

Starter N Fertilizer and Rhizobia Inoculant Effects on Dry Pea

by Chengi Chen, Jinwen Huang, and Reza Keshavarz Afshar, Eastern Agricultural Research Center, Sidney, MT

INTRODUCTION

Dry pea production in the USA has increased in the past decades, especially in Montana, where pea production occurred on more than 600,000 acres in 2016, making Montana the number one dry pea producer in the USA (Montana Agricultural Statistics, 2016). Uncertainties exist about the importance of using rhizobia inoculant and/or application of starter N in dry pea production.

METHODS

Three field trials were conducted to evaluate how rhizobia inoculant and starter N fertilizer affect pea yield at Central Agricultural Research Center (CARC, with pea growing history) and a cooperator farmer's field (without pea growing history) in central Montana. Commercial peat-based inoculant (Nodulator®, BASF) was mixed with seed prior to planting at the manufacturer recommended rate. Starter N fertilizers were applied into the seed furrow in the form of urea at 20 lb N/acre, slow-release polymer-coated nitrogen (ESN®) at 20 lb N/acre, and a combination of both (20 lb N/acre of each). One additional level of 80 lb/acre (40 lb/acre urea + 40 lb/acre ESN) was added to the experiment at CARC in 2015. A 0N control was used in all experiments. Peas were planted at a rate of 8 seeds/ft². The soil background information is presented in Table 1.

RESULTS

Application of commercial rhizobia inoculant significantly increased pea grain yield at both sites in 2012 (Table 2). This response was small (54 lb/acre) at CARC with a previous history of pea, compared to response on our cooperator's farm (192 lb/acre) which had no history of pea. However, rhizobium inoculant did not significantly increase pea yield in 2015, which is very likely due to the high initial soil N (30 lb/acre in top 6 inches).

Application of starter N increased yield at CARC but had no effect ($p>0.05$) on pea yield at the cooperating farmer's field in 2012 (Table 2) likely because the farmer's field had higher initial soil N (16 lb N/acre compared to 9 lb N/acre in top 6 inches). In 2015, application of starter N showed a deleterious effect on pea seedling establishment, which reduced yields especially when applied at high rates (80 lb N/acre; Table 3). However, the highest N application increased protein content over the control and 20 lb N/acre rates.

FERTILIZER FACTS

- The benefit of applying commercial rhizobia inoculant in fields with a history of pea is small. However, to prevent a crop failure due to low indigenous rhizobia population in this semi-arid rainfed environment, application of commercial rhizobia inoculant with pea is still warranted especially on fields with no pea history or with a longer rotation interval from a previous pea crop.
- Application of starter N could have small benefit to pea yield when top soil initial available N is low (<10 lb/acre in top 6 inches soil), but yield benefit might not substantially offset the N cost.
- Applying more than 20 lb N/acre with the seed can have a significantly negative effect on seedling establishment, nodule formation, and yield in peas.

ACKNOWLEDGEMENTS

This project was supported by the Montana Agricultural Experiment Station.

Tables are on page 2.

Table 1: Soil characteristics in CARC and in the cooperator farmer's field (top 6 inches).

Year	Site	pH	Organic matter (%)	NO ₃ -N (lb/acre)		K (ppm)	S(ppm)	Olsen-P (ppm)
				0-6"	6-12"			
2012	CARC	6.9	5.1	9	17	399	3	15
2012	Farmer field	6.8	4.0	16	18	Not available	Not available	28
2015	CARC	6.7	4.3	30	Not available	371	3	25

Table 2: ANOVA and mean comparisons for the effect of rhizobia inoculation and starter N fertilizer on pea yield at two experimental sites (CARC and a cooperator farmer's field) in 2012.

Treatments		Grain yield (lb/acre)	
		CARC	Cooperator farmer's field
Starter Nitrogen	0	1163 b	1408 a
	20 lb N/acre (urea)	1270 a	1241 a
	20 lb N/acre (ESN)	1309 a	1319 a
	40 lb N/acre (urea+ESN)	1310 a	1246 a
Rhizobium inoculant	No	1236 B	1207 B
	Yes	1290 A	1399 A

Means in a column with a least one same letter are not different with 95% confidence.

Table 3: Effects of rhizobia inoculation and starter N fertilizer application on seedling establishment, yield, and protein of pea (year 2015).

Treatment		Establishment (%)	Grain yield (lb/acre)	Grain protein (%)
Starter Nitrogen	0	79 a	1517 a	22.3 bc
	20 lb N/acre (urea)	59 b	1291 b	22.6 bc
	20 lb N/acre (ESN)	64 b	1349 ab	21.9 c
	40 lb N/acre (urea+ ESN)	55 b	1330 ab	23.1 ab
	80 lb N/acre (urea+ ESN)	26 c	1096 c	23.9 a
Rhizobia inoculation	No	59 A	1332 A	23.0 A
	Yes	54 A	1301 A	22.5 A

Means in a column with at least one same letter are not different with 95% confidence.