Branching in field pea

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Introduction

Field pea is an important crop in western Canada. Manipulation of plant populations through varied seeding rates is a critical management tool that can be used to modify crop productivity (Johnston et al. 2002). The current recommended seeding rate in field pea is 88 plants/m^2 (Saskatchewan Pulse Growers, 2000). Any yield advantage above that rate is unlikely to be economic, due to the additional seed costs (Moot and McNeil, 1995). With some of the newer pea varieties having increased branching ability, it is possible that a producer could plant at a lower rate and not notice a substantial decrease in yield. The objectives of this research are to determine if differences in the extent of basal branching in pea cultivars have an affect on productivity at different plant densities; and to determine if differences in the extent of basal branching have an affect on competitiveness of pea cultivars.

Materials and Methods

The first experiment involved examining the extent of basal branching of field pea cultivars with regards to seeding rates. In 2005, seven pea cultivars were seeded in the experiment; one green (CDC Striker), three yellow (Alfetta, CDC Bronco and Carrerra) two maple (CDC Acer and Courier) and one silage (CDC Sonata). Each of the seven cultivars were seeded at five different seeding rates (10, 30, 90, 120, and 150 plants/m^2). They were arranged in a Randomized Complete Block Design (RCBD) with four replicates. The plots were seeded May 9th, 2005 at Saskatoon and May 10th at Rosthern. They were harvested on Sept 1st at Saskatoon and on Sept 5th at Rosthern. Emergence counts, branching numbers, canopy light interception, plant height, plant biomass, lodging scores and blight ratings were taken throughout the year. The harvested samples were cleaned and weighted and seed weights were measured. The experiment was repeated for 2006 with the inclusion of 3 more cultivars (40-10, CDC Montero and Eclipse).

The second experiment involved examining the competitive ability of field pea cultivars with regards to basal branching. In 2005, eight cultivars were seeded in a Split Plot design with four replicates at both locations. The same seven cultivars were used as in the previous experiment as well as 40-10. They were seeded at 50 plants/m^2, one set with no weeds present and the other set with canola and wheat seeded as surrogate weeds to provide competition (at 25 plants/m^2 each) into the pea plots. The same measurements were taken throughout the year as in the previous experiment with the exception of canopy light measurements. This experiment was also repeated in 2006 with the inclusion of 2 more cultivars (CDC Montero and Eclipse).

Results and Discussion

The yield data for the seeding rate experiment was fitted to an asymptotic curve with the equation "**Yield = (Ymax * seeding rate) / (seeding rate + D_{50})".** The yield and seeding rate are inputted values and Ymax and D_{50} are fitted values. Ymax is the yield potential of the cultivar and D_{50} is the seeding rate at which 50% of maximum yield is achieved. The branching data for each cultivar was fitted to a linear regression with all of the slopes of the cultivars being the same and only the intercepts being different, depending on the amount of branching that occurred.

	Acer	Alfetta	Bronco	Carrerra	Courier	Sonata	Striker
Saskatoon							
Branches	2.45	1.93	2.15	1.86	1.02	2.09	2.00
D_{50}	8.6	10.9	7.1	12.2	11.2	4.4	8.4
Rosthern							
Branches	0.67	0.62	0.66	0.59	0.00	0.57	0.46
D_{50}	7.0	9.8	5.5	9.9	13.3	1.5	16.3

Table 1: Branching and D_{50} values at both locations for 2005.

The seeding rate results from the 2005 year are displayed in Table 1. At the Saskatoon location, the cultivars that exhibited less branching were Courier, Carrerra and Alfetta with Courier having the least amount of branching. When comparing these results to the D_{50} values, the cultivars with the highest D_{50} values were also Courier, Alfetta and Carrerra. The cultivars which branched more were CDC Acer, CDC Bronco and CDC Sonata with CDC Acer having the most branching occur. The cultivars with the lowest D_{50} values were the same cultivars that had the most branching (CDC Acer, CDC Bronco and CDC Sonata).

At the Rosthern location for 2005 (Table 1), the cultivars which had more branching were CDC Acer, CDC Bronco and Alfetta (Table 1). The cultivars with the lowest D_{50} values were CDC Sonata, CDC Bronco and CDC Acer. Two of the highest branching cultivars had the lowest D_{50} values. The cultivars with the lowest branching were CDC Striker, CDC Sonata and Courier. The highest D_{50} values were that of CDC Striker, Courier and Alfetta. Two of the lowest branching cultivars exhibited the highest D_{50} values.

At the Saskatoon location, the general trend was that the cultivars with the higher ability to branch exhibited the lower D50 values and the cultivars with the lower ability to branch exhibited the higher D50 values. At the Rosthern location, the same trend was not as clear as at Saskatoon. There were cultivars with high branching that did have low D50 values but there were also high branching cultivars with high D50 values. The opposite was also seen with the low branching cultivars and high D50 values.

	40-10	Acer	Alfetta	Bronco	Carrerra	Courier	Sonata	Striker
Saskatoon								
Branches	2.07	2.45	1.93	2.15	1.86	1.02	2.09	2.00
Yield Loss (%)	4	17	N/A	13	34	22	22	0
Rosthern								
Branches	0.55	0.67	0.62	0.66	0.59	0.00	0.57	0.46
Yield Loss (%)	6	12	39	24	47	18	0	22

Table 2: Branching and yield losses at both locations for 2005.

In the weed competition experiment (Table 2) for 2005, the Saskatoon location cultivars with the most yield loss were Carrerra, Courier and CDC Sonata. The cultivars with the least yield loss were CDC Striker and 40-10. The most branching occurred in CDC Acer and the least branching occurred in Courier. At the Rosthern location, the cultivars with the most yield loss were Carrerra and Alfetta and the least yield loss occurred in CDC Sonata and 40-10. The highest branching cultivar was CDC Acer and Courier was the lowest branching cultivar.

There does not appear to be any general trend with regards to branching and yield loss in the cultivars. Some of the higher branching cultivars had low yield losses and some had high yield losses. The same was true with the lower branching cultivars. When looking at the cultivars with respect to variety (green, yellow, maple and silage) as shown in Table 3, more of a trend shows through.

Cultivars	**Saskatoon**			**Rosthern**	
	Branching	**Yield Loss (%)**		**Branching**	**Yield Loss (%)**
Yellow					
CDC Bronco	2.15	13		0.66	24
Alfetta	1.93	N/A		0.62	39
Carrerra	1.86	34		0.59	47
Maple					
CDC Acer	2.46	17		0.67	12
Courier	1.02	22		0.00	18
Silage					
CDC Sonata	2.09	22		0.57	0
40-10	2.08	4		0.55	6
Green					
CDC Striker	2.00	0		0.46	22

Table 3: Branching and yield loss for 2005 divided into pea varieties.

Once the cultivars are separated into their groups, is appears that the higher the branching ability, the less yield loss that occurs. The highest branching cultivars for each variety are CDC Bronco, CDC Acer and CDC Sonata. The cultivars with the least yield loss in each variety are CDC Bronco, CDC Acer and CDC Sonata. The data exhibits a trend of high branching and low yield loss to be somewhat correlated from the data in Table 3.

These experiments showed that branching ability of field pea cultivars could be good indicators in the competition of the different cultivars. In the first experiment, branching ability of peas could indicate that higher branching cultivars achieve yields at lower seeding rates. In the second experiment, there were not high correlations between branching ability and yield loss of field peas in general. Once the field peas were separated into their groups, more of a trend could be seen with higher branching cultivars having less yield loss exhibited.

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