

Comparison of Mulches for Fresh-market Basil Production

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Abstract. Using various mulches for small-scale, commercial basil (*Ocimum basilicum* L.) production was examined. Sweet basil and bush basil, on raised beds with drip irrigation, were grown on bare ground or mulched with black polyethylene, wheat straw, hardwood bark, or mixed wood chips. Bacterial soft rot (*Erwinia* spp.) was highest for both basil grown with wheat straw and for sweet basil grown on bare ground or with black polyethylene mulch. Both basil grown with hardwood and pine bark mulches had few soft rot symptoms. All mulches provided acceptable weed control. Yields throughout the growing season were highest with black polyethylene mulch and lowest with hardwood and pine bark mulches.

Ricotta and Masiunas (1991) indicated that black polyethylene mulch improved basil yields. Black polyethylene, however, is costly to use and disposal is difficult. Recent efforts to reduce organic materials in sanitary landfills have resulted in readily available, low-cost, fresh, organic mulches. Organic mulches may be more costly to apply than black polyethylene but do not need to be removed and can be incorporated into the soil. My objective was to evaluate mulches for small-scale, fresh-market basil production.

Two basil and six mulch treatments were examined in a factorial experiment in a randomized complete-block design with four replications. Although both taxa are classified as *O. basilicum*, one basil was the common sweet basil that grows to 60–90 cm high, with 4- to 10-cm-long glabrous, ovate leaves. The other basil was a bush basil, 'Green Improved', that grows to 15–25 cm high, with thickened, glabrous, acute leaves ≈2cm long. This bush basil closely resembles the description for *O. basilicum* 'Minimum'. Mulch treatments were black polyethylene (1.5 m wide × 0.04 mm thick), hardwood bark, pine bark, mixed hardwood and softwood chips, wheat straw, and bare ground. The fresh bark mulches were

from a sawmill, and the fresh mixed wood chips were from a local utility roadside clearing operation. Plots consisted of raised beds 4.6 m long × 1 m wide and 1.5 m apart center to center with drip irrigation (0.5 mm thick, 46 cm between emitters) (Typhoon; Netafim Irrigation, Valley Stream, N.Y.). Soil was a Delanco loam (fine loamy, mixed, mesic, Aquic Hapludults) with a pH of 6.0. Before bedding, 112 kg N, P, and K/ha, were broadcast-applied to the soil and incorporated. On 14 June 1991, 5-week-old, greenhouse-grown, basil plants were transplanted to the field. At 24, 35, and 52 days after planting, 22 kg N/ha (20N–8.6P–16.6K), 18 kg N/ha (12N–21P–6.6K), and 20 kg N/ha [Ca(NO₃)₂], respectively, were applied through the drip-irrigation system. Soil was irrigated as needed to maintain soil moisture content near field capacity. Plants were grown in double rows with 20 cm between plants and 30 cm between rows. Holes were punched in the black polyethylene mulch with a hand-operated bulb planter and organic mulches were applied to a depth of ≈8 cm.

Leaves were harvested four times. At each harvest, new leaf growth was cut, leaving several axillary buds on each branch for regrowth. Data are presented on a fresh-weight basis; percent dry weight averaged 13% for both basil. All data were subjected to analysis of variance and means were separated using the protected least significant difference procedure (MSTAT-C, Michigan State Univ.).

By 15 Aug., 75% of the sweet basil and 84% of the bush basil plants grown on wheat straw had symptoms of bacterial soft rot (*Erwinia* spp.), as did >50% of the sweet basil grown on bare ground or with black polyethylene mulch (Table 1). In contrast, both basil grown on hardwood and pine bark mulches had few soft rot symptoms, and bush basil grown on bare ground had no soft rot. This difference in soft rot infection between the two basil on bare ground is the primary cause of the significant basil × mulch interaction. Soft

rot, which was a problem due to extended periods of rain, enters plants primarily through wounds and can be spread by direct contact and in water splashed up from the soil (Agrios, 1978). Thus, fresh-market basil is at high risk of infection because of many wounds inflicted on plants during harvest. Although mulch might reduce the spread of infection by preventing water-borne spores from splashing from soil onto the foliage, soft rot was common in mulched treatments. The indication that certain mulches may reduce the incidence of this disease, however, warrants further study. Keeping weed populations low is an important factor in basil production (Ricotta and Masiunas, 1991), and compared to bare ground, all mulches were effective in controlling weeds, with the best control provided by black polyethylene (Table 1).

At first harvest of both basil, plants treated with black polyethylene mulch obtained the greatest yields (Table 2), probably because of high soil temperatures (Ashworth and Harrison, 1983). For bush basil, however, first-harvest yields with black polyethylene were not different from those obtained with wheat straw. This was unexpected because Ashworth and Harrison (1983) reported soil temperatures under straw were lower than under bark or black polyethylene. At all harvests, yields of both basil were the same or higher with black polyethylene than bare ground. Basil grown on wheat straw had yields similar to those on bare ground at all harvests, whereas plants grown with any wood-based mulch had the lowest yields. Even with high percentages of plants infected with soft rot, total yields for both basil were higher with black polyethylene than bare ground (Table 2). In contrast, even though soft rot infection was minimal, yields from plants grown with hardwood bark or pine bark were lower than those grown on bare ground. Total yields for plants grown with wheat straw or mixed wood chips were

Table 1. Mulch effects on bacterial soft rot (*Erwinia* spp.)^a and weed populations in fresh-market basil.

Mulch	Plants with soft rot (%)		
	Sweet basil	Bush basil	Weeds ^b
Bare ground	57.5	0.0	9.1
Black polyethylene	61.0	31.5	1.4
Hardwood bark	15.0	3.0	3.4
Pine bark	5.0	8.8	2.8
Mixed wood chips	49.0	11.8	4.1
Wheat straw	75.3	84.0	4.0
LSD _{0.01}	31.3	31.3	1.8
Significance			
Basil		**	NS
Mulch		**	**
Basil × mulch		**	NS

^aSoft rot incidence was evaluated on 15 Aug.

^bMeans are for main effects over both basil. Weeds were rated on 10 Sept. on a subjective scale (0= no weeds; 10 = heavy weed population).

NS, Nonsignificant or significant at $P \leq 0.01$, respectively.

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Table 2. Mulch effects on fresh-market basil yields per unit bed length.^z

Mulch	Basil yield (g·m ⁻¹)									
	Sweet					Bush				
	Harvest date				Total yield	Harvest date				Total yield
19 July	2 Aug.	21 Aug.	11 Sept.	19 July		2 Aug.	21 Aug.	11 Sept.		
Bare ground	632	4450	549	5067	2460	616	284	839	721	2138
Black polyethylene	1055	566	782	621	3026	885	396	929	817	3024
Hardwood bark	170	218	398	460	1739	238	238	596	666	1245
Pine bark	222	282	386	502	151	210	539	660	1552	1391
Mixed wood chips	429	344	479	443	1996	410	292	707	587	1695
Wheat straw	769	350	520	542	2675	746	348	815	763	2182
LSD _{0.01} ^y			230					185		
LSD _{0.01} ^x					554					390
Significance										
Mulch		**					**			
Harvest date		**					**			
Mulch × harvest date		**					**			

^zTo provide an indication of the differences in yields obtained with the two basil types, yields are presented by basil type. Basil type was significant at $P \leq 0.01$ for all but the first harvest; basil type × mulch was significant at $P \leq 0.05$ for two harvest dates (data not shown).

^yFor individual harvest dates.

^xFor total yield.

**Significant at $P \leq 0.01$.

not different from those on bare ground. For both basil types at every harvest date, the highest yields were obtained with black polyethylene mulch. The significant mulch × harvest date interactions were caused by the varying yield response to the other five treatments at each harvest date.

Overall, highest yields and best weed control were obtained with basil grown on black

polyethylene mulch; although for sweet basil, yields were not significantly different from those obtained with straw mulch. All mulches provided acceptable weed control. Bacterial soft rot was highest in the wheat straw treatment. Using fresh wood mulches resulted in the lowest yields, although incidence of bacterial soft rot was lowest with hardwood bark and pine bark.

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