FINAL REPORT

AGT10

Agronomic evaluation of short season brassica spp for low rainfall and short season environment

PROJECT DETAILS

PROJECT CODE:	AGT10
PROJECT TITLE:	AGRONOMIC EVALUATION OF SHORT SEASON BRASSICA SPP FOR LOW RAINFALL AND SHORT SEASON ENVIRONMENT
START DATE:	01.07.1997
END DATE:	30.06.2000
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Summary

Project aims

1. Agronomic evaluation of *Brassica* species suitable for low rainfall zones of the Western Australia wheatbelt.

2. Increase the adoption of canola and improve the profitability of the cropping rotation in low rainfall zones.

3. Develop an extension package for agronomists, advisers and consultants to facilitate dissemination of information to growers.

Conclusions

This project has identified a limited number of canola varieties suitable for the low rainfall regions of the wheatbelt. To be successful and widely adopted, the varieties must be mid-short season, herbicide tolerant and semi determinant thus allowing the canola to take advantage of any extension of the growing season.

As with most crops in the WA agricultural environment, early sowing of canola is the greatest determinant of yield and quality.

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Conclusions

Canola is regarded by Western Australia growers as more of an opportune crop driven by season and price. Canola will not become a stable part of the WA broad-acre crop rotation in medium to low rainfall regions until a range of suitable medium to short season, herbicide resistant lines are released to WA growers.

Time of sowing is by far the greatest influence on yield and quality attributes of canola.

As the area sown to canola began to increase, there were few problems with nutrition of canola and crops following canola across much of the canola growing regions. Following the 1999 and 2000 growing seasons, nutrition is a significant emerging issue.

Recommendations

If canola is to become an integral part of the Western Australia farm rotation, short to mid season varieties with herbicide tolerance and semi-determinant attributes enabling varieties to benefit from extended seasons must be bred specifically for the low- medium rainfall regions.

Outcomes

Project aims

1. Agronomic evaluation of *Brassica* species suitable for low rainfall zones of the Western Australia wheatbelt.

2. Increase the adoption of canola and improve the profitability of the cropping rotation in low rainfall zones.

3. Develop an extension package for agronomists, advisers and consultants to facilitate dissemination of information to growers.

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Background

The introduction of canola into the cropping rotations of the medium and low rainfall zones of WA has the potential to lift profitability in these regions by $80/ha over unimproved pasture/cereal rotations. At present 70% of the medium to low rainfall regions is devoted to cropping due to the current variable meat and depressed wool prices, which has reduced the profitability of the pasture phase.

Currently 5.3 million tonnes (76%) of the state's wheat is produced in these zones, 65% of which is grown following unimproved pasture or cereal. Significant profits are consequently foregone due to the lack of suitable rotational options for farmers. The gross margins for various rotations in the low and medium rainfall zones demonstrate this (see Results, AGT 5, Legume Rotations for Low Rainfall Regions). The results of this GRDC funded project show a range of farm practices that contain canola in rotation with wheat and legumes. This rotation has a mean gross margin (GM) of $165/ha compared to $33/ha of unimproved pasture/wheat rotation. It must be noted the canola phase of the rotation was grown in exceptionally good years with high prices, which has biased the results.

The main problem is that when prices dip and or we are faced with a short growing season, the returns from canola in the rotation are significantly lower than wheat following wheat or wheat following grain legumes in the low to medium rainfall regions.

Growers essentially cannot influence price and they are faced with lack of choice when it comes to variety. Canola varieties are currently limited to Karoo⌽ and Pinnacle⌽ , with these two varieties constituting over 95% of the state's deliveries. There is also a lack of knowledge on how these and other available varieties perform under a wide range of planting times, soil types and environmental conditions in the medium to low rainfall regions of the WA wheatbelt.

Project Outputs

This project has identified a limited number of canola varieties suitable for the low rainfall regions of the wheatbelt. To be successful and widely adopted, the varieties must be mid-short season, herbicide tolerant and semi determinant thus allowing the canola to take advantage of any extension in the growing season.

As with most crops in the WA agricultural environment, early sowing of canola is the greatest determinant of yield and quality.

Achievement/Benefit

Project Achievements

Figure 1: Scott, Kellerberrin, 1997, Yields (t/ha)

Variety	T1 (15/5/97)	T2 (11/6/97)
Monty⌽	2.277	2.077
Narrandera⌽	2.06	1.693
Karoo⌽	1.802	1.183
Hyola 42	1.753	1.116
He96-14	1.266	1.355
Ndl	1.007	0.996
Jm97-3	0.981	1.319
Hemola9	0.875	0.833

Oe-1	0.772	0.87
Nd4	0.645	0.748
Jm97-1	0.454	0.619
Jm97-4	0.405	0.815
CV (%)	**25.62**	**24.86**
LSD (P = 0.05)	**0.496**	**0.546**

In year one of the project a number of canola, specialty canola and mustard (*Brassica juncea*) varieties were evaluated for their suitability to the medium to low rainfall regions of Western Australia .

Some of the specialty canola varieties evaluated have been bred for their oil properties. The oil has been developed for industrial use and for use in the catering industry. The Hemola and Oela varieties have unique oil properties, however their suitability to the drier environments has to be questioned, as indicated by the low yields when compared to the industry standard canola varieties.

The mustard varieties evaluated also lacked in terms of yield. The main problem with mustards, both industrial and domestic use, is that the current markets are extremely small and limited in the volumes they can absorb.

Consequently, the price received must be significant to compensate for the inherently low yields of the varieties evaluated. When compared to the current industry standards of current canola varieties and the price received, many of these current specialty lines will not be suitable for the drier environments due to their low yields, lack of markets and likely price volatility. Further breeding is required to develop higher yielding varieties that will perform in drier environments.

Years two and three of the project concentrated on evaluating a number of canola varieties for suitability across a range of soil types in the drier climates.

Figure 2: 1998 Canola Yields (t/ha)

Variety	Jones, Lake CowCowing		Raston, Tammin		
	T1 (30/4/98)	T2 (16/5/98)	T1 (23/4/98)	T2 (18/5/98)	T3 (12/6/98)
Hyola 42	1.011	1.507	2.092	1.144	0.854
Monty[ⓟ]	0.98	1.482	1.725	1.387	0.6603
Rainbow[ⓟ]	0.952	1.283	1.92	0.9	0.4611
Pac 145	0.884	1.55	1.752	1.384	0.594
Pac 144	0.813	1.235	1.15	0.526	0.4609
Karoo[ⓟ]	0.721	1.059	1.685	0.449	0.7429
Narrandera[ⓟ]	0.713	1.321	1.845	1.041	0.7524

CV (%)	11.17	5.435	10.38	9.1	16.13
LSD (P = 0.05)	0.158	0.1197	0.2947	0.148	0.1704

In 1998 we investigated time of sowing x variety, concentrating on varieties with attributes that would more likely fit the drier regions of the wheatbelt.

The newly released variety, Monty, was evaluated against possible new short season varieties PAC 145 and Pac 144. A medium maturity variety, Rainbow, was included, with Narrandera and Hyola 42 being the shorter season checks. Karoo was included because of the increased plantings and wider adoption of this variety throughout the medium to low rainfall regions.

The T1 yields at Jones, Lake CowCowing were reduced by around 60% due to a wind event prior to harvest. The T2 was less affected due to the varieties being less mature and consequently less prone to shatter. The T2 yields reflect the expected T1 yields and variety rankings, with all the quick varieties performing well. At the Raston site, as the time of sowing extends beyond mid May, yields decrease significantly.

The CowCowing trial was duplicated, with both times of sowing evaluated for response to additional applied phosphate. The basal applied P was 7 units, the additional P was a further 9 units. This was a high reactive iron site with high phosphate binding capacity. Results showed no significant responses to phosphate at this site.

All three times of sowing at the Raston site were evaluated for response to additional sulphur and nitrogen. The canola was following a lupin in 1997. An additional 100kg/ha of Amsul (20N 24S) was applied over and above the basal application of Agras Nol (17.5N 17S 7.5P). There was no significant response at this site to the additional sulphur and nitrogen.

The short season varieties performed well at early plantings as well as mid May plantings, Monty being a good all round short season variety performing across a range of soil types and environments.

Figure 3: 1999 Canola, Yields (t/ha) and Oil Content (%).

2.025 (43.6)

Variety	Gardner, Doodlakine		Stewart, Wongan Hills		Rielly, Nth Wyalkatchem
	T1 (25/5/99)	T2 (10/6/99)	T1 (14/5/99)	T2 (8/6/99)	T1 (13/5/99)
Rainbow[PBR]	1.201 (42.4)	1.476 (40.6)	0.883 (41.5)	1.056 (43.9)	
Pac 145	0.463 (41.0)	0.796 (39.9)	0.825 (42.8)	0.666 (42.8)	0.926 (42.9)
Mystic[PBR]	1.157 (44.3)	1.591 (43.4)	1.808 (45.5)	1.302 (44.4)	1.172 (46.0)
44C71[PBR]	1.027 (43.9)	1.418 (42.9)	1.210 (45.6)	0.883 (42.8)	0.833 (45.8)
Karoo[PBR]	0.825 (40.4)	1.172 (38.0)	1.215 (41.0)	0.694 (39.4)	0.833 (42.4)
TM5[PBR]	0.926 (38.9)	1.071 (38.7)	1.418 (43.1)	0.637 (39.7)	0.839 (44.3)

TM8	0.969 (41.5)	1.013 (37.9)	1.403 (43.7)	0.651 (40.5)	0.854 (44.5)
Monty	1.042 (44.0)	1.664 (44.0)	2.069 (45.4)	1.505 (43.8)	1.128 (46.4)
Bugle	0.825 (40.6)	0.984 (38.7)	1.128 (43.7)	0.506 (40.6)	0.796 (45.8)
Hylite 200	0.362 (40.5)	0.521 (38.9)	0.694 (41.5)	0.506 (39.1)	0.738 (42.3)

(Oil Contents shown in parentheses)

1999 was the year of significant rainfall events. The greatest challenge was to keep the trial sites above water. All 1999 trials evaluated varieties on a time of sowing basis only and, as in previous years, the same trends "exist, with early sowing providing the greatest yields.

The aim was to see how the very quick lines of PAC 145 (non-TT) and Hylite 200 (triazine# resistant) would perform relative to district standards. In previous years, these two varieties showed promise as an Integrated Weed Management (IWM) strategy in the fight against herbicide resistant ryegrass and wild radish. As these two varieties are up to 15 days faster to mature than Monty they may provide growers with the opportunity to delay sowing, crop top, mechanically swath or collect resistant ryegrass and wild radish seed while providing an economic yield in a short growing season environment. Unfortunately the Pac lines were extremely susceptible to blackleg, did not maintain yield with delayed sowing and suffered from water logging in the wet growing conditions of 1999. Hylite 200 and Pac 145 both performed poorly. These two varieties have also performed poorly in the drier environment of the 2000 growing season.

1999 was a year when most varieties of canola, long and short season, performed above expectations at the T1 sowings. In a number of the trials longer season varieties such as Rainbow, Clearfield 44C71 and Mystic were amongst the top performers. Monty was a good all round performer at T1 and T2 sowings.

Figure 4: Boyle, York, 1999. Canola Yields (t/ha) and Oil (%) at 5 Times of Sowing.

Variety	Sowing Dates					Mean
	11-May	20-May	29-May	11-Jun	22-Jun	
Pinnacle	2.83 (44.1)	2.30 (43.8)	2.60 (40.8)	0.90 (40.7)	1.10 (38.3)	1.96 (41.5)
Karoo	1.12 (41.7)	1.40 (42.0)	1.10 (39.0)	0.42 (39.7)	0.55 (37.2)	0.91 (39.9)
Hylite 200TT	1.60 (44.1)	1.40 (43.1)	0.90 (41.6)	0.22 (40.9)	0.46 (39.7)	0.92 (41.9)
44C71	2.91 (45.6)	2.94 (45.7)	2.68 (44.2)	1.20 (43.8)	1.24 (41.4)	2.19 (44.2)
Grouse	2.46 (45.3)	2.97 (45.7)	1.26 (40.8)	1.09 (42.3)	1.03 (39.1)	1.76 (42.6)
Monty	2.99 (45.8)	2.65 (45.2)	2.35 (43.3)	1.17 (43.1)	1.70 (40.6)	2.17 (43.6)

Mystic$^{(b)}$	3.43 (48.1)	2.60 (46.3)	3.02 (45.2)	1.64 (44.1)	1.40 (42.4)	2.42 (44.8)
Oscar$^{(b)}$	2.94 (45.0)	3.05 (44.4)	2.82 (42.9)	1.06 (42.4)	1.39 (40.2)	2.25 (43.0)
Pac 145	2.19 (46.3)	1.78 (44.4)	1.45 (42.6)	0.45 (42.0)	0.64 (42.4)	1.30 (43.5)
Rainbow$^{(b)}$	3.31 (45.0)	3.30 (45.0)	3.44 (43.3)	1.64 (42.3)	1.72 (40.6)	2.68 (43.2)
Mean	**2.57 (44.9)**	**2.45 (44.5)**	**2.16 (42.4)**	**0.98 (42.1)**	**1.12 (40.2)**	

(Oil Contents shown in parentheses)

The most significant factor affecting yield and quality of canola over the three years of the project was time of sowing. The three years of the project coincided with three very favourable growing seasons in terms of early sowing opportunities and length of growing season. 1997 had a Summer rainfall event with 130mm growing season rainfall (GSR), 1998 had 200mm growing season rainfall (GSR), followed by 1999 with 325mm growing season rainfall (GSR) in the drier environments.

In terms of canola production the area sown to canola in 1997 was 400,000ha, increasing to 915000ha by the end of 1999. It would be nice to credit this success to AGT 10, however on a more realistic front, the production increase was price driven and the fact that the drier regions of the state had extremely favourable conditions for canola production over the three year period. It must also be noted that this period of production increase was achieved with two varieties. In 1997 and 1998, 95% of deliveries were Karoo, with an increase in the %age of Pinnacle for the 1999 season, this in spite of huge numbers of canola varieties being evaluated for suitability to drier environments over the life of this and other associated projects.

This trial program evaluated a range of Non TT and TT lines in a weed free environment. With about 3.5million hectares of WA crop land infested with wild radish, the breeding of new canola varieties must concentrate on providing inherent herbicide resistance and shorter season varieties suitable for short season environments in order to reduce the impact of weeds on yield and quality.

In discussion with Agseed, Pacific and Pioneer breeders, the number of varieties bred for and soon to be available for the drier environments is limited. Breeders are endeavouring to rectify this problem and are concentrating on providing drought and heat tolerance attributes combined with herbicide resistance.
The main stumbling block still remains in that all breeding programs are Eastern States based and WA largely gets its varieties by default.

In the majority of the trials over the three-year project, Karoo has been one of the mid to poorer performers in terms of yield and quality when compared to mid and shorter season non-TT lines Monty, Mystic, Narendra$^{(b)}$ and Hyola 42.

The biggest concern with this result is that most of the WA crop is Karoo, a necessary evil due to the high levels of *Brassica* weeds in most regions where canola is grown. To add to this there are few herbicide tolerant varieties that can take the place of this variety. A significant level of yield and quality is being foregone because of the limited number of suitable substitute varieties.

Only now are there a slightly greater selection of varieties that may have a fit in the drier environments, this will improve in the future as more suitable lines are reaching the final stages of breeder evaluation.

Industry Benefits

1. Increased profitability of the cropping rotation in low rainfall regions.
2. Increase in tonnage of canola delivered resulting in increased export earnings.
3. Canola provides growers with an alternative break crop and an important option in integrated weed management strategies. Canola can be swathed and windrows burnt or collected, providing growers with a cultural method of weed

control as opposed to chemical weed control options.

4. Possibility of niche manufacturing industries developing to process speciality lines of canola, mustard and industrial rapeseed as new improved specialty lines are developed.

Expected Outcome (benefits)

Outcome (benefits) achieved during the project

Growers and industry have been provided with a best practise agronomic package on growing canola in drier environments. This includes a greater understanding of varietal performance and time of planting limitations of new canola varieties under various environmental conditions.

Expected outcome (benefits) post project

As each years data is produced, and with a coordinated approach to regional evaluation and extension, farmers will adopt new and improved varieties of canola at a rapid rate. Essential to this project is the extension and dissemination of information as it is collected.

In the absence of this research changes to the low rainfall crop rotation would be greatly reduced as growers would tend to stay with known district practice. Nearly 2,000,000ha of land would remain in the unprofitable unimproved pasture phase.

If suitable varieties can be selected and successfully grown, rotation profitability has the potential to increase by $80/ha.

Other Research

The first of the IT herbicide resistant lines of canola that show some promise will enter the market place in 2001. Independent evaluation of these and other comparable herbicide resistant lines must continue in order to provide growers with sound agronomic packages that will enable them to achieve maximum genetic potential of canola varieties and maintain consistent yield and quality across a range of soil types, seasonal variation and environments

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