

Oilseeds WA Research & Industry Review

1 Introduction

The objective of this review is to list current and recent canola research projects and then use the list to draw conclusions on aspects that appear well covered and those that need further attention. We also aim to identify important research areas that are not widely recognised by the canola industry in WA and to encourage others to add to the review.

We are aware that “in house commercially sensitive” projects are being conducted on new oilseed Brassica varieties, such as specialty oil varieties and industrial oils that have significant potential benefits. We do not wish to compromise this confidentially and therefore have not listed any projects that have not been freely provided to us.

Not all research on Canola has been listed due to lack of knowledge of all the work being carried out and time constraints to track down all relevant research. This report will act as a catalyst to others to add projects, discussion and findings.

A detailed review and analysis of the value of each project is well beyond the scope of this initial report. Priority projects identified in the review could be the focus for a more detailed follow-up.

The main outcome we seek from this review is an improved understanding of the majority of the body of research that has been or is now being carried by industry members so that we can make better judgements on future R&D investment for the benefit of the oilseed industry in WA.

2 Industry Issues

Breeding / Varieties (4 - 8 years)

- Disease – more durable host resistance
- Pests – better host resistance
- Frost – better tolerance
- Drought – better tolerance
- Pod shatter – better tolerance

New varieties are currently being bred at an unprecedented rate. The current emphasis is now on further improving polygenetic resistance to Blackleg disease in order to fill the void left by the failure of the former highly successful major gene *sylvestris*-derived resistance incorporated into the ‘Surpass’, some ‘Hyola’ varieties and some other varieties such as ‘Tribune’.

Breeding continues to emphasise Triazine Tolerant varieties, as TT tolerance is essential to maintaining a viable industry in WA until alternative GM weed management options are available.

Breeding programs need to assess the need for improved tolerance to frost, drought and pod shattering, and better resistance to diseases other than blackleg, (such as downy mildew, white rust, Sclerotinia and soil borne diseases) and insect pests, and while some programs are at least assessing the benefits from including at least some of these additional aspects, few are actually addressing these aspects through breeding at this stage.

Input supplies

Input supply issues have recently concentrated on seed coatings (such as fluquinconazole) to assist to reduce blackleg and other fungal diseases following establishment. Further development of liquid Nitrogen fertilisers has increased the options for more timely application of N on canola. The application of other crop chemicals incorporated with liquid N is being developed and could have implications for early insect control in canola.

Sowing

Recent sowing issues include the further adoption of no tillage sowing which can permit earlier sowing before the season opening rains but which increases risk especially in the low rainfall zone. Manipulation of sowing time to avoid synchronization of seedling emergence with the main blackleg ascospore showers is now a practical additional option that many growers can utilise to reduce the severity of losses from blackleg disease.

A few cases of canola seed bounce involving air seeders were reported last year.

Disease

Concern over the collapse of blackleg resistant varieties containing major gene resistance was widely expressed by growers throughout WA early in 2004. It is clear that varieties containing single dominant gene-based resistance derived from *Brassica rapa* ssp. *sylvestris* contain a form of resistance that has already broken down in some areas of WA. Researchers from the University of Western Australia were the first any where in the world to warn the industry of this impending problem, warnings given as early as the beginning of 2003. They have shown that new strains of blackleg fungus are present in WA that can overcome this formally outstanding resistance. This means that utilizing varieties with good polygenic resistance in conjunction with sound management practices offers the best prospects for effective management of blackleg disease.

Downy Mildew is a persistent problem early in each season, particularly on the slower growing TT varieties where it is now considered an important constraint to realizing yield potential, especially under the early seasonal conditions normally prevailing at the beginning of the cropping season in WA. Sclerotinia is becoming an increasing problem, especially in the more northern coastal and central coastal regions. White leaf spot is now present in nearly all crops in WA at high levels and growers are concerned about the potential losses they are incurring from this disease. Concerns have also been raised by growers about the impact of seedling damping-off caused by soilborne fungi such as Pythium and Rhizoctonia. With the planned release of Brassica juncea mustard in 2005/2006, there is also concern about the future role that white rust disease may play in limiting disease potential of mustards in WA.

Insects

RLEM, Bryobia and Balaustium mites were very active in 2004. Growers who did not use the Timerite® strategy for RLEM in combination with protection afforded through seed coating and may have found that seed coating alone was inadequate. DBM has not been a big problem in the north since many growers ceased growing canola.

Slugs were also a problem early in the season. It is considered that slugs are increasing in significance as a pest each year.

Frost

Mid season frost was an issue in the east & south.

Chemical (1 – 3 years)

The APVMA (Australian Pest and Veterinary Medicines Authority) released it's Atrazine Review Draft report for comment in late 2004. The report provided a welcome finding that Active constituents (registrations) are to be affirmed however existing labels instructions are deemed inadequate and the latest approved labels are to be amended. Interested parties are able to comment on the report.

Atrazine resistance in weeds is a potential serious problem that may warrant investigation. The WA Herbicide Resistance Initiative (UWA) is surveying this. Research by DAWA is looking at techniques to delay the onset of Atrazine resistance in weeds.

Threats to the canola industry

Competition from other oilseed crops such as palm, soybean, olives and to a lesser extent sunflower should be worth investigating as the market for vegetable oil is price driven especially in developing countries. Dietary preference for oils is also an issue for the canola oil industry which needs to be monitored and the potential for manipulating preferences is an issues potentially worth following up on.

Post farm issues

The post farm gate industry drives much of the work on oilseeds industry yet relatively few resources are devoted by the industry as a whole to these sectors as evidenced by the lack of research projects on this issue. The significant effect of consumer preference can be quite significant and as such is suspected that more should be devoted to being aware of supply chain issues and consumer demand and dietary issues. A broader investigation involving more post and pre farm gate sectors of projects in this area would be beneficial.

3 Recent and Current Research

The most prolific research organisation on canola has been the Department of Agriculture Western Australia (DAWA) with around 300 different canola projects carried out in the past four years. Other research organisations such as the University of Western Australia and several grower based organisations have conducted around another 100 projects that have been listed in reports. A summarised (non official) list is attached as Appendix 1.

3.1 Varietal Selection and Breeding

Most breeding selection trials are conducted as “commercial in confidence” by the major breeding companies. It is estimated that each company may have more than twenty (20) different potential varieties in the breeding pipeline at any given time.

Other organisations such as CLIMA are working on new varieties with good potential for industrial applications such as Indian Mustard. Specialty oils such as HOLL (High Oleic Low Linolenic) varieties are also being developed. Dovuro, Pacific Seeds, CBWA, Pioneer and the Canola Alliance are reportedly actively involved in developing new varieties through conventional breeding programs. GM Breeders Bayer and Monsanto have apparently reduced or suspended their breeding programs in Australia due to a frustration over the lack of approval to conduct larger scale trials on GM canola and the uncertainty of when, if ever, approvals for full scale production may be given.

The Department of Agriculture Western Australia has conducted around 80 different variety projects in the past four years. This number is expected to be reduced in coming years due to funding cuts to the Department.

Thirty (30) trials concentrated on identifying and demonstrating varietal differences. 2 addressed the understanding of techniques for breeding such as utilisation of double haploids.

Thirty one (31) trials investigated the performance of early mid and late maturing varieties for specific rainfall zones. The proliferation of new varieties has meant that DAWA in particular has put a lot of resources into variety comparison trials to allow growers to make informed choices. The rapid turn-over of varieties makes it difficult to conduct variety specific management trials, although some have been done.

Hence when the above are totalled 20% of all recent research projects in WA were aimed at understanding varietal differences. This suggests that the industry is clearly still under development in WA in that a more mature industry with better knowledge on which varieties grow best in which locations could be expected in the future. However, it is clear that the effect of different specific grower practices on the performance of the most suitable varieties still needs to be addressed and could form a focus of further varietal evaluation trials. Over the next two to three years it is hoped that the new NVT program will assist to address this issue.

3.2 Paddock Selection

Six trials which concentrated on differences in performance according to soil type and soil-based constraints have highlighted this issue as a serious limitation to the potential of canola. Because all these trials were concentrated in the Northern Region there is room for extending this research into other regions to lead to a greater understanding of the relative performance of canola according to soil type which is needed across the canola growing areas of WA. This work could better define the differential responses to yield of canola varieties as they relate to differences in soil type.

3.3 Sowing and Establishment

Forty four (44) experiments looked at various aspects of establishment including

5	seeding rate,
4	stubble effects,
10	time of sowing,
2	deep ripping,
4	nutrients,
1	soil amelioration,
4	tillage equipment,
2	waterlogging,
3	seed treatment,
5	seed size and quality,
3	sowing depth

A number of these trials looked at multiple establishment factors. Time of sowing was the most popular with an assumption that this is related to maturity and growing season length. Clearly, sowing and establishment issues are of high priority and remain an area where further benefits could be obtained from additional research, especially trials that focus on multiple establishment factors.

Due to work carried out to develop a booklet on canola production on this project advice on best establishment techniques appear to be lacking in Western Australia. It would be useful to develop this advice based on the above research and farmer experience especially with no-till establishment techniques.

3.4 Nutrition

Fifty eight (58) trials looked at nutrition.

Of these twenty two (22) looked at various strategies for use of different nutrients and application methods. While 21 investigated nitrogen rates, timing and sources. Only three investigated K by itself, two on sulfur and one on lime. K, S nutrition and liming appear to be areas warranting further investigation. It also appears that more work could be done on better defining the most appropriate management practices in relation to nutrition for the wide-ranging different soil types and across rainfall zones. The combination/interaction effects of N, P, K and S are poorly understood and justify further work.

As the WA canola main production districts have inherently nutritionally poor soils, it is inevitable that there will be strong interactions between level of nutrition and disease, with disease impacts likely to be much worse on crops suffering from sub-optimal nutrition. This is an area warranting further investigation.

3.5 IPM

Weeds

There are around forty eight (48) trials investigating weeds in canola. Of these trials only four were aimed at specific weed species while 44 concentrated either on a comparison of herbicide tolerant varieties (22) or on Triazine tolerant varieties (20). Some were perhaps more akin to variety trials rather than really looking at weed control. The current, almost total reliance upon triazine for weed management is at risk both from the development of triazine resistant weeds and threats to the continuing registration and permitted use of triazines in WA. There is an urgent need to access alternative weed control strategies to atrazine.

Insects

There are around thirty seven (37) trials focused on insects and pests in canola. Of these four looked at cultural control of pests while six (6) investigated chemical control.

The other projects looked at the various insect pests. Bronzed beetle was the subject of a number of experiments as were aphids. For the other insects, including DBM and RLEM, the main problems appear to be under researched. Recommendations for when it is economic to spray for aphid control need to be better defined and in relation to particular varieties or variety types for which the thresholds for insecticide application appear to be different.

Diseases

Around fifty (50) projects investigated disease in canola of these twenty one (21) looked at various aspects of blackleg. Six (6) trials and one research project looked at seedling damping-off caused by *Rhizoctonia*. Another thirteen (13) investigated the efficacy and strategies for fungicides in canola, mainly focussing on control of blackleg disease. While Blackleg disease issues appear to have been (and still are) very well addressed by research at DAWA, it is clear from research undertaken at UWA that new more virulent isolates of blackleg are now appearing in WA have the ability to severely attack even varieties with high blackleg polygenic resistance ratings. This sends a clear warning to growers that failure to implement sound integrated cultural management practices will expose them to significant yield losses from blackleg in the future.

It is clear that other important diseases of canola, such as downy mildew, *Sclerotinia*, white leaf spot, damping-off (except for *Rhizoctonia*) and white rust (*B. juncea* mustard only) have had little if any research in recent decades.

White rust has the potential to dampen the benefits expected from the planned commercial release of *B. juncea* mustard in 2005/06. There is initially a need for the incidence, severity and extent of these diseases other than blackleg to be defined for WA by way comprehensive surveys. Trials then need to be set up to define the yield impacts of the most common of diseases under WA conditions to highlight those diseases that need or warrant further investigations in order to develop effective management options for growers.

It is evident to growers that, in combination, diseases other than blackleg of canola in WA are having a significant adverse impact on yield and profitability of canola in WA. The increasing incidence and severity of some of these diseases, such as downy mildew, *Sclerotinia*, white leaf spot and damping-off is cause for concern.

3.6 Harvest / Transport and Storage

Only four (4) projects have been recently conducted on these aspects. Two (2) focused on weed management rather than improving harvesting suggesting firstly an review of farmer harvesting issues which may confirm a need for more research on harvesting.

3.7 Marketing / Market Research

Twelve projects (12) investigated markets for canola meal and oil.

The meal projects (4) studied the usefulness of canola meal for various animal diets suggesting that significant research could be added or that commercial in confidence work is not reported here as canola meal accounts for ~ 50% of canola's products.

The other eight (8) projects looked at agronomic aspects of growing specialty oils rather than marketing.

None of the projects listed directly focused on marketing aspects of canola. However, a wider investigation is likely to uncover that additional studies have been done on canola markets. There would be benefit from compiling an additional list of canola market reports and projects.

3.8 Production

Thirty (30) projects investigated rotations, constraints to production and canola in various regions. These experiments have provided some key insights into the constraints of canola production in WA. The "Constraints to Production" Projects are recent projects that will provide important data to help further develop farming systems that include canola in the rotation. However, as constraints appear variable between farms, areas and regions, a more comprehensive and detailed set of studies need to be made across the main canola areas of WA to highlight and focus on the main constraints in particular areas and regions.

More case studies of leading canola growers could be useful to benchmark production techniques and results across the state.

3.9 Seasonal Conditions

Four (4) projects investigated seasonal conditions. Of the four three investigated drought in low rainfall districts suggesting that they looked at short season varieties performance in the low rainfall zone rather than improving performance through cultural techniques, site selection or other agronomic packages.

As many projects listed under varietal investigation section 3.1 have investigated variety performance for different season length/rainfall there does not appear to be a need to investigate this beyond current variety breeding programs and pre release and post release demonstration / trials.

4 Priority Issues for Future Research

Priority issues are provided as a starting point for specialists and industry leaders to workshop a more comprehensive canola research strategy for WA.

Varieties

- Investigate breeding for improved tolerance to frost, drought, pod shattering, insects and diseases other than blackleg
- Evaluate varieties for yield response to soil type and different grower practice

Establishment

No further research is identified in this area. Effort to further develop advice on best establishment techniques based on past research and farmer experience especially with no-till establishment techniques is suggested.

Nutrition

- Applied research relying heavily on past and current project results needs to be the basis to formulate better fertiliser management practices for different soils types and rainfall zones including advice on the combination/interaction effects of N P K and S
- Quantify the effect of disease on crops suffering from sub-optimal nutrition
- Measure effects/benefits of application of crop chemicals with liquid N

Weeds

- Define and access alternative weed control strategies to atrazine / TT canola
- Assess occurrence and extent of Atrazine resistance in conjunction with the WA Herbicide Tolerance Initiative

Insects

- Assess potential for increased slug damage in early crops
- Assess slug control methods
- Extend results on economic aphid control research for new varieties

Disease

Investigate the incidence, severity and extent of downy mildew, Sclerotinia, white leaf spot, damping-off (except for Rhizoctonia) and white rust (*B. juncea* mustard only) diseases by way comprehensive surveys and targeted trials.

Continue to develop grower friendly "Managing Blackleg" packages and models with particular focus on cultural practices and polygenic type resistant varieties.

Markets

- Further define the uses / role of canola meal
- Compile and report on recent canola market investigations
- Investigate current consumer preference /demand dietary issues

Grower Surveys / Case Studies

- Conduct detailed studies on the main production constraints in specific districts
- Benchmark production techniques and constraints through leading growers
- Conduct a review of harvesting issues

5 Recommendations

Many projects listed have delivered their results in the last few years or are about to report. A first priority is arguably to review in detail these results and add their advice to the "Oilseeds WA Grower Updates" and "Growing Western Canola" Booklet for 2006.

Based on this review and knowledge of the current industry situation research projects could now concentrate on the following five priority areas.

1. Determine extent of atrazine resistance
2. Define alternative weed control strategies to atrazine / TT canola
3. Continue to develop blackleg management strategies.
4. Investigate extent and impact of downy mildew, sclerotinia, white leaf spot and damping-off
5. Benchmark production techniques and constraints of leading growers

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Appendices

1 List of Research Projects

1. Varietal Selection and Breeding

Dovuro Canola Variety Trial	MIG	2000
Broadleaf varieties - peas, lupins and canola (Meckering, WA)	WANTFA	2002
Canola genotype x seed sources	DAWA	18-Jan-02
Canola Interstate variety Trial (High Rainfall)	DAWA	23-Feb-00
CANOLA Interstate variety Trial 1991 (MED RAINFALL)	DAWA	23-Feb-00
Canola phenology series	DAWA	18-Jan-02
Canola Variety Demonstration	MIG	2000
Canola Variety Demonstration	MIG	2002
Canola Variety Demonstration (South Mingenew, WA)	MIG	2000
Canola variety growth responses to environment	DAWA	28-Jun-04
Canola Variety Trial	MIG	2003
Canola variety trial	MIG & OWA	Apr-03
Canola Variety trial – Farmscale	MIG & OWA	2003
Determination of histological and biochemical resistance mechanisms for the identification of molecular markers for blackleg resistance in oilseed Brassica (WR)	UWA	31-Dec-03
Double Haploid canola evaluation	DAWA	26-Jul-02
EVALUATION OF CANOLA VARIETIES	DAWA	13-Dec-01
EVALUATION OF NEW RAPESEED AND RADISH VARIETIES	DAWA	27-Oct-00
Preliminary yield trial - NSW canola accessions, S3-2 (National)	DAWA	14-Dec-99
Preliminary yield trial - Victorian canola accessions, rde1 (DAWA	13-Dec-99
Preliminary yield trial - Victorian canola accessions, rde2 (DAWA	23-Nov-99
preliminary yield trial - WA canola SELECTIONS 1997 (NATIONAL)	DAWA	23-Nov-99
Preliminary Yield Trial, Canola Breeding Program High oleic/low	DAWA	5-Sep-03
Preliminary Yield Trial, D. Bowran canola selections	DAWA	19-Nov-99
Single plant selection rows, National Canola Breeding Program	DAWA	21-Jun-04
WA single plant selection rows, National Canola Breeding Program	DAWA	19-Nov-99
WA single plant selection rows, National Canola Breeding Program	DAWA	23-Jul-02
WA single plant selection rows, National Canola Breeding Program	DAWA	5-Sep-03
2002 Early Maturity Canola Stage 4	DAWA	5-May-03
2003 Canola S4 early Maturity	DAWA	16-Jun-04
2003 Canola S4 Mid Maturity	DAWA	16-Jun-04
2004 Canola S4 Mid Maturity	DAWA	2-Jul-04
CANOLA: ATR HIGH RAINFALL CULTIVAR ASSESSMENT	DAWA	23-Feb-00
CANOLA: STAGE 2 MED RAINFALL	DAWA	23-Feb-00
Canola: Time of Flowering	DAWA	23-Feb-00
Evaluation and selection of high quality Brassica breeding lines for short season environments of WA (WR)	DAWA	30-Jun-04
Improving the performance of new canola varieties in the high RF	DAWA	26-Aug-03
Late sowing of canola series	DAWA	18-Jan-02
Late sowing of early maturity canola	DAWA	6-Oct-01
Stage 2 - Early maturity Canola Evaluation Interstate selection	DAWA	20-Jul-02
Stage 2 - Early maturity Canola Evaluation WA	DAWA	20-Jul-02
Stage 2 - Late Maturity Canola Evaluation Interstate selection	DAWA	20-Jul-02
Stage 2 - Mid Maturity Canola Evaluation WA	DAWA	20-Jul-02
Stage 2 - Mid Maturity Canola Evaluation WA	DAWA	23-Jul-02

Stage 2 early and Mid-maturity canola evaluation WA Selections	DAWA	31-Mar-04
Stage 2- Early maturity Canola Evaluation Interstate selection	DAWA	25-Jul-02
Stage 2 Early Maturity Canola Evaluation Interstate selections	DAWA	6-Oct-01
Stage 2- Early maturity Canola Evaluation WA	DAWA	25-Jul-02
Stage 2 interstate canola evaluation mid maturity	DAWA	12-May-04
Stage 2 Late Maturity Canola Evaluation Interstate selections	DAWA	6-Oct-01
Stage 2 Mid Maturity Canola Evaluation	DAWA	6-Oct-01
Stage 2 Mid Maturity Canola Evaluation Interstate selections	DAWA	6-Oct-01
Stage 2, Early and Mid maturity canola WA Selections	DAWA	1-Oct-03
Stage 2, Early and Mid maturity canola WA Selections	DAWA	1-Oct-03
Stage 2, Early and Mid maturity canola WA Selections	DAWA	28-Jun-04
Stage 2, Early maturity canola Interstate	DAWA	1-Oct-03
Stage 2, Early maturity canola Interstate	DAWA	1-Oct-03
Stage 2, Mid maturity canola Interstate	DAWA	1-Oct-03
WA early maturity canola selections yield evaluation	DAWA	19-Nov-99
WA early maturity canola selections yield evaluation	DAWA	19-Nov-99
Commercial evaluation of HOLL canola lines	DAWA	13-May-04
	DA & Mingenew-Irwin Group	
Evaluation of alternative oilseeds	Group	20-May-03
Stage 2 Interstate mustard evaluation	DAWA	6-Apr-04
Stage 2, High oleic/low linolenic canola evaluation	DAWA	28-Jun-04
Stage 2, Mustard Interstate	DAWA	21-Jun-04
Phenological response in canola varieties to time of sowing	DAWA	28-Jun-04
AgrEvo Non Transgenic canola Yield Trial	DAWA	14-Dec-99
2003 Canola IT and TT Compare	DAWA	16-Jun-04
2004 Canola IT and TT Compare	DAWA	2-Jul-04
New Triazine Tolerant Canola Varieties	MIG	2000
Roundup Ready canola - WA advanced Yield Trial	DAWA	9-Mar-01
Stage 2 TT/IT canola evaluation WA selections	DAWA	31-Mar-04
Stage 2, Triazine tolerant canola WA selections	DAWA	28-Jun-04
Field screening of advanced canola varieties for their resistance	DAWA	16-Nov-99
Field screening of canola genotypes to locate and improve resistance	DAWA	16-Nov-99
Field screening of canola germplasm for Rhizoctonia resistance	DAWA	16-Nov-99
EVALUATION OF CANOLA VARIETIES VARYING IN GLUCOSINOLATE LEVELS FO	DAWA	10-May-02
Canola Seeding Rate Demonstration	MIG	2003
canola variety trial and a deep ripping demonstration	LIEBE	2004
2. Paddock Selection		
CANOLA ESTABLISHMENT TECHNIQUES ON A LOAMY SAND AT MINGENEW	DAWA	29-Jan-04
CANOLA ESTABLISHMENT TECHNIQUES ON clay loam AT MAYA	DAWA	29-Jan-04
CANOLA ESTABLISHMENT TECHNIQUES ON clay loam AT OGILVIE	DAWA	29-Jan-04
CANOLA ESTABLISHMENT TECHNIQUES ON SANDPLAIN AT MAYA	DAWA	29-Jan-04
CANOLA ESTABLISHMENT TECHNIQUES ON SANDPLAIN AT MINGENEW	DAWA	29-Jan-04
CANOLA ESTABLISHMENT TECHNIQUES ON SANDPLAIN AT OGILVIE	DAWA	29-Jan-04
3. Sowing and Establishment		
Stubble, Seeding Technique and seed size affect canola establishment and Yield	MIG	2001
STUDY THE EFFECTS OF SEEDING RATE AND PLANTING PATTERN ON THE GROWTH OF CANOLA	DAWA	3-May-00
Canola seed rates and time of sow effect on oil quality in low	DAWA	31-May-01
Effect of increasing canola seedling rates on rye grass competition	DAWA	31-Mar-03

ROW SPACING AND FERTILISER PLACEMENT FOR KAROO CANOLA AT TWINDEW	DAWA	26-Jun-00
Seed rates for Triazine Tolerant canola IN A DRY ENVIRONMENT	DAWA	16-May-00
Seeding rates of canola demonstration	DAWA	18-Oct-00
CANOLA SEEDING RATE IN LOW RAINFALL ENVIRONMENTS	DAWA	23-Feb-00
CANOLA: VARIETY X SEEDING RATE X TIMING OF NITROGEN APPLICATION	DAWA	23-Feb-00
CANOLA: VARIETY X SEEDING RATE X TIMING OF SEEDING	DAWA	23-Feb-00
Effect of polymer seed coating on CANOLA seeding establishment	DAWA	29-Jan-04
Evaluation of ways of placing Impact (treated fertilizer for	DAWA	26-Jun-00
Wet Vs Dry Sown Canola and Evaluation of Polymer seed coating	MIG	2001
Canola Seed increase plots, Dr Roy	DAWA	27-Apr-00
Canola seed quality over different generations and different	DAWA	19-Jan-02
Canola seed size and seed rate (Meckering, WA)	WANTFA	2002
Effect of seed size on canola establishment, growth and yield	DAWA	29-Jan-04
effect of seed size on seeding emergence rate and vigor of Canola	DAWA	29-Jan-04
Effect of seeding depth and seed size on canola establishment	DAWA	29-Jan-04
Seeding depth of canola demonstration	DAWA	18-Oct-00
Sowing depth with canola	DAWA	4-Sep-04
CANOLA: VARIETY X SOIL TYPE X NITROGEN	DAWA	23-Feb-00
Constraints to canola production on the loamy soils of northern	DAWA	31-Mar-03
CANOLA Stubble management through cultural practices for blackleg	DAWA	9-Jul-02
EFFECT OF CANOLA RAPESEED STUBBLE ON ESTABLISHMENT OF CLOVER	DAWA	17-Jul-00
Effect of stubble, seeding technique and seed size on canola	DAWA	29-Jan-04
Effect of Stubble, seeding technique and seed size on Canola	MIG	2000
CANOLA VARIETIES X TIME OF SOWING	DAWA	23-Feb-00
CANOLA: TIME OF SEEDING FACTORIAL	DAWA	23-Feb-00
Dry-sowing canola	DAWA	18-Jan-02
Early sowing of canola	DAWA	27-Apr-00
EFFECT OF SOWING DATE ON SEED YIELD AND GROWTH OF CANOLA	DAWA	17-Mar-01
Effect of temperature on canola germination rate	DAWA	29-Jan-04
Effect of time of sowing on incidence and severity of damping-off	DAWA	9-Jul-02
Effect of time of sowing on incidence and severity of pre/post-	DAWA	16-Nov-99
TIME OF SOWING AND SEED BED FOR CANOLA AT TENINDEWA	DAWA	26-Jun-00
Time of sowing canola (Mullewa)	DAWA	2-Mar-00
DEEP RIPPING FOR CANOLA	DAWA	28/04/2000
DEMONSTRATION OF EFFECT OF DEEP RIPPING ON GROWTH OF CANOLA	DAWA	18-Oct-00
EFFECT OF RATE AND TIMING OF NITROGEN ON SEED YIELD AND GROWTH	DAWA	17-Mar-01
EFFECT OF NITROGEN ON SEED YIELD OF CANOLA	DAWA	8-May-01
EFFECT OF PHOSPHATE PLACEMENT ON SEED YIELD OF CANOLA	DAWA	8-May-01
Tillage and nitrogen on canola production	DAWA	31-Mar-03
Demonstration of effect of lime on canola	DAWA	18-Oct-00
EFFECT OF NO TILLAGE OPENER TYPE ON SOWING CANOLA, WITH AND WITHO	DAWA	7-Jun-00
Evaluation of alternative No Tillage Establishment	DAWA	7-Jun-00
Knifepoint depth for wheat and canola (Meckering, WA)	WANTFA	2002
The effect of different seeding point size, cultivating point size	DAWA	1-Jul-00
CONTROL OF WATERLOGGING IN CERIAL CROPS ON DUPLEX SOILS BY SURFACE	DAWA	11-Feb-00
Waterlogging tolerance of canola	DAWA	5-Aug-00

4. Nutrition

Assessment of different canola nutrition strategies in the high	DAWA	14-Mar-02
Canola seed mixed with fertilizers	DAWA	23-Feb-00
DEMONSTRATION OF EFFECT OF POTASH NAD NITROGEN ON GROWTH OF CANOLA	DAWA	18-Oct-00
DEMONSTRATION OF EFFECT OF THE APPLICATION OF POTASH AND NITROGEN	DAWA	18-Oct-00
Effect of fertilizer, plant density and row spacing on nutrient	DAWA	28-May-04
Improving soil fertility using canola meal	DAWA	15-Jan-03
Nitrogen and potassium application on wheat and canola for improving	DAWA	9-Jun-00
Nitrogen x Phosphorous on canola	DAWA	12-May-04
Nitrogen x Phosphorous on canola and wheat	DAWA	6-Mar-03
Nitrogen x phosphorus on canola	DAWA	11-Sep-01
Nitrogen x potassium on canola	DAWA	23-Apr-03
Nitrogen x potassium on wheat and canola	DAWA	6-Mar-03
Nitrogen x sulphur on canola	DAWA	12-May-04
NUTRIENT UPTAKE OF CANOLA	DAWA	2-Mar-02
Nutrition of second wheat crop following swathed canola	DAWA	6-Mar-03
Nutrition of second wheat crop following swathed canola	DAWA	6-Mar-03
Nutrition of wheat following canola	DAWA	14-Feb-01
Nutrition of wheat following swathed canola	DAWA	6-Mar-03
Potassium and Nitrogen for wheat and canola (Meckering, WA)	WANTFA	2002
POTASSIUM AND SULPHUR FERTILISERS REQUIREMENTS FOR CANOLA AT	DAWA	26-Jun-00
RATES AND PLACEMENT OF NITROGEN/PHOSPHORUS COMPOUND FERTILIZER	DAWA	26-Oct-00
RATES OF NITROGEN AND PHOSPHORUS ON WHEAT AND RAPESEED	DAWA	26-Oct-00
Response of wheat, lupins and canola to topdressed and drilled	DAWA	13-May-04
Nitrogen benefits to canola from field pea and lupin crops	DAWA	8-Apr-03
AMMONIUM NITRATE AND UREA, DRILLED COMPARED WITH BROADCAST, FOR	DAWA	26-Oct-00
EFFECT OF AMMONIUM NITRATE RATES AND SEEDING RATES ON RAPESEED	DAWA	26-Oct-00
EFFECT OF NITROGEN ON SEED YIELD AND QUALITY OF CANOLA	DAWA	18-Oct-00
EFFECT OF NITROGEN ON SEED YIELD AND SEED QUALITY OF CANOLA	DAWA	18-Oct-00
EFFECT OF RATES OF UREA AND SEEDING RATE ON RAPESEED	DAWA	26-Oct-00
EFFECTS OF RATE AND TIME OF NITROGEN APPLICATION ON BARLEY QUALITY	DAWA	1-Jun-00
Flexi-N placement for canola (Meckering, WA)	WANTFA	2002
Interaction of nitrogen with other nutrient elements for production of canola grain and oil	DAWA	31-Dec-05
Nitrogen application for canola varieties	DAWA	12-May-04
Nitrogen for triazine tolerant (TT) CANOLA AND NON-TT CANOLA	DAWA	18-Jan-02
NITROGEN REQUIREMENT OF BARLEY AFTER CLOVER LUPINS AND CEREAL	DAWA	7-Mar-01
Nitrogen x time of application for canola	DAWA	26-Nov-02
Nitrogen x time of application for canola	DAWA	23-Oct-03
Nitrogen x time of sowing for canola	DAWA	18-Jan-02
RATES AND SOURCES OF NITROGEN ON RAPESEED	DAWA	26-Oct-00
RATES AND TIMES OF APPLICATION OF UREA ON RAPESEED	DAWA	26-Oct-00
Rates of Nitrogen on canola and wheat	DAWA	18-Jan-02
Rates of Urea on Rapeseed and wheat	DAWA	26-Oct-00
SPLIT APPLICATION OF NITROGEN FOR RAPESEED	DAWA	26-Oct-00
Tillage and nitrogen effects on canola productivity (Mingenew, WA)	DAWA	2002
TIMES OF APPLICATION OF NITROGEN ON RAPESEED VARIETIES	DAWA	26-Oct-00
What is the best nitrogen timing for canola? (Badgingarra, WA)		2002
COMPARATIVE POTASSIUM REQUIREMENT OF BARLEY, RAPESEED, LUPINS AND	DAWA	15-Dec-01
DEMONSTRATION OF EFFECT OF THE APPLICATION OF POTASH ON GROWTH OF		
CANOLA	DAWA	18-Oct-00

POTASSIUM NUTRITION OF CANOLA AND WHEAT	DAWA	18-Jan-02
CANOLA RESPONSES TO DEEP BANDING OF LIME	DAWA	11-Sep-03
Sulphur application for canola	DAWA	13-May-04
Sulphur application for canola varieties	DAWA	12-May-04
6. Weed		
Biofumigation: Can canola and mustard reduce the incidence/severi	DAWA	26-Jun-00
CHLORMEQUAT MANIPULATION OF CANOLA	DAWA	21-Aug-00
2,2-DPA in canola - 1999	DAWA	17-Dec-99
2002 Canola IT/TT Comparison	DAWA	5-May-03
canola Tolerance to herbicides	DAWA	18-Dec-99
Diuron, a possible alternative to simazine (Mingenew, WA)	MIG	2002
Environmental impacts of herbicide tolerant canola and associated agronomic on soil biological processes	CSIRO	30-Nov-04
Herbicide Tolerant Canola package evaluation (non GENETICALLY	DAWA	12-May-00
Interstate Conventional Canola Evaluation Early Maturity	DAWA	21-Jun-04
Post emergent Herbicides for canola - 1997	DAWA	2-Mar-00
Pre and Post-Emergent Herbicides for canola	DAWA	8-Sep-99
Preliminary Yield Trial, Canola Breeding Program Conventional	DAWA	5-Sep-03
Preliminary Yield Trial, Canola Program - conventional	DAWA	31-Mar-04
Preliminary Yield Trial, Canola Program Imidazolinone Tolerant	DAWA	31-Mar-04
Single Plant Selection Rows, National Canola Program - Convention	DAWA	13-May-04
Single Plant Selection Rows, National Canola Program Herbicide	DAWA	13-May-04
Stage 2 herbicide tolerant canola evaluation Interstate early	DAWA	12-May-04
Stage 2 herbicide tolerant canola evaluation Interstate mid	DAWA	12-May-04
Stage 2, Herbicide tolerant canola Interstate Early maturity	DAWA	21-Jun-04
Stage 2, Herbicide tolerant canola Interstate Mid maturity	DAWA	28-Jun-04
Stage II herbicide tolerant canola: Mid maturity (Mingenew, WA)	DAWA	2002
Tolerance of imidazolinone tolerant (IT) canola to herbicides	DAWA	19-Jan-00
TT & IT Canola Variety Demonstration	MIG	2001
TT & IT Canola Variety Trial	MIG	2001
2002 Triazine Tolerant Canola Stage 4	DAWA	5-May-03
2003 Early Maturity Triazine canola	DAWA	16-Jun-04
TT Canola Variety Demonstration	MIG	2002
an investigation into the hydrogeological transport of atrazine in soils of the WA wheat-belt	Chemistry Centre WA	30-Nov-04
Effect of triazine on blackleg resistance of triazine tolerant (DAWA	21-Jul-99
Preliminary yield trial - Victorian TRIAZINE TOLERANT canola	DAWA	23-Nov-99
Preliminary yield trial - Victorian TRIAZINE TOLERANT canola	DAWA	13-Dec-99
Preliminary Yield Trial, Canola Breeding Program Triazine	DAWA	5-Sep-03
Preliminary Yield Trial, Canola Breeding Program Triazine	DAWA	5-Sep-03
Preliminary Yield Trial, Canola Program Triazine Tolerant	DAWA	31-Mar-04
Radish control in triazine tolerant (TT) Canola - 1998	DAWA	6-Nov-02
Stage 2 - Triazine Tolerant Canola evaluation Interstate	DAWA	23-Jul-02
Stage 2 - Triazine Tolerant Canola evaluation WA	DAWA	26-Jul-02
Stage 2 Triazine Tolerant Canola Evaluation	DAWA	6-Oct-01
Stage 2 Triazine Tolerant Canola Evaluation Interstate selections	DAWA	6-Oct-01
Stage 2, Triazine tolerant canola WA selections	DAWA	30-Sep-03
Stage II triazine tolerant canola: WA selections (Mingenew, WA)	DAWA	2002
Triazine tolerant canola - Seed increase plots	DAWA	26-Jul-02

Triazine tolerant Canola bulk-up	DAWA	17-Dec-99
Triazine tolerant Canola Herbicides	DAWA	2-Mar-00
Triazine Tolerant Canola Varieties	MIG	1999
COMPETITION OF RAPESEED AND WIMMERA ANNUAL RYEGRASS AT TWO LEVELS	DAWA	26-Oct-00
Double gee / dock control in canola	DAWA	23-Feb-00
Emerging weeds in broad-leaved crops (canola and pulses)	DAWA	29-Aug-00
The effect of seeding rate on the suppression of annual ryegrass	DAWA	14-Aug-03
7. Insects		
Cultural management and canola seedling pests after pasture	DAWA	22-Nov-02
Cultural management and canola seedling pests IN STUBBLE	DAWA	22-Nov-02
Rotation effects on canola pests	DAWA	23-Jan-04
Bronzed field beetle in canola (effects of rotations)	DAWA	16-Jan-03
Bronzed field beetle in canola (size of larvae)	DAWA	16-Jan-03
Bronzed field beetle in canola (sprays against larvae)	DAWA	16-Jan-03
Bronzed field beetle in canola, effects of rotations on population	DAWA	22-Nov-02
Bronzed field beetle larvae in canola	DAWA	22-Nov-02
Bronzed field beetle larvae in canola, effects of seeding rates and seed	DAWA	22-Nov-02
Damage to canola seedling crops by Weevil species	DAWA	23-Jan-04
Assessment of seed dressings on the growth, yield and oil of Cano	DAWA	14-Mar-02
Chemical control of canola seedling pests	DAWA	22-Nov-02
effect of seed dressings on insect pests during canola seedling	DAWA	21-Aug-01
Effect of single or multiple spray treatment on the control of	DAWA	21-Nov-02
Effectiveness of different rates of Gaucho seed dressing in	DAWA	12-May-04
EFFICACY OF LOWER CHEMICAL RATES TO CONTROL APHIDS IN CANOLA CROP	DAWA	1-Aug-02
False wireworm in canola following lupins	DAWA	22-Nov-02
POT TRIAL TESTING SEED DRESSINGS ON CANOLA FOR FALSE WIREWORM	DAWA	22-Nov-02
Slugs in canola, effects of treatments after seeding	DAWA	22-Nov-02
Damage to canola seedling crops by mite species	DAWA	23-Jan-04
Damage to canola seedling crops by three mite species	DAWA	23-Jan-04
Honey bee pollination of canola (<i>Brassica napus</i> cv karoo) in	DAWA	27-Apr-01
The effect on canola cv karoo yields of honey bee density and	DAWA	27-Apr-01
Management of native budworm in chickpeas, other new pulse crops	DAWA	26-Jun-00
Native budworm management in new pulse crops and canola	DAWA	26-Jun-00
Management of earwigs as pests of canola seedlings	DAWA	31-Mar-04
APHID COLONISATION PATTERNS ON CANOLA PLANTS	DAWA	7-Apr-03
Aphid numbers and virus in canola data collection for	DAWA	1-Dec-01
Aphid Resistance in Canola Cultivars and Alternative Oilseeds	DAWA	7-Apr-03
Effect of green peach aphid, turnip aphid and cabbage aphid on canola	DAWA	20-Jan-04
Optimal Aphid Spraying Time in yellow lupins and Canola	DAWA	10-Feb-00
THE EFFECT OF APHID FEEDING DAMAGE ON SEED YIELD AND OIL CONTENT	DAWA	1-Aug-02
THE EFFECT OF APHID FEEDING DAMAGE ON YIELDS AND OIL CONTENT OF	DAWA	1-Aug-02
DETERMINING YIELD loss in canola due to diamond back moth (<i>plutell</i>)	DAWA	6-Apr-01
NOTHERN AGRICULTURAL REGION DIAMOND BACK MOTH (DBM) PHEREMONE	DAWA	6-Apr-01
THE EFFECT OF DIAMONDBACK MOTH FEEDING DAMAGE ON YIELDS AND OIL	DAWA	1-Aug-02
Chemical control on the canola pest, weed web moth	DAWA	23-Jan-04
8 Disease		
Developing new screening methods for identifying host resistance to Sclerotinia and White rust	UWA	2004/09
Determination of histological and biochemical resistance mechanisms for identification of molecular makers for blackleg resistance	UWA	2001/04

Manipulation of canola stubble for the management of blackleg disease	UWA	2001/04
Effect of rotational sequence of canola on severity of damping-off caused by <i>Rhizoctonia solani</i>	UWA	2000/04
Field evaluation of seed dressing fungicides for canola against	DAWA	17-Nov-99
Infection period of canola leading up to development of crown	DAWA	12-May-04
Investigations on ascospore release of <i>leptosphaeria maculans</i> on	DAWA	14-Nov-02
Management of fungal diseases of canola for sustainable canola industry in Western Australia	DAWA	30-Jun-04
Monitoring fungal diseases in canola	DAWA	22-Mar-01
Monitoring fungal diseases in canola crops	DAWA	24-Jun-00
Yields of commercial canola cultivars grown under a severe diseases	DAWA	24-Jun-00
AgrEvo Transgenic canola Blackleg disease nursery	DAWA	12-Mar-01
Blackleg Control in Canola	MIG	1999
Blackleg Disease Nursery, advanced canola varieties	DAWA	17-Nov-99
Blackleg Disease Nursery, canola	DAWA	6-Oct-01
Blackleg Disease Nursery, canola	DAWA	5-Sep-03
Blackleg Disease Nursery, canola	DAWA	21-Jun-04
Chemical suppression of blackleg on canola residues	DAWA	9-Jul-02
Collection of blackleg isolates from canola	DAWA	13-Oct-03
CONTROL OF BLACKLEG SEEDLING INFECTION IN RAPESEED	DAWA	14-Mar-01
Controlling blackleg (<i>leptosphaeria maculans</i>) and <i>pythium</i> on Cano	DAWA	14-Jul-03
efficacy of fungicides for control of blackleg in canola	DAWA	27-Jul-01
Evaluate efficacy of flusilazole 40EC for control of blackleg in	DAWA	24-Jun-00
Feasibility study to evaluate potential biocontrol agents (parasitic wasps) for sustainable management of blackleg disease (WR)	UWA	31-Dec-05
Foliar spray application of fungicides for control of blackleg in	DAWA	24-Jun-00
Foliar sprayed fungicides for control of blackleg in canola at	DAWA	1-Jul-00
FOLIAR tilt fungicide for control of blackleg in canola	DAWA	14-Nov-02
Impact Applied "In Furrow" Controls Blackleg	MIG	2000
Investigations on dynamics of ascospore discharge from 1998 canola	DAWA	24-Jun-00
Investigations on perithecial maturation and ascospore release of	DAWA	24-Jun-00
Manipulation of canola trash for the management of blackleg disease (WR)	UWA	21-Jan-04
Monitoring blackleg in canola	DAWA	9-Jul-02
Transgenic canola with robust field resistance to blackleg disease (A)	CSIRO	5-Aug-03
Efficacy of fungicides as combination of seed dressings and folia	DAWA	24-Jun-00
efficacy of fungicides as foliar sprays and the timing of their	DAWA	27-Jul-01
Efficacy of fungicides as combination of seed dressings and folia	DAWA	24-Jun-00
Evaluate efficacy of fungicides as in furrow treatments for control	DAWA	24-Jun-00
The effect of Impact-in-Furrow fungicide on canola	DAWA	18-Oct-00
The effect of Impact-in-Furrow fungicide on canola Tenindewa	DAWA	26-Jun-00
Collect and identify <i>Rhizoctonia</i> strains associated with hypocotyl	DAWA	9-Jul-02
Glasshouse screening of canola germplasm against <i>Rhizoctonia</i>	DAWA	16-Nov-99
INVOLVEMENT OF RHIZOCTONIA SPP. WITH A SEEDLING HYPOCOTYL ROT OF	DAWA	8-Mar-01
Pathogenicity and strain typing in <i>Rhizoctonia</i> resistance	DAWA	17-Nov-99
Pathogenicity and strain typing in <i>Rhizoctonia</i> species associated	DAWA	17-Nov-99
Screening of canola germplasm against <i>rhizoctonia solani</i> strain Z	DAWA	9-Jul-02
DETERMINING THE IMPACT OF BEET WESTERN YELLOWS VIRUS ON YIELD AND	DAWA	8-Jul-02
6. Harvest / Transport and Storage		
Canola Harvesting - Windrowing Vs DesicCation Vs Direct Harvest	DAWA	29-Aug-00
Effect of swathing and seed catching on wild radish in triazine	DAWA	18-Jan-02
Impact of swathing and crop topping on the seed viability of wild	DAWA	18-Jan-02

Timing for swathing wheatbelt canola	DAWA	18-Jan-02
7. Marketing / Market Research		
Canola increases marbling and fat texture in long grain-fed cattle	DAWA	29-Aug-00
Effect of level of dietary canola seed, basal diet and season on	DAWA	5-Sep-03
Effect of treated canola meal on milk production and composition	DAWA	17-Nov-99
Staple strength of commercial Merino ewes fed canola meal plus	DAWA	11-Oct-99
Herbicide Tolerant Specialty Oil canola Seed increase/Observation plots	DAWA	5-Apr-01
Preliminary Yield Trial, High oleic Non triazine tolerant canola	DAWA	26-Jul-02
Preliminary Yield Trial, High oleic triazine tolerant canola	DAWA	26-Jul-02
Specialty canola - seed increase/Observation plots	DAWA	5-Apr-01
Specialty Oil canola - Seed increase plots	DAWA	26-Jul-02
Specialty Oil canola Group B - Observation plots	DAWA	5-Apr-01
Specialty Oil canola Observation plots - III Dr Roy	DAWA	15-Dec-99
Stage 2 - Specialty Oil Canola evaluation x Time of sowing	DAWA	23-Jul-02
11 Production		
Assessment of seed dressings on the growth, yield and oil of Cano	DAWA	21-Nov-02
CANOLA AGRONOMY	DAWA	8-May-01
Improving the performance of new canola varieties	DAWA	22-Apr-03
International canola yield trial	DAWA	6-Oct-01
Manipulation of canola development for increased yield and quality	DAWA	11-Aug-03
OILSEEDS AND GRAIN LEGUME SPECIES UNDER SUMMER IRRIGATION	DAWA	27-Oct-00
Preliminary Yield Trial, Nation Canola Breeding Program	DAWA	26-Jul-02
Single Plant selection - National canola breeding program	DAWA	6-Oct-01
CANOLA ROTATION: ALLWLOPATHIC EFFECT OF CANOLA IN A LUPIN/WHEAT	DAWA	17-Jul-00
CANOLA ROTATION: FIELD PEAS	DAWA	17-Jul-00
CANOLA ROTATION: PROCESSING PEAS	DAWA	17-Jul-00
CANOLA ROTATION: WHEAT	DAWA	17-Jul-00
THE PLACE OF CANOLA IN ROTATIONS	DAWA	18-Jan-02
CANOLA AGRONOMY IN THE GREAT SOUTHERN - Blackleg control, foliar	DAWA	1-Jul-00
Crop management for reliable canola production in the northern farming system (NR)	CSIRO	30-Jun-04
Getting the best out of canola in the low rainfall central wheatbelt of WA (WR)	Elder LTD	30-Jun-04
Improved profitability of grain production from low rainfall	DAWA	15-Dec-01
	Esperance Organised Primary Producers	30-Jun-05
Can we identify and overcome constraints to canola production on growers paddocks? (WR)	Farmlink	17-Jun-03
Canola Plus - addressing canola yield decline	Farmlink Research PTY LTD	30-Jun-05
Canola Yield decline: Expanding the regional focus and disease emphasis using surveys, simulation studies and targeted soil/plant analysis (SR)		
Develop and deliver sound agronomic solutions to the key constraints for canola production in the Western region	DAWA	30-Jun-04
Management of Key constraints for canola production in the West	DAWA	18-Jun-04
Removing the constraints to profitable canola production	DAWA	31-Mar-03
Removing the constraints to profitable canola production improve	DAWA	26-Aug-03
Removing the constraints to profitable canola production on dupl.	DAWA	28-Jul-03
12 Seasonal conditions Frost Drought		
Canola adapted to drought for low rainfall region - heavy land	DAWA	9-May-00
Canola adapted to drought for low rainfall region - light land	DAWA	9-May-00
Canola adapted to drought for low rainfall regions	DAWA	23-Nov-99
Rapid screening techniques to select canola for drought resistance and high oil concentration	UWA	30-Jun-04
comparison of canola and wheat for frost prone soil types	DAWA	8-Sep-99

2 Extract from GRDC Project “Growing Western Canola Technology”

Output 2 Evaluation, dissemination and supplementation of existing Canola R&D to the target audience

1. Evaluate and communicate Canola R&D (with AOF and CAA)
2. Independently demonstrate and scientifically test/compare latest canola varieties
3. Demonstrate best practice and production maximization
4. Facilitate / coordinate industry to research current issues such as sowing techniques and machinery, pest control, nutrition, disease management and harvesting techniques, new varieties and oilseed crop.

Milestone 5

A written report on current Canola R&D projects and project needs for growers and researchers. (this report)

Industry needs/issues such as blackleg threat to production to be reported as early as possible. (OWA initially met this component of the milestone well with the grower workshops in 2004, and the various press releases in 2004. It was only following these workshops in early 2004 that growers actually 1, changed varieties sown to non sylvestris types; and 2, finally got sufficiently concerned to actually go back to implementing better management practices rather than simply relying solely upon the sylvestris resistance to take care of the blackleg problem).