MALAWI

1.0 INTRODUCTION

Malawi developed the Environmental Management Act as a follow-up to the Vienna Convention and the Montreal Protocol for the protection of the ozone layer. One of the recommendations under the Montreal Protocol on the protection of the ozone layer is the phasing out of all non-essential and non-critical uses of ozone layer depleting substances, which include methyl bromide, fluorines, chlorofluorocarbons (CFC) and halogens.

Various types of research have been initiated to develop mechanisms of protecting and monitoring the ozone layer, and determining the effects of ultra violet light due to the depletion of the ozone layer. Ozone layer and ultra violet light research and monitoring activities in Malawi have been done indirectly with emphasis on adaptive research on management of ozone layer depleting substances, developing strategies to phase out all the ozone layer depleting substances and development of alternatives to these undesirable substances.

Malawi has been using about 132 metric tones of Methyl Bromide of which 21 tonnes were being used for commercial storage of grain by the Agricultural Development and Marketing Corporation (ADMARC) while 111 tonnes were used in the tobacco industry for raising tobacco seedlings. ADMARC with the help of the British government undertook research on alternatives to Methyl Bromide and came up with a fumigant called Phosphine which is environmentally friendly and does not affect the ozone layer adversely. The Cooperation is now using Phosphine only for grain storage. The task now is to phase out the remaining 111 tonnes of Methyl Bromide in the tobacco industry which makes significant contribution to the ozone layer depletion.

The Agricultural Research and Extension Trust (ARET) in Malawi is currently investigating into the efficacy of the various chemicals and systems as alternatives to Methyl Bromide use in the tobacco industry. These include the Floating tray system, Basamid (granular), Metham Sodium, Telon II, EDB and Burning maize stalks over the soil to sterilize soils for tobacco nurseries.
This research will contribute to the protection of the ozone layer and avoid ultraviolet radiation reaching the earth. The highlights of the on-going research on ozone layer and the planned research activities are outlined in the following sections

2.0 ON-GOING RESEARCH ON OZONE LAYER

2.1 Soil-less Culture : Floating Tray System

The technology was borrowed from Zimbabwe and the Republic of South Africa (RSA). The floating tray system uses a polystyrene tray, pine bark as the medium for growth and water in a pond for irrigation and nutrition of the plants. It is a soil-less medium and no chemicals are used to sterilize the pine bark medium. Therefore, the medium does not require fumigation thereby doing away with the use of ozone layer depleting substances.

Malawi started with 1.5 ha area of nursery in year 2001/2002 using the floating trays and will expand to 6.5 ha during the second year i.e. year 2002/2003. Observations made indicate that the system will enable growers use less nursery area i.e. 1 pond of 22.5m by 1.05m/ha instead of 3 beds/ha of 30 m^2 each; a permanent nursery site can be used because there is no need for rotation, and the system has reduced labour requirement because one person instead of three can manage over 50 beds or ponds. However, the limiting factor is the initial cost of the trays, the need to use pelleted seed, lack of equipment to pelletize the seed, and the small-size seedlings which may be difficult to use during dry planting. However the technology is promising and may enable Malawi effectively stop the use of ozone layer depleting substances.

2.2 Chemical Soil Sterilization System : Basamid (Granular), Metham Sodium or Herbifume (Liquid Formulation) and Telon II

The two compounds Basamid and Metham Sodium have the same active ingredient (Methylisothiocynate) the difference being that one is in granular form while the other one is in liquid form. These two chemicals have been evaluated for their effectiveness in controlling weeds and nematodes. Both chemicals turn into Methylisothiocynate (MITC) gas upon reacting with water in the soil and it is the MITC gas that kills weeds, soilborne pathogens and nematodes.

Observations from the research results show that Basamid is very effective in killing weeds and nematodes while Metham Sodium has shown inconsistent results over seasons in the control of nematodes and weeds (Table I). Research efforts are being made to improve the application procedures of Metham Sodium to enhance its effectiveness.

The major disadvantage of the two chemicals is that the treatment period and procedures take almost a month before sowing which is 10 days more than methyl bromide treatment.

TABLE 1: EFFECTS OF SOIL FUMIGANTS ON WEED AND NEMATODE CONTROL IN HEAVY AND LIGHT SOILS DURING SOIL

STERILIZATION IN THE NURSERY

TREATMENT	WEED POPULATION		NEMATODE POPULATION				NEMATODE INFECTION	
			INITIAL		FINAL		(ROOT GALL SCORES)	
	HEAVY SOIL	LIGHT SOIL	HEAVY	LIGHT	HEAVY	LIGHT	HEAVY SOIL	LIGHT SOIL
Burning	16.3	4.5	73	95	487	593	6.5	4.9
Methyl Bromide	1.9	1.3	51	78	0	0	0	0
Metham Sodium	4.2	8.3	52	85	331	477	5.1	4.8
Basamid	2.0	1.3	43	75	145	105	3.0	1.2
Telon II	145.5	6.8	45	74	0	0	0	0.1

Combination of Metham Sodium and Telon II

In an effort to improve the efficacy of Methum Sodium in the control of both nematodes and weeds another chemical called Telon II was tried in combination with Metham Sodium. It has been observed that a combination of Telon II and Metham Sodium is very effective in controlling weeds and nematodes (Table 2). However, it has been noted that Telon II is highly effective in controlling nematodes but not weeds. Additional experiments on the use of Telon II alone for controlling nematodes in the nursery have shown Telon II to be highly effective for nematode control (Refer to Table I).

TABLE 2: SYNEGETIC EFFECTS OF METHAM SODIUM AND TELON II ON THE CONTROL OF NEMATODES AND WEEDS IN A TOBACCO NURSERY

TREATMENT	WEED COUNT		ROOT (GAP) GALL SCORES	
	FIRST	FINAL	FIRST	FINAL
30ml MS and 21ml Teleon II	6	2.3	0	0.2
60ml MS and 21ml Teleon II	7	3	0	0.5
30ml MS and 28ml Teleon II	11	4.7	0	0
60ml MS and 21ml Teleon II	4.7	4.3	0	0

2.3 Physical Soil Sterilization System : Burning Maize Stalks over the Soil

Most smallholder farmers in Malawi do not use chemicals to sterilize soil in their nursery beds due to poverty but burn maize stalks on top of the nursery bed and the heat generated kills the weeds and nematodes. The farmers heap maize stalks 0.3 – 1.0 metre high on the nursery beds and burn them.

The method is very effective in controlling weed seeds, adult nematodes and eggs if applied correctly i.e. by pre-watering the beds to allow weeds to germinate and nematode eggs to hatch before burning the maize stalks which will generate heat to kill them. However due to scarcity of grass and maize stalks not many farmers are able to sterilize their beds effectively and most of them are turning to the use of chemicals. This is the right time to prepare them for the use of ozone layer friendly chemicals.

3.0 PLANNED OZONE LAYER RESEARCH

Malawi has both smallholder farmers with limited resources and skills and Estate farmers who have relatively adequate resources and good skills. It is therefore important to compare the effectiveness and feasibility of the various chemical and non-chemical methods of sterilizing tobacco nursery bed soils under both conditions. Two experiments have been proposed to be implemented during the next two to three years i.e. 2002/2005. The parameters to be monitored and measured are as follows:- a) weed control, b) nematode control, c) soil borne disease control, d) seedling vigour and uniformity and plant size at transplanting, e) cost of production for each method used, f) practicability and feasibility under both smallholder farmer and commercial farmer conditions.

Project 1: The effectiveness of the various chemical and non-chemical methods in the sterilization of nursery bed soils for raising tobacco seedlings as an alternative to Methyl bromide.

a) Objective: To identify a chemical which is as effective as Methyl bromide in the sterilization of nursery seed bed soils for raising tobacco seedlings.

b) Proposed Treatments

- Methyl bromide (control)
- Basamid (granular formulation)
- Metham Sodium (liquid formulation)
- Telon II

- New chemical (x)
- New chemical (y)
- Grass burning on nursery beds
- Grass burning with pre-watering treatment

Project 2: To determine the effectiveness of the various sterile growth media and container systems in raising tobacco seedlings in the nursery as an alternative to the use of Methyl bromide.

a) Objective: To raise seedlings in soil-less media to avoid fumigation procedures for sterilization of tobacco nursery seed beds aimed at controlling weeds, soil borne diseases and insect pests.

b) Proposed Treatments:

i) Main plot: container systems

- Floating tray system
- Dry tray system
- Controlled concrete trenches
- Open nursery beds in a plastic tunnel

ii) Sub-plot: Growth Medium

- Pine bark (imported)
- Pine bark (local)
- Rice husks
- Groundnut shells
- River sand
- Mixture of sand/rice husks (50/50)
- Mixture of sand/saw dust (50/50)
- Mixture of sand/local pine bark (50/50)
- Mixture of sand and groundnut shells (50/50)

4.0 CONCLUSION

Very good effort has been made to look for an alternative to Methyl bromide in the fumigation of nursery soils for raising tobacco seedlings. Basamid has to-date shown that it is a good alternative to Methyl bromide. However, some farmers are experiencing problems in implementing the procedures of application accurately and they follow short cuts resulting in inconsistent results. Initiatives have been undertaken to fine-tune the technology to make it farmer friendly. The floating tray technology has been accepted by limited number of farmers because it was introduced late and we had problems in getting the pinebark on time for the season. Furthermore the technology has high cost of investment initially and requires skills in its management. ARET is also trying its best to conduct adaptive research to fine-tune the technology and simplify the procedures. These two technologies, Basamid and the floating tray system, have the greatest potential to replace the use of the ozone layer depleting chemical substance, Methyl bromide. There is therefore good hope that in five years time Malawi will be ready to stop using Methyl bromide.

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