CONFIDENTIAL*

ESTABLISHMENT OF OILSEED RAPE 1984

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SUMMARY

A range of cultivation techniques to establish oilseed rape was tested in a crop sown at three different seed rates on a sandy clay loam soil in September 1983. The two ploughing treatments gave extremely cloddy seedbeds and the use of the Flatlift also increased the level of clods. Direct drilling produced the most compaction at depths of 5 cm and below but gave significantly fewer large aggregates than most treatments and a higher level of fine aggregates than both ploughed treatments. The ploughing treatments gave seed yields significantly better than minimum cultivations using deep tines or shallow tines preceded by the Flatlift. Yields of oil were not significantly affected by cultivation treatments. The lowest seedrate produced a reduction in both oil and seed yields.

OBJECT

To compare cultivation techniques and seedrates to improve the establishment of winter oilseed rape.

INTRODUCTION

Winter oilseed rape is drilled at a time of year when establishment of small seeded crops can be unpredictable due to variation in the quality of the seedbeds. Oilseed rape is grown mainly on the heavier soils which are prone to cloddiness if seedbed preparation is not ideal. In addition, dry weather after drilling in late August may result in a low level of germination because of insufficient seedbed moisture. Trials were initiated on several ADAS Experimental Husbandry Farms to examine various cultivation methods for establishing the crop, to monitor the seedbeds achieved and subsequently the growth of the oilseed rape. The Norfolk Agricultural Station mounted a trial series to complement the ADAS series. It was carried out on a farm at Runhall, near Dereham, Norfolk, which practiced minimum cultivations for a five year rotation of four cereals followed by a break of oilseed rape. This, the third and final year of the trial, was completed in August 1984.

TREATMENTS

Main plots

1. Plough followed by appropriate conventional cultivations to obtain the fine seedbed required.

2. Plough and press followed by appropriate cultivations.

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3. Deep tine cultivations to 15 - 20 cm.

4. Shallow cultivations (up to 5 cm deep) based on tines.

5. Shallow cultivations as 4, but preceded by the use of a Flatlift to give loosening to at least normal plough depth. [The Flatlift replaced a Paraplow used in previous years].

6. Direct drill.

7. Direct drill preceded by the Flatlift, as in 5.

Sub plots (seedrate)

Low (4 kg/ha) Medium (6 kg/ha) High (8 kg/ha)

The seedrate comparisons were included in the trial to determine whether low or high levels of plant establishment, which might result from any of the cultivation methods, could be compensated for by altering the seedrates.

METHOD

The trial was laid down on a sandy clay loam soil in a field of burnt winter wheat stubble. The extremely dry weather which had prevailed since June delayed the start of the experiment until early September when heavy showers arrived. On 5 September the appropriate plots were Flatlifted at a depth of 30 - 33 cm at right angles to the proposed direction of drilling. Earlier attempts to Paraplow these plots were unsuccessful because of the hard ground. It was decided to use the host farmer's Flatlift because the Paraplow was not available when conditions were right. Both the ploughed treatments were carried out on 6 September but the lack of penetration by the rain prevented ploughing deeper than 20 cm. These plots were then cultivated with a reciprocating harrow on 8 September along the proposed line of drilling. Treatment 3 consisted of a heavy cultivator set to work at a depth of approximately 20 cm along the intended line of the plots only. The idea was to retain fine tilth on the surface and to prevent unwanted clods from being produced. The shallow tine cultivation was set to 5 cm depth and carried out along and then across the plots. Where the Flatlift had preceded this cultivation, the second shallow tine cultivation was omitted to prevent the production of excessive amounts of large clods.

The treatments were drilled on the same day (8 September) as the cultivations were done. The drill depth required resetting for the direct drilled plots.

Soil moisture content of the seedbed was measured on 9 September and the trial area rolled later that day.

Wet weather which began towards the end of drilling prevented the trial area from being sampled for soil aggregate size distribution until 23 September. At the same time assessments were made of soil shear strength at 0 - 5, 5 - 10 and 10 - 15 cm depth.

Crop assessments began on 28 September with a seedling emergence score, which was followed by a further emergence score on 5 October. Counts of established oilseed rape seedlings, blackgrass and 'volunteer' cereal seedlings were made on 21 October.

An assessment of the compaction through the soil profile was made on 31 January using a soil penetrometer provided and operated by ADAS Soil Science personnel from

Cambridge. A count of the overwintered oilseed rape population was made on 14 March. *The trial was harvested on 11 August and sub-samples taken for moisture and oil* content determination.

Fertiliser application consisted of 43 kg N, 94 kg P2O5 and 94 kg K2O on 24 August before drilling. This was followed by 65 kg N on 20 February 1984 and 195 kg on 9 April. This supplied a total of 303, 94 and 94 kg/ha of N, P2O5 and K2O respectively.

The trial received Fradone Plus (dimefuron + carbetamide) at 4 kg/ha on 27 October for broad-leaved and blackgrass weed control. Sprays of Rovral (iprodione) and Ambush (cypermethrin) were applied on 25 June against foliar diseases and insect pests, and the trial was dessicated with Reglone 40.

RESULTS

Particle size distribution and organic matter of the sandy loam soil at the start of the trial are shown below.

Table 1

Particle Size Distribution %

C. Sand	Sand	F.Sand	V.F. Sand	C. Silt	Silt	Clay	Organic matter
4.5	27.4	15.8	6.8	12.8	9.6	23.1	1.8

Table 2 Soil shear strength (kPa) and moisture content

Cultivation treatment	Shear strength kPa on 23 September			% Moisture at drilling (9 September)
	0-5	5-10	10-15	0-5 cm
1) Plough	11.7	15.7	18.5	6.7
2) Plough + press	11.5	15.6	16.7	6.4
3) Deep tine cultivation	9.6	13.4	25.0	8.3
4) Shallow cultivation	10.2	27.5	43.8	8.8
5) Shallow cultivation + Flatlift	9.2	14.2	17.6	7.9
6) Direct drill	14.7	34.4	38.1	7.9
7) Direct drill + Flatlift	9.8	14.0	19.6	7.9
(S.E.)	(±0.71)	(±1.28)	(±2.90)	(±0.57)
Standard error per plot (12 d.f.)	±1.23 or 11.2%	±2.23 or 11.4%	±5.03 or 19.6%	±0.98 or 12.7%

At the 0 - 5 cm depth, direct drilling (treatment 6) resulted in more compacted soil than all the other treatments (Table 2). Where the Flatlift preceded direct drilling (treatment 7) this compaction was reduced significantly. At the 5 - 10 cm depth, both the shallow tine (treatment 4) and direct drilling (treatment 6) produced significantly more compaction than the other treatments but again use of the Flatlift (treatments 5 and 7) reduced the compaction to the level of the other treatments. This effect was also evident at the 10 - 15 cm depth.

There was no significant difference in seedbed moisture between the cultivation treatments. Rain began at the end of drilling and continued into the evening and could have reduced any differences which might have existed.

Very large aggregates (> 53 mm).
Treatments had a marked effect on these (Table 3). Both the ploughing treatments produced considerably more large aggregates than the tine cultivations without the Flatlift (treatments 3 and 4) and the direct drill with or without Flatlift (treatments 6 and 7). The action of the furrow press reduced significantly the number of these large clods when compared with ploughing only. The action of the Flatlift also increased significantly the number when it was used before the shallow tine cultivations or direct drill.

Large aggregates (53 - 26.5 cm).
The direct drill without Flatlift (treatment 6) produced significantly fewer of these than all treatments except the shallow tine. The Flatlift increased significantly the incidence of this type of aggregate in treatments 5 and 7 compared to treatments 4 and 6.

Soil aggregates less than 26.5 mm
Ploughing (treatments 1 & 2) produced significantly fewer aggregates in this size range when compared with the two tined treatments without the Flatlift (treatments 3 and 4).

Fine soil aggregates (<9.5 mm)
The ploughed treatments also had a significantly lower proportion of these when compared with direct drill and shallow tine (treatments 4 and 6). The Flatlift also reduced significantly the number of these soil aggregates when used before the direct drill or shallow tine.

Soil penetrometer readings taken in late January showed no significant difference between any of the treatments on surface compaction (Table 4). This was in spite of the big differences shown in the first column of the results table. At 5 cm depth the direct drilled plots (treatment 6) were significantly more compact than all the other treatments. At the 10 and 15 cm depths the shallow tine cultivated and direct drilled land was significantly more compact than after the ploughing or deep tine cultivations. However, where the Flatlift was used before shallow cultivations and direct drilling this difference was eliminated. Furthermore, the loosening effect of the Flatlift was also apparent at the 20 and 25 cm depths. At 20 and 25 cm the soil was looser after ploughing followed by conventional seedbed cultivations compared with ploughing and pressing or deep tine cultivations. Below 25 cm there was no significant difference between treatments.

The seedling emergence score on 28 September (12 days after drilling) showed that the direct drilled plots (treatment 6) emerged quicker than the other treatments but the use of the Flatlift beforehand (treatment 7) removed this advantage (Table 5). Seedrate had no significant effect on this assessment.

A late score in April for evenness of crop establishment showed that both the ploughed treatments had established more evenly than the other treatments and had achieved a better ground cover. The Flatlift reduced crop cover when used before the shallow tine cultivator. There was a progressive increase in evenness of establishment with increasing seedrate.

Table 3 Seedbed quality assessments on 23 September

Seedbed treatment	% soil aggregate size distribution in the seedbed					
	) 53 mm	53-26.5 mm	26.5-9.5 mm	9.5-4.75 mm	4.75-1.7 mm	(1.7 mm
1) Plough + conventional seedbed cultivation	50.6	21.9	16.9	4.7	2.9	2.9
2) Plough + press	37.2	25.5	21.9	6.9	4.4	4.5
3) Deep tine cultivation	7.0	21.7	30.8	15.0	13.3	12.3
4) Shallow tine cultivation	6.6	17.0	31.3	17.4	14.6	13.0
5) Shallow tine cultivation + <u>Flatlift</u>	31.7	25.8	20.6	8.2	7.3	6.5
6) Direct drill	5.6	11.1	26.8	19.0	19.8	17.7
7) Direct drill + <u>Flatlift</u>	19.2	21.5	26.9	11.1	11.0	10.4
(S.E.)	(±3.89)	(±2.29)	(±2.05)	(±1.48)	(±1.36)	(±1.59)
Standard error per plot (12 d.f.)	±6.74 or 29.9%	±3.96 or 19.2%	±3.56 or 14.2%	±2.56 or 21.8%	±2.36 or 22.5%	±2.76 or 28.7%

Table 4 Seedbed penetrometer readings

Seedbed treatment	Penetrometer readings kPa on 31 January 1984									
	Soil depth cm									
	0	5	10	15	20	25	30	35	40	45
1) Plough + conventional seedbed cultivation	15.3	134	206	189	255	650	1101	1157	1130	1268
2) Plough + press	18.3	98	202	236	514	917	1108	1202	1273	1166
3) Deep tine cultivation	16.0	90	232	330	570	915	1036	1109	1092	1199
4) Shallow tine cultivation	1.7	158	509	525	679	956	1071	1066	1160	1212
5) Shallow tine cultivation + <u>Flatlift</u>	32.7	144	222	319	376	678	966	1220	1189	1223
6) Direct drill	8.3	299	458	465	705	919	1097	1130	1159	1137
7) Direct drill + <u>Flatlift</u>	3.3	94	202	276	415	716	1013	1112	1170	1331
(S.E.)	(±7.53)	(±28.4)	(±35.4)	(±36.4)	(±58.6)	(±58.0)	(±43.0)	(±58.3)	(±51.4)	(±51.5)
Standard error per plot (12 d.f.)	±13.05 or 95.5%	±49.2 or 33.8%	±61.4 or 21.2%	±63.0 or 18.9%	±101.5 or 20.2%	±100.4 or 12.2%	±74.5 or 7.1%	±101.0 or 8.8%	±89.0 or 7.6%	±89.1 or 7.3%

Table 5 Oilseed rape emergence assessments

Cultivation treatment	Seedling emergence score on 20 September (10 = complete uniform emergence) Seedrate (kg/ha)				Score for evenness of crop establishment on 25 April (10 = completely uniform crop cover) Seedrate (kg/ha)			
	4	6	8	Mean	4	6	8	Mean
1) Plough + conventional seedbed cultivation	0.7	1.3	1.0	1.0	8.3	9.3	9.7	9.1
2) Plough + press	1.7	1.7	1.3	1.6	8.3	9.7	9.7	9.2
3) Deep tine cultivation	0.3	1.7	0.3	0.8	4.7	6.0	6.7	5.8
4) Shallow tine cultivation	1.0	1.3	0.7	1.0	6.7	7.0	7.7	7.1
5) Shallow tine cultivation + *Flatlift*	0.7	0.7	0.0	0.4	5.3	6.0	6.3	5.9
6) Direct drill	3.7	4.3	4.3	4.1	6.3	6.3	6.7	6.4
7) Direct drill + *Flatlift*	0.7	1.0	0.7	0.8	5.3	6.3	6.7	6.1
(S.E.)	(±0.50 VI)(±0.38 H)			(±0.34)	(±0.54 VI)(±0.43 H)			(±0.37)
Mean	1.2	1.7	1.2		6.4	7.2	7.6	
	(±0.14)				(±0.16)			
Standard error per plot	Main 12 d.f. ±0.59 or 42.6%		Sub plot 28 d.f. ±0.66 or 47.8%		Main 12 d.f. ±0.63 or 8.9%		Sub plot 28 d.f. ±0.75 or 10.6%	

Table 6 — Weed assessments on 21 October

Cultivation treatment	'Volunteer' cereal and Blackgrass population '000s/ha on 21 October 1983 Seedrate kg/ha			
	4	6	8	Mean
1) Plough + conventional seedbed cultivations	25	115	72	71
2) Plough + press	54	83	29	55
3) Tine cultivation to plough depth	222	176	147	182
4) Shallow cultivation by tines	205	233	215	218
5) Shallow cultivation + Flatlift	226	169	266	220
6) Direct drill	1005	987	911	968
7) Direct drill + Flatlift	298	240	276	271
	(±201.5 VI)	(±61.8 H)		(±140.6)
Mean	291	286 ±23.4	274	
Standard error per plot	Main 12 d.f. ±278.2 or 98.1%		Sub plot 28 d.f. ±107.1 or 37.8%	

'Volunteer' cereals and blackgrass numbers were significantly higher on the direct drilled plots (treatment 6) than on all the other treatments (Table 6). Seedrate had no effect on the incidence of these weeds.

Deep tine cultivation (treatment 3) and the use of the Flatlift (treatments 5 and 7) significantly reduced plant populations in October (Table 7). In most instances at the lower two seedrates this resulted in lower populations than normally regarded as satisfactory (40 plants/m2, or 400,000 per ha). However, all the other cultivation treatments produced acceptable populations at all seedrates. Overall, populations increased with increasing seedrate.

There was a noticeable reduction in plant population at the March assessment. The two Flatlift treatments (5 and 7) and the deep tine cultivation (treatment 3) gave less than adequate populations, whilst the remaining treatments were satisfactory. The overall populations achieved by the 4 kg/ha seedrate at this assessment were too low but this was caused by the low population obtained with deep tine cultivation and the two Flatlift treatments (5 and 7).

The two ploughed treatments gave the highest seed yields (Table 8) and these were significantly higher than those after deep tine cultivation (treatment 3) and the shallow tine cultivation preceded by the Flatlift (treatment 5). The plough and press treatment gave a significantly higher yield than that produced by the direct drill preceded by the Flatlift.

The lowest seedrate (4 kg/ha) produced significantly lower yields than the other two, but a large part of the difference was caused by the low yield following the deep tine cultivation.

The yield of oil was significantly lower with the lowest seedrate but the differences between the different cultivation techniques failed to reach statistical significance.

Table 7 Plant population '000s/ha recorded on 21 October and 14 March 1984

Cultivation treatment	October 1983 Seedrate (kg/ha) 4	6	8	Mean	March 1984 Seedrate (kg/ha) 4	6	8	Mean
1) Plough + conventional seedbed cultivation	535	775	707	672	409	685	628	574
2) Plough + press	520	657	764	647	459	492	693	548
3) Deep tine cultivation	237	355	445	346	201	298	330	276
4) Shallow tine cultivation	402	617	890	636	438	581	585	535
5) Shallow tine cultivation + Flatlift	312	527	484	441	283	431	380	365
6) Direct drill	578	714	1102	798	492	682	875	683
7) Direct drill + Flatlift	352	384	402	379	294	388	445	376
(S.E.)	(±67.8 VI)(±58.2 H)			(±44.0)	(±52.9 VI)(±53.8 H)			(±30.0)
Mean	419	576 ±22.0	685		368	508 ±20.3	562	
Standard error per plot	Main (12 d.f.) ±76.2 or 13.6%		Sub plot (28 d.f.) ±100.8 or 18.0%		Main (12 d.f.) ±52.0 or 10.8%		Sub plot (28 d.f.) ±93.2 or 19.4%	

<u>Table 8</u> <u>Harvest yields</u>

Cultivation treatment	Yield of seed (t/ha) at 91% d.m. Seedrate (kg/ha)				Yield of oil (t/ha) at 100% d.m. Seedrate (kg/ha)			
	4	6	8	Mean	4	6	8	Mean
1) Plough + conventional seedbed cultivation	2.95	3.00	3.04	3.00	1.203	1.225	1.247	1.225
2) Plough + press	3.05	3.08	3.05	3.06	1.242	1.247	1.245	1.245
3) Deep tine cultivation	2.38	2.76	2.70	2.61	0.956	1.125	1.112	1.064
4) Shallow tine cultivation	2.80	2.85	2.97	2.87	1.165	1.193	1.223	1.194
5) Shallow tine cultivation + <u>Flatlift</u>	2.51	2.88	2.82	2.74	1.012	1.196	1.182	1.130
6) Direct drill	2.83	2.78	2.99	2.87	1.174	1.162	1.237	1.191
7) Direct drill + <u>Flatlift</u>	2.68	2.87	2.83	2.79	1.094	1.186	1.166	1.149
(S.E.)	(±0.133 VI)		(±0.121 H)	(±0.083)	(±0.0578 VI)		(±0.0517 H)	(±0.0366)
Mean	2.74	2.89	2.91		1.121	1.191	1.202	
		(±0.046)				(±0.0195)		
Standard error per plot	Main (12 d.f.) ±0.144 or 5.0%		Sub plot (28 d.f.) ±0.209 or 7.3%		Main (12 d.f.) ±0.0634 or 5.4%		Sub plot (28 d.f.) ±0.0895 or 7.6%	

CONCLUSIONS

In this, the third year of the trial, the ploughed treatments produced heavier seed yields than certain other treatments. This was in sharp contrast to the results obtained in the previous two years, when direct drilling had been the best option. Very dry weather had led to extremely cloddy seedbeds after ploughing in August 1983. This was followed by very wet weather which persisted for much of September. However the continuing wet weather maintained a good germination environment for the seedlings in spite of the cloddy seedbeds. The clods may even have provided shelter for the emerging seedlings in the cold wet conditions in September. The lowest seedrate (4 kg/ha) resulted in lower yields than the two higher rates. The use of a deep loosening implement (a Flatlift in 1983/84) reduced plant population but not to such an extent that the reduction in yield reached statistical proportions. This result confirmed the conclusions of the previous years' trials that a deep loosening implement should not be used in the preparation of a seedbed for a fine seeded crop such as oilseed rape. Where such an implement is needed it would possibly be best used in the year prior to oilseed rape, when any increase in cloddiness which may result would have less effect on the establishment of a large seeded crop such as winter cereals.

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