Determination of forage production of spring cereals under-seeded to perennial cereal rye, winter cereals and Italian ryegrass under irrigation.

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Summary
In three years of irrigated trials the average biomass dry matter production was over 10 t ha[1]. In the first cut the spring cereals under-seeded to winter cereals produced almost three times as much biomass as the winter cereal and Italian ryegrass monocultures. In second cut, the winter cereal and Italian ryegrass monocultures produced three times more biomass than the under-seeded spring cereals showing that the spring cereals caused a significant suppression of the under-seeded crops. There were no significant differences in the biomass yield of the monocultures of winter cereals, perennial cereal rye and Italian ryegrass. Winter survival data indicated that winter rye and perennial cereal rye survived well under irrigation and that winter triticale and Italian ryegrass did not so choice of winter crop may be influenced as to whether a producer wanted to have some early spring grazing or not. Protein content of the spring cereals averaged 14% compared to over 20% in the winter cereals and Italian ryegrass.

Introduction
Extending the grazing into the late fall and early winter to provide season long grazing is one way to reduce beef production costs. Under-seeding of spring cereals with winter cereals has been proposed as a way to provide a season-long grazing system. To date there is no quantification of the production and quality of forage produced under irrigated conditions. The spring cereals utilized as annual forages are barley, oat and triticale and potential winter cereals would include winter rye, winter triticale and perennial cereal rye, developed from the hybrid between cultivated rye (*Secale cereale* L.) and *Secale montanum* Guss. In previous studies, perennial cereal rye was less tolerant of winter conditions and low input production in the semiarid prairie than under irrigated high input conditions near Lethbridge, AB where it was developed (Lennox et al. 2003, Iwaasa et al. 2005). The study of Lennox et al. (2003) showed that soil moisture conditions were a key factor in the winter survival of perennial cereal rye. Also of interest for annual forage production under irrigation is Italian ryegrass. The objective of this experiment was to compare the productivity and quality of winter cereals and Italian ryegrass seeded in spring-time and spring cereals under-seeded to winter cereals and Italian ryegrass under irrigation.

Materials and Methods:
An experiment was designed with three spring cereals, oat cv Pinnacle, triticale cv Pronghorn and barley cv Westford, under-seeded to each of winter rye cv Prima, triticale cv Bobcat, perennial cereal rye cv ACE-1 and Italian ryegrass cv Fabio. The winter cereals, perennial cereal rye and the Italian ryegrass were seeded as mono-cultures as well. The experiment was laid in a randomized complete block design with four (4) replicates and planted in 2003-2005, inclusive. All the experiments were located on an irrigated Clay Loam, a Brown Chernozem soil, at Swift Current, Saskatchewan. Agronomic practices for each year are shown in Table 1.

In vitro organic matter digestibility, Nitrogen concentration, Phosphorus concentration, Calcium concentration, Acid detergent fiber (ADF) and Neutral detergent fiber (NDF) were determined at SPARC laboratories.

Analysis of variance (Proc GLM) by SAS Software was calculated. When treatments effect was significant at P= 0.05, a LSD value was calculated from the error mean square for mean separation testing.

Table 1. Agronomic operations for the experiment from 2003-2005, inclusive.

Operations	2003	2004	2005
Pre-plant tillage	Cultivated and harrow pack	Rototilled, cultivated and harrow pack	Rototilled, cultivated and harrow pack
Seeding Date	May 28	May 20	May 20
Fertilizer	Pre-plant N (46-0-0) at 125 lb /ac, broadcast. With seed (11-52-0) at 35 lbs/ac. Post Cut 1 N (46-0-0) at 50 lb/ac on August 7.	Pre-plant N (46-0-0) at 125 lb /ac, broadcast. With seed (11-52-0) at 35 lbs/ac.	Pre-plant N (46-0-0) at 125 lb /ac, broadcast. With seed (11-52-0) at 35 lbs/ac. Post Cut 1 N (46-0-0) at 50 lb/ac on August 9.
Herbicide	Buctril M @ 0.4 L /ac, June 25.	Round-up @ 1 L / ac, May 13. Buctril M @ 0.4 L /ac, June 14.	Round-up @ 1 L / ac, May 18.
Cut 1	July 31 Barley – Soft dough Oat – Milk Triticale - flowering	August 16 Barley – Hard dough Oat – Soft dough Triticale - Milk	August 4 Barley – Soft dough Oat – Milk. Triticale - flowering
Cut 2	September 5	October 15	September 19
Irrigation	419 mm	125 mm	150 mm
Precipitation - April 1 to last cutting date	201.1 mm	321.5 mm	281 mm

Results:

- **Dry Matter Yield:**

The three year mean total dry matter (DM) yield was over 10.2 t ha^{-1}. Overall the total DM yield of the monocultures of PC rye, winter cereals and Italian ryegrass mono-cultures was about 60% of that of the spring cereals under-seeded (Fig. 1). Spring barley, oat and triticale under-seeded to PC Rye, winter rye and triticale and Italian ryegrass, produced 2.8 times more DM yield than the monocultures of PC Rye, winter rye and triticale and Italian ryegrass (10.2 and 3.6 t ha^{-1}, respectively) in the first cut (Fig. 1). In the second cut, the monocultures produced 2.9 times more DM than the spring cereals under-seeded (3.3 and 1.1 t ha^{-1}, respectively) (Fig. 1). The three year study showed 90% of DM yield was produced in the first cut of spring cereals under-seeded whereas first and second cuts were about equal for the monocultures. No significant differences were detected between the monocultures of PC rye, winter rye and triticale and Italian ryegrass.

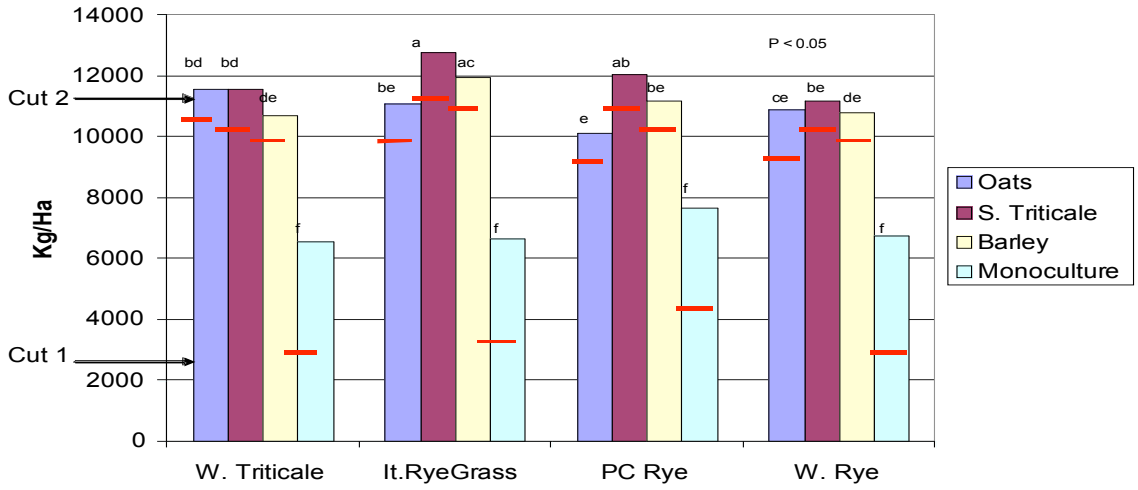

Figure 1. Mean total forage dry matter (DM) yield (kg/ha) for 3 spring cereals (oats, barley, triticale) under seeded and mono-culture plots to winter triticale, winter rye, PC Rye, and Italian ryegrass for the crop years 2003, 2004, and 2005 on an irrigation site.

- **Forage Quality:**

Forage quality analyses were determined for all years. The biomass for the monoculture crops was over 21% crude protein (CP) for both Cut 1 (Fig. 2) and Cut 2; compared to the spring cereal crops under-seeded which averaged about 14 % CP for Cut 1 (Fig. 2). In cut 2 the protein content was more than 20% in all but one treatment indicating that the re-growth consisted mainly of the winter monocultures and Italian ryegrass.

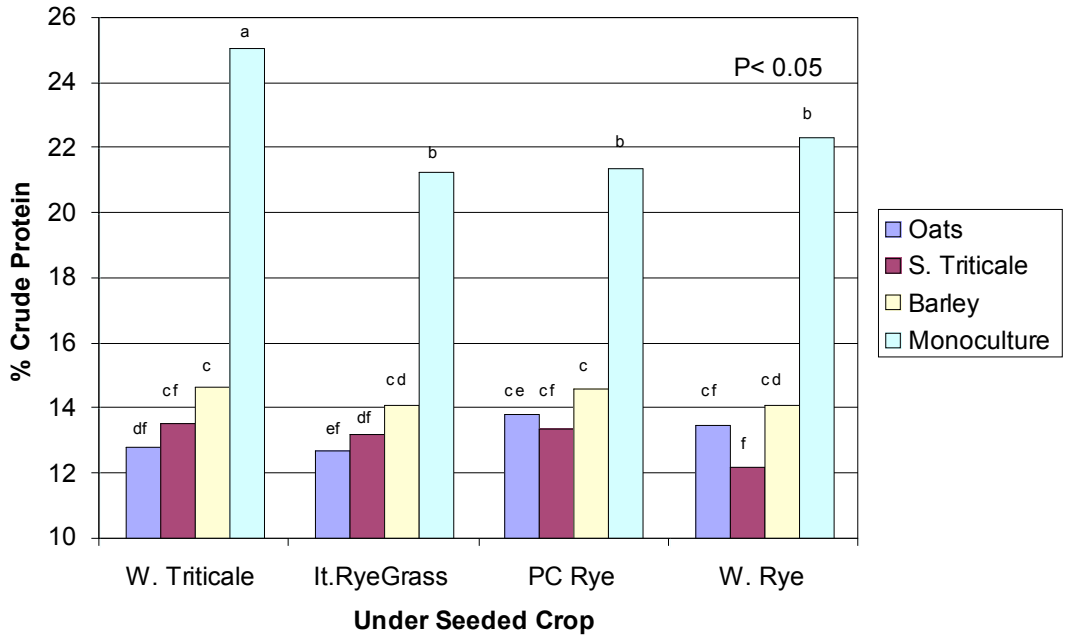

Figure 2. Mean % crude protein (CP) for 3 spring cereals (oats, barley, triticale) under seeded and mono-culture plots to winter triticale, winter rye, PC rye, and Italian ryegrass for the crop years 2003, 2004, and 2005 on an irrigation site.

Organic matter digestibility (OMD) of cut 1 was 73-76% for the monocultures compared to 57-63% for the spring crops under-seeded to winter cereals; whereas in cut 2 all treatments were in the 72-75% range, again indicating a predominance of the winter cereal in the re-growth. ADF and NDF showed similar patterns to those of protein and OMD. In cut 1 ADF and NDF were greater in the spring cereal treatments than in the winter cereal and Italian ryegrass monocultures whereas in cut 2 they were similar.

In cut 1, calcium (Ca) was significantly greater in all barley treatments than the winter monocultures which were greater than the oat and triticale treatments. In cut 2 Ca was greater than in cut 1 for all treatments.

- **Winter Survival :**

Winter survival stand notes were taken the fallowing year after establishment. Percent (%) plot stands for winter rye and PC rye seeded in monoculture plots or under seeded with spring cereals was significantly greater than winter triticale and Italian ryegrass treatments (Fig. 3). Barley seeded as a spring cereal reduced the stands of the under seeded crops compared to oats and spring triticale (Fig. 3). Under seeding your spring cereals with Italian ryegrass would be beneficial for the fallowing spring seeding. You would have limited biomass growth to intend with.

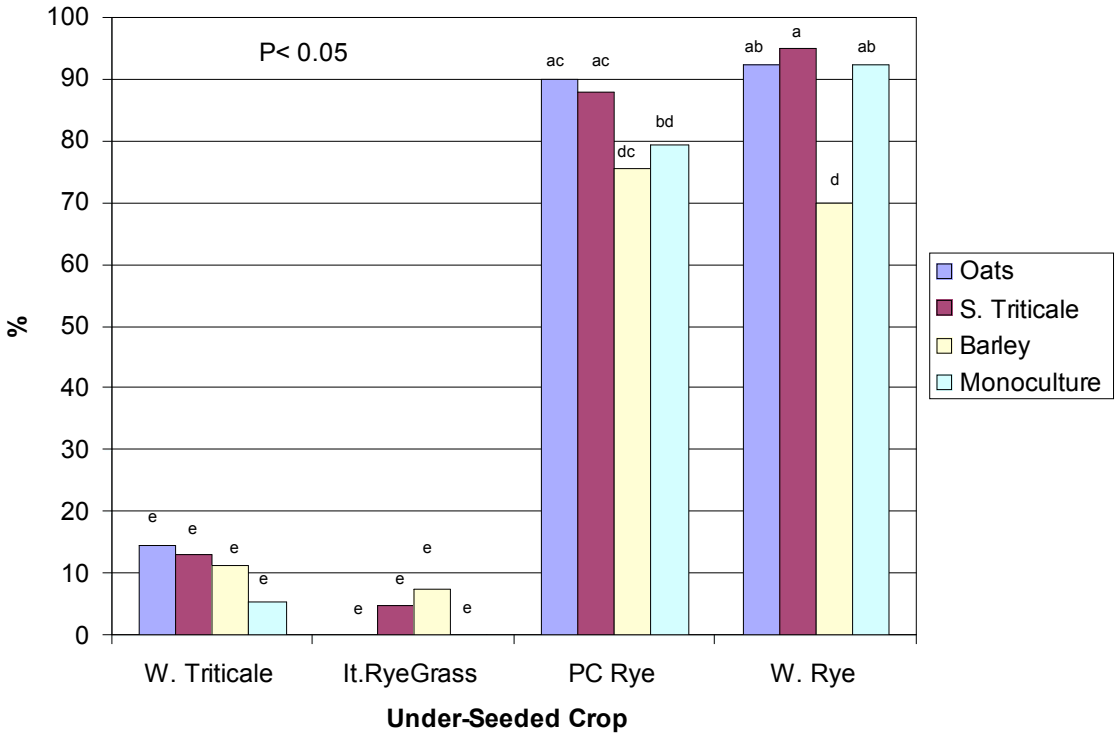

Figure 3. Mean % plot stand for 3 spring cereals (oats, barley, triticale) under seeded and monoculture plots to winter triticale, winter rye, PC rye, and Italian ryegrass for the crop years 2003 and 2005 on an irrigation site.

Conclusions:

The spring cereals have the capability to be high biomass producers. Under seeding oats or spring triticale with winter rye or PC rye in the spring will give quality forage for fall grazing and spring grazing the fallowing year. Under seeding your spring cereals with Italian ryegrass would be beneficial for the fallowing spring seeding. You would have limited biomass growth to intend with. Winter cereals can benefit from irrigation in the month of May which is the period of first irrigation on many Southwest irrigation projects. Renovation of perennial forages on irrigated land in the Southwest requires productive and flexible cereal green feed component. With provincial cattle numbers on the rise and an increased pressure on land for beef production; the versatility and potential new irrigated uses of perennial cereal rye and winter cereals deserve further study for beef producers.

References

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