

FINAL REPORT

DAN00158

Increasing the market value of canola through improved quality traits

PROJECT DETAILS

PROJECT CODE: DAN00158

PROJECT TITLE: INCREASING THE MARKET VALUE OF CANOLA THROUGH IMPROVED QUALITY TRAITS

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Summary

This study aimed to evaluate the quality traits in canola grown in Australia, and to determine the potential for improvement of quality in Australian canola germplasm.

Quality traits were measured in canola varieties from the National Brassica Germplasm Improvement Program (NBGIP) and the National Variety Trials (NVT) with considerable variation observed. Canola varieties which showed desirable quality traits were evaluated in field trials in south eastern Australia to determine genotype (G) and environmental (E) effects.

Using the information gained from this study, there is potential for improvement of Australian canola, and in turn, higher returns to growers.

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Conclusions

This project has shown the potential for improvement of the quality of Australian canola. Considerable variation was shown for almost all of the traits analysed. The inclusion of some of this material in future breeding lines will have the effect of producing higher quality oil, with increased oxidative stability. Data gained from the project showed that the quality of canola meal could be significantly improved, paving the way for greater inclusion of canola meal in animal feed, with less reliance on imported soybean meal and other feed types.

Recommendations

It is important to determine the stability of the quality traits across the main agronomic environments where canola is grown in Australia. A new project which is funded by GRDC for 2014-2017 will investigate the effect of G and E on quality traits. Some effort needs to be focused on educating breeders, growers, processors and end-users of the importance of the inclusion of some of these traits into Australian canola germplasm.

Outcomes

The economic outcome of this project will be quantified through the potential increased uptake of improved canola germplasm. Canola varieties identified in this study with desirable quality traits will increase the value of the oil and meal if included in the Australian canola germplasm, leading to increased returns to growers and processors. The improvement of canola meal quality could lead to the replacement of current soybean meal imports with locally produced canola meal.

Social benefits of this research will be realised through improved returns to growers. There will potentially be more options available to growers when selecting which varieties to grow, leading to greater flexibility.

Achievements/Benefits

Canola breeding programs in Australia have significantly enhanced canola as a commercially attractive oilseed crop. While current breeding programs tend to concentrate on production traits, such as increasing yield and oil content, as well as disease and insect resistance and drought tolerance, there has been minimal focus on oil and meal quality. This study aimed to evaluate the quality traits in canola grown in Australia, and to determine the potential for improvement of quality in Australian canola germplasm.

At the beginning of this project, a series of meetings were held with different industry participants, including processors, breeders, meal and oil end-users and growers to gather market intelligence and determine the needs of each group and the ability of researchers to meet those needs. The meetings gave a good insight to how each industry currently uses canola seed,

oil and meal, and which quality traits are important to target for improvement, or which anti-nutritional components to target for reduction. It also gave an insight into current industry uptake of canola and its by-products in each industry sector, and the potential increase in uptake if quality traits were improved.

A comprehensive literature review was undertaken to assess the variability of quality traits in canola seed, oil and meal. This provided an overview of canola production figures, processing, and physical parameters, as well as oil and meal quality. Also included were typical ranges for those parameters in canola in Australia and overseas. Details of the importance of the different quality parameters, and factors which affect these parameters, such as agronomy and processing, are reported. There is also a discussion on the utilisation of canola products, their benefits, and how these products can be improved in the future.

The evaluation of variation in quality traits in canola involved laboratory analysis of 850 canola varieties from the NBGIP and from canola NVT. The laboratory analysis of these canola varieties took place in 2012 and 2013, with more than 20 parameters measured in whole seed, oil and meal. Results indicate that considerable variation exists for most traits targeted in this project. The evaluation of some NVT lines alongside the NBGIP lines showed the levels of quality traits in current Australian canola lines and the potential for improvement of some of the traits with future breeding programs. Some NBGIP lines showed relatively higher levels of total tocopherols than the NVT lines. One hundred and one NBGIP lines have a total tocopherol concentration greater than 1,000mg/kg in oil, while six of the NVT lines were shown to be greater than 1,000mg/kg. Increased levels of total tocopherol concentrations in edible oils contribute to oil stability and shelf life, and can increase the frying life of the oil.

End-users identified relatively high fibre contents in canola meal as a disincentive for using canola meal in feed rations. Researchers have reported minimum values for neutral detergent fibre (NDF) as approx. 24% (oil free meal, dry matter (DM)), while for acid detergent fibre (ADF), the lowest reported values are approx. 16% (oil free meal, DM). In this project, five NVT lines had an NDF of less than 24%, while 79 lines from NBGIP had less than 24%. For ADF, nine lines from NVT had less than 16%, while 81 lines from NBGIP had ADF values less than 16%. Lowering the fibre content of canola meal will increase the digestibility of the meal, as well as increasing available energy to the animal. This is reflected in the results obtained for the metabolisable energy (ME) for ruminants. The highest reported ME values are approx. 11.5MJ/kg (oil free meal, DM). The results for this project showed that none of the NVT lines were above 11.5MJ/kg (oil free meal, DM), however 63 of the NBGIP lines had a ME greater than 11.5MJ/kg (oil free meal, DM).

Some canola lines and varieties from the NBGIP which showed desirable and non-desirable levels of quality traits were grown in field trials in New South Wales (NSW), Victoria (VIC) and South Australia (SA) in 2013 to determine G, E and G x E effects on the traits. Genotype appears to have an effect on some of the quality parameters in canola. Significant effects were also found for environment and G x E in some cases.

Other research

Project results indicate that there is potential for improvement of the quality of Australian canola germplasm. While stability of the high quality genotypes across environments is currently under investigation, other influences which may affect canola quality will need to be investigated. Agronomic factors such as fertiliser inputs, including rates of application as well as timing of the application, will be important factors which may have an impact on the quality traits in canola. The effect of processing on these components is also an important factor affecting the quality of canola oil and meal.

Canola meal is seen as a reasonable protein supplement in animal feed rations, however the presence of anti-nutritional components, such as glucosinolates and relatively high fibre contents sometimes limit inclusion rates. Higher inclusion rates may be achievable through applied research into areas such as the dairy and aquaculture industries. Joint funding from GRDC and peak bodies for those different industries may be able to overcome these issues.

Intellectual property summary

Information gained from this project will be made available to private breeding programs through the current NBGIP and pre-breeding arrangements.

Information on quality characteristics, individual variety attributes and outcomes from this project will be made available to industry through meetings organised in collaboration with the Australian Oilseeds Federation (AOF).

Additional information

Publication

Ayton, J, Graham, K., Mailer, R., Potter, T., Salisbury, P. and Meyer, R. (2014). Increasing the market value of canola through improved oil and meal quality traits. Proceedings of the 18th Australian Research Assembly on Brassicas, 29 September-2 October 2014, Tanunda, South Australia.

Attachments

1. Canola lines with desirable levels of components.
2. The effect of genotype and location of quality traits in canola grown in Australia.
3. 2013 GxE trial results.
4. Additional information on screening of canola germplasm.
5. NSW DPI review - Variability of quality traits in canola seed, oil and meal.