SPENT MUSHROOM COMPOST FOR GREENHOUSE CROPS

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Increasing costs and diminishing supplies of peat moss and topsoil have forced many growers to seek alternative ingredients for greenhouse soil mixes. Among the possible substitutes is the spent compost from the production of mushrooms in Connecticut. Mushrooms are grown in a partially composted mixture of horse manure and straw and topped with sphagnum peat and limestore. The mixture is amended with organic nitrogen fertilizer as well as with salts of phosphorus and potassium. These additions can create high concentrations of ammonium nitrogen and soluble salts by the time the growth medium is disposed of after 35 to 45 days. Fresh wastes generally have a 1-1-1 (total N-P_2O_5-K_2O) analysis and have been used successfully at the Valley Laboratory and commercially for field grown vegetables. This report examines the usefulness of this waste for growers of greenhouse crops.

Mixes--Five potting soils were formulated (Table 1) utilizing spent mushroom waste in two forms: fresh from the mushroom farm (FM), and aerobically composted for 6-12 weeks (CM). These two forms were then used as a topsoil

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**Chrysanthemum rooted cuttings were supplied through the courtesy of Bristol Nurseries, Bristol, CT.*

TABLE 1. Greenhouse soil mixtures, percent by volume.

Treatment	Field Soil	Canadian Peat Moss	Per-lite	Spent Mushroom Growing Media		(lbs/yd^3)	
				Fresh	Composted	Limestone	0-20-0
1 C	33	33	33			18 lbs	2.5
2 CM		33	33		33	0	0
3 FM		33	33	33		7.5 lbs	0
4 FM	33		33	33		0	0
5 CM	33		33		33	5 lbs	0

2

TABLE 2. Color and flowering in chrysanthemums grown in spent mushroom compost.

Treatment	Foliage Color[z]	% Plants Flowering by Weeks		
		9 wk	10 wk	11 wk
1 C	3.3 bc[y]	0	13.3	30.0 ab[y]
2 CM	3.1 bc	6.7	23.3	46.7 a
3 FM	3.0 c	0	6.7	16.7 b
4 FM	3.5 b	0	6.7	10.0 b
5 CM	4.0 a	3.3	16.7	46.7 a

[z] 1=yellow, 2=yellow-green, 3=lt. green, 5=dk. green

[y] Mean separation within columns by Duncan's Multiple Range Test, 5% level.

substitute (mixes 2, 3) and as a peat moss substitute (4,5). Mix 1 was a standard greenhouse soil and served as the control (C). One type of garden chrysanthemum ('High Regard')* and two types of bedding plants (Tomato 'Roadside Red' and French Marigold 'Dainty Marietta') were grown in each of the five soil mixes with five replicates of each treatment.

Chrysanthemums--One hundred fifty rooted cuttings were potted individually in 4 1/2 inch plastic pots on February 14, grown in a 60° greenhouse, pinched after two weeks and treated with aldicarb (Temik). All plants were fertilized according to soil tests at 7-14 day intervals beginning at day 20 with 15-0-15 liquid fertilizer (400 ppm N from calcium & potassium nitrates). Fertilization was halted after 10 weeks. The time needed for each plant to flower was noted, as was foliage color. After 11 weeks, those plants that had not flowered were also evaluated for foliage color.

Soils containing composted mushroom wastes (2, 5) were the earliest to flower while soils containing fresh wastes (3, 4) were delayed (Table 2). Foliage color did not differ greatly in any treatment. The soil pH, (higher than desireable) remained fairly constant throughout the experiment, but excessive nitrogen and soluble salt levels had diminished by six weeks (Table 3).

Bedding Plants--Three-week-old seedlings of tomatoes and marigolds were potted individually in plastic "six-pack" containers on April 10. All plants received minimal liquid fertilization of 15-0-15 (as above) at four weeks, and 10-15-20, 300 ppm N, at five weeks. After eight weeks the marigolds bloomed with no significant difference in

TABLE 3. Chrysanthemum soil test values vs. time (Morgan Test).

Treatment	pH		NO_3-N		NH_4-N		Soluble Salts[z] mmhos/cm^3	
	0 weeks	6 weeks	0 weeks	6 weeks	0 weeks	6 weeks	0 weeks	6 weeks
1	7.5	7.5	VL	Tr	L	VL	0.35[y]	0.2
2	7.2	7.0	VH	Tr	VL	VL	2.6	1.2
3	7.7	7.3	L	0	MH	VL	2.5	0.9
4	7.0	7.1	VL	0	MH	VL	2.9	1.5
5	6.6	7.3	VH	M	VL	VL	2.75	1.6

[z]Saturated paste extract: a reading of over 2.0 is probably too high for transplanting cuttings.

[y]This is considered to indicate an infertile soil.

flowering date or number of flowers. Plant heights did not vary greatly among the different treatments (Table 4). Tomatoes planted in either CM or FM generally showed superior color to the control soil (since the control received no fertilizer until week four).

Conclusions--These experiments suggest that spent mushroom growth media can be useful in greenhouse crop production as a partial substitute for topsoil or for peat moss. In these experiments, the plants grew faster and could have been sold sooner when the soil was amended with mushroom compost.

The dangers of high ammonium nitrogen and soluble salt levels can be minimized if the amounts of the wastes are limited to 33% or less of the total mix volume. These dangers can be further reduced by composting the material outdoors in windrows and turning several times. The use of the fresh material is not suggested. Soil tests can readily indicate when the material is suitable for use.

Editors' Note: Several greenhouse operators regularly use spent mushroom compost in their mixes. From 10-15% by volume has proven to be acceptable. More than this generally results in slower growth due to toxic levels of salts or specific ions.

TABLE 4. Bedding plants (eight weeks after transplant).

Treatment	Foliage Color[z]		Average Height, cm	
	Tomatoes[y]	Marigolds[y]	Tomatoes	Marigolds
1	2.2 b[x]	3.0 a	14.5 b	12.9 b
2	3.2 a	3.6 a	20.6 a	15.7 a
3	2.8 ab	3.4 a	15.9 b	13.1 b
4	3.0 a	3.0 a	17.8 ab	13.5 b
5	3.2 a	3.4 a	17.9 ab	12.8 b

[z] 1=yellow, 2=yellow-green, 3=lt. green, 4=green, 5=dk. green

[y] Treatment 1 values indicate insufficient fertility for good quality, all indices should have been 4.0 or above.

[x] Mean separation within columns by Duncan's Multiple Range Test, 5% level.