FIELD PEA PRODUCTION

Seeding rates, seeding depth, and inoculant

Strahinja Stepanovic, Rodrigo Werle, Cody Creech, Chuck Burr, Dipak Santra, Julie Peterson, Tony Adesemoye, Daran Rudnick

Overview

Grain-type field peas are a cool season grain crop (typically planted in mid-March and harvested late-July) grown as an alternative for no-till summer fallow in a semiarid cereal-based cropping systems such as wheat-corn-fallow and/or wheat-fallow. Currently, no information is available on how field pea responds to seeding practices in semiarid Nebraska as compared to other major field pea growing regions (Table 1.). The objective of this study was to determine the economically optimal seeding rate, seeding depth, and inoculant use to grow field peas in western Nebraska.

Table 1. Recommended field pea seeding practices for various regions (pea and lentil rhizobia inoculant was recommended practice for all regions)

Region	Seeding depth (inch)	Seeding date	Seeding rate (lbs/ac)*	Source
Manitoba, CA	1 - 2	Before May 21	150-171	Manitoba Agriculture (2016)
Alberta, CA	1 - 2	Before May 15	161-193	Alberta Pulse Growers (2016)
Saskatchewan, CA	1– 3	Mid-April to Mid-May	161-184	Saskatchewan Pulse Growers (2016)
North Dakota, USA	1 - 3	early-April to mid-May	161-184	Schatz and Enders (2009)
Montana, USA	1 - 3	late-March to early-May	184-229	McVay et al. (2016)
South Dakota, USA	1.5 - 3	mid-April	184	Beck et al. (2015)
Washington/Idaho, USA	1.5 - 3	March 25- May 10	191-231	Muehlbauer et al. (1997)
Wisconsin/Minnesota, USA	1 - 3	mid-March to mid-April	204	Oelke et al. (1991)

*Seeding rates target final plant population ranging from 300,000 to 500,000 plants/ac

Seeding rate study

Results from our three site-year study on seeding rates conducted in 2015 and 2016 in Perkins County, NE, field peas response to plant population was linear at lower densities (up to 200,000 plants/ac), then began to plateau at about 200,000 plants/ac reaching its maximum at approximately 310,000 plants/ac (Figure 1). Yield in 2015 was higher (max yield 33 bu/ac) than in 2016 (max yield 25-26 bu/ac) regardless of population density. Although yield response at populations higher than 310,000 plants/ac was seldom observed, there is an indication that for yield goals greater than 30 bu/ac increasing seeding rate may be justified. Higher yield goals for field pea may be obtained under irrigation or in years when hot ambient temperatures do not occur during heat/drought sensitive flowering period.

The economically optimal plant population (EOPP) can be defined as population that maximizes profit made on investment, which in this case is seed. Our results suggest that maximum profit is obtained at 220,000 plants/acre, which corresponds to seeding rate of 116 lb of seed/acre (Figure 2). A penalty of about $0.19/acre may occur for each additional pound of seed planted over this EOPP. Planting higher populations to maximize yield potential is not always the best economic strategy due to the asymptotic nature of yield response to planting density.

Further research is needed to validate our optimal seeding rates for Nebraska (116 lbs/ac) as recommendations for seeding rates in other field pea growing regions range from 150 to 230 lbs/ac (Table 1.).

Recommendation: Although this study shows the potential for reduction in field pea population without lowering profits, these results are yet to be confirmed in additional production years and/or locations and should be considered cautiously until further research is completed and results validated. Current recommendations for field peas seeding rates ranges from 180 to 200 lb/ac. Further research to evaluate optimal seeding rates will be conducted at a broader geographic region during in 2017 and 2018.

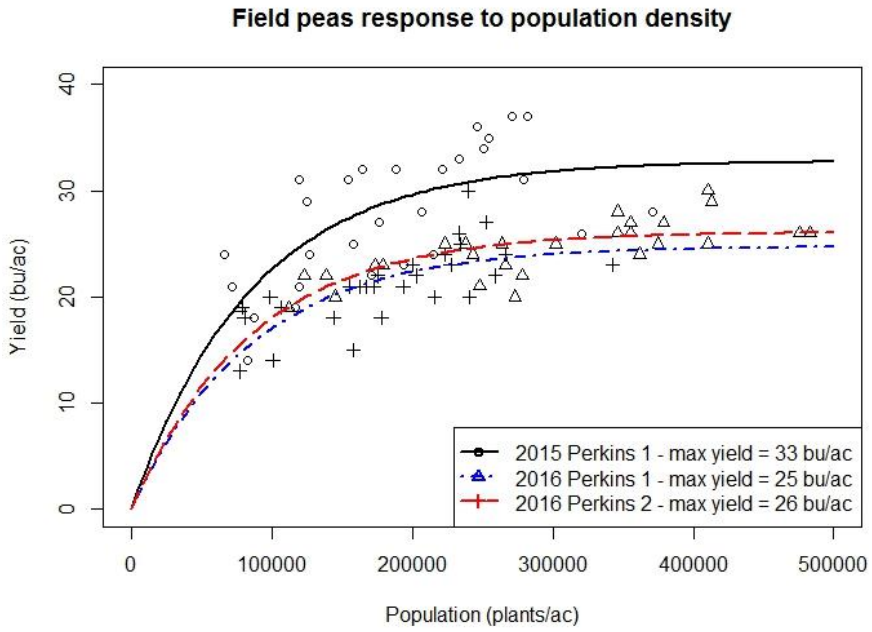

Figure 1. Field pea grain yield (bu/ac) response to population density (plants/ac).

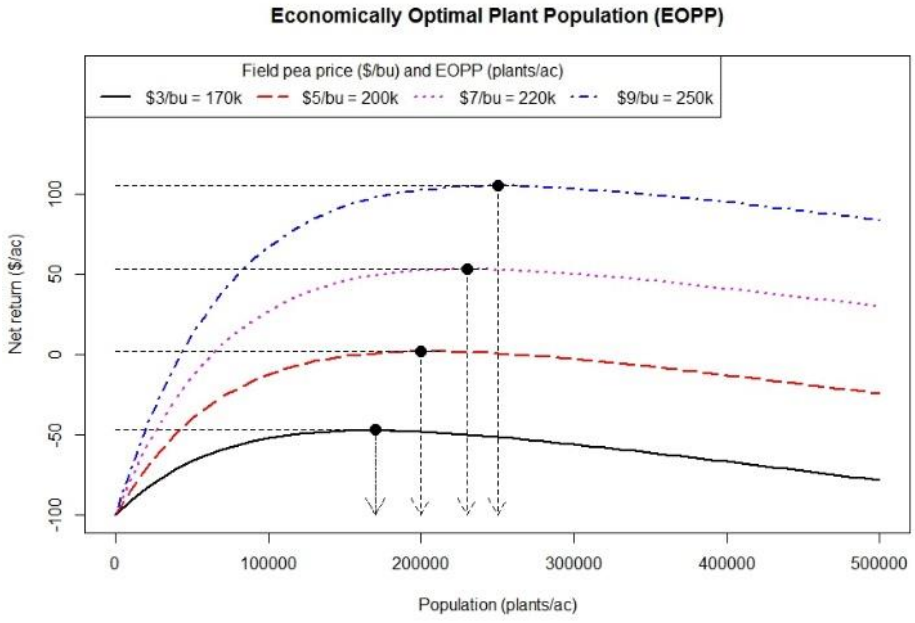

Figure 2. Changes in Economically Optimal Plant Populations (EOPP) with increase of field pea price on the market.

Seeding depth and rhizobia inoculant study

Seeding depth study. Feld pea is a large seeded crop that generally requires deeper seeding than smaller seeded cereals for proper soil-seed contact (Table 1). Large seeds can emerge from greater depths because they have larger amounts or stored energy. However, to ensure proper germination and emergence, seeds should be placed in soil with adequate moisture. For example, dry top soil moisture at planting is the main reason why slightly deeper seeding depth is recommended for the dry and warm climate of Pacific North West (1.5 inches) as compared to Canada and Norther Great Plains (1 inch; Table 1). Although field peas can tolerate deeper seeding, research from Canada showed that seeding depth greater than 2.5 inches can cause significant reduction in stand and up to 8.5% yield loss as compared to shallower seeding (1-2.5 inches).

Rhizobia inoculant study. The need to re-introduce rhizobia with each field pea crop is dependent on many factors, but the ability of the bacteria to survive in the soil over a given time period is crucial. Research conducted in Mediterranean soils showed that population size of field pea rhizobia is likely to be under the optimal nodulation thresholds (<100 rhizobia per g of soil) if soil pH <6.6, summers are hot and dry, and a plant host has been absent for > 5 years. On the American continent, there are few documented studies that can provide economic justification for re-introduction of field pea rhizobia at each planting, especially at sites that have recent history of field pea production. Further research needs to be conducted to evaluate these recommendations

Preliminary seeding depth and rhizobia inoculant studies were conducted in 2015 (site 1). In 2016, we tested the potential for carryover of rhizobia inoculant in the soil by selecting site 2 that had history of field pea crop grown two years prior (2014), and site 3 that had field pea crop grown 3 years prior (2013).

Table 2. Field pea grain yield from seeding depth and inoculant study

Study	Year	Location	Treatment	Yield (bu/ac)
Seeding depth (inches)	2015	Site 1	1.5	29
			2.5	26
	2016	Site 2	1	10
			2	13
			3	12
	2016	Site 3	1	22
			2	23
			3	25
Rhizobia Inoculant	2016	Site 2	none	10
			Liquid inoculant	13
	2016	Site 3	none	20
			Liquid inoculant	23

Recommendation: We observed no significant difference in yield between 3 seeding depths (Table 2). We recommend placing the seeds between 1 to 3 inches deep where there is moisture and good seed-to-soil contact can be obtained. Although yield differences between inoculated and non-inoculated field pea were not observed, non-inoculated field peas did not produce nodules and will have to rely solely on residual soil nitrogen rather than biological fixation. Therefore, we recommend using inoculant at planting until more research is conducted to evaluate field pea nitrogen uptake and inoculation needs.