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ESTABLISHMENT OF OILSEED RAPE 1983

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2nd Year

SUMMARY

A range of establishment techniques to establish oilseed rape was tested in a crop on a sandy loam soil in August 1982. Direct drilling gave the highest percentage of fine and very fine soil aggregates, but the Paraplow reduced this. Direct drilling yielded significantly better than both the ploughed and the shallow tine treatments. Seedrate had no effect on yield.

OBJECT

Winter oilseed rape is drilled at a time of year when seedbed conditions may be far from ideal. Dry weather at the end of August can hinder the making of ideal seedbeds by conventional means, whilst cultivation or lack of rainfall after drilling may result in insufficient seedbed moisture. Furthermore, oilseed rape is grown mainly on 'heavy' soils which are prone to cloddiness if cultivation techniques are not ideal. It was for these reasons that trials at several ADAS Experimental Husbandry Farms were initiated to examine various cultivation methods of establishing the crop; to monitor the seedbeds achieved and subsequently the growth of the oilseed rape. The Norfolk Agricultural Station mounted a trial to complement the ADAS series. It was carried out on a farm which practices minimum cultivation to drill the cereals and oilseed rape in a rotation of four cereals followed by a break of oilseed rape. The second year of the trial was completed in July 1983.

TREATMENTS

Main plots

1. Plough followed by appropriate conventional cultivations to obtain the fine seedbed required.
2. Plough and press followed by appropriate cultivations.
3. Deep tine cultivations to 10-15 cm.
4. Shallow cultivation (up to 5 cm deep) based on tines.
5. Shallow cultivation as 4, but preceded by the use of a Paraplow to give loosening to at least normal plough depth.
6. Direct drill.
7. Direct drill preceded by the Paraplow, as in 5.

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Sub plots (seed rate)

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

The seedrate comparisons were included in the trial to see whether low levels of plant establishment which might be given by any of the cultivation methods could be compensated for by high seedrates, or vice versa.

METHOD

The trial was laid down in a field of burnt winter wheat stubble in mid-late August. The ploughing treatments were carried out on 23 August at a depth of 15 - 18 cm deep along the future line of drilling. On 24 August the appropriate plots were Paraploved at right angles to the proposed direction of drilling at a depth of 36-38 cm. Both the ploughed treatments were harrowed with a light set of spring tines to a depth of 10 cm along the plots. Treatment 3 had a heavy tine set to work at approximately 15 cm deep along the plots and then across them.

The shallow tine cultivation was set to work at 5 cm deep and was carried out along the plots and then across the direction of drilling.

In view of the dry conditions prevailing, drilling was left until 25 August. The direct drilled plots were sown first and the drill was then reset for the rest of the treatments, with the exception of the deep tine cultivated plots, which were left until last, because of the depth control problems encountered. The trial area was rolled the day after drilling with a ribbed roll.

Soil physical measurements were taken on 26 August, and consisted of soil shear strength at 0 - 5, 5 - 10 and 10 - 15 cm, soil moisture content and soil aggregate size distribution at 0 - 5 cm depth.

Crop assessments began on 8 September with a seedling emergence score, and a 'volunteer' cereal count and common couch score were made on 15 October. An establishment count of the oilseed rape seedlings was also carried out on 15 October.

An assessment of the compaction at increasing depths through the soil profile was made on 3 February using a soil penetrometer provided and operated by ADAS Soil Science personnel from Cambridge. A final count of the overwintered oilseed rape population was made on 10 March. The trial was harvested on 30 July and sub-samples were taken for [illegible] and oil content determination.

The trial received Fusilade at 3 l/ha against graminaceous weeds on 1 December, and Cambyhaven + Renwalon at 1.7 kg/ha + 1 kg/ha together with Gamma Col at 0.7 kg/ha on 13 November. Manuring consisted of 375 kg/ha of 0:25:25 in late August before drilling and 125 kg/ha of 34.5% N on 19 November. followed by 157 kg/ha of 34.5% N on 25 February and 625 kg/ha of 34.5% N on 18 March. This supplied a total of 313, 94 and 94 kg/ha of N, P_2O_5 and K_2O respectively.

Sprays of Bayleton at half-rate (1 l/ha) were applied on 18 May and 8 June against foliar diseases, and the trial was dessicated with Reglone 40 in mid July.

RESULTS

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

Particle Size Distribution %

C. Sand >600 µ	Sand 210-600 µ	F. Sand 106-210 µ	V.F. Sand 63-106 µ	C. Silt 20-63 µ	Silt 2-20 µ	Clay <2 µ	Organic Matter
6.1	35.8	17.1	6.8	9.5	11.2	13.5	1.7

Soil shear strength (Kpa) and moisture content on 26-27 August (table 1)

Cultivation treatment	Shear Strength Kpa Soil depth (cm) 0 - 5	5 - 10	10 - 15	% moisture at drilling 0 - 5 cm
1) Plough	9.9	22.6	25.6	13.6
2) Plough and press	9.4	23.8	31.9	13.6
3) Deep tine cultivation	8.4	18.3	26.1	13.3
4) Shallow cultivation	10.2	50.3	53.4	14.1
5) Shallow cultivation + Paraplow	10.4	42.5	39.4	14.1
6) Direct drill	10.7	40.4	38.4	13.8
7) Direct drill + Paraplow	9.5	31.1	32.4	14.5
	(±0.54)	(±3.97)	(±4.98)	(±0.83)
Standard error per plot (12 d.f.)	±0.94 or 9.6%	±6.88 or 21.0%	±8.63 or 24.4%	±1.44 or 10.4%

At the 0-5 cm depth the slight differences between treatments did not reach statistical significance. At the 5-10 cm depth both the ploughed treatments and the deep tine were significantly less compacted than the shallow tine and direct drill plots, apart from where the Paraplow was used before direct drilling. At the lowest depth (10-15 cm), only the shallow cultivation treatment was significantly more compacted than the others.

In view of the showery conditions at drilling it is not suprising that only slight but non-significant differences in seedbed moisture were evident.

Seedbed quality assessments on the day after drilling (26 August) Table 2

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	2.91	19.88	35.12	19.28	13.46	9.34
2) Plough and press	1.55	17.56	37.02	18.87	14.73	10.26
3) Deep tine cultivation	4.63	20.73	30.76	18.93	13.22	11.73
4) Shallow cultivation	3.67	14.47	29.23	20.16	17.03	15.43
5) Shallow cultivation + Paraplow	2.26	25.83	30.12	17.55	13.54	10.69
6) Direct drill	1.87	11.43	31.74	20.89	17.00	17.08
7) Direct drill + Paraplow	7.16	16.18	31.53	17.36	14.49	13.28
	(±2.007)	(±2.332)	(±1.798)	(±0.993)	(±0.812)	(±0.877)
Standard error per plot (12 d.f.)	±3.427 or 102.2%	±4.039 or 22.4%	±3.115 or 9.7%	±1.719 or 9.0%	±1.407 or 9.5%	±1.519 or 12.1%

Treatments did not significantly affect the incidence of very large aggregates (>53 mm). The action of the Paraplow when followed by shallow cultivations was to increase significantly the percentage of large aggregates (53-26.5 mm) recorded, compared with shallow cultivations alone. This effect was less pronounced in the context of direct drilling, and did not reach statistical significance. None of the treatments was significantly different to the others when the medium soil fractions were considered (26.5-9.5 mm and 9.5-4.75 mm). Direct drill and shallow cultivations without Paraplowing gave the highest percentage of fine soil aggregates (4.75-1.7 mm), but the action of the Paraplow significantly reduced these values. Direct drilling without Paraplowing also produced the highest percentage of very fine soil (<1.7 mm). The action of the Paraplow reduced the levels of very fine soil with both the shallow cultivations and direct drilling. However, the direct drilling + Paraplow still gave a significantly higher proportion of very fine soil than both the ploughed treatments.

Soil penetrometer readings taken in February showed no significant differences between any of the treatments in effect on surface compaction. Between 3.5 cm and 17.5 cm inclusive, the shallow tine and direct drill when used without Paraplowing gave significantly higher figures than the ploughed or deep tined treatments. However, the use of the Paraplow gave substantial reductions in the penetrometer values on shallow tined and direct drilled land virtually throughout the range of soil depths sampled. Most of these reductions were statistically significant.

Both the ploughed treatments were moderately compact at 21.0 cm depth, but were still significantly less so than the shallow tine and direct drill where these were not preceded by Paraplowing. However this difference disappeared at 28.0 cm and below. At 21 cm and below the deep tined land was just as compact as the non-Paraplowed shallow tined and direct drill treatments.

Seedbed penetrometer readings (Table 3)

	Penetrometer readings Kpa on 3rd February 1983 Soil depth cm									
	0	3.5	7.0	10.5	14.0	17.5	21.0	24.5	28.0	31.5
1) Plough	14	68	106	163	215	252	407	705	1015	1222
2) Plough + press	3	56	58	86	113	190	437	705	872	1063
3) Deep tine	3	51	86	121	170	349	594	904	1164	1304
4) Shallow tine	16	185	360	605	623	652	777	954	1048	1233
5) Shallow tine + Paraplow	4	64	152	303	391	374	366	409	555	764
6) Direct drill	21	365	535	560	598	640	746	974	1193	1355
7) Direct drill + Paraplow	15	115	157	222	241	235	269	439	535	706
	(±8.1)	(±42.5)	(±61.8)	(±54.4)	(±55.4)	(±61.2)	(±109.0)	(±123.0)	(±99.3)	(±101.4)
Standard error per plot (12 d.f.)	±14.0 or 127.0%	±73.6 or 57.0%	±107.0 or 51.5%	±94.3 or 32.0%	±95.9 or 28.5%	±106.0 or 27.6%	±188.7 or 36.7%	±213.0 or 29.3%	±172.0 or 18.9%	±175.5 or 16.1%

Seedling assessments of Oilseed rape emergence (Table 4)

	Seedling emergence on 8 September (10 = complete uniform emergence) Seedrate (kg/ha)				Score for evenness of crop establishment (10 = completely uniform crop cover) Seed rate (kg/ha)			
	4	6	8	Mean	4	6	8	Mean
1) Plough followed by conventional seedbed cultivation	2.7	1.7	4.2	2.8	6.3	6.0	7.6	6.7
2) Plough + press	1.8	1.8	2.7	2.1	4.2	4.7	4.8	4.6
3) Deep tine cultivation	3.2	5.5	3.5	4.1	6.5	7.3	6.8	6.9
4) Shallow tine cultivation	3.5	5.3	6.2	5.0	6.2	6.2	7.0	6.4
5) Shallow tine preceded by Paraplow	3.3	4.8	5.8	4.7	5.5	6.8	7.2	6.5
6) Direct drill	4.5	6.8	7.3	6.2	7.0	7.8	8.2	7.7
7) Direct drill preceded by Paraplow	3.2	5.5	4.5	4.4	5.8	6.8	6.8	6.5
		(±0.75 VI)	(±0.67 H)	(±0.51)		(±0.88 VI)	(±0.57 H)	(±0.74)
Mean	3.2	4.5 (±0.25)	4.9		5.9	6.5 (±0.21)	7.0	
Standard error per plot	Main 12 d.f. ±0.89 or 21.2%		Sub plot 28 d.f.) ±1.16 or 27.7%		Main 12 d.f. ±1.28 or 19.9%		Sub plot 28 d.f. ±0.98 or 15.2%	

The seedling emergence score on 8 September (14 days after drilling) showed that all the non-ploughed treatments emerged quicker than the ploughed ones. The direct drilled crop emerged significantly faster than all other treatments except the shallow tine. The highest seedrate was significantly more uniformly emerged at this date than the lowest. These differences were much less than those recorded in the dry conditions of the previous years trial.

In late January there were no differences in the evenness of the crop establishment between the cultivation treatments, but the highest seedrate still had given a more uniform cover as shown by the higher score.

Seedling assessment of weed populations (Table 5)

	'Volunteer' cereal population '000s/ha on 15 October 1982	Couch grass score 0-10 on 15 October 1982
1) Plough + conventional seedbed cultivations	71.8	1.0
2) Plough + press	50.8	1.3
3) Tine cultivation to plough depth	113.6	3.7
4) Shallow cultivation by tines	134.5	4.0
5) Shallow cultivation + Paraplow	122.6	4.7
6) Direct drill	68.8	1.3
7) Direct drill + Paraplow	140.5	9.0
	(±26.26)	(±1.00)
Standard error per plot (12 d.f.)	±45.49 or 45.3%	±1.73 or 48.4%

In spite of the apparently big differences in 'volunteer' cereal emergence, there were no significant differences between treatments. The couch grass emergence score was much greater on the direct drill + Paraplow plots than on any of the others, and may be a result of the loosening effect of the Paraplow coupled with the lack of surface disturbance.

Plant population '000s/ha when recorded on 15 October 1982 and 10 March 1983 (Table 6)

	October 1982 Seedrate (kg/ha) 4	6	8	Mean	March 1983 Seedrate (kg/ha) 4	6	8	Mean
1) Plough followed by conventional seedbed cultivations	355.2	340.9	566.9.	421.0	255.1	311.0	498.3	354.8
2) Plough + press	111.2	197.3	326.5	211.7	155.5	199.3	311.0	221.9
3) Deep tine cultivation	276.3	452.1	366.0	364.8	370.8	378.7	402.7	384.0
4) Shallow tine cultivation	369.6	484.4	595.6	483.2	462.5	470.4	621.9	518.3
5) Shallow tine preceded by Paraplow	330.1	459.3	520.3	436.5	418.6	534.2	578.1	510.3
6) Direct drill	405.4	502.3	613.5	507.1	398.7	629.9	709.6	579.4
7) Direct drill preceded by Paraplow	326.5	477.2	538.2	447.3	287.0	629.9	510.3	475.7
	(±85.22VI)(±68.19H)			(±64.50)	(±78.36 VI)(±72.14 H)			(±51.67)
Mean	310.6	416.2 (±25.77)	503.9		335.4	450.5 (±27.27)	518.8	
Standard error per plot	Main (12 d.f.) ±111.72 or 27.2%		Sub plot ±118.11 or 28.8%		Main (12.d.f.) ±89.49 or 20.6%		Sub plot ±124.94 or 28.7%	

Plant population was lower than advisable ($40/m^2$) with the lowest seedrate when assessed in October. The plough and press treatment produced poor emergence. The ploughing treatment with conventional seedbed cultivation appeared to lose plants over winter, and both this treatment and the plough + press has significantly lower plant populations than the shallow tine or direct drilled treatments. The deep tine also produced a significantly lower plant population than direct drilling at the March assessment.

Direct drilling gave the highest yield of seed (Table 7), and this was significantly higher than both the ploughed and the shallow tine without Paraplow treatments. Seedrate had no effect on yield. Direct drilling gave a higher yield of oil than all the other treatments, with the exception of deep tine cultivation and the shallow tine preceded by the Paraplow. However the use of the Paraplow significantly reduced the yield of oil in the context of direct drilling.

In the second year of the trial direct drilling once more gave the highest yield and significantly outyielded the ploughed treatments. This was in a showery season when rates of establishment were less variable than in the previous year. The seedrates tested again had no effect on yield. The use of a Paraplow in a fine seeded crop such as oilseed rape must be open to question. This implement, whilst excellent for reducing soil compaction, tended to increase the level of clods and the yield of oil suffered as a consequence. If compaction problems exist, it may be advisable to carry out deep loosening in the previous cereal crop where a few extra clods will not prejudice emergence.

Yields when harvested on 30 July 1983 (Table 7)

	Yield of seed (t/ha) at 91% dry matter Seedrate kg/ha				Yield of oil (t/ha) Seedrate kg/ha			
	4	6	8	Mean	4	6	8	Mean
1) Plough followed by conventional seedbed cultivation	1.94	2.02	1.87	1.94	0.75	0.78	0.72	0.75
2) Plough + press	1.75	1.66	1.60	1.67	0.69	0.65	0.63	0.66
3) Deep tine cultivation	2.25	1.96	2.05	2.09	0.89	0.76	0.80	0.81
4) Shallow tine cultivation	1.89	1.90	2.01	1.93	0.74	0.73	0.78	0.75
5) Shallow tine cultivation preceded by Paraplow	2.04	2.14	2.11	2.10	0.79	0.83	0.82	0.81
6) Direct drill	2.34	2.25	2.22	2.27	0.92	0.89	0.87	0.90
7) Direct drill preceded by Paraplow	2.15	1.82	2.13	2.03	0.82	0.71	0.82	0.78
	(±0.125 VI)		(±0.105 H)	(±0.092)	(±0.050 VI)		(±0.043 H)	(±0.036)
Mean	2.05	1.96 (±0.040)	2.00		0.80	0.76 (±0.016)	0.78	
Standard error per plot	Main plot (12 d.f.) ±0.159 or 7.9%		Sub plot (28 d.f.) ±0.182 or 9.1%		Main plot (12 d.f.) ±0.063 or 8.1%		Sub plot (28 d.f.) ±0.074 or 9.5%	

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