# LINSEED WEED THRESHOLD LEVELS, 1993-95
(HGCA sponsored)

*F C Andrews*

## Summary

Cultivated oats, common chickweed and fat-hen at different population levels were used to study competition effects on linseed. Significant differences were found between the highest and lowest densities of all weed populations. The trial suffered each year from drought and, in 1994 and 1995, from flea beetle attacks. All weeds showed differences in ground cover, although this was more noticeable with common chickweed owing to the weed's growth habit. Cultivated oats consistently produced the greatest yield reductions in response to weed populations throughout the experiment. An oat density of 137.2 plants/m$^2$ significantly reduced crop yield from 1.29 t/ha where no weeds were present to 0.44 t/ha.

## Introduction

Cost effective production is dependant on timely decisions being made on all aspects of crop management. Linseed is vulnerable to weed competition owing to the slow establishment and final crop height and biomass (Lutman, 1991). The crop has problems competing against weeds such as charlock (*Sinapsis arvensis*), common chickweed (*Stellaria media*), mayweed (usually *Tripleurospermum* spp.), *Polygonum* spp. (Anon., 1983). Linseed is a low input crop and the relative importance of different weeds needed to be determined. Weed control in cereals and oilseed rape is an area which has benefited from investigations into threshold levels of weeds. There are indications that linseed yields can be greatly reduced by weed competition (Turner, 1987). Little work has previously been carried out.

The trial was part of a national series funded by the Home-Grown Cereals Authority Oilseeds Levy and co-ordinated by Arable Research Centres. Work at Morley concentrated on determining the effect of different populations of three weed species on linseed growth and yield. The three species used in the experiments were cultivated oats (*Avena sativa*; mimicking wild-oats), common chickweed and fat-hen (*Chenopodium album*).

## Method

Three weed species were grown at different population levels within plots of Antares as shown in Table 1. The oat varieties used were Rollo in 1993 and 1994 and Aberglen in 1995.

Table 1. *Target weed population levels (no./m²)*

| Weed level | Cultivated oats | | Common chickweed | | Fat-hen | |
|---|---|---|---|---|---|---|
| | Seeds sown | Plants expected | Seeds sown | Plants expected | Seeds sown | Plants expected |
| Nil | 0 | 0 | 0 | 0 | 0 | 0 |
| Level 1 | 12.5 | 6 | 62 | 25 | 100 | 10 |
| Level 2 | 50 | 25 | 250 | 100 | 400 | 40 |
| Level 3 | 100 | 50 | 500 | 200 | 800 | 80 |
| Level 4 | 200 | 100 | 1000 | 400 | 1600 | 160 |

The experiment was a factorial design with three replicates and plots 12 m (1993) or 6 m long (1994, 1995) by 1.54 m wide. The weeds were sown in the middle 4 m of the plot. Oats were sown first, then the crop, with the common chickweed and fat-hen seeds broadcast last.

The trials received normal farm treatments of nitrogen and insecticides. Site and assessment details are given in Table 2. Counts were recorded from randomly selected quadrats within each plot. Plant scores were assessed on a whole plot basis. An area of the weed plot, one metre square, was hand harvested and the samples threshed using a stationary Wintersteiger plot combine.

Table 2. *Site details*

| | 1993 | 1994 | 1995 |
|---|---|---|---|
| Site | Myll Field, Morley | Bacons, Wood Farm | Donnyngs, Morley |
| Soil type | sandy loam | sandy clay loam | sandy loam |
| Soil series | Ashley | Beccles | Ashley |
| Previous crop | winter wheat | winter wheat | winter wheat |
| Date sown | 31 March | 19 April | 14 April |
| Assessments | | | |
| - plant counts | 24 May, 3 August | 1 July, 26 July | 27 June |
| - plant scores | 30 June, 20 July | 26 July, 3 August | 7 August |
| Trial desiccated | 30 July | 2 August | 2 August |
| Trial harvested | 2 September | 26 August | 22 September |

Each year, periods of dry weather affected the trial, delaying weed emergence and producing variable populations. To overcome this in 1993 and 1994, the trial was watered with the equivalent of 3 mm rain. Establishment and emergence of the crop were also affected in 1994 and 1995 by flea beetle (*Longitarsus parvulus* and *Aphthona euphorbiae*) attacks.

## Results

### Plant counts

The target populations were only achieved by the cultivated oats, however reasonable levels of the other weeds were obtained. Means of the weed populations attained are shown in Table 3.

Table 3. *Means of weed populations, 1993-95 (plants/m²)*
*Plant counts recorded on 3 August 1993, 1 July 1994 and 27 June 1995*

| Weed level | Cultivated oats | Common chickweed | Fat-hen |
|---|---|---|---|
| Nil | 0.0 | 1.8 | 1.0 |
| Level 1 | 11.2 | 28.3 | 6.9 |
| Level 2 | 32.7 | 38.7 | 21.5 |
| Level 3 | 59.4 | 54.6 | 39.9 |
| Level 4 | 137.2 | 68.2 | 66.8 |
| LSD | 20.02 | 17.02 | 21.48 |

LSD = least significant difference at 95% probability level

### Ground cover scores

Ground cover of the weeds (Table 4) mainly reflected the differences seen in the numbers. Common chickweed generally showed the greatest differences in ground cover though, in 1995, this weed had completely died out by early August, owing to the drought conditions.

Table 4. *Mean ground cover scores, 1993-95*
*Scores recorded on 30 June 1993, 3 August 1994 and 7 August 1995*
*(%, scores used 0 for no cover and 100 for complete cover by weeds)*

| Weed level | Cultivated oats | Common chickweed | Fat-hen |
|---|---|---|---|
| Nil | 0.0 | 0.0 | 0.9 |
| Level 1 | 3.1 | 4.8 | 3.3 |
| Level 2 | 8.6 | 12.1 | 6.9 |
| Level 3 | 10.6 | 15.2 | 6.9 |
| Level 4 | 20.9 | 33.3 | 11.9 |
| LSD | 3.51 | 9.27 | 2.72 |

### Yields

Differences in the weed populations were shown in the plot yields (Table 5). The cultivated oats consistently reduced yield with increasing levels of weeds throughout the three years. Significant yield losses were achieved with oats at a density of 59.4 plants/m² and common

chickweed at 28.3 plants/m². No significant differences were caused by the fat-hen populations.

Table 5. *Mean yield achieved by each weed level, 1993-95 (t/ha at 91% dm)*

| Weed level | Cultivated oats | Common chickweed | Fat-hen | Mean |
|---|---|---|---|---|
| Nil | 1.29 | 1.43 | 1.25 | 1.32 |
| Level 1 | 1.24 | 1.22 | 1.28 | 1.25 |
| Level 2 | 1.12 | 1.10 | 1.29 | 1.17 |
| Level 3 | 0.93 | 1.06 | 1.19 | 1.06 |
| Level 4 | 0.44 | 1.12 | 1.25 | 0.94 |
| LSD (interaction) | | 0.230 | | |
| Mean | 1.00 | 1.19 | 1.25 | |
| LSD (mean) | | 0.103 | | 0.133 |

## Discussion

The experiment was affected by drought in all three years. This reduced weed emergence such that the target populations were not achieved. In 1994 and 1995, the crop was attacked by flea beetle and, despite treatment, this influenced crop emergence and establishment. The cultivated oats produced populations nearest to the targets and differences in the established populations of the other weeds were acceptable.

These variations in populations were reflected in the ground cover scores. Ground cover from common chickweed was high relative to plant numbers and it was this which had the greater effect on yield. The physical habit of the cultivated oats is unlike that for common chickweed and differences in yield were associated with plant number rather than ground cover. Effects from cultivated oats may have been a reflection of competition for nutrients and the height of this weed which overshadowed the crop. It was unfortunate that the fat-hen populations did not establish satisfactorily. This would have allowed comparisons with an intermediate habit to that of the other weeds.

Weed competition, as a result of increases in weed density or ground cover, can significantly reduce yield. Certain weed species are more likely to cause this effect than others. This is outlined in the trends shown in Figures 1 and 2. If population levels or ground cover indicated by these trends are reached, there is the potential for significant yield losses. Exact weed threshold levels for the different species cannot be produced from this work alone.

This experiment was one site of a more comprehensive project involving six locations in England. The work, reported by Carver *et al.* (1996) has highlighted a number of areas which need consideration when attempting to determine weed threshold levels.

Good crop establishment and emergence significantly affected the results produced, as did drought susceptibility of both crop and weeds. This was observed at a number of trial sites. Appreciation of the habit and biomass potential of weed species present is important when trying to identify possible competition effects.

Figure 1. *Yield against weed populations*

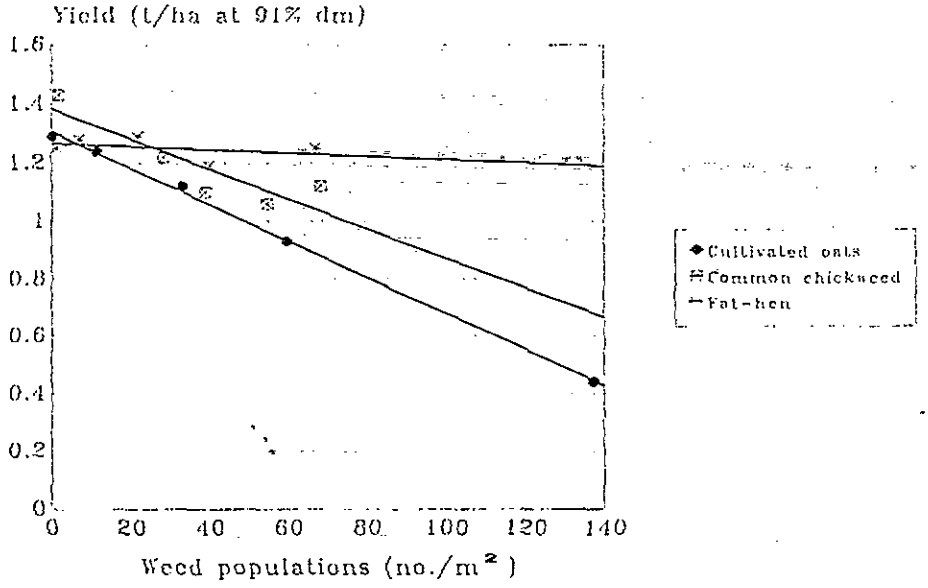
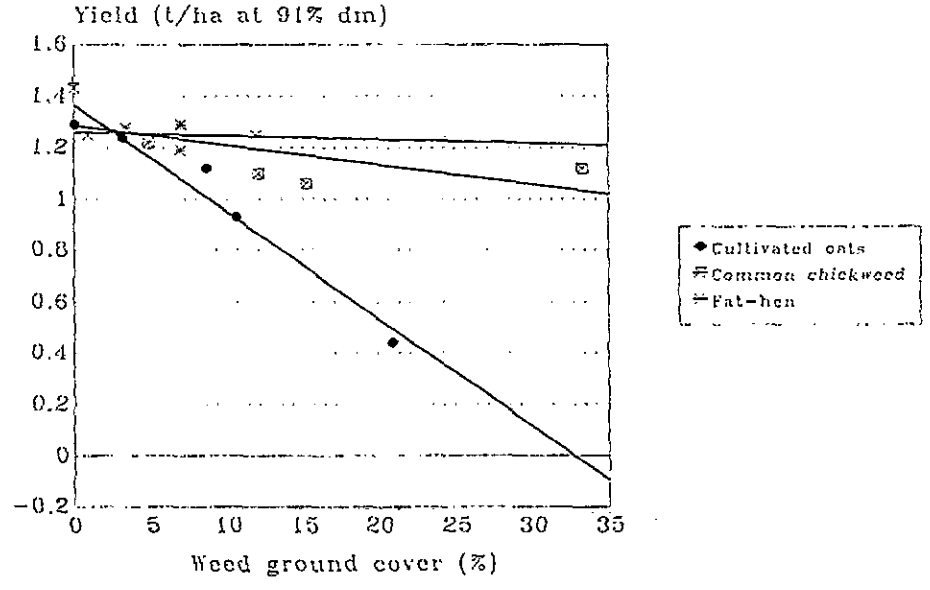



Figure 2. *Yield against weed ground cover*



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