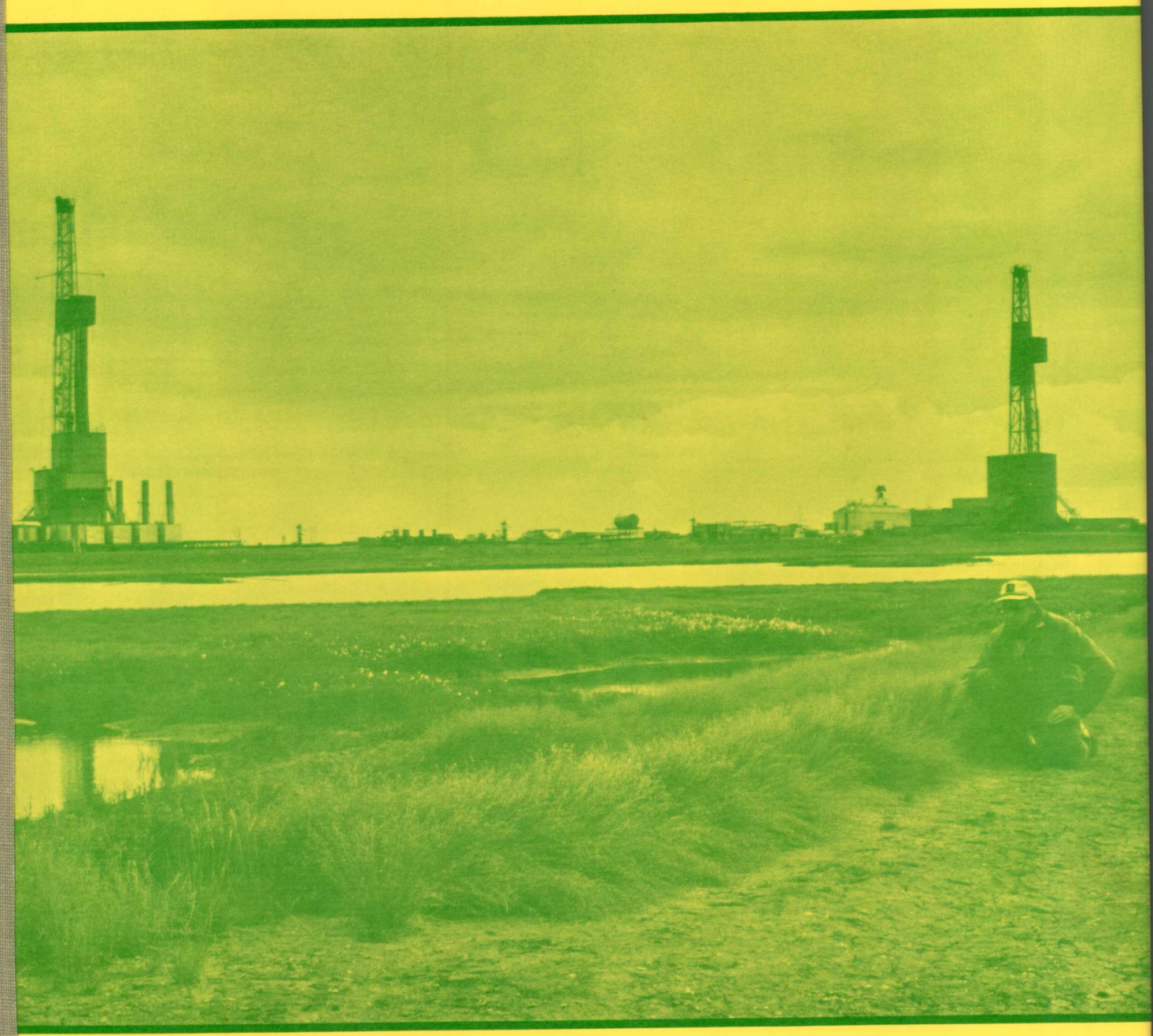
Three Varieties of Native Alaskan Grasses for Revegetation Purposes



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COVER: These grass plots, established from seed of individual plants selected for the breeding stock of 'Tundra' glaucous bluegrass (*Poa glauca*), have provided excellent cover for six years at Prudhoe Bay. Cottongrass (*Eriophorum* sp.) and a tundra pond intervene between the winter haul road in the foreground and an Atlantic Richfield drilling site in the background. The winter haul road was used for the initial activities that led to the discovery of oil at Prudhoe Bay. It is now used for experimental plots, including numerous plant-material, planting-procedure, and fertilizer trials that extend for almost a mile on the haul road, and often by caribou as a travel route. Geese nest in the vicinity and graze on the experimental plots. Well heads (also known as "Christmas trees") visible on the drill site currently are supplying oil to the trans-Alaska pipeline.

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Preface

With the discovery of the Prudhoe Bay oil field in 1968, research on plant materials for revegetation in northern Alaska was stimulated because of concerns for the integrity of tundra and taiga ground surfaces following disturbances. This research was largely supported by petroleum companies and pipeline consortia (see Acknowledgements). The immediate objective of these studies involved determining commercially available cultivars that would satisfy immediate needs for ground cover on disturbed sites. A longer-term objective was to identify and develop materials of native origin for this use. Progress on the long-term objective was aided by a program initiated in the 1950s at the Alaska Agricultural Experiment Station with support from the Rockefeller Foundation to collect and evaluate native or naturalized plants for possible use in Alaska. Materials derived from that program include Arctared fescue (Hodgson *et al.*, 1978; Taylor, 1970) and Nugget bluegrass (Hodgson *et al.*, 1971).

Introduction

Management objectives of some revegetation plantings encourage the use of native species. Where reinstatement of a native flora is desired, the inclusion of suitable native materials can hasten the process. Further, properly adapted native plants may provide a persistent, winter-hardy cover requiring little management. The use of poorly adapted introduced grasses can result in stand decimation, such as that experienced along southcentral Alaska's roadsides after the severe winter of 1975-1976 (Klebesadel, 1977).

Tests have revealed, however, that not all indigenous materials are suitable for revegetation purposes. Some have been insufficiently winterhardy for general use, as apparently their ability to persist in their native habitat is related to the particular set of conditions in which they occur. Susceptibility to diseases or failure to persist well in a dense stand militates against the use of certain native types. Growth form also must be considered. If the objective of a planting is to maintain a fairly uniform, turf-like growth, then tall, coarse-growing plants should be avoided. Patience is required in the use of native plants in that their seedling vigor is often low compared to that of many commercially available cultivars, and the natives may be suppressed when seeded along with more vigorous cultivars.

The investigations on revegetation in conjunction with the Prudhoe Bay oil field and trans-Alaska pipeline activities have resulted in the release of three cultivars derived from indigenous Alaskan materials. Many of the collections for these cultivars were made prior to 1969 and some date back to 1966. The establishment of this material in small nurseries at the Palmer Experiment Station prior to the oil field activity enabled seed to be obtained for the early testing programs. The three cultivars were developed primarily for revegetation purposes and are particularly important to arctic rehabilitation efforts (Mitchell, 1978) where the need for additional material is most pressing. One cultivar, Tundra, is recommended strictly for arctic use. The other two, Alyeska and Sourdough, can be applied throughout mainland Alaska in appropriate situations. The latter two may also have application as forage grasses in areas where other available materials may be poorly adapted.

Varieties

Tundra Glaucous Bluegrass

The cultivar, Tundra glaucous bluegrass (*Poa glauca*), sometimes called Greenland bluegrass, was developed from bulk seed samples collected in arctic Alaska in 1969 and 1970. The parents were found growing along the Sagavanirktok River in the vicinity of Sagwon, about 65 miles south

Figure 1: 'Tundra' glaucous bluegrass (*Poa glauca*) is a short, turfted grass with mostly basal leaves and abundant flowering culms (the stake is about 10 inches high). Breeder seed was used to establish this planting for the production of foundation seed. The one-fifteenth-acre plot produced seed at the rate of about 1,000 lbs per acre in the first harvest year, which exceeded the usual rate of about 300 lbs per acre. The yield declined to about 225 lbs per acre in the subsequent and final year of harvest. Tundra is of arctic origin and is recommended only for arctic use.

of Prudhoe Bay, during a botanical survey along the pipeline route (Mitchell, 1970). Though not a member of well-developed tundra communities, plants of glaucous bluegrass were prominent on many barren-ground sites. Furthermore, unlike many species in the Arctic, the plants appeared to be forming abundant seed, with each plant generally producing numerous flowering culms. When grown under boreal conditions in nurseries at Palmer, glaucous bluegrass was found to be the most successful of the arctic grasses evaluated for seed-producing capabilities.

Tundra bluegrass was selected from a 500-plant nursery established in 1971. The variety was originally based on 84 individual plants selected in 1973. Seed from these plants has been used for the production of foundation seed. The number of selections comprising the breeding base for the cultivar was later reduced to 23 plants. Selections were made on the basis of growth form and persistence under growing conditions at Palmer in southcentral Alaska. Growth form of the plants in the nursery ranged from extremely prostrate to relatively upright, and many died after one or two winters. Those selected for breeding material for the variety were the more upright plants that persisted beyond the third and fourth winters. Uniformity of progeny from individual parents of the breeding stock suggests inbreeding or, possibly, reproduction by apomixis.

Tundra bluegrass is a tufted perennial producing relatively short, basal leaves and numerous flowering culms with leaves borne near the base (Figure 1). The plants generally grow to 20 to 24 inches (5 to 5.5 dm) or less in height. The short, somewhat open inflorescence is narrowly pyramidal in shape. The species is found throughout most of mainland Alaska, occurring on disturbed ground along river and stream courses and often colonizes exposed slopes and dry upland sites. Its conservative growth habit suits it well for infertile or dry sites.

Tundra bluegrass has been the most reliable performer in revegetation trials conducted in the Prudhoe Bay region of arctic Alaska (frontispiece). It has maintained excellent cover in all upland plots in which it has become well established, and in mixed seedings Tundra bluegrass has dominated the mixture. This arctic selection commences growth earlier than other grasses that have been tested and heads abundantly under arctic conditions. It is not as well adapted, however, to low, wet areas as the other two varieties described herein.

Individual seed weights of Tundra have averaged about .34 milligrams, equalling about 1.32 million seeds per pound. When grown for seed-production purposes, it is recommended that Tundra be seeded at about 6 to 8 lbs per acre, either in rows 4 to 6 inches apart or broadcast. Narrow row spacing causes the flowering culms to grow more erect. Fields for seed production should be well drained, not subject to ponding, and mostly free of weeds that compete with the seedlings. With early planting (by mid-May) followed by good growing conditions, Tundra bluegrass is capable of producing seed in the year of planting, though unfavorable conditions may prevent it. Yields of about 100 lbs of seed per acre have been obtained in the year of planting at Palmer. Second-year yields have ranged from 300 to over 1,000 lbs per acre. Productivity has declined after the second year in the Palmer trials. When grown in the boreal region, Tundra is subject to fungal diseases that most likely weaken it, thus affecting its durability.

Tundra bluegrass is believed to be the first cultivar of arctic origin developed for use in the North. But the demanding selection processes of the Arctic have limited its range of application; Tundra is recommended only for revegetation purposes in the Arctic, not for use south of the Brooks Range. Tundra has been issued Plant Variety Protection Certificate No. 7700033 and shall be sold by variety name only as a class of certified seed.

Alyeska Polargrass[1]

The cultivar, Alyeska polargrass (*Arctagrostis latifolia*), is based on 27 collections made in a number of locations in interior and western Alaska. These plants have been grown in nurseries at Palmer for 7 to 10 years and have demonstrated satisfactory vegetative performance and fair to

[1]The cultivar was originally released employing the common name arcticgrass, previously used by Klebesadel (1969) and Beetle (1963). The use of polargrass by Hulten (1968) and Welsh (1974) is acceded to, however, to prevent a confusion of names.

good seed-producing ability. Inclusion of a number of collections from different locations in the breeding stock provides a broad genetic base, thus conferring wider adaptability on the cultivar. Attempts at including entries from the Arctic and other north-Alaska locations have failed because of their poor seed-producing qualities (Figure 2).

Polargrass is a strictly north-latitude species with a circumpolar distribution (Hulten, 1968). It occurs throughout mainland Alaska as a component of various native plant communities and often occupies areas denuded by disturbances. It generally grows in moist to moderately wet sites.

Figure 2: A dramatic difference in performance is evident between material of polargrass from an arctic location (foreground) and that from a boreal location (background), as seen in a Palmer nursery. Many of the arctic plants in the foreground are diseased and are heading very poorly or not at all; those producing heads are forming very little seed. The plants from a southcentral Alaskan location in the background are growing vigorously, without disease, and are producing numerous heads with good seed.

Alyeska is a medium to tall grass, capable of achieving heights of 3.5 to 4.5 ft (ca. 1 to 1.4 m). It produces relatively wide leaves and new tillers from rather stout, underground stems (rhizomes) that spread laterally from the parent plant. Plants growing in open communities on disturbed sites or in spaced-plant nurseries develop into tall, robust clumps with numerous, leafy stems (Figure 3). Growth is much more restricted in well developed, closed stands. Inflorescences are open and lax to narrow and relatively constricted.

Various components of the cultivar have been included in revegetation trials in interior and northern Alaska, and many are being evaluated for forage possibilities in the southcentral region. These tests indicate its adaptability to forested, alpine, and arctic regions from southcentral to northern Alaska. Components of Alyeska have been among the best performers in the arctic oil field trials at Prudhoe Bay. Alyeska is an important addition to the materials that are adapted for arctic use. It also may be expected to do well in tundra regions along the western coast (though no tests of the material have been conducted there) and in alpine tundra sites. It is best suited to moist to moderately wet sites. It tolerates acid soils and appears immune to snow mold.

Alyeska is not well adapted to dry sites or exposed sites subject to desiccating winds. Unless Alyeska is to be applied to a particular site most appropriate for its use, it is recommended that it be included in a mix with other grasses, particularly where varied situations encompassing dry

Figure 3: Polargrass develops a robust, leafy clump when grown in open stands or spaced-plant nurseries. Plants pictured here are producing breeder seed of 'Alyeska' polargrass in a Palmer nursery. 'Alyeska' is adapted for arctic use and other cool, moist situations.

sites are to be encountered. A relatively light seeding of the mix would encourage its expression. Though forage potential has been reported for the species (Klebesadel, 1969), Alyeska was not selected for its yielding qualities. It possibly could have application as a forage grass in areas such as those found in Alaska or northern Canada where acid soils, cool, short growing seasons, and snow mold militate against the use of the standard forage grasses, bromegrass, and timothy. Studies are underway to select superior types of polargrass for forage purposes.

Seed yields of different plantings of polargrass in small plots have varied from 80 to 450 lbs per acre. No definitive studies have been conducted on management for seed production. It is believed that the grass should be grown in rows spaced about 2 to 2-1/2 ft apart planted at about 1/2 to 1 lb per acre for seed-production purposes. Individual seed weights have averaged about .25 milligrams, equalling about 1,800,000 seeds per pound. One pound of seed evenly distributed over an acre would supply almost 42 seeds per square foot.

Sourdough Bluejoint Reedgrass

The cultivar, Sourdough bluejoint reedgrass (*Calamagrostis canadensis*), is based on 36 collections made in various locations throughout interior and southcentral Alaska. These plants have performed satisfactorily in nurseries at Palmer for 7 to 10 years.

Sourdough is a medium to tall grass (Figure 4), capable of growing over 6 ft (2 meters) tall. It resembles polargrass, developing tall, robust plants with numerous, leafy stems. New tillers arise from relatively thin rhizomes. Its leaves are thinner and generally not as wide as those of polargrass. The extremities of the leaves and of the inflorescence often become reddish, probably accounting for the common name "redtop" given the species by many Alaskans. This confuses it, however, with another grass—*Agrostis alba*—that also has the common name of redtop. The inflorescence is narrow and constricted for a short period after emergence but opens into a diffuse, fairly erect spray of small spikelets. The seed-bearing florets are retained for only a brief period when the seed ripens. Seed dissemination is aided by the presence of long hairs on the floret.

Bluejoint reedgrass is abundant throughout mainland Alaska south of the Brooks Range but is rare in the Arctic north of the range, occurring there mainly along some protected stream bottoms. It is well adapted to a wide range of sites. Bluejoint dominates some well developed, tall-growing grassland communities that prevail on bottomland to upland situations in south-central and southwestern Alaska. It often develops dense stands or is a prominent member of colonizing communities on newly cleared or burned-over forest lands throughout mainland Alaska. Native stands of this grass are harvested as forage by some stock growers and hay producers.

The diversity of breeding material from a number of locations provides the cultivar Sourdough with a broad genetic base. Components of Sourdough have been tested in the Interior, including harsh alpine sites, where they have generally performed well, and in the Arctic, where most have persisted and have provided fair to good cover. It may be expected to perform better in the foothill and mountain region of the Arctic than in the coastal region. Sourdough is adapted for inclusion in revegetation mixes throughout mainland Alaska, providing a hardy, persistent performer under a variety of conditions, from moderately wet to moderately dry sites. It can endure drier sites than Alyeska polargrass. It tolerates strongly acid soils and appears immune to snow mold. Sourdough has poor seedling vigor in the first year but can develop a vigorous, rank growth in succeeding years.

Individual seed weights have averaged about .12 milligrams, equalling about 3.75 million seeds per pound. Low seed production and difficulties in processing (Klebesadel *et al.*, 1962) will probably make seed purchases of Sourdough bluejoint reedgrass expensive. Initial data indicate seed yields of 20 to 50 lbs per acre may be expected, although ca. 100 lbs per acre have been obtained from some small plots. Seed production can be seriously affected by the incidence of silver top, or white top, in which the flowering culm becomes severed at the base of the peduncle and dies without producing any seed. This is believed to be caused by insects that invade the

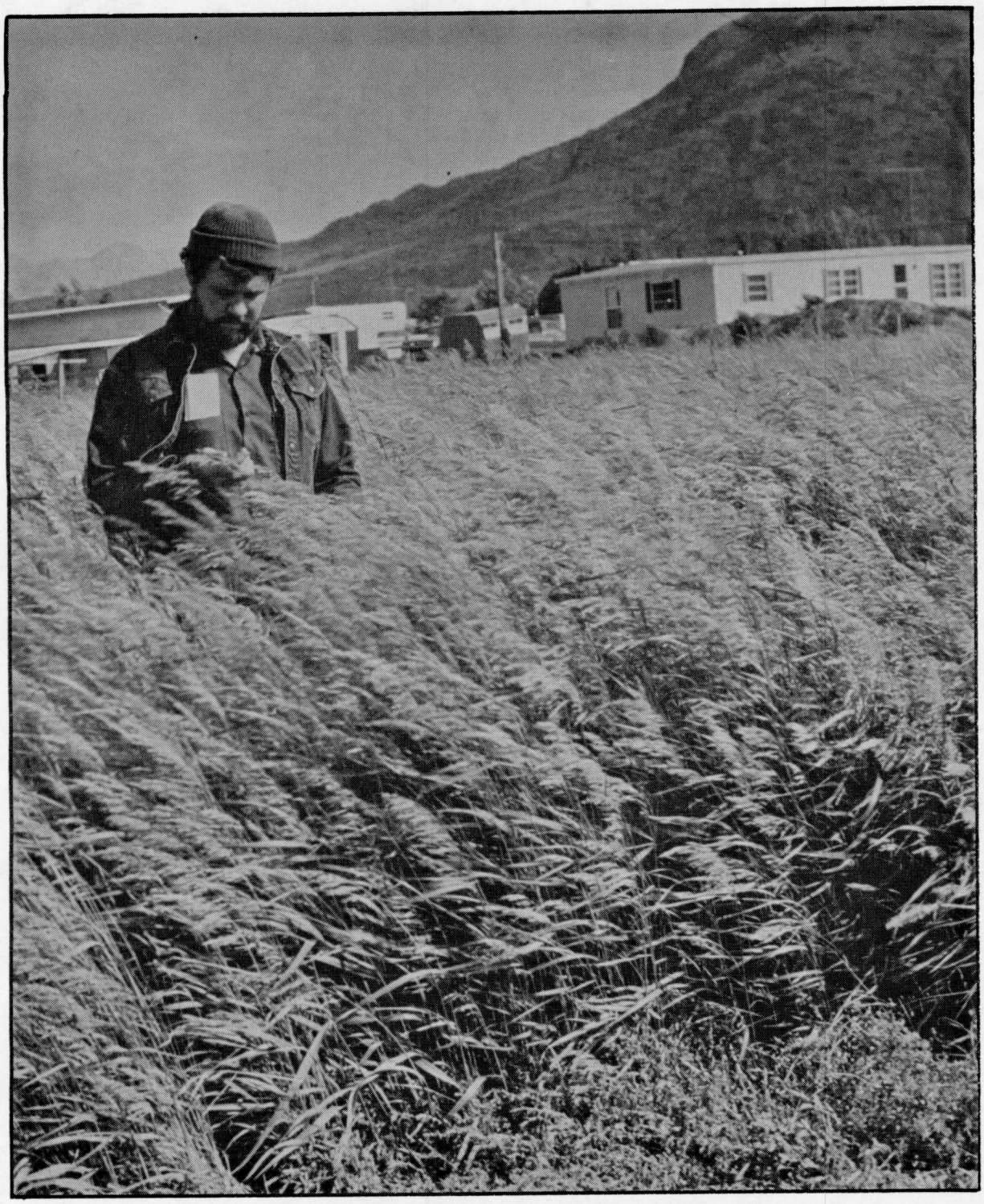

Figure 4: Agronomy aid and foreman, Richard Hill, inspects the readiness of 'Sourdough' bluejoint reedgrass (*Calamagrostis canadensis*) for harvest of foundation seed. Since bluejoint seed is disseminated soon after reaching maturity, it must be watched closely to guard against significant losses of seed. Sourdough is widely adapted for use throughout mainland Alaska. Some plants are capable of growing over 6 ft. tall, but it generally grows much shorter, particularly when occurring in dense stands or on infertile sites.

sheath of the flag leaf and sever the culm or transmit a fungus that attacks the culm at the base of the peduncle. It is recommended that Sourdough be seeded at 1/2 to 1 lb per acre in rows 2 to 2-1/2 ft apart for seed-production purposes. Because of the extremely small size of the seed, one pound of the material could make a significant contribution to a light seeding mix for revegetation purposes. Open, rather than dense, stands would provide more opportunity for development of grasses like Sourdough and Alyeska, which have poor seedling vigor.

Summary

Three varieties of native Alaskan grasses are described for use in revegetation efforts in Alaska.

Tundra glaucous bluegrass (*Poa glauca*) was developed from material collected in the foothill region of the Arctic about 65 miles south of Prudhoe Bay, located on the north coast of Alaska. It has been a superior performer in trials conducted in the Prudhoe Bay oil field. Tundra is recommended as a significant component of arctic revegetation mixes but not for other regions of Alaska. For seed-production purposes it should be grown on well-drained fields that are not subject to ponding.

Alyeska polargrass (*Arctagrostis latifolia*) is based on 27 collections made through interior and western Alaska. This variety also is adapted for use in the Arctic and on moist to moderately wet sites south of the Brooks Range. It may be particularly useful in moist alpine and coastal tundra regions where other materials are of limited value. Its low seedling vigor requires some care in its use in mixes which include vigorous cultivars. Heavy seedings of the more vigorous cultivars may suppress the development of Alyeska.

Sourdough bluejoint reedgrass (*Calamagrostis canadensis*) is based on 36 collections made through interior and southcentral Alaska. Sourdough is adapted for use throughout mainland Alaska including the Arctic. It has a wide ecological amplitude, coping with drier sites than polargrass. Like Alyeska, it is low in seedling vigor. Both Sourdough and Alyeska may have particular application where high soil acidity and snow mold are serious problems, and both can tolerate moderately wet, poorly drained sites. Seed production of Sourdough is more difficult than of Alyeska.

Breeder seed of thse three varieties is maintained at the Alaska Agricultural Experiment Station. Foundation, registered, and certified generations are recognized for seed increase purposes. The Alaska Crop Improvement Association is responsible for distribution to seed growers.

Acknowledgments

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