PRODUCTIVITY OF RENOVATED NATURALIZED PASTURES INATLANTIC CANADA

Y.A. Papadopoulos[1], E. Charmley[1], R.C. Martin[2], A.H. Fredeen[3], K.B. McRae[4], D. Mason[1] and S.A.E. Fillmore[4]
[1] Agriculture and Agri-Food Canada, Research Farm, Nappan, Nova Scotia, B0L 1C0, Canada.
[2] Plant Science, Nova Scotia Agricultural College, Truro, Nova Scotia, B2N 5E3, Canada.
[3] Animal Science, Nova Scotia Agricultural College, Truro, Nova Scotia, B2N 5E3, Canada.
[4] Agriculture and Agri-Food Canada, Research Centre, Kentville, Nova Scotia, B4N 1J5, Canada.

ABSTRACT
The main objective of this study was to evaluate the effectiveness and improved productivity of reduced tillage pasture renovation methods in the establishment of triple species pasture mixtures into an existing naturalized stand. Experimental treatments, 2 (low and high stocking rates) by 2 (frost- and sod-seeding methods) factorial with an additional non-renovated pasture control treatment, were arranged in a randomized complete block design with two replications. Despite the fact that high stocking rates resulted in reduced herbage yield, animal production per hectare was substantially improved in the establishment and the first post-establishment year. Sod-seeding was the most effective establishment method of introducing species and resulted in numerically higher total animal gain per hectare (gain/ha) than frost-seeding and control treatments. Frost-seeding had no effect on the establishment of introduced species and animal performance.

KEYWORDS
Beef, production per hectare, average daily gain, pasture renovation, Atlantic Canada, frost-seeding, sod-seeding, stocking rate

INTRODUCTION
Pasture renovation is advocated as an economically feasible means of improving existing pastures in the Atlantic region of Canada. The main reduced-tillage pasture renovation methods include frost-seeding and sod-seeding. Frost-seeding alfalfa (*Medicago sativa* L.) into an existing timothy (*Phleum pratense* L.) sward is shown to be more effective under simulated grazing than under a hay management system (Grant 1961). Frost-seeding grasses into an existing sward is not a widespread farming practice, probably because results from surface sowing are often poor. Presently, there is no published information on the effectiveness of frost-seeding new grasses in the Atlantic region. Kunelius *et al.* (1982) and Kunelius and Campbell (1984) demonstrated that sod-seeding is effective in establishing alfalfa, red clover (*Trifolium pratense* L.), white clover (*Trifolium repens* L.), birdsfoot trefoil (*Lotus corniculatus* L.) and timothy. These studies also demonstrated that sod-seeding these species increases sward productivity and quality. The main objective of this study was to evaluate the effectiveness and improved productivity of the above pasture renovation methods in the establishment of triple species pasture mixtures timothy, meadow fescue (*Festuca elatior* L.) and white clover] into an existing naturalized stand.complementary objective was to assess the impact of low and high stocking rates on the effectiveness of pasture renovation methods and pasture productivity.

METHODS
The study was conducted in a field where the sward contained predominantly naturalized species. In 1993, the establishment year, renovation treatments were applied to 10 experimental units (1.6 ha each) for frost-seeding on April 19, 20 and sod-seeding from April 22 to May 11. Seeding rate for both treatments was 5-10-5 kg/ha of timothy, meadow fescue and white clover, respectively. A “Hunter” seeder (Hunter of Chester Ltd., Cheshire, England) was used in the sod-seeding treatment. The experimental design was a 2 x 2 factorial with an additional non-renovated pasture control treatment using a randomized complete block with two replications. The factors were renovation methods (frost- and sod-seeding) and stocking density (low and high). Each experiment unit (EU) was fenced and sub-divided into 12 equal-size paddocks to facilitate rotational grazing. In 1993, grazing commenced on June 3 and ended September 20. The two stocking rate treatments were three cows suckling single (low) or twin (high) calves. In 1993 grazing commenced on June 3 and ended September 20.One paddock (the same for each EU) was selected at random from each EU. Just prior to the animals entering the paddock, three 0.25 m*2* quadrant samples were taken for determination of dry matter (DM) yield. On two sampling dates (early June, early July) one quadrant sample was analysed for botanical composition and a second quadrant was analysed for chemical composition. The following analyses were conducted on the 50o C oven dried samples: 100° C oven DM, nitrogen, ash and neutral detergent fibre. In 1994 and 1995, at the beginning of the grazing season, half of the total area of each EU was reserved for first-cut silage. Second-cut silage was made from 25% of the area. In 1994 and 1995, each EU had the same treatment designation as the establishment year (1993). Low stocking rate and control pastures remained at 1.6 ha, but high stocking rate pastures were halved in area (0.8 ha) and sub-divided into 12 paddocks as before. Fifty yearling steers of British breeding were put on pasture in early May for 1 to 2 wk prior to placing on trial pastures. At the beginning of the 1994 season, all steers were weighed, blocked according to body weight into 10 blocks of five steers, and allocated within the block to one of the five treatments. However, after 6 wk of grazing it became apparent that the high stocking rate was too severe. Consequently one steer from the high stocking rate EUs was transferred to the low stocking EUs. The same approach was used in 1995, except the switch was made at the beginning of the grazing season. Grazing began on May 18 in 1994 and May 24 in 1995, and ended on September 14 in 1994 and on September 5 in 1995. Steers were weighed every 2 wk. Each paddock was grazed until the sward height was reduced to an average height of 6 cm.

RESULTS AND DISCUSSION
Herbage yield and distribution varied significantly during the establishment year between sod-seeding and frost-seeding methods. On average, DM yield of sod-seeded plots was 15% lower than frost-seeded plots (Table 1). However, these differences did not persist in the post-establishment years. Differences were not significant between frost-seeding and the control treatment in the establishment year, nor in the post-establishment years. Sod-seeding was the most effective establishment method of introducing species in this study (data not shown). This was due to facilitated seed-soil contact and reduced competition from the original stand. In the post-establishment years, high stocking rate resulted in reduced DM yield ($P<0.05$). The combination of high stocking rates and sod-seeding resulted in the most effective establishment of introduced species, especially of meadow fescue and white clover. As for timothy, it was difficult to compare the results since the original sward, following the application of effective rotational grazing management system, contained a significant timothy population. Average daily gain (ADG) of steers on all treatments was indicative of good pasture performance in the Atlantic region (Table 1). In general, the low stocking rates

resulted in numerically higher individual ADGs than the high stocking rates. Despite the fact that high stocking rates resulted in reduced DM yield, animal performance per hectare was substantially improved in 1993 and 1994. Sod-seeding resulted in numerically higher gain/ha than frost-seeding and control treatments. This response was not observed in 1995. We believe that the high stocking rate during the 1994 season was too severe and greatly influenced herbage productivity in 1995. Frost-seeding had no effect on gain/ha or individual ADG.

The results of this study clearly demonstrate that poor management, rather than species composition, can limit pasture productivity in the Atlantic region of Canada. Therefore, introducing improved species may not translate to increased animal performance or profits. A similar conclusion was reached by Papadopoulos *et al.* (1993) when reviewing the factors influencing pasture productivity in the Atlantic region. Although overseeding cool-season forage species can be effectively accomplished with a variety of methods, sod-seeding was shown to be the most effective.

REFERENCES

Grant, E.A. 1961. Reseeding legumes in an established grass stand. Forage Notes **7:** 25.

Kunelius, H.T. and Campbell, A.J. 1984. Performance of sod-seeded temperate legumes in grass dominant swards. Can. J. Plant Sci. **64**: 643-650.

Kunelius, H.T., Campbell, A.J., McRae, K.B. and Ivany, J.A. 1982. Effects of vegetation suppression and drilling techniques on the establishment and growth of sod-seeded alfalfa and bird's-foot trefoil in grass dominant swards. Can. J. Plant Sci. **62**: 667-675.

Papadopoulos, Y.A., Kunelius, H.T. and Fredeen, A.H. 1993. Factors influencing pasture productivity in Atlantic Canada. Can. J. Anim. Sci. **73**: 699-713.

Table 1
Mean annual dry matter (DM) yield, average daily gain (ADG) and total animal gain/ha as affected by pasture renovation methods and beef cattle stocking rate

Method	StockingRate	DM Yield (t/ha)			ADG (kg/animal/day)			Gain/ha (kg/ha)		
		1993	1994	1995	1993	1994	1995	1993	1994	1995
Frost-seeding	Low	7.8	11.8	12.1	0.82	1.02	1.07	341	358	399
	High	6.1	6.8	8.4	0.75	1.00	0.69	571	563	340
Sod-seeding	Low	4.8	10.6	10.8	1.08	0.98	0.85	449	343	317
	High	5.4	6.7	7.7	0.72	1.09	0.72	598	608	358
Control	Low	7.8	11.2	11.3	0.84	1.13	1.05	350	394	324
Mean		6.4	9.4	10.0	0.84	1.04	0.90	462	453	347
SEM (df=9,n=2)		0.49	1.20	1.20‹	0.090	0.085	0.090	70.0	28.5	35.1