

PEPPERMINT VARIETY TRIAL, CENTRAL OREGON, 1995-1997

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Abstract

In paired, uniformly infested (in 1994) and noninfested variety trials in Central Oregon, yields were not much different in infested and non-infested areas during 1995-1997, indicating that wilt incidence was not yet sufficient to reduce yields. Oil and hay yields were not statistically different among varieties in 1995-1997 ($P < 0.05$). Wilt incidence was not statistically different among varieties in 1995 and 1996 ($P < 0.05$). After tillage (without flaming) in the fall of 1996, wilt incidence in 1997 was much greater for Black Mitcham than other varieties ($P < 0.05$).

In 1997, inoculum recovered from soil from initially noninfested plots remained below the limit of delectability. Inoculum recovered in 1997 from plots initially uniformly infested remained similar for all varieties except Black Mitcham which was 4 to 5 times that found for other varieties ($P < 0.05$). Wilt levels were closely associated with recovered inoculum levels. It appeared that Black Mitcham was not more inherently susceptible to wilt, but that inoculum increased disproportionately on Black Mitcham than on other varieties. These results have implications on inoculum management and varietal selection under different infestation scenarios.

Introduction

Well designed field trials were established in Central Oregon and elsewhere in 1994 and 1995 to compare yield, oil character, verticillium wilt tolerance and other noteworthy responses among MIRC-sanctioned peppermint varieties and advanced MIRC selections. Reported here are data from the third full season from the trial in Central Oregon, along with selected data from 1995 and 1996. Reports from Central Oregon for 1996 and 1995 area available and provide perspective on results from the first and second full harvest seasons, especially information on water usage differences between Black Mitcham and other peppermint varieties (Crowe, 1996; Crowe et al., 1997). Previously, no comparative trials existed in mint which could be subjected to statistical analyses.

In Central Oregon and in some other locations, varieties were tested both with and without a uniform background of added inoculum of the verticillium wilt fungus, *Verticillium dahliae*. Cultural practices were applied uniformly across the trial, and were considered appropriate for commercial peppermint production in central Oregon.

The 1997 year was to be the last for this trial, but unexpected results reported below indicated that the trial should be held over into 1998.

Materials and Methods

In two adjacent trial areas (main plots), rooted cuttings for six peppermint varieties (subplots) received from Plant Technologies Inc. were established during the summer of 1994 in 8.5'x20' plot, replicated and randomized within four blocks within each area. Mint growth thereafter was maintained within a 10'x20' subplot area. All individual subplots in one of the areas were overseeded with microsclerotia (MS) of *V. dahliae* in the fall of 1994, sufficient to provide a calculated 2 MS/g soil in the top 10 cm of each subplot. Both areas were rototilled in the fall of 1994, which also re-distributed rhizomes and provided for more uniform plant stand in the spring of 1995.

Through harvest of 1996, with respect to irrigation, fertility, weed and pest control, etc., the overall trial was uniformly maintained as per routine mint culture in central Oregon, but great care was taken to avoid cross-contaminating *V. dahliae* into the non-infested trial area. No fall tillage was imposed in 1995, and all plots were propane flamed.

In 1996, infested plots were not post-harvest flamed but were tilled in the fall of 1996. The intent was to intensify wilt incidence in infested plots in 1997. Propane flaming kills most microsclerotia (MS) of *V. dahliae*, which reduces the MS which might later find their way into the soil; tillage tends to incorporate any MS from wilted stems directly into the soil, which eventually intensifies wilt (Homer and Dooley, 1965; McIntyre and Homer, 1973). Noninfested plots were not tilled and were flamed in 1996. Thus, in 1997, the split-plot design was abandoned, and the two trial areas were handled as independent trials.

Data on plant growth and performance, oil yield and character, and disease incidence were taken since establishment. More growth data are included in annual reports for 1995 and 1996 years of production than for 1997. Detail of data collection methods is included in the footnotes of accompanying tables.

Individual wilt strikes were marked individually and recorded as in previous years. However, as such strikes develop closer than 1 foot, they can no longer be distinguished, and the number of strikes becomes increasingly underestimated as they become more abundant. An effective upper limit on the number of strikes for these 200 ft² plots is 200 strikes per plot (i.e. 1 strike per each ft²), although underestimation probably becomes marked as this number exceeds 1 per 2 ft².

Harvest was on August 13, 1997. Subsamples from each plot were collected and distilled at the Oregon State University (OSU, Corvallis) stills. Oil from each plot sample was provided to A.M. Todd Co. for oil component analysis.

Data were analyzed by analysis of variance.

Results

Mean wilt disease levels, percent lodging, fresh hay weights and oil yields for 1997 are shown in Table 1. Wilt continued to be nearly absent from noninfested plots, in spite of the close (30 ft) distance to nearby infested plots. Fall tillage of infested plots resulted in slight delay in growth of infested plots compared to noninfested plots. This delay is reflected in the lower level of lodging in infested plots than infested plots as late as the week before harvest. As in other years, Black Mitcham lodged more extensively than other varieties.

Based on the very high incidence of wilt in Black Mitcham in the infested area in 1997 compared to other varieties, hay and oil yields were anticipated to be lower than are shown in Table 1 relative to the other varieties. This was not the case, which probably reflects the high yield capacity for Black Mitcham compared to other varieties. Yields were slightly higher in the noninfested area, but this might reflect maturity rather than disease incidence. Within each area, no statistically significant differences ($P < 5\%$) were measured among any of the six peppermint varieties.

Oil component analysis is not shown. Differences among oil components by variety was thought to be due to subtle growth and development differences and water usage differences discussed more extensively in reports on 1995 and 1996 harvest years.

Soil was collected from selected plots during the August, 1997. Twenty 6-inch deep x f-inch dia soil cores per plot were composited per subsample, and two subsamples were collected per plot. Soil was air-dried for 5 wks following sampling to allow conidia of *V. dahliae* to die. The soil assay was as per Harris et al. (1993). Means for each treatment are shown in Table 2. Data were expressed as colony forming units (CFU) per gram of soil. CFU may include individual and aggregated microsclerotia, which both appear as a single colony on selective agar growth medium, but CFU is considered an estimate of MS population. CFU in infested plots was much higher than from noninfested plots, which primarily reflects the fact that they were artificially infested in the fall of 1994. The small number of CFU in noninfested plots probably reflects the presence of *V. dahliae* which already existed in the soil and which is not pathogenic to mint

The data suggest that, by mid-summer of 1997, soil populations of MS increased disproportionately higher on Black Mitcham than on other varieties.

Hay yield, oil yield and wilt strikes for 1995 through 1997 are graphed in Figures 1, 2 and 3. Inoculum recovery for 1997 is graphed in Figure 4. The pattern of wilt strikes per variety in each year is remarkably similar to that of inoculum recovery. It seems a reasonable assumption that inoculum did not change in Black Mitcham plots until tillage in the fall of 1996, based on the relative similarity in wilt incidence among varieties in 1995 and 1996. These data suggest that inoculum builds up more rapidly with Black Mitcham than other varieties, but that Black Mitcham is not more inherently susceptible to wilt than other varieties.

Discussion

Wilt levels in 1995 and 1996 were comparable among all varieties. We had anticipated much higher wilt in Black Mitcham in 1995 and 1996, but this simply did not occur. In 1997, after tillage and no propane flaming, great differences in wilt did develop in infested Black Mitcham plots compared to infested plots of all other varieties. These data suggest that Black Mitcham serves to reproduce MS more than do other varieties, but this hypothesis needs to be further tested. If true, there are implications for following Black Mitcham with other varieties after Black Mitcham has "wilted out". The other varieties likely will do no better than Black Mitcham under these conditions. In other words, other varieties really are not more tolerant of wilt. Further, these data suggest that inoculum management by propane flaming without tillage, or other means, needs serious consideration, rather than depending upon so-called varietal tolerance. In new production regions, growers should consider converting from Black Mitcham to other varieties before much wilt is present.

In past years, we noted that Black Mitcham used water differently than other varieties. Common irrigation of all varieties resulted in either over watering of Black Mitcham as in 1996 (which possibly contributed to enhanced lodging and reduced wilt symptoms), or under watering of other varieties as in 1995 (which is reflected in lack of lodging, water stress and early maturity, less new leaf development near harvest, over maturity of oil, premature leaf drop and reduce yield, and possibly greater wilt symptoms). In 1997, we tended to over water as we did in 1996.

Literature Cited

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Acknowledgments

This research supported in 1997 by a grant of \$7,000 from Oregon Mint Commission and the Mint Industry Research Council

Table 1. Peppermint variety trial harvest data, 1997, OSU-COARC Madras¹

Treatments	Wilt Strikes per 200 ft 8/12/97	Lodging % of plot 8/1/97	Fresh Hay Wt (lb/Ac)/1,000 8/13/97	Oil Yield lb/Ac 8/13/97
Non-infested ²				
Murray	0 a ²	44 a	23.6	75
Todd	0 a	48 a	24.6	78
Black Mitcham	1 b	81 b	20.5	64
Roberts	0 a	61 ab	22.4	72
M83-7	0 a	54 a	25.1	76
T84-5	0 a	46 a	24.0	73
(MEAN	0	55.8	23.5	73
Infested ²				
Murray	36 a	4 a	19.8	63
Todd	45 a	5 a	19.8	65
Black Mitcham	197 b	31 b	13.8	65
Roberts	52 a	1 a	15.8	65
M83-7	27 a	1 a	17.4	67
T84-5	31 a	3 a	17.3	52
(MEAN	64	7.5	17.3	63

¹ Trial was planted from rooted cuttings in 1994; 1997 was third harvest year. Experimental design was a randomized split plot, with half of the trial area artificially and uniformly infested with approx. 2 microsclerotia/g soil of *V. dahliae*, and the other half noninfested. There were 4 replications of each variety within each split plot. Because non-infested plots were flamed, and Infested plots were tilled, they were treated as two independent trials in 1997

with respect to statistical analysis; no infestation interaction analyses were performed.

² Means with letters in common are not statistically different (P<5%).

Table 2. Inoculum density estimates for *Verticillium dahliae* in August, 1997, from the mint variety trial at Madras OR¹.

Variety	Non-Infested	Infested
Murray	0	4.3 a ²
Todds	0.1	2.7 a
Bl. Mitcham	0.2	18.1 b
Roberts	0.1	5.0 a
M83-7	0.1	2.4 a
T84-5	0	4.0 a

Plots were uniformly infested with (calculated) 2 nnicrosclerotia/g soil in 1994. Plots were flamed and not tilled in 1995, but were tilled in the fall of 1996 without post-harvest flaming in 1996.

² Means with letters in common are not statistically different (P<5%).

Fig 1. Fresh Hay Yield (Infested Plots)

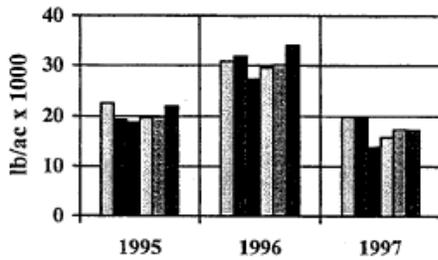


Fig 2. Oil Yield (Infested Plots)

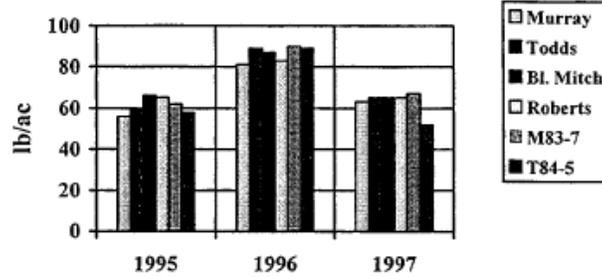


Fig 3 Wilt Strikes at Harvest (Infested Plots)

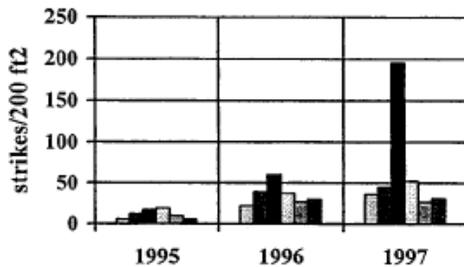


Fig 4 CFU/g Soil Recovered at Harvest (All Plots)

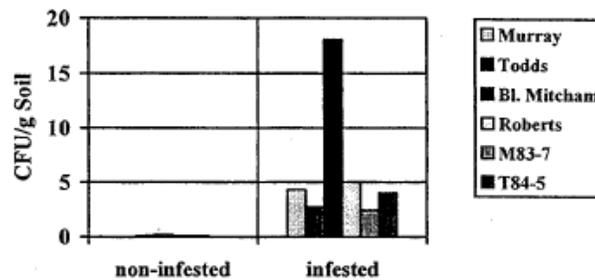


Fig. 1. Mint variety trial data, 1995-1997, at Madras OR.

¹ Mean hay weight for plots uniformly infested with *V. dahliae* in 1994. No statistical differences were found within each year ($P < 5\%$).

² Mean oil yield for plots uniformly infested with *V. dahliae* in 1994. No statistical differences were found within each year ($P < 5\%$).

³ Mean wilt strikes at harvest for plot uniformly infested with *V. dahliae* in 1994. No statistical differences were found among varieties in 1995 or 1996 ($P < 5\%$). In 1997, significantly more wilt strikes were found in plots with Black Mitcham than in other varieties ($P < 5\%$). The infested trial was tilled following harvest in 1996.

⁴ Mean colony forming units (CFU) of *V. dahliae* recovered from varieties in infested and non-infested trial areas in 1997. More wilt strikes were found in plots with Black Mitcham than in other varieties ($P < 5\%$). The infested trial was tilled after harvest, 1996.