CONFIDENTIAL*

2.10 EFFECT OF ROTATIONAL CULTIVATIONS ON WEED BEET, 1986

NAS 203/2 ML
6th year

Summary

In a long term cultivation experiment comparing ploughing, tine cultivation and direct drilling, large numbers of weed beet seed were sown immediately after a sugar beet crop was harvested in 1980. Emergence of weed beet has been studied in a three year rotation of sugar beet, winter wheat, winter wheat.

Relatively few weed beet plants emerged in 1986 and there was no significant difference between treatments. This investigation is now complete.

Object

Ploughing, tine cultivation or direct drilling have been compared on main plots for two cereal crops, whilst ploughing, tine cultivation or strip tillage for sugar beet have been compared on sub plots within each main plot in a long term cultivation experiment (NAS 203/1 ML) started in 1975 and with the detailed comparison completed in 1985.

The object of the subsidiary investigation (NAS 203/2 ML), started in 1981, has been to study the emergence of weed beet within the main NAS 203/1 trial following the scattering of large numbers of weed beet seed immediately after harvesting a sugar beet crop in 1980.

Treatments and method

"Existing" cultivations trial

1. Main plots for cereals in 1975, 1976, 1978, 1979, 1981, 1982, 1984 and 1985

   (a) Traditional - conventional plough
   (b) Minimal - tine cultivation
   (c) Direct drill

2. Sub plots for sugar beet in 1977, 1980, 1983 and 1986

   (a) Traditional - conventional plough
   (b) Minimal - tine cultivation
   (c) Strip tillage

*NOT FOR PUBLICATION WITHOUT THE DIRECTOR'S CONSENT. This report deals primarily with only one year's work, so any conclusions given are only provisional.

Mini plots (4 m^2) of weed beet seed were sown on sub plots immediately after the 1980 sugar beet crop was harvested. With three replicates of the cultivation treatments in sugar beet, 27 of these mini plots were established. Approximately 5000 viable weed beet seed/m^2 were sown.

Winter wheat was harvested on 30 August 1985. The appropriate cultivations were carried out and Amethyst sugar beet seed was drilled on 2 May 1986.

To allow for dispersal of some seed from the edges of each mini plot during subsequent cultivations, the numbers of weed beet in a 1 m^2 quadrat at the centre of each of the 4 m^2 plots were counted on 24 June and 1 August.

Results and discussion

In 1986, some weed beet plants had emerged by 24 June, with further plants emerging by 1 August.

Weed beet populations (total plants/m^2)
(Data in brackets are % of seeds sown)

Method of cultivation for 1985 W wheat crop	Method of cultivation for 1986 beet crop Traditional	Minimal	Strip tillage	Mean
(ESE)		(±2.457 VI)	(±1.902 H)*	(±1.419)
Traditional	6.33	3.67	1.33	3.78 (0.08)
Minimal	4.67	2.67	4.33	3.89 (0.08)
Direct drill	2.33	0.67	2.00	1.67 (0.03)
(ESE)		(±1.098)		
Mean	4.44 (0.09)	2.33 (0.05)	2.56 (0.05)	
S.E. per plot (12 d.f.) = ±3.294 or 105.9% of G.M.				

* H = standard error for comparing results at the same level of cultivation treatment in 1985 (i.e. horizontal lines)
VI = standard error for comparing all cultivation treatments except those at the same level of cultivation treatment in 1985.

There was no significant difference between treatments in the numbers of weed beet plants which emerged in 1986. Numbers which emerged were slightly higher than in 1984 whilst no weed beet emerged in 1985. These numbers were still only a small proportion of the seeds sown in 1980 (treatment means 0.09% or lower). There may have been a considerable decline in viability (due to predators or the herbicides used etc) and the seed burden may be almost exhausted. However even this low level of emergence needs to be controlled since 5,000 seeds could easily be shed by three weed beet plants/m^2. Monitoring of weed beet emergence on this site has now ceased.

Summary 1981-1986

Patterns of weed beet emergence since this trial started are presented below.

1981-1982

Weed beet populations (plants/m^2)
(Data in brackets are % of seeds sown)

Method of cultivation for winter wheat crop	In wheat 1981	In wheat 1982
Traditional	0	14.7 (0.29)
Minimal	30.8 (0.62)	23.0 (0.46)
Direct drill	115.1 (2.30)	27.7 (0.55)

In 1981, conventional ploughing had effectively buried the weed beet seed, with none emerging in this first winter wheat crop. In contrast, a relatively large number of weed beet seed emerged after direct drilling, with tine cultivation being intermediate, but these were only a small proportion of the seed sown. There was generally a more even emergence of weed beet in 1982.

1983

Method of cultivation for 1982 W wheat crop	Method of cultivation for 1983 beet crop: Traditional	Minimal	Strip tillage	Mean
(ESE)		(±4.86 VI) (±4.50 H)*		(±3.18)
Traditional	20.0	14.0	12.0	15.3 (0.31)
Minimal	11.0	26.3	11.7	16.3 (0.33)
Direct drill	0	15.7	11.3	9.0 (0.18)
(ESE)		(±2.60)		
Mean	10.3 (0.21)	18.7 (0.37)	11.7 (0.23)	

* H = standard error for comparing results at the same level of cultivation treatment in 1982 (i.e. horizontal lines)
VI = standard error for comparing all cultivation treatments except those at the same level of cultivation treatment in 1982.

In 1983, the average total numbers of weed beet emerged after conventional ploughing, minimal cultivations and strip tillage were 10.3, 18.7 and 11.7 plants/m^2 respectively. It is interesting to note that where two winter wheat crops were grown after direct drilling and the following sugar beet crop was grown after conventional ploughing, no weed beet emerged in that sugar beet crop.

1984

Method of cultivation for 1984 W wheat crop	Method of cultivation for 1983 beet crop Traditional	Minimal	Strip tillage	Mean
(ESE)		(±0.632 VI)	(±0.629 H)*	(±0.368)
Traditional	1.00	0.33	2.33	1.22 /0.02/
Minimal	0.33	0.67	4.00	1.67 /0.03/
Direct drill	0	0.33	1.00	0.44 /0.01/
(ESE) Mean	0.44 /0.01/	(±0.363) 0.44 /0.01/	2.44 /0.05/	

* H = standard error for comparing results at the same level of cultivation treatment in 1984 (i.e. horizontal lines)
VI = standard error for comparing all cultivation treatments except those at the same level of cultivation treatment in 1984.

Where the previous sugar beet crop was grown after strip tillage, significantly more weed beet emerged in the 1984 wheat crop than where the sugar beet was established after conventional ploughing or minimal cultivations. For the second consecutive year, no weed beet emerged where two winter wheat crops were grown after direct drilling, followed by sugar beet grown after conventional ploughing and the 1984 wheat crop again grown after direct drilling.

1985

No weed beet emerged in 1985.

1986

Weed beet populations (total plants/m^2)
/Data in brackets are % of seeds sown/

Method of cultivation for 1985 W wheat crop	Method of cultivation for 1986 beet crop Traditional	Minimal	Strip tillage	Mean
(ESE)		(±2.457 VI)	(±1.902 H)*	(±1.419)
Traditional	6.33	3.67	1.33	3.78 /0.08/
Minimal	4.67	2.67	4.33	3.89 /0.08/
Direct drill	2.33	0.67	2.00	1.67 /0.03/

* H = standard error for comparing results at the same level of cultivation treatment in 1985 (i.e. horizontal lines)
VI = standard error for comparing all cultivation treatments except those at the same level of cultivation treatment in 1985.

There was no significant difference between treatments in the numbers of weed beet plants which emerged in 1986. Numbers which emerged were slightly higher than in 1984 whilst no weed beet emerged in 1985. These numbers were still only a small proportion of the seeds sown in 1980 (treatment means 0.09% or lower). There may have been a considerable decline in viability (due to predators or the herbicides used etc) and the seed burden may be almost exhausted. However even this low level of emergence needs to be controlled since 5,000 seeds could easily be shed by three weed beet plants/m^2. Monitoring of weed beet emergence on this site has now ceased.

M. NUTTALL
M.J. MAY

APPENDIX - NAS 203/2 ML

Effect of rotational cultivations on weed beet, 1986

Soil type: Sandy loam over chalky boulder clay (Oate Close field)

Previous cropping: Winter wheat after winter wheat

Diary

Mini plots of weed beet seed (4 m^2) were sown on sub plots: immediately before ploughing the appropriate main plots on 31 October 1980, before tine cultivation on 1 November and before a shallow pass with a Dutch harrow and direct drilling with winter wheat using a Carier drill on 3 November 1980.

30 August 1985	Previous winter wheat crop harvested.
Early October	Fertiliser applied to supply 150, 300, 71 and 171 kg/ha of phosphate, potash, sodium and magnesium respectively.
14 October	Loose straw removed from trial site. Strip cultivation carried out using Rotavator rig.
14 November	Appropriate treatments were ploughed to 25 cm.
16 December	Appropriate treatments were tine cultivated to 16 cm with an MF 23 Flexitine.
2 May 1986	Appropriate cultivations carried out and trial drilled with Amethyst seed at 15.2 cm seed spacing.
6 May	Nitrogen applied overall (42 kg/ha).
24 May	Goltix + Actipron applied overall (1.7 kg + 1.7 l/ha)
3 June	Goltix + Nortron aplied overall (1.5 kg + 1.8 l/ha)
12 June	Nitrogen applied overall (84 kg/ha)
17 June	Fusilade 5 applied to strip tillage plots (1.5 l/ha + 0.1% Agral
24 June	Counted numbers of weed beet in a 1 m^2 quadrat
25 June	Betanal + Nortron applied overall (3.0 l + 1.5 l/ha)
4 July	Format applied overall (2.0 l/ha)
1 August	Counted numbers of weed beet in a 1 m^2 quadrat