EVALUATION OF LOCAL SUBTRATES AS GROWTH MEDIA FOR RAISING TOBACCO SEEDLINGS IN MALAWI

BY

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1.0. ABSTRACT

Malawi phased out the use of Methyl Bromide (MeBr) in Tobacco Nursery seedbeds in December 2004 and is promoting three alternative technologies namely Basamid, Metham Sodium and the Floating Tray system. The Floating Tray system uses raw materials which are being imported into the country i.e. polystyrene trays, pine bark compost, soluble fertilizer and chemicals for the control of pests. The Agricultural Research and Extension Trust conducted an experiment to develop compost for the floating tray system using local substrates. Eight substrates were identified and composted. The compost of two substrates namely tobacco stems and maize stalks was not suitable for the floating tray system hence they were discarded.

Five local substrates produced good compost. An experiment was conducted to evaluate the performance of the 5 local substrate composts in raising tobacco seedlings in the nursery. The results showed that pine bark compost and used coal pebbles had the fastest rate of seed germination and total germination percentage followed by coffee

husks and groundnut shells. Furthermore pine bark compost, macadamia husks and coffee husks had promoted the highest plant growth. Farmers are therefore being encouraged to use groundnut shell compost, coffee husk compost, macadamia husk compost and used coal pebbles as growth media when raising tobacco seedlings in the floating tray system. This is in an attempt to make the floating tray system cheaper for farmers as an effective alternative technology to Methyl Bromide which was phased out completely in December, 2004.

2.0 INTRODUCTION

Tobacco farmers in Malawi have been using Methyl Bromide (MeBr) to sterilize seedbeds in the nursery which are used for raising tobacco seedlings. MeBr was identified as one of the ozone depleting substances at the Vienna Convention which was established for the protection of the ozone layer. It was therefore recommended that its use be phased out in the World. Malawi ratified the Vienna Convention in March 1985 and the Montreal Protocol in 1990. Malawi was therefore given targets to phase out MeBr by December 2004.

Malawi is the second largest user of Methyl Bromide in the tobacco sector in Africa and was requested to phase out 111 ODP tonnes by December 2004. Indeed Malawi phased out the use of MeBr by December 2004. Three alternatives to Methyl Bromide have been promoted i.e. Basamid, Herbifume (Metham sodium) and the Floating Tray system.

The floating tray system uses polystyrene trays with 200 cells, growth medium in the form of pinebark compost, water and soluble fertilizers. Malawi does not have pine bark compost hence it has been importing it

from Zimbabwe and the Republic of South Africa. Imports of pine bark compost are very expensive and hence are making the floating tray system expensive and unsustainable. The Agricultural Research and Extension Trust undertook an initiative to identify locally available substrates which can be composted and used as growth medium in the floating tray system.

The objective of this experiment was therefore to evaluate the effectiveness of the compost from locally available materials as growth medium in the floating tray system.

3.0. **MATERIALS**

Eight types of materials were identified locally, composted and their performance evaluated in the floating tray system. The materials were groundnut shells, macadamia husks, coffee husks, pine saw dust, rice husks, used coal pebbles, tobacco stems and maize stalks. These materials are found in abundance in Malawi. The materials were composted in heaps 4m long, 2m wide and 1.5m high. When ready at the end of the composting period the materials were sieved to remain with particle size distribution of 0-6 mm. However tobacco stems compost and maize stalks compost were discarded because the texture of the compost was not suitable for the float tray system.

4.0 **PROCEDURES**

The composted materials were wetted to field capacity and the trays were then placed in the pond to float. Seed was sown after 48 hours using the conventional method. Germination started 8 days after sowing.

Soon after germination, fertilizers were applied according to recommendation and pests were controlled using integrated pest management approaches.

5.0 **EXPERIMENTAL DETAILS**

5.1 **Experimental design:** Randomized Complete Block design with three replicates and a plot size of three trays per treatment

5.2 **Treatments:** Composted substrates

S1: Pine bark (control)
S2: Groundnut shells
S3: Coffee husks
S4: Rice husks
S5: Macadamia husks
S6: Pine saw dust
S7: used coal pebbles

6.0 **DATA COLLECTION**

The data collected included rate of wicking, rate of seed germination, plant vigour, disease and pest incidence, water electral conductivity, acidity of medium, acidity of pond water 48 hours after basal application of fertilizer, Carbon and Nitrogen content of medium and seedling survival rate. The C/N ratios were calculated using the Carbon and Nitrogen values of the compost.

5.0 **RESULTS**

Results of the performance of the various local substrates are summarized in table 1. The reported data include pH of pond water 48 hours after application of basal fertilizer, Electral Conductivity (EC) of pond water, Germination rate (days taken for 50% of the seeds to germinate), total seed germination (%) and plant height (cm) at 4 weeks after seed germination. It was observed that tobacco stems and maize stalks did not compost well enough to be used as medium and were therefore discarded. Five substrates composted well and hence their performance was evaluated in the floating tray system. Most of the selected local substrates performed very well as growth medium in the floating tray system for raising tobacco seedlings.

Pine bark compost and used coal pebbles had the fastest rate of seed germination and the highest total seed germination percentage followed by coffee husks and groundnut shells (Table 1). Furthermore pine bark compost, macadamia husks and coffee husks had promoted the highest plant growth. The Electral Conductivity of pond water 48 hours after applying basal fertilizer was the best (0.81- 0.90) for pine bark, coffee husks, used coal pebbles and rice husks while pH of pond water varied between 7.0 and 7.3 for all substrates. The acidity of most of the local substrate compost was between pH 5.5 and pH 7.0 while the Carbon/Nitrogen (C/N) ratios were between 8 and 30. The Nitrogen content of most composted materials was between 0.5 and 1.5% while the organic carbon content was 9-27%.

In general pine bark, used coal pebbles, groundnut shell coffee husks and macadamia husk compost performed well while rice husks and pine saw

dust compost had the least performance. The following media are therefore listed in their descending order of good performance: pine bark, groundnut shells, used coal pebbles, coffee husks, macadamia husks, Rice husks and pine saw dust.

Currently the challenge is to establish composting procedures so that substrates become fully composted before being used in the floating tray system. It was observed that pine saw dust and rice husks take a long time to be composted, macadamia husks need to be pre-treated before using them, and that groundnut and macadamia compost contain a lot of Nitrogen (1.0-1.5%). Currently farmers are encouraged to use the imported pine bark compost, local groundnut shell compost, Macadamia husk compost and used coal pebbles as growth media for the floating tray system.

TABLE 1: PERFORMANCE OF COMPOSTED LOCAL SUBSTRATES USED A GROWTH MEDIA IN THE FLOATING TRAY SYSTEM

Substrate	pH (pond water)	EC (pond water)	Germination		Plant height (cm)
			Rate (days)	Total (%)	
S1: Pine bark	7.2	0.83	8.0	77.8	22.3
S2: Groundnut shells	7.3	1.28	10.1	70.7	16.3
S3: Rice husks	7.3	0.89	11.8	67.7	20.1
S4: Macadamia husks	7.3	1.26	11.3	69.2	23.3
S5: Pine saw dust	7.0	0.99	11.5	58.8	16.3
S6: Coffee husks	7.1	0.81	9.6	71.3	22.7
S7: Used coal pebbles	7.3	0.9	8.0	82.1	16.3

6.0 **DISCUSSION AND CONCLUSION**

Good progress has been made in identifying local substrates which can be used as growth media for use in the floating tray system when raising tobacco seedlings. Currently farmers will be encouraged to use the following local composts in their floating tray system: Groundnut shells compost, macadamia husks compost, coffee husks compost and used coal pebbles in addition to the imported pine bark compost. This research was aimed at reducing the cost of producing tobacco seedlings in the floating tray system to ensure that tobacco farming remains a viable agricultural enterprise. Once successful Malawi will encourage commercial production of local compost to avoid importing pine bark compost which is rather expensive currently. More effort will be made to fine tune the composting procedures for local materials and development of quality standards for the local compost.

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TABLE 2: PERFORMANCE OF COMPOSTED LOCAL SUBSTRATES USED AS GROWTH MEDIA IN THE FLOATING TRAY SYSTEM

Substrate	PH Substrate	C/N ratio	OC %	% N	PH (of pond water)	EC (of pond water)	Wicking Rate (%/12hr)	Germination		Growth Rate (plant ht)	% Survival
								Rate (days)	Total (%)		
S1: Pine bark	5.97	45.7	22.8	0.5	7.2	0.83	83.0	8.0	77.8	22.3	99
S2: Groundnut shells	5.57	8.3	9.1	1.1	7.3	1.28	82.0	10.1	70.7	16.3	85
S3: Rice husks	6.62	27.2	19.0	0.7	7.3	0.89	93.5	11.8	67.7	20.1	93
S4: Macadamia shells	5.75	10.9	16.4	1.5	7.3	1.26	62.3	11.3	69.2	23.3	95
S5: Pine saw dust	6.83	29.3	26.3	0.9	7.0	0.99	72.8	11.5	58.8	16.3	91
S6: Coffee husks	6.6	26.0	23.4	0.9	7.1	0.81	88.5	9.6	71.3	22.7	85
S7: used coal pebbles	7.45	1.0	0.29	0.3	7.3	0.90	85.3	8.0	82.1	16.3	82