

Smart Ag Applied Research

Dialing it in: Faba Beans

Olds College Centre for Innovation (OCCI) evaluated how different opener configurations and seeding rates influence early plant development, canopy characteristics, flowering behaviour and yield. Insights gained will support more informed seeding decisions in faba bean production.

INTRODUCTION

A single-row opener places seed in a single furrow, offering a simple design, less soil disturbance and better moisture retention. In contrast, a paired-row opener splits the seed into two rows, improving airflow and providing better seed-fertilizer separation to prevent burn.

Seeding rate (lb/ac) dictates plant population, weed competition and yield, while also impacting input costs. OCCI evaluated these factors to determine how opener configuration and plant density influence faba bean development and yield.

OBJECTIVES

- Evaluate the effect of single vs. paired row openers on faba bean growth and yield.
- Evaluate the agronomic effects of faba bean seeding rates (240 lb/ac vs. 180 lb/ac), with a focus on plant stand establishment and final yield.

STUDY DETAILS

Experimental Design

The trial was conducted at OCCI Field 13/14 using a four-treatment design comparing two opener types and two seeding rates:

- **Openers:** Single-row vs. Paired-row
- **Seeding Rates:** 180 lb/ac vs. 240 lb/ac
The field was divided into 474 experimental grids (100' x 5'). For data collection, 240 grids were randomly selected (60 per treatment) to ensure statistical balance.

Field Scouting & Data Collection

Three scouting events were conducted between June and September 2025.

- **Early Season:** Measured plant stand (count stems within a two ft² hoop) and plant stem spacing (measure number of plants and space between them using a metre stick).
- **Mid-Season:** Monitored flowering stage/intensity (visually) and stem diameter (digital callipers).
- **Late Season:** Assessed pods per stem (visually) and final stem diameter as vegetative growth reached senescence.

Remote Sensing and Drone Analytics

A DJI Matrice 350 RTK equipped with multispectral, thermal and LiDAR sensors performed five flights.

- **Precision:** Six permanent Ground Control Points (GCPs) and a D-RTK 2 base station ensured high geospatial accuracy.
- **Vegetation Indices:** Multispectral data was processed in Pix4D to generate NDVI layers for crop health analysis.
- **Growth Modelling:** LiDAR data was processed via LiDARmill to create Canopy Height Models (CHM) by comparing Digital Surface Models (DSM) against a pre-emergence bare-earth Digital Elevation Model (DEM).

Harvest Sampling

On September 19, 2025, 48 randomized grids (12 per treatment) were hand-harvested.

1. **Selection:** 20 representative plants per grid were cut at the base.
2. **Processing:** Pods and leaves were stripped and air-dried for one week in the OCCI lab.
3. **Final Yield:** Pods were hand-shelled to determine treatment-specific seed weight and quality.

RESULTS

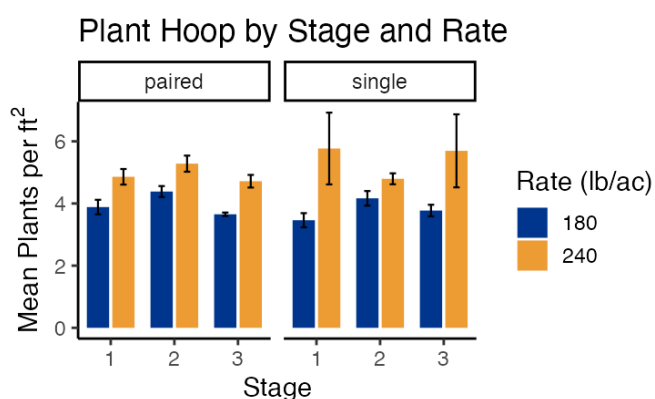
Plant Stem Diameter: Plants at 180 lb/ac averaged 13.2 mm across at the base; plants at 240 lb/ac averaged 11.6 mm. That pattern was consistent across the field and statistically significant. Opener type made no difference at either rate, only the seeding rate moved stem thickness.

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Stem Counts and Spacing: The 240 lb/ac treatments consistently counted higher stem counts and closer spacing than the 180 lb/ac rate. Opener type had no significant effect on establishment, indicating that seeding rate was the primary driver of stand density. There was no statistical difference in the number of plants per ft² (Chart 2 and 3). The plants were not pulled out, then the plant count considered all the stems as a plant.

Figure 1 - The chart represents the mean plant stand in ft².



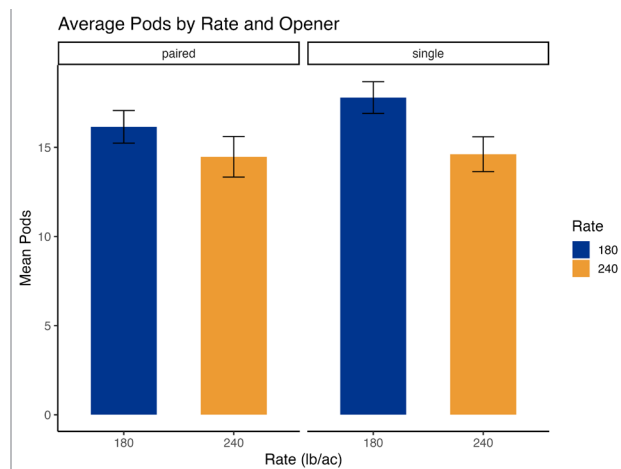
Flowering: Plots seeded at 180 lb/ac carried roughly twice the blooms of the 240 lb/ac plots through the flowering window – another sign that plants with less competition had more resources to spend on reproduction (Image 1).

Image 1 - Faba bean plants at the flowering stage, when bloom observations were made



Pod Count: Stems in the 180 lb/ac plots carried about 17 pods on average, and stems in the 240 lb/ac plots carried about 14. Once again, the opener had no significant effect at either rate (Figure 2).

Figure 2 - The chart below represents the mean of the numbers of pods per stem in each group.

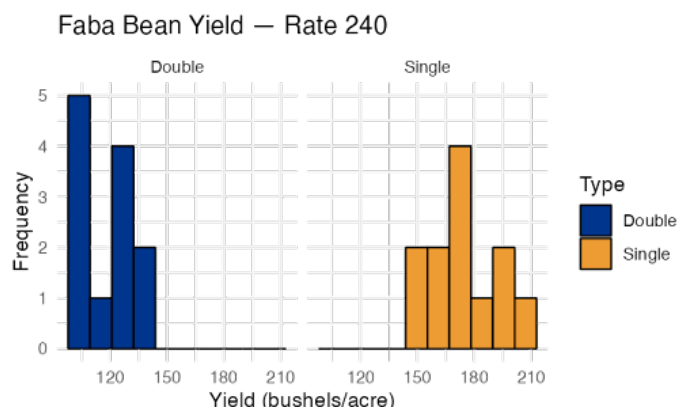


Canopy height: Canopy height data were obtained from images captured by drones equipped with specific sensors. Images were taken on July 2, 2025 and August 12, 2025 for crop height.

Regarding canopy height on July 7, 2025 at a seed rate of 180lb/ac, the paired opener produced a significantly greater mean crop height than the single opener. At a seed rate of 240lb/ac, the paired opener also produced a significantly greater mean crop height than the single opener.

On August 12, 2025, at seed rate 180 lb/ac, the single opener produced a slightly greater mean crop height than the paired opener, and this difference was statistically significant. At 240 lb/ac, there was no significant difference between the openers.

Figure 3 - The chart below represents the yield in bushels per acre at the rate 240 lb/ac.

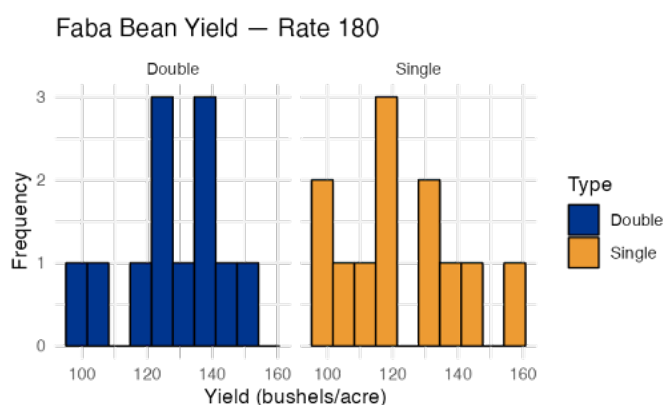


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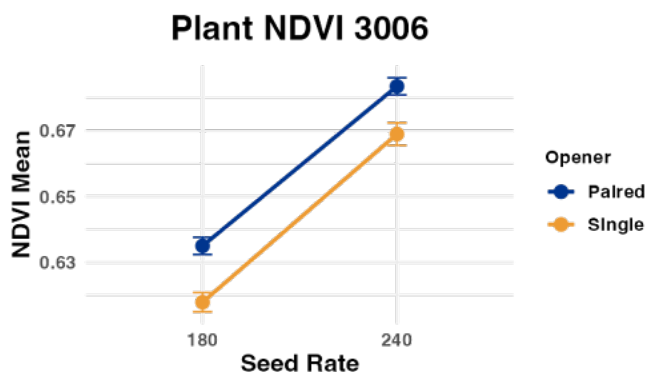
Figure 4 - The chart below represents the yield in bushels per acre at the rate 180 lb/ac.

Normalized Difference Vegetation Index (NDVI): NDVI is a greenness score measured from the air. Healthy leaves reflect near-infrared light strongly and absorb red light, so the drone's sensor can compare the two and score how much living plant material covers the ground, from 0 (bare soil) to 1 (a thick, healthy canopy). NDVI data were obtained from images captured by drones equipped with specific sensors. Images were taken on June 30, 2025 (3006) and August 12, 2025 (1208).



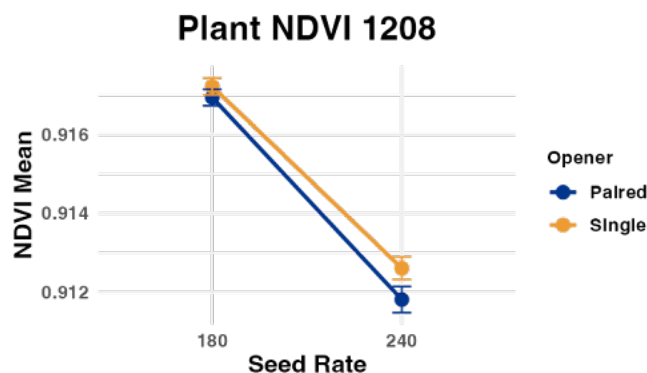
On June 30: The 240 lb/ac plots scored higher than the 180 lb/ac plots (NDVI = 0.68 vs. 0.63), more seed, more stems, more green covering the soil. The paired opener also edged out the single opener, regardless of rate. The two effects worked independently, the higher rate added about the same amount of green whichever opener was used (Chart 8).

Chart 8 - The chart below represents the NDVI mean on July 30, 2025.



On August 12: All four treatments had reached near-complete canopy greenness, with NDVI values above 0.91 across the trial. Differences between treatments were still detectable. The single opener recorded slightly higher values than the paired opener at both rates (0.9172 vs. 0.9170 at 180 lb/ac; 0.9126 vs. 0.9118 at 240 lb/ac), but not statistically significant (Chart 9).

Chart 9 - The chart below represents the NDVI mean on August 12, 2025.



Yield: With the single opener, 240 lb/ac was the best performer in the trial, reaching the highest estimated yield at 174 bu/ac. With the paired opener, the same rate produced the lowest yield of all. At 180 lb/ac, the opener made much less difference. Both configurations landed mid-range, about 128 bu/ac with the paired opener and 122 with the single (Charts 7 and 8).

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Conclusion: The 180 lb/ac rate resulted in wider plant spacing, thicker stems, more pods and more abundant flowering, likely due to reduced competition for resources. Conversely, the 240 lb/ac rate led to thinner stems and fewer blooms and pods. Opener type (single vs. paired) had no significant effect on establishment or development, suggesting that seeding rate is the more critical factor for faba bean performance (Table 1).

Table 1 - The table shows the overview of the main results for the groups.

Metric	180 lb/ac	240 lb/ac
Stem thickness	Thicker stems (13.2 mm)	Thinner stems (11.6 mm)
Flowering	More abundant	Fewer blooms
Pods per stem	More pods (17)	Fewer pods (14)
Seed per plant	About 15% more	Less per plant
Stems in the ground	11 per metre of row	15 per metre of row
Estimated yield	"Single - 122 bu/ac Paired - 128 bu/ac"	"Single - 174 bu/ac Paired - 116 bu/ac"
Opener effect	No measurable difference	No measurable difference