Field Pea Protein Response to Mid-season Nitrogen Application

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Field peas are growing in popularity as a protein source for both human and animal markets. Only recently has grain protein been included in the marketing process. Several field pea processors now offer tiered protein premiums for high protein peas. Unfortunately, field management for protein content has not been well studied. In 2018 (Carrington) and 2019 (Carrington and Minot) trials were conducted to evaluate potential methods for enhancing field pea protein content. The focus for this report is the treatments involving nitrogen applications at different phases of field pea reproduction. The theory behind the treatments is to add an additional nitrogen source at the time the plants have the biggest need for nitrogen, and when innate nitrogen fixation would be affected the least. This would be comparable to a post-anthesis nitrogen application that can be used to improve wheat protein content. For these studies, nitrogen was applied as UAN at a rate of 10 gal/ac mixed with an additional 10 gal/ac water, resulting in a nitrogen addition of about 30 lb/ac. In 2018, the application occurred at end-bloom, when greater than 90% of the flowers were desiccated. The variety was Admiral. In 2019, this was expanded to include three timings; early bloom, mid-bloom, and end-bloom using three field pea varieties.

In each case where mid-season nitrogen was applied, there was never any observed signs of crop injury from the nitrogen. In 2019 conditions were favorable for injury, as similarly timed applications in spring wheat caused very noticeable leaf burning. If nothing else, this practice appears to be quite safe to the field peas regardless of timing.

In 2018 the end-bloom application gave a boost of 0.74% protein compared to the check with no effect on yield or physiological response. In 2019, the results were not so straight-forward. In both locations there was once again no yield response (Table 1). In Minot, only one of the treatments provided a boost to protein content. This was at the early bloom stage on the NDSU experimental field pea variety (0.41% increase). In Carrington, the only protein response was with an end-bloom application to the variety Agassiz (0.64% increase). Other physiological effects were also evident in Carrington. Early bloom applications caused an increase in lodging to both AAC Carver and the NDSU experimental. The same application also caused Agassiz to grow taller than the check. The later application times did not seem to affect field peas in any other visible way.

Table 1. 2019 field pea variety response to nitrogen application timing.

						Minot			Carrington		
Treatment	N timing	Days to PM	Harvest Lodge	Lodge at PM	Plant Ht at PM	Yield	Test Weight	Protein	Yield	Test Weight	Protein
	10 gal UAN/ac		0 to 9	0 to 9	cm	bu/ac	lb/bu	%	bu/ac	lb/bu	%
Agassiz	Check	98.8	8.8	2.3	76.0	48.0	63.7	25.69	50.9	64.7	27.21
	Early Bloom	98.8	8.3	1.5	90.3	49.0	63.3	25.82	55.1	65.0	27.11
	Mid-Bloom	98.8	7.8	2.0	81.3	48.1	63.7	25.96	52.8	65.0	27.01
	End Bloom	98.8	8.5	1.3	77.3	47.7	63.8	25.82	55.2	65.2	27.85
NDSU Exp	Check	95.8	8.8	4.3	72.5	49.2	63.8	24.63	58.4	64.9	25.15
	Early Bloom	96.3	8.8	6.0	70.3	49.6	63.5	25.04	60.0	64.8	25.26
	Mid-Bloom	96.5	8.8	4.3	73.3	50.1	63.8	24.98	61.5	65.2	25.18
	End Bloom	96.5	9.0	5.3	68.0	49.2	63.6	24.93	61.0	65.0	25.48
AAC Carver	Check	97.3	7.0	1.8	82.8	50.8	64.2	24.43	64.9	66.0	24.65
	Early Bloom	96.8	5.8	1.8	82.8	50.6	64.8	24.16	64.0	66.2	24.06
	Mid-Bloom	97.0	7.3	2.0	91.5	51.3	65.0	24.07	67.0	66.0	24.20
	End Bloom	97.3	7.5	2.0	80.5	50.6	64.9	24.27	63.3	65.9	24.64
LSD (0.05)		0.7	0.8	1.9	14.1	2.1	0.4	0.36	7.1	0.9	0.56

It is difficult to explain the variability of protein response. The suitability for mid-season nitrogen application may be variety specific and a response appears less predictable than with a post-anthesis nitrogen application. Field pea nodulation likely complicates the issue of nitrogen availability, particularly late in the season. Due to these factors, it is likely that protein response may even be site-specific within a field, depending on nutrient availability, nodulation, soil characteristics, water status, etc. For now, we cannot recommend a mid-season nitrogen application until we have a better understanding of the conditions needed to make it successful. Even if a response is observed, only meager gains should be expected (<0.5%), likely resulting in non-economical application.