ICIS – *where are we at?*

Canola Breeders

canola growers' choice

COGGO

GRDC
Grains
Research &
Development
Corporation

The University of
Western Australia
A Leading University

LEMBKE®

CBWA background

- Private canola breeding company – genetics only!
- Funded by, UWA, COGGO, GRDC, NPZ-Lembke
- Focus on efficiency in breeding and making the most of our resources – hence ICIS!
- Started in 2001 CBWA has released 8 OP lines and branching out into commercial hybrid canola in 2009

CBWA and ICIS

- GMS…

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Genetic diversity in Australian canola and implications for crop breeding for changing future environments

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Abstract

Australian canola breeders have successfully improved blackleg resistance, seed oil and meal quality and local adaptation of oilseed rape (*Brassica napus*) from 1970 to 2000 in five breeding cycles, averaging 6 years/cycle, in a closed population. The 18 ancestral varieties in 1970 included 16 *B. napus* from Canada, Europe and Asia and 2 *B. juncea* varieties. Introductions with improved seed quality were generally very susceptible to blackleg under Australian conditions. Of the varieties released from 1995 to 2002, 11 ancestral varieties contributed 98.7% of the pedigree composition, and 2 ancestors (Canadian low erucic spring variety Zephyr, and Polish low glucosinolate spring variety Bronowski) were present in the pedigrees of every variety. Approximately half of the ancestral contribution was from Asian *B. napus* or *B. juncea*, and half from European or Canadian *B. napus*. Assuming an effective population size of 11, the inbreeding coefficient of the population at the end of the fifth cycle was 0.21, which represents 21% cumulative loss of alleles through random genetic drift. The coefficients of ancestry among four varieties released from 1996 to 2002 ranged from 0.127 to 0.371. While the original parents were very diverse, the population is showing signs of loss of genetic diversity that will impact on future breeding progress. There has been a slow decay in polygenic blackleg resistance (average −0.15 resistance units per year) which, so far, has been countered by a net genetic improvement rate of approximately +0.13 resistance units per year over 30 years. New genetic diversity should be introduced to maintain a positive net improvement rate in blackleg resistance, or for adaptation to low rainfall environments. New technologies such as doubled haploidy may improve the efficiency of selection for earliness and other polygenic characters, and accelerate cycles of selection. Major challenges exist for Australian canola breeders to introgress new genetic diversity and increase effective population size, while retaining genetic gains made over the past 30 years. Similar challenges face most crop breeders who are attempting to improve their crop in the face of changing future environments.

Keywords: Oilseed rape; Canola; Genetic diversity; Drought tolerance; Recurrent selection; Inbreeding

1. Introduction

Oilseed rape (*Brassica napus* L.) varieties were introduced to Australia from Europe or Canada prior to 1970. These varieties were late flowering under Australian conditions, and restricted to high rainfall regions. They were also very susceptible to blackleg disease in this environment, and the rapeseed industry disappeared as a result of this susceptibility "double low" or canola quality) (Salisbury and Wratten, 1999). As a result, the production of canola exceeded 1.6 million tonnes in Australia by 1998/1999 (Colton and Potter, 1999).

Australian canola breeding underwent several cycles of recurrent selection in a closed population from 1970 to 2000. The success of the breeding effort was due to the introduction of moderate blackleg resistance in oilseed rape from Asia and Europe, and intercrossing these with low erucic acid and low

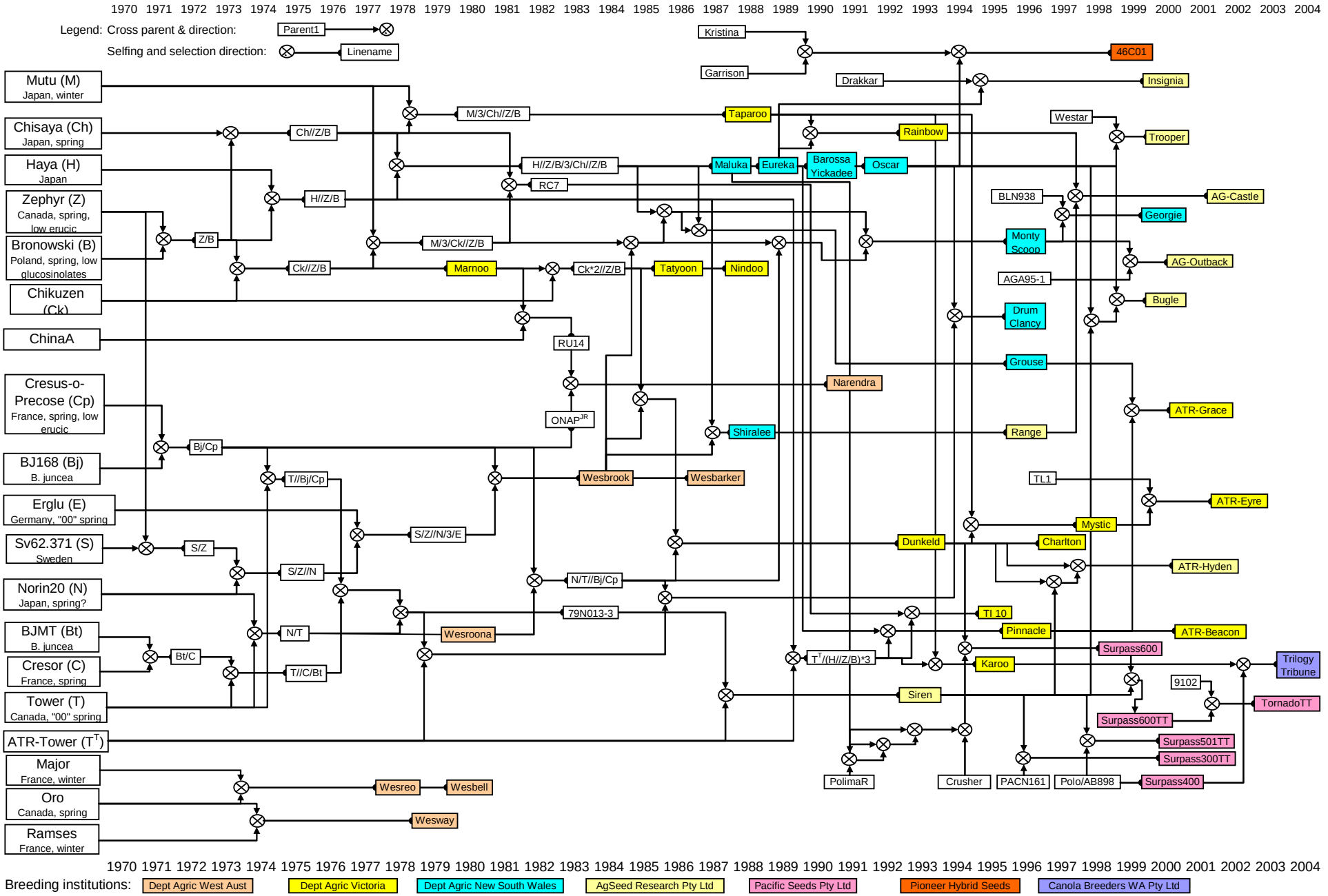

Figure 1. Pedigrees of selected Australian canola varieties 1970 to 2004 (from Wratten and Salisbury [1999], and IP Australia [http://www.ipaustralia.gov.au/pbr/]). Varieties not listed: hybrid, Clearfield™ (imidazolinone-tolerant) and those with uncertain pedigrees (eg, Rivette, Ripper, Purler, Lantern, AV-Sapphire, AG-Emblem, AG-Comet).

CBWA and ICIS

- Our ICIS focus has really been in GMS – using browse to extract specific cross histories
- we have used the COP function extensively and fixed issues with Graham eg: DH lines treated as F2's
- new .ICP LST <LVL> command added
- I would like these functions to be available from SetGen – bit clunky at the moment

CBWA and ICIS

- We use such lists to create relatedness matrices to be used in MET analysis.
- The Goal – use as much G information when assesing GxE and you can knock out more E

Where to with ICIS for CBWA

- Develop our DMS
- Develop out inventory management
- Develop full time staff for ICIS management