Chickpea phenology and grain yield response to surface residue in southern NSW

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Chickpea (*Cicer arietinum* L.) growth is susceptible to low temperatures especially during the reproductive phase and require an average daily air temperature above 15°C for viable pod development and retention. Stubble or surface residue insulates and affects the crop environmental factors such as moisture availability, canopy air and soil temperature. Air temperature is reduced above stubble due to a reduction in heat absorption in the soil, potentially leading to lower soil surface and canopy temperatures. This experiment aimed to determine the effect of surface residue (stubble load) on chickpea phenology and grain yield.

The experiment was conducted in 2018 at Wagga Wagga, NSW under dryland conditions using CICA1521 (breeding line), PBA Slasher and PBA HatTrick (varieties), under the Grains Agronomy and Pathology Partnership (GAPP). Surface residue treatments (0, 3, 6, 9 and 12 t/ha) were applied to a uniform site immediately post sowing to ensure there was no treatment effect on stored soil water at sowing. Stubble treatments simulated a flattened surface residue, not standing cereal stubble. The 2018 growing season was one of the most difficult and extreme on record with a high incidence of frost and below average growing season rainfall of 152.6 mm (April - October), significantly lower than the long term average of 276 mm.

High surface residues decreased plant establishment, lengthened the duration of growth phases and overall time to maturity. Grain yield did not increase as stubble load increased and no interaction between variety and stubble load treatments was observed. The higher residues treatments did produce greater pod number (filled and unfilled) and seed number, but also produced lower grain weight.

For the 12 t/ha surface residue treatment, 84, 11 and 5 frost days were recorded during vegetative, flowering and podding phases respectively. In contrast the 0 t/ha surface residue treatment recorded 60, 9 and 0 frost days during the vegetative, flowering and podding phases respectively. The low temperatures and severe frost damage resulted in decreased biomass accumulation, lower grain weight and grain yield observed at 12 t/h surface residue treatment. The overall growth duration was shorter for 0 t/ha (172 days) compared to 12 t/ha (189 days) treatment. The longer growth duration, including delayed flowering in the 12 t/ha surface residue treatment was likely due to significant frost damage observed in this treatment. The consistently lower air temperatures with increasing surface residue delayed floral initiation and overall plant growth. In response to the severe main stem necrosis, new branches were produced below the necrotic tissue. The delayed development of these compensatory branches added significantly to the overall growth duration of the 12 t/ha treatment. Podding in the 12 t/ha treatment on the later developing compensatory branches occurred from late September to late October a time when the mean temperature was above 15°C but approaching the heat and moisture stress period. As a result there was no significant response in grain yield.

This research will improve chickpea profitability through better understanding plant growth responses to variable levels of surface residues in southern NSW.