Medics as self-regenerating cover crops in Canadian prairie grain systems

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Abstract

In western Canada, legumes used as relay cover crops in grain systems improve system sustainability, however reseeding costs and establishment risks hinder adoption. The objective of this program is to develop self-seeding legumes for Canadian grain systems. Components of the research are: 1) germplasm screening; 2) assessing the influence of agronomic management on seedling recruitment success of *medicago lupulina*; and 3) field observation of medics in a commercial farming system. Thirty medic and subclover lines from the South Australian collection as well as several commercial cultivars were screened in Manitoba, Canada from 1998 to 2001. Field trials and a farm case study in North Dakota, US have demonstrated that it is possible to maintain medics in a continuous grain farming system, with obvious benefits to both soils and crops.

Key Words

seedling recruitment, legumes, integrated cropping systems

Introduction

Traditionally, cover crops are seeded annually in double or relay-cropping systems (1). Research on self-regenerating legumes was started in Australia in the 1940s. Scientists in other parts of the world (e.g., 2) have since developed similar systems. In northerly climates, the traditional concept of regenerating cover crops needs further innovation. Required is the adaptation of a regenerating summer annual legume that increases the overlap period with the main crop to capitalise on the shorter growing season.

Methods

Lines from the South Australian collection (SARDI) were field-tested in Manitoba, Canada in 1999 and 2000. Seeds were germinated in the greenhouse and transplanted into the field at approximately the first true leaf stage. Measurements in the year of establishment included growing degree days (GDD) (5C base temperature) to flower and pod development, plant yield and plant spread (a measure of soil protection). Field trials were established in 2000 at three western Canada locations to evaluate performance of *medicago lupulina* in a cropping system. Measurements include medic recruitment, growth and rotational N benefits as well as near surface environmental conditions. A farm case study involves a 40 ha field near Goodrich, North Dakota where three medic species were established in 1992 (snail medic, barrel medic and black medic). Observations in 2002 involved medic growth and seed production.

Results

Some highlights from the medic screening trial are shown in table 1. Given that the Canadian prairie environment only offers 1400 to 1800 GDD, rapid legume plant development is critical to the success of this system. Several species, in particular *M. lupulina, obicularis, scutellata and polymorpha*, demonstrated a development pattern that would allow later emerging legume plants to complete their life cycle prior to freeze-up. Seed production under the “no-competition” conditions in this study ranged from 0 to over 5000 seeds/plant. Several of the species that completed pod formation in less than 800 GGD also produced high levels of seed production (i.e., more than 200 seeds/plant). Plant spread was impressive for many of the species indicating a good potential to protect soil and suppress weeds. Plant dry matter production of several Australian lines was higher than *M. lupulina*, the currently available medic in our region.

Table 1. Growth and development characteristics of medic species grown under field conditions at Carman, Manitoba, Canada in 1999 and 2000.

				Seeds / plant		Dry matter (g / plant)		Plant spread (cm)	
Species	**Origin**	**Cultivar/ Number**	**Gdd to first pod**	**1999**	**2000**	**1999**	**2000**	**1999**	**2000**
M. obicularis	Russia	4404	787	1327	378	28	27	83	65
M. littoralis	Italy	7666	1166	4901	143	58	35	122	80
M. littoralis	Australia	30796	1102	5160	1067	48	34	118	68
M. truncatula	Australia	Caliph	1356	2943	197	57	22	106	63
M. scutellata	Australia	Silver	743	600	48	40	3	85	31
M. scutellata	Hungary	3508	679	194	75	19	13	45	36
M. polymorpha	Israel	8250	877	282	503	4	10	35	47
M. lupulina	USA	George	<600	-	46	-	16	-	57
M. sativa	USA	Nitro	1357	140	0	33	12	52	22
T. sub.	Australia	322	1166	525	13	26	9	84	51

Only preliminary results are available from the cropping systems trials. Excellent recruitment of *M. lupulina* has been observed in early spring each year. Additional in-crop flushes of seedlings appear correlated with precipitation events. *M. lupulina* appears somewhat resistant to glyphosate herbicide.

Observations during year 9 (i.e., 2002) of the commercial field study indicate poor performance of barrel medic (few plants or pods visible at maincrop maturity). Snail medic pods were plentiful on the soil surface (about 160 m^2), however the average plant population at maincrop maturity was only 10 m^2. Plant population of *M. lupulina* at maincrop maturity averaged 200 m^2. Presence of *M. lupulina* has been associated with system benefits (i.e., higher wheat protein, greater crop stands and growth) (Jon Hagen, farmer, pers. comm.).

Conclusions

Based on field trial and on-farm observations it appears that medics can survive in a continuously-cropped no-till production system in a dry region with the potential to provide benefits to the cropping system. Higher dry matter production (i.e., potential N contribution) and greater plant spread (i.e., soil protection) of Australian lines compared with *M. lupulina* suggests that further investigations into adaptation of Australian-based germplasm is warranted.

References

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