

Peaola Power: Using Pea-Canola Intercrops to Improve Yield and Land-Use Efficiency

Lauren R. Stubbs^{1,5*}, Ava E. Heathman¹, Surendra Singh^{1,5}, Don Wysocki², Garrett C. Heineck³, Aaron Esser⁴, Haly L. Neely⁵, and Shikha Singh^{1,5}

¹Lind Dryland Research Station, Washington State University, Lind, WA 99341; ²Oregon State University Extension, Pendleton, OR 97810; ³Smith Seed Services, Halsey, OR 97348;

⁴Adams County Extension, Washington State University, Ritzville, WA 99169; ⁵Department of Crop and Soil Sciences, Washington State University, Pullman, WA 99164

*Presenting author: lauren.stubbs@wsu.edu

Introduction

- Declining soil health, increasing input costs, herbicide-resistant weeds, and droughty conditions are challenging dryland producers in the inland Pacific Northwest (iPNW)
- In the intermediate rainfall zone of the iPNW (12-18 in. annual precipitation), pea (*Pisum sativum* L.) and canola (*Brassica napus* L.) are crops used in rotation with soft white winter wheat (*Triticum aestivum* L.)
- Previous studies have shown that intercropping with pea and canola can promote on-farm resilience and improve iPNW soil health
- Little is known about the effect of seeding ratios and applied nutrients on intercrop productivity

Objective

- To evaluate the suitability of varied seeding rates and nitrogen (N) fertility regimes on an intercropped spring pea-canola (“peaola”) system in the intermediate rainfall zone of the iPNW

Materials and Methods

- Study duration:** April 2024 – Present
- Study location:** WSU Wilke Research & Extension Farm, Davenport, WA
- Study site precipitation:** 11.2 in. from 1 Sept. 2023 to 31 Aug. 2024
- Soil type:** Broadax silt loam (fine-silty, mixed, superactive, mesic Calcic Argixerolls)
- Experimental design:** Randomized complete block design with four replicates (Table 1)

Table 1: Experimental treatments, listed numerically by treatment ID, ratio of pea-to-canola seeded, seeding rate in lb./ac., N fertilizer input as a percent of the recommended total for spring canola, and rate of N applied in lb./ac.

Treatment ID	Seed Ratio	Seeding Rate (Pea ¹ + Canola ² , lb./ac.)	N Fertilizer ³ Input	N Fertilizer Rate (lb. N/ac.)
TRT 1	Canola monoculture check	0 + 5	100% N	67.0
TRT 2	1/3 pea + 2/3 canola	50 + 3.5	0% N	0.0
TRT 3	1/2 pea + 1/2 canola	75 + 2.5	0% N	0.0
TRT 4	2/3 pea + 1/3 canola	100 + 1.75	0% N	0.0
TRT 5	1/3 pea + 2/3 canola	50 + 3.5	50% N	22.0
TRT 6	1/2 pea + 1/2 canola	75 + 2.5	50% N	17.0
TRT 7	2/3 pea + 1/3 canola	100 + 1.75	50% N	11.0
TRT 8	1/3 pea + 2/3 canola	50 + 3.5	100% N	45.0
TRT 9	1/2 pea + 1/2 canola	75 + 2.5	100% N	33.5
TRT 10	2/3 pea + 1/3 canola	100 + 1.75	100% N	22.3
TRT 11	Pea monoculture check	150 + 0	0% N	0.0

¹Winter pea cultivar Vail (Pure live seed count: 2,700 seeds/lb.), inoculated with *Rhizobia* bacteria

²Spring canola cultivar NCC101S (Pure live seed count: 86,000 seeds/lb.)

³N fertilizers used were dry starter (16-20-0-14.5) and dry urea (46-0-0)

- Soil sampling:** Pre-plant and post-harvest bulk soil samples at 0-4 in. and 4-8 in. depths
- Grain processing and analysis:** Total and separated grain weights; grain moisture, canola oil content, and pea protein content were measured via near infrared (NIR) analysis
- Land equivalency ratio calculation:** TRT LER = (TRT “N” intercrop pea yield/monoculture pea yield) + (TRT “N” intercrop canola yield/monoculture canola yield)
- Statistical analysis:** ANOVA using mixed-model in SAS

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Results

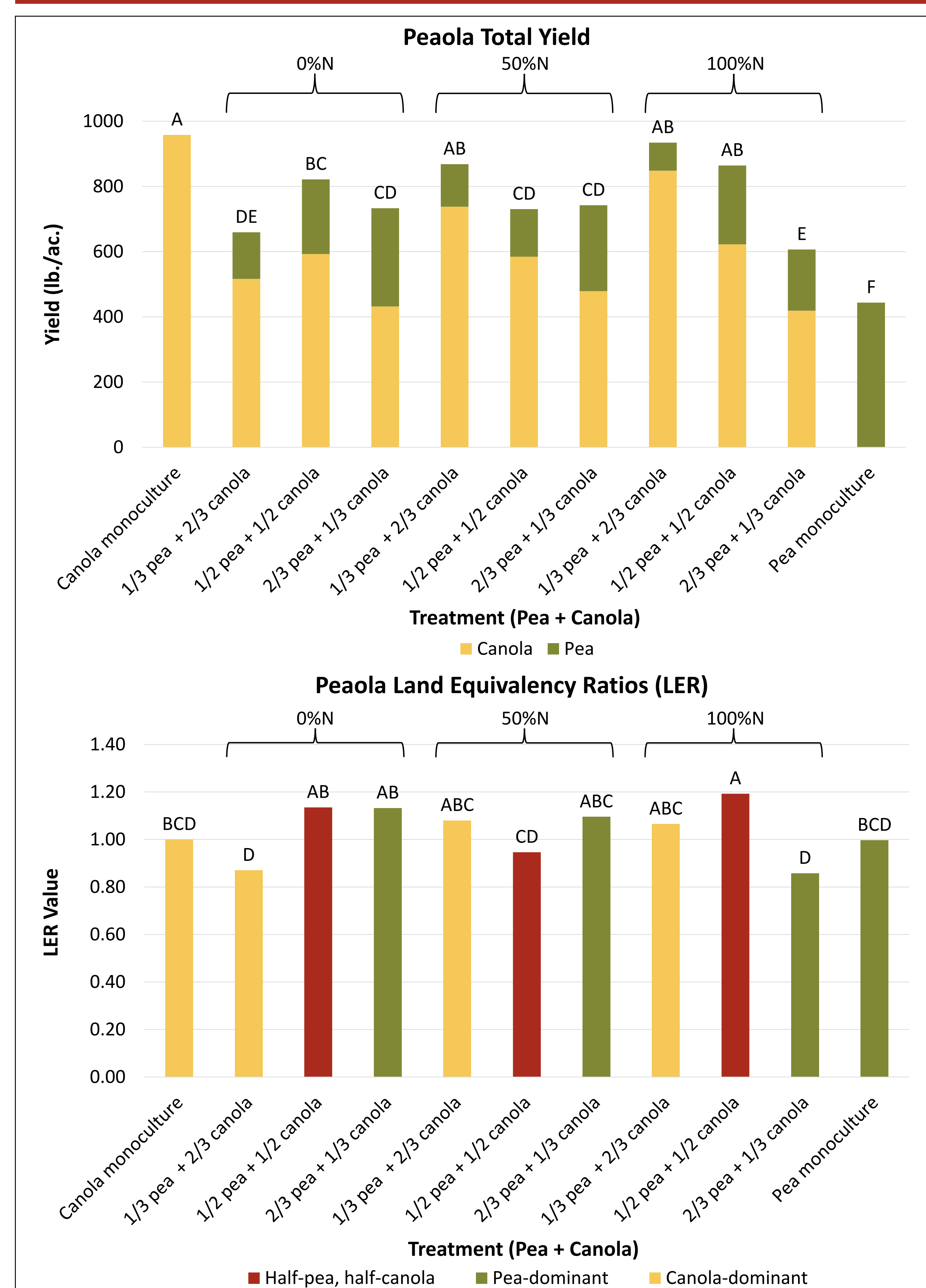


Figure 1: Total yield and LERs of each treatment. Letters shared between treatments indicate no significant difference between yields or LER values. *LER* ≥ 1.00 indicates intercropping advantage

Table 2: Responses of grain quality attributes across treatments.

NS: Not significant

Grain Attribute	Response
Canola Moisture	NS
Pea Moisture	NS
Canola Oil	NS
Pea Protein	NS

Table 3: Responses of soil fertility measures across treatments post-harvest.

*Significant at $p \leq 0.05$, NS: Not significant

Soil Response	0-4 in.	4-8 in.
pH	NS	NS
EC (mmhos/cm)	NS	NS
OM (%)	NS	NS
NO ₃ -N (ppm)	NS	NS
NH ₄ -N (ppm)	NS	NS
P (ppm)	NS	NS
K (ppm)	NS	NS
Ca (ppm)	NS	*
Mg (ppm)	NS	NS
Na (ppm)	NS	NS
S (ppm)	*	NS
Zn (ppm)	NS	NS
Fe (ppm)	NS	NS
Mn (ppm)	NS	NS
Cu (ppm)	NS	NS
B (ppm)	NS	NS

Conclusions

- Canola-dominant treatments outyielded pea-dominant treatments (Figure 1)
- Treatments with $\geq 50\%$ N outyielded treatments that received 0% N (Figure 1)
- Treatment had no significant effect on grain quality attributes (Table 2)
- Treatment had no significant effect on soil fertility at either depth (excluding S at 0-4 in. and Ca at 4-8 in.) (Table 3)
- Treatments with an intercropping advantage ($LER \geq 1.00$) over a pea or canola monoculture ($LER = 1.00$) were predominantly or half-canola with $\geq 50\%$ N or pea-dominant with $\leq 50\%$ N (Figure 1)
- Peaola systems can be as productive as monoculture pea and canola systems at $\geq 50\%$ N if the mixture is canola-dominant

Implications

- This investigation is a resource for producers and researchers that are interested in establishing on-farm peaola trials in the iPNW’s intermediate rainfall zone