FORAGE PRODUCTION IN ALTERNATIVE AGRICULTURE: DAIRY FARMS IN EASTERN CANADA

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ABSTRACT
Alternative agriculture has been adopted by dairy farmers in response to concerns over conventional agriculture. The purpose of this study is to compare forage production characteristics on 12 alternative or conventional dairy farms. Yields and quality components were determined for the first and the second cuts of forage harvested in 1994 and 1995. Similar yields as well as similar crude protein and ADF concentrations were obtained for forages produced on alternative and conventional farms. Although potassium concentrations were lower under alternative farming, forage production is not a limiting factor in alternative dairy farming.

KEYWORDS
Forage production, alfalfa, dairy production, alternative agriculture

INTRODUCTION
Conventional agriculture has been heavily criticized since the 1980's. In the 1940's, agriculture began to evolve from a very diversified production to a more specialized one; heavy farm equipment as well as chemicals (fertilizers and pesticides) were introduced and used intensively. Concurrently, Western society became more preoccupied with environment quality, safety of the food supply and animal well-being.

The dairy industry ranks first for its farm revenue in the Eastern Canadian provinces: Québec, Ontario and the Maritimes. While dairy farming has become specialized through the years, the majority of the milk produced in Québec is still supplied by family farms; Québec dairy herds average 45 cows.

Alternative agriculture, defined as an agriculture with low synthetic chemical inputs, was adopted in the late 1980's by some Québec dairy farmers to address their concerns over conventional agriculture. While Québec dairy farmers usually try to grow their own feed: forages and cereals, self-sufficiency becomes a necessity if not an obligation for dairy farmers practicing alternative agriculture. However, to be economically viable, forage production on alternative farms needs to compare with the production obtained on conventional farms. The purpose of this study is to compare some characteristics of forage production on alternative and conventional dairy farms.

METHODS
Twelve dairy farms were selected in a region near Québec City: six practicing alternative agriculture, two in transition and four practicing conventional agriculture. Herd sizes varied from 32 to 55 cows. In the spring of 1994, one forage field larger than 1 ha and in its second year of production was selected on each farm. In 1994 and 1995, 16 samples were taken from each field prior to the first and second forage harvests by the farmers (Doyon et al., 1982). Transition farms used alternative practices in the field and were treated as alternative farms. Yields as kg of dry weight per ha were estimated. Samples were analysed for crude protein, acid detergent fiber (ADF) and potassium contents.

All forage fields were seeded with a basic mixture of alfalfa (*Medicago sativa* L.) and timothy (*Phleum pratense* L.); other species [white clover (*Trifolium repens* L.) and red clover (*T. pratense* L.), orchardgrass (*Dactylis glomerata* L.) and smooth bromegrass (*Bromus inermis* Leyss.)] were seeded but they were found sporadically in one half of the fields. Dairy farmers near Québec City take a first forage cut in mid-June, a second cut in the beginning of August and, if needed, a third cut around the beginning of October after the first frost.

RESULTS AND DISCUSSION
For all farmers, the second (1994) and third (1995) years in forage production corresponded to the final two years of a 5-yr rotation with cereals.

Yields in 1994 were higher under alternative farming and could be linked to a 1-wk delay in harvesting the first and second forage cuts (Table 1). First-cut yields were 15% higher than second-cut yields. Proportions of legumes in the forage were slightly higher at the first cut under alternative farming, but the reverse was true for the second cut.

In 1995, yields were similar for both types of farming practices (Table 2). First-cut yields were 45% higher than yields for the second cut. These unusually high yields could be linked to a wet spring that triggered grass growth indicated by the lower proportion of legumes in the harvested forage at the first cut.

Forage quality was similar for both types of farming practices for both years (Tables 1 and 2). Crude protein concentrations were lower at the first cut compared to the second cut and could be linked to the lower proportion of legumes in the first-cut forage: the lowest proportion of legumes in the 1995 first cut corresponds to the lowest protein content. Percentages of ADF varied between 31 and 34% for all cuts suggesting that all farmers cut their forages at the recommended maturity stage corresponding to early flowering of alfalfa. Net energy of lactation calculated from the ADF data suggests that these were good quality forages for dairy cows.

Potassium contents were generally lower under alternative farming compared to conventional farming (Tables 1 and 2). Differences were more pronounced in 1994 compared with 1995. In fact, in 1994, potassium concentrations of forages produced on alternative farms were lower than the 2% generally considered to be adequate for alfalfa forage mixture (Follett and Wilkinson, 1995). Concentrations in 1995 were close to 2%. Since legumes are more sensitive to potassium deficiency than grasses, the proportion of legumes in the mixture could be reduced prematurely. This would result in lower forage yields, lower forage protein content and reduced nitrogen fixation, the major supplier of nitrogen in alternative farming.

From these data, it is concluded that forage production is similar whether it is produced on an alternative or a conventional dairy farm. Forages were mainly grown as a mixture of alfalfa and timothy. Their yields and quality components were similar and all forages produced were considered a good quality feed source for dairy production.

Potassium concentrations were lower under alternative farming, even

lower than 2% in 1994. A more efficient recycling of potassium through better manure management practices could eliminate this problem. Otherwise forage production does not appear to be a limiting factor to the development of alternative dairy farming in Québec.

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Table 1

Characteristics of forage production on alternative and conventional dairy farms in 1994

	Alternative		Conventional	
	1st cut	2nd cut	1st cut	2nd cut
Yield (Ton ha^{-1})	3.20 (1.04)[z]	2.77 (0.73)	2.36 (0.36)	1.90 (0.23)
Proportion legumes[y]	2.0 (0.0)	2.1 (0.4)	1.6 (0.5)	2.5 (0.6)
Crude Protein (%)	15.3 (2.2)	17.1 (1.3)	14.0 (2.4)	18.2 (3.7)
ADF (%)	32.1 (2.6)	32.2 (2.4)	31.1 (4.3)	33.0 (2.5)
NE lactation (Mcal kg^{-1})	1.41 (0.07)	1.40 (0.06)	1.45 (0.13)	1.37 (0.06)
Potassium (%)	1.71 (0.60)	1.77 (0.30)	2.71 (0.28)	2.29 (0.37)

[z] Standard error.

[y] Proportion of legumes in the forage: 1, 0-30%; 2, 31-69%; 3, 70-100%.

Table 2

Characteristics of forage production on alternative and conventional dairy farms in 1995

	Alternative		Conventional	
	1st cut	2nd cut	1st cut	2nd cut
Yield (Ton ha^{-1})	4.46 (0.94)[z]	2.64 (0.59)	4.49 (0.69)	2.37 (0.46)
Proportion legumes[y]	1.3 (0.3)	2.6 (0.5)	1.2 (0.5)	2.0 (0.0)
Crude Protein (%)	13.8 (1.4)	18.5 (1.4)	13.5 (1.4)	16.8 (2.1)
ADF (%)	34.1 (1.7)	33.1 (1.9)	33.7 (1.2)	32.0 (1.8)
NE lactation (Mcal kg^{-1})	1.36 (0.05)	1.37 (0.05)	1.37 (0.04)	1.42 (0.06)
Potassium (%)	2.11 (0.34)	1.95 (0.42)	2.31 (0.38)	2.17 (0.54)

[z] Standard error.

[y] Proportion of legumes in the forage: 1, 0-30%; 2, 31-69%; 3, 70-100%.