

**Alison Smith<sup>1</sup>**

Justin Kudnig<sup>2</sup>  
Willow Liddle<sup>3</sup>  
David Tabah<sup>3,4</sup>  
Brian Cullis<sup>1</sup>

<sup>1</sup> University of Wollongong,  
Wollongong, Australia

<sup>2</sup> Pacific Seeds, Highett,  
Australia

<sup>3</sup> Pacific Seeds, Toowoomba,  
Australia

<sup>4</sup> InterGrain, Bibra Lake,  
Australia

**Background:**

Historically, the evaluation of commercial or near-to-release canola varieties has been conducted using field trials with separate sub-experiments for different herbicide technologies. This has precluded valid comparisons of varieties across technologies, despite the distinct need of such information by Australian consultants, advisors and growers.

**Objective:**

In this presentation we discuss a new Industry leading approach led by Pacific Seeds for experimental design that facilitates valid comparisons across herbicide technologies. We also show how an appropriate multi-environment trial (MET) analysis of yield data from such trials enables provision of information for growers on the relative yield performance of all canola varieties, irrespective of single or stacked herbicide technology, hybrid or open pollinated, across a range of environmental conditions.

**Methods:**

We consider 30 trials conducted by Pacific Seeds in 2021 and 2022. A total of 98 varieties was grown (not all were grown in every trial), covering seven herbicide technology group types. The experimental design for each trial comprised a separate block of plots for each technology, with blocks separated by buffer rows. Within each block, a randomised complete block design was used to allocate the varieties for that technology. The key feature that allows comparisons of varieties across technology blocks is the testing of double and triple stacked varieties, developed exclusively by Pacific Seeds, in multiple blocks. The MET data were analysed using a factor analytic linear mixed model and the resultant predictions of variety performance in individual trials were summarised across trials using the interaction class (iClass) methodology of Smith et al. (2021).

**Results:**

A factor analytic model with four factors was fitted to the MET data and explained 95.1% of the variation between variety effects. The first three factors were used to construct four iClasses (groups of environments), with the number of environments in each ranging from four to eleven. In the presentation we will examine variety performance across these iClasses for key varieties from different technology types.

**Conclusions:**

This study has demonstrated that it is possible to construct experimental designs for canola evaluation trials that allow varietal comparisons across all current herbicide technologies. This has been achieved with the use of stacked herbicide varieties and importantly we note there is no added burden in terms of trial management. We have also demonstrated the benefit of using a factor analytic linear mixed model for MET analysis and the definition of iClasses (groups of trials that capture patterns of variety by environment interaction, VEI). Overall variety performance can then be obtained for each iClass by averaging predicted effects from the MET analysis across all trials in an iClass. This is to be contrasted with uninformed measures of overall performance obtained by averaging across all trials (ignoring VEI entirely) or averaging across trials in different regions or years (typically capturing very small amounts of VEI).

**References:**

Smith A, Norman A, Kuchel H and Cullis B (2021). Plant variety selection using interaction classes derived from factor analytic linear mixed models: Models with independent variety effects. *Front. Plant Sci.* 12:737462. doi: 10.3389/fpls.2021.737462