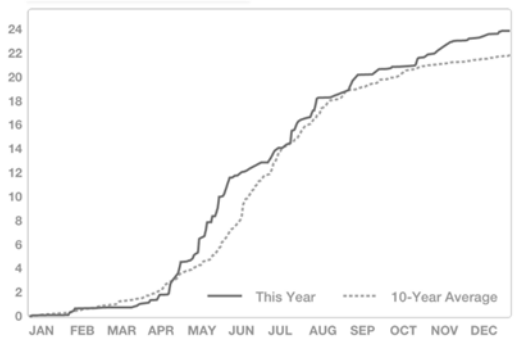
Nebraska On-Farm Research Network

Field Pea Planting Population

Study ID: 175135201501
County: Perkins
Soil Type: Rosebud loam;
Planting Date: 5/1/2015
Harvest Date: 7/28/2015
Row Spacing (in.) 10
Cultivar: DS Admiral
Reps: 4
Previous Crop: Wheat
Tillage: No-Till
Herbicides: ***Pre:*** NA ***Post:*** 32 oz/ac RoundUp applied after planting and before emergence.
Seed Treatment: Cell Tech liquid inoculate
Foliar Insecticides/Fungicide: None
Fertilizer: None
Irrigation: None, Total: N/A
Rainfall (in.):



Introduction: Grain-type field peas are a cool season grain crop (grown mid-March to late-July). They are typically grown as an alternative to no-till summer fallow in a semiarid, cereal-based, no-till cropping system such as a wheat-corn-fallow and/or wheat-fallow rotation. Replacing summer fallow with field peas provide numerous benefits: (1) easy implementation –modifications to crop rotation or farm equipment are not necessary, (2) breaking weed and pest cycles, thereby reducing the number of herbicide/pesticide applications and delaying evolution of resistance in troublesome weeds/pests; (3) gaining rotational benefits such as N fixation (10-24 lb/ac), increasing soil organic matter, elevating populations of beneficial insects and soil mycorrhizal fungi, (4) achieving better water utilization by allowing sufficient time for summer rains to recharge soil profile and ensure good winter wheat establishment; and (5) increasing profitability. Trade-offs are that field peas may deplete soil moisture and potentially hurt the yield of the succeeding wheat crop (yield penalty = 5-6 bu/ac/inch), especially in dry years.

Agronomic recommendations for growing field peas come mostly from University research done in Canada, the Northern U.S., and the Pacific Northwest. Very little information is available on how field peas respond to different agronomic practices in semiarid Nebraska. Therefore, **the objective of this study was to determine the optimum planting population for field peas in western Nebraska.**

Research Methods: Field peas were planted on May 1 targeting seven planting populations including an optimal population of 311,000 plants/ac and three populations over and under that recommendation (Table 1). Due to only a 60% germination rate, yield responses were plotted against the actual number of plants/ac that were taken from mid-season stand counts. Data was analyzed using asymptotic regression model: $\mathbf{Y = c + (d - c)(1 - \exp(-X/e))}$

Where, Y is crop yield (bu/ac), X is plant population (plants/ac), the parameter *c* is the lower limit (at x = 0) and was set to 0, the parameter *d* is the upper limit and the parameter *e* > 0 is determining the steepness of the increase as X.

Table 1. Seven targeted field peas populations for during field studies in Southwest Nebraska in 2015.

Populations	targeted population	adjusted for 90% germ	lb/ac
1	100,000	111,111	56
2	170,000	188,889	94
3	240,000	266,667	133
4	310,000	344,444	172
5	380,000	422,222	211
6	450,000	500,000	250
7	520,000	577,778	289

Results:

Data was analyzed in R software using drc package (Ritz, C. & Streibig, J. C. (2005) Bioassay Analysis using R. J. Statist. Software, Vol 12, Issue 5.)

Results show that **yield response to plant population** is linear at low populations. The response then begins to plateau as population increases (>150,000 plants/ac), and reaches its maximum yield at approximately 310,000 plants/ac (Figure 1-left). At populations over 310,000 plants/ac, only negligible yield increase occurs (Figure 1-left).

Difference in yield response in **low and high yielding environments** was also observed. This suggests that planting higher populations in high-yielding environments and lower populations in low-yielding environments is justified to optimize yield and maximize economic benefit (Figure 1-left).

The **economically optimal population (EOP)** can be defined as the population that maximizes profit made on investment, which in this case is seed. Thus, planting populations that maximize yield potential are often not economically justified due to the nature of the asymptotic yield response, and will most likely result in profit reduction (Figure 1-right).

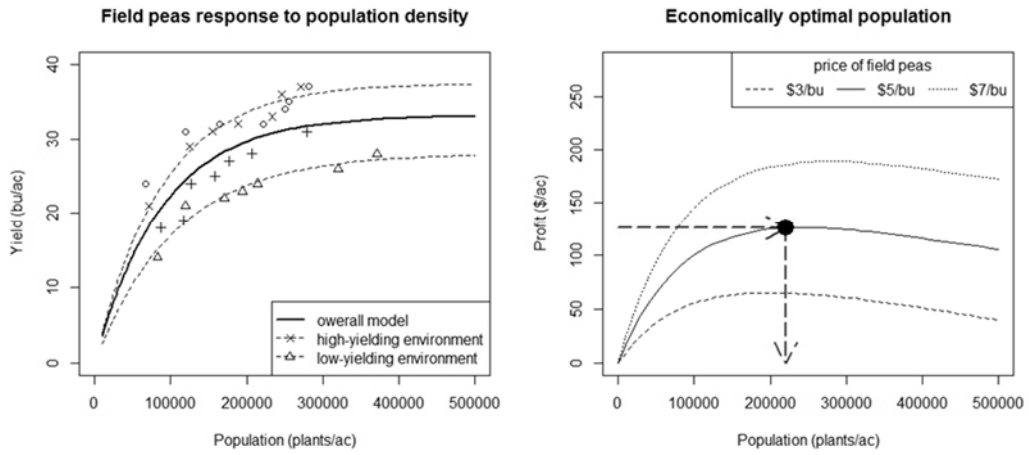


Figure 1. Field peas response to population density: overall model, model for low yielding environment, and model for high-yielding environment (left); Economically optimal population: profitability as affected by field peas population and price of field peas on the market (right)

The economic analysis assumes that:

1. field pea varieties have 2100 seeds/lb, 60 lb/bu, and a 90% germination rate,
2. a hail event or some other population reduction factor does not occur,
3. the price to purchase certified field pea seed is equal to $15/bu, and
4. the market price of field peas is $5.00/bu.

The analysis is also based on data from only one year and location.

Under these assumptions, EOP (i.e. maximum profit) for field peas is 116 lb/ac, and an approximate $19 profit penalty will occur for each pound planted over this EOP (Table 2). The curent recommendation for planting populations is 200 lb/ac; these results indicate farmers can save up to $16/ac when planting at the EOP. Refer to Table 2 for determining EOP under a few different scenarios.

Conclusions:

Although this study shows potential for reducing field pea populations without hurting profits, planting populations of ≥ 180 lb/ac are justified due to potential risk factors associated with reducing plant populations (e.g. poor germination, hail event). This demonstrates the necessity for additional data from multiple years and locations that would support the yield response to population that was seen this year.

Table 2. Economically optimal population (EOP) and profit for field peas when planting certified seed with 90% germination and bin-run seed with 80% germination at different market price market.

	Certified see with 90% germination			Bin-run seed with 80% germination		
Market price	**Profit**	**EOP**	**EOP**	**Profit**	**EOP**	**EOP**
$/bu	$/ac	plants/ac	lb/ac	$/ac	plants/ac	lb/ac
3	63	180000	95	81	230000	137
5	123	220000	116	145	280000	167
7	185	240000	127	210	310000	185

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