2009- 2010 Nitrogen Rate Trials on Edible Beans

Purpose:

A 2000 kg/ha (1800 lb/ac) dry bean crop takes up approximately 140 kg/ha (125 lb/ac) of nitrogen and removes about 89 kg/ha (80 lb/ac) in the seed. The rhizobia associated with dry beans are a different strain than those for soybeans, and are more sensitive to environmental factors. Dry beans obtain less than half their nitrogen requirement through fixation. Ontario nitrogen research has not demonstrated an economic response to applied nitrogen. However, it is common practice for dry bean growers to apply 33 - 67 kg/ha (30 - 60 lb/ac) of nitrogen. The goal of this project is to validate the OMAFRA recommendation to apply zero nitrogen unless there is significant root rot present, in which case up to 100 kg/ha (90 lbs/ac) is suggested.

Methods:

On-Farm trials were established in fields without a history of manure or forage plow down. Four nitrogen rates of 0, 45, 90 and 134 kg/ha (0, 40, 80, 120 lb/ac) were used at each location that included 2 or 3 replications. In 2010, there were 13 sites established, 7 white beans, 2 kidney, 4 cranberry beans. Nitrogen was applied at the time of planting, except for one kidney bean site at Thorndale, where nitrogen was side dressed prior to flowering using 28% nitrogen behind a coulter. Soil nitrate & ammonium was measured at planting and at maturity. A standard soil test was collected at each site.

White Bean Results:

Rainfall in both 2009 & 2010 was average to above, resulting in lush canopies and excellent yields at most sites. Visually there was a large increase in vegetative growth across nitrogen rates, especially between the check (0 N) and the other treatments (Figure 3). There was little to no increase in yield observed from added nitrogen at the white bean sites (Table 1). In both 2009 & 2010 yields were increased marginally 40% of the time with the 40 lb/acre N rate.

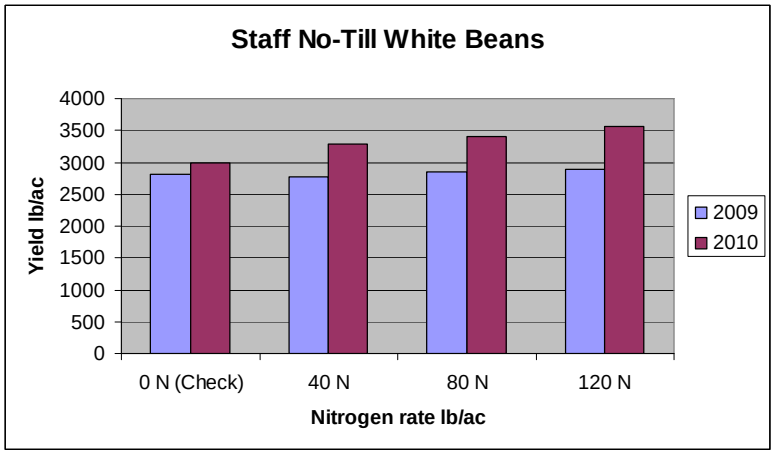
Table 1: 2010 White Bean Nitrogen Trial

Location	Soil Type	Bean Type	Nitrogen Rate lb/ac			
			0 N (Check)	40 N	80 N	120 N
			Yield (lbs/ac)			
Monkton	Clay Loam	White	3414	3297	3252	3231
Auburn	Clay Loam	White	2408	2359	2192	2264
Staffa	Clay Loam	White	2984	3287	3400	3569
Fullarton	Clay Loam	White	2636	3085	3064	2936
Dublin	Clay Loam	White	3042	3075	2706	3016
Listowel	Clay Loam	White	2453	2136	3066	2674
St Mary's	Clay Loam	White	3101	2965	2764	2970
Average			2863	2886	2921	2952

At the Staffa location in 2009 there was a small yield increase and larger yield response in 2010 up to the highest nitrogen rate (Figure 1). Nitrogen in no-till situations may

warrant further investigation. The Staffa and Listowel location were planted in 76 cm (30 inch) row widths, all other sites were seeded in 38 cm (15 inch) rows.

Figure 1 : Response to Nitrogen at Staffa Ontario 2009-2010



Kidney and Cranberry Bean Results

Figure 3: Visual Response to Nitrogen in Dry Beans, August 1 (Thamesford)

40 lbs/ac N

0 lbs/ac N

The coloured beans produced a positive yield increase to nitrogen application (Table 2). Nitrogen application increased the yield slightly for kidney beans but with only 3 locations over 2 years, no conclusions could be drawn. Cranberry beans showed the largest yield increase to nitrogen application, over 300 lb/ac when averaged across the 6 sites in 2009 - 2010. It is interesting that this increase was the same at all 3 nitrogen rates; and thus there was no further yield gain to increasing nitrogen rates over the 40 lb/ac rate of nitrogen. In 2010 the Denfield cranberry site showed excellent growth, but severe dry weather from flowering to maturity resulted in poor pod fill and small seed. This site showed no increased yield with increasing nitrogen rate. The positive yield response in cranberry beans may be due to their determinate growth habitat, short flowering period and shorter growing season. The nitrogen may help stimulate production of a large plant (i.e. seed factory) prior to flower on which to set pods. The indeterminate and vine nature of kidney and white beans and longer growing season allows them to continue to grow and produce flowers once flowering begins.

Table 2: Dry Bean Yield Results in Response to Increasing N Rate

Year	Location	Soil Type	Nitrogen Rate lb/ac			
			0	40	80	120
			Yield (lbs/ac)			
KIDNEY BEANS						
2010	Thorndale	Sandy Loam	3392	3458	3459	3580
2010	Thamesford	Clay Loam	3420	3529	3768	3772
2010 Average			**3406**	**3494**	**3614**	**3676**
2009	Thorndale	Clay Loam	2544	2749	2881	2777
2009-10 Average			**3119**	**3245**	**3369**	**3376**
CRANBERRY BEANS						
2010	Seaforth	Clay Loam	2231	2548	2499	2596
2010	Denfield	Clay Loam	1795	2123	1892	1943
2010	Thorndale	Clay Loam	1851	2128	2321	2191
2010	Dorchester	Sandy Loam	2734	3116	2932	3090
2010 Average			**2153**	**2478**	**2411**	**2455**
2009	Thorndale	Sandy Loam	2559	2896	3012	2826
2009	Denfield	Clay Loam	1883	2196	2319	2370
2009 Average			**2221**	**2546**	**2666**	**2598**
2009-10 Average			**2175**	**2501**	**2496**	**2503**

Fall soil nitrate values collected from each nitrogen rate showed only a slight increase in levels with higher N rates. There were no noticeable delays in maturity from the higher nitrogen rates. This would agree with research results. There was an increase in white mould versus the check, particularly with the 80 and 120 lb/ac nitrogen rate. At higher nitrogen rates at the white bean sites, the greater amount of vine and top growth resulted in more lodging.

Summary:

Over 2 years and 14 sites there was no significant yield increase in white beans. Kidney bean yields were marginally increased, while cranberry yields were improved by over 300 lb/ac with nitrogen application. There was some increase in white mould especially in white beans with increasing nitrogen rates, due to the dramatic increase in plant growth at higher nitrogen rates. Further testing of nitrogen needs to be conducted on various bean types and the response under dry growing conditions.

Acknowledgements:

- Ontario Agribusiness Assoc (OABA)
- Ontario Coloured Bean Growers Assoc
- OSCIA- Nutrient Management Grant
- Huron Research Station of University of Guelph, Ridgetown

Project Contacts:

Brian Hall, Canola & Edible Bean Specialist, OMAFRA, brian.hall@ontario.ca