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EVALUATION OF PLANT SPECIES AND GRASS SEED MIXES FOR MINED LAND REVEGETATION YEAR 3 (1991) RESULTS

D.J. Helm

Research Associate Professor of Vegetation Ecology
Palmer Research Center, Agricultural and Forestry Experiment Station
University of Alaska Fairbanks

Introduction

Careful selection of plant species in a seed mix is important for successful reclamation. The main purpose of grass seed mixes is to establish a living plant cover to stabilize soils at least in the short term. Grasses have a fibrous network of roots which is instrumental in stabilizing soils before outplanted woody species or local colonizers can establish additional roots. Sometimes the grass cover is the end product; other times grass cover is temporary until local species colonize and form a more diverse, natural community. Where moose browse is a desired goal, the grass cover should not compete with the woody plants. At other times, dense grass cover may be needed to suppress undesired native species, such as bluejoint (*Calamagrostis canadensis*). This same competitiveness may also suppress desired local species and reduce the diversity, thus being a negative factor. The grass species should be able to compete with each other to create a diverse mix. The pH and nutrient levels of soils may also limit the plant species that will grow well.

Local species are plant species growing in the area, whether they are native or introduced (possibly by past disturbances in the area or the surrounding region). Native species are indigenous to Alaska but may not grow in the local area.

The objectives of this study were to determine:

1. The grass cultivars that would grow on low pH soils (5.2) in the Wishbone Hill area.
2. A ratio of grass species within the seed mix that would improve the diversity of the resultant community.
3. A seeding rate that would allow establishment of local species and outplanted browse without jeopardizing the cover needed to stabilize the soils.

Methods

Grass species were selected based on recommendations by investigators at the Alaska Plant Materials Center (Division of Agriculture) and the Agricultural and Forestry Experiment Station (University of Alaska Fairbanks). Seven cultivars were tested alone and in mixes to evaluate grasses for reclamation: 'Arctared' red fescue (*Festuca rubra*), 'Norcoast' Bering hairgrass (*Deschampsia beringensis*), 'Nugget' Kentucky bluegrass (*Poa pratensis*), 'Alyeska' arcticgrass (*Arctagrostis latifolia*), 'Nortran' tufted hairgrass (*Deschampsia caespitosa*), 'Sourdough' bluejoint (*Calamagrostis canadensis*), and 'Gruening' alpine bluegrass (*Poa alpina*). The main seed mix consisted of the first four cultivars. The ratio of Arctared to Norcoast, Nugget, and Alyeska was varied from 0:1 to 1:2 to 1:1 (Appendix Table 1). The other species were paired with Arctared as a standard to evaluate their competitiveness. More details on the design of the different mixes are in Helm (1991).

The vegetation was cleared and the soil stripped from the study site and temporarily stockpiled (less than one day) in mid-June (Helm 1990). Each plot was divided into three strips: unfertilized, unfertilized but with five rooted willow cuttings, and fertilized (Helm 1991). The cuttings were planted to assess any differences in competition from grasses on the browse plants. Seed was broadcast by hand in early July 1989 when weather

Table 1. Cover (%) of categories of plant species at the end of the third growing season, August 1991. Mixes are arranged in decreasing order of seeded plant cover.

Seed Mix	Total Vascular	Seeded	Local[1]	Blue joint	Moss	Litter
Nortran	90	86	13	3	10	85
Arctared:all 1:2	95	83	36	22	1	100
Heavy Mix w/out Arctared	90	78	31	17	7	91
Arctared	87	70	33	9	12	80
Alpine:Arctared 2:1	85	70	33	1	16	77
Nortran:Arctared 2:1	79	67	19	7	10	86
Heavy Mix w/ all species	77	66	28	16	10	93
Light Mix w/ all species	78	60	41	26	16	79
Light Mix w/out Arctared	80	50	50	34	29	67
Norcoast	63	50	27	15	21	77
Alpine	85	47	59	33	24	27
Sourdough:Arctared 2:1	85	47	66	47	22	76
Nugget	95	16	92	74	36	53
Control	93	1	93	67	39	46
Sourdough	92	1	91	80	43	61
Alyeska	67	1	67	44	50	46

[1] Local species are those that regenerated from the propagule bank (seeds or rhizomes) or were wind borne. Seeded Sourdough bluejoint could no longer be identified separately from the natural regeneration of bluejoint from rhizomes so was included in the natural regeneration.

conditions were still dry. Fertilizer (20:20:10) was spread by hand on the third of the plot to be fertilized.

Cover estimates by plant species were made in late August 1991, at the end of the third growing season. Three observations were made in each strip (unfertilized, woody plants unfertilized, fertilized) of each plot (seed mix) with a point frame containing five pins (sharpened welding rods) spaced 10 cm (4 in) apart, resulting in cover recordings for 15 points in each strip or 45 points per plot. A pin was dropped at each point and all plant species hit by that pin were recorded. The number of points hit was converted to a percentage cover for each species and categories of forbs (broad-leaved herbaceous species), grass-likes, shrubs, and trees. All species observed in a plot, whether they were hit by a pin or not, were also recorded.

Results

Excellent surface protection, as indicated by cover percent, was achieved by most grass mixes by the third year. Total vascular plant cover in the grass trial plots ranged from 63% to 95% (Table 1). In some of these plots the cover was predominantly from the seeded grasses. In other plots, cover was predominantly by local species. Litter from past growth covered at least half the surface area on most plots. The one exception was Gruening alpine bluegrass where the grass is very short and created little litter. Moss cover increased, especially where seeded grass cover was lower than on other plots. Moss cover may be underestimated in plots with heavy litter because of the difficulty in finding mosses under the litter.

The grass species which provided the most cover by itself at the end of three growing seasons was Nortran (86% cover in monoculture) (Table 1). The mix with the most seeded cover after three years was the Arctared: all species at a ratio of 1:2 which had 83% cover by seeded species and 95% total cover of vascular plants (Table 1). No bare ground was recorded in any treatments except the heavy mix without Arctared. Natural regeneration of local species was greatest where seeded cover was least, as might be expected.

Vascular plant cover on the control plots, where no grasses were seeded, averaged 93% (Table 1) with similar cover in fertilized and unfertilized strips. Bluejoint cover increased somewhat in many of the plots compared to Year 2. This occurred especially where seeded grass cover was less than on other plots. Nortran has been able to suppress bluejoint growth through the first three years. The least amount of bluejoint after three years resulted with Nortran, Nortran:Arctared 2:1, Arctared, and alpine bluegrass:Arctared 2:1.

Fertilization resulted in more cover of vascular plants, local species, bluejoint, and litter when compared with the unfertilized strips (Table 2). Although bluejoint cover was slightly greater when fertilized, tall fireweed (*Epilobium angustifolium*) cover was much greater when fertilized. Cover of seeded species was similar whether the strip was fertilized or not. Litter increased in the third

Table 2. Cover (%) of vegetation categories in response to fertilization at end of third growing season, August 1991.

Category	Total Vascular	Seeded	Local[1]	Bluejoint	Moss	Litter
Fertilized	89	49	56	43	14	85
Not fertilized	83	51	42	30	28	63

[1] Local species are those that regenerated from the propagule bank (seeds or rhizomes) or were wind borne.

year as a result of seeded species and bluejoint growth in past years. Moss cover was greater in unfertilized strips.

Discussion

Some grass species and seed mixes which were tested have been suitable for soil stabilization for the first three years under the soil conditions in the Wishbone Hill area and the weather conditions of 1989–1991. Other grass species and mixes that were tested have been more appropriate for diverse communities or for low competition with woody cuttings. Nortran tufted hairgrass has been vigorous and is still green after three years without additional fertilizer. It has suppressed bluejoint which has only 3% cover on Nortran plots at this time. Nortran does not grow as tall as bluejoint so aboveground competition with woody plant species should be less than that of bluejoint.

Vascular plant cover in Arctared plots increased this year, but mostly as a result of local species other than bluejoint. Arctared does not appear to be as vigorous as Nortran. Norcoast Bering hairgrass still provides good cover but appears to have decreased somewhat in the past year. Local colonization has not increased substantially in the Norcoast plots. Species with poor cover in the past, such as Alyeska and Nugget, continued to decline but local species increased in cover in these plots.

Alpine bluegrass cover has declined while local colonizers, especially bluejoint, have substantially increased. This grass appears suitable for short-term stabilization but will not compete with other seeded or local species because of its short height. It would be a good grass to seed around woody seedlings or cuttings.

The mix suggested a year ago (Helm 1991) for soil stabilization consisted of Nortran, Arctared, Norcoast, and alpine bluegrass in about equal quantities. Two of these components, Norcoast and alpine bluegrass, appear to be declining over time, which will allow more local species to colonize. Nortran still seems to be the chief means of controlling bluejoint. These species may perform differently on other soils or with different weather conditions.

Effects of fertilization on seeded species has decreased over time although cover of vascular plant species and local species has increased on fertilized strips. Fertilization still appears to have the drawback of favoring dominant local species such as bluejoint and fireweed. Fertilizer was needed for rapid establishment of the grasses (Helm 1990).

Litter has begun to accumulate but does not appear to be hindering plant growth substantially. Girdling of woody stems by small mammals hiding in this litter has not occurred. Most of the stems are large enough that girdling is not expected to be a problem. Moss cover has increased in the unfertilized strips probably because there was more area to colonize.

In summary, Nortran tufted hairgrass and Arctared red fescue are the best species tested for cover on these low pH (5.2) soils under early-season drought conditions after three years. Variations in species ratios within a mix and rates of seed mix application could be used to alter composition of the resultant plant community. The lighter rates of seeding resulted in less seeded cover which is allowing more local colonization, but not as much as with the mixes that provided little cover from the start.

Literature Cited

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Appendix Table 1. *Species composition of seed mixes on a relative seed count and weight basis. Rate is the equivalent seeding rate for the entire mix on a lb/acre basis.*

	Species Composition by Relative Seed Counts							Species Composition by Weight (%)							Rate (lb/acre)
	Arctared	Nugget	Alyeska	Norcoast	Sourdough	Nortran	Alpine	Arctared	Nugget	Alyeska	Norcoast	Sourdough	Nortran	Alpine	
Heavy Mix w/all species	2	2	2	2				49	13	15	23				37.2
Arctared:all 1:2	1	2	2	2				32	17	20	30				32.1
Heavy Mix w/out Arctared		2	2	2					25	30	45				25.4
Light Mix w/all species	1	1	1	1				49	13	15	23				18.6
Light Mix w/out Arctared		1	1	1					25	30	45				12.7
Arctared	2							100							36.4
Nugget		2							100						9.4
Alyeska			2							100					11.4
Norcoast				2							100				17.2
Sourdough					2							100			5.5
Sourdough:Arctared 2:1	1				2			77				23			15.8
Nortran						2							100		17.2
Nortran:Arctared 2:1	1					2		52					48		23.6
Alpine							2							100	9.4
Alpine:Arctared 2:1	1						2	66						34	18.4
Control (nothing seeded)															

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Agricultural and Forestry Experiment Station
School of Agriculture and Land Resources Management
University of Alaska Fairbanks