APRC Project Report

Project SP77	Orchard soil management (including requirements for Integrated Fruit Production [IFP])
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Background

The project contains two field trials that have continued from the previous funding period 1994-97. The first compares suitable alternatives to residual herbicides for controlling competition by weeds in an apple orchard (named Trial 4 in previous reports). A second trial (named Trial 6 in previous reports), investigates the effects of previous soil herbicide management on the growth of apple trees. This report includes results obtained or analyzed during the period March 1997 - September 1997.

Alternatives to residual herbicides for controlling weed competition in an apple orchard

This trial investigates the use of plastic mulch, organic (straw) mulch and non-residual herbicides (glufosinate ammonium) as alternatives to residual herbicide (simazine) in a Bramley/M.9 orchard (3 m x 5 m spacing) planted in 1992. All treatments were applied with or without irrigation. Glufosinate ammonium was applied on 9 May and 17 July 1997 at 5 l/ha. The plastic and straw mulch treatments received spot treatments on these dates. No simazine was applied this year to the residual herbicide treatment, but glufosinate ammonium was applied on 21 July 1997 to suppress newly emerged summer weeds. Assessments of weed populations were made on 29 April and 7 July 1997 (Table 1). Graminaceous and non-graminaceous weed cover were low in the plots under plastic and straw mulches. The plots which received non-residual herbicide had a high infestation of grass whereas those plots which received residual herbicide were not affected. The predominant weeds in the plots, which received residual herbicide were groundsel and annual nettle.

The growing season was exceptional due to a severe frost on 21 April. The orchard floor management influenced the temperature within the branch framework of the trees. The temperature remained 1ºC lower for two hours longer in the straw mulch and non-residuall herbicide treatments than in the residual herbicide and plastic mulch treatments (Figure 1). However, this was of little importance because during the frost period the blossom of all trees remained below 0ºC for several hours; this resulted in extensive blossom damage in all treatments. A second frost occurred on 7 May (Figure 2) and again this showed the effects of weed cover (particularly grass) on temperature depression in the branch framework of the tree.

Most of the fruit that set were on secondary blossom that developed after the initial frost damage. The number of floral buds were counted prior to the frost (Table 2), but the fruit set cannot be directly related to these numbers because most of these buds were destroyed in the frost. The fruit from the secondary blossom sized up well, but yields remained low. Trees growing in the non-residual herbicide-treated soil had the lowest yield, probably due to poorer weed control during the season. Non-residual herbicide applications were made after the weeds became well established; earlier control would be more beneficial.

Leaf samples were taken in August and fruit samples were taken at harvest for mineral analysis. The fruit was graded to commercial standards and assessments of colour, starch, sugar and firmness were made at harvest. Further fruit samples were put into controlled atmosphere cold store to determine quality after storage.

Soil solution samples were taken regularly for analysis of nitrate concentration and soil water potential was measured with tensiometers. Results from these measurements will be presented in the next report.

Effects of previous herbicide management on the growth of a newly planted apple orchard

This trial investigates the effects of previous herbicide management on the growth, fruit yield and eating quality of Royal Gala/M.9 apple trees (2 m x 3.25 m spacing). The trees were planted in February 1996 on a site that had been previously under grass or herbicide-treated for 20 years. Remedial treatments originally tested include different rates of nitrogen fertiliser (calcium nitrate) at 0, 20, 40, 60 g N/tree, trickle irrigation and use of potting compost. This year the application of nitrogen fertiliser was doubled for all treatments so the application rates were 0, 40, 80, 120 g N/tree respectively (equivalent to 57, 114, 171 kg N/ha)

Irrigation increased initial fruit set from 13 to 19 fruitlets/tree. All the other treatments including the previous management of the plots had no effect. To enhance canopy growth the fruitlets were removed following fruit set so harvest yield data are not available.

Soil samples were taken for analysis of available nitrogen on 20 June and 28 July (Table 3). The greater soil fertility of soil previously under grass was reflected by a two to three times greater availability of nitrogen in this soil. A further set of samples was taken on 8 August and will be analysed later.

Leaf samples were taken in August for mineral analysis, girth and shoot extension will be measured during the winter.

Figure 1 Air temperature adjacent to fruit buds 60 cm above soil surface

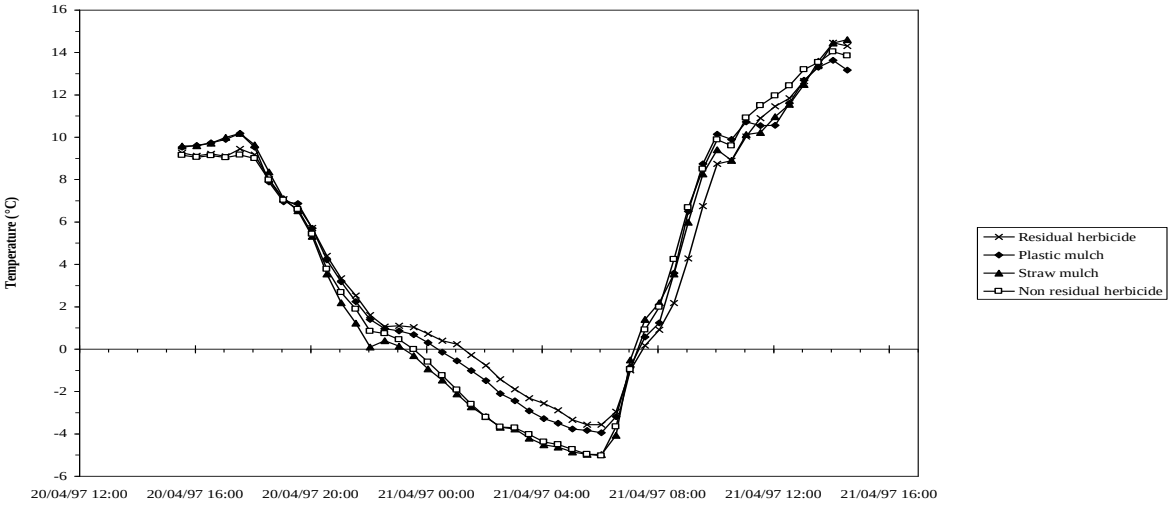

Figure 2 Air temperature in branch framework 60 cm above soil surface

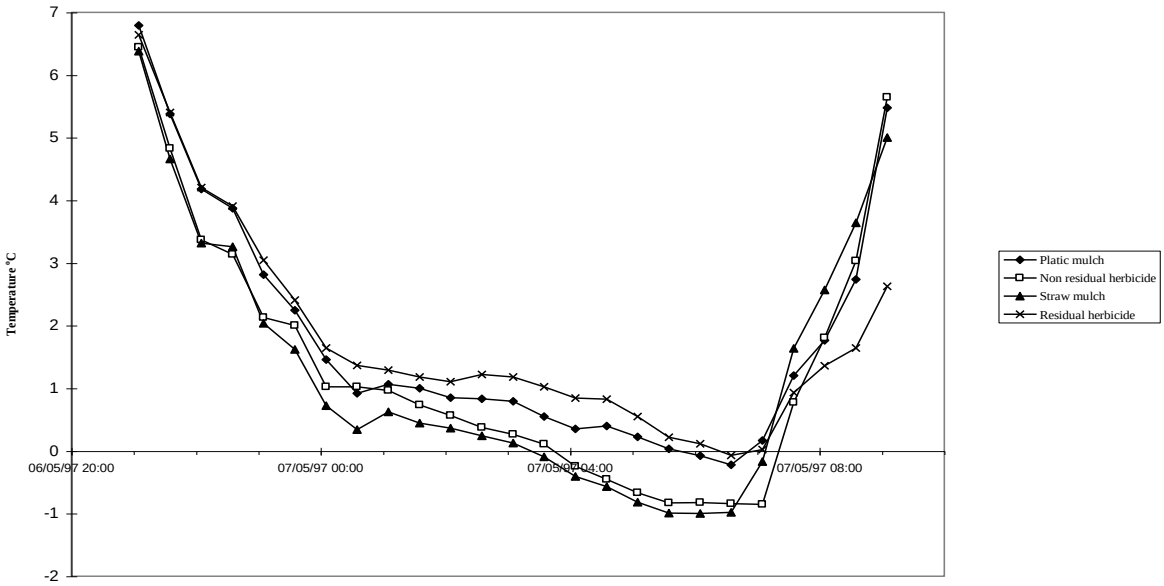

Table 2. The main effects of soil management treatments on the number of fruit buds and final set in spur and terminal positions per tree and harvest yield of Bramley/M.9 in 1997

	Fruit levels	Fruit set	Harvest yield (kg)
Non-residual herbicide	80	14	7.99
Residual herbicide	105	22	11.69
Plastic mulch	92	24	9.78
Straw mulch	98	16	10.46
Statistical significance	ns	ns	*

ns = not statistically significant
* = statistically significant

Table 3. The effect of previous herbicide management on extractable nitrate concentration in soil at 0-30 cm depth (μg N/g soil)

Date	Previously grass	Previously herbicide	Statistical significance
20/6/97	20	9	**
28/7/97	10	3	**

** = highly statistically significant