**From Sequence to Selection: Genomic and Predictive Breeding for Pulse Crop Improvement**

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With escalating demand for food legumes amidst global population growth, climate change challenges and a shift towards plant-based diets, there is an urgency to enhance genetic gain in pulse crops. Genomic and predictive breeding tools offer promising solutions to expedite crop genetic improvement. This plenary session will delve into the integration of a diverse range of approaches aimed at trait improvement and accelerated crop breeding including genomic selection (GS) and advanced predictive analysis techniques such as environmental covariates combined with genomic selection (EC-GS) and crop growth model enabled whole genome prediction (CGM-WGP). EC-GS is particularly useful for connecting genotype-environment interactions with environmental covariates, while CGM-WGP can enable prediction for unobserved (latent) traits underlying crop growth models, providing the opportunity to select on component traits. This talk will also include the use of simulation modelling to optimize genomic selection deployment, speed breeding techniques to shorten generation times, and AI-augemented trait stacking for variety development. The successful implementation of these tools in the Australian lentil breeding program has notably increased the rate of genetic gain. These tools are also deployed in our pre-breeding research to enhance heat stress tolerance during flowering in lentils and disease resistance in chickpeas. By leveraging such techniques, breeders can develop pulse crops better suited to a changing environment, with enhanced yields and improved tolerance. Join us in this session to explore the transformative potential of genomic and predictive breeding in revolutionizing pulse crop improvement.

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