

1991

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Recommended Citation

Eichenberger, Rudolph J. (1991) "Microwave Pasteurization of Potting Mixes," *Journal of the Arkansas Academy of Science*: Vol. 45 , Article 9.

Available at: <http://scholarworks.uark.edu/jaas/vol45/iss1/9>

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MICROWAVE PASTEURIZATION OF POTTING MIXES

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ABSTRACT

A study was conducted to determine if potting soils could be pasteurized with a typical 1200 watt microwave oven. Microwave radiation times varied from 0 to 6.0 minutes. Preliminary results indicated that "damping-off" diseases could be prevented in tomato seedlings with the use of potting soils pasteurized by microwaves.

INTRODUCTION

Many home gardening books recommend baking containers of soil before sowing seeds to prevent damping-off diseases (Doty, 1973; Raymond and Raymond, 1978; Williamson, 1975). Damping-off pathogens can be killed by baking potting soil in the oven for 30-45 minutes at 180 degrees Fahrenheit (Roberts, 1981). The baking procedure suggested by these authors is costly, inconvenient, and time consuming for the home gardener. Hansen *et al.* (1990) reported the control of *Fusarium* and *Pythium* in nurseries by fumigation with the chemicals chloropicrin and dzaonet. The authors noted that soil fumigation is costly and the chemicals are extremely hazardous. Economic and environmental factors are stimulating interest in alternative strategies for disease suppression.

A microwave oven was used to kill spores of *Bacillus subtilis* (Jeng, 1987). Jeng (1987) found that a treatment of 45 minutes by 2450 MHz microwaves was required to kill spores in dry glass vials at 137°C. Microwave sterilization was a function of field strength and exposure time. The nonthermal effects were not significant in dry microwave sterilization and the sterilization of spores was a function only of thermal effects. Microwave radiation has been found to be effective in the death of soil borne plant pathogens in soil (Ferriss, 1984). The purpose of this experiment was to determine if a microwave oven could be used to pasteurize potting soil mixes to prevent damping-off of tomato seedlings.

MATERIALS AND METHODS

Three potting mixes were tested by microwaving them in a 1200 watt oven at a frequency of 2450 MHz. The potting soil types used were commercial potting soil from Hyponex and Wal-Mart and composted garden waste. Soils (30-55 g) were placed in small peat pots (80 ml) and then placed in the microwave oven for times ranging from 0 to 6.0 minutes. The potting mixes were first moistened with 10 ml of tap water, except where noted. After the soils had cooled, the pots were planted with three (3) seeds. From two to five replications were used. Pepper, melon, and broccoli and gardens oil was examined in nonreplicated experiments. Pots were then placed in a south facing laboratory window and kept at 20-22° Celsius. The soil was kept moist and the pots covered with clear plastic covers to prevent drying. Emergence and seedling survival were recorded over a one month period. Seedlings which died as a result of damping-off were examined under the microscope and the pathogens were identified with the use of monographs from Commonwealth Mycological Institute (1966).

RESULTS

In the replicated experiments, Table 1, ten pots were not treated with microwaves of which 6 pots (60%) were observed to have fungus *Pythium*, no growth, or damping-off. The seedlings were assigned a disease rating (1 = no *Pythium*, 2 = *Pythium* observed on soil or plants, 3 = plant death) and statistically analyzed. A t-test was applied to the disease rating. A null hypothesis of no significant difference between microwaved and nonmicrowaved samples was rejected at the (@) signifi-

cance level of greater than .01 ($t=3.03$). A total of 24 pots was microwave treated for times varying from 1.7 to 6.0 minutes in the replicated experiments. Only one microwaved sample was observed to have fungus or damping-off mortality (4.2%). Observation of dead seedlings indicated *Pythium* spp. were the causal agents of damping-off. The results indicate soil pasteurization by microwaves from 1.7 to 6.0 minutes is effective in preventing damping-off in tomatoes.

Table 1. Influence of microwave treatments on tomato seedling emergence in potting soils.

Potting mix	Microwave Time (min)	Moisture (wet = 10 ml)	Disease Rating			Mean
			Exp 1	Exp 2	Exp 3	
Wal-Mart	0	wet	2	2	2	2
	0	wet	2	2	2	2
	3.4	dry	1	1	1	1
	3.4	wet	1	3	2	2
	6.0	dry	1	1	1	1
	6.0	wet	1	1	1	1
Composted	0	wet	1	3	2	2
	4.5	wet	1	1	1	1
	6.0	wet	1	1	1	1
Hyponex	0	wet	1	1	1	1
	1.7	wet	1	1	1	1
	4.5	wet	1	1	1	1
	6.0	wet	1	1	1	1

Table 2 is a display of all data with multiple variables when microwaving time was the common variable. Statistical analysis of a t-test applied to this data on the basis of microwaved and nonmicrowaved samples produced a t value of 1.47. This allowed rejection of the null hypothesis (no significant difference between microwaving and nonmicrowaving) at the 0.1 level. Preliminary results indicate soil pasteurization is also effective in preventing damping-off of broccoli, pepper, and melons (data not specifically shown).

Table 2. Data displayed by microwave treatment variable regardless of soil and seed types.

Microwave time (min)	Moisture (wet 10 ml)	Number of trials	Number infected	Percent infected
0	wet	14	7	50
1.7	wet	3	0	0
3.4	dry	2	0	0
3.4	wet	7	1	14
4.5	wet	9	0	0
6.0	dry	3	0	0
6.0	wet	10	0	0

CONCLUSION

Based on the results of this study, potting soil can be sterilized through the use of a microwave oven. Seedling damping-off can be controlled by microwave treatment of the potting soil for at least 2 minutes in a 1200 watt microwave oven operating with a frequency of 2450 MHz.

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