



Early season P nutrition of forage grasses

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Introduction

- The early season P supply has been shown to be critical for optimum crop yield, mostly for annual crops species (Grant et al., 2001).
- Few studies, however, have established the importance of the P supply for the early season growth of perennial crop grasses and legumes (Duru and Ducrocq, 1997; Calvière and Duru, 1999).

Objective

- To determine the influence of P fertilization on the spring regrowth of forage grasses.

Materials and Methods

- Six locations in four countries with varying annual rates of P fertilization.
 - Lévis, Canada : Timothy.
 - Seeding in 2009; 0, 10, 20, 40 kg P ha⁻¹
 - Normandin, Canada : Timothy.
 - Seeding in 2009; 0, 10, 20, 40 kg P ha⁻¹
 - Charlottetown, Canada : Timothy
 - Seeding in 2012; 0, 10, 20, 40 kg P ha⁻¹
 - Maaninka, Finland : Timothy.
 - Seeding in 2009; 0, 10, 20, 40 kg P ha⁻¹
 - Les Verrières Switzerland : Multi-species.
 - Long-term (> 18 years); 0, 8, 17 kg P ha⁻¹
 - Ercé, France : Multi-species.
 - Long-term (> 11 years); 0, 50 kg P ha⁻¹
- Soils (0 – 15 cm) with low to medium available P content (Mehlich-3 P, mg kg⁻¹).
 - Québec (34), Normandin (48), Charlottetown (153), Maaninka (136).
 - Les Verrières: 8, 13, and 22 for the three P rates, respectively.
 - Ercé: 7 and 75 for the two P rates, respectively.
- Four replications.
- Measurements from 2010 to 2014.
 - Four sampling dates, one week apart, in spring regrowth.
 - From vegetative to late heading.
 - Dry matter (DM) yield by cutting at a 5-cm height.
- Separation of the effect of P fertilizer rates between early season shoot growth up to the first sampling day and rates of shoot growth later in the growth cycle was done by curve analysis.

Results and Discussion

- Increasing P fertilization did not significantly affect shoot biomass on most sampling dates of the spring regrowth in most years at Lévis, Maaninka, and Charlottetown but it increased shoot biomass on most sampling dates and in most years at Normandin, Ercé, and Les Verrières (data not shown).
- This lack of a response to P fertilization at three of the six sites puts into question the validity of the soil P tests and their interpretation, and confirms the need for improved methods for predicting P requirements of forage grasses.
- Shoot growth rates were not significantly affected by P rates at any of the site-years but the estimated shoot biomass on the first day of sampling, however, was significantly increased by P fertilization at Normandin in 2012, 2013, and 2014, at Ercé in all four years, and at Les Verrières in the two years (Table 1).

Table 1. Estimated shoot biomass on the first day of sampling (Intercept, Day 0) and shoot growth rates (Slope) at sites and years with a positive response to P fertilization.

Sites	Years	Shoot biomass on Day 0 ¹ (Mg DM ha ⁻¹)		P-value ²	Shoot growth rates ¹ (kg DM ha ⁻¹ d ⁻¹)		P-value ²
		0	40		0	40	
Normandin		P rates (kg ha ⁻¹)			P rates (kg ha ⁻¹)		
		0	40		0	40	
	2011	1.27	2.03	0.080	135	110	0.69
	2012	0.93	1.89	<0.001	73	80	0.98
	2013	2.12	2.78	0.004	59	51	0.27
2014	1.19	2.83	<0.001	55	44	0.78	
Ercé		P rates (kg ha ⁻¹)			P rates (kg ha ⁻¹)		
		0	50		0	50	
	2010	0.77	1.66	0.025	63	116	0.35
	2011	1.07	3.00	0.004	104	212	0.19
	2012	1.61	2.70	<0.001	77	106	0.23
2013	1.42	1.83	0.005	43	93	0.10	
Les Verrières		P rates (kg ha ⁻¹)			P rates (kg ha ⁻¹)		
		0	17		0	17	
	2010	1.61	2.86	<0.001	54	68	0.55
2011	1.02	1.77	<0.001	49	54	0.22	

¹ Estimated values from the linear parallel curve analysis for shoot biomass (SB) as a function of the number of days from the first sampling day.

² Statistical significance of the additional mean square contributed to the model SB = a + b × Days as individual parameters a (intercept) and b (slope) for each P rate are estimated in steps.

Conclusions

- Early season growth from the initiation of growth to the first day of sampling was affected by P fertilization at three of the six sites but shoot growth rates later during spring regrowth were not affected at all site-years.
- Our results confirm the importance of an adequate P supply during early season grass growth.

References

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