

Yield of Barley and Canola When Grown as a Companion Crop

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Perennial forage crops such as alfalfa are normally established using a cereal companion crop such as oats or barley. The cereal companion crop can be harvested for grain and straw or cut green and ensiled. Red clover is also underseeded with crops such as wheat for use as a ploughdown to improve soil structure. Canola has not traditionally been used as a companion crop for forage establishment, but there has been interest in having a red clover ploughdown crop grown in association with canola.

To ensure good forage establishment, a companion crop should allow good light penetration of the canopy and be mature by mid-summer so that water and nutrients are available to the forage plants. Using these criteria, barley cut green for silage is considered to be a better companion crop than barley harvested as grain. Canola is not considered a good companion crop since it tends to be very competitive, allows little light to penetrate to the ground, and with Argentine varieties, is a long-season crop. To make it more likely that forage would establish under a canola crop, one could use a shorter season type (ie: Polish) and/or use wider row spacing to allow more light penetration through the crop canopy. This article discusses the effect of different companion crop options on companion crop yield. Subsequent forage yields are discussed in a separate article.

Methods: The trial was conducted at New Liskeard in 1999 and 2000. Barley was sown for silage and for grain (Table 1). Both Argentine and Polish canola were grown and each was sown in 17.5 and 35 cm row spacings. Each of the companion crop treatments was underseeded to alfalfa-timothy and red clover-timothy mixtures. The forage mixtures were also direct seeded (no companion crop). The barley silage plots were cut about 10 days after head emergence. The grain crops were all direct combined at grain maturity.

Table 1. Companion crop treatments.

Companion Crop	Variety	Row Spacing	Seeding Rate
Direct Seed (No companion crop)	Centurion alfalfa Walter red clover Climax timothy	17.5 cm	12 kg/ha 11 kg/ha 4 kg/ha
Barley Silage	AC Stephen	17.5 cm	90 kg/ha
Barley Grain	AC Stephen	17.5 cm	120 kg/ha
Argentine canola	Hyola 401	17.5 cm	5 kg/ha
Argentine canola	Hyola 401	35 cm	4 kg/ha
Polish canola	HySin	17.5 cm	5 kg/ha
Polish canola	HySin	35 cm	4 kg/ha

Results: Direct seeded forages were not harvested in 1999 due to slow establishment and low yield (Table 2). The alfalfa mixture suffered from potato leafhopper feeding and was quite stunted. In 2000, both legume mixtures produced excellent yields. Barley silage produced the highest overall yield in 1999 and 2000. For producers who can use cereal silage, this appears to be a good option to establish forages without sacrificing yield in the seeding year.

Among the grain crops, barley outyielded canola in both years. Within the canola treatments, very different results occurred in 1999 as compared to 2000. In 1999, canola in 17.5 cm rows outyielded canola in 35 cm rows, but within each row spacing, there was no yield difference between Argentine and Polish types. This was surprising since it is generally accepted that Polish canola will yield only $\frac{1}{2}$ to $\frac{3}{4}$ that of Argentine. In 2000, Argentine outyielded Polish canola, but there was no significant difference between 17.5 and 35 cm row spacings.

The type of legume underseeded (alfalfa vs. red clover) had no effect on seeding year yields of forage or grain in either test year. No interactions between companion crop and underseeded legume occurred in either year.

Table 2. Yield (kg DM/ha) of forage or grain from companion crops in the seeding year.

Factor	1999	2000
A) Companion Crop		
Direct Seed	0	4676 b
Barley Silage	7600a ^c	5512a
Barley Grain	4000 b	3393 c
Argentine Canola - 17.5 cm	1965 c	2820 d
Argentine Canola - 35 cm	1503 d	2681 d
Polish Canola - 17.5 cm	2008 c	1522 e
Polish Canola - 35 cm	1597 d	1386 e
Significance ^a	***	***
LSD ^b	434	486
B) Underseeded Legume (effect on companion crop yield)		
Alfalfa-Timothy	2690	3204
Red Clover-Timothy	2645	3079
Significance	ns	ns
AxB Interaction	ns	ns
Average	2668	3141
CV (%)	14.2	14.2

a: ***: Significant at the 0.001 level of probability; ns: not significant

b: least significant difference under a protected LSD test

c: within a column averages followed by different letters are significantly different at the 0.05 level of probability

Discussion: These results support previous work that New Liskeard that showed a high yield potential from cereal silage. This is a good option for producers who want successful forage

establishment but also need forage produced in the seeding year. Direct seeded forage was very good in 2000, but did not produce a harvestable crop in 1999. The 1999 crop could have been grazed lightly, but this is often not an option due to lack of fencing or water supply. It should be noted from observations at New Liskeard that under good management, direct seeded legumes should produce a yield of 3 to 5 t/ha at least 3 years in 5.

Barley grain yields were normal for this area. Canola yields in general were average to above average. The difference in yield across canola treatments in 1999 and 2000 is difficult to explain. The 2000 result would be expected: ie: lower yields from Polish types and little effect of row spacing. Canola has the ability to branch readily if the stand is thin (as with wide rows) and therefore the effect of row spacing should be minimal. The 1999 results may be related to particular conditions that reduced branching in the wide-row treatments. Additionally, the Argentine canola yields in 1999 may have been reduced by seed pod shattering, which can be a concern with direct harvested canola.

Conclusions:

- i) If forage production in the seeding year is required, cereal silage is the best option, although direct seeded legumes can also produce high yields under good conditions.
- ii) Growing Polish canola as a companion crop is likely to result in reduced canola yields as compared to Argentine types.
- iii) Growing canola in wide rows as a companion crop may result in lower canola yields, but this effect is variable.
- iv) Regardless of what companion crop is grown, grain yield is not affected by the legume that is underseeded (alfalfa or red clover).