Final Project Summary

Improving oilseed rape for effective weed control

Project number	RD-2009-3652	**Final Project Report**	PR530
Start date	August 2009	**End date**	January 2013
HGCA funding	£155,000	**Total cost**	£155,000

What was the challenge/demand for the work?

In oilseed rape (OSR) crops one option for adapting to the loss of key herbicides or for reducing herbicide use is to increase row spacing to allow for band spraying herbicides or mechanical weeding. Increasing row spacing may have implications on several aspects of OSR growth. It is possible that closer spacing of plants within the row may reduce plant establishment and lead to smaller weaker plants that are more prone to lodging. Light interception may be reduced from that achieved at the optimum Green Area Index (GAI) of 3 to 4 units at flowering due to the failure of the crop canopy to meet between the rows. Weeds may be more likely to exploit areas where competition from the crop is reduced and wider plant spacing between rows can lead to greater weed emergence. Wide row crops may also be more vulnerable to attack from pigeons.

How did the project address this?

The aim of the project was to produce a 'specification' for an oilseed rape crop which balances the needs of crop performance with those required for weed control. This aim was broken down into 4 specific objectives:

1. To determine the optimum row spacing and plant population within the rows to achieve economic yield and prevent additional lodging.
2. To evaluate the effect of the wide-spaced rows on crop performance, weed emergence and seed return, monitor the effects on pests, disease and lodging.
3. To evaluate the effect of varietal type on optimum row spacing and plant population.
4. To assess the economic implications of conversion to wide-spaced rows and alternative methods of weed control.

Two trials were done in each of three years. Each year the trials were sown to oilseed rape, a conventional open-pollinated variety at ADAS Boxworth and a hybrid variety at ADAS Terrington. There were two herbicide treatments: No herbicide and With herbicide. The 'With herbicide' treatment received a full herbicide programme including pre- and post-emergence treatments. There were four row spacings, three seed rates in 2010 and four seed rates in 2011 and 2012. In the No herbicide treatment the number of seed rates was less. A summary of the treatments is included in Table 1. Each year OSR and weed plant counts were done in the winter and the spring. The growth stage of the weeds and growth stage, height and width of the OSR plant was also recorded. GAI assessments were done in late February/early March through photographs or destructive sampling. The fraction of incident radiation that was intercepted by the crop or reflected

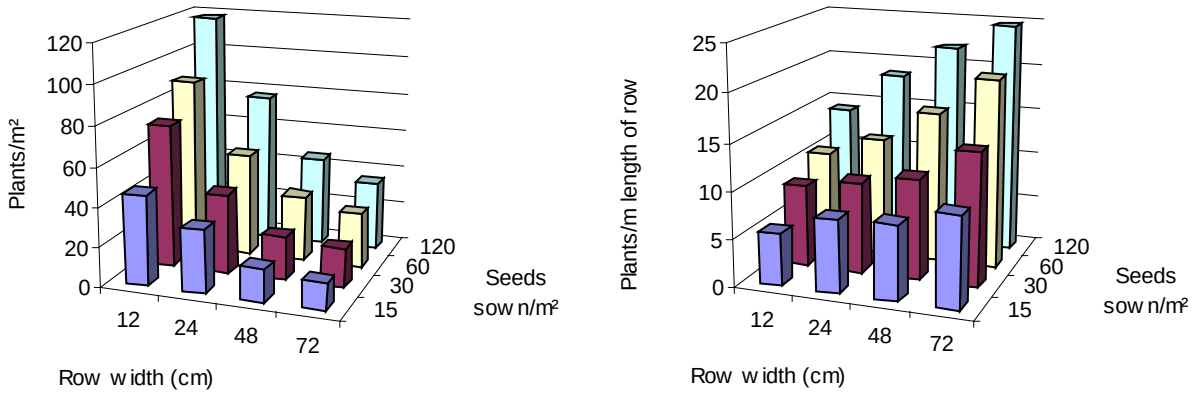
by the crop was measured at mid-flowering. Percentage lodging was measured at the end of flowering and at harvest. Plots were harvested and samples taken for determination of moisture content. Subsamples of harvested grain were assessed for weed seed content.

Table 1. Summary of treatments

		With herbicide Seed rate (seeds sown/m²)							**No herbicide Seed rate (seeds sown/m²)**						
Year	Row width (cm)	15	20	30	40	60	80	120	15	20	30	40	60	80	120
2010	12		✓		✓		✓			✓				✓	
	24		✓		✓		✓			✓				✓	
	48		✓		✓		✓			✓				✓	
	72		✓		✓		✓			✓				✓	
2011 & 2012	12	✓		✓		✓		✓			✓				✓
	24	✓		✓		✓		✓			✓				✓
	48	✓		✓		✓		✓			✓				✓
	72	✓		✓		✓		✓			✓				✓

What outputs has the project delivered?

- The percentage of seeds that established plants was lower at wider row widths and higher seed rates. Over 70% of seeds sown failed to establish plants in the widest row width and highest seed rate, due to inter-plant competition
- The range of spring populations achieved both per m² and per meter length of row were significantly different between the row width treatments. At any one site the highest populations /m^2 were achieved at the narrowest row width (12 cm) with the lowest populations in the 72 cm row widths (Figure 2). The highest number of plants per metre row occurred in the widest rows.
- There was no evidence that row width affected the optimum seeds/m^2 sown or the optimum plants/m^2. However it was shown that, as a result of inter-plant competition limiting plant establishment, it was not possible to establish more than 25 plants per metre of row and yields may decrease above 17 plants per metre. This means that it may not be possible to establish more than 50 plants/m^2 for 48 cm row widths or more than 35 plants/m^2 for 72 cm row widths.
- A wide range of weeds were recorded in the experiments, including black-grass, common chickweed, common poppy, ivy-leaved speedwell and volunteer winter wheat. Overall weed control from the herbicide programme was very good.
- Weed populations were higher at the low seed rate and there were no interactions between row width and seed rate. The effects of seed rate on individual weed species followed the same pattern as for total weed numbers with significantly fewer weeds at the higher seed rate. For example, at Boxworth in 2011, black-grass populations were reduced by 41% and chickweed by 28% by increasing the seed rate from 30 to 120 seeds/m².
- Generally, changing the row width had no effect on the population of weeds.



a) per m² b) per m length of row

Figure 1. The effect of seed rate and row width on plant population and plants per meter length of row (mean of all sites).

- Reducing weeds by increasing seed rate was less effective in wide row crops because there is a limit to the number of plants that can be established per m length of row, which means the maximum plants/m^2 is smaller in wide row crops.
- In situations where weeds were well controlled there was scope to increase row widths up to 48 cm without reducing yield potential. There was also scope to increase row width to 72 cm without reducing yield potential, but only in conditions which allow the plant to compensate fully in terms of branching and pods per branch. Row widths of 72 cm were shown to have a reduced yield following a severe spring drought compared with row widths of 48 cm or less. The widest rows intercepted less light at flowering.
- In situations where weeds were not well controlled, coupled with factors which limit the plants potential for compensation (e.g. spring drought), increasing row width from 24 cm to 48 cm and 72 cm was shown to reduce yield potential.
- Increasing row width did not affect the weed population.
- In the absence of herbicides, higher seed rates reduced weed populations and usually increased yields.
- In conditions where growth was not limited, open-pollinated varieties were shown to compensate as well as hybrids against wide row widths and low plant populations.
- There was no evidence that plants in wide rows were attacked more by pigeons, although more work is required to test whether not cultivating between rows affects this.
- There were only low levels of lodging in the experiments so it was not possible to conclude about the effect of row width on lodging risk.

Who will benefit from this project and why?

This work shows that row width could be increased quite substantially (up to 48cm) without decreasing final yield (in the absence of heavy weed infestation). It was shown that yield did

decline at the widest row widths (72 cm) in some situations and it is postulated that extreme row widths could lead to lower yields in challenging seasons such as severe spring drought.

Manipulating the row width for oilseed rape can be done simply and without cost by shutting off coulters of a standard drill to achieve the required width, but there has been a trend in recent years to establishing oilseed rape by subcasting seed behind the legs of soil cultivators such as a sub-soiler or flatlifter. In this system the row spacing tends to be approximately 40 to 60 cm, and it has been widely adopted (50% of UK farmers) because it reduces the time required for the drilling operation.

Results from the project indicated that there was no evidence for altering the number of seeds/m² sown to maximise gross margin over seed costs for different row widths. Yield was also likely to start to decrease when plants/m row exceeded 17/m and it was not possible to establish more than 25 plants/m due to inter-plant competition. As a result of this, at 48cm row spacing it may not be possible to establish more than 50 plants/m² and at 72cm, more than 35 plants/m².

Herbicide use is a key factor in maximising the yield of oilseed rape. Yields were increased by an average of 41% (range 0–262%) through the use of herbicides. There is little movement for cost-saving here particularly in high black-grass situations or where poppies are a problem.

This project has shown that optimum yields can be achieved on wider rows and this will allow the band herbicide technology developed in RD-2009-3605 to be taken up by the industry. Reductions in herbicide use of 50% may occur due to band spraying, the use of a non-selective herbicide such as glyphosate between the rows will reduce the burden resistant black-grass and difficult to control brassica weeds.

If the challenge has not been specifically met, state why and how this could be overcome
A ‘specification’ for an oilseed rape crop which balances the needs of crop performance with those required for weed control has been established, but there was limited experience of wide rows on lodging or the crop’s vulnerability to pigeon damage. A grower survey may be the best way to collect this information.

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Scientific partners	-
Industry partners	-
Government sponsor	-