'Schmidt' sweet cherries without stems would seemingly be enhanced by preharvest treatment of the fruit with ethephon since there was a reduction in physical damage caused by removing the stems. Better means for decay control, however, would have to be utilized. The acceptance of such practices as continuous refrigeration during the marketing period, for example, might justify the further evaluation of ethephon as an aid to the fresh marketing of stem-less cherries.

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Influence of Mulch on Residue Accumulation and on Injury to 'Richhaven' Peach trees from 2,6-Dichlorobenzonitrile (Dichlobenil)[1]

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Abstract. **Hay mulch applied only the year of planting under 'Richhaven' peach trees reduced foliar injury following annual applications of dichlobenil. Dichlobenil residues were greater than those of its breakdown product, 2,6-dichlorobenzamide (BAM), in mulch and at 0-15 cm soil depth under mulch. Mulch did not reduce amount of dichlobenil in soil. Only dichlobenil at 13.44 kg/ha, twice the rate labeled for usage under fruit trees, applied on mulch residue partially prevented an influx of annual weeds.**

We reported previously that simazine accumulated in the hay mulch under apple trees (5). As a consequence, the residue in the soil under the mulch was less than when simazine was applied on non-mulched soil. Hay mulch could be a practical means for the reduction of herbicide phytotoxicity to young fruit trees from a pre-emergence herbicide such as dichlobenil. Dichlobenil adsorbs tightly on certain organic materials (7, 8), has low water solubility (1) and in general does not move rapidly in soil (2, 8). Benyon and Wright (2) found that BAM is formed after application of dichlobenil and its residues in several soils were generally greater than those of the dichlobenil, except in peat. Since the organic matter content of hay residues is high, it was of interest to determine dichlobenil and BAM residues both in mulch and soil.

'Richhaven' peach trees planted in April, 1968 in Scituate sandy loam (organic matter – 4.9%; sand – 61%; silt – 30%; clay – 8%; pH – 6.2%) at the Horticultural Research Center, Belchertown, Mass., were selected for the study. All trees were mulched with 4 bales of hay (approx 72 kg) spread over a circular area extending 2.13 m from the tree trunk to maintain a similar soil management system until establishment of treatments. No more mulch was applied for the remainder of the experiment. Eight single-tree replications of the following treatments were established in Nov., 1968: (A) hay mulch applied only at planting; (B) cultivation annually in May and July; (C) 4% granular dichlobenil applied at 6.72 kg active ingredient per ha (ai/ha) on non-mulched soil; (D) dichlobenil at 13.44 kg ai/ha on non-mulched soil; (E) dichlobenil applied on mulch at 6.72 kg ai/ha, and (F) dichlobenil applied on mulch at 13.44 kg ai/ha. The mulch was removed prior to establishment of treatments B, C, and D. Dichlobenil was applied in mid-Nov., 1968-72.

Mulch and soil samples were obtained under 6 of the single-tree replications in treatment F and soil samples from 6 of the trees in treatment D in late Oct., 1970, and 1972, to determine dichlobenil and BAM residues. A different area under the trees was selected on each date to insure sampling of undisturbed soil or mulch. A soil sampling tube was thrust vertically into the soil to a depth of 30 cm. This was done a sufficient number of times to obtain 0.95 liter samples from the 0-15 and 15-30 cm soil depths under mulched and non-mulched trees. The mulch and soil samples were analyzed by Thompson-Hayward Chemical Company, Kansas City, KS.

Leaf phytoxicity. Foliar phytotoxicity symptoms, characterized by leaf margin yellowing (LMY) and leaf tip burn, resulted from dichlobenil applications both at the rate labeled for usage under peach trees (6.72 kg/ha) and double that rate (Table 1). The hay mulch application of May, 1968, prevented foliar injury in 1969, but was increasingly less effective from 1970 through 1973. In 1972, LMY appeared later and was less severe than in 1971 and 1973 (Table 1). Annual variation in the occurrence of LMY has been reported by others (4).

Dichlobenil and BAM residues. Mulch residues adsorbed dichlobenil (Table 2) and probably delayed the formation of BAM, the causative agent of LMY (4). Otherwise, BAM which a very water-soluble and weakly adsorbed by soil (4) should have been equally available to tree roots and caused equally severe foliar phytotoxicity on trees in mulched and non-mulched soil since the hay decomposed rapidly and consisted of a layer 2.54 cm or less thickness by spring, 1970.

Contrary to the findings of Beynon and Wright with several soils (2), dichlobenil residues were greater than

Table 1. Foliar phytotoxicity on terminal shoots of 'Richhaven' peach trees following dichlobenil usage.

Treat.	Dichlobenil[z] placement and rate (kg ai/ha)	% leaves showing injury in late August[y] 1969	1970	1971	1972	1973
C	On non-mulched soil, 6.72	30b[x]	69b	78a	15bc	50b
E	On mulched soil, 6.72	0c	18c	47b	8c	30b
D	On non-mulched soil, 13.44	69a	94a	94a	70a	97a
F	On mulched soil, 13.44	0c	53b	81a	29b	91a

[z]Dichlobenil applied annually in mid-Nov. for 5 consecutive years starting in 1968; 8 single-tree replications.
[y]3 shoots per tree.
[x]Mean separation, within columns, by Duncan's multiple range test, 5% level.

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those of BAM in mulch and at 0-15 cm soil depth under mulch (Table 2). Variable results seem expectable, however, since physical and biological conditions of the soil would affect dichlobenil degradation and varying rainfall would influence leaching.

The dichlobenil residue in the mulch and soil both years and the BAM residue in 1972, varied so greatly that a heterogeneity of errors was judged to exist; therefore, as suggested by Cochran and Cox (3), the mulch treatment was omitted in a second analysis of the data in Table 2. This analysis showed that more dichlobenil and BAM were present at 0-15 cm soil depth than at 15-30 cm depth; mulch had significant influences on residues, but these influences varied with years. Less dichlobenil was present in the non-mulched 0-15 cm soil layer than the mulched 0-15 cm layer in 1972, but not in 1970. Conversely, higher amounts of BAM were present in the 0-15 cm non-mulched layer of soil than the mulched 0-15 cm layer in 1970, but not in 1972. The concn of dichlobenil found in 0-15 cm soil depths are in the range found detrimental to greenhouse-grown M.9 apple rootstocks (6). The residual accumulation of dichlobenil and BAM in mulch (Table 2) likely explains the reduced LMY on trees where dichlobenil was applied on mulched rather than on non-mulched soil (Table 1). However, herbicide residues accumulated in soil under mulch with time (Table 2), and this was reflected by increasing LMY appearing on mulched trees in 1970 through 1973 (Table 1). This accumulation in the soil may have been due to mulch decomposition and/or leaching of dichlobenil and BAM from the mulch. Since mulch is readily available to many orchardists, its use under newly-planted fruit trees may be a practical means of reducing the risk of herbicide phytotoxicity but periodic applications of mulch appears necessary to retain this beneficial effect.

Weed control. The single application of mulch in 1968 was of little or no value for weed control (Table 3), due mainly to reinfestation by quackgrass (*Agropyron repens* (L.) Beauv). Several annual weeds, especially smooth crabgrass (*Digitaria ischaemum* (Schrib.) Muhl), barnyard grass (*Echinochloa crusgalli* (L) Beauv), witchgrass (*Stirga lutea* Lour.), and the perennial quackgrass invaded the cultivated and herbicide-treated areas. From April through July in 1969, 1970 and 1971, 39, 28 and 35 cm of rain fell, respectively. During the same periods in 1972 and 1973, there were 58 and 55 cm of rain, respectively. During these latter 2 years, only 13.44 kg/ha of dichlobenil, twice the rate labeled for use under fruit trees, applied on mulch appreciably prevented an influx of annual weeds and quackgrass (Table 3).

Table 2. The persistence of 2,6-dichlorobenzonitrile (dichlobenil) and 2,6-dichlorobenzamide (BAM) in hay mulch, and the soil under the mulch, and in non-mulched soil.

Treat.	Substance analyzed	Ppm (oven-dried basis)[z] Oct. 28, 1970 Dichlobenil	Oct. 28, 1970 BAM	Oct. 27, 1972 Dichlobenil	Oct. 27, 1972 BAM
F	Mulch	6.22a[y]	0.47a	7.20a	1.48a
F	Soil under mulch, 0-15 cm depth	0.64b	0.27b	0.76b	0.29b
F	Soil under mulch, 15-30 cm depth	0.12b	0.08c	0.16b	0.13b
D	Non-mulched soil, 0-15 cm depth	0.55b	0.58a	0.41b	0.33b
D	Non-mulched soil, 15-30 cm depth	0.23b	0.26b	0.04b	0.16b

[z]Dichlobenil applied at rate of 13.44 kg ai/ha in mid-Nov., 1968-71.

[y]Mean separation, within columns, by Duncan's multiple range test, 5%.

Table 3. Effects of soil management practices on weed control under 'Richhaven' peach trees planted in 1968.

Treat.	Dichlobenil placement[z] and rate (kg ai/ha)	Weed control in mid-August (%) 1969	1970	1971	1972	1973
A	Mulched control	16d[y]	7d	3e	-[x]	-[x]
B	Cultivated control	95a	56c	45d	7c	2c
C	On non-mulched soil, 6.72	44c	54c	50cd	9c	3c
D	On non-mulched soil, 13.44	83b	81a	77b	29b	8bc
E	On mulched soil, 6.72	53c	68b	61c	9c	13b
F	On mulched soil, 13.44	91ab	90a	94a	60a	44a

[z]8 single-tree replications.

[y]Mean separation, within columns, by Duncan's multiple range test, 5% level.

[x]Since the effectiveness of mulch for control of weeds had disappeared, the data were not included in the statistical analysis.

Tree performance. For the first 3 years of the experiment, there was no growth or yield difference among treatments with the exception of the mulch treatment (A). The mulched trees produced significantly less vegetative growth in 1970 and 1971 and had the least yield in 1971.

Limb breakage and the presence of weak limbs invalidated the growth and yield data after the 1971 growing season. This was unfortunate since leaves on the trees receiving either 6.72 or 13.44 kg/ha dichlobenil on non-mulched soil (Treatments C and D) had interveinal chlorosis and brown tattered leaf margins. Some of the more severely injured leaves dropped in early Sept.

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