REVEGETATION IN THE CANADIAN NORTH - A 15 YEAR PERSPECTIVE

SUMMARY OF FINDINGS

by

H. Martens[1] and W. Younkin[2]

Introduction

Reclamation studies in the Canadian North were begun in the early 1970's in response to the increased pace in the search for oil and gas. Since then a wide range of studies and trials have been conducted over a broad and highly diverse geographic area. Because of the harshness of the Northern environment and a lack of adapted plant material, the major emphasis in reclamation research was on revegetation--the establishment of a protective plant cover. Studies included trials of species, seed mixes, fertilizers, sod stripping and replacement, mulches etc. Although many of these studies were essentially abandoned after fulfilling short-term practical goals, long-term observations have provided a great deal of useful information. We at Hardy BBT Limited have been fortunate to have been involved in the establishment and long term assessment of many of these studies. The following is a summary of the major findings by category:

Species and Seed Mixtures

1. A sizable list of commercially available species of grasses and legumes, useful for revegetation in forest regions, is available and expanding (Table 1). In the woodland and tundra regions, legumes drop off the list and the number of grasses is somewhat lower yet still significant (Tables 2 and 3). No revegetation species have been identified for polar desert regions.

2. Although native grasses have made significant contributions to northern revegetation efforts, the majority of successful species are selections from northern adapted commercial stocks.

3. Generally better adapted species are slower to establish and less responsive to fertilizer additions while less hardy species tend to provide

[1]Harvey Martens is a senior reclamation specialist with Hardy BBT Limited, Calgary, Alberta, T2E 6J5

[2]Walter Younkin is Vice President Environmental and Chemical Sciences with Hardy BBT Limited, Calgary, Alberta, T2E 6J5

Proceedings America Society of Mining and Reclamation, 1989 pp 91-100
DOI: 10.21000/JASMR89010091

https://doi.org/10.21000/JASMR89010091

Table 1. Revegetation Species for the Forest Region

	Moisture Preference*	High Initial Cover**	Low Initial Cover
Bentgrass			
Highland Colonial	M-W	X	-
Creeping bentgrass	M-W	X	-
Common redtop	M-F	X	-
Bluegrass			
Common Kentucky	M-W	-	XX
Icelandic Holt	M-W	-	XX
Fescue			
Boreal creeping red	M-D	-	XX
Arctared creeping red	M-D	-	XX
Durar hard	M-D	-	XX
Foxtail			
Common creeping	M-F	XX	-
Common meadow	M-F	XX	-
Smooth bromegrass			
Carlton	M	XX	-
Manchar	M	XX	-
Reed Canarygrass	M-F		
Frontier		XX	-
Vantage		XX	-
Timothy			
Climax	M-D	X	-
Engmo	M-D	X	-
Rye (Spring or Fall)	M-D	X	-
Wheatgrass			
Fairway crested	M-D	-	X
Nordan crested	M-D	-	X
Revenue slender	M-D	XX	-
Sodar streambank	M-D	XX	-
Critina thickspike	M-D	-	X
Alfalfa	M-D		
Anik		-	XX
Drylander	-	-	XX
Sainfoin			
Nova	M-D	-	XX
Melrose	M-D	-	XX
Clover			
Aurora alsike	M-W	-	XX
White Dutch	M	-	XX

* Moisture - D-dry; M-mesic; W-wet; F-prolonged flooding

** X - Maintains 15-20% live cover for approximately 5 years.
XX - Maintains 15-20% live cover in excess 10 years.

Table 2. Revegetation Species for the Woodland Region

	Moisture Preference*	High Initial Cover**	Low Initial Cover
Bentgrass			
Highland Colonial	M-W	X	-
Creeping bentgrass	M-W	X	-
Common redtop	M-F	X	-
Bluegrass			
Nugget Kentucky	M-W	-	X
Fowl	M-W	XX	-
Icelandic Holt	M-W	-	XX
Fescue			
Boreal creeping red	M-D	-	XX
Arctared creeping red	M-D	-	XX
Durar hard	M-D	-	XX
Foxtail			
Common creeping	M-F	XX	-
Common meadow	M-F	XX	-
Smooth bromegrass			
Carlton	M	-	X
Reed Canarygrass	M-F		
Frontier		X	-
Vantage		X	-
Timothy			
Engmo	M-D	X	-
Rye (Spring or Fall)	M-D	X	-
Wheatgrass			
Revenue slender	M-D	X	-
Sodar streambank	M-D	X	-

* Moisture - D-dry; M-mesic; W-wet; F-prolonged flooding

** X - Maintains 15-20% live cover for approximately 5 years.
XX - Maintains 15-20% live cover in excess 10 years.

Table 3. Revegetation Species for the Tundra Region

	Moisture Preference*	High Initial Cover	Low Initial Cover**
Bentgrass			
Highland Colonial	M-W	X	-
Common redtop	M-F	X	-
Bluegrass			
Nugget Kentucky	M-W	-	XX
Canon Canada	D-W	-	X
Tundra	D-W	-	XX
Icelandic Holt	M-W	-	XX
Fescue			
Boreal creeping red	M-D	-	X
Arctared creeping red	M-D	-	XX
Durar hard	M-D	-	X
Foxtail			
Common creeping	M-F	X	-
Smooth bromegrass			
Carlton	M	-	X
Reed Canarygrass	M-F		
Frontier		X	-
Timothy			
Engmo	M-D	X	-
Rye (Spring or Fall)	M-D	X	-
Wheatgrass			
Revenue slender	M-D	X	-

* Moisture - D-dry; M-mesic; W-wet; F-prolonged flooding

** X - Maintains 15-20% live cover for approximately 5 years.
XX - Maintains 15-20% live cover in excess 10 years.

rapid cover prior to winter kill.

4. Similar to more temperate regions, seed mixes improve the chances of success of revegetation efforts in the north. Long term observations in tundra regions suggest that a mixture of rapidly establishing but less hardy species with generally slower establishing winter hardy species provides both a rapid and long-lasting protective cover while allowing native species to invade gradually.

Shrub Cuttings

5. Shrub cuttings of locally available willow, birch, alder and dogwood established at Sans Sault, NWT in 1971 and 1972 demonstrated that over a 12 year period, willow (Salix alexensis) had by far the highest survival rate. Only willow (96%) and alder (Alnus crispa) survived to year three with willow achieving heights of over 2 m by year 12.

6. Observations of shrub cuttings over two seasons along the IPL Norman Wells to Zama pipeline demonstrated that Salix interior had the highest survival (82%) on moist, sandy slopes, while Salix alexensis had the highest survival (80%) on wet clay-loam soils. Growth of all species was poorest and mortality highest in areas with ponded water.

Fertilizer Formulation and Application Rate

7. Most northern areas are uniformly low in plant nutrients and complete fertilizers containing N, P_2O_5, and K_2O, in a 1:2:1 ratio at 56, 112, and 56 kg per hectare respectively provide good initial growth.

8. In most northern regions fertilizer effects were not apparent by the second or third year following application, however, species well adapted to the northern climate such as Arctared creeping red fescue and Nugget Kentucky bluegrass still provided luxuriant growth and copious seed production 7 to 12 years following fertilization.

Seed and Fertilizer Rate Trials

9. In tundra regions increasing the seeding rate from 28 to 112 kg/ha for slow establishing but hardier species such as Nugget Kentucky bluegrass and Arctared creeping red fescue resulted in significant increases in first year cover (from a low of 8% to a high of 27% cover). Faster establishing but less hardy species such as Engmo timothy, were not as effected by seeding rate, producing high initial cover at even the lowest seeding rate (60%).

10. In the forest region the rate of fertilizer application was far more important in ground cover production than seeding rate, each increase in

fertilizer from 0 to 500 kg/ha resulting in significant increases in first year cover especially at the highest rate (Figure 1). By year two fertilizer effects were greatly deminished and by year four cover production was nearly the same in all plots.

Sod Stripping and Replacement Trials

11. Sod stripping and replacement was not judged to be successful in polar desert regions. Three years following stripping and replacement in a lowland meadow on Melville Island, vascular plant cover was only 1 to 2 percent vs. 43 percent in adjacent control areas.

12. In tundra near Tuktayaktuk, NWT replacement of sod in three plant communities: shrub-heath tundra, tussock tundra and sedge meadow, provided a fourth year plant cover similar in composition and total cover to native plant communities but with a generally higher proportion of grasses and sedges and lower proportion of evergreen and deciduous shrubs.

13. Replacement of sod maintained fourth year active layer thickness similar to undisturbed plant communities (averaging 27 cm) compared with 63 cm under areas where sod had not been replaced.

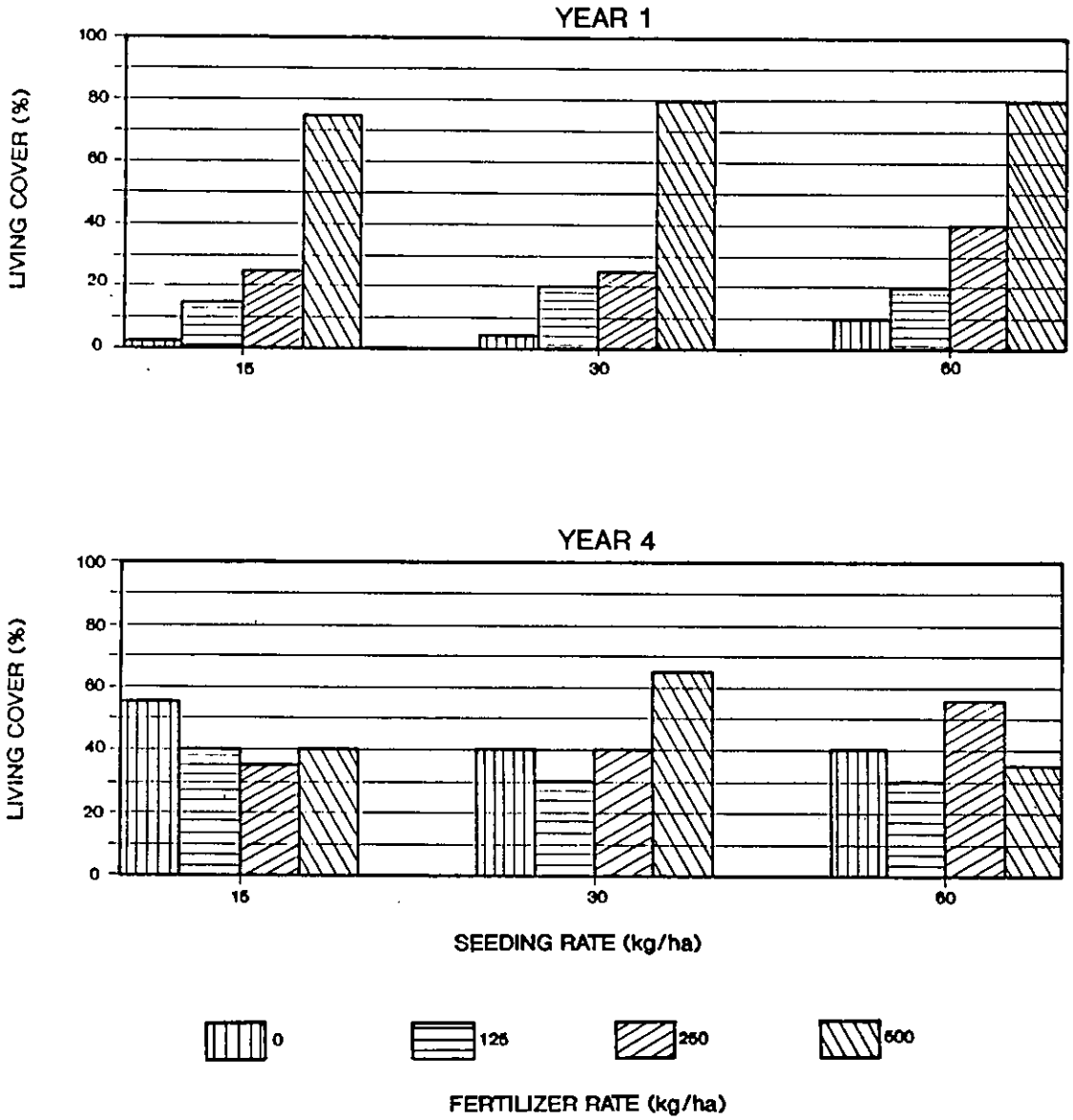
Effects of Seed and Fertilizer on Natural Recovery

14. The seeding of pure stands of hardy mat forming grasses such as Nugget Kentucky bluegrass and Arctared creeping red fescue significantly reduced the rate of invasion of native species in the tundra region (Figure 2).

15. Seeding of mixtures of short-lived rapid establishing grasses with more hardy mat-forming grasses allowed a rate of native species invasion similar to that of unseeded controls while providing a high level of protective cover (Figure 2).

16. In the forest region the application of seed and fertilizer significantly retarded the establishment of native species. Although native species cover was nearly equal on both seeded and fertilized plots and unseeded control plots the first year (8%), by the fourth year native species provided three times more cover on control plots (30%) than on seeded and fertilized plots (10%) (Figure 3).

17. Although unseeded and unfertilized control plots were more encouraging to the establishment of native species, the amount of protective plant cover established was significantly lower in all years studied than in the seeded and fertilized plots (16% vs. 40% in year 2 and 34% vs. 65% in year 2).



Hardy BBT Limited
CONSULTING ENGINEERING & PROFESSIONAL SERVICES

Figure 1. Percentage Living Cover on the Seed and the Fertilizer Rate Study Established on the IPL Norman Wells to Zama Pipeline in 1984.

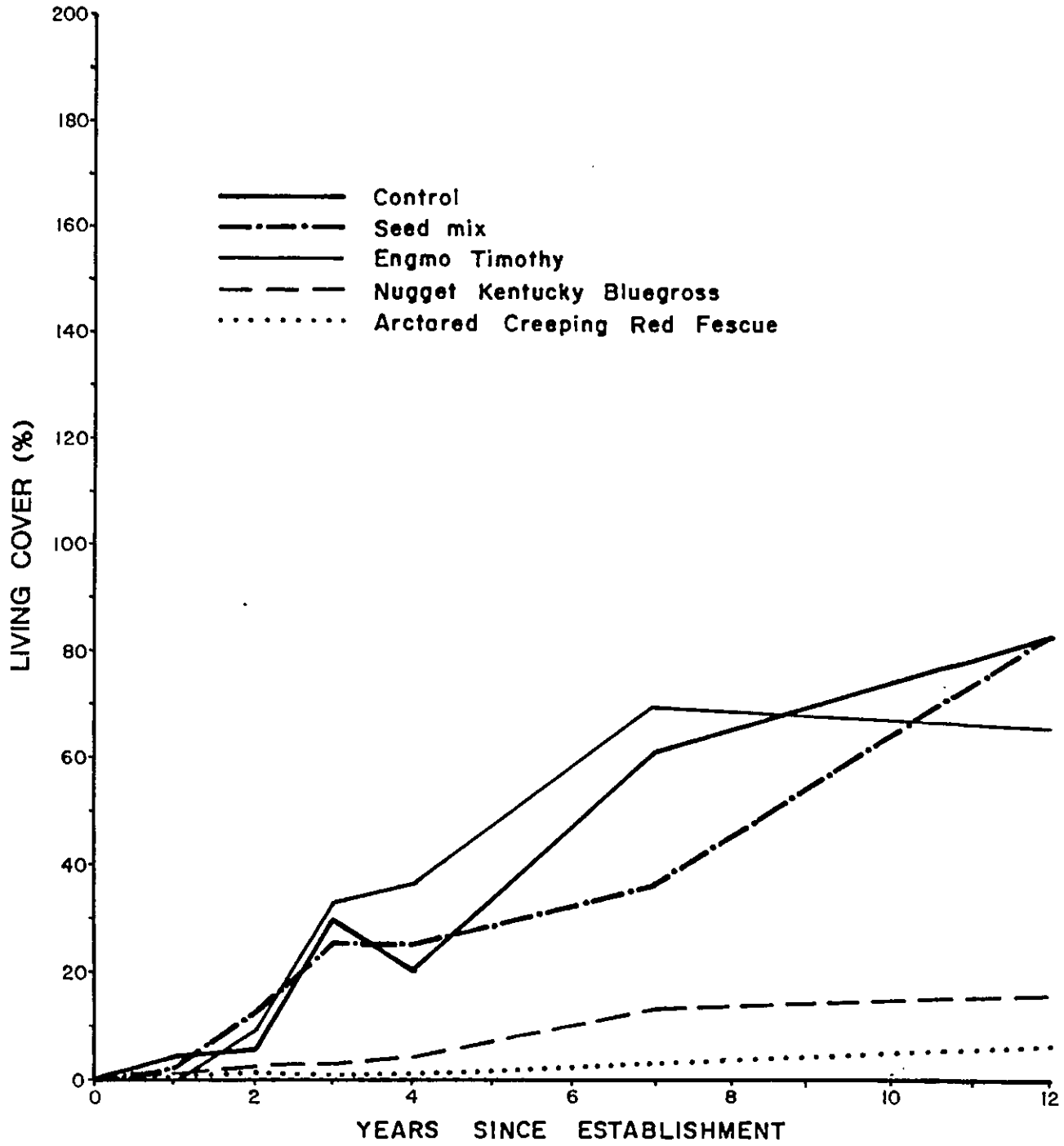
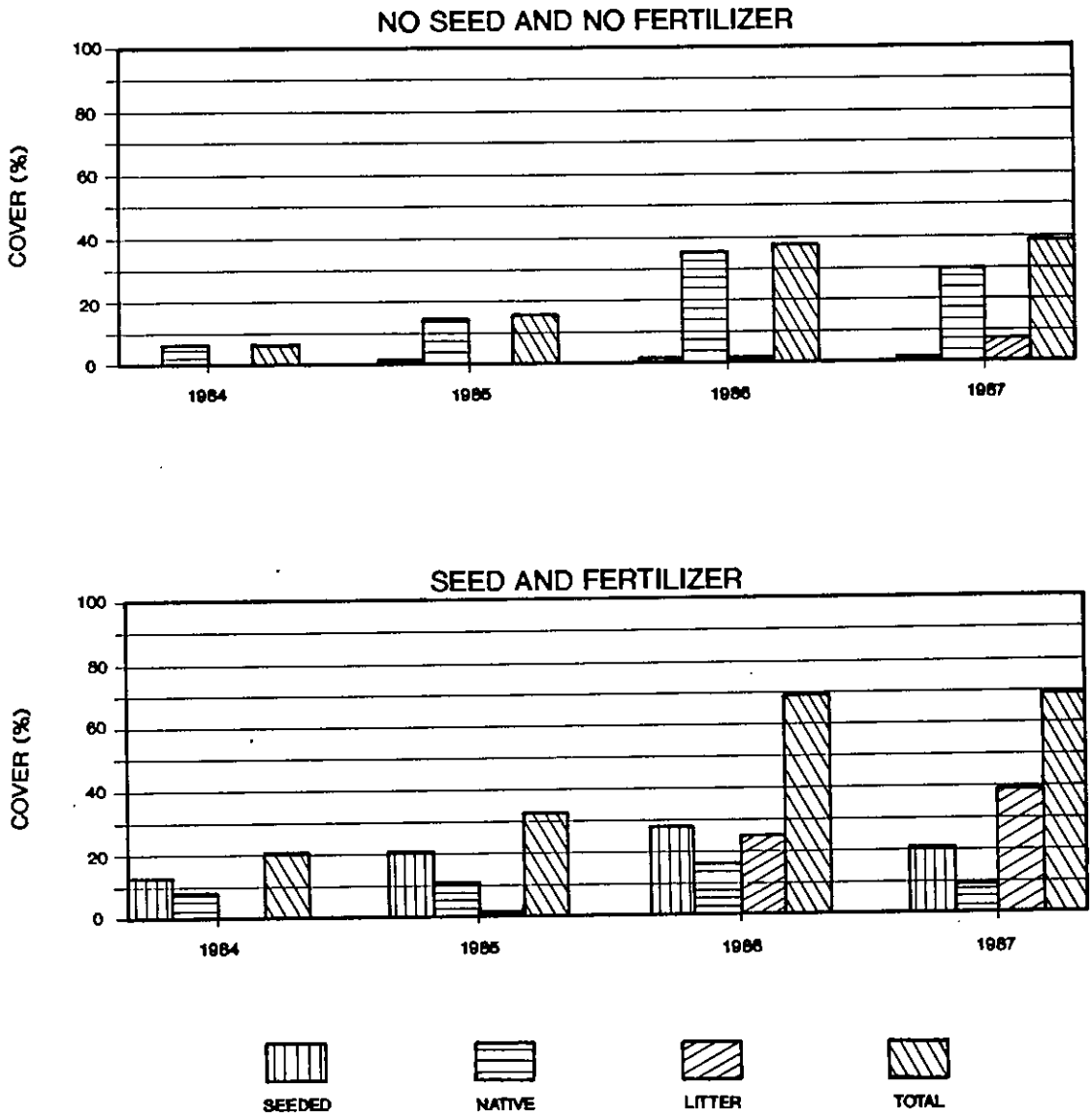


Figure 2. Percent Living Cover of Native Invaders.



Hardy BBT Limited
CONSULTING ENGINEERING & PROFESSIONAL SERVICES

Figure 3. Percentage Cover by Plant Cover Category on Revegetation Trial Sites on the IPL Norman Wells to Zama Pipeline Treated in 1984.