Environmental Influences on Australian Canola Quality

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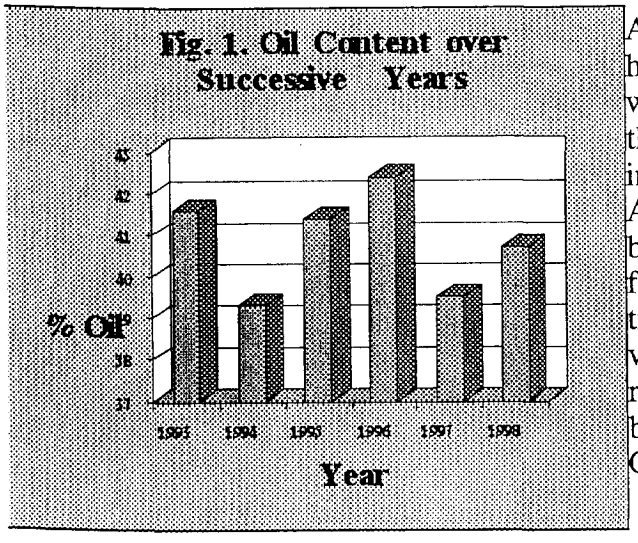
Australia has developed a high quality canola from the early Canadian types imported in the late 1970's. Since that time, European and Japanese lines have been introduced to the pedigrees to produce a characteristic Australian canola. The characteristics of the cultivars include high oil contents, high protein content and very low levels of glucosinolate in the meal. The crop is also renowned to have some of the world's most blackleg disease resistant cultivars.



Australia's major concern with quality has been the range of environments over which canola is grown. The results of this variability have led to inconsistencies in an otherwise high quality product. Annual analysis of large numbers of breeders trials and commercial samples from bulk handling companies, as illustrated in Fig 1, indicates the level of variation which we experience and these results are published each year in a booklet called ``Quality of Australian Canola.''

Oil Content: The high oil content of canola has always been the major factor, which has driven research and development in canola. This has been further driven by industry in awarding farmers a bonus for high oil production in a scheme referred to as the ``bonification' scheme. Farmers are paid a bonus of 1.5% for every 1% the oil content exceeds a standard, currently set at 40% oil. Canola crops containing less than 40% oil receive a deduction of 1.5% for each percentage under 40%. For example, a canola crop of 44% oil would be paid a 6% bonus.

Table 1 indicates the range of oil contents produced from the 1999 canola trials at three selected sites within New South Wales. It is clear that despite considerable variation between the sites and cultivars, the relative position of the cultivars is consistent. New South Wales has a wide range of environments from the drier western sites to long season, high rainfall sites.

Protein Content: As for oil content, protein shows considerable cultivar and environmental variability. Unlike oil content, there has been little demand for increased protein until recent years with a need to improve meal quality for animal feed. Protein generally shows a reduction in concentration at sites which produce high oil contents.

Table 2 indicates that sites, which are high in oil, are also the sites, which are lowest in protein. However, also illustrated in Table 2, is that the relative order of cultivars for increasing protein is generally the same as the order for increasing oil concentration in Table 1. This shows that Australian breeders have found it possible to increase both oil and protein simultaneously in new cultivars.

For many years, Australian laboratories have measured protein content by the Kjeldahl method. However, most laboratories are now using the Dumas method of sample combustion, which gives a slightly higher and more accurate result. This has the result of showing that Australian canola has a satisfactorily high protein level.

Oil Yield: Despite the variation in oil content, a factor which has been more important to farmers is the oil yield per hectare. Often the highest oil producing site is not the highest for seed yield. Table 3 shows the oil yield per hectare from the same three sites shown in Tables 1 and 2. It is clear that although Coolamon produced the highest oil concentration, Borenore produced the maximum oil yield. Under good growing conditions the cultivars remain in relatively the same order of productivity. However, under stress conditions such as those at North Star, more tolerant cultivars perform better than the higher oil cultivars.

Fatty Acids: There have been slight changes in the fatty acid profiles of canola over the last 20 years, to produce a canola crop with what is suggested to have an ideal fatty acid profile. Current cultivars show little variation across environments. Higher levels of saturated fatty acids are apparent at some sites, which appear to be in response to drier conditions or higher temperatures. Higher levels of polyunsaturates might occur under cooler and/or higher rainfall conditions.

Erucic acid has been reduced to only trace amounts and virtually eliminated from current cultivars. Only some cultivars contain levels higher than 0.5%. The only variation to this is under the effect of weed contamination. Weeds such as *Sinapis arvensis* (charlock), *Brassica tournefortii* (wild turnip) and *Raphanus raphanistrum* (wild radish) have high levels of erucic acid and can significantly reduce the quality of canola. Wild turnip, for instance, contains around 50% erucic acid and only a 5% contamination results in 2.5% erucic in the crop.

Glucosinolates: In 1980, rapeseed crops introduced from overseas contained glucosinolate concentrations of around 20-80 μmoles/g. There has been a constant reduction over the years to current cultivars with only 5 - 10 μmoles/g. Despite annual variations to the concentration, particularly increases in crops grown under dry condition, glucosinolates seldom vary beyond levels less than half of the internationally recognized canola limit. Weeds, as for their effect on erucic acid, can contaminate the crop and again wild turnip (120 μmoles/g) and wild radish (135 μmoles/g) can cause quality reductions.

Other Quality Factors: Environmental conditions control many aspects of the quality of Australian canola. Basically, canola is high quality and exceeds the requirements of the industry. However some variation may exist due to extreme weather conditions. Australian standards control the levels of variation which are acceptable in canola.

- Chlorophyll - green seed has been detected in isolated batches of Australian canola. Generally chlorophyll is not a problem as Australian canola matures into the warm spring and early summer. Comparisons with canola from the Northern Hemisphere indicate that the levels are generally insignificant. The maximum content measured in this laboratory has been around 30 ppm and even this level is seldom reached.

- Sprouted seed - rainfall at final stages of maturity may result in sprouted seed. The consequences of this are increased levels of free fatty acids and reduction in seed quality.

- Wax - precipitate from refined canola oil have sometimes resulted in a cloudy appearance. The components in the oil are referred to as wax but often contain several components including triacylglycerols (TAGs), hydrocarbons and wax esters. Studies in this laboratory indicate that water stress and high temperatures during seed development may contribute to higher levels of saturated TAGs and an increased potential for cloudy precipitate to develop in the oil.