated that his soybeans had followed two crops of maize. It is possible, however, that the maize had been intercropped with more susceptible hosts such as pumpkin or okra. Another case of serious root-knot infection was in a vegetable garden where okra was being grown. The population of juveniles of Meloidogyne in the soil was 1,410 per litre. Almost all the okra plants were severely stunted, chlorotic and not forming pods. A maximum of 210 mature females of Meloidogyne sp. were recovered from each gram of the massively galled root systems. This high infection level had resulted from ineffective crop rotation - the okra had been planted following a crop of highly susceptible tomatoes. The tomatoes had followed cabbage which, although tolerant to root-knot nematode attack, does not cause the nematode population to decline. The farmer had intended to re-plant his garden with peas. Unfortunately peas are also

highly susceptible to root-knot nematodes.

Diseases

Maize streak virus was found causing a 70% level of infection. *Cercospora fusimaculans* and *Puccinia* sp. were isolated from lesions on maize leaves. *C. arachidicola* and *Colletotrichum* sp. were each causing leaf spot on groundnut and soybean leaves, respectively. Both *Septoria lycopersici* and *Alternaria solani* were responsible for leaf spot on tomatoes.

Insect Pests

The farmers were concerned mostly about the maize stalk-borer, *Busseola fusca*. High infestations were being controlled by thiodan 1% dust. Although aphid, *Rhopalosiphum maidis* was found feeding on the tassels, leaves and silk of maize, the level of infection was not thought to be serious enough to warrant spraying. The groundnut hopper *Hilda patruelis* was a major pest on a few farms. The elegant grasshopper *Zonocerus elegans, Anoplocnemis curvipes* and *Lycas* spp. were all observed on cotton, but damage was insignificant. Signs of maize leaf damage due to snout beetles was observed at two sites. In one case a whole tomato crop had been devastated by red spider mite, *Tetranychus* sp.

3. COMMUNAL AREAS IN SEMI-INTENSIVE FARMING REGION III

Although rainfall in this region is moderate (650-800 mm) there may be marked dry spells, making it marginal for the production of maize, tobacco and cotton. A mixed farming system involving both livestock and crop production is, therefore, recommended. Forty-one percent of this region is reserved for communal farmers (Fig. 1). Four communal areas were visited by the survey team.

Mashonaland West Province

(i) Ngezi

This communal area supports 6,019 farming families and has a sandy-loam soil-type. Fertilizer was being widely used on maize crops. Other crops included groundnut, cotton, sunflower and finger millet. Three farms were sampled in this area.

Nematode Pests

Rotylenchulus parvus was common and found associated with poor growth of both maize and sunflower. In one field *Pratylenchus* sp. and *Meloidogyne* sp. were also found in the roots of retarded maize plants, while in another *Xiphinema* cf. *variable* was found feeding on maize roots. *R. parvus*, *Scutellonema unum*, *X.* cf. *variabile* and *Helicotylenchus* sp. were all extracted from soil from around the roots of stunted sunflower at a site, where it was being cultivated following several crops of maize. Severely

stunted cabbage was infested with Meloidogyne sp. Trichodorus sp., Scutellonema sp. and very large numbers of Meloidogyne juveniles (2,410 per litre) were extracted from the soil. This was the second crop of cabbage from the same piece of land. Tomato had been grown previously and was probably responsible for the initial build up of root-knot nematodes in the vegetable garden, which was then sustained by the repeated planting of a moderately susceptible crop.

(ii) Urungwe

This communal area is divided into 4,400 farms and has a shallow gravel to coarse grained sandy soil type. Crop rotation was being attempted by some farmers. Striga asiatica was a problem where cereals were being grown continuously. Five farms were sampled in this area.

Nematode Pests

Pratylenchus zeae was a widespread pest of maize and populations in excess of 300 per gram of root were encountered. Scutellonema unum, Helicotylenchus sp. or Criconemoides sp. were also contributing to the poor condition of the maize plants in some fields. A mild infestation of root-knot nematodes was noted in one cotton field, although this will be held in check so long as the farmer continues to rotate his cotton with cereal crops. S. unum, Telotylenchus obtusus and Rotylenchus incultus were associated with stunted sorghum and lesions were visible on the roots.

Insect Pests

Termite damage in the form of felled young maize plants was observed. Levels of stem-borer attack were low. The coreid bug, Anoplocnemis curvipes was causing an undetermined amount of damage to sorghum. The groundnut aphid Aphis craccivora was associated with the high incidence of rosette virus. Farmers were applying the "acaricide rotation scheme" to control red spider mite. Minor bollworm damage could be seen although the larvae were not found.

Midlands Province

(iii) Sabi North

This communal area provides lands for 12,043 farming families, where the average holding is 2 ha. The soil-type is predominately coarse grained sands. Few farmers were using fertilizer and yields were expected to be low. Maize was either being grown continuously or rotated with sorghum or millet. Groundnut, edible bean and sunflower were also being cultivated. Samples were taken from five farms in this area.

Nematode Pests

Rotylenchulus parvus, Scutellonema unum, Pratylenchus sp., Helicotylenchus sp. and Xiphinema sp. were all associated with stunted, chlorotic maize and sorghum plants. The farmers in this area need to improve their methods of crop rotation before they will benefit from using fertilizers.

(iv) Chiwundura Province

This is a small communal area, midway between Kwekwe and Gweru. It accommodates 2,499 farming families, with average holdings little over one hectare. The soil-type consists of coarse-grained sands. Maize was being grown the most widely and there was very little land left over for such crops as sorghum, finger millet, groundnut and edible beans. Striga sp. was causing damage in some fields.

Nematode Pests

Pratylenchus sp. was widespread causing stunting and chlorosis of maize, finger millet and sorghum. Root populations in excess of 200 per gram were discovered at one site. Rotylenchulus sp. was also detrimentally affecting the growth of maize and finger millet, while one severely stunted and chlorotic crop of maize, which was flowering at a height of 30 cm was heavily infested with Meloidogyne sp. in addition to Rotylenchulus sp. and Pratylenchus sp.

Diseases

There was an 80% infection of maize streak virus. A less serious disease Puccinia sorghi was causing rust on sorghum. Covered kernal smut, Sphacelotheca sorghi was isolated from conical cream or light brown sacs on sorghum heads. Pod rot, Aspergillus flavus and leaf spot, Cercospora sp. were infecting groundnut.

Insect Pests

The cotton stainer Dysdercus spp. were feeding on cotton bolls and white grubs were causing wilting of the whole plant. The american bollworm, Heliothis armigera, was a pest on both cotton and maize, while termites Hodotermes spp. and Macrotermes spp. were also causing damage to these crops.

Matebeleland North Province

(v) Mzola

A total of 770 farms occupy this communal area which is mainly made up of infertile Kalahari sands or small exposures of black, cracking clay loams. This area is marginal for maize so sorghum and millet are also widely grown as food staples. Problems included a high incidence of malaria, faulty water pumps and drought. Only two farms were sampled here due to the security situation.

Nematode Pests

A large population of Xiphinema cf. variabile was found to be responsible for restricting the growth of some maize plants. Affected plants were stunted, with chlorotic, rolling leaves, tassles but not cobs had been produced and the roots were distorted with a "feathery" appearance. The farmer concerned had been growing continuous maize for a number of years. Scutellonema unum, Hoplolaimus pararobustus and Telotylenchus obtusus were extracted from the soil supporting a crop of sorghum which was very poor, despite fertilizer applications. The same

unthrifty growth had been noted in the previous crop of maize. S. unum was also found in the soil from around the roots of stunted cotton. This cotton had also followed a crop of maize.

Diseases

Leaf blight, Helminthosporium turcicum was affecting sorghum and Cercospora sp. was isolated from leaf spots on groundnuts.

Insect Pests

White grubs and termites were major problems on maize. The green stink bug, Nezara viridula and termites were also feeding on pearl millet. The american bollworm, Heliothis armigera was found grazing on sorghum heads.

4. COMMUNAL AREAS IN SEMI-EXTENSIVE FARMING REGION IV

This region experiences comparatively low rainfall (450-650 mm) and is subject to periodic seasonal droughts and severe dry spells during the rainy season. The farming system in this region should be semi-extensive livestock production with drought resistant crops being grown only as a sideline. Communal lands cover 46% of this region, where more than half of the rural population live - almost half a million farming families (Fig. 1). Ten communal areas, covered by seven different provinces in this region were included in the survey.

Mashonaland West Province

(i) Piriwiri

This communal area supports 1,031 farming families and is overlain by very shallow soils, often of a clay type. Just two farmers fields were sampled here.

Nematode Pests

Pratylenchus sp., *Scutellonema unum* and *Helicotylenchus* sp. were associated with stunted growth of sunflower and cotton.

Insect Pests

Sunflower was being attacked by leaf-eating ladybirds, *Epilachna* spp. Red bollworm *Diparopsis castanea* was a major pest on cotton. Other pests included aphids, red spider mite and termites.

(ii) Umfuli

Five thousand subsistance farming families occupy this communal area. The soil-type is clay or shallow gravel. Cotton and sunflower are important cash crops and were being grown in rotation with maize. Three farms were sampled in this area.

Nematode Pests

Pratylenchus sp. and Scutellonema unum were associated with poor growth of sunflower, sorghum and maize. The latter crop had followed cotton and the farmer stated that maize never does well on his land. 660 Pratylenchus sp. were counted in each gram of root from his maize plants.

Mashonaland Central Province

(iii) Mzarabani

This communal area lies in the Zambezi valley where temperatures are high, droughts frequent and malaria rife. It provides land for 1,781 farming families many of whom were harvesting their first food crop for three years. The soil-type is mainly fine to medium-grained sandy loams. Many farmers in the area cultivate their land co-operatively (though a poor widow whom we spoke to was not a member of a local co-operative because she said she would have been required to weed collectively for two days each week and creche facilities were not provided for her children). Cotton is a popular cash crop but transport was said to be a problem. One farmer said she had been charged $10

per bale for her cotton to be transported to a market 84 km away the year before. Five farms were sampled in this area.

Nematode Pests

Pratylenchus zeae and *Rotylenchulus parvus* were together causing severe stunting of maize where it was being continuously cropped on the same land. A growth reduction of 80% was noted in maize growing in soil infested with 1,925 immature females of *R. parvus*, in addition to *P. zeae*, *Scutellonema unum* and *Xiphinema* sp., when compared with maize growing alongside, in soil that had previously formed part of the compound adjoining the farmer's hut and was thus free of nematode infection, (Plate 1d). A patch of severely stunted maize growing in sandy soil that was showing a form of streaked chlorosis in the leaves (normally associated with magnesium defficiency), was being attacked by a large population of *Xiphinema* sp. This nematode was also causing stunted root growth and root tip galling, (Plate 1f). *Hoplolaimus pararobustus* was extracted from the soil around stunted maize plants at one site.

Diseases

Maize streak virus was estimated as causing a 30% level of infection in the area. Rust, *Puccinia sorghi* was isolated from maize and *Cercospora sorghi* were isolated from grey rectangular leaf spots on sorghum.

Insect Pests

An infestation of red bollworm, Diparopsis castanea and american bollworm Heliothis armigera was very high at one site and the farmer concerned was spraying the affected cotton with thiadon. Severe aphid, Aphis maidis was observed on maize at two sites. Jassid, Empoasca sp. infestations were too low to warrant chemical control measures. Other less important pests were coreid bugs on groundnut and stem-borers on sorghum.

Manicaland Province

(iv) Chinyauwhera

This communal area provides lands for 4,058 farming families. The soil-type is a shallow layer of coarse-grained sand or silty, sandy loams. The average land holding was between two and four hectares. Most of the farmers had used fertilizer on their crops, especially maize. Two farms were sampled in this area.

Nematode Pests

Scutellonema sp. and Helicotylenchus sp. were associated with poor growth of cotton at one site and Helicotylenchus sp. with poor growth of finger millet at another.

(v) Muwushu

This communal area is situated in the Makura Range of the Eastern Highlands and is occupied by 4,000 farming families. The whole area is covered by a shallow layer of sandy soil. It was surprising to find that the soil-type in the adjoining new

resettlement area was equally poor and strewn with large boulders which would make it extremely difficult to cultivate mechanically. Baboon attacks were a problem. Three farms were sampled in this area.

Nematode Pests

It was the first year of cropping in the resettlement area and as expected, nematodes were not yet an important constraint on crop production. *Rotylenchus incultus* was extracted from soil surrounding sickly maize plants and *Helicotylenchus* sp. and *Scutellonema* sp. were present around the roots of chlorotic sweet potato plants. Outside the resettlement area a patch of reduced and chlorotic growth was noted in a field of soybean. The affected plants were infested with large numbers of *Meloidogyne incognita* (120 mature females per gram of root) which was entirely due to their close proximity to a group of paw-paw trees. Paw-paw is very susceptible to root-knot nematodes and consequently are always a source of infection for these nematodes. The same farmer was raising tomato seedlings in a seed-bed that was infested with root-knot nematodes. She was advised to sterilize the seed-beds by burning wood on the surface and relocating them each season.

Diseases

Fusarium sp. was found causing wilt of tomato. No control measures were being taken. *Phytophthora infestans* was estimated as being responsible for a 70% infection in another field of

tomatoes and in this case Dithane M45 had been used in an attempt to control the disease. A 60% infection of maize streak virus was noted in some fields. Other minor diseases of maize were leaf blight Helminthosporium turcicum, causing large linear, irregular, ellipsoidal lesions on both leaves and leaf sheaths and Puccinia sorghi the rust fungus which was isolated from light olivaceous-brown to black pustules on the leaves.

Insect Pests

Low populations of semi-loopers were observed on a soybean crop. Red spider-mite was a serious problem on tomato and potato. Dimethoate was recommended for its control. Hilda patruelis attack on groundnut was observed but fortunately populations were low. Other less important pests observed in this area were Heliothis armigera feeding on maize cobs, aphids on maize leaves and tassels, Zonocerus elegans on finger millet and white grubs on maize.

(vi) Ndowoyo

Fifteen thousand farming families live in this communal area where the soil-type is shallow, sandy loam or black vertisol. The whole area borders the Sabi river, though drought was reported to be a problem by many farmers. Continuous cropping of cereal crops is common. Cotton is the main cash crop for farmers who can afford the inputs. Malaria was said to be a serious problem here. Six farms were sampled.

Nematode Pests

Mixed populations of Paralongidorus ?n.sp. and Xiphinema sp. (750 per litre of soil) were extracted from around the roots of severely stunted maize plants at two sites, in an area overlain with Kalahari sand. These month-old plants were less than 30 cm in height and displaying obvious mineral deficiency symptoms, while their roots were stunted and distorted with "bunched" tertiary roots and tip galls (Plate 1e). Exceptionally high numbers of Pratylenchus zeae (>1,000 per gram of root) and Scutellonema sp. were found in the roots of the same plants. Such damaging nematode population levels were attributed to the fact that maize had been grown continuously on the same land at least since 1981/82. When these fields were revisited seven weeks later it was noted that the plants which had been growing in the stunted areas were still less than half the size of maize plants growing in other parts of the field (Plate 1c). They were also chlorotic and showing signs of water stress, such as leaf rolling, presumably because of the poor root growth. Very few of these plants had produced cobs and some had also failed to tassle.

S. unum was present in vertisol in which a small patch of stunted maize plants was growing. Nematodes associated with reduced growth of sorghum included Paratrophurus sp. and S. cf. truncatum in vertisol and Rotylenchulus parvus, Histotylenchus histoides and S.brachyurum in the lighter soils. Paratrophurus sp. and Telotylenchus obtusus were extracted from vertisol

supporting chlorotic groundnut while, S. cf. truncatum was found in soil around the roots of stunted cotton.

Diseases

The grey leaf spot fungus Cercospora sorghi and the rust fungus Puccinia purpurea were found on sorghum. Leaf spots on cotton and groundnut were caused by Phyllostica sp. and C. arachidicola, respectively.

Insect Pests

The american bollworm, Heliothis armigera was a major pest, especially on sorghum heads. Amoured crickets were also a problem on sorghum, devouring most of the grain. Stalk-borer infestation of maize was reported on most of the farms, but damage was not serious. Aphis craccivora was very serious in a field of cotton where the farmer had been unable to spray. Other pests reported were Hilda patruelis affecting bambara nut, semi-loopers on cowpea, cotton stainers, Dysdercus spp. on cotton and termites on groundnut.

Midlands Province

(vii) Mberengwa

This large communal area supports 54,643 farming families. The soil-type is either shallow gravel or sandy loam where more than 50% of the land is occupied by bare granite batholiths which would seriously hamper any mechanical cultivation of the soil. Many farmers were harvesting crops for the first time in three

years because of the recent drought. Sunflower was a popular cash crop probably because it requires few inputs, poverty being a serious problem for the majority of these farmers. The local extension officer said that farmers were being recommended to rotate their maize with groundnut, followed by finger millet, though few of them appeared to be acting on this advice and many were growing cereal crops continuously. Striga asiatica, rats and poor transport facilities were amongst the problems brought to our attention. Three farms and the Mataga Irrigation Scheme were included in the survey.

Nematoda Pests

Pratylenchus zeae was causing severe stunting and chlorosis in all four maize fields that were sampled and populations were in excess of 200 per gram in the roots and 1,000 per litre in the soil (Plate 1a). Paralongidorus ?n.sp., Scutelonema sp., Rotylenchus unisexus and Rotylenchulus parvus were found in addition to P. zeae at one site, where the maize was planted following three years of enforced fallow. In Mataga Irrigation Scheme soil populations of R. parvus as high as 1,000 per litre, were co-existing with P. zeae and S.magniphasmum. The farmer was worried that the growth of the covering maize crop was poor despite fertilizer applications. The vegetables being grown in this irrigation scheme were free from root-knot nematode infection because they were being rotated with maize. Root-knot nematodes were a problem on sunflower in a field in Danga, however, more than 200 females of Meloidogyne javanica being

counted in each gram of sunflower root. The infested plants were severely stunted with 3 to 5 cm diameter flower heads (Plate 2d) and 1,250 juveniles of M. javanica per litre were extracted from the soil around the roots of these plants. This high level of infestation had originated from the very susceptible weed locally known as derere, Abelmoschus esculentus, the growth of which had been actively encouraged in the previous years fallow as it can be used as a vegetable.

(viii) Gutu

The communal area is divided up between 21,022 farming families, where the soil is composed of coarse-grained sands. Most farmers were able to use fertilizers on their maize crops. Other important crops were groundnut, bulrush millet, finger millet and edible bean. Striga asiatica was causing serious damage in some fields. Four farms were sampled in the area.

Nematode Pests

Meloidogyne sp., Rotylenchulus parvus, Pratylenchus zeae, Xiphinema sp. and Scutellonema unum were all widespread and causing severe damage to maize, finger millet and bambara nut. The most serious damage to maize was attributed to a combination of P. zeae (200 per gram of root) and R. parvus (2,150 per litre of soil). A high population of Meloidogyne sp. juveniles was also found in the soil (920 per litre) but as females were not found in the roots it was unclear whether these nematodes were contributing to the severe stunting of the maize. The farmer

concerned had been rotating his maize with finger millet only. Bambara nut and finger millet were both good hosts for the root-knot nematode, Meloidogyne sp. as populations as high as 200 mature females per gram of root were recorded. This nematode was seriously retarding the growth of both of these crops.

Matebeleland North

(ix) Ntabazinduna

This communal area of 2,015 farming families had a soil type of either sandy loam or coarse-grained sand. The whole area was comparatively unaffected by the recent war due to the political expediency of the local chief. Many of the farmers are benefitting from the possession of private boreholes with which they are able to irrigate their winter vegetables. The town of Bulawayo which is close by provides a ready market for these horticultural crops. Some farmers were attempting to follow the field crop-rotation of maize - sorghum or sunflower - legume, which is recommended by Agritex, though the small amounts of legumes that are normally grown, in comparison with the amount of subsistance cereal crop that is required, makes it difficult to put this rotation into practice. Four farms were sampled in this communal area and Striga asiatica was noted in one of them.

Nematode Pests

Rotylenchulus parvus and Pratylenchus zeae were stunting the growth of maize and sorghum at two sites where crop rotation was with cereals only. Repeated cultivation of tomato had led to the

early death of a complete crop of tomato plants in one garden. High numbers of root-knot nematode, Meloidogyne incognita were identified in the roots of these dead and dying plants (46 mature females per gram of root).

Diseases

Puccinia sorghi was a major problem in this communal area, causing up to 100% infection on maize. Leaf blight, Helminthosporium turcicum and head smut, Sphacelotheca reiliana were also isolated from maize. Loose smut, S. cruenta and leaf blight H. turcicum were causing damage to sorghum. Stem break and rust were observed in sunflower and this was found to be due to Alternaria helianthi and P. helianthi, respectively. Damage was severe and many plants were dying as a result. Cercospora sp. was isolated from pale and dark brown lesions of groundnut leaves.

Insect Pests

Termites, stemborers and cutworms were serious pests of maize though little was being done to control them. Red spider-mite, Tetranychus cinnabarinus was collected from dying tomatoes on one farm and dimethoate was recommended for its control.

Matebeleland South Province

(x) Glassblock

A total of 924 farms occupy this communal area which is overlain with shallow clays or coarse grained sand. Drought is often a limiting factor in crop production, although maize cv. R201 was still the preferred cereal crop. There was a serious shortage of wood both for cooking fuel and building purposes and transport was also mentioned as a problem, there being only two buses each day. Five farms were sampled for pests and diseases.

Nematode Pests

Mixed populations of Pratylenchus zeae, Rotylenchulus parvus, Scutellonema sp., Rotylenchus sp. and Meloidogyne javanica were associated with severly stunted and chlorotic maize at three sites where there was a 50% growth reduction, plus failure to produce cobs and even tassles in some cases. This high nematode infestation was due to rotation with sorghum and other susceptible cereals at one site, although drought had ensured that there was four years of fallow preceding the maize at the two other sites, where nematode damage was equally serious. At the fourth farm R. parvus and Telotylenchus sp. were extracted from soil in two fields, one containing maize and the other sorghum. Both crops were stunted despite fertilizer applications and had been cultivated following maize crops.

Several women in this area asked for advice on growing vegetables. Root-knot nematodes were widespread and appeared to

be responsible for much of the poor growth that was evident in the vegetable crops. At one vegetable garden in particular, stunted wilting and chlorotic tomato plants were found to be harbouring up to 700 mature females of M. incognita in each gram of root and 1,750 juveniles per litre of soil. Continuous, mixed cropping of vegetables, especially tomatoes and rape in each of the 5 beds in this garden had led to such a massive build-up of this pest.

Diseases

Aspergillus flavus was causing pod-rot of groundnut.

5. COMMUNAL AREAS IN EXTENSIVE FARMING REGION V

This region receives rainfall which is too low and erratic for the reliable production of even drought resistant fodder or grain crops and is suited only to an extensive form of cattle ranching. The two main areas which are covered by this region are generally less than 900 m above sea level and include the Zambezi Valley in the north eastern part of the country, which has a mean rainfall below 650 mm and the Sabi-Limpopo Valleys where the rainfall is below 600 mm per annum (Fig.1) A large part of this region has been given over to game reserves while 50% is reserved for communal farmers, supporting more than 100,000 families. Six communal areas, each from a different province were included in the survey of this region.

Mashonaland West Province

(i) Omay

This communal area borders onto Matusadona National Park and many of the 3,000 farms provide an extended range for its wild animals. This has led to some unusual pest problems with these animals trampling crops and carrying off harvests. The soil-type is shallow gravel or loamy sands. Four farms were sampled in the area.

Nematode Pests

Pratylenchus zeae was extracted from the soils from around the roots of unthrifty plants (sorghum, maize or cotton) in all five

fields sampled. More than 100 P. zeae were counted in each gram of sorghum root, in addition to significant numbers of Rotylenchulus parvus and Paralongidorus ?n.sp. in the soil at one site, while 2,010 Scutellonema unum per litre of soil were found at another site where sorghum was growing, both sorghum crops were stunted. Mixed populations of P. zeae and S. unum were also associated with poor growth of maize and cotton.

Insect Pests

Serious pest problems were recorded on cotton. These included aphids, bollworms, stainers Dysdercus spp., jassids Empoasca spp., blister beetles, Mylabris spp. and cotton leaf miners. Stalkborers, Busseola fusca and pink stem-borers, Sesamia calamistis were collected from maize. Large populations of gryllids, Eurychorypha spp. were found causing a type of damage to maize and sorghum, similar to that caused by army worms.

Manicaland Province

(ii) Mutema

This communal area is inhabited by 4,800 farming families. The soil-type is mainly shallow gravels with some loamy sands. Most farmers were growing cereal crops continuously, though the local extension worker told us that farmers would be encouraged to grow more legumes in future. Some women, who are unable to grow sufficient maize to feed their children, supplement their incomes by re-selling the tomatoes that they buy from the local irrigation scheme. Four farms from this area were included in

the survey.

Nematode Pests

Pratylenchus zeae was again widespread, occurring in all six fields that were sampled, often together with Telotylenchus obtusus, and soil populations of both nematodes was often in excess of 1,000 per litre. The ectoparasitic nematode, Xiphinema louisi, was present in addition at two sites. The occurrence of these nematodes was associated with severe stunting, chlorosis and in some cases, failure to set seed, in maize, sorghum and bulrush millet (Plate 2a & b). In all cases the affected crops had been cultivated without an adequate rotation.

Diseases

Maize streak virus was observed in some fields. Puccinia purpurea and loose smut disease Sphacelotheca cruenta was found on sorghum though damage was insignificant. The rust fungus P. penicillariae was isolated from lesions on bulrush millet leaves.

Insect Pests

Some sorghum plants were showing the "dead heart" symptoms which are characteristic of shootfly attack, Atherigona spp. Stalk-borer damage on maize and sorghum varied from minor to very heavy and insecticides were not being applied. Communal farmers in this area seemed to be reluctant to use pesticides. Less serious crop pests were the elegant grasshopper feeding on

sorghum and aphids, Rhopalociphum maidis feeding on maize.

Midlands Province

(iii) Mazvihwa

This relatively small communal area is farmed by 1,005 families. The soil-type is coarse-grained sand, which was extremely dry at the time of sampling. Maize and bulrush millet were both the most widely grown cereal crops with cotton serving as a cash crop for those farmers who can afford the inputs. Surplus produce can be sent to market via the local railway. The transport costs for inputs was said to be high since they had to come from Gweru or even Harare. Three farms were sampled in this area.

Nematode Pests

Plant parasitic nematodes were a limiting factor in many of the plots that were sampled. Paralongidorus ?n.sp., Scutellonema brachyurum and Pratylenchus zeae were associated with stunted maize and bulrush millet in adjacent fields. P. zeae, Rotylenchulus parvus and S.brachyurum were all causing severe stunting and chlorosis of maize. Histotylenchus histoides and S. unum were causing similar damage to bulrush millet while on the same farm the growth of finger millet was being seriously retarded by a heavy infection of Meloidogyne javanica (32 mature females per gram of root). It was noted that all the root-knot-infested finger millet plants were growing in an area of the field that was being intercropped with melon (Plate 2c).

It was suspected that these melon plants were providing the infection source as some varieties are known to be very susceptible to root-knot nematodes.

Most of the nematode-infested cereals had been cropped continuously, for at least three years in the case of one field of maize. Groundnuts that were growing alongside these cereal crops were found to be unaffected by any of the above-named nematodes. Another farmer, who had been rotating his maize with cotton had moderately high soil populations of Rotylenchulus parvus and Scutellonema unum which were affecting the growth of both crops. In addition, his chlorotic sweet potato was found to be harbouring large numbers of Meloidogyne javanica in their roots (24 mature females per gram).

Insect Pests

The american bollworm, Heliothis armigera was a serious pest as it was feeding on soft grain. Damage to cotton bolls was due to the red bollworm, Diparopsis castanea. Maize was being attacked by the blister beetle Mylabris spp. which had devoured the sheath tip exposing the young cob to further infection.

Masvingo Province

(iv) Matibi 2.

This communal area is farmed by 11,179 families and although the soil is fertile, being composed mainly of vertisols with some loamy-sands, rainfall is scant. The people are therefore restricted in the types of crops that they are able to grow

successfully and the production of sorghum often takes precedence over that of maize. With adequate rain, good harvests are assured in this area without the use of fertilizers, as was expected to be the case this season. Four farms were sampled.

Nematode Pests

Large populations of Paralongidorus ?n.sp. (up to 1,500 per litre) was extracted from soil around stunted sorghum and maize. Scutellonema spp. and Paratrophurus sp. and in one instance Telotylenchus obtusus were also present in these soils. Affected plants were stunted, chlorotic and many had failed to flower. At all five sites where these nematode pests had been discovered the rotation was between maize and sorghum only. Individual cotton plants that were displaying poor growth in one field were subsequently found to be harbouring damaging levels of S. brachyurum (200 per gram) in their roots.

Diseases

Several damaging pathogens were isolated from diseased sorghum tissue. These were head mold Curvularia sp.; leaf spot, Phyllosticta sorghiphila; leaf blight, Helminthosporium turcicum; downy mildew, Sclerospora sorghi; root-rot and charcoal rot, Macrophomina phaseolina.

Insects Pests

Maize silk and tassels were often found covered with aphids, Rhopalosiphum maidis. Damage due to cotton stainers, Dysdercus

spp. was observed on cotton bolls. Other less important pests were the elegant grasshopper which was collected from maize leaves and Hilda patruelis feeding on groundnut.

Matebeleland North Province

(v) Hwange

This communal area is divided into 5,580 farms and was one of the most impoverished visited during the survey. The soil is extremely poor being composed of shallow gravels or Kalahari sand and the rainfall is always both low and unreliable, even during this particular season when the majority of the country was enjoying plentiful rainfall and expecting bumper harvests. Many of the women are forced to brew beer to pay for sufficient food. Sorghum and millet were the main cereal crops and some farmers stated that it was not worth using fertilizer on these crops as they often did not reach maturity due to drought. Local people complained of a whole range of wild animals, many of which originated from the nearby game parks, including elephant, hyaena, porcupine and baboons that ate both crops and livestock. There were several reports of baboons killing and eating young goats. Transport was also said to be a problem as the local buses gave preference to those passengers travelling long distances, i.e. to Bulawayo, 300 km away. Five farms were selected by the local extension officer for sampling though the condition of the crops generally was very poor.

Nematode Pests

Xiphinema sp. was found in several soils which were supporting stunted, chlorotic maize or sorghum plants. Numbers of this nematode were found to be low compared with the amount of damage that was observed and this may have been due to the dryness of the soil. *Hoplolaimus pararobustus* was extracted from distorted and swollen maize roots at one site. This nematode may have been contributing to the poor growth and failure to produce cobs, which was noted in these maize plants. This area deserves further sampling for plant nematodes earlier in the growing season next year.

Diseases

Sphacelotheca sorghi was found causing covered smut on sorghum. Wilt disease of tomato was caused by *Fusarium oxysporium* while *Phytophthora parasitica* was causing buck-eye rot. The rust fungus *Puccinia penicillariae* was isolated from bulrush millet and the root-rot fungus *Macrophomina phaseolina* was identified from root samples.

Insect Pests

Maize and sorghum were under attack from stem-borers, termites and armoured cricket, *Acanthoplus* spp. (Plate 2e). The cricket population was extremely high and infestation so severe that large yield reductions were obvious. Carbaryl 85 w.p. had been used in an effort to control this pest though it was said to have been ineffective. Although armoured cricket has been observed in

low rainfall parts of the country, by far the highest infestion was seen in this area.

Matebeleland South Province

(vi) Gwaranyemba

This communal area is occupied by 2,445 farming families. The soil-type is either shallow clay or coarse-grained sands. Although the area is prone to droughts, bulrush millet, sorghum and maize were all being grown widely. Few farmers were practising a clearly defined crop rotation, probably because they are limited in their choice of crops. Striga asiatica was infesting some fields. The main complaints were a shortage of firewood, poor transport facilities and the inaccessibility of water. Samples were taken from fields in three farms.

Nematode Pests

Pratylenchus sp. and Rotylenchulus parvus were the main nematode pests encountered. These nematodes often occurred together in both fields of maize and sorghum, causing a reduction in growth of at least 50%, delayed tassling and a failure to set seeds. Scutellonema spp. and Rotylenchus sp. were also present in some fields.

Diseases

Covered smut caused by Sphacelotheca sorghi was found on sorghum in several fields.

Insects Pests

All three stem borers, Busseola fusca, Sesamia calamistis and Chilo partellus were collected from this communal area. The maize aphid, Rhopalosiphum maidis and the sorghum aphid, Aphis sorghi were found feeding on their respective hosts as was the sorghum pest, the green stink bug, Nezara viridula.

TABLE 1a

NEMATODE PESTS OF CROPS IN MANICALAND PROVINCE

Communal Area	Farming Region	Nematode Pests (in order of importance)
Manga	I	Pratylenchus Rotylenchulus parvus Scutellonema magniphasmum Helicotylenchus Xiphinema sp.
Tamandayi	I	Pratylenchus zeae P. brachyurus Rotylenchulus parvus Meloidogyne sp. Xiphinema sp. Criconemella sphaerocephala
Chiduku	II	Pratylenchus sp. Rotylenchulus sp. Meloidogyne sp. Scutellonema sp. Helicotylenchus sp.
Mutasa South	II	Pratylenchus sp. Rotylenchulus parvus Scutellonema unum Helicotylenchus sp.
Zimunya	II	Pratylenchus zeae Rotylenchulus sp. Meloidogyne sp. Scutellonema brachyurum
Chinyauwhera	IV	Scutellonema sp. Helicotylenchus sp.
Muwushu	IV	Meloidogyne incognita Scutellonema sp. Helicotylenchus sp. Rotylenchus incultus
Ndowoyo	IV	Pratylenchus zeae Rotylenchulus parvus Paralongidorus ? n.sp. Xiphinema sp. Scutellonema brachyurum S. cf. truncatum S. unum Paratrophurus sp. Telotylenchus obtusus Histotylenchus histoides

TABLE 1b

DISEASES OF CROPS IN MANICALAND PROVINCE

Communal Area	Farming Region	Disease (in order of importance)	Common Name
Tamandayi	I	Maize streak virus	Streak
		Helminthosporium turcicum	Leaf blight
		Cercospora sp.	Leaf spot
Manga	I	Maize streak virus	Streak
		Puccinia sorghi	Rust
		Colletotrichum sp.	Anthracnose
		Phytophthora infestans	Late blight
Muusha	III	Maize streak virus	Streak
		Helminthosponium turcicum	Leaf blight
		Phytophthora infestans	Late blight
		Fusarium sp.	Wilt
Buhera	III	Helminthosporium turcicum	Late blight
		Erysiphe cichoracearum	Powdery mildew
		Puccinia penicillariae	Rust
Zimunya	III	Maize streak virus	Streak
		Cercospora fusimaculans	Leaf spot
		Cercospora arachidis	Leaf spot
		Colletotrichum sp.	Anthracnose
		Altenaria solani	Early blight
Ndowoyo	IV	Maize streak virus	Streak
		Cerospora sorghi	Grey leaf spot
		Cercospora arachidis	Leaf spot
		Phyllostica sp.	Leaf spot
		Maize streak virus	Streak
		Puccinia purpurea	Rust
Mutema	V	Maize streak virus	Streak
		Puccinia purpurea	Rust
		Sphacelotheca cruenta	Loose smut
		Puccinia penicillariae	Rust

TABLE 1c

INSECT PESTS OF CROPS IN MANICALAND PROVINCE

Communal Area	Farming Region	Insect Pests (in order of importance)
Tamandayi	I	Busseola fusca Sesamia calamisti Chilo partellus Hilda patruelis Cicadulina mbila Zonocerus elegans
Chiduku	II	Busseola fusca Sesamia calamistis Chilo partellus Eulepids machona Gryllotalpa africana Tetranychus spp. Dysdercus spp. Contarinia sorghicola Anoplocnemis curvipes Heliothis armigera Rhopalosiphum maidis Aphis craccivera Nezara viridula Bagrada helaris
Manga Top	II	Busseola fusca Sesamia calamistis Chilo partellus Cicadulina mbila Systates spp. Zonocerus elegans Dysdercus spp.
Mutasa South	II	Busseola fusca Sesamia calamistis Chilo partellus Cicadulina mbila Hodotermes spp. Anoplocnemis curvipes Zonocerus elegans
Muwusha	III	Busseola fusca Sesamia calamistis Chilo partellus Heliothis armigera Anoplocnemis curvipes Tetranychus spp. Hilda patruelis Cicadulina mbila Eulepida mashona

TABLE 1c cont.

Muwusha cont.		Atherigona spp.
		Agrotis spp.
		Zonocerus elegans
		Aphis sorghi
Zimunya	III	Phynocoris segmentarius
		Sagra stevens
		Systates spp.
		Cicadulina mbila
		Busseola fusca
		Sesamia calamistis
		Chilo partellus
		Zonocerus elegans
		Anoplocnemis curvipes
		Tetranychus spp.
		Hilda patrueli
		Heliothis armiger
		Rhopalosiphus maidis
Mutema	IV	Busseola fusca
		Sesamia calamistis
		Chilo partellus
		Anoplocnemis curvipes
		Rhopalosiphum maidis
		Atherigona soccata
		Eulepida mashona
Ndowoyo	IV	Aphis craccivora
		Hilda patruelis
		Aphis gossypii
		Heliothis armigera
		Zonocerus elegans
		Dysdercus spp.
		Busseola fusca
		Sesamia calamistis
		Chilo partellus
Mid-Sabi	V	Busseola fusca
		Sesamia calamistis
		Chilo partellus
		Zonocerus elegans
		Acanthoplus spp.
		Enyaliopsis spp.
		Cicadulina mbila
		Rhopalosiphum mbila

TABLE 2a

NEMATODE PESTS OF CROPS IN MASHONALAND WEST PROVINCE

Communal Area	Farming Region	Nematode Pests (in order of importance)
Zvimba	II	*Pratylenchus brachyurus* *Rotylenchulus parvus* *Trichodorus* sp. *Scutellonema unum* *Meloidogyne* sp.
Ngezi	III	*Pratylenchus* sp. *Rotylenchulus parvus* *Meloidogyne* sp. *Xiphinema* cf. *variabile* *Trichodorus* sp. *Scutellonema unum* *Helicotylenchus* sp.
Urungwe	III	*Pratylenchus zeae* *Scutellonema unum* *Helicotylenchus* sp. *Criconemoides* sp. *Rotylenchus incultus* *Telotylenchus obtusus*
Piriwiri	IV	*Pratylenchus* sp. *Scutellonema unum* *Helicotylenchus* sp.
Umfuli	IV	*Pratylenchus* sp. *Scutellonema* sp.
Omay	V	*Pratylenchus zeae* *Scutellonema unum*

TABLE 2b

DISEASES OF CROPS IN MASHONALAND WEST PROVINCE

Communal Area	Farming Region	Disease (in order of importance)	Common Name
Zvimba	II	Maize streak virus	Streak
		Septoria helianthus	Leaf spot
		Cercospora gossypina	Leaf spot
		Alternaria gossypina	Leaf spot
		Cercospora arachidicola	Leaf spot
		Rosette virus	Rosette
Mzola	III	Rosette virus	Rosette
		Fusarium moniliforme	Head blight
Umfuli	III & IV	Maize streak virus	Streak
Omay	V	Phoma arachidicola	Leaf/blotch
		Puccinia penicillariae	Rust
		Maize streak virus	Streak
		Colletotrichum graminicola	Anthracnose & Red rot

TABLE 2c

INSECT PESTS OF CROPS IN MASHONALAND WEST PROVINCE

Communal Area	Farming Region	Insect Pests (in order of importance)
Karuru	II	Busseola fusca Sesamia calamistis Chilo partellus Aphis craccivora Eulepida mashona Agrotis spp. Aphis gossypii Mylabris spp. Zonocerus elegans Tetranychus spp. Anoplocnemis curvipes Diparopsis castanea Heliothis armigera Hodotermes spp. Macrotermes spp.
Zvimba	II	Busseola fusca Sesamia calamistis Hodotermes spp. Macrotermes spp. Eulepida mashona Aphis craccivora Tetranychus spp. Mylabris spp. Epilachna spp. Heliothis armigera Diparopsis castanea Cicadulina mbila Hilda patruelis
Urungwe	III	Eulepida mashona Cicadulina mbila Busseola fusca Sesamia calamistis Chilo partellus Anoplocnemis curvipes Atherigona saccata Hodotermes spp. Mylabris spp. Hilda patruelis Aphis craccivora Tetranychus spp. Zonocerus elegans

TABLE 2c cont.

Communal Area	Farming Region	Insect Pests (in order of importance)
Mupfure	III & IV	Busseola fusca
		Sesamia calamistis
		Chilo partellus
		Tetranychus spp.
		Anoplocnemis curvipes
		Mylabris spp.
		Nezara viridula
		Heliothis armigera
		Melanagromyza spp.
		Atherigona spp.
		Diparopsis castanea
		Spodoptera littoralis
Piriwiri	IV	Tetranychus spp.
		Epilachna spp.
		Diparopsis castanea
		Hodotermes spp.
		Macrotermes spp.
		Heliothis armigera
Omay	V	Diparopsis castanea
		Aphis craccivora
		Aphis sorghi
		Rhopalosiphus maidis
		Dysdercus spp.
		Heliothis armigera
		Empoasca spp.
		Mylabris spp.
		Busseola fusca
		Sesamia calamistis
		Chilo partellus
		Aphis craccivora
		Nezara viridula

TABLE 3a

NEMATODE PESTS OF CROPS IN MASHONALAND EAST PROVINCE

Communal Area	Farming Region	Nematode Pests (in order of importance)
Chinamora	II	*Rotylenchulus parvus* *Scutellonema unum* *Meloidogyne javanica*
Chiota	II	*Pratylenchus zeae* *P. brachyurus* *Rotylenchulus* sp. *Paralongidorus* ? n.sp. *Xiphinema* sp. *Scutellonema brachyurum* *Helicotylenchus* sp. *Meloidogyne* sp.
Kunzwi	II	*Pratylenchus* sp. *Helicotylenchus* sp. *Meloidogyne* sp.

TABLE 3b

DISEASES OF CROPS IN MASHONALAND EAST PROVINCE

Communal Area	Farming Region	Disease (in order of importance)	Common Name
Chinamora	II	Puccinia sorghi	Rust
		Helminthosporium turcicum	Leaf blight
		Cercospora arachids	Leaf spot
		Septonia lycopersici	Leaf blotch
		Phytophthora infestans	Late blight

TABLE 3c

INSECT PESTS OF CROPS IN MASHONALAND EAST PROVINCE

Communal Area	Farming Region	Insect Pests (in order of importance)
Mtoko	III	Busseola fusca Sesamia calamistis Chilo partellus Tragiscoschema bertolinii Aphis craccivora
Maramba	IV	Hodotermes spp. Macrotermes spp. Microtermes spp. Aphis gossypii Empoasca spp. Heliothis armigera Busseola fusca Sesamia calamistis Chilo partellus Diparopsis castanea
Mudzi	IV	Busseola fusca Sesamia calamisti Chilo partellus Mylabris dicincta Aphis gossypii Empoasca spp.

TABLE 4a

NEMATODE PESTS OF CROPS IN MASHONALAND CENTRAL PROVINCE

Communal Area	Farming Region	Nematode Pests (in order of importance)
Bushu	II	*Pratylenchus zeae* *Scutellonema* sp. *Paralongidorus* n.sp. *Meloidogyne javanica*
Chiweshe	II	*Pratylenchus zeae* *Rotylenchulus parvus* *Scutellonema brachyurum* *S. unum*
Kandeya	II	*Pratylenchus zeae* *Rotylenchulus* sp. *Scutellonema unum* *S. maginphasum*
Mzarabani	IV	*Pratylenchus zeae* *Rotylenchulus parvus* *Xiphinema* sp. *Scutellonema unum* *Hoplolaimus pararobustus*

TABLE 4b

DISEASES OF CROPS IN MASHONALAND CENTRAL PROVINCE

Communal Area	Farming Region	Disease (in order of importance)	Common Name
Mzarabani	IV	Maize streak virus	Streak
		Puccinia sorghi	Rust
		Cercospora sorghi	Leaf spot

TABLE 4c

INSECT PESTS OF CROPS IN MASHONALAND CENTRAL PROVINCE

Communal Area	Farming Region	Insect Pests (in order of importance)
Bushu	II	Busseola fusca Sesamia calamistis Chilo partellus Rhopalosiphum maidis Zonocerus elegans Agrotis spp.
Chinamora	II	Busseola fusca Sesamia calamistis Chilo partellus Zonocerus elegans Rhopalosiphum maidis
Kandeya	II	Busseola fusca Sesamia calamistis Chilo partellus Aphis craccivora Aphis gossypii Eulepida mashona Hodotermes spp. Empoasca spp.
Mzarabani	IV	Busseola fusca Sesamia calamistis Chilo partellus Empoasca spp. Diparopsis castanea Aphis sorghi Anoplocnemis curvipes
Rushina	IV	Heliothis armigera Diparopsis castanea Busseola fusca Sesamia calamistis Aphis gossypii Aphis craccivora

TABLE 5a

NEMATODE PESTS OF CROPS IN MIDLANDS PROVINCE

Communal Area	Farming Region	Nematode Pests (in order of importance)
Sabi North	III	*Pratylenchus* sp. *Rotylenchulus parvus* *Scutellonema unum* *Xiphinema* sp. *Helicotylenchus* sp.
Chiwundura	III	*Pratylenchus* sp. *Rotylenchulus parvus* *Meloidogyne* sp. *Scutellonema* sp.
Mberengwa	IV	*Pratylenchus zeae* *Rotylenchulus parvus* *Paralongidorus* ? n.sp. *Meloidogyne javanica* *Scutellonema magniphasmum* *Rotylenchus unisexus*
Mazvihwa	V	*Pratylenchus zeae* *Rotylenchulus parvus* *Paralongidorus* ? n.sp. *Meloidogyne javanica* *Scutellonema brachyurum* *S. unum* *Histotylenchus histoides*

TABLE 5c

INSECT PESTS OF CROPS IN THE MIDLANDS PROVINCE

Communal Area	Farming Region	Insect Pests (in order of importance)
Chiwundura	III	Mylabris spp. Dysdercus spp. Heliothis armigera Nezara viridula Spodoptera littoralis Eulepida mashona Hodotermes spp. Macrotermes spp.
Mazvihwa	V	Heliothis armigera Diparopsis castanea Mylabris spp. Mirperus jaculus

TABLE 6a

NEMATODE PESTS OF CROPS IN MASVINGO PROVINCE

Communal Area	Farming Region	Nematode Pests (in order of importance)
Gutu	IV	*Pratylenchus zeae* *Rotylenchulus parvus* *Meloidogyne* sp. *Xiphinema* sp. *Scutellonema unum*
Matibi 2	V	*Paralongidorus* ? n.sp. *Scutellonema brachyurum* *Telotylenchus obtusus* *Paratrophurus* sp.

TABLE 6c

INSECT PESTS OF CROPS IN MASVINGO PROVINCE

Communal Area	Farming Region	Insect Pest (in order of importance)
Masvingo South	III	Busseola fusca Sesamia calamistis Chilo partellus Tetranychus spp. Hodotermes spp. Macrotermes spp. Enyaliopsis spp. Aphis gossypii
Matsai	IV	Aphis sorghi Rhopalosiphum maidis Busseola fusca Sesamia calamistis Chilo partellus Zonocerus elegans
Nyajena	IV	Busseola fusca Sesamia calamistis Chilo partellus Acanthoplus spp. Enyaliopsis spp.
Maranda	V	Busseola fusca Sesamia calamistis Chilo partellus Aphis sorghi Rhopalosiphum maidis
Matibi 2	V	Heliothis armigera Rhopalosiphum maidis Nezara viridula Dysdercus spp. Zonocerus elegans Hilda patruelis Busseola fusca Sesamia calamistis Acanthoplus spp.

TABLE 7a

NEMATODE PESTS OF CROPS IN MATEBELELAND NORTH PROVINCE

Communal Area	Farming Region	Nematode Pests (in order of importance)
Mzola	III	*Hoplolaimus pararobustus* *Xiphinema* cf. *variabile* *Scutellonema unum* *Telotylenchus obtusus*
Ntabazinduna	IV	*Pratylenchus zeae* *Rotylenchulus parvus* *Meloidogyne incognita*
Hwange	V	*Hoplolaimus pararobustus* *Xiphinema* sp.

TABLE 7b

DISEASES OF CROPS IN MATEBELELAND NORTH PROVINCE

Communal Area	Farming Region	Disease (in order of importance)	Common Name
Mzola	III	*Cercospora* sp.	Leaf spot
Ntabazinduna	IV	*Puccinia sorghi*	Rust
		Sphacelotheca reiliana	Head smut
		Helminthosporium turcicum	Leaf blight
		Sphacelotheca cruenta	Loose smut
		Puccinia purpurea	Rust
		Cercospora sorghi	Grey leaf spot
		Cercospora sp.	Leaf spot
		Alternaria helianthi	Stem break & Leaf spot
Hwange	V	*Macrophomina phaseolina*	Root rot & Charcoal rot
		Sphacelotheca sorghi	Covered smut
		Puccinia penicillariae	Rust

TABLE 7c

INSECT PESTS OF CROPS IN MATEBELELAND NORTH PROVINCE

Communal Area	Farming Region	Insect Pests (in order of importance)
Mzola	III	Busseola fusca Sesamia calamistis Chilo partellus Nezara viridula Microtermes spp. Macrotermes spp. Eulpeida machona Heliothis armigera
Ntabazinduna	IV	Eulepida mashona Hodotermes spp. Microtermes spp. Macrotermes spp. Busseola fusca Sesamia calamistis Agrotis spp. Tetranychus spp.
Hwange	V	Acanthoplus spp. Enyaliopsis spp. Busseola fusca Sesamia calamistis Chilo partellus Aphis sorghi Rhopalosiphum maidis Zonocerus elegans Macrotermes spp. Microtermes spp. Eulepida mashona

TABLE 8a

NEMATODE PESTS OF CROPS IN MATEBELELAND SOUTH PROVINCE

Communal Area	Farming Region	Nematode Pests (in order of importance)
Glassblock	IV	*Pratylenchus zeae* *Rotylenchulus parvus* *Meloidogyne javanica* *M. incognita* *Scutellonema* sp. *Telotylenchus* sp. *Rotylenchus* sp.
Gwaranyemba	V	*Pratylenchus* sp. *Rotylenchulus parvus* *Scutellonema* spp. *Rotylenchus* sp.

TABLE 8b

DISEASES OF CROPS IN MATEBELELAND SOUTH PROVINCE

Communal Area	Farming Region	Disease (in order of importance)	Common Name
Mtetengwe	IV	Maize streak virus	Streak
		Sphacelotheca reiliana	Head smut
		Helminthosporium turcicum	Leaf blight
		Puccinia penicillariae	Rust
Dombodema	IV	Maize streak virus	Streak
		Puccinia sorghi	Rust
		Sphacelotheca sorghi	Covered smut
		Cercospora sp.	Leaf spot
Ngwizi	IV	Maize streak virus	Streak
		Sphacelotheca sorghi	Covered smut
Tengwani	IV	Puccinia sorghi	Rust
		Cercospora arachidis	Leaf spots
Masendu East	IV	Puccinia sorghi	Rust
Ndolwane	IV	Cercospora sp.	Leaf spot
Gwanda	IV	Sphacelotheca sorghi	Covered smut

D. PESTS AND DISEASES OF DIFFERENT CROPS THAT WERE SAMPLED DURING THE SURVEY

1. MAIZE

Maize, Zea mays, is grown extensively in communal areas as it provides the main staple food for the majority of people in Zimbabawe. Most farmers are obliged to grow hybrid varieties, either R201 or R215, which require high inputs of fertilizer; traditional, open-pollinated cultivars having been displaced following the 1925 Maize Act. Maize crop packs for small farm operations, which include seed, fertilizer and insecticide are available from the Agricultural Finance Corporation, through the provision of credit facilities. Credit facilities are extended to "better-off" farmers - who, of necessity, must have access to sufficient land to allow them to produce either cash crops or cereal crops surplus to their domestic requirements. Unfortunately there are thousands of communal farmers who are struggling against the triple constraints of inadequate land, impoverished soil and unpredictable rainfall and, therefore, are unable to take advantage of these credit facilities. Most of these farmers are in the difficult position of having to buy hybrid maize seed every year, while being unable to afford the inputs which are necessary to ensure that the maize reaches its yield potential. In the absence of inorganic fertilizer, organic amendments such as manure and soil from termite mounds are used, though the quantities available seemed to be small. Weeds, especially witch-weed, Striga asiatica, are a problem in many maize fields. This was often said to be due to a shortage in

labour brought about by the introduction of free primary education! Many farmers were unaware of the parasitic and potentially devastating nature of S. asiatica and were allowing it to flower and seed quite freely. Many farmers complained of weavil infestations in stored maize and it was noted that the kernals of R201 are somewhat softer than those of a pounded, traditional maize cultivar from Malawi.

Many farmers were growing maize continuously or at best rotating it with other cereal crops such as sorghum or millet and this had led to serious problems with pests and diseases.

Nematode Pests of Maize and their Control

Root Lesion Nematode, Pratylenchus spp.

Pratylenchus spp. (mainly P. zeae, but also P. brachyurus) was one of the most serious and widespread nematode pests of maize, being present in 60% of samples that were collected during the survey. It was equally common in both clayey and sandy soils though the most serious damage was observed in maize growing in sandy soil, for example, in Mberengwe communal area, where root and soil populations both exceeded 1,000 per gram and litre respectively (Plate 1a.). Typical symptoms are stunting and general chlorosis (indicating that the nematode was interfering with nitrogen uptake). Pratylenchus spp. is a migratory endoparasite of the root cortex. It enters the smaller roots at any point to feed on parenchyma cells until they become exhausted, before moving back into the soil, leaving a trail of

necrotic cells behind. Eggs are laid in between the cortical cells and as the population builds up the necrotic cells coalesce to form reddish-brown lesions, which may be visible on the outside of the root. These lesions often provide an entry point for root-rotting fungi. Yield losses attributed to Pratylenchus spp. are up to 33% (Martin et al., 1975) and all the popular maize cultivars appear to be equally susceptible. Although farmers who had applied fertilizer and top dressing at the recommended rates were experiencing less Pratylenchus damage in their maize crop, any improvement in the soil nutrient supply will lead to increased root growth and thus a corresponding increase in the nematode population to await the following crop.

Control of Pratylenchus spp.

P. zeae and P. brachyurus populations build up to damaging proportions either under continuous maize or other cereal crops such as sorghum, finger millet and bulrush millet, when they are rotated with maize. Unlike the commercial farming sector, most communal farmers have insufficient land to allow for a portion to be fallowed at regular intervals, so continuous cropping with the same or similar crops is a feature of communal farming. Rotation with legumes especially groundnut or soybean will cause the population of Pratylenchus spp. to decline as they are poor hosts for this nematode. In addition, tolerant or resistant cultivars of maize should be sought as these will provide the long term solution for farmers who have pest problems and a limited amount of land.

Reniform Nematode, Rotylenchulus parvus

Rotylenchulus parvus was also associated with damage to maize where it was present in 53% of the maize samples collected. It tended to occur in highest numbers in heavier soils. The largest population, consisting of 9,624 juveniles and immature females, was found in a maize field in Tamandayi communal area, together with destructive root population of Pratylenchus zeae. At Gukwe in Chinamora communal area, a population of 3,400 R. parvus was associated with a growth reduction of approximately 30% and a yield loss of more than 40% when compared with maize in other parts of the field. In both cases no crop rotation was being practised.

The mature female of R. parvus is a sedentary semi-endoparasitic nematode, having its head embedded in the cortex of a maize root, where it feeds, while the rest of the body remains outside the root. Eggs are deposited directly into the soil, where they hatch into juvenile stages that subsequently develop into immature females, prior to invasion of the host plant. It is the number of juveniles and immature females extracted from the soil which give the most accurate estimate of the population level of R. parvus, as mature females are easily dislodged from the host roots during laboratory processing.

Control of Rotylenchulus parvus

This nematode should be controlled by crop-rotation and where possible by the use of resistant cultivars. R. parvus appears to

have a wide host range; results from the survey show that maize which has followed a crop of cotton is more severly damaged by R. parvus (Plate 1b). Although this nematode has previously been identified from soil extracts from maize fields in Zimbabwe (Dasgupta, et al., 1968) and South Africa (Furstenburg, 1974) there are no reports of work having been done to determine its pathogenicity. A related species, R. reniformis is known to cause significant yield losses to a variety of crops, it is, therefore, vital that the pathogenicity of R. parvus is determined before specific control measure can be worked out.

Needle Nematode, Paralongidorus ?n.sp.

Paralongidorus sp. was less common than either Pratylenchus spp. or Rotylenchulus parvus, being present in 12% of soil samples collected from maize fields during the survey, but wherever it was found, this nematode was associated with severe stunting of the whole plant. There was more than a 70% reduction in plant height, with a stunted and distorted root system often with root-tip galls. Affected plants either tassled early or not at all, there were few or no cobs produced and that was an estimated yield loss of more than 50% (Plate 1c).

Paralongidorus sp. is an ectoparasitic nematode. It feeds on the delicate cells of the root tip causing meristematic activity to cease and thus prevent further root extension. Instead the root-tips become swollen and secondary root growth immediately behind the tip may be enhanced, giving a feathery appearance. Young maize plants that were growing on Paralongidorus-infested

PLATE 1

SYMPTOMS OF NEMATODE DAMAGE IN MAIZE

a. Chlorosis and stunting caused by *Pratylenchus zeae* (>1,000/L of soil), Mberengwe.

b. Stunting and chlorosis caused by *Rotylenchus parvus* and *Scutellonema magniphasmum*, Kandeya.

c. Severe stunting and leaf rolling associated with *Paralongidorus* ?n.sp., *Xiphinema* sp. and *P. zeae*, Ndowoyo.

d. Severe stunting and chlorosis due to *R. parvus* (1,925/L of soil) and *P. zeae* (note maize in the background growing in the absence of these nematodes), Mzarabani.

e. Stunted roots with galled tips associated with the feeding habit of *Paralongidorus* sp. (note red colouration in leaves indicating root damage).

f. Streaked chlorosis and stunted roots associated with *Xiphinema* sp., Mzarabani.

Plate 1

soil displayed a type of reddish discolouration in the outer leaves which is sometimes symptomatic of excess sugar accumulation due to root damage, although in older plants phosphorus deficiency would be suspected (Plate 1e).

A species of Paralongidorus has recently been shown to cause poor growth of rice in Australia (Stirling, 1984), although there are no previous records of this nematode being associated with cereal crops in southern Africa. Paralongidorus sp. appears to be a completely new pest of maize that is well adapted to hot, dry savannah areas. Its absense from the results of previous surveys is probably due in part to the kind of extraction methods employed and in part to the types of areas surveyed. As this species of Paralongidorus is up to one centimeter in length, it must be extracted by a specialised sieving technique (see section B). The comparatively large size also means that this nematode is restricted to sandy soils and it seems to have a preference for areas with higher temperatures, i.e. Farming Regions IV and V.

Control of Paralongidorus sp.

Before any control measures can be devised for this nematode it will be necessary to survey more communal areas, particularly in Regions IV and V, to determine the extent of its distribution. In addition research into the biology and pathogenicity of this pest needs to be conducted to establish its nature and severity. If Paralongidorus sp. does turn out to be a serious pest of maize it is likely to be very difficult to control. In addition to

maize and other cereal crops, a number of graminaceous weeds, including Eragrostis aspera and Digitaria sp. were found to be hosts, which would explain why populations of Paralongidorus sp. in excess of 300 per litre of soil were found in a field of maize which had been fallowed for the previous three years due to drought. Although rotation with non-graminaceous crops may turn out to be effective in reducing the population of Paralongidorus, the low and erratic rainfall which haunts Regions IV and V, prevents local farmers from planning future cropping patterns and in any case their choice of crops is limited. Their best hope will lie in the future success of plant breeders in producing maize cultivars which are resistant to this "new" nematode pest.

Dagger Nematode, Xiphinema spp.

Xiphinema spp. was identified from 13% of samples collected from maize fields, all of which were situated on sandy soils. Two species were identified, these were X. louisi and X. cf. variabile, both had originally been recorded from grasslands in South Africa (Heyns, 1966 & 1979) and there are no previous reports of either being a pest of maize.

X. cf. variabile was associated with stunted, chlorotic, rolling maize plants in fields in Mzola, Ngezi and Mberengwe communal lands and the distorted root system was symptomatic of that described for graminaceous hosts of other Xiphinema species. Namely suppressed root growth with root-tip galls, similar to that already described for Paralongidorus sp.

Control of Xiphinema spp.

This should be based on crop rotation and the use of resistant maize cultivars and will depend on the results of relevant field trials.

Stubby-root Nematode, Trichodorus sp.

Although Martin et al. (1975) confirmed that Trichodorus sp. can cause severe, early stunting of maize plants in Zimbabwe, this nematode was not found in any of the maize fields in the communal areas sampled during the survey. It is well known that Trichodorus sp. cannot survive periods in transit and for the purpose of this work, samples normally had to be transported in the back of a vehicle for several days prior to being processed in the laboratory in Harare. In addition, Trichodorus being a sluggish nematode, is not easily extracted by the tray method that was routinely employed. Some modifications need to be made to these methods before the true pattern of distribution for Trichodorus sp. can be assessed.

Spiral Nematode, Scutellonema spp.

Scutellonema spp., mainly either S. brachyurum or S.unum and occasionally S. magniphasmum, was found in 50% of the soil samples collected from maize fields and was often associated with chlorosis and stunting. Occasionally these nematodes were also found in the roots of maize. Despite its common occurrence, Scutellonema spp. alone is unlikely to be causing significant damage. It is possible that there may be a synergistic effect

when Scutellonema spp. shares the same habitat with other parasites such as Pratylenchus spp. or Rotylenchulus parvus but this remains to be proved.

Lance Nematode, Hoplolaimus pararobustus

This nematode was found in only two of the maize fields included in the survey, both of them in the Zambezi Valley. It was present in nectrotic, stunted roots which were devoid of fibrous roots - symptoms typical of other species of Hoplolaimus which are capable of causing losses in maize of 26% (Norton & Hinz, 1976). There is no previous record of H. pararobustus infesting maize.

Root-knot Nematode, Meloidogyne spp.

M. javanica was occasionally found infesting maize roots, though numbers were low and not thought to be causing significant damage. Nevertheless even a low level of susceptibility to this ubiquitous pest is unacceptable in a crop such as maize particularly when resistant cultivars are commonly available in other parts of the world. A cultivar of maize which is resistant to M. javanica and M. incognita is vital for farmers who wish to control these pests in tobacco, cotton, sunflower, soybean or vegetables, by crop rotation. In order to satisfy this requirement all Zimbabwean cultivars of maize should be screened for resistance to these two root-knot nematodes and if necessary a search for a more suitable cultivar should be initiated.

Other Nematodes

Other plant parasitic nematodes which were occasionally extracted from maize soil samples were Telotylenchus obtusus, Paratrophurus sp. and Rotylenchus incultus. Although they were normally associated with stunted plants, these nematodes are unlikely to be causing significant reductions in the growth of maize.