NSW GOVERNMENT Department of Primary Industries

Increasing the market value of canola through improved quality traits.

GRDC project DAN00158

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Introduction

- Current breeding programs focus on increasing yield and oil content, disease resistance and drought tolerance.
- Opportunities exist to increase the oil and meal quality, increasing the value of the crop.
- Aim - To identify quality traits in canola oil and meal which can be included in the Australian canola germplasm to increase the value of canola.

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Overview

- Current industry requirements
- Canola lines
- Laboratory analysis
- Results
- Summary

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Current industry requirements

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Current industry requirements

- Meetings were held and surveys undertaken with different industry sectors at the beginning of the project.

- Participants included:
  - processors
  - refiners
  - oil and meal end users
  - breeders

- Purpose of meetings was to determine each sectors requirement of canola seed, oil and meal.

- These requirements helped establish the analytical protocols for the project.

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Stock Feed Requirements

PORK

MEAL

↑ Protein
↓ Glucosinolates (<5)
↓ Fibre

POULTRY

MEAL

↑ Protein
↓ Sinapine
↓ Glucosinolates (<10)

WHOLE SEED

↑ Protein
↑ Linoleic acid (C18.2)
↓ Glucosinolates

DAIRY

(wants non GM)

MEAL

↑ Protein
↓ Fibre

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Processors, Crushers and Refiners Requirements

OIL

↑ Iodine Value – 120 ideal
↑ Oil content - >42%

MEAL

Consistent seed size – crushing concerns

↓ Glucosinolates – odour concerns

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Commercial Users

RETAIL SPREADS

OIL

↑ Linoleic acid (C18.2)
↑ Linolenic acid (C18.3) – > 20% ideal
↓ Saturated fatty acids
↑ Polyunsaturated fatty acids - > 50% ideal
↑ Tocopherols

FOOD SERVICE

OIL

↑ Oleic acid (C18.1) - > 80% ideal
↓ Linolenic acid (C18.3) - < 2% ideal, < 5% realistic
↑ Tocopherols

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Growth Industries

BIOFUELS

OIL
- Sold to the biofuel market where it is converted to biodiesel
- ↑ volume canola meal due to expansion of biofuels industry

AQUACULTURE

MEAL
- Potential ingredient in aquaculture diets
- Comparable amounts of digestible protein and energy to fishmeal
- World demand of fishmeal outweigh supplies – canola meal an alternative

PET FOOD

MEAL
- ↑ potential in the pet food industry
- Already utilised in the manufacture of dog biscuits

COSMETICS

OIL
- ↑ Tocopherols – alpha and gamma
- Market for naturally occurring tocopherols

AGRICULTURAL

MEAL
- Protein concentrates for stock feeds
- Use as an organic fertiliser – N, P and S availability
- Hi gluc meal - potential use as a bio-fumigant replacing soil fumigant, methyl bromide

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Laboratory analysis

- Canola samples – 850 in total
  - 685 Brassica lines from NBGIP - wide variety of germplasm from across the world. Countries of origin include China, Taiwan, Russia, Ukraine, France, Australia
  - 165 canola lines from NVT - provides information on current Australian marketplace.

NBGIP – National Brassica Germplasm Improvement Project

NVT – National Variety Trials

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Laboratory analysis

WHOLE SEED

- Oil content
- Seed size
- Seed weight
- Moisture

OIL

- Tocopherols – alpha, gamma, total
- Fatty acid profile
- Iodine Value

MEAL

- Glucosinolates
- Protein
- Sinapine
- Starch
- Water soluble carbohydrates
- Ash
- Organic matter
- Fibres – NDF, ADF
- Digestibility
- Metabolisable energy (Dairy/Sheep/Beef)
- Apparent Metabolisable Energy (Poultry)
- Digestible Energy (Porcine/Aquaculture/Equine)

Over 42 000 individual results

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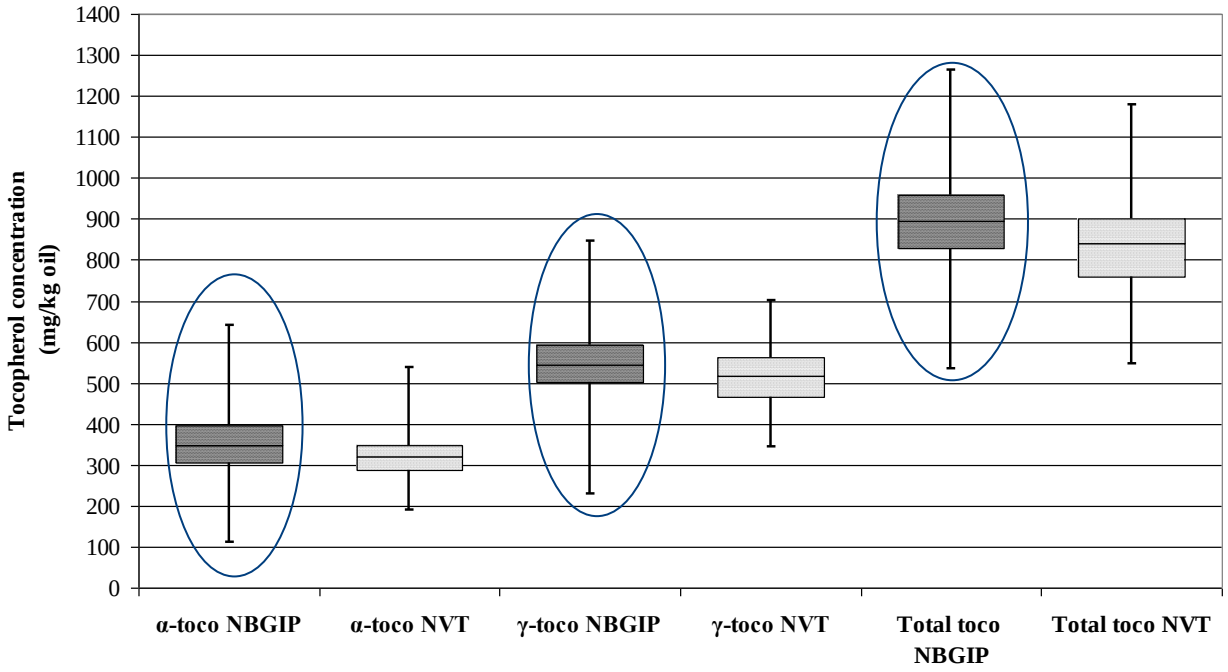
Tocopherols in oil



- Otherwise known as vitamin E
- Alpha (α) and gamma(γ)
- Efficient natural antioxidants
- Contribute to oil stability and shelf life
- Some removed during refining (reported at 15-40%)
- Retailers want increased tocopherols
- Other studies - mean approx 800 mg/kg total tocopherols.

Total tocopherols

- **NBGIP** - 101 lines >1000 mg/kg
- **NVT** - 6 lines >1000 mg/kg

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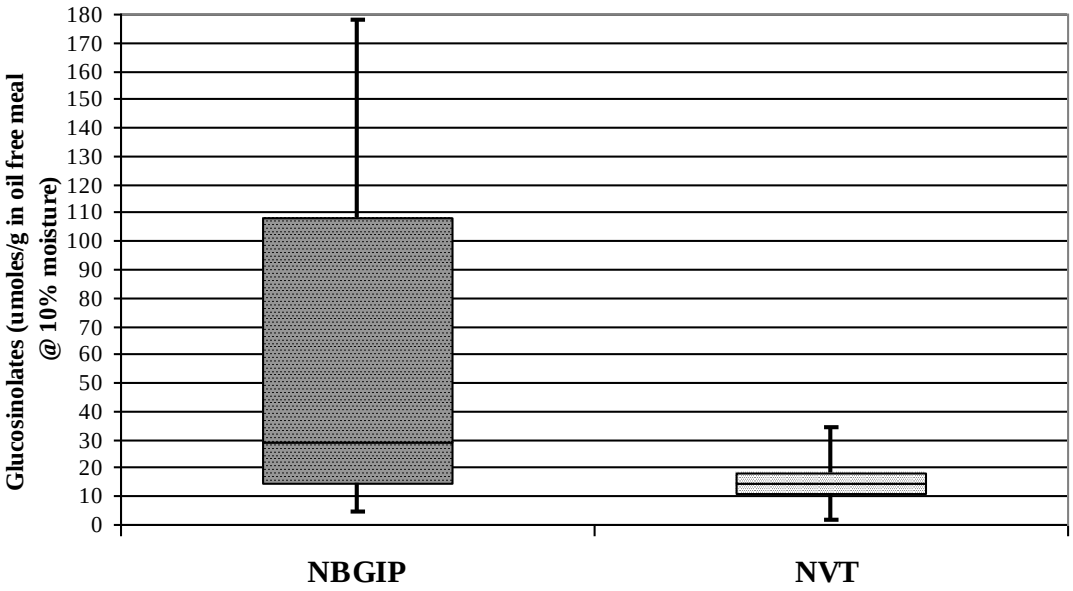
Glucosinolates in meal



- **Glucosinolates**
  - Breakdown products can impair feed intake and growth performance due to bitter taste.
  - Interfere with thyroid and liver function
  - High levels can increase mortality in poultry and lower egg production

- NBGIP - **345** lines with glucosinolate content <30 umoles/g in oil free meal @ 10% moisture
- NVT – **160** lines <30 umoles/g in oil free meal @ 10% moisture

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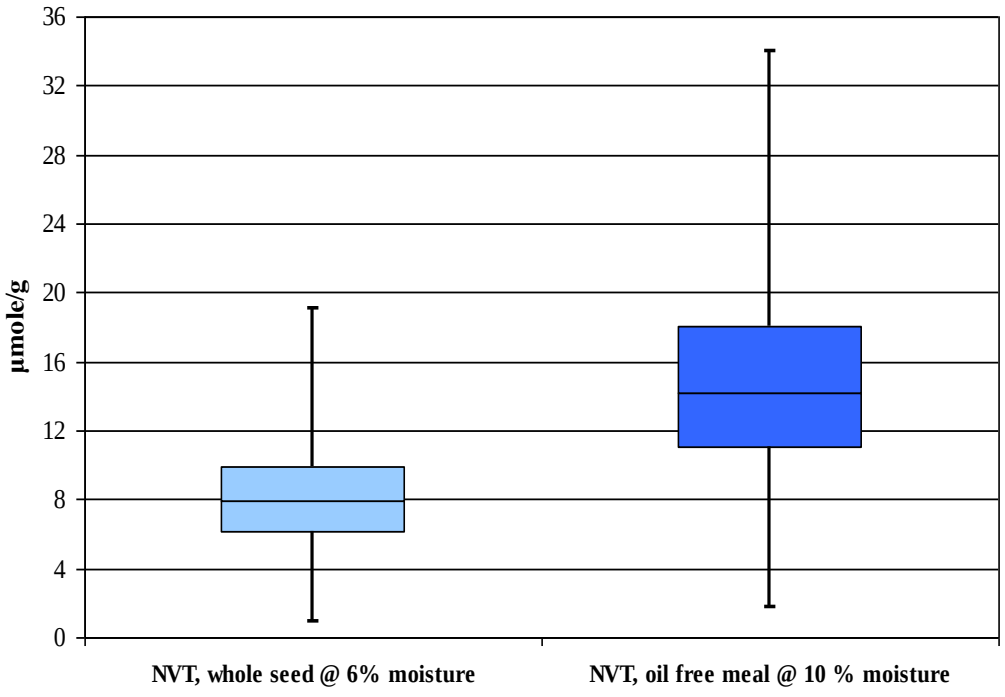
Glucosinolates - NVT lines
Whole seed v oil free meal



- Industry convention to report glucosinolate content µmoles/g, whole seed @ 6% moisture
- Definition of canola –
  - **glucosinolate content as µmoles/g in oil free, air dry meal**

- **5** NVT lines above 30 µmoles/g in oil free meal @ 10% moisture
- **11** NVT lines between 25-30 µmoles/g in oil free meal @ 10% moisture

Need to ensure we understand the units being used to report glucosinolates.

Same data – different units

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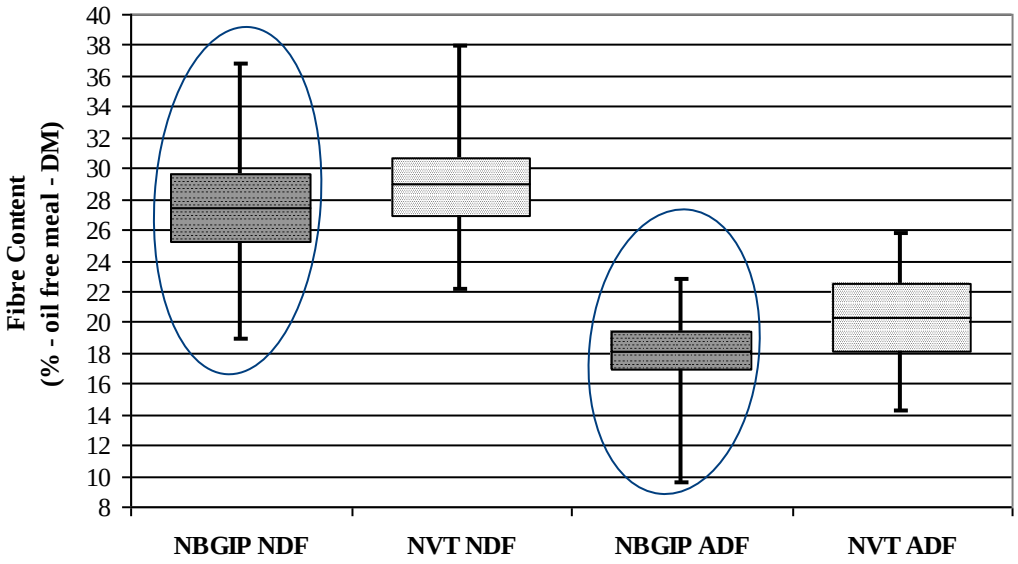
Fibres – Neutral detergent (NDF) and acid detergent (ADF)



Stock feed requirements
↓ Fibre

- NDF – amount of fibre in a sample that is insoluble in a neutral detergent solution.
- ADF – amount of fibre in a sample that is insoluble in a weak acid.
- Minimum reported values from other studies:

NDF – 24%

NBGIP - **79 lines** with NDF <24%
NVT – **5 lines** with NDF <24%

- Minimum reported values from other studies

ADF – 16%

NBGIP - **81 lines** with ADF <16%
NVT – **9 lines** with ADF <16%

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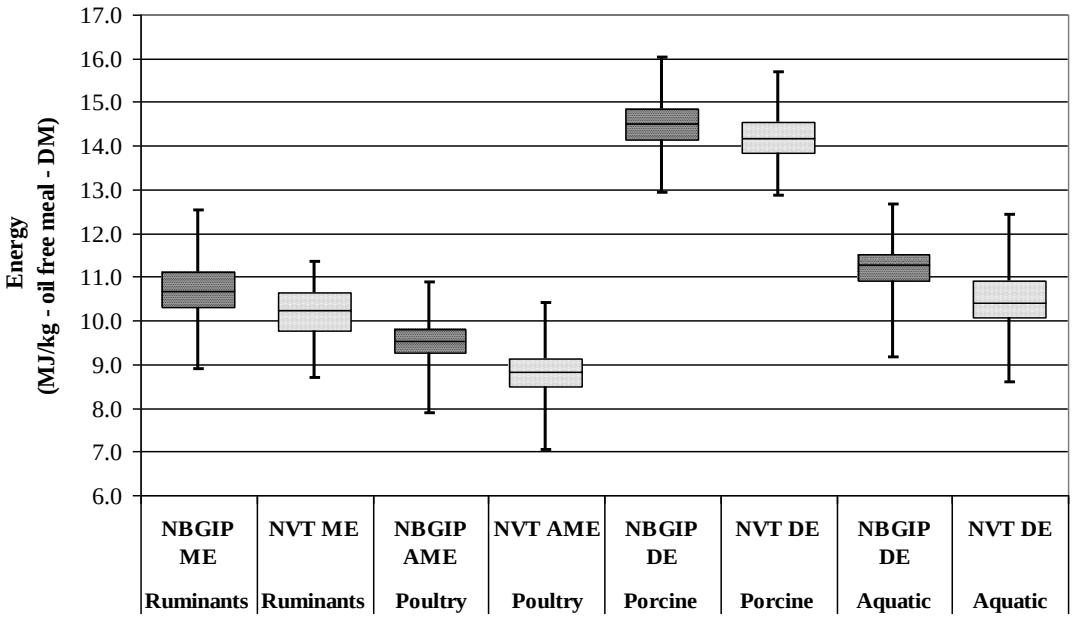
Available energy



- Canola meal used as a protein supplement in animal feeds, however available energy is an important factor.
- A single energy value cannot be applied to all species.
- Determined by:
  - difference between gross energy supplied and energy excreted in faeces

  OR

  - Standard calculations based on ruminant, monogastric, illeal and aquatic digestive systems.
- Depending on species carbohydrates, protein, oil content, fibres, digestibility are used for energy calculation.
- Available energy in NBGIP lines generally higher than NVT.

ME – metabolisable energy

AME – apparent metabolisable energy

DE – digestible energy

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Summary

- The results from this study show that inclusion of some of the lines identified in the NGBIP germplasm into the Australian canola germplasm could have a positive impact on the quality of Australian canola oil and meal.

- Further funding has been provided by GRDC to use the information gained from this project to study the effect of G x E interactions on canola quality traits.

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