FORAGE RESEARCH REPORT No. 2
March 1964

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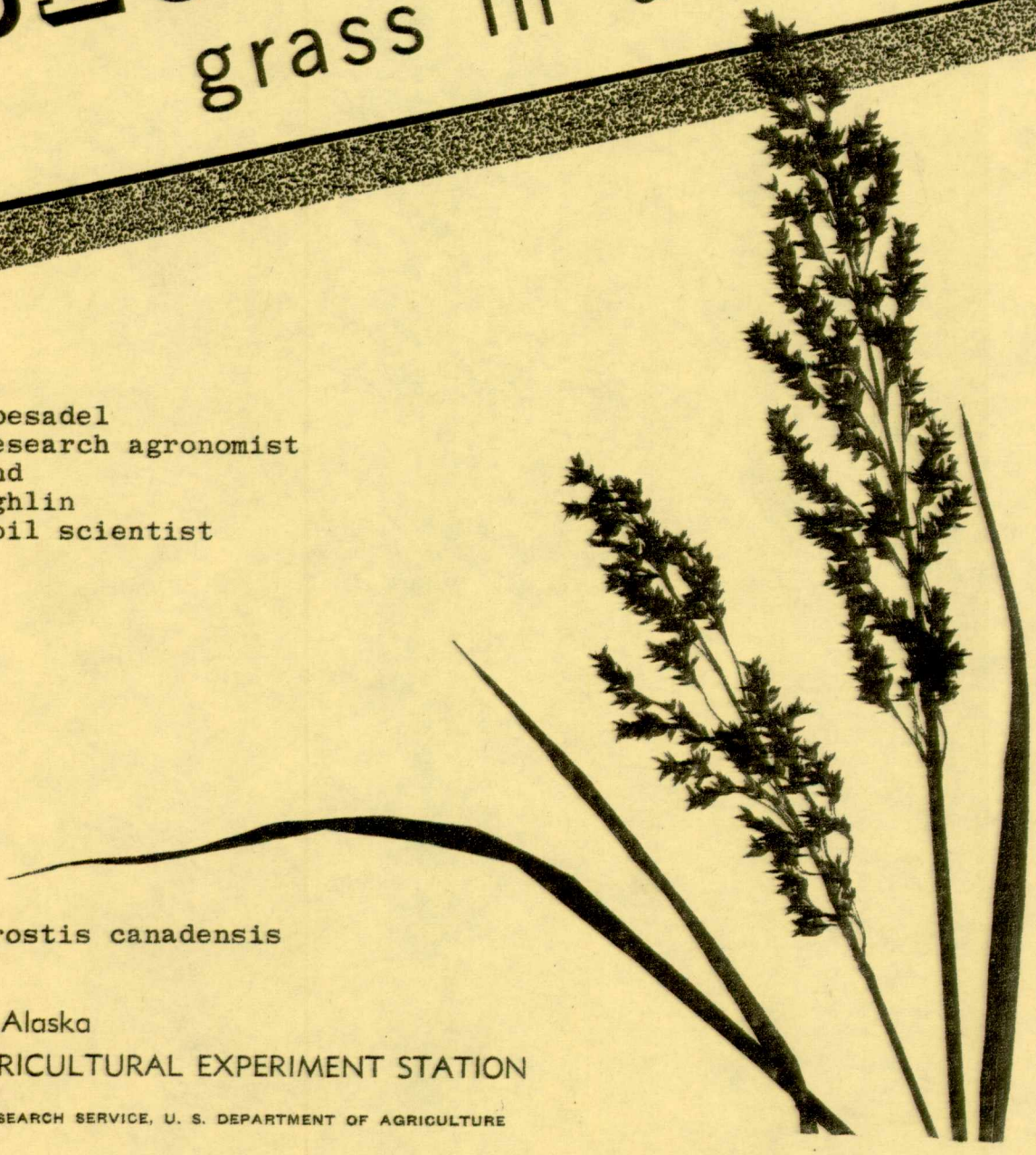

*Calamagrostis canadensis

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ALASKA AGRICULTURAL EXPERIMENT STATION
Cooperating with the
AGRICULTURAL RESEARCH SERVICE, U. S. DEPARTMENT OF AGRICULTURE

UTILIZATION OF NATIVE BLUEJOINT GRASS (*Calamagrostis canadensis*)* IN ALASKA**

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* TAXONOMIC NOTE: *Calamagrostis canadensis* (bluejoint) in this report refers to the species in the broad sense which occurs over most of North America, northern Europe, and northern Asia (9).*** Considering more critical subspecific taxa, the grass in the coastal region of Alaska is recognized as *C. canadensis* subsp. *langsdorfii* by Hulten (9) and as *C. canadensis* var. *scabra* by Hitchcock (8). The range of this taxon in Alaska reaches northward to the central part of the state and overlaps that of the interior form which ranges northward to the Brooks Range. The latter is recognized by Hulten (9) as *C. canadensis* subsp. *canadensis* and is given full species rank by Hitchcock (8) as *C. canadensis*. The latter differs from the coastal form in being a shorter plant with smaller panicles and florets and narrower leaves.

** This report has been prepared, and a portion of information in it derived, under a project supported in part by funds from The Rockefeller Foundation (Grants RF-58108 and RF-61036).

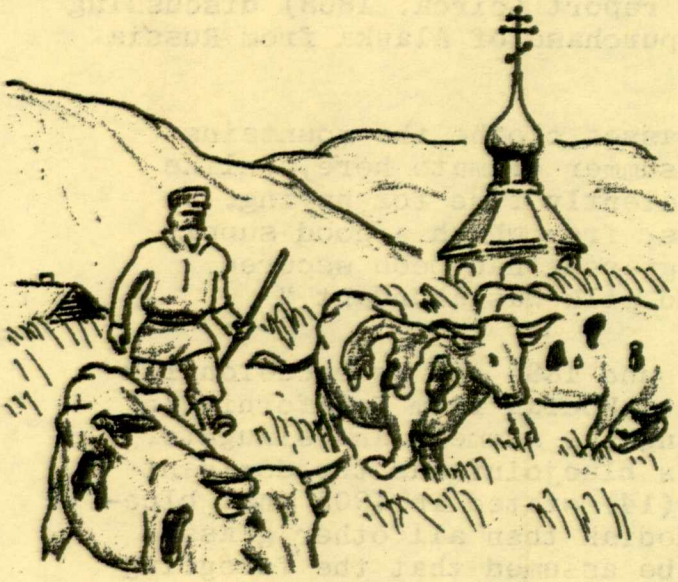
*** Numbers in parentheses refer to sources of information in numbered references at the end of this report.

There has been much interest in the extensive stands of native bluejoint grass that occur throughout the southern coastal region of Alaska and sporadically elsewhere in the state. Interest usually involves speculation on how these grasslands can be utilized as forage for livestock. This report has been prepared in response to many inquiries and summarizes much of what is known about bluejoint. The report provides a background of information that can assist in assessing in a general way the potential value of native stands of this grass. Additional experimental studies are currently underway on the management of bluejoint as a forage crop. Results derived from these and future investigations will contribute further information toward intelligent utilization of this grass resource.

DESCRIPTION Several species of Calamagrostis are native to Alaska and most are widely distributed in the state. The grasses in this genus are referred to as "reedgrasses" and bluejoint is the most widespread and abundant of this group. Bluejoint has been also referred to variously as "marsh reedgrass", "bluejoint reedgrass", and "bluetop" in addition to its preferred common name. Also, it has been erroneously called "redtop" but this is the accepted common name for an altogether different grass (Agrostis alba).

Bluejoint is an extremely winterhardy, perennial grass that spreads to a limited extent by underground rootstocks. It is uniquely adapted to the cool growing seasons and relatively abundant rainfall characteristic of the rangelands adjacent to the Gulf of Alaska. Bluejoint thrives in this environment and is especially abundant in the coastal region from Yakutat westward into the Aleutians. Often reaching 4 to 6 feet in height in favorable locations, bluejoint is present in considerable abundance in many different types of plant communities ranging from coastal lowlands to low alpine habitats. It is present in open meadows, intermingled with shrub species, and in open forests (7).

Seed heads have a purplish color when they first appear but they later turn gradually to tan. The heads are from 4 to 10 inches long. Bluejoint possesses an unusual stem growth characteristic found in only a very few other grasses--the development of short, leafy branches from the nodes (joints) along the stem (in addition to the single leaf that originates from each stem node in grasses).



HISTORY The first accounts of utilization of native grasses in Alaska were recorded when the area was being explored and settled by the Russians. Bancroft (4) reports that early Russian settlers possessed cattle in Alaska as early as 1795 on the islands of Kodiak and Unalaska. In 1833 the Russian American Company is said to have had at least 220 head of cattle in Alaska. Another source reports that about 300 cattle were maintained on northeastern Kodiak Island from 1795 to 1868 by the same company (11). The only records of crops planted by these early settlers mention vegetables and very limited trials with grain crops. There is little doubt that the roughage requirements of these animals was met by the utilization of native forages, principally grasses. Owing to its present and former abundance in the region occupied by the Russians, bluejoint undoubtedly served as a dominant source of forage. Dall (6) in 1870, intimately familiar with Alaska's seacoast and major rivers, commented regarding bluejoint:

> "The blue joint grass (Calamagrostis canadensis) also reaches the latitude of Kotzebue Sound, and grows on the coast of Norton Sound with a truly surprising luxuriance. It reaches at very favorable situations four or even five feet in height, and averages at least three feet."

Speaking of the settlement of St. (or Fort) Nicholas (now the site of Kenai), Dall quotes from the official report of the Committee on the Colonies to the Emperor of Russia (St. Petersburg, 1863):

> "Among the annual productions of the colony are enumerated 108,000 pounds of salted meat, ..."

Dall also quotes Dr. Kellogg, botanist with the U. S. Coast Survey Exploring Party, in a report (circa. 1868) discussing Kodiak Island following the purchase of Alaska from Russia in 1867:

> "Various herbs and grasses clothe the mountains to their summits. The summer climate here, unlike that of Sitka, is sufficiently fine for haying. We saw many mown valleys, from which a good supply of hay from the native grasses had been secured. The cattle were fat, and milk was abundant."

Bancroft (4) records that around 1885 it was occasionally the practice to ship cattle to Kodiak from California in the spring, fatten them during the summer, and slaughter them in October. Inasmuch as bluejoint was the dominant grass in this region (Piper (14) stated in 1905 that bluejoint was more abundant on Kodiak than all other grasses combined), it can logically be assumed that the foregoing accounts therefore describe the earliest domestic utilization of this grass in Alaska.

Bluejoint, owing to its widespread abundance, provided forage for horses following the importation of these animals in considerable numbers for service in the gold stampedes of Alaska and Yukon Territory near the turn of the century. Many bluejoint meadows were harvested for "horse hay" in areas adjacent to mining activities.

Ross (16) in 1907, referring to haymaking with bluejoint at the Kenai Experiment Station, stated:

> "The native grass, while from three to four feet high, has a slender stalk and is comparatively easy to cure."

Irwin (10), in a summarization of experience with forage crops in Alaska prior to 1945, reported that considerable quantities of bluejoint hay were harvested at the Kodiak Experiment Station prior to the massive volcanic ash deposition there in 1912. In the years 1909, 1910, and 1911, bluejoint hay harvests totalled 75, 85 and 100 tons, respectively.

CURRENT UTILIZATION Pownall and Tye (15) reported in 1960 (the last year in which harvested native grass hay in Alaska was summarized separately from seeded cropland hay) that approximately 600 acres of "native" grass hay were harvested in Alaska. The percentages of this acreage harvested in different areas of the state were as follows:

Kenai Peninsula	44%
Southeast Alaska	30%
Tanana Valley	13%
Matanuska-Susitna Valleys & Anchorage	8%
Kodiak and adjacent islands	5%

The yield from this acreage was estimated to be 500 tons, or slightly less than one ton per acre. Although "native" grasses include other species in addition to bluejoint, it is without question that this class of hay consists predominantly of bluejoint.

The U. S. Bureau of Land Management reported (18) that approximately 1.66 million acres of Alaskan rangeland were under lease for grazing purposes in 1961, most of which was in the Southwestern portion of the state. They also reported that bluejoint is one of the dominant forage species on this leased range supporting 3670 head of cattle, 460 horses, and over 14,000 sheep.

RANGELAND HAZARDS Poisonous plants are frequently encountered in Alaska's native grasslands. Several species of plants in these grasslands are known to be toxic to livestock and others are suspected of being poisonous without the existence of conclusive evidence in this regard. Native Alaskan plants known to be poisonous include larkspur (Delphinium glaucum), 3 species of waterhemlock (Cicuta spp.), and 2 species of arrowgrass (Triglochin spp.). Other plants frequently present in native grasslands and which are suspected of being toxic to livestock include false hellebore (Veratrum eschscholtzii) and monkshood (Aconitum delphinifolium).

Although plants known to be poisonous are widespread on many stocked range areas, actual instances of poisoning are relatively rare except at times of the season when non-poisonous forage is in scarce supply. Waterhemlock is especially dangerous in spring when its new growth can attract livestock before grasses become abundant. The arrowgrasses inhabit tide flats and other lowland areas and are believed to be most dangerous after the first frosts at the end of the growing season.

Intestinal impaction caused by incidental ingestion of large quantities of old, dead grass when cattle are grazing new grass in early spring can also be lethal.

Predatory animals present another hazard to livestock on native grasslands in certain areas of Alaska. Coyotes and foxes are responsible for some losses of sheep. Bears present the greatest predatory hazard to cattle on the Alaskan mainland and islands such as Kodiak where some stock is lost to bears every year. Many smaller islands are free of bears, however.

RESEARCH FINDINGS · Major emphasis in crops research in Alaska has been directed toward evaluation, management, and improvement of introduced species and varieties for use on arable cropland. Consequently, relatively little research information has accumulated that relates to the utilization of native grasslands, including those dominated by bluejoint. When present knowledge is summarized, however, certain concepts concerning bluejoint utilization can be set forth quite clearly.

Forage Quality

A report by White (20) in 1927 from the Matanuska Experiment Station relates:

> "It is common practice in parts of Alaska to delay cutting the native grasses until late in the summer on the assumption that a higher yield will be secured and that the hay will have a higher feeding value than if cut earlier. Often rains set in in August and September, and curing hay is very difficult. In order to determine the best stage of growth of bluetop (bluejoint) for making hay, samples of the grass were cut at weekly intervals from May 21 to November 12, air dried, and analyzed for the usual feeding-stuffs data ...(by) the Bureau of Chemistry and Soils, U. S. Department of Agriculture...the native bluetop grass attained its average height in 1927 by July 9, when the plants were 30 to 48 inches tall, were in advanced stage of blooming, and the lower part of the stems was becoming woody. Seed formation was beginning July 23, when the lower third of the stems had become hard. From that date the crude fiber increased rather regularly because of the greater hardening of the stem. Early in August the seeds began to shatter, and by August 20, 75% of the seed had fallen from the plants. This, in part at least, would account for the quite general lowering of the protein content. Rains and

cloudy days set in in August and continued through September, and haymaking then would have been very difficult. The analyses of the samples harvested late in the fall would indicate a very low feeding value.

"No palatability or digestion experiments were carried on nor were data obtained on comparative yields. Considering the stage of growth of the plants and their composition, the period from June 25 to July 30 would appear to be the best for haymaking. This is usually a period of light rainfall and clear weather, which should be taken advantage of for haymaking."

The following table was published in conjunction with the above report:

TABLE 1.—*Analysis of native bluetop grass, Calamagrostis sp., cut at different stages of growth at the Matanuska station*

Sample No.	Date of harvesting	Height of plants	Description of sample	Loss of weight in air-drying	Air-dried samples				
					Water	Fat	Crude fiber	Protein N×6.25	Ash
	1927	*Inches*		*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
1	May 21	4–10	Practically all leaves	72.7	5.2	3.9	20.0	27.20	10.0
2	May 28	10–14	Stems 4 to 10 inches	77.5	5.3	3.4	25.0	21.05	9.3
3	June 4	10–16	Stems 5 to 12 inches	71.0	5.4	3.1	26.1	18.56	9.5
4	June 11	12–24	Stems 10 to 20 inches	79.1	5.3	2.1	29.1	18.75	9.1
5	June 18	18–26	Stems 10 to 24 inches; heads breaking from boot	69.2	5.1	1.9	34.2	11.25	6.9
6	June 25	24–36	About half heads out of boot	72.2	4.9	1.7	36.4	10.69	6.1
7	July 2	30–38	Half heads purple; 90 per cent headed	74.1	4.8	1.6	38.8	9.26	5.6
8	July 9	30–48	Fully headed, pollen dropping	57.4	4.9	1.8	36.2	6.94	5.0
9	July 17	(1)	Advanced blooming stage; lower stems woody	52.3	5.0	1.6	38.4	5.37	4.4
0	July 23	.....	Seeds forming; few heads in bloom; lower stems woody	56.2	4.8	1.7	35.6	7.31	5.9
11	July 30	.....	Half heads formed seeds	48.6	4.8	2.2	35.7	5.50	4.8
12	Aug. 6	.....	All seeds formed; 5 per cent heads dropped seeds	41.8	5.0	1.6	35.9	5.18	4.1
13	Aug. 13	.....	Seed shattering; lower leaves drying and dropping	39.5	4.8	1.3	35.7	4.37	4.2
14	Aug. 20	.....	75 per cent seed dropped; many heads broken	(2)	5.1	1.5	34.1	3.93	4.0
15	Aug. 27	.....	Seed practically all shattered; many heads dropped	(2)	.....	.8	34.6	3.93	6.0
16	Sept. 3	.....	All seed dropped; lower leaves off; lower stem woody	(2)	5.0	1.8	36.8	4.18	3.7
17	Sept. 10	.....	10 per cent stalks broken	(2)	5.0	1.8	38.8	2.62	4.9
18	Sept. 17	.....	Grass dead from frost; many heads whipped off by wind; stalks broken	(2)	4.8	1.8	40.8	1.93	5.3
19	Oct. 1	.....	Grass brittle; leaves frosted, ready to fall	(2)	5.1	1.6	44.5	1.37	5.6
20	Oct. 15	.....	Grass heavily frosted; brittle leaves dropping rapidly; stalks woody and stiff	(2)	4.9	1.7	41.7	1.50	6.1
21	Oct. 29	.....	Heavy freeze; grass breaking; seed all dropped	(2)	4.8	1.9	42.3	1.81	5.3
22	Nov. 12	.....	Leaves practically gone from lower three-fourths of stalk	(2)	4.6	1.5	41.9	1.25	5.5

[1] Plants after this date were of mature size.

[2] Rainy weather made it impracticable to determine water loss in drying.

Alberts (3) in 1933 discussed the use of bluejoint for hay in the Matanuska Valley:

> "The first hay in the region was made from native grasses, which consist principally of bluetop (bluejoint). When cut about June 25, or when the heads are approximately half out of the boot, these grasses make a hay of fair quality for horses. The hay may also be fed to cattle, but it is not recommended for such use. When cut at a late stage, the grasses are woody and low in palatability....Native bluetop grass yields approximately one ton of dry matter per acre at its first cutting. The yield generally decreases considerably the second year, and in succeeding years is too low to be cut profitably. The native grasses are not a dependable source of hay."

> "Native grasses for hay should be cut when heads are 50 percent out of the boot. Earlier cutting results in lower yields. When cut later, the grasses will be high in percentage crude fiber and low in percentage of digestible nutrients."

A report from the Soviet Union (13), in referring to the economic importance of bluejoint, relates:

> "In Siberia and the Far East it constitutes an important part of hay for storage. The quality of hay prepared before flowering (pollen dispersal by grass heads) is satisfactory, later poor."

Response to Harvest and Fertilizers

Attempts have been made in recent years in Alaska to obtain meaningful data on the productivity of stands of native bluejoint and on the response of this grass to management, including times and frequency of cutting and fertilizer applications.

An experiment was initiated in 1952 by Dr. W. M. Laughlin on a lowland area dominated by bluejoint near Eklutna, Alaska. The grass was harvested twice during 1952 following spring topdressing of fertilizers. Topdressings were applied on May 14, 1952. Rates of N-P_2O_5-K_2O applied in terms of pounds per acre were: 0-0-0, 0-0-40, 0-80-0, 60-0-0, 0-80-40, 60-80-0, 60-0-40, and 60-80-40. Grass harvests were made June 18 and August 14. Grass from the various treatments was analyzed for protein content following harvest in June but not after the August harvest. Data from this test are summarized in the following table:

Table 2. Data from lowland bluejoint stand near Eklutna cut twice in 1952. Each value represents average of 16 determinations.

Fertilizer applied (lbs. per acre)	Dry matter harvested (tons per acre) June 18	Aug. 14	Total	Percent crude protein (dry matter basis) June 18	Crude protein yield (lbs. per acre) June 18
Nitrogen	(Influence of nitrogen over all levels of P_2O_5 and K_2O)				
0	0.45	0.80	1.25	13.78	124
60	0.57	1.22	1.79	17.16	196
P_2O_5	(Influence of phosphorus over all levels of N and K_2O)				
0	0.52	1.00	1.52	15.57	163
80	0.50	1.02	1.52	15.37	157
K_2O	(Influence of potassium over all levels of N and P_2O_5)				
0	0.52	1.01	1.53	15.64	166
40	0.50	1.01	1.51	15.30	154
Least significant difference: 5%	0.06	0.09		0.85	14
1%	0.08	0.13		1.16	20

Application of 60 pounds of nitrogen per acre resulted in highly significant increases in the forage dry-matter yields in both cuttings and in the crude protein content and yield in the first cutting. The influence of fertilizers on protein content and yield in the August cutting is not known because analyses were not conducted on this forage. Applications of phosphorus and potassium had no effect on the yield or protein content. The second cutting yielded approximately twice as much forage as the first cutting. The grass regrowth was uniformly poor in 1953 regardless of fertilizer treatment and so the study was discontinued. Because all plots were cut twice in 1952, nothing is known of what the influence of one cutting would have been on stand or yield of bluejoint the following year.

Somewhat similar results were noted in 1958 in an experiment initiated by the senior author to study the influences of several schedules of harvest on native stands of bluejoint. In order to have an adequate area of reasonably uniform grass stand for the study, it was necessary to establish replications in three separate areas--one at the Matanuska Farm, another within the Palmer city limits, and the last along the Glenn Highway north of Palmer. These areas were typical of other native bluejoint stands with uniform, tall growth from many individual tussocks. The hummocky nature of these stands and the presence of a considerable accumulation of undecomposed old plant debris required that the forage be harvested with hand sickles. A 10 to 12-inch stubble was left. Twelve 10 by 10-foot plots were harvested at each location on July 21, 1958 when the grass was well headed. No topdressings had been applied prior to harvest. Data concerning forage yields are presented in Table 3.

Table 3. Data from bluejoint harvest on July 21, 1958, in three areas near Palmer, Alaska. Each value represents average of 12 plots.

Plot area	Forage yield (tons per acre) green	oven-dry	Percent dry matter	Protein percent	lbs. per acre
Matanuska Farm	5.567	2.076	37.29	8.35	347
Palmer	3.771	1.398	37.08	8.00	280
Glenn Highway	4.584	1.676	36.56	9.88	331
Avg.	4.641	1.717	36.98	8.74	319

This study was discontinued when it became obvious that one replication (farm) contained a considerable quantity of bromegrass. The brome was not evident in the tall-growing bluejoint prior to initiation of the study when the area was under a status of relatively low soil fertility. However, the presence of bromegrass became apparent by its marked regrowth (fertilizer was applied immediately after plot harvest) in comparison to the almost negligible regrowth of the bluejoint.

Referring to the failure of bluejoint to tolerate the intensity or frequency of defoliation that is customarily imposed without harmful effects on cultivated grasses, Aamodt and

Savage (2) stated in 1949:

> "Local experience and observation (in Alaska) indicate that bluetop (bluejoint) plants are rapidly reduced in vigor by successive annual mowings or continuous grazing. Rotational use of the grass is indicated as a desirable practice. The inability of bluetop and other native grasses of Alaska to withstand close and frequent use is undoubtedly the result of the conditions under which they have evolved. These plants, unlike those of the Great Plains, have had no opportunity to develop resistance (tolerance to harvest) through generations of use by buffalo or domestic livestock."

In 1960 an area of native bluejoint on the upper benchland near Homer was topdressed in spring for observational purposes by Ed Liebenthal, District Agricultural Agent. Four levels of fertility were compared utilizing the following rates of N-P_2O_5-K_2O in terms of pounds per acre: (1) 0-0-0, (2) 44-20-20, (3) 110-50-50, and (4) 220-100-100. On July 19, 1960, when the grass was beginning to head, only slight differences could be noted among treatments. This relatively poor response of bluejoint in a typical native stand to considerable quantities of fertilizer has been noted in several other instances. Views proposed to explain this negligible response of bluejoint to fertilizers include the following:

(a) Applied fertilizer becomes incorporated into the decomposition of the abundant plant debris present on the soil surface in native bluejoint stands so that little reaches the plant roots to become available to the living grass;

(b) Soil fertility present prior to topdressing is essentially adequate for maximum expression of the growth potential of the grass;

(c) Because it is typically not harvested, the grass functions as a "closed system". As such it transports for storage in the roots and crowns most of the nutrients that will be required for growth the following season before topgrowth deteriorates in a given season. Growth during the following season would then be produced primarily from nutrients stored in underground parts with relatively little reliance on nutrients extracted from the soil; or

(d) Bluejoint is less demanding of soil fertility for a given amount of dry matter production than other grasses.

The first hypothesis (a) cited above undoubtedly plays a dominant role in suppressing fertilizer response in bluejoint stands. The second (b) is probably in error because these soils require liberal applications of fertilizer for crop production when tilled. Little is known regarding the third hypothesis (c) except that it cannot serve to explain poor response to fertilizers after the grass has been harvested several times.

An experiment was devised by the senior author which, among other objectives, served to test the validity of the latter possibility (d) mentioned. Seeds of bluejoint and four "tame" or cultivated grasses (smooth bromegrass, Kentucky bluegrass, reed canarygrass, and meadow foxtail) were germinated and placed into pots containing vermiculite. The pots were watered with a nutrient solution formulated to supply the following rates of N-P_2O_5-K_2O in terms of pounds per acre: 20-10-10, 100-50-50, and 200-100-100. All pots were supplied equally with other mineral elements necessary for plant growth.

After approximately two months of development in a lighted growth chamber, the topgrowth of all plants was harvested and dried to constant weight. At the lowest fertility level, all grasses made poor but approximately equal growth as measured by dry weight of leaf and stem tissue produced. Response of bluejoint to the medium and high fertility levels, as measured by dry matter production in excess of that produced under low fertility, was approximately equal to bromegrass and meadow foxtail, greater than bluegrass and less than reed canarygrass. These results indicate that bluejoint is roughly comparable to cultivated grasses in its growth response to different levels of the major elements necessary for plant growth. It appears, therefore, that the relatively poor response of bluejoint to fertilizer topdressings in native stands is due to applied fertilizers becoming incorporated into the undecomposed plant debris on the soil surface. More recent investigations, not yet completed, support this view. Bluejoint has shown considerable response to fertilizer applications where the mantle of undecomposed plant debris has been removed by shallow blading with a bulldozer.

In summary, the limited observations cited permit certain generalizations regarding the response of bluejoint to harvest and fertilizers. The grass will not persist if harvested more frequently than once annually. Native stands that possess a considerable accumulation of undecomposed plant debris are not likely to respond well to applied fertilizers.

A recent report by Corns and Schraa (5) described a 3-year study conducted on a lowland stand of bluejoint near Edmonton, Alberta. They reported on the seasonal productivity of the grass, its chemical composition and response to one rate of fertilization compared with no topdressing:

(a) Bluejoint yielded less when cut more times than once per year (single cutting was at the end of the season). Yields were reduced 15 to 20% with two to four cuttings, 35 to 45% with five to six cuttings, and about 70% with seven cuttings.

(b) Percentage nitrogen in forage declined progressively throughout the season (crude protein content varies in direct relationship to nitrogen content).

(c) Fertilizer (32-40-0 per acre) did not influence the percentage nitrogen in the forage but resulted in greater yields of nitrogen because of increased forage yields.

(d) Fertilizer approximately doubled the percentage of phosphorus but had no effect on percentage of crude fiber or calcium in the harvested forage.

(e) Fertilizer increased forage yields (1) by 46% when bluejoint was harvested twice annually--late June or early July + late August or early September, and (2) by 55% when bluejoint was harvested once annually in late August or early September.

Seeds and Seeding

Seeds of bluejoint are among the smallest known for grasses, numbering approximately 3.7 million per pound (12). No seed stocks of this grass are available commercially. A bristly ring of stiff, divergent hairs arises from the base of the tiny pair of hulls that encloses each bluejoint seed (see Figure 1). These bristly hairs serve a useful purpose in nature. They assist in freeing the caryopses (seeds) from the seed heads when the hairs dry, stiffen, and spread apart at maturity. Moreover, they are effective in holding the very small, lightweight bluejoint seeds aloft in air currents and in causing them to be disseminated widely by winds. However, these hairs cause seed threshed in a typical cylinder-concave thresher to be a lightweight, fluffy mass that clings

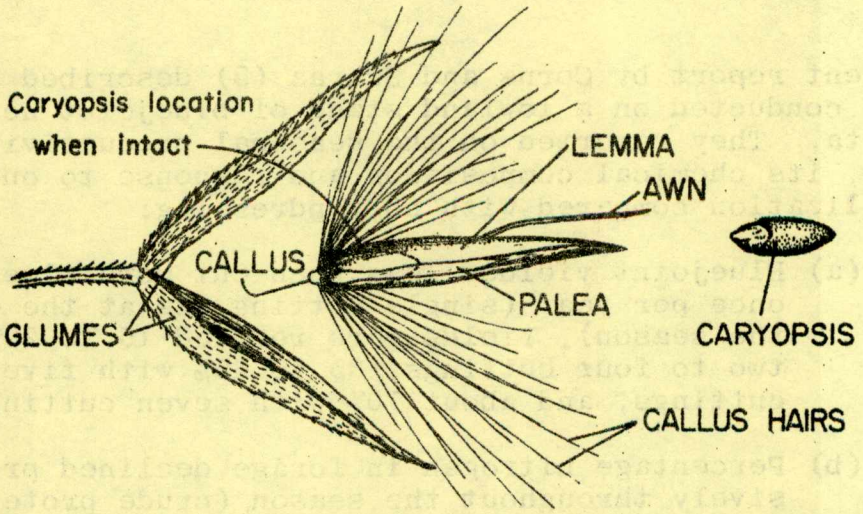


Figure 1. Components of an individual spikelet of bluejoint showing lemma-palea-caryopsis unit as it appears when released from glumes and naked caryopsis as it appears after release from lemma and palea.

From The Journal of Range Management, Volume 15, Number 4, July, 1962.

together and is unsuitable for seeding by conventional means (12). C. I. Branton, Agricultural Engineer at this Station, has devised successful means for threshing bluejoint seed free of the undesirable, bristly hairs (12). Successful threshing was accomplished by using either a hammer mill or a threshing machine with rubber-covered rasping bars.

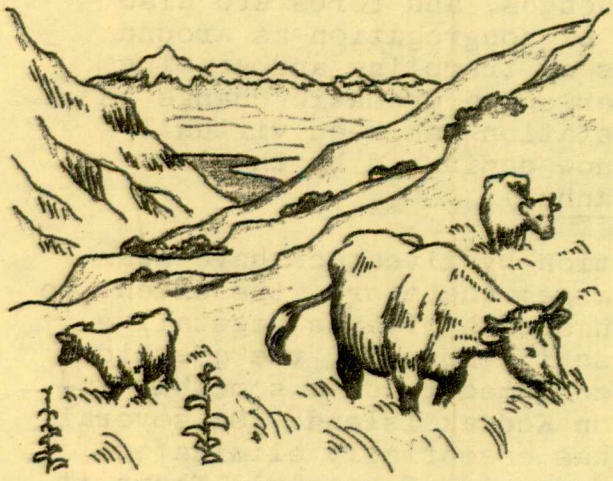
Irwin reported (10) that bluejoint has been planted successfully by harvesting entire heads of the grass, when seed was ripe but before it shattered, and scattering the heads onto a seedbed.

Vigor of bluejoint seedlings in comparative plot seedings in 1963 was vastly inferior to cultivated grasses including timothy and bromegrass. On the basis of present knowledge of the agronomic characteristics and nutritional value of bluejoint, seeding this grass for forage is not considered worthwhile in Alaska. Practical considerations dictate that whenever efforts and expense have been put forth to prepare a seedbed for a forage grass, more desirable grasses should be planted in preference to bluejoint. Attention should certainly be directed toward the intelligent utilization for forage of the native stands of bluejoint already in existence but more desirable forage grasses should be planted on arable cropland. Planting of bluejoint may become a desirable practice, however, for conservation or other purposes.

FACTORS AFFECTING UTILIZATION Many considerations must be weighed to arrive at a logical and well conceived approach to the utilization of bluejoint. Where bluejoint range serves only as a supplement to a livestock enterprise based primarily on tilled cropland, relatively less dependence and less consideration need be devoted to the native grass as a forage source because other sources are at hand whenever required. However, as the location and orientation of a livestock enterprise places the primary dependence upon native bluejoint forage, the potentialities and limitations of this grass species become more vividly important.

Grazing

Bluejoint declines rapidly in quality following heading. Thereafter, during the growing season and particularly during winter, it serves as a poor source of pasture forage. Poor animal performance is the result when bluejoint in advanced stages of maturity is the sole source of nutrition. However, cattle fare much better when pastured on mountain slopes and mountain meadows dominated by bluejoint where the grass reaches maturity later in the season with increasing elevation. Cattle on such ranges are thus able to obtain more immature and thereby higher quality forage over more of the growing season.



One method that has been used to improve the palatability, nutritive value, and consumption of rank, mature forage is to spray it with molasses. Molasses and molasses-urea sprayed on such forage in California (19) resulted in complete forage utilization and superior animal performance in comparison with untreated grass. However, this practice was successful only during a period of no precipitation. Dew and rainfall caused the soluble sprayed materials to be washed from the plants. The frequency and quantity of precipitation during the latter half of the growing season in the areas dominated by bluejoint in Alaska would tend to impose serious limitations on this practice.

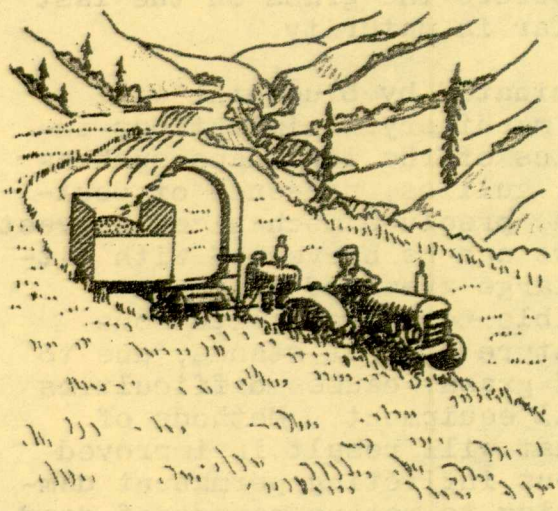
The regrowth of bluejoint available in late summer (following harvest of a grass crop in late June or early July) is for some reason quite unpalatable to cattle even though it is leafy and appears to be of good quality. Regardless of the reason for its lack of palatability, this regrowth should not be grazed or harvested if bluejoint stands are to remain productive. The regrowth must be left intact for food manufacture by the grass, recovery of vigor, and preparation for winter. One harvest annually is apparently the maximum frequency that bluejoint will tolerate. More frequent harvest will result in loss of the grass stand. Some reports indicate that with unfertilized stands, best utilization commensurate with stand maintenance is accomplished by harvesting only once every second year.

W. J. Sweetman (17), Research Animal Husbandman at this Station, reports very satisfactory rates of gain for cattle stocked on mountain slope range in the Little Susitna Canyon area of the Talkeetna Mountains. Over a number of years heifers and steers on this range have averaged 1.8 and 2.2 pounds of gain per day, respectively. Cattle are trucked to the range in spring and removed in late summer or fall. Salt is the only item supplied in addition to the native range forage. Although bluejoint is the dominant grass over most of this range, other grasses are present including alpine timothy (Phleum alpinum), mountain hairgrass (Deschampsia atropurpurea), native bluegrasses (Poa spp.), altai fescue (Festuca altaica), and native bromegrasses (Bromus spp.). Many rushes, sedges, and forbs are also available for grazing. Areas of congregation as around salt blocks, where the effects of trampling and grazing have been excessive, have undergone a dramatic change in vegetative cover. Native vegetation has been virtually eliminated. These areas are now dominated by the low-growing annual bluegrass (P. annua).

No studies of species utilization by livestock have been conducted on native Alaskan range; therefore, the extent to which bluejoint is utilized in such a diverse vegetative community is not known at present. However, the question of the extent to which it is consumed finds a somewhat indirect but convincing answer on Kodiak Island. On several leased ranges there, grazing has essentially eliminated bluejoint from areas that it dominated formerly. There it has been largely supplanted by grasses that differ morphologically from bluejoint in that they possess an abundance of basal leaves. These grasses, principally hairgrass (Deschampsia sp.) and fescue (Festuca sp.), are less susceptible to total defoliation by grazing than is the tall-growing bluejoint.

Mechanized Harvest

Some stored roughage such as hay or silage is required for winter feeding in all areas of Alaska. The quantity required varies greatly throughout Alaska. The length of grazing season that prevails in each geographical area governs the amount of stored roughage that must be fed during the infeeding period. Much less stored winter feed is required, for instance, in the southwestern islands, where cattle can graze 10 to 11 months, than is necessary in more interior areas. Almost all areas of the mainland, however, excepting the outer reaches of the Alaska Peninsula, require feeding of stored roughage for a minimum period of 7 to 8 months. The necessity of providing winter feed and the amount that can be harvested will govern the size and success of livestock operations dependent upon bluejoint for roughage.



Roughage of good quality is required in any successful livestock enterprise. Early season growth of bluejoint presents grass of good quality up until the time that it heads. Thereafter until the following spring it provides forage of inferior quality. It therefore seems desirable in an operation that depends on bluejoint as a major forage source to place emphasis on harvesting large quantities of the grass at the most desirable stage of growth. The forage can be preserved as hay or silage. The amount harvested will of course be limited by needs, harvestable stands of the grass, and labor and equipment available. Bluejoint should be harvested:

(a) before quality (which declines with advance in maturity during the season) becomes inferior,

(b) when yields are substantial but not at maximum (highest yields will be obtained when the forage is no longer of good quality), and

(c) when the grass can withstand harvest without detrimental effect to vigor and persistence of the stand.

Considering all 3 of the preceding criteria, bluejoint should be harvested not earlier than when the grass is in the boot stage (heads in the uppermost leaf sheath prior to emergence) and not later than when the grass has reached fully headed stage. Optimum stage for harvest is probably at the time that heads are appearing in the stand. However, the time required to harvest a large acreage will require that harvest begin somewhat prior to heading stage so that harvest is completed before the grass on the last acreage cut has advanced too far in maturity.

The vast majority of areas dominated by bluejoint will never be suited to harvest by machinery. Limitations imposed by surface characteristics of the landscape such as inaccessibility, steep slopes, gullies, presence of boulders, poor drainage, and so on, preclude mechanized harvest. However, some bluejoint meadows can be harvested with little difficulty. In addition large areas of bluejoint rangeland can be made susceptible to harvest with some modification. The hummocky nature of most stands, due to the large individual clumps of grass, causes difficulties in harvesting with conventional equipment. Methods of treatment must be evaluated that will result in improved trafficability of stands without inflicting permanent damage to the grass. Close clipping to remove mounds of dead grass with a flail-type chopper, followed by burning of the trash may prove beneficial. Shallow shearing just above frozen soil with a dozer blade in very early spring will remove hummocks and also much of the surface mat of organic debris. This method has been used successfully by John Nash on his farm in the Matanuska Valley. After scattered trees, brush, and the surface mat of old grass debris were bladed off, the bluejoint sod "filled in" to become a uniform stand of grass. This type of blading, if accomplished without undue harm to the grass, will vastly improve trafficability of grass stands with harvest machinery. Moreover, applied fertilizers will then become available to the living grass instead of becoming incorporated into organic debris on the soil surface.

In undisturbed stands of bluejoint, presence of the mat of thick, undecomposed organic debris on the soil surface is detrimental for another reason. It functions as insulation that slows the thawing of soil in spring. This deterrent to warming of the soil therefore delays spring growth of bluejoint.

SUMMARY CONSIDERATIONS Information presently available on the value of bluejoint as a forage grass is limited in extent, often vague and inconclusive. Conflicting conclusions may occasionally be drawn from separate sources of evidence. More research is needed. However, the information at hand provides some insight regarding this grass resource in Alaska.

Bluejoint possesses certain characteristics that favor its use as a forage crop. These include:

- the reasonably good forage quality of the grass during early stages of development and the tendency of the grass to cure easily as a hay crop,
- the tall growth habit of bluejoint contributing to ease of harvest with machinery and better forage yields than from most other native grasses.

Bluejoint also possesses certain inherent shortcomings that have prevented its widespread acceptance and utilization as a forage grass. These include:

- the inability of the grass to persist and remain productive under intensities of grazing or frequencies of harvest commonly imposed on "tame" forage grasses,
- the early and rapid decline in forage quality of bluejoint as it advances in maturity during the season, and the low level of quality of the grass as a forage after it has headed.

Certain factors above and beyond the intrinsic characteristics of the grass itself influence the utilization of bluejoint. Some of these have a favorable influence and others have a restrictive effect. Among the favorable aspects are:

- the widespread presence of bluejoint in vast acreages presenting an extensive crop resource that does not require forest removal, tillage, and planting operations,
- the low cost involved in the utilization of accessible bluejoint range areas whether the grass is harvested for storage or grazed by livestock,

- the tendency for bluejoint range to extend from bottomland to well up on mountain slopes thereby enabling livestock to continue to graze the immature, higher quality forage throughout much of the growing season as the grass matures later in the season at progressively higher altitudes.

Some factors that impose restraints on the utilization of native stands of bluejoint include:

- the occurrence in native grass stands of various woody species and untraversable terrain owing to streams, rocks, water seeps, steep or uneven land surface preventing machine harvest of large, continuous tracts of grass,

- the distant location of much of the native grass acreage far from areas of present agricultural development and far from marketing centers for livestock and livestock products,

- the relatively poor response of unmodified stands of the grass to applied fertilizers because nutrients become incorporated into the accumulated organic debris,

- the occasional occurrence, in native bluejoint stands, of plants that are poisonous to livestock if consumed,

- the hazards of predatory animals such as the brown bear in many rangeland areas.

As much as possible of the bluejoint required in a livestock enterprise should be harvested for preservation as hay or silage at about the time that heads appear. Modification of stands to remove sod hummocks and other obstacles to mechanized harvest is frequently necessary. Removal of accumulated organic debris appears mandatory if fertilizers are to be useful. For persistence and continued productivity, bluejoint should not be harvested more than once annually.

From the standpoint of conservation, the extensive, presently unutilized areas of bluejoint rangeland in Alaska fulfill an important role in stabilizing and maintaining soils safely intact from the effects of wind and water erosion.

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