Pigeonpea: a new dryland summer pulse for northern region farming systems

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Take home message

Pigeonpea is showing promise as a new option for growers seeking a hardy dryland summer pulse crop to fill a gap in their farming systems. Demand is growing for high quality pigeonpea grain for human consumption in India, and among the Indian consumers in Western countries. Last summer, DAF evaluated new experimental pigeonpea lines at four sites across southern and central Qld in GRDC-funded trials. These lines showed high grain yield, quick maturity, short height and short flowering window, and were easy to harvest using existing equipment. Given these encouraging results, efforts to commercialise pigeonpea are continuing.

Background

Pigeonpea (*Cajanus cajan* (L.) Millsp.) is showing potential as a widely adapted summer pulse crop that can be grown in regions where mungbean and soybean are not well-suited. Pigeonpea originated in India and is widely grown and consumed across the Indian subcontinent. The grain is dehulled and split to produce 'toor dal', a staple food for many millions of consumers. In Australia, pigeonpea is mostly known as an insect refuge crop in the cotton industry, where varieties such as 'Sunrise' are planted for their long flowering window, indeterminate growth habit, and slow maturity, but are unsuited for grain production.

The GRDC northern region has a reputation for producing and exporting high quality pulses. However, current summer pulse options are limited. Mungbean, peanut and soybean are not sufficiently resilient, drought-tolerant, or easily managed for broad-scale dryland production in low rainfall areas. Pigeonpea is the most obvious option to fill this critical gap in northern region farming systems.

Demand for pulses in India is forecast to more than double, from 22 million tonnes in 2020 to 46 million tonnes in 2035 (Trade and Investment Queensland, 2023). India imported 894,000 tonnes of pigeonpea in 2022, mostly from Myanmar and central Africa, with projected import demand of 1.2 million tonnes in 2023-24 (APEDA AgriXchange, 2023). With a continued shortfall in domestic production, and growing demand in India, import volumes are expected to increase. Currently, there is no tariff on whole pigeonpea imported into India. In addition to export of bulk grain, pigeonpea presents an opportunity for local value-adding. The grain can be dehulled and split to produce dahl for a growing number of Indian consumers in western countries who value pigeonpea as part of their traditional diet.

The introduction of pigeonpea will further benefit northern farming systems through the opportunity to grow a summer pulse, additional nitrogen fixation, reduced need for nitrogen fertiliser, carbon sequestration, rotational weed control options and better disease suppression in subsequent crops.

The current GRDC project builds on research conducted by the Qld Department of Agriculture and Fisheries (DAF) over the last five years. This preliminary research included the importation and multiplication of advanced experimental lines from the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in India, research on:

- insect and weed management
- agronomic trials (optimising planting times, plant population and row spacing)
- root systems
- planting depth
- grain quality, and
- post-harvest grain storage.

Locally adapted pigeonpea varieties, together with enhanced management strategies for insect and weed control, will allow Queensland farmers to produce high quality pigeonpea to meet growing global demand.

GRDC provided funding to conduct a series of preliminary grain yield trials in the 2023-24 summer, to demonstrate that new pigeonpea experimental lines and agronomic practices were viable for commercial production, and to inform the direction of future research.

Method

Field trials were conducted at four locations in southern and central Qld: Kingaroy Research Facility (planted 1/11/23), Tosari Crop Research Centre (planted 12/12/23), Wade Bidstrup's property northwest of Warra (planted 13/12/23) and Emerald Smart Cropping Centre (planted 16/1/24). Each site assessed 27 experimental lines and three plant population treatments on a sub-set of 3 lines, with three replicates per entry, in standard yield plots (2 x 12m) with 50cm row spacing and target population of 30 plants/m^2. Each site also included demonstration strips of older check varieties Sunrise™ and Quest and two promising advanced experimental lines. In addition to yield, emergence, phenology, and height were recorded and any insect, disease and weed management issues noted. Field walks were conducted with local growers and agronomists at each site in the early pod-fill stage.

Results and discussion

At the time of writing, collation and statistical analysis of the trial data is ongoing. A summary of results will be presented at the Goondiwindi GRDC Update on the 30-31 July 2024, and available as a handout.

Most experimental lines flowered in 45–50 days and reached harvest maturity 100–105 days after planting. Days to flowering was consistent across a range of planting dates, suggesting these lines are less photoperiod sensitive than older pigeonpea varieties such as Quest. The reduced photoperiod sensitivity and quick maturity suggest the window of opportunity to plant these lines is wider, extending from late October to late January in southern Qld.

Plant height of most experimental lines at maturity ranged from 50–60cm at Kingaroy, and 75–95cm at Tosari. All trials were planted using standard small plot equipment, and no special modifications were made to the plot headers used to harvest the trials.

The key to commercial pigeonpea production will be minimising insect damage at flowering and pod-fill, especially from *Helicoverpa* spp. (refer to main paper from Trevor Volp, DAF Toowoomba, on insect management in pigeonpea in these proceedings). All trials required one or two preventative sprays of Vantacor® during flowering for control of *Helicoverpa*. The pigeonpea trials were unaffected by fall army worm.

Successful management of weeds was achieved at all trial sites using existing herbicide products registered for summer pulse production. However, a number of these products are not currently registered for use in pigeonpea or are only registered for weed control in pigeonpea cotton refuges. Dr. Troy Frederiks, DAF Toowoomba, has recently completed initial crop safety field trials on a range of pre-plant, pre-emergent and post-emergent herbicides, and these results could help support a special permit application to use these products in pigeonpea for grain production. A crop competition trial conducted in 2021-22 suggested that narrow row spacing, and to a lesser extent increased plant population, reduced weed growth during the early growth period when pigeonpea is most susceptible to weed competition.

Like previous pigeonpea trials in Qld, disease pressure was generally low. A very low incidence of phytoplasma was observed at most sites but did not cause significant yield loss. In Emerald, charcoal rot (*Macrophomina phaseolina*) infection late in the season may have reduced grain yield and may be a constraint to commercial production in central Qld.

Previous research has shown pigeonpea to be highly tolerant of deep sowing. In a sowing depth trial on a black clay soil at Wellcamp in 2023-24, pigeonpea seedlings emerged from a planting depth of 20cm with minimal reduction in population and vigour, and little to no reduction in grain yield (Troy Frederiks, pers. com.).

A glasshouse trial by Dr. Kirsty Owen at USQ showed that a wide range of pigeonpea experimental lines were highly resistant to *Pratylenchus thornei* at seedling stage (Owen et al., 2023). While this result needs to be confirmed in field trials, it suggests that pigeonpea may be suitable for planting in soils where *P. thornei* is known to be present.

The trial harvest at Warra and Tosari was delayed by several periods of heavy rain during April and May 2024. However, trials at both sites showed only minor weathering damage, with very low levels of splitting, sprouting and grain mould.

References

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