BLACK POLYTHENE MULCHES AS AN AID IN FIELD PROPAGATION OF HARDWOOD CUTTINGS

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Abstract. The response of *Salix* and *Populus* hardwood cuttings to mulching with black polythene during field propagation was studied. The effect of the mulch was to suppress weed growth, increase soil temperature, and conserve soil moisture, as compared with a non-mulched control. Results of trials in 1982 and 1983 demonstrated an increase in growth with both species due to mulching.

Work at Long Ashton Research Station from 1973 to 1975 (1,2,3) has demonstrated the benefits of polythene mulches for strawberry cultivation. Mulching produced larger plants, with more runners, which flowered and fruited earlier than the non-mulched controls. The number and weight of fruit were higher from mulched plots. Comparisons between clear and black polythene showed that clear polythene produced a greater growth response than black polythene. Clear polythene, however, did not surpress weed growth, and subsequent weed seed germination lifted the mulch.

Recent work at East Malling Research Station (4,5) has investigated the effect of polythene film on soil temperatures beneath maiden fruit trees. Materials studied included black polythene, perforated black polythene, and reflective polythene. A black polythene mulch increased soil temperatures by about 2°C in the early part of the season, the reflective polythene reduced soil temperatures by 6°C at 5cm depth and 3°C at 20 cm depth.

The objective of the experiments reported in this paper are to ascertain the advantages and disadvantages of using a black polythene mulch in the field propagation of hardwood cuttings and to determine whether the use of a mulch would aid rooting establishment and growth.

MATERIALS AND METHODS

In the first trial (1981-82) hardwood cuttings of *Salix viminalis*, *Salix fragilis* 'Basfordiana', *Salix alba* 'Lancashire Dicks', *Populus trichocarpa* × *P. balsamifera* 'Clone 32', *Populus* × robusta, and Populus nigra 'Vereekens' were collected in late November, 1981. All cuttings were graded by weight into three categories, 0-15 g, 16-30 g, and 31-45 g. The base of each cutting was dipped for 5 seconds in an indolebutyric acid solution of 2500 ppm and allowed to dry before insertion. Cuttings were struck in beds 1 m wide, with 0.5 m between

the rows and 0.05 m between cuttings within the row, giving a density of 60 cuttings/m^2. Half of the beds were covered with 200 gauge black polythene which was laid by hand and the cuttings were pushed through the polythene. For each weight grade there were 3 replicates, each of 20 cuttings, with and without black polythene, arranged in a randomised block design.

In the 1982-83 experiment the materials and methods were identical to the first, except that the cuttings were not graded by weight and the collection of cuttings was delayed until mid-February. Soil temperature and moisture deficit were monitored.

RESULTS

The height of the main shoot at the end of each growing season is shown in Table 1 (1981-82 experiment) and Table 2 (1982-83 experiment). In both trials the use of a black polythene mulch encouraged the growth of all species and all weight grades. Failure to grade cuttings for the second trial increased variation in the analysis of that experiment.

Table 1. Height of shoots from mulched and non-mulched treatments (1981-82).

	Height of main shoot (cm)						
	Mulched			Non-mulched			
Cutting weight (g)	0-15	16-30	31-45	0-15	16-30	31-45	Mean
Species							
Salix viminalis	105	106	102	84	88	98	97
S. *fragilis* 'Basfordiana'	72	85	87	59	57	55	69
S. alba 'Lancashire Dicks'	76	70	75	56	50	51	63
Populus nigra 'Vereekens'	31	37	35	27	27	28	31
P. × *robusta*	40	38	34	30	30	30	34
Populus 'Clone 32'	49	52	48	46	44	47	48
Mean	62	65	64	50	49	52	—
S E. species, 2.46							
S.E. treatment, 1.42							
S.E. weight, 1.94							

Establishment figures for both trials are shown in Table 3. Despite increased extension growth resulting from the use of black polythene mulch the establishment figures were lower where mulching had been used, but differences between treatments are slight.

Cuttings were monitored for bud development in March-April. There was little difference in the date of 50% bud break between mulched and non-mulched treatments although there was a distinct trend for mulched plots to break bud earlier.

Table 2. Height of shoots from mulched and non-mulched treatments (1982-83).

Species	Height of main-shoot (cm)		
	Mulched	Non-mulched	Mean
Salix viminalis	106.9	101.7	104.3
S. fragilis 'Basfordiana'	77.2	57.4	67.3
S. alba 'Lancashire Dicks'	87.2	69.8	78.5
Populus nigra 'Vereekens'	62.3	51.3	56.8
P. × robusta	54.5	48.6	51.6
Populus 'Clone 32'	80.9	66.2	73.6
Mean	78.2	65.8	—
S.E. species, 38.6			
S E treatment, 22.3			

Table 3. Percentage establishment of cuttings from mulched and non-mulched plots for both 1981 and 1982 experiments.

Species	Percentage establishment			
	Mulched		Non-mulched	
	81-82	82-83	81-82	82-83
Salix viminalis	97.8%	97.7%	98.9%	100.0%
S. fragilis 'Basfordiana'	95.0	93.7	100.0	99.3
S. alba 'Lancashire Dicks'	63.3	85.0	81.0	90.0
Populus nigra 'Vereekens'	82.2	98.0	79.4	100.0
P. × robusta	83.8	96.3	83.8	100.0
Populus 'Clone 32'	95.0	95.7	98.9	99.3
Mean	96.0	94.4	90.3	98.1

Results for the 1982-83 experiment are shown in Table 4.

Table 4. Date of 50% bud break on cutting material for 1982-83 experiment.

Species	Date of 50% bud break	
	Mulched 82-83	Non-mulched 82-83
Salix viminalis	Mar. 19	Mar. 19
S. fragilis 'Basfordiana'	Apr. 2	Apr. 8
S. alba 'Lancashire Dicks'	Mar. 24	Mar. 25
Populus nigra 'Vereekens'	Apr. 11	Apr. 12
P. × robusta	Apr. 11	Apr. 12
Populus 'Clone 32'	Mar. 23	Mar. 24

Records of soil temperature were taken during experiments. In the 1981-82 trial temperature was measured between May and August whereas in the 1982-83 trial the soil temperature was measured from March to October. Figure 1 shows the mean monthly soil temperature for both experiments. The soil temperature in 1983 was consistently higher under the mulch especially during the early part of the season.

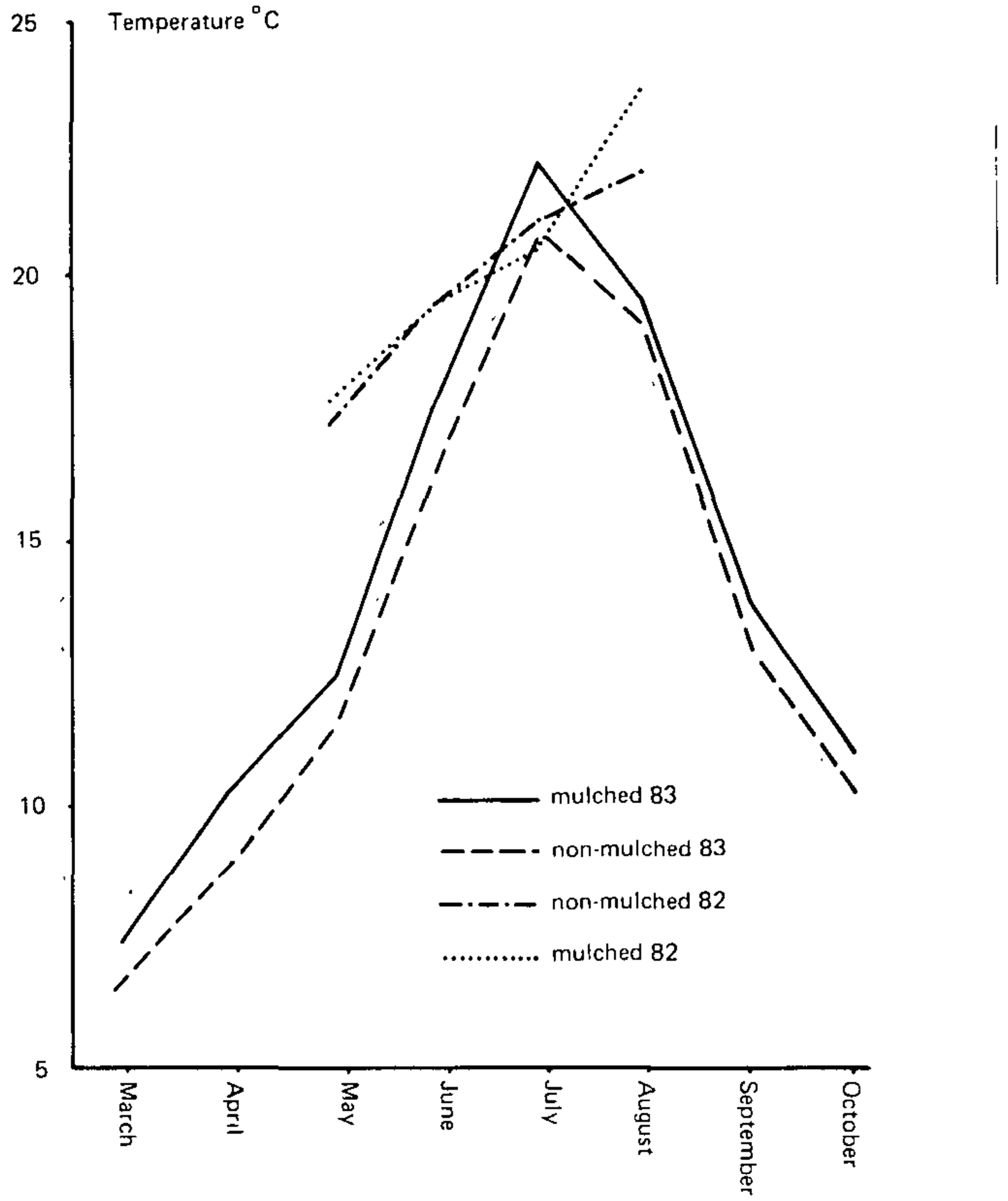

Figure 1. Mean soil temperatures for each month for mulched and non-mulched treatments for both 1982 and 1983 trials.

In the 1982-83 trial the soil moisture was measured in mulched and non-mulched plots using a soil moisture tensiometer. Results of the determinations are shown in Table 5.

Table 5. Soil moisture deficit for 1982-83 experiment expressed as centibars of soil suction.

	Average soil moisture deficit (centibars of soil suction)	
Month	Mulched	Non-mulched
March	6.3	5.9
April	4.5	3.7
May	2.5	1.9
June	3.2	4.3
July	16.8	18.7
August	60.7	50.7
September	51.3	44.5
October	9.2	5.0

During March to May, 1983, the season was particularly wet and non-mulched plots were considerably wetter than mulched plots. This was reversed in June and July when mulched plots were more moist than non-mulched plots; from August to October mulched plots were again drier.

DISCUSSION

Both experiments showed that insertion of hardwood cuttings of *Salix* and *Populus* through a black polythene mulch gave improved shoot extension growth. This is in agreement with work at East Malling Research Station (4,5) which showed that shoot length of maiden fruit trees was increased by 28% when grown with a polythene mulch.

Suppression of weed growth should assist in the establishment and growth of cuttings; however, the non-mulched plots were maintained in a weed free condition by hand-weeding and consequently improved growth cannot be due entirely to lack of weed competition. It is more likely that the improved growth is as a result of higher soil temperature and conservation of moisture, as indicated in the results of the monitoring programme. The tendency for the black polythene to reduce infiltration of water during periods of high rainfall could lead to problems during prolonged dry spells, particularly if lateral movement of water in the soil is limited either by the nature of the soil structure or the polythene skirt which is buried to provide anchorage.

Whilst the use of clear polythene may give an improved response, compared to black polythene, as was the case for strawberries at Long Ashton (1,2,3), the problem of weed competition requires a residual herbicide programme. Although the black polythene did suppress weed growth, occasional weeds appeared where the polythene had become torn around the base of cuttings.

Initial attempts to lay the polythene mulch underlined the importance of keeping the mulch taut across the bed. Loose polythene which flapped in the wind had a damaging effect on the emergent buds. Direct insertion of the cuttings by pushing them through the polythene can loosen the mulch. This can be overcome by use of polythene with planting holes already in it or by puncturing the polythene *in situ* with a sharp instrument rather than a blunt-ended cutting.

Although the polythene in both experiments was laid by hand, it is feasible to lay the polythene using a tractor-mounted machine which has a capital cost of between £500-600. The comparative cost of some of the plastic mulches is shown in Table 6. It should be noted that the list of products is not

exhaustive and serves only as a guide of the relative costs involved.

Table 6. Comparative cost of different mulching materials.

Product	Roll width*	Roll length	Useable area	No of rolls	Cost	Cost	Cost	Gauge
	m	m	m^2	/ha	£/roll	£/ha	£/m^2	
BCL polythene	1.225	150	150	67	12.90	864	0.09	200
BCL polythene	1.325	150	150	67	14.00	938	0.09	200
ICI mulch	1 300	200	200	50	14.95	748	0.07	150
Polycrop blanket	1.330	600	600	17	66 00	1122	0.11	—

* It is assumed that additional breadth will be used for anchorage. BCL = British Cellophane Ltd; ICI = Imperial Chemical Industries.

The approximate cost of Simazine applied at 1.1 kg/ha would be in the region of £12/ha which is less than the cost of the polythene. The cost of a polythene mulch per plant becomes progressively more expensive as the density of cuttings is decreased.

In conclusion, the use of black polythene mulch improves the growing environment of cuttings and does promote additional growth. When production is carried out on a large scale the mechanisation of the technique may prove too costly at present but the technique has considerable advantages for propagation and the production of difficult species.

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