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Agronomic challenges to adapting canola into cropping systems of the world

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Canola (Brassica napus L.) or edible oilseed rape is the third most important oilseed globally and production has expanded 2-, 3-, and 4-fold in China (to 14.5 Mt), Canada (to 17.9Mt), and the EU (to 20.9 Mt) respectively since 1993. In the same period, production in Australia has increased 10-fold from 0.3 to 4.0 Mt from 2.6 M ha, and canola is now Australia's third most important crop worth around $3Bill pa. The agronomic challenges to adapt canola to the driest continent on earth can provide useful insights into those faced elsewhere, a challenge that is ongoing as climate change deepens and canola expands into new areas of the continent. Yield gap analyses suggested canola in Australia was achieving only 48 to 62% of its water-limited potential from 1998 to 2012. Since then, research effort has focussed on the use of physiological understanding of crop responses to underpin variety and tactical agronomy choices in diverse environments. Aligning phenology and phase durations with sowing dates to reduce stress during the critical period was a key first step. Manipulating inputs to manage the trajectory of biomass production cost-effectively to achieve target yields is also important for a crop considered risky by farmers in semi-arid areas. Protecting the yield potential by managing weeds, virulent stains of Blackleg (Leptosphaeria maculans) and other emerging pests is an ongoing imperative, especially as the crop intensifies. The industry-wide G x E x M approach has seen success in Australia with vigorous winter canola hybrids in the high rainfall zones used for grazing and grain, yield increases in earlier sown, slower developing spring hybrid varieties in medium rainfall zones, and timely-sown open-pollinated varieties with delayed N application in the risky lower rainfall zones. Canola expansion and that of related oilseed species in other parts of the world including South Africa, USA, South America and eastern Canada each face specific agronomic challenges, but the same physiological principles can be applied to underpin adaptation and tactical agronomy advice. Validated crop simulation models embedded within multidisciplinary field-based research teams provide a powerful tool to highlight likely constraints and to direct agronomic research.