# Trends in quality of canola grown in Australia

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## ABSTRACT

The quality of canola grown in Australia can vary between seasons, as well as locations due to variations in growing conditions. Oil content of Australian canola crops can vary from less than 35% to over 45% depending on the season and the growing area. Two factors that are significant for the crop are the high oil content and the quality of the meal by-product. Higher oil content increases the economic value of the crop. A high level of protein in canola meal is highly sought after in the poultry and porcine industries. Having a high value by-product increases the overall value of the crop. Glucosinolates in canola meal can cause nutritional disorders in animals, and have been associated with poor growth and even death in poultry.

The NSW Department of Primary Industries Australian Oils Research Laboratories in Wagga Wagga NSW has been involved in the analysis of canola as well as mustard for many years. Samples from all over Australia are analysed each year for various projects and breeding trials, including the National Variety Trial (NVT).

Data from all sources have been collected and collated to give a general overview of trends in canola quality over the last decade including oil, protein and glucosinolate content. Other components such as fibre, sinapine and tocopherols have also been included.

**Key words**: canola – quality – Australia – oil content – glucosinolates

## INTRODUCTION

Canola research in Australia is aimed at establishing high oil yields while reducing disease susceptibility and increasing drought and herbicide resistance. Canola production in Australia was approx. 1.9 million tonnes in 2009/10, with the 2010/11 production estimated to be 2.1 million tonnes, with an approximate economic value of over $2 billion per annum. Western Australia produces the greatest volume of canola, with NSW usually the second largest producer. Production volumes for 2010 were 850 000 hectares and 310 000 hectares respectively. Significant quantities were also grown by Victoria and South Australia (Seberry et al 2011). In NSW canola crops are grown throughout the inland portion of the state, with most grown in the Riverina. Australian canola is exported to many countries including Japan, China, Pakistan, the United States and the EU with approximately one million tonnes exported each year.

Each year the Australian Oils Research Laboratory (AORL) in Wagga Wagga analyses canola samples from a number of sources, including the National Variety Trial (NVT) and a number of commercial breeding trials. These analyses were used to compile an overview of the trends in canola quality for a number of components over the past decade.

## MATERIALS AND METHODS

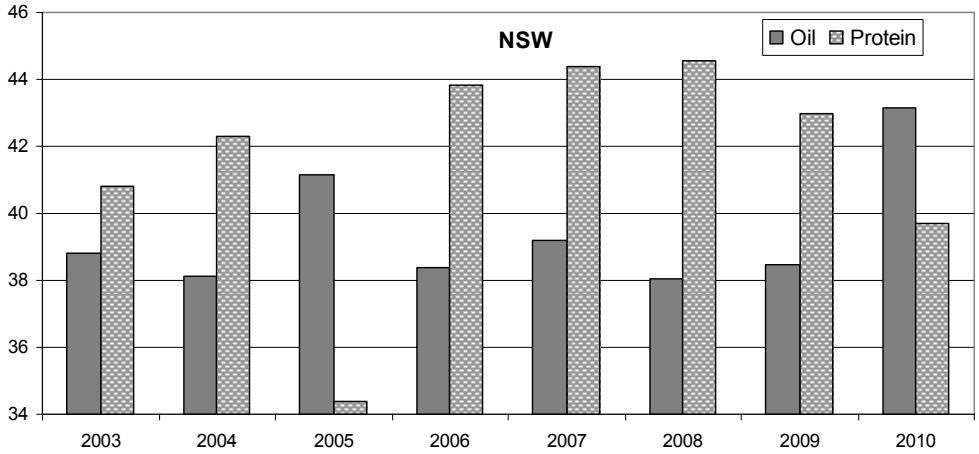
Samples were obtained from various research projects and the AORLs commercial testing service each year. Oil content, protein and glucosinolates were analysed using a Foss 6500 NIR. The NIR was calibrated using reference methods: oil content - AOCS Am 2-93 (AOCS, 1998), protein – In house method 2-1112 (based on method AOCS BA4E-93(AOCS, 1998)), glucosinolates - AOF method 4-1.22(AOF, 2007). Fatty acid profiles were analysed using in house methods 2-1701 and 2-1702. The samples were derivatised using methanolic potassium hydroxide and then analysed using GC. Sinapine content of the meal was measured using in house method 2-1519. The sinapine is isolated from oil free meal, separated and quantified using HPLC. Neutral Detergent Fibre (NDF) was analysed using AFIA method 1.9A(a), Acid Detergent Fibre (ADF) was analysed using AFIA method 1.8A(a) (AFIA, 2007) and crude fibre

was analysed using AOAC method Ba 6a-05. Total tocopherol was analysed using ISO method 9936:2006(E) and quantified using HPLC.

## RESULTS

Adverse conditions in Western Australia in the last two seasons has seen the mean oil content decrease substantially, from a high 44.7% in 2007 to 40.8% in 2010. Since 2003, the highest mean oil content in Australia was 45.8% in Victoria in 2010, while the lowest state mean was in NSW in 2008 at 38.0%

Mean protein content in oil free meal was inversely proportional to the oil content in most cases; that is, the mean protein content increased when oil content decreased and vice versa. Since 2003, the highest mean protein content was 44.5% in NSW in 2008, while the lowest was 34.4% in 2005 also in NSW (Fig. 1).




Note: % oil content at 6% moisture in whole seed. % protein at 10% moisture in oil free meal

Fig. 1. Mean oil and protein content of canola grown in NSW from 2003-2010.

Mean glucosinolates content ranged from 20 µmoles/g oil free meal at 10% moisture in Western Australia in 2010 down to 5 µmoles/g in 2006 also in Western Australia.

Saturated fatty acids are generally undesirable nutritionally. The level of saturated fatty acids (the major saturated fatty acid in canola oil being Palmitic acid – C16:0) showed limited variation in samples analysed between 2003 and 2010. The highest saturated fatty acid content was 8.2% in NSW in 2008 and Victoria in 2009, while the lowest was 6.9% in 2005 in both South Australia and Western Australia. The major monounsaturated fatty acid in canola oil is oleic acid (C18:1). Monounsaturated fatty acids ranged from 59.7% in Western Australia in 2005 to 65.3% in Victoria in 2009 (Table 1). Mean polyunsaturated fatty acids, the major fatty acids being linoleic and linolenic acids (C18:2 and C18:3), varied from 26.5% in Victoria in 2009 to 33.4% in Western Australia in 2005.

Sinapine content in oil free meal was found to vary considerably between seasons. The lowest sinapine content was 4 g/kg in 2003 with the highest being 13 g/kg in 2010.

Fibre is an important measure in the nutritional value of canola meal. Neutral detergent fibre (NDF) was found to range from a minimum of 20.3% (oil free meal at 10% moisture) in 2003 up to 42.9% in 2006, however the mean value ranged between 26.6 to 33.7%. Acid detergent fibre (ADF) ranged from a minimum of 12.8% up to 24.3%, both in 2005.Crude fibre ranged from 8.8% in 2003 up to 19.2% in 2006, with the mean value for each year ranging from 11.9 to 12.5%.

Tocopherols are natural anti-oxidants which are present in canola oil. The main tocopherols found in canola are alpha (α) and gamma (γ). The mean values ranged between 828 and 895 mg/kg oil, with a maximum level of 1135 mg/kg oil recorded in 2006.

Table 1. Mean monounsaturated fatty acids in each state from 2003-2010. Results are % of total fatty acids.

| | NSW | SA | Vic | WA |
|---|---|---|---|---|
| **2003** | 63.4 | 62.1 | 63.7 | - |
| **2004** | 62.4 | 60.6 | 62.0 | 61.8 |
| **2005** | 63.5 | 62.8 | 62.8 | 59.7 |
| **2006** | 62.3 | 60.9 | 60.3 | 61.6 |
| **2007** | 62.3 | 60.9 | 60.3 | 61.6 |
| **2008** | 61.8 | 62.0 | 61.8 | 61.1 |
| **2009** | 63.0 | 61.9 | 65.3 | 61.8 |
| **2010** | 63.7 | 63.1 | 63.7 | 62.2 |

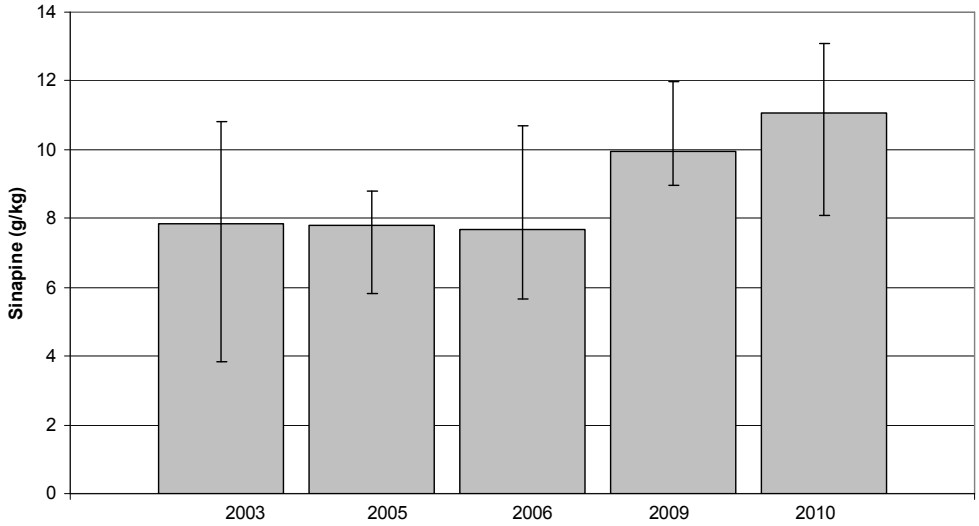



Fig. 2. Mean sinapine content in oil free canola meal analysed by Australian Oils Research Laboratory between 2003 and 2010.

## DISCUSSION

Oil content in canola varies depending on variety, agronomic and climatic conditions. Drought conditions along the east coast of Australia for most of the past decade has seen oil contents in canola from NSW and Victoria remain lower than those produced in Western Australia which had more favourable conditions. However, favourable conditions in 2009 and 2010 in South Australia, and 2010 in NSW and Victoria has seen the mean oil content for those states increase.

Together with the high demand for oil, canola meal is also a significant product. Canola meal is relatively high in protein and is used particularly in the poultry and pig industries. Mean protein content in each state was found to be inversely proportional to the oil content; seasons which produced higher oil contents had lower protein values and vice versa.

Glucosinolates are a group of anti-nutritional components found in canola meal, imparting a bitter taste. When glucosinolates break down after ingestion, they have been found to have detrimental effects on some animals such as impairing thyroid function (Mailer et al, 2008). Glucosinolates were found to vary according to season. Generally when canola is under water stress conditions, the glucosinolates level increases. While the level of glucosinolates is still below the Australian canola standard of <30 µmoles/g oil free meal, there has been some increase in the mean levels in the past few years, especially in Western Australia.

Canola oil is valued for its high monounsaturated fatty acid content (mainly oleic acid) as well as the relatively high levels of polyunsaturates including the omega-3 linolenic acid, which totals about 10-12% of the total fatty acids. Variations in the fatty acids occur due to variety and the climatic conditions where the canola is grown. Generally the range of fatty acids from canola grown in Australia is narrow, with the greatest variation occurring in the polyunsaturated fatty acids.

The samples analysed by the Australian Oils Research Laboratory between 2003 and 2010 show a gradual increase in the mean sinapine content of oil free meal. It is possible that new varieties are being released with higher levels of this compound, which may lead to some problems in the future with the use of canola meal in animal feed. Sinapine is a bitter tasting compound which makes it less palatable to animals, while its presence in the diet of some poultry can lead to the development of a fish odour or taste in their eggs (Mailer et al, 2008).

Fibre content is an important measure in canola meal. When developing animal nutrition diets, the amount of fibre which is present will have an impact on the animals feed intake as well as its performance (Jung, 1997). While the mean NDF and ADF contents are generally stable, some varieties of canola do have large amounts of fibre as shown in the maximum levels obtained in this survey. It is important that these levels are maintained at a relatively low levels to ensure that animal nutritionist see canola meal as a viable option when preparing feed rations.

Tocopherols are important antioxidants in edible oils. While some tocopherols are removed from canola oil during the refining process they remain an important component. Mean levels of over 800 mg/kg in canola oil, with maximum levels around 1100 mg/kg compare well with other oils, such as olive oil which has mean levels of tocopherols at about 200-300 mg/kg.

Overall, it can be shown that the quality of canola in Australia is greatly dependent on a number of factors including variety, agronomic conditions and climate. Vigilance is required to maintain the current yields for oil and protein, as well as disease and herbicide resistance, while also maintaining other components such as minimising the levels of sinapine, glucosinolates, fibre and other anti nutritional factors found in canola

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