

QUALITY OF CANOLA IN AUSTRALIA

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SUMMARY

- Quality of Australian canola varies widely from year to year and from location to location within years, due to the fluctuations in the environment and the range of growing conditions experienced.
- Recently released conventional varieties have significantly improved the oil and protein content of the Australian crop.

INTRODUCTION

Canola is grown over a wide range of environments in Australia which has a marked influence on the quality of the final products. The higher rainfall areas produce significantly higher oil and protein canola than the low rainfall areas. The seasons are also very variable, producing fluctuations from year to year in oil, protein and fatty acid profiles. Despite this apparent instability in quality, cultivars developed and grown in Australia today are consistently of a high quality, unlike the original introduced cultivars 20 years ago. Australia's main growing areas are New South Wales, Western Australia, Victoria and South Australia.

Selection for enhanced oil and protein content is most advanced in conventional mid-season varieties, with rapid improvement also occurring in new conventional early-season varieties. Oil contents in triazine tolerant varieties are significantly less than the conventional varieties. The widespread use of the lower oil and protein content triazine tolerant canola varieties has reduced the quality of Australian canola in recent years.

QUALITY OF AUSTRALIAN CANOLA

The Canola Association of Australia's annual publication "Quality of Australian Canola" (QAC) shows typical analyses of canola delivered to seed receival sites throughout the canola growing areas within Australia. The booklet provides information on oil and protein contents, glucosinolate levels, fatty acid profiles and iodine values of samples provided by the Bulk Handling Authorities.

OIL CONTENT

Eastern Australian farmers are paid for their canola crop on the basis of a bonification scheme, providing a bonus of 1.5% for every percentage point above 40% oil, on an as received moisture content. For a crop with 46% oil, the farmer would be paid a 9% bonus. This also works in reverse with a similar penalty rate for every 1% below 40% oil. In Western Australia, the base oil content for payment is 42% and the penalties for low oil content are greater than in eastern states. Evidence collected from annual

trials and research studies by Mailer and Cornish show that moisture availability and temperature during seed development strongly influence oil content.

Oil content of Australian canola crops can vary from less than 35% to over 45% depending on the season and the growing area. In 1994, a particularly dry year, the Australian crop averaged only 39% oil content and was as low as 34% at some sites. In 1996 however, with good conditions, the Australian crop averaged 42.4% with some sites up to 46%. Several individual farmer samples had oil contents over 50% in 1996 and 1997, due mainly to the release of new higher oil content varieties such as Dunkeld.

The higher rainfall areas in Victoria and southern New South Wales generally produce the highest oil contents although this can vary with climatic conditions from year to year. The lower oil contents in northern areas of Western Australia and New South Wales are a problem which prevents the expansion of the crop to the north. Attempts to improve the oil content production of crops in the drier areas have included both selection of higher oil content varieties *per se*, and the selection of varieties which mature earlier to benefit from winter rainfall and avoid the hot, dry summer periods during seed development. Although the triazine tolerant canola varieties produce lower oil content than conventional varieties, they are grown in some drier areas to control major cruciferous weed infestations.

PROTEIN CONTENT

Together with the high demand for the oil, the meal by-product is a significant component of canola. Canola meal is a high protein product and is used particularly in the poultry and pig industries. Protein levels in the meal have been shown to vary with seasonal conditions and generally work in an inverse relationship to oil content. For consistency and reliability to the industry it is important to maintain a minimum protein content, determined to be 35% protein at 13% moisture by the Australian Oilseed Federation (AOF). New varieties such as Dunkeld and Grouse have been introduced which produce both higher oil contents and increased protein.

GLUCOSINOLATE CONTENT

Early rapeseed varieties introduced into Australia and some subsequent Australian varieties had high glucosinolate concentrations, in excess of canola standards. Through plant breeding and selection, varieties today have only very low glucosinolate levels, generally less than 7 μ moles of total glucosinolate /g of whole seed. This is equivalent to approximately 11 μ moles/g of oil-free meal and well less than the canola standard of 30 μ moles/g of meal of only four specified glucosinolates. Mailer and Cornish found that environment has a major influence on glucosinolate content with sulphur availability and water stress contributing to an increase. Despite some year to year variation, maximum levels never approach the canola limit in the Australian crop. In 1994, under water stress conditions, glucosinolate concentration reached 9 μ moles per gram of seed, or 15 μ moles per gram of meal, at some sites. Despite dry conditions in 1997, as indicated by low oil and high protein concentrations, glucosinolates remained low, perhaps indicating more stability in more recent varieties.

MOISTURE CONTENT

Determining the moisture content is important to determine the value of other components in the seed. Oil is generally expressed as a percentage of whole seed at 8.5% moisture whereas protein is expressed as a percentage in the oil-free meal at 13% moisture. High moisture content in stored canola seed can cause overheating of the seed and subsequent deterioration of quality, particularly increases in free fatty acid content. Moisture contents can vary in the seed from <5% to >15%. The majority of the Australian crop is harvested at around 6% moisture. The AOF Standards Committee have recently introduced a maximum moisture concentration at seed delivery of 8%.

FATTY ACID PROFILES

Canola oil is valued for its high mono-unsaturated oleic acid level. It also contains a good proportion of polyunsaturates including 10-12% omega-3 linolenic acid. Early rapeseed cultivars contained high levels of erucic acid, C22:1, although current cultivars have only trace quantities (< 0.1%) of this undesirable product. Variation in fatty acids still occurs with the main variation obvious in oleic acid, which ranges from approximately 59-62%. Linoleic and linolenic acids also vary from 18-22% and 10-12% respectively.

SATURATED FATTY ACIDS

Although it is desirable to decrease total saturated fats from the current levels of around 7%, the variability in current Australian canola varieties is very limited. Palmitic acid, the major saturated fat, is approximately 4 - 5% of the total fatty acids. It is likely that any reduction in total saturated fats would involve selection for lower levels of palmitic acid.

IODINE VALUES

Iodine value is a measure of the degree of unsaturation of the fatty acids. A higher iodine value, generally indicates a lower saturated fat level and/or lower oleic acid level. High iodine values also may indicate a lower level of stability of the oil. Iodine values for Australian canola samples ranged from 114 to 120 in 1998.

CHLOROPHYLL CONTENT

Australian canola is generally harvested in November to December, in late spring and early summer. As a result, canola crops have little problem with chlorophyll as the plants dry off and the chlorophyll degrades rapidly in the hot weather. Occasionally however, there have been problems with frost damage which have resulted in sudden plant death and resultant green seed. Even in these suspect crops, the chlorophyll levels were generally less than 10 ppm and no higher than 30 ppm. This compares favourably with Canadian No. 1 canola which, during December 1998, averaged 18 ppm.

FUTURE DIRECTIONS

Enhanced oil and protein content in the Australian crop is a high priority for the canola industry. This is being achieved both through breeding and through agronomic management such as early sowing. Reduced saturated fats and higher oleic/lower linolenic acid are likely changes to Australian canola in the future.

FURTHER READING

Mailer, R.J., Colton, R.T. and O'Bree, B.L. (1998) Quality of Australian Canola. Canola Association of Australia. ISSN 1322-9397.

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