POLAR BROMEGRASS
A NEW WINTERHARDY FORAGE FOR ALASKA

Vigorous regrowth of Polar bromegrass after the severe 1961-62 winter contrasts with sparse regrowth of other varieties, including Manchar (M), Canadian commercial (Cc), and Carlton (C). This is a small plot planting at the Alaska Experiment Station's Matanuska Farm.

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POLAR BROMEGRASS, NEW WINTERHARDY FORAGE

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SMOOTH bromegrass (*Bromus inermis* Leyss.) is the principal perennial forage crop grown in Alaska. Despite this, none of the varieties developed elsewhere are sufficiently winterhardy for consistently good survival in most of the State. Approximately two-thirds of Alaska's perennial grass acreage is in the Matanuska-Susitna Valley area. In two seasons since 1956 there has been widespread winterkill of bromegrass fields in the Matanuska Valley. Nearly half of the planted acreage winterkilled during 1956-57 and again in 1961-62. In other years individual fields have shown winter injury. Polar bromegrass, a new improved variety, has consistently displayed outstanding winter hardiness and forage yields in experimental tests in Alaska.

HISTORY

Polar bromegrass originated partly from hybrids between smooth bromegrass (*Bromus inermis*) from the northcentral states and arctic bromegrass (*Bromus pumpellianus*) from Alaska and northern Canada.* Hybrid plants were grown in the greenhouse in Alaska and interpollinated in 1949. Seed from these plants was used to establish at the Matanuska Farm a large spaced-plant source population that also included plants grown from seed of several other northern bromegrass varieties. Selected from this large nursery on the basis of winter hardiness, spring vigor, leafiness, seed production, and disease resistance, 216 clones were transplanted into a replicated polycross nursery. Following further evaluation in this nursery, seed was harvested from 61 superior clonal lines in 1954. In broadcast-seeded plots, the selected lines were compared over three seasons for forage yield and winter hardiness and 16 lines excelled in these characteristics. Following the severe winter of 1956-57, nearly all of these 16 lines produced about 50 percent more forage than the winter-injured Canadian commercial bromegrass.

These superior lines were genetically diverse. Eleven of them traced back to *B. pumpellianus* x *B. inermis* hybrids and five were from the varieties Manchar, Canadian commercial, Mandan 404, B. in. 12, and Colorado 144. These lines were combined into a synthetic variety. Subsequent evaluations from 1960 to 1965 confirmed the superiority in

*These hybrids were produced by Dr. F. C. Elliott at Iowa State University as part of his investigations of North American bromegrasses.

Alaska of this synthetic bromegrass over commercially available varieties. This synthetic has been named Polar, a name that infers the new variety's adaptation and superior hardiness in northern latitudes.

CHARACTERISTICS

Polar bromegrass can be readily recognized by the very hairy nodes (stem joints) of about 5 percent of the plants, and slight nodal hairiness of approximately 60 percent of them. About 75 percent of the lemmas (seed hulls) are slightly to extremely hairy. Polar has relatively strong stems that impart excellent lodging resistance to dense stands. The considerable variability in appearance among individual plants of Polar is attributed to its diverse ancestry.

The new variety is also characterized by a darker green color, earlier spring growth, and less vigorous spreading habit than other varieties. The dark green color is most noticeable in spring. Polar has frequently shown a slightly higher protein content in harvested forage than Manchar bromegrass. In tests at Palmer and Fairbanks, Polar has developed earlier in the spring than the northern varieties Carlton, Sac, Saratoga, and Canadian commercial. It is equal to Manchar in this regard. Polar has inherited the less vigorous spreading habit of growth from its *B. pumpellianus* ancestry.

WINTER HARDINESS

Polar has been evaluated in Alaska in both the Matanuska and Tanana Valleys, in Canada, and in several northern states. During the severe winter of 1961-62 and the less severe winter of 1963-64, Polar displayed exceptional winter hardiness in comparison with other northern varieties of brome at the Matanuska Farm (Table 1). The experimental site was exposed to severe winter stresses as are most farm fields. Winter winds blew away the insulating mantle of snow, exposing the grass to sub-zero temperatures and dehydrating winds. During winter the exposed experimental fields were subjected occasionally also to thawing and refreezing. Plants proved winterhardy under these conditions are usually winterhardy when grown in other

Table 1.—Winterkill in two tests of bromegrass varieties, Matanuska Experiment Farm. Values are means of 16 plots in 1961-62 and of 4 plots in 1963-64. In each column, values followed by different letters differed significantly at the 5 percent level of probability. If followed by the same letter, differences were not significant.

Variety	% Winterkill 61-2	63-4
Polar	15 a	0 a
Carlton	87 b	14 b
Manchar	93 bc	26 c
Canadian commercial	97 c	NI
Sac	NI	63 d
Saratoga	NI	70 d

NI - not included in test.

Table 2.—Dry matter yields of bromegrass varieties at Matanuska and College Experiment Farms. Values are means of four-replicate tests, harvested in 1964 and 1965. In each column, values followed by different letters differed significantly at the 5 percent level of probability. If followed by the same letter, differences were not significant.

Variety	Matanuska			College		
	First cutting	Second cutting	Season totals	First cutting	Second cutting	Season totals
	Tons per acre					
Polar	1.54 a	1.85 a	3.39 a	2.53 a	2.53 a	5.06 a
Carlton	1.46 a	1.73 a	3.19 a	2.53 a	2.28 a	4.81 a
Manchar	1.58 a	1.66 a	3.24 a	2.54 a	2.44 a	4.98 a
Canadian commercial	1.41 a	1.75 a	3.16 a	2.57 a	2.54 a	5.11 a
Sac	0.67 b	1.99 a	2.66 b	2.44 a	2.40 a	4.84 a
Saratoga	0.71 b	1.92 a	2.63 b	2.43 a	2.51 a	4.94 a

places where a snow cover persists through much of the winter. The magnitude of the winter injury suffered by the bromegrass varieties in the first test is illustrated in the cover picture.

FORAGE YIELDS

Following the severe winter of 1961-62, stands of all bromegrasses but Polar were so badly decimated (Table 1 and cover photo) that plots were not harvested. Only Polar survived adequately to produce a satisfactory forage crop in 1962. Grass yields from the second test, for which winter injury data are presented in the second column of Table 1, are not tabulated here. However, in the first cutting (June, 1964), Polar yields were 1.6 times those of Carlton and 2.5 times those of Manchar. Yields of Sac and Saratoga were very low.

Another experiment at Matanuska, located in a more sheltered position than were the plots of Table 1, survived reasonably well during the 1963-64 winter. This test was harvested in 1964 and 1965. The 1964-65 mean forage yields are presented in Table 2 along with data from a similar test at the College Experiment Farm. In both seasons, the relatively nonhardy varieties Sac and Saratoga again were winter-injured as revealed by their low yields in first cuttings of both seasons at Matanuska. In this test where Carlton, Manchar, and Canadian commercial sustained no winter injury, those varieties yielded about as much forage as Polar. In a test where winter injury was relatively insignificant, as at College (Table 2), yield differences were not great enough to be significant when analyzed statistically. All varieties produced high yields.

Foundation seed field of Polar bromegrass, Matanuska Experiment Farm, August 1962. Seeded in rows two feet apart in early June 1961, this satisfactory stand developed after an exceptionally severe winter.

Polar's promise of consistently good winter survival and high yield in first cuttings greatly enhances the possibility of making hay in much of Alaska. The second cutting of bromegrass is usually stored as ensilage because poor drying weather during late summer precludes field-drying of the cut grass.

SEED YIELDS

Tests in Alaska, Canada, and Washington indicate Polar is a good seed producer. In Canadian experiments at Saskatoon, Saskatchewan and Lacombe, Alberta, Polar yielded almost as much seed as some commercial varieties of bromegrass

Table 3.—Seed yields per acre of Polar and Manchar smooth bromegrass at the Matanuska Experiment Farm, 1963, 1964, and 1965. Values are means of four replications. In each column, values followed by different letters differed significantly at the 5 percent level of probability. If followed by the same letter, differences were not significant.

Variety	Years after planting		
	First	Second	Third
	Pounds per acre		
Polar . .	770 a	228 a	174 a
Manchar	312 b	126 b	102 a

and considerably more than others. In Washington test plots it yielded as high as 908 pounds of seed per acre. In limited tests in Alaska, Polar has consistently surpassed Manchar in seed yield (Table 3). On the basis of present information it is believed that Polar seed yields will be greatest when planted in rows without a companion grain crop. Best seed yields are usually obtained the year following planting.

DISEASE REACTION

Disease has not been a major factor affecting bromegrass yields in Alaska. Therefore, Polar has not been completely appraised for its reaction to various diseases that affect bromegrass. Infestations have not been reported in the variety in experiments outside of Alaska.

AREAS OF ADAPTATION

Best performance of Polar in Alaska can be expected in the Matanuska and Tanana Valleys. It is not suited to the strongly acid soils of the Kenai Peninsula and Kodiak Island unless lime is applied to reduce soil acidity. At present, it appears to have its greatest use in areas where winter hardiness is an advantage.