Development of oilseeds for biodiesel feedstock in South Australia

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Abstract

In Australia, canola production has been approximately 1.5 million tonnes per annum over the past 6 years. Of this, about one quarter is crushed locally and three quarters is exported. In the past two years there has been an expanding interest in biofuels, particularly biodiesel with the potential for canola to be used as a feedstock. As well, over the last 25 years there has been a breeding program for mustard (*Brassica juncea*). While much interest has been in developing juncea canola as a food crop, there is also the possibility of using mustard in low rainfall areas for biodiesel production.

Production capacity of biodiesel from larger scale facilities is likely to reach over 500 ML by mid 2007 and there is also significant interest by individual farmers or farmer groups in the development of small scale facilities to produce their own fuel needs for farm operations. Costs of production for these small scale operations are likely to be a significant problem.

Issues that are likely to have an impact on biodiesel production from oilseeds include: cost of canola as a feedstock, variable production of mustard that is grown in low rainfall areas, ability to sell meal from the processing that may be done in regional centres, and government policies.

SARDI is undertaking a breeding program to develop oilseeds as a feedstock source for biodiesel production in South Australia and will aim to develop both mustard and canola for this use. Other oilseed options will also be investigated.

Key words: Biodiesel, *Brassica juncea*, Australia, canola, breeding, oilseeds

The Australian fuel industry uses over 15 billion litres of diesel per year, with the majority used in road transport, mining and agriculture. Demand for diesel is currently growing at about 3% per year. Over the past few years there has been a significant increase in interest in developing a biofuel industry in Australia to reduce the reliance on imported fuel. Significant investment has occurred in larger scale biodiesel production plants while many farmers are also investigating the feasibility of smaller on-farm production to turn their own crops into fuel. Costs of production for these small scale operations are likely to be a significant problem. In 2001 the Australian Federal government established a target of 350 million litres of biodiesel by 2010, but this is likely to be surpassed by 2007 when at least 500 million litres is likely to be produced. By 2010 it is likely that biodiesel production in Australia will be between 800 million and 1 billion litres per year. Biodiesel processing plants near most Australian capital cities are either operational, being built or are in the planning stage. In addition, plans are also being developed to increase the number of oilseed crushing plants which will also be built near capital cities and intensive livestock enterprises to make use of the increased meal production.

Much of the short term biodiesel production will be based on tallow, used cooking oil, palm oil and on oil from *brassica* crops. Each of these feedstock sources have issues to be considered if biodiesel production reaches the estimated 2010 figure. About 350,000 tonnes of tallow are exported from Australia at present and would be able to be processed into biodiesel. Used cooking oil is in limited quantities and collection and useage is limited. Palm oil will be used in biodiesel production in northern areas of Australia that are close to palm oil producing regions but use will be limited in southern areas due to biodiesel problems in colder conditions during winter. Canola oil produces very good quality biodiesel but is only able to be used in large amounts when the price of canola is at the lower limits or when mineral oil prices are at historically high levels. Canola production in Australia has averaged approximately 1.5 million tonnes over the past 8 years although the range has been from 2.3 million tonnes in 1999 down to about 400,000 tonnes in the drought of 2006. Of this, about one quarter is crushed locally and three quarters is exported. The other *brassica* crop that can be considered is *B. juncea*, that can be grown in lower rainfall areas.

Research into *B. juncea* in Australia has occurred over the past 25 years with the aim of developing an oil crop with equivalent oil quality to canola (Burton et al., 2003). *B. juncea* has many characteristics that should make it a viable crop in lower rainfall areas of Australia. These include good early vigour, early flowering, good blackleg tolerance, shatter tolerance and higher grain yields than canola when site yields are 1.2 t/ha or less. Both canola and *B. juncea* should have ready acceptance by farmers in lower rainfall areas as both crops have been shown to fit into cropping rotations and act as disease break crops in cereal production (Potter et al., 1997; Angus et al., 1999). Interest in *B. juncea* in Australia centres around three uses. The first is as a food crop equivalent to canola, secondly as a condiment crop and also as a possible feedstock for biodiesel. The first canola quality *B. juncea* cultivars, that will be used as a food crop, are expected to be commercialised in 2007. These cultivars will have low erucic acid, low glucosinolates and oleic acid levels of greater than 60%. However, these first cultivars will not have herbicide tolerance and so will need to be grown where broad leaf weeds are unlikely to occur. Future breeding efforts will be based on developing triazine tolerant and Clearfield *B. juncea* in the same way that canola

cultivars with herbicide tolerance have been bred.

Based on current rotations, if *B. juncea* could be grown on 10% of the total cereal growing area in the low rainfall winter cereal zones, the production area for Australia would be over 600,000 ha (Norton et al., 2005). In South Australia, we have estimated that up to 165,000 ha could be grown at maximum uptake of *B. juncea*. This area could produce average annual production of about 150,000 tonnes, fluctuating from 80,000 to 250,000 tonnes depending on seasonal rainfall. To produce this level of production it is likely that *B. juncea* would mainly be substituted for feed barley and land sown to pasture. Modelling by Primary Industries and Resources SA (PIRSA) suggests a 25-33% increase in average cropping gross margins in lower rainfall regions from the introduction of *brassica* break crops into the farming system.

SARDI has initiated a breeding program for *B. juncea* to develop this crop as a feedstock for biodiesel production. Initial breeding material was sourced from the Victorian Department of Primary Industries and a selection program began in 2003. Selection criteria have been earliness to flower, high grain yield, low glucosinolates and high oil content. Lines with lower levels of oleic acid have been used so as not to impact on the development of canola quality *B. juncea* which will be marketed as juncea canola. A breeding program has now begun in 2006 to enable a greater diversity of germplasm to be evaluated. While initial breeding will be with non-herbicide tolerant germplasm, efforts will be made to incorporate both triazine tolerance and imidazolinone tolerance into the *B. juncea* program. As much of the initial breeding over the past 25 years has been to develop canola quality characteristics, it is thought that more rapid improvement in grain yield is possible for *B. juncea* than for early maturing canola.

Conclusions

Significant investment in biodiesel production has occurred in Australia over the past two years. In southern Australia, oilseeds are likely to be a major source of biodiesel feedstock in the short to medium term. Issues that are likely to have an impact on biodiesel production from oilseeds include: cost of canola as a feedstock, variable production of mustard that is grown in low rainfall areas, ability to sell meal from the processing that may be done in regional centres, and government policies.

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