

EFFECT OF CEREAL STRAW ON ESTABLISHMENT OF WINTER BEANS 1993-94

G M Palmer and D B Stevens

Summary

Ploughing down a substantial mat of wet chopped straw did not affect the establishment, growth or yield of winter beans on a medium sandy loam site. This applied whether the seed was either ploughed in with the straw or was drilled subsequent to ploughing.

Introduction

Winter beans are usually established by spreading beans on the soil surface and ploughing them down with a conventional plough. In some recent seasons there have been reports of poor emergence owing to interaction of emerging plants and wet cereal straw, presumably as a result of germination inhibitors or ethylene produced by rotting straw. The problem has been reported since the banning of straw burning.

This experiment was initiated to determine the effect of cereal straw on emergence and yield of winter beans.

Method

The experiment was on sandy clay loam soil (Ashley Series) at Morley in the 1993 and 1994 harvest years following a previous cereal crop. In both years cereal stubble was cleared of loose straw by baling. Straw was subsequently returned to plots as appropriate for the allocated treatments at a rate equivalent to 7 t/ha. The straw was chopped after being spread. Bean seed was broadcast with a Carrier seed drill on 12 November 1992 and 9 November 1993 on the soil surface where the establishment involved ploughing in of seed. Ploughing was carried out on the same day at a depth of approximately 25 cm. On drilled plots, seed was placed at a depth of approximately 8 cm with a Monoair pneumatic drill on 13 November 1992 and 12 November 1993. Two seedrates were used for both broadcast/ploughed and ploughed/drilled plots.

The site was subject to normal farm inputs of herbicides, insecticides and fungicides. Assessments of crop establishment, vigour and incidence of slug damage were made in the spring and the plots were harvested on 1 September 1993 and 19 August 1994.

The main plots were arranged in a randomised block with sub-plots placed at random within main plots. There were four replicates. Plot size was 8 m x 24 m of which a central area of 2.15 m x 21.5 m was harvested for yield estimation.

Results

In the 1993 experiment, crop damage was inflicted differentially by rooks during January as the seedlings emerged. Damage was confined almost entirely to the drilled areas and these were redrilled on 1 February 1993. All results for the first year refer, for this reason, to the ploughed in treatments.

Straw treatments

As the result of exceptionally wet weather in the autumn of 1993 the swathes of straw became saturated with water and there was difficulty in spreading them evenly on the plots and chopping the straw effectively. Consequently the straw mat was more dense along the centre of each plot than had been intended.

Plant emergence and establishment

Although seedling emergence from the ploughed in treatments was slower than that from those drilled, final counts showed no effects from establishment method on plant population in either year (Table 1 and 2). There was too much variability in the data to deduce significant effects from any treatment, including seedrate. However, in both years the population was close to the target. Some distention was noted in March 1993 but there was no interaction between the treatments used.

Slug damage

There was a low incidence of slug grazing in 1994, although damage was worse on one replicate than the others. Variable data prevented the detection of any significant effects.

Table 1. *Treatment details*

Cereal straw treatment (main plots)
1. Straw removed
2. Chopped and spread
Sowing method (sub-plots)
1. Bean seed broadcast and ploughed in
2. Land ploughed, cultivated and seed drilled
Final target population
1. 15 plants/m ²
2. 20 plants/m ²
Cultivar
Punch

Table 2. *Plant populations, 23 March 1993 (plants/m²)*

	Straw treatment		Mean
	Removed	Ploughed in	
Low populations	15.9	19.2	17.6
High populations	24.4	27.9	26.1
LSD		5.23*	3.70
Mean	20.1	23.6	
LSD		NS	

*LSD for comparison within same straw treatment
 LSD = least significant difference at 95% probability level
 NS = no significant difference

Table 3. *Final plant population, 8 April 1994 (plants/m²)*

	Straw treatment		Mean
	Removed	Ploughed in	
Method of establishment			
Seeds ploughed in	13.6	17.1	15.4
Seeds drilled	14.7	19.1	16.9
LSD		NS	NS
Target population			
15 plants/m ²	13.6	15.1	14.3
20 plants/m ²	14.8	21.1	17.9
LSD		NS	NS
Mean	14.2	18.1	
LSD		NS	
Method of establishment			
	Seeds ploughed in	Seeds drilled	
Target population			
15 plants/m ²	13.2	15.4	
20 plants/m ²	17.5	18.4	
LSD		NS	

Crop vigour

There were no signs that crop growth was affected by straw being ploughed in either year. However, in 1994 there were differences between establishment methods (Table 4), with the vigour of ploughed in plots significantly lower than that of drilled plots.

Table 4. *Crop vigour score, 28 June 1994*
(scores used 1-10 scale; 1 = poor and 10 = vigorous)

	Straw treatment		Mean
	Removed	Ploughed in	
Method of establishment			
Seeds ploughed in	7.7	7.7	7.7
Seeds drilled	9.1	8.8	8.9
LSD		v=0.76; hi=0.56	0.54
Target population			
15 plants/m ²	8.2	7.8	8.0
20 plants/m ²	8.6	8.7	8.6
LSD		v=0.76; hi=0.56	0.54
Mean	8.4	8.3	
LSD		NS	
Method of establishment			
	Seeds ploughed in	Seeds drilled	
Target population			
15 plants/m ²	7.3	8.7	
20 plants/m ²	8.0	9.2	
LSD		NS	

v = vertical comparison; hi = horizontal comparisons and interactions

Yield

In the first year there was no effect of either straw treatment or plant population on yield (Table 5). In 1994, dry conditions in the early summer led to early crop senescence and poor yields. While straw treatment did not appear to affect yield, Table 6 shows a significant yield benefit from drilling compared with ploughing seed in and from the higher compared with the lower plant population.

Table 5. *Effect of straw treatments and population on yield, 1993 harvest (t/ha at 85% dm)*

	Straw treatment		Mean
	Removed	Ploughed in	
Low populations	4.64	4.45	4.55
High populations	4.75	4.51	4.63
LSD		NS*	NS
Mean	4.70	4.48	
LSD		NS	

*LSD for comparison within same straw treatment

Table 6. *Effect of straw treatment and method of establishment on yield, 1994 harvest (t/ha at 85% dm)*

	Straw treatment		Mean
	Removed	Ploughed in	
Method of establishment			
Seeds ploughed in	3.40	3.62	3.51
Seeds drilled	4.23	4.19	4.21
LSD		v=0.538; hi=0.391	0.380
Target population			
15 plants/m ²	3.58	3.74	3.66
20 plants/m ²	4.06	4.07	4.06
LSD		v=0.538; hi=0.391	0.380
Mean	3.82	3.90	
LSD		NS	
Method of establishment ploughed in			
	Seeds drilled	Seeds	
Target population			
15 plants/m ²	3.21	4.11	
20 plants/m ²	3.81	4.31	
LSD		NS	

Discussion

The experiment has been unable to demonstrate any serious harmful effect of chopped straw on bean establishment even where the swath was dense.

Slower crop establishment and subsequent poorer vigour from ploughing seed in may have been exacerbated in this experiment by the wet soil conditions in the autumn and winter and the relatively late sowing date in 1994. Under more normal conditions, advantages from ploughing in seed might be expected as the result of lower plant losses from bird damage.

In 1993 subterranean growth distortions were detected. It is possible that in the presence of large quantities of decaying straw there may be some interference with seedling growth.

The experiment has provided no clear evidence of consistent effects of straw or establishment on yield. It could be concluded that, except where very severe site contamination with anaerobic straw mats occurs, straw disposal method might have little adverse effect on crop performance. However, this work represents only two seasons in one soil type and the limited scope of the work must be remembered.

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