Potential Benefits of a Pea Cover Crop Seeded Following Winter Wheat Harvest

Purpose:

A study was developed to determine the benefits of a summer planted pea cover crop, to fix nitrogen, sequester residual soil nitrogen, contribute organic matter and have a living crop present during the extended non crop season following winter wheat harvest. The objective was to determine if this system could sequester and produce and hold nitrogen in the pea crop and transfer it to the following corn crop to reduce the fertilizer nitrogen requirements. If successful, this outcome could add substantially to the economic value of wheat in the rotation.

Methods:

A supply of peas was secured and distributed to a number of co-operators throughout southwestern Ontario. The co-operators were asked to plant strips of peas into their winter wheat stubble separated by strips of undisturbed stubble as the standard treatment. The co-operators were asked to create a minimum of two replicates of the treatments. The plots were marked in late fall of 2006. Co-operators treated the fields as was their normal practice in the fall. Some elected to leave the site untouched, while others performed standard fall tillage operations.

In the spring of 2007 corn was planted into the field area using normal practices. Co-operators were asked to not apply nitrogen in the spring, other than starter nitrogen at a rate not to exceed 30 lbs/ac. At side dress time in June, the previous pea and no cover strips in the field were divided into plots so that a zero and full rate of nitrogen could be applied as a side dress application. I would take it out since we are not referencing that data in the report . The two N rate strips allowed for the determination of a delta yield calculation, while the 4 N rate strips allowed a yield response curve to be calculated.

Results:

In the fall of 2007 the sites were harvested to collect yield data from a minimum of four plots per site, no cover zero and full rate and pea cover zero and full rate. The results of the trials are summarized in Table 1. Although a larger number of plots were originally established, only 8 trials were carried through to completion by the co-operators due to the weather and other factors.

Table 1: Statistical Analysis of the Corn Yield Data by Cover and Nitrogen Rate

Site	P7GC	P7IM	P7MC	P7MM	P7NS	P7RM	P7SF	P7TH
Location	Ailsa Craig	Foldens	Lambeth	Delaware	Strathroy	North Pelham	Kerwood	Dashwood
Cover	N	Y	N	N	N	N	Y	N
N_Rate	N	Y	Y	Y	Y	Y	Y	N
Cover * N_Rate	Y	N	N	Y	N	N	Y	N

[1] Y indicates significant treatment differences within the category, N indicates no significant difference detected at P=0.15

Cover

No significant effect of Cover treatment was detected in 6 of the 8 sites (Table 1 and Figure 1). For the two sites showing significant effects of Cover the differences were not large (Figure 2). The positive effect of the Pea cover crop in these two cases would not have been enough to pay for the cost associated with establishing the pea cover crop.

Table 2: Statistical Analysis of Cover Effect Across Nitrogen Rate

Site	P7GC	P7IM	P7MC	P7MM	P7NS	P7RM	P7SF	P7TH	Avg.
Location	Ailsa Craig	Foldens	Lambeth	Delaware	Strathroy	North Pelham	Kerwood	Dashwood	All
VOL	113.0	139.4	152.4	122.2	148.4	156.7	165.4	165.8	145.4
PEA	118.9	144.4	152.7	124.8	142.6	142.5	167.6	164.1	144.7
RC						158.3			
Significance	N[1]	Y	N	N	N	N	Y	N	

[1] Y indicates significant treatment differences within the category, N indicates no significant difference detected at P=0.15

Figure 1: Corn Yield Effect from Cover Crop Treatments Across Nitrogen Rates

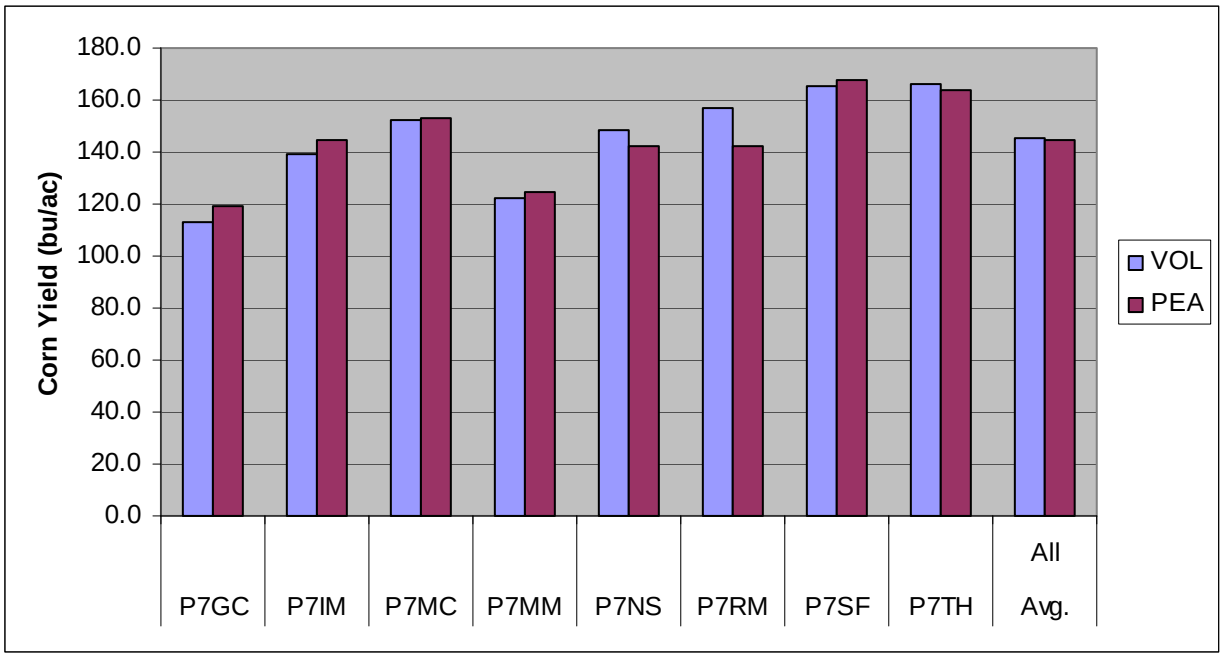
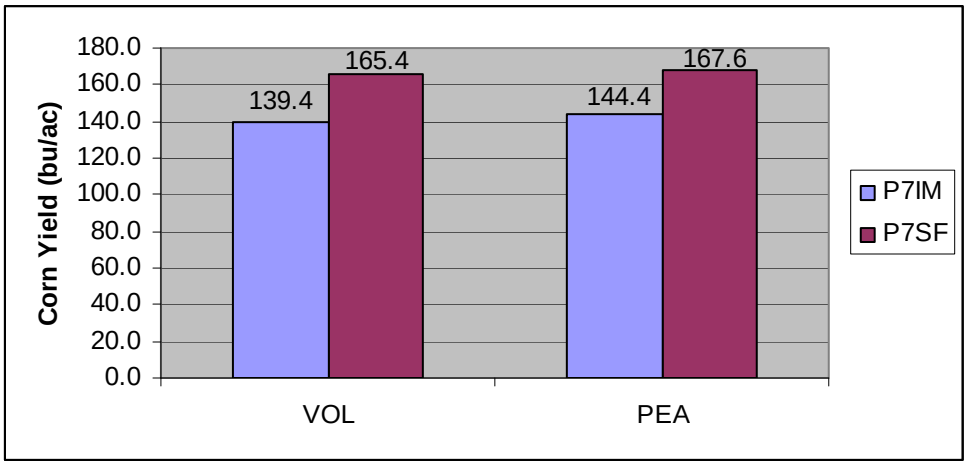


Figure 2: Sites Where a Significant Cover Effect Across Nitrogen Rates was Detected



Nitrogen Rate

The two rates of nitrogen applied at side dress at each location were a zero and a full rate of nitrogen that exceeded 150 lbs N/ac. These were applied as a side dress treatment. Despite the zero N plots not receiving additional nitrogen, the applicator was pulled through these plots to mimic the amount of soil disturbance, compaction and potential for corn row damage that was experienced by the full N treatment.

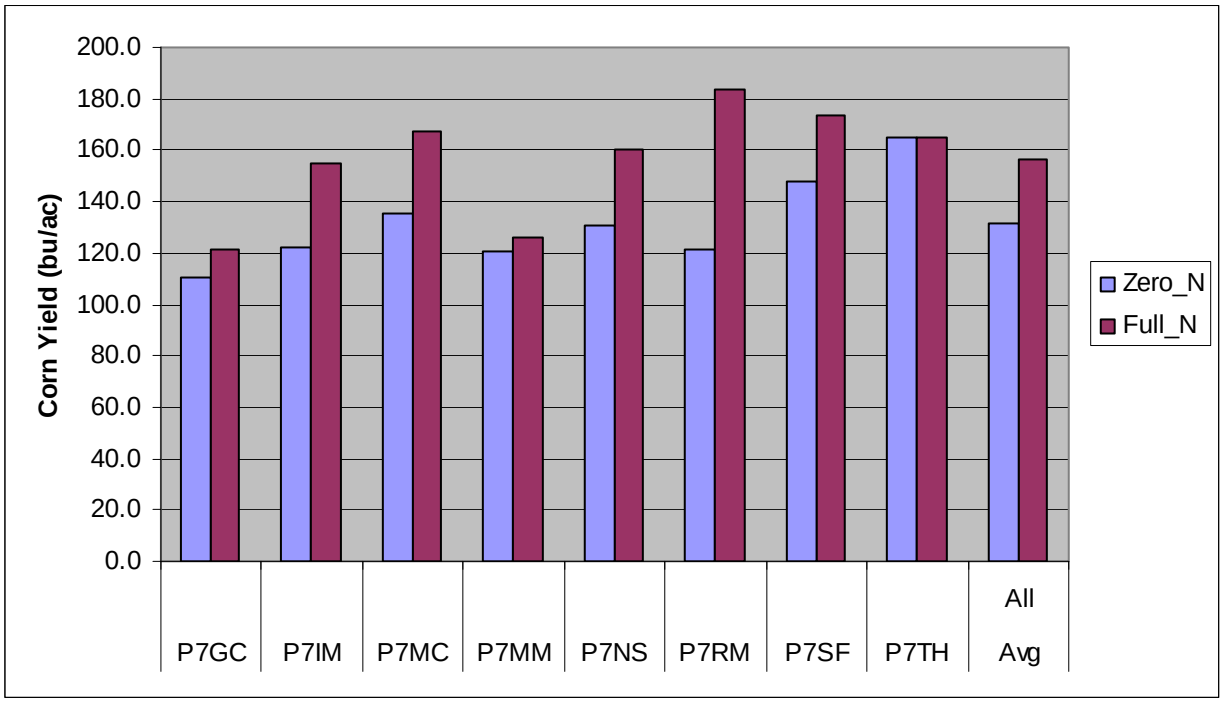
Nitrogen rate was significant at 6 of the 8 sites and all sites tended toward higher yields associated with the full nitrogen rate treatment. It is expected that nitrogen rates with this difference of magnitude would result in significant increases in corn yield associated with the full N treatment. The nitrogen response presented in Table 3 and Figure 3 is across all cover crop treatments. Summarized across all sites and cover treatments, there was an average 25 bu/ac difference in yield between the zero and full nitrogen rate treatments.

Table 3: Nitrogen Rate Effects Over Cover Crop Treatments

Site	P7GC	P7IM	P7MC	P7MM	P7NS	P7RM	P7SF	P7TH	Avg
Location	Ailsa Craig	Foldens	Lambeth	Delaware	Strathroy	North Pelham	Kerwood	Dashwood	All
Zero N	110.3	122.1	135.4	120.8	131.0	121.2	147.8	164.8	131.7
Full N	121.6	154.9	167.6	126.2	160.0	183.8	173.2	165.1	156.5
Significance	N[1]	Y	Y	Y	Y	Y	Y	N	

[1] Y indicates significant treatment differences within the category, N indicates no significant difference detected at P=0.15

Figure 3: Yield Response Across Cover Crops of Delta Yield Nitrogen Rates



Cover by Nitrogen Rate

Table 4 summarizes the corn yield response to the Cover by Nitrogen Rate interaction. Three sites showed a significant effect and are highlighted in Figure 4.

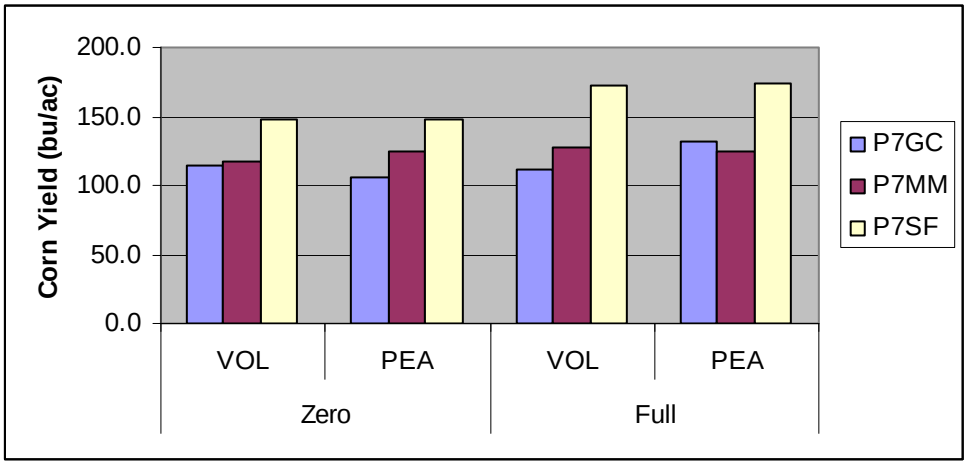
Table 4: Corn Yield Response to Cover by Nitrogen Rate

Site		P7GC	P7IM	P7MC	P7MM	P7NS	P7RM	P7SF	P7TH
Location		Ailsa Craig	Foldens	Lambeth	Delaware	Strathroy	North Pelham	Kerwood	Dashwood
N_Rate	Cover								
Zero	VOL	114.9	118.1	134.1	116.9	131.6	126.4	147.8	167.0
	PEA	105.6	126.1	136.6	124.6	130.4	105.2	147.9	162.7
Full	VOL	111.1	152.9	166.0	127.5	165.2	187.0	172.2	164.6
	PEA	132.1	156.9	169.3	125.0	154.8	179.7	174.3	165.5
Cover * N_Rate		Y[1]	N	N	Y	N	N	Y	N

[1] Y indicates significant treatment differences within the category, N indicates no significant difference detected at P=0.15

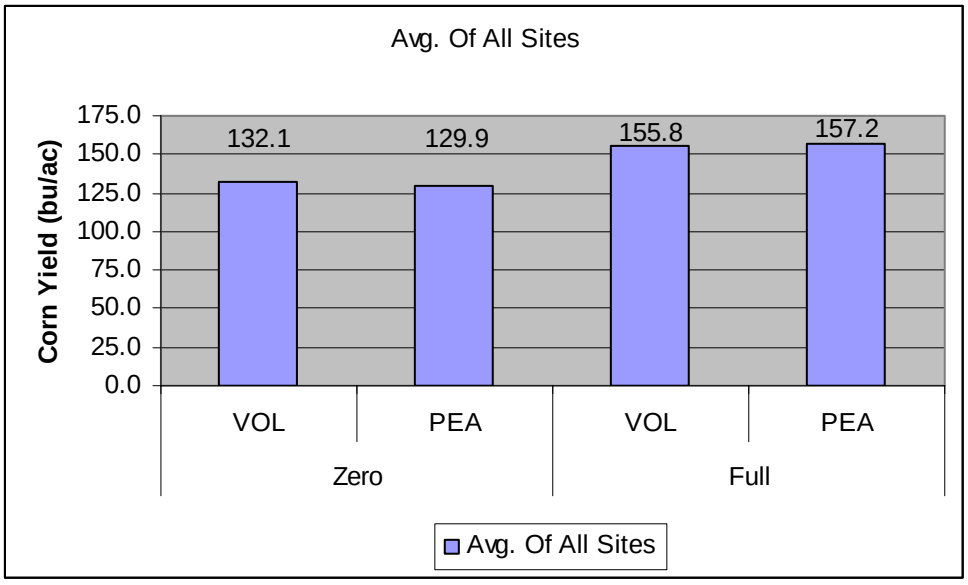
Oddly site P7GC indicated a reduction in corn yield with the Pea cover crop at the Zero nitrogen rate compared to the No Cover plot (VOL). This reversed at the Full nitrogen rate. At the Full rate of nitrogen this site experienced the largest benefit to Pea cover crop at 21 bu/ac. The next biggest range between the nitrogen rates was 11 bu/ac (P7NS).

Figure 4: Sites With a Significant Cover by Nitrogen Rate Interaction



It was surprising how little difference there was in corn yield response when comparing nitrogen rate and cover. Averaging across all the sites of the project detected no difference between the No Cover and Pea cover treatments (Figure 5).

Figure 5: Corn Yield Response to Cover and Nitrogen Rate Averaged Across All Sites



The yield difference between the zero and full rate nitrogen were 131 bu/ac and 156.5 bu/ac respectively. Assuming 150 lbs/ac nitrogen at $0.52/lb and corn price of $3.50/bu, the nitrogen cost $86.00 for material and application. This cost resulted in a revenue increase of 25.5 bu/ac generating $89.25. The full nitrogen rate is essentially breakeven ($89.25 vs $86.00). The Pea cover crop showed no corn yield benefit compared to the standard practice of leaving the wheat

stubble following cereal harvest. This result suggests that the producers would have invested the full cost of seeding the Pea cover with zero economic return. Although there are other inherent benefits to cover crops including erosion control, weed suppression, soil health etc, these are difficult parameters to assign an economic value to.

Considering the two cover crop scenarios separately the delta yield for the no cover plot was 23.7 bu/ac and 27.3 bu/ac for the pea cover crop plots. Running this data through the Delta Yield Calculator with a corn price of 3.50/bu and a nitrogen price of $0.52/lb suggests a nitrogen requirement for the no cover treatment of 75.7 lbsN/ac and 83.0 lbsN/ac for the pea cover. Based on these results the impact of the pea cover crop was negligible in 2006-7. Previous work has suggested a reduced fertilizer nitrogen requirement for corn when Peas were seeded as a cover crop following wheat harvest.

Next Steps:

These results were disappointing relative to our expectation based on previous cover crop work. These results are from a single year and a year with a very wet fall. Further study is necessary to quantifiably determine if there is an economic and environmental benefit to the inclusion of peas as a cover crop following wheat harvest, especially where no manure is applied.

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