Agroborealis

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Alaska Agricultural Experiment Station
University of Alaska

A Review of Some Research in Progress

from the

Director's Desk . . .

There is nothing wrong with being rich! In fact, we Alaskans are finding the prospect quite delightful. But that's really not what brought us here in the first place. Most of us came looking for things money can't buy: air so pure that on most days you can see the mountains a hundred miles away, streams clean enough to drink from, rivers leaping with salmon, herds of wild animals and great flocks of birds; a chance to see eagles soaring, to watch the aurora, perhaps to hear wolves howl; the feeling that possibly no one has ever seen the other side of that hill, that maybe if we dug a hole right here we'd uncover gold. We came in search of a place where there are still many things undone, where there are questions still to be answered. We came in search of what Matthew Arnold called, "The Glory of the Imperfect," hoping to be able to add our own contribution. Above all, we came believing that someday our children would say, "Aren't we lucky to be living here, Dad?"

Director Horace F. Drury

The point of all this is that money is not the first thing Alaskans think of. More than most people, they are concerned with the "quality of life." They have proven this by their willingness to pay high prices, to put up with all sorts of inconveniences, and even to endure separation from friends and relatives in the lower 48, all for the sake of being able to live here. They find the oil bonanza very exciting but they would have continued to love Alaska just as much without it.

We are all having a fine time leafing through the catalog and deciding what to do with $900,000,000 and even more. We haven't mailed our order in yet but it already seems clear that most of us want to use the money to protect and enrich the Alaskan flavor of our lives still further. May I suggest that it would be hard to think of a more worthy and promising project for this purpose than the encouragement of Alaskan agriculture?

Alaska could continue to get along without farmers. We've managed to survive with very few of them for a long time now. And no one claims that farming will ever rank as one of the top sources of income in the State. But agriculture is capable of providing a good living and a satisfying way of life for many families. In addition, the processing, storage, and distribution of its products as well as the furnishing of its supplies would support a lot of other people.

But more important than this, an agricultural industry of our own could raise the standard of living for every one of us by lowering prices and improving the quality of our food. Already milk, meat, and many vegetables are being produced here at least as cheaply as they can be shipped in from "Outside." The local products are always fresher and often, like the famous Matanuska Valley peas, they are of better quality to begin with. Our farmers should be able to supply the whole market for their products in Alaska and cut prices at the same time, while contributing enough to our economy to justify every cent we invest. Finally, remember that agriculture encompasses more than just farming. In addition to economic benefits, it can provide the means for beautifying roadsides, parks, and lawns and increasing the enjoyment which Alaskans, more than almost any other people, seem to derive from their gardens.

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ABOUT THE COVER . . .

Pictured on the front of this issue of Agroborealis is a mink from the Petersburg Fur Station in Southeast Alaska. The photograph was made by Editor William L. Fox and is part of a picture-story feature which appears on Pages 11-13.

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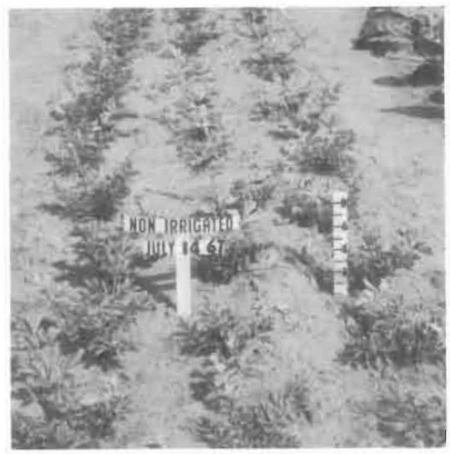

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A Scientific Tour of Pipeline Route

WILLIAM W. MITCHELL
Associate Professor, Agronomy

Anyone traversing the proposed Trans Alaska pipeline route would be privileged to view most of Alaska's principal physiographic regions and a major sampling of its flora. It would be a memorable experience.

This experience was afforded a group during the past summer when TAPS, a consortium of oil companies undertaking to construct the pipeline, financed an ecological study along the northern portion of the route. The group included a fisheries biologist, a mammologist, and a botanist[1] with Bryan Sage, a British Petroleum biologist, as project leader.

The Alaska Experiment Station became involved in the study because of its program in identifying and assessing native plant resources, their potential uses, and their position in natural ecosystems. The possible relationship of the pipeline to the environment was considered by studying successional occurrences in plant community development and processes of revegetation on disturbances. Plant materials were collected for further study and testing at the Alaska Experiment Station.

Research workers and explorers who have had to rough it on foot and by boat would have envied the helicopter support and camp catering service provided the group. However, weather, smoke and mechanical difficulties often grounded the helicopter.

The study was conducted out of five campsites from north of Livengood to the North Slope. Camps were located on Hess Creek, about 20 miles northwest of Livengood; on Kanuti Creek, at the base of Caribou Mt. about 40 miles southeast of Bettles; in the Dietrich Valley of the Brooks Range; and at two sites along the Saganavirktok River on the North Slope. One site was at an unnamed lake about 2,900 feet elevation just north of the Brooks Range and the other at Lake 730 (730 feet elevation) on a bluff overlooking Sagwon.

Among the purposes of the overall study was a survey of the flora and kinds of plant communities that the pipeline would traverse. This survey provides the basis for the following account.

The receiving station on the north end of the line will be located on the coastal plain of the arctic tundra in the Prudhoe Bay area. This is a soggy, drab plain dotted with ponds and small lakes. In distant view, its generally featureless surface is broken only by the occurrence of large, peculiar mounds, called pingos, and an occasional oil rig. It is distinguished in aerial view by the overall pattern of polygonal formations. Permafrost is encountered at a shallow depth and ice wedges underlie the margins of the frost polygons. Sedges, cottongrass, a few grasses, and dwarf willows are the most common plants. Among the more colorful plants to occur here are the small, yellow marsh saxifrage and arctic poppy.

The gravelly flood plains of the Saganavirktok River provide some relief from the wet tundra type. The relatively firm surface of the drier flood plains will sustain much more vehicular activity than the wetter tundra types. Plants that characteristically inhabit dry sites occur here, including arctic bromegrass, mountain avens, alpine bearberry, wild sweetpea, vetch, and lichens. Patterned ground also develops in the wetter areas of this bottomland with water sedge the principal species.

The pipeline will leave the coastal plain and enter the foothills province at Franklin Bluffs. These are very picturesque bluffs with prominent cobblestone slopes and should be left undisturbed as a landmark along the route. The uplands of the foothills are vegetated to a great extent with tussocked, cottongrass communities. Through the coastal plains and lower foothills the pipeline will cross land that was never glaciated during the Ice Ages; thus

[1] Dr. Peter McCart, University of Saskatchewan, Dr. Peter Elliott, Okanagan College of British Columbia, and Dr. Wm. W. Mitchell, University of Alaska Agricultural Experiment Station.

plants adapted to arctic conditions survived the glacial onslaught in this important refuge.

The pipeline will pass into glaciated terrain south of Sagwon on higher ground in the foothills. The vegetation here is more variable where plant communities have not reached the more stabilized stage of development as those on unglaciated terrain. Among the more colorful flowers to be seen are bistort, monkshood, dwarf fireweed, several saxifrages, arnica, and cassiope. Dwarf willows are common, a single shoot of one kind being no larger than a small fingernail. One may see the northernmost outliers of green alder and tall fireweed on sheltered slopes and draws above the "Sag" River in the high foothill region.

The pipeline will enter the Brooks Range proper through the Atigun Canyon and ascend a high pass in the neighborhood of some small persistent glaciers. It will cross an alpine heath-and-dwarf birch-type meadow containing a small colony of tall fireweed that is probably near its altitudinal limit at this latitude. Prior to pipeline activity this alpine meadow likely had been visited by only a few men.

After crossing the divide, one encounters the first timber upon descending into the Dietrich Valley. Timberline for white spruce at this northern limit runs at about 2,400 feet elevation on the valley bottom to about 2,800 feet on the slope. Both balsam poplar and alder occur up the valley beyond the white spruce timberline. Migrating caribou have made deep trails through this headwater region. The Dietrich River, frequently muddied by heavy discharges from snow melt and summer thunderstorms, has carved a broad, braided, gravelly stream bed in the valley floor. White spruce, balsam poplar, willow, alder, and tall, shrubby birch have developed on abandoned stream beds. Sedge and cottongrass meadows occur on wetter, poorly drained sites. The pipeline will avoid the bases of the mountain slopes as much as possible, since they are subject to considerable soil movement from frost action and solifluction. Green alder and the beautiful white saxifrage, boykinia, often can be found together on solifluction lobes.

The Dietrich is one of the valleys explored by the intrepid Robert Marshall. Multihued, barren rock faces of the taller, steeper mountains provide a breathtaking contrast to the green vegetated slopes below. Dwarf fireweed adds splashes of color to gravel bars along the river, and tucked away on mossy mats lurks an interesting violet-like plant, the insectivorous butterwort.

The pipeline will encounter the northern outliers of paper birch near Sukakpak Mt. where the Bettles joins the Dietrich River to form the Middle Fork of the Koyukuk River. Small groves of birch trees can be seen on slopes between there and Wiseman. Bluejoint, Alaska's most abundant grass, and tall fireweed become conspicuous in the Wiseman area and southward.

The pipeline passes from glaciated terrain as it leaves the southern flank of the Brooks Range below Wiseman. Upon entering this northern interior region it will encounter its first black spruce stands, commonly found on north slopes and in bogs. However, the pipeline will attempt to avoid the wet permafrost problems generally associated with black spruce by holding to the drier ridges. The interior forested region through which the pipeline will pass for most of its length is dominated by white and black spruce with balsam poplar, paper birch, and aspen developing under certain circumstances. The wetter, poorly drained grounds and drier knobs and bluffs are more or less open.

Though prospectors and others have ventured into the region between the Koyukuk and Yukon Rivers, little is known about this territory. The area generally is a blank on maps showing the distribution of plants found in the interior of Alaska. Southeast of Bettles in the vicinity of Caribou Mt. and Dall Mt. (named after one of Alaska's earliest explorers) the pipeline will cross some sandstone ridges. Prostrate heaths, such as bearberry, crowberry, and blueberry, and low birch, alder, and lichens are common on these ridges and knolls. Occasionally a peculiar fleshy, russet-colored plant, about 4 to 10 inches in height, occurs at the base of alder. The association is not accidental. The plant, called boshniakia, is a parasite on the roots of alder. In the alpine zone of this region on extremely dry, rocky slopes one can find the native carnation with its delicate rose to lavender colored flowers, truly a pleasant surprise in such a harsh environment. Extensive sedge and cottongrass meadows occur in the lowlands draining to the Yukon River.

The pipeline will cross the Yukon just below the Yukon Flats near the outlet of the Ray River. It will head southeastward across rolling hills, passing west of Livengood and keeping north of Fairbanks. The ridges of the highlands will provide it some relief from the deep, wet permafrost situations of the black spruce and cottongrass lowlands; whereas in the Arctic it was the gravelly flood plains that were sought for drier relief.

The generally stunted growth of the trees through this region attests to the

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Campsite near Wiseman Was Made at Base of Sukakpak Mountain

Stretching the Forage Production Season

L. J. KLEBESADEL
Research Agronomist

Alaska's citizens - - including its farmers - - probably live in this northernmost state as a matter of choice. People are drawn here for many reasons; some enjoy the scenic beauty, others believe Alaska is a land of fresh opportunity and still others come to enjoy the wilderness and the unparalleled hunting and fishing that it offers.

Unfortunately, there are a few disadvantages to living in the 49th State. Livestock farmers face the frustrating dilemma created by the long winter infeeding period and the short summer growing season.

Dairymen must supply stored feedstuffs to their herds throughout the cold winter months and then replenish their feeds and forages during a growing season which is relatively short when compared to that in other states.

Matanuska Valley farmers, for example, grow crops during an average annual frost-free period of about 105 days, compared to the 140 - 170 frost-free days available in Iowa. Longer daylight hours in Alaska compensate to some degree, but not entirely.

Recognizing the problem, Alaskan dairy farmers strive to make the most of their growing seasons by using the most up-to-date research information to guarantee a maximum yield of high quality forage crops.

Experiment Station agronomists work closely with the farmers in helping them develop new crops and improve their cultural practices.

In a specific area of research, the Experiment Station is studying forage crops which will begin growth earlier in the spring than forages now commonly grown.

Much progress has been made in this area. One of the earliest spring forages in other areas of North America is winter rye. However, management procedures followed in lower latitudes are of little use in Alaska. In fact, when management recommendations used in more southern latitudes are applied in Alaska, they may doom a crop to failure.

A continuing study at the Alaska Experiment Station has evaluated nine winter rye varieties for comparative winter hardiness. In addition, the effects of different planting dates during August and September have been studied. Winter survival and spring forage yields are the criteria by which rye varieties and planting dates were compared for usefulness and desirability.

A wide range in winter hardiness was noted in the varieties of rye used in the experiments. Several varieties considered to be very hardy in more southern areas winterkilled consistently in the Alaska tests. Caribou, Emerald, Pierre, and Sitnikoff were the most winterhardy of all the varieties tested. No single variety was consistently best in winter survival or in subsequent spring forage production. Several new varieties released recently in Canada, the northern states, or in Scandinavian countries remain to be evaluated in continuing tests here.

Time-of-planting was an important factor influencing winter survival as well as earliness and abundance of spring growth of winter ryes. (Note in the accompanying photo the superiority of the August 9 planting date for Pierre rye over plots of the same variety planted August 23 and September 9). This study revealed that August 10 to 15 was the best time for planting winter rye in south-central Alaska. Farther south in southern Saskatchewan, the recommended time for planting winter rye is September 1 to 10. Still farther south in South Dakota, winter rye does best when planted September 15 to October 1. Optimum planting dates for winter rye differ with latitude because of differences in time of termination of the growing season.

Spring growth of winter rye was ready for pasturing from one to three weeks earlier than perennial grasses in nearby fields and plots. Moreover, spring growth of winter rye can be pastured intensively without regard for recovery considerations necessary in the management of perennial grasses. Because winter rye forage would be needed only during the spring period when other forage sources are in short supply, intensive grazing could bring about a desirable weakening of the rye stand before it was destroyed by tillage.

Winter rye could probably best be incorporated into Alaskan crop rotations by planting in August shortly after forage harvest of early-planted oat-pea mixtures. Oats and peas replanted the following June, after heavy disking or plowing of the rye previously weakened by grazing, should achieve normal growth for harvest for forage in September.

Continuing studies will document grazing animal responses on winter rye pasture. Another point to be investigated concerns the effects of autumn grazing of August-planted rye on subsequent winter survival and spring forage production.

Spring growth of Pierre winter rye on May 22 at the Matanuska Experiment Farm as influenced by planting dates during the previous summer. Plants were planted (left) August 9, (center) September 9 and (right) August 23.

The Merits of Irrigation in Alaska

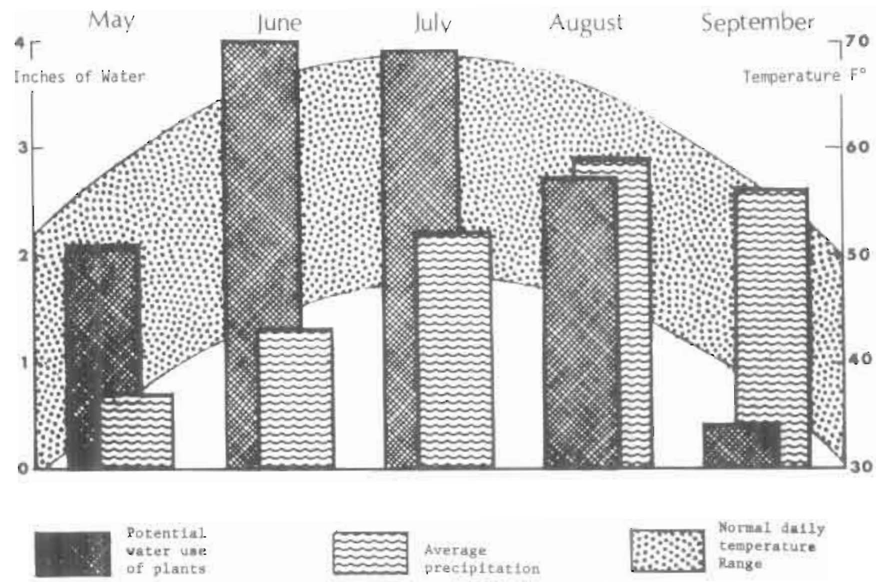
C. IVAN BRANTON, LEE ALLEN
Agricultural Engineers
and NEIL MICHAELSON*

Alaskan farmers have just experienced the worst drought since 1938 and it is already apparent there will be insufficient available moisture for initiating early spring crop growth. Anticipating a severe water shortage, the Alaska Agricultural Experiment Station is urging farmers to give serious consideration to the establishment of irrigation systems as early as possible this spring when seeds are germinating and when perennial plants have the greatest need for moisture.

Records kept in the Matanuska Valley show that only 7.02 inches of water were available to plants during the past growing season. In the previous 50 years only 1938 was a drier year when just 6.43 inches were available. This is less than 60 percent of the average rainfall of 12.6 inches available per growing season for the 35-year period, 1917-52. September and October precipitation is absorbed into the soil and available during the following spring. Almost negligible rainfall during this period in 1969 will limit soil moisture levels in the spring of 1970. Precipitation between November and April is not considered to be effective in increasing the moisture reserve for plant use.

A shortage of moisture one year often leads to a similar situation the following season. Part of the problem in 1969 stemmed from the fact that there was a two-inch deficit in 1968. That, compounded with higher than normal evaporation throughout 1969, created the critical moisture shortage.

Sparse rainfall during early summer in the intensely farmed areas of Alaska requires that the soil act as a water storage medium. In favorable seasons sufficient moisture is available to supply crop needs for a considerable period. The depth of the topsoil is the limiting factor in determining how much moisture can be stored from year to year. Fortunately in the Matanuska Valley, the areas with the most shallow soil receive the most frequent summer rainfall. Bodenburg and Knik silt loams are capable of storing up to 4.5 inches of moisture per foot of soil, of which 3.5 inches can be removed by crops.



Rainfall, Temperatures and Water Use of Bromegrass in the Matanuska Valley

Moisture Supply, Selected Seasons:

Period of Record	Water Available Per Crop Year
Ave (1917-52)	12.61
Dry Seasons	
1919	8.25
1927	7.69
1938	6.43
1950	7.93
1968	10.66
1969	7.02
Wet Seasons	
1930	17.87
1944	15.39
1949	15.18
1959	18.24

Some plants cannot obtain as much as others under comparable soil moisture levels. Small-seeded vegetables and cereal grains are not likely to have roots extending below 12 inches, whereas an established bromegrass or timothy sward may have roots reaching beyond 18 inches.

Soil moisture below the root zone moves by capillary action to areas of lesser concentration, the amount depending on characteristics of the soil. It is probable that at least half the available moisture in a soil profile will move into the plant zone when a sufficient gradient exists.

Although specific research has not been conducted in Alaska on moisture requirements for seed germination, it is estimated that the moisture content of a soil should be at least 2.1 inches per foot of soil in the seeded zone for good results. Wind, soil and air temperatures, sunlight, stage of plant development

*Now Soil Scientist, USDA Forest Service, Tempe, Arizona and available soil moisture all play a role in the use of water by plants. Research in Alaska has shown that a maximum of .15 inch of water per day is necessary to support rapid plant growth before mid-summer in the case of bromegrass and timothy. Where forage grasses are concerned, a reduction in moisture needs has been noted during August. This is probably related to higher prevailing humidity and slower growth rates.

Records indicate that the seasonal water use for forage crops and potatoes in the Matanuska Valley roughly equals the average amount of moisture available. Thus in a normal year there generally is no extra water which can serve as a reserve of soil moisture for future crops.

In recommending that farmers consider irrigating in 1970, the Experiment Station suggests that from two to six inches of water should be applied this spring depending on the depth of the topsoil and the cropping program. The only irrigation method adaptable to most Alaskan farms is a sprinkler system which can be set up without the costly necessity of land leveling. This method of irrigation can make use of whatever water supply is available and operate with a minimum of water loss.

Water Use of Bromegrass and Potatoes During Various Months:

Year	May	June	July	Aug.	Total
1956					
Grass	2.3	4.7	3.9	2.8	13.7
1957					
Grass		4.3	3.8	2.3	10.4
Potatoes		1.62	3.47	1.93	7.02
1958					
Grass	1.9	2.48	4.0	2.89	11.27
Potatoes		2.90	3.20	2.20	8.30
1960					
Grass	2.07	4.52	3.02	2.92	12.53
Potatoes		2.86	4.79	4.13	11.78

Soil intake rates must be known to design a sprinkler system. The following table includes the latest determinations made with a sprinkling infiltrometer for three Alaskan soils.

To avoid wasting water and keep within the capability of soil to absorb water under all conditions, an application rate of 0.33 inches per hour should be a practical design maximum.

Cost of developing a water source is one of the most important considerations in irrigation. Common sources of surface water in the Matanuska and Tanana Valleys are running streams, lakes, and impounded run-off. These sources can be exploited with small cash expense. A well, however, can be a large capital investment if adequate water supply is not available at shallow depth. Local experience in drilling domestic wells should be utilized, keeping in mind the fact that 10 to 15 gallons per minute is adequate for household requirements but that from 50 to 400 gallons per minute may be needed for a suitable irrigation system.

Most farmers will find it desirable to obtain technical assistance in planning the details of an irrigation system. Three agencies which have assisted Alaskan farmers are: The Soil Conservation Service, the Cooperative Extension Service, and the Alaska Agricultural Experiment Station.

Water Intake Rates for Three Alaskan Soils. Averages of Six Wet Runs in Inches Per Hour 1963-65.

	Treatments								
	Fallow				Bromegrass				Disked Sod
Year	1963	1964	1965	Av	1963	1964	1965	Av	1965
Bodenburg Silt Loam									
Intake rate, Av.	0.53	0.51	0.50	0.51	0.28	0.38	0.43	0.37	0.55
Knik Silt Loam									
Intake rate, Av.	.42	.34	.39	.38	.53	.42	.36	.44	.37
Minto Silt Loam									
Intake rate, Av.	.30	.41	.40	.37	.25	.41	.69	.45	.39

Red Fescue---A Valuable Species

R. L. TAYLOR
Research Agronomist

Red fescue is a fine-leaved, spreading, perennial grass species, utilized in many areas of Europe, Canada and the United States for forage and turf purposes. The low growing, leafy character of this grass makes it more suitable for pasture than as harvested forage.

Its success as a native grass in all areas of Alaska, from the Arctic coast through the Southeastern region, suggests that red fescue could be a valuable agricultural species.

Early trials of red fescue were disappointing from the standpoint of winter survival, particularly in the Matanuska Valley. Despite being generally accepted as a winterhardy species, imported commercial varieties were not satisfactory in this environment. More recent tests

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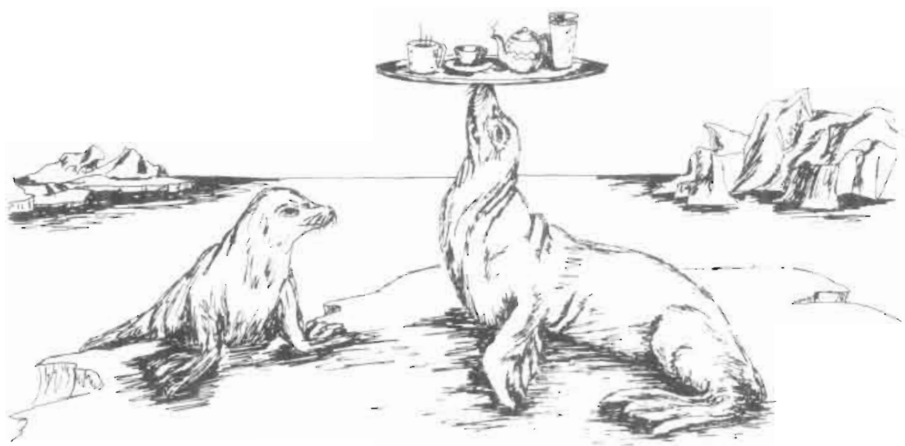
'Coffee, Tea, or Milk?'

C. F. MARSH
Research Economist



"Coffee, tea, or milk?" Every day we must choose our beverages, whether on a plane, in a restaurant, at a party, or at home. Most of us do so without considering our diet. The kind of beverage we drink daily does affect substantially the level of our nutrition.

Many have studied the beverage buying and consumption habits of consumers, but little is known of the basic psychological factors influencing their use. Do we select the beverages we drink on the basis of taste, habit, custom, sociability, nutrition, hot or cold effect, or for still other reasons?

Traditionally, milk is considered to be a drink for children. This, perhaps, is because it is nature's first and best food provided for the new-born of all mammals. Consumer surveys indicate adults use less milk than young people. Why a significant portion of adults stop drinking nature's most nearly perfect food is a question nutritionists have pondered for some time.

To help answer some of these questions, a study was made recently of 400 households (1503 people) at Fairbanks, Alaska. The study was designed to discover some of the attitudes and concepts we have about milk and other beverages.

Table 1. Distribution of Fairbanks household members by age and cups of milk consumed per day:

Age	None	1-2	3-5	6+	Total
0-9	15	108	320	32	475
10-19	14	61	149	21	245
20-29	54	95	85	9	243
30-39	70	88	49	5	212
40-49	75	68	33	3	179
50-65	62	42	22	4	130
66 +	11	3	2	0	16
*Other	1	1	1	0	3
Total	302	466	661	74	1503

*Age not given.

Of the 302 individuals who drank no milk, less than 10 percent were under 20 years of age. Approximately 35 percent of all adults 20 years old and over drank no milk. Among the non-milk drinkers, females outnumbered the males three to two. While households in the study appeared to meet the National Research Council's recommendations for calcium, nearly 4 out of 10 adults could be deficient.

The study of the Fairbanks households showed that coffee is not only consumed in greater quantities than milk or tea, but that it competes directly with milk in the diet of many people.

Table 2
Cups of Milk, Coffee, and Tea consumed per day.

Milk drinkers	Milk	Coffee	Tea
Adult males	2.76	3.83	0.38
Adult females	2.28	3.19	0.61
Boys	3.39	0.10	-
Girls	3.12	0.01	-
Non-milk drinkers			
Adult males		5.70	0.59
Adult females		5.40	0.96
Boys		1.00	-
Girls		2.58	-

In an attempt to find out some of the reasons why people drink certain beverages and not others, each homemaker was asked why she did or did not drink coffee, tea, or milk. The reasons given for not drinking milk are listed below in order of their importance:

- Do not like milk
- Health (does not agree with, allergic to, non-cholesterol diet)
- Milk is fattening
- Price of milk too high

Respondents' reasons for drinking coffee and tea were:

- Like it
- Habit
- Need it (stimulant)
- To be sociable
- Is not fattening

Over half of the homemakers gave "because I like it" and "because I do not like it" as their reasons for drinking or not drinking these beverages.

Homemakers were queried as to whether they drank milk regularly as a child of grade school age. Eight out of ten answered, "yes." Of these, over one-third no longer drank milk. A majority indicated they stopped drinking milk during their late teens and early twenties. Their reasons for having stopped were grouped as follows:

- Milk too expensive (price, lived in Alaska bush)
- Left home (marriage, military service, away at college, went away to work)
- Health (weight control, allergic to milk, milk does not agree with, etc.)
- Dislike milk

This revealed that over a third of the young people stop drinking milk at the time they leave home to marry, enter military service, or to attend college.

Homemakers were shown typical menus for breakfast, lunch, and dinner and asked what their choice of beverage for each meal would be. Coffee was chosen over tea or milk for breakfast and dinner. Milk was selected over coffee and tea for lunch. Homemakers agreed their families followed this pattern quite closely although normally more than one beverage such as coffee, milk, and fruit juice would be consumed by members of the family during specific meals.

What would be your choice of beverage if you were visiting in another home? A much larger percentage of housewives than before said their selection would be coffee for each meal. Although they considered coffee most appropriate to serve guests, they usually offered them a choice of beverages. When asked what beverage they would choose when eating meals at a restaurant, again over half would order coffee, even if milk were included in the price of the meal.

When asked, "Do you feel that there are times or places when it would be out of place, or embarrassing to drink milk?", 81 of the 385 homemakers said yes. They said it would be embarrassing to drink milk at the homes of others, at formal dinners, parties, etc.

Respondents were shown a list of six foods, namely vegetables, bread, whole milk, eggs, fruit and meat, and were asked which three foods in their opinion contributed most to health. Eighty percent chose milk first as one of the three foods, vegetables were second and meat third. This is interesting, considering the fact that 42 percent did not drink milk.

These facts suggest that our likes and dislikes influence our choice of beverages much more than does our knowledge about nutrition. We know much more than we practice. Perhaps more educational and promotional effort needs to be aimed at creating an image of milk as a social drink. Research to make milk and dairy products more appealing and appetizing is needed. Who knows, maybe flavored milk is the answer. How does carbonated milk sound to you? "Make mine a pineapple-milk fizz, please."

Studying the Milk Picture

Research in economics of producing and marketing milk in Alaska has been carried on by economists at the University of Alaska Agricultural Experiment Station since 1964. This research has involved all facets of the production, marketing, and consumption of milk and other dairy products.

Information obtained from the farmer provides an insight into the efficiencies of various management practices, amount of money invested, capital structure, cost of producing milk, economies of scale and other facts useful to the farmer.

Marketing research begins at the farm gate and deals with the transportation, processing, packaging, distribution and consumption of the finished product. This research provides information regarding the cost of marketing milk, pricing practices and efficiencies throughout the marketing channel.

Consumer-oriented research reveals what, why, when, where and how much consumers use milk and dairy products and their concepts and attitudes about these foods. Knowing these facts, scientists and others concerned with developing and expanding the sale of dairy foods are better able to define and project the market, evaluate trends and gear the marketing phase to best serve the consumer.

Red Fescue—A Valuable Species —

(Continued from Page 8)

indicate that some imported varieties of red fescue are hardy and productive in some areas of the state.

ARCTARED, developed from an Alaskan collection by your Experiment Station and released in 1965, represents a significant advancement toward overcoming the winter survival problem. This variety, along with an ever increasing number of collections from throughout Alaska, provides material for evaluation in all areas of the state.

Availability of commercial quantities of ARCTARED has been delayed by problems associated with seed production. Research studies have demonstrated that seed production methods commonly utilized in other areas are not satisfactory in Alaska. Until more satisfactory techniques are developed, and grower interest stimulated, seed production contracts in other areas will be necessary to provide seed of ARCTARED and other improved strains for use in the state.

ARCTARED was developed as a turf variety, and was only recently tested for forage purposes. This variety, or some other adapted strain, may find a definite place in a pasture program for the developing beef industry. It is unlikely that fescue will replace other grasses in providing harvested forage.

A concurrent development, NUGGET Kentucky bluegrass, produces an outstanding turf, which may limit the turf use of ARCTARED to special situations in areas where bluegrass does not perform satisfactorily.

The most important use of red fescue in Alaska may well be for non-agricultural purposes. This grass performs relatively well under adverse growing conditions in comparison with other grasses. It appears adapted to growing conditions all over Alaska. Selections are currently being evaluated for use as ground cover along roadsides, airports and other disturbed areas where soil holding capacity with minimum maintenance is the goal. The problem of adequate ground cover becomes more important as man accelerates the pace of disturbing the environment.

Red fescue currently has a limited place in the agricultural picture of Alaska. Indications are, however, that varieties will be developed for specialized turf, pasture and ground cover uses. All will contribute to agricultural development as demand for seed stimulates more farmers to enter the field of grass seed production.

An Unusual Test at Petersburg

WILLIAM L. FOX
Editor, Agroborealis

The quiet southeast Alaska community of Petersburg has just received nearly 700 new residents. For most towns the size of Petersburg, a jump in the population of this magnitude would cause quite a bit of confusion. In this case, however, many of the townspeople are unaware of their new neighbors.

The "new residents" happen to be mink from Salem, Ore. - - some $14,000 worth of them. They're alive and well and are part of a $100,000 experiment sponsored by the federal government and aimed at determining once and for all whether unusually loud noises - - particularly sonic booms - - have any effect on mother mink and their newborn babies.

Heading the project for the University of Alaska is James Leekley, biologist in charge of the Petersburg Fur Station which is a branch of the Alaska Agricultural Experiment Station. The experiment, however, is far different than any conducted previously at the Petersburg facility.

"We've never been involved in anything like this before," said Leekley. "We've always been working in the field of nutrition and genetics. This is something totally new to us."

Actually, the experiment is going to be something totally new to everyone involved, including the mink. Among the agencies participating in the project are the Federal Aviation Administration, the U.S. Air Force and the Department of Agriculture.

One morning in late April or early May two Air Force F-4 Phantom Jets will swoop down near Petersburg and crash through the sound barrier in an effort to show scientists what effect, if any, sonic boom can have on mink. The jets will make three passes over the mink - - one at 11 a.m., one at 11:45 and the last at noon. The sonic boom is expected to generate from four-and-a-half to six pounds of pressure per square foot in the area where the mink are housed. The mink will be studied from behind blinds by movie camera,

James Leekley Stands Next to Two-Ton Sonic Boom Simulator

their cages will be wired for sound and some of the foremost fur animal scientists in the U.S. will be observing their actions.

The decision to conduct the experiment came as a result of several court suits by mink ranchers against the Air Force claiming that sonic booms have startled their animals and caused them to panic, sometimes killing their young. A number of claims have been paid off and flying over mink ranches has become a rather expensive operation for the Air Force.

In setting up the experiment at Petersburg, plans call for the test to be run during the time when the female mink are having their young or whelping. The exact date of the experiment has not been set, but sometime between April 25 and mid-May when 40 percent of the female mink on experiment have had their young, the jets will be called in to break the sound barrier.

Leekley said the mink selected for the test all contain the Aleutian gene, which traditionally makes them hard to raise and very nervous and high-strung. In preparation for the experiment, Leekley and his staff have constructed housing for 320 female and 80 male mink at the test sites.

The actual site of the test is located some 18 miles from the Fur Station at a campground in the Tongass National Forest. Two hundred female mink will be housed at this location. In addition, 120 females will be kept at a site some two miles from the Fur Station and be subjected to a simulated sonic boom which will be delivered by a two-ton amplifier sent to Petersburg by the Air Force for the experiment. An additional two hundred mink will be kept at the Fur Station, but will not be boomed. They will act as controls for the experiment.

The mink were all brought to Petersburg from Oregon in mid-January so that they could get accustomed to their new surroundings long before the experiment. They will be bred in March and should begin whelping in late April.

The experiment has involved some detailed planning by all agencies involved. In addition to supplying the two jets and a refueling aerial tanker, the Air Force is providing several airlifts for animals, personnel, scientific equipment and supplies to Petersburg.

Staff members at the Fur Station have been working overtime in an effort to ready their facilities for the test. Several hundred mink were pelted and sent to the fur market in December and early January to make room for the new arrivals.

One man was employed full-time to live at the site where the sonic booms will be discharged. His job is to care for the 200 mink which will undergo the test. The site is located near sea level, but in hilly country which is densely wooded with tall trees.

The Fur Station, which has been in existence for some 30 years, is probably one of the most interesting, least talked about branches of the University of Alaska's Experiment Station. Among other things, the station cares for the largest collection of marten in captivity. About 40 of these curious little creatures are living in Petersburg, some of them more than 10 years old.

Obtaining consistent reproduction has proven to be the main problem with raising these animals.

In addition to its marten and mink collections, the Fur Station has a small herd of blue, white and mutation blue foxes. The primary purpose of the station is not to raise the fur-bearing animals for sale at the fur market, but to learn about their eating habits, diseases, growth patterns and reproductive activity.

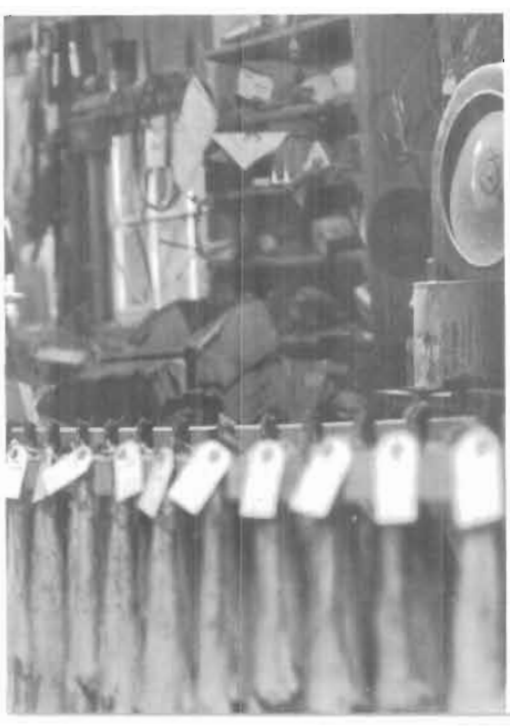
The upcoming sonic boom experiment has drawn nationwide attention to the Petersburg Fur Station. Over the past eight years the Air Force has paid off more than 20 claims involving mink trouble allegedly connected with sonic booms. Numerous other claims are pending in the courts and the test at Petersburg is expected to have a strong bearing on the outcome of the pending litigation.

Two years ago the U.S. Dept. of Agriculture attempted to determine a sonic boom-mink relationship with the same simulator which will be used in Petersburg this spring. That test was conducted in Christensburg, Virginia, and involved the booming of mink eight times a day for about two months. No adverse effects on the mink were recorded, but in court action following

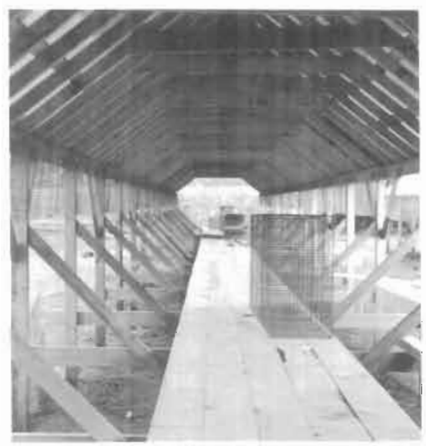
the experiment it was argued that such persistent booming on a regular schedule acclimated the mink to loud noises.

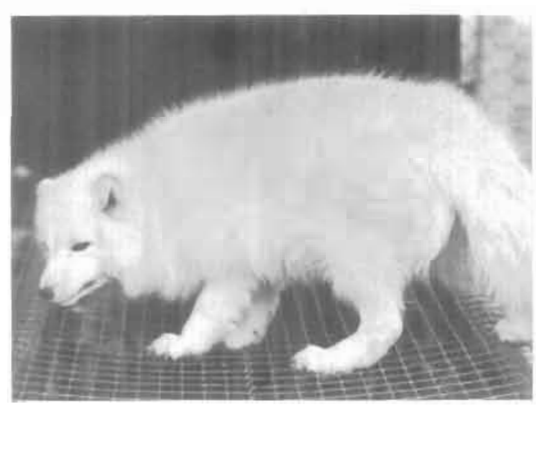
Leekley said he would be hard-pressed to guess what effect the authentic sonic booms will have on the mink at Petersburg. He said a number of factors could enter into the final analysis, however, everything is being controlled to the best of their ability.

"I wouldn't bet a nickel that we'd lose one mink," said Leekley, "but I really have no idea what's going to happen."



The Petersburg Fur Station - - a division of the Alaska Agricultural Experiment Station - - has been in existence for more than 25 years and during that time has served as a "laboratory" for studies connected with genetics, diets and reproductive habits for selected fur bearing animals. The station, as shown in top-center photo, consists of several sheds which are used to house mink, marten and foxes. The house at right of photo is where James Leekley, who operates the station, lives with his wife. The home doubles as an office for Leekley. One of the most unusual experiments the station has ever conducted is in process now. It involves tests to determine the effects of a sonic boom on mink during the whelping season. A special shed nearly 20 miles from the station was constructed for the experiment and it is pictured at bottom-left. The test site is located near sea level in a heavily wooded area. At bottom-center, mink pelts are hung and labeled before they are shipped to the fur market in Seattle where they are sold to the highest bidder. These mink were pelted shortly before Christmas to make room for the mink which were shipped in for the sonic boom experiment. In photos at right, from top: A marten looks curiously at camera. The animal is one of 39 which are kept at the Fur Station. Some are over 10 years old and together they represent the largest herd of marten in captivity in the entire world. In next photo, Leekley holds one of the cages which will house a mink during the sonic boom experiment. The cage will be kept inside the special shed built for the experiment. The interior of the shed, before it was completed, is shown in next photo. At bottom, one of the foxes which lives at the Fur Station, paces impatiently across the floor of his cage.





Potato Skin Spot, a Northern Disease

CHARLES E. LOGSDON
Professor, Plant Pathology

Most of the diseases of economic plants in Alaska have been introduced from the other states. Occasionally, however, a disease is found which is either native to Alaska or has been introduced from some other area.

Such a disease is potato skin spot caused by a fungus called *Oospora pustulans.* Although almost unknown in the Lower 48, this disease is found in some areas of Canada and is very common in Northern Europe. It has recently been reported from the Kamchatka Peninsula in Siberia. No one knows exactly when it first appeared in Alaska, nor do they know its origin. Observations of the disease since it was first seen in the Fairbanks area in 1955 would seem to indicate that it may have come from northern Europe in somebody's pocket as an infected "Swedish" or "Peanut" potato. The disease is now well established in all the major potato growing areas of Alaska and is the kind of disease that could become very troublesome.

Skin spot gets its name from the symptoms of the disease on stored tubers. Infected tubers, when harvested, show no sign of the disease; but after they are in storage for from four to five months, black raised spots, about 1/8 inch in diameter are produced. These may occur as single spots, or they may occur as large numbers of spots growing so close together as to form a black patch on the surface of tubers. These black pustules are seldom, if ever, more than 1/8 inch deep since the tuber forms a layer of cork beneath the pustule, preventing its penetration.

The disease also produces symptoms in the field, although they are not as readily recognized as those on the tubers. These field symptoms resemble very closely the symptoms of Rhizoctonia, another fungus disease of potatoes. Both fungi attack the base of the stem disrupting food translocation in the plant, thus causing a stiffening of the plant, yellowing of the foliage, and sometimes a rolling of the leaves. The only way to distinguish which disease is present is to pull up the plant and examine the underground portion. The skin spot fungus induces a very characteristic cinnamon brown color to the underground stem, roots, stolons, and new tubers. No one has yet determined just how detrimental this phase of the disease might be to the growth of the plant or to yield, nor has the relationship between this phase of the disease and development of skin spot in storage been investigated thoroughly.

Arrows Show Skin Spot Infection on Growing Roots

Skin spot disease is potentially hazardous for the Alaskan potato industry for a number of reasons. The most obvious reason is that badly affected tubers are discarded in grading and represent a direct loss to the producer. But there are more subtle effects.

Eyes on infected seed pieces are often killed before the seed can sprout, or if not killed, emergence may be delayed a week to ten days. With Alaska's relatively short growing season, ten days can make a tremendous difference in yield. Reports from Great Britain indicate that if pustules develop anywhere on a tuber, they are most apt to develop on or near the eyes. We have observed, however, in Alaska, that pustules develop most often on or around the stolon scar. Our studies on humidity in relation to tuber infection have shown that a long period of high humidity immediately following infection is necessary for skin spot lesions to develop. On this basis, it can be postulated that where there is soil clinging to a deep stolon scar or to deep eyes, the humidity is apt to remain high in those areas long enough for infection to take place. If so, one could predict that deep eyed potatoes would be more susceptible to eye damage than shallow-eyed tubers.

Another reason skin spot is potentially serious for Alaska is that we now have good evidence that the fungus can and will survive in the soil over winter and infect subsequent crops. It is not yet known how many years it will survive in soil without potatoes, but in England it has been shown to survive many years. We must consider now, until more information is obtained, that once a field becomes infested by planting infected seed, it will remain infested indefinitely and potatoes planted in that field may develop skin spot.

Why is this disease a problem in Alaska and not in the other states? The major reason is probably temperature. The organism causing the disease is a cool temperature fungus. Its optimum temperature for growth is about 60° F and its maximum for growth is about 70° F. The fungus is not killed at 70°. In fact, if the fungus is moved from a temperature of 60° where it is growing vigorously to 70°, growth may stop, but the fungus will immediately start producing quantities of spores by which it reproduces. Growth resumes when the fungus is again placed back at 60°.

If you visualize what that means in the field, as the temperature fluctuates up and down in the range of 50° to 70° (which is the kind of growing season temperature we may have) the fungus can increase very rapidly. This is generally much cooler than most potato growing areas in the other states, but does resemble the temperature situation in other areas of the world where this disease is found.

The disease and the causal fungus found in Alaska very closely resemble the published descriptions and pictures of those found in Great Britain, but there was a possibility that the one found here might actually be different. We obtained a culture of the fungus from Scotland, where the disease is a very serious problem, and have made a number of comparisons with the fungus isolated from Alaskan potatoes. In addition, through the courtesy of Professor Hirst at Rothampstead, I was personally able to observe the disease in the field in England in 1968. There seems no doubt that Alaskan skin spot is identical to the skin spot disease in northern Europe.

It may be interesting to know that we have a disease that is the same as one found in other northern areas, and that it is caused by a little fungus which lives in the soil, but the pertinent question is what can be done to decrease its damage and to prevent its becoming more of a problem? The purpose of studying the disease in all its aspects and the life history of the fungus causing the disease is to try to find weak points in the system so that the most effective and most economical control measures can be developed. With our present state of knowledge about this particular disease, it appears there are three steps that can be taken to keep the disease under control:

- Avoid planting infected potatoes in land known to be free of the disease.
- If it is impossible to avoid planting infected seed, then by all

–Please Turn to Page 19

A Hardy Strawberry: 'Alaska Pioneer'

ARVO KALLIO
Associate Professor of Horticulture
University of Minnesota

and

DONALD H. DINKEL
Associate Professor, Plant Physiology

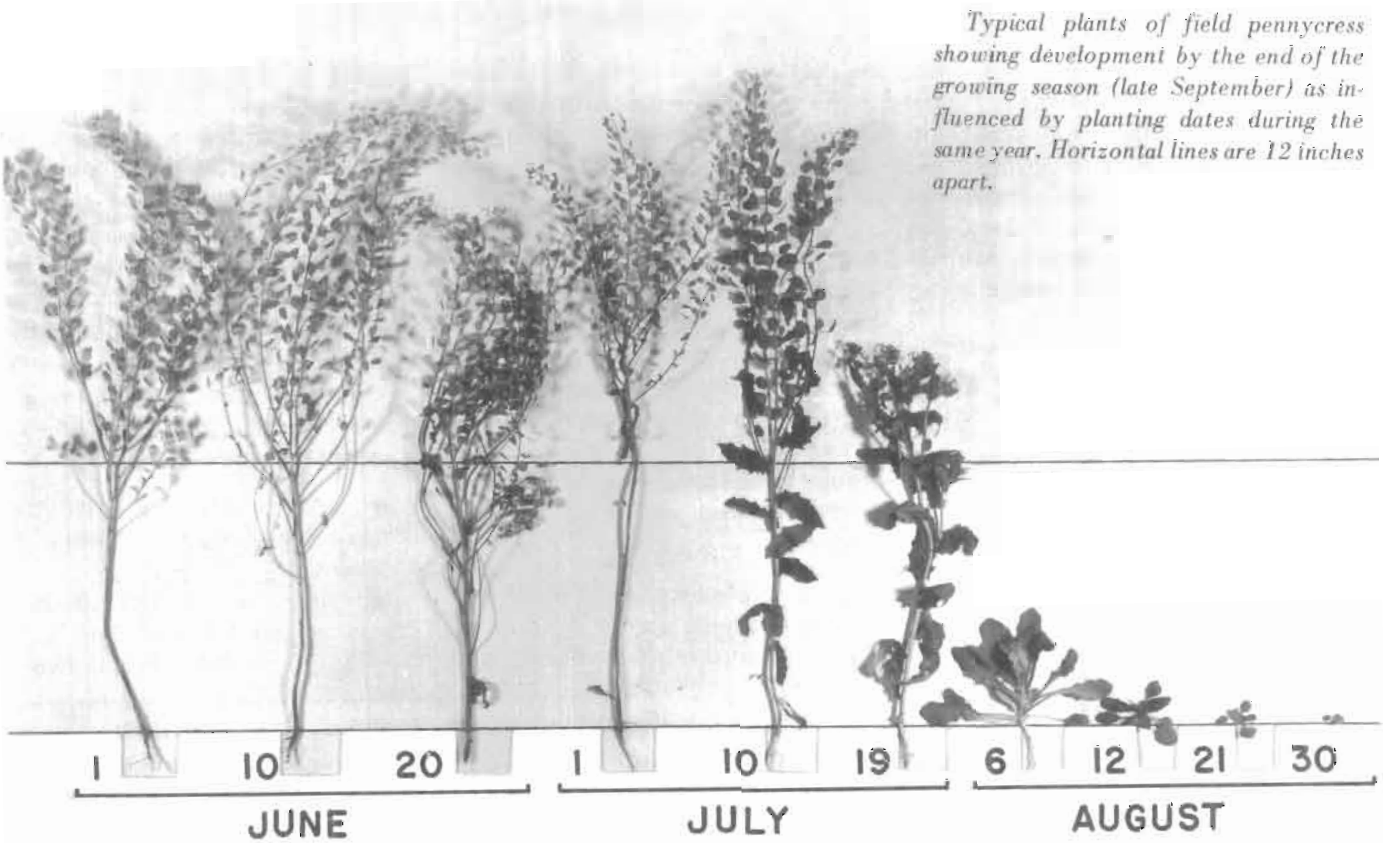
Strawberry varieties that are adapted and suitable for home gardens or commercial production in the "South 48" are not reliably hardy in most of the interior and southcentral areas of Alaska. Some of the more hardy kinds may survive for a year or two but do not persist.

Dr. C. C. Georgeson, at the Sitka Station in the early 1900's utilized both native and commercial kinds as parents in developing strawberry selections that were reliably hardy and survived the severe winter conditions found in Alaska. These selections, referred to as the "Sitka Hybrids," were distributed in Alaska and may still be found around early settlers' cabins and as the main dependable home garden strawberry. Although hardy, the fruit of these plants lack the color, size, and other qualities of the strawberries from commercial "Stateside" production areas.

Intensive strawberry breeding programs at the Research Center at College, Alaska, promise to provide the improvement in quality desired by commercial producers and home gardeners, combined with the hardiness needed for dependable winter survival. The ALASKA PIONEER variety, formerly known as Alaska 6344 seedling, was released in 1968. It originated from a controlled cross made in 1958, and was first selected by Dr. Arvo Kallio in 1960. ALASKA PIONEER is an early, hardy strawberry proven to be very vigorous and produces runners in abundance. No serious disease problems have been noted with this variety. It is the first variety to ripen at College, producing a medium to small fruit and having a pleasant, lively flavor and characteristic wild aroma. Its tender skin does not permit much handling without damage. The fruit is well suited for fresh use, freezing and preserves because the berries retain their shape and color well after processing.

ALASKA PIONEER has a wide range of adaptability within Alaska. It has been grown successfully on a considerable range of soil types including silt loam, sandy loam, acid and alkaline soils low in organic matter. ALASKA PIONEER will persist and produce a moderate crop of fruit even if neglected. When planted in a good garden soil, fertilizer should be used sparingly to prevent excessive runner production. For best results ALASKA PIONEER should be maintained as a planting of individually spaced plants rather than in matted rows. Alaska's commercial nurseries should have the variety available to the public in limited quantities this spring.

Research on strawberry improvement is continuing at the University with the objective of producing a commercially acceptable fruit with the hardiness and persistent characteristics of the plants that are needed for this climate. Program leaders are optimistic that more desirable varieties are now in the advanced stages of development.



Typical plants of field pennycress showing development by the end of the growing season (late September) as influenced by planting dates during the same year. Horizontal lines are 12 inches apart.

Weeds Studied for Strengths, Weaknesses

L. J. KLEBESADEL
Research Agronomist

Championship football teams and prizefighters devote many hours to studying their next opponents. By reading scouting reports or watching films of the "enemy" in action, athletes learn both the strengths and the weaknesses of future combatants. This practice is accepted as a vital, strategic means of securing an advantage over opponents.

To help Alaskan farmers win the battle against weeds, Experiment Station agronomists are also "studying the enemy." One of many agronomy research projects is concerned with learning more about combating weeds, - - plant enemies that lower crop yields, reduce crop quality, and require farmer's time, money, and effort when he must turn his attention to fighting them.

Alaska's weed pests are many in number; therefore, they cannot all be investigated at once. Each weed species has unique characteristics so each must be studied individually to learn about its strengths and weaknesses.

Weeds are simply plants growing where they are not wanted. Farmland weeds compete with crop plants for soil moisture, light, plant nutrients, and growing space. One of the strongest "trump cards" in the weeds' arsenal of weapons, and a weed characteristic that causes much frustration to farmers, is the bewildering ability of most weeds to reproduce themselves abundantly, that is, to spread either by vegetative means or by producing seeds. As each succeeding crop of weeds appears, farmers can destroy them by tillage, mowing, or with chemicals. However, new crops of weeds spring up continuously from seeds remaining in the soil. This happens because when one weed plant succeeds in reaching maturity, it can produce enough seeds for hundreds or even thousands of new plants. Therefore, as one approach to fighting weeds we must learn all we can about how and when to prevent these serious pests from producing their large crops of seeds.

Alaska's native soils contain none of the most serious weed pests that now plague Alaskan farmers. These weeds were introduced by planting weed-contaminated seed and spread in some cases by wind-blown seeds, or by transfer of weed seeds or whole plants on farm machinery from infested fields to clean fields.

Field pennycress (***Thlaspi arvense***) was selected as the first weed for intensive study. This plant is known also as fanweed, Frenchweed, and stinkweed. One of the reasons it was chosen was to learn more about some peculiarities noted in its patterns of growth. It seemed that when this weed emerged as a seedling in spring, it proceeded to flower, produce seeds, and die, all during the same growing season (summer-annual habit.) However, when pennycress seedlings emerged somewhat later during summer, they flowered little or not at all during that growing season but produced many leaves and remained alive over winter and flowered, produced seeds, and died the following year (winter-annual habit).

By harvesting seeds of pennycress, planting some in rows every 10 days during two growing seasons, and observing results, we learned a great deal about growth behavior, life cycles, and seed production of this weed.

Indeed, time of seedling emergence,

as influenced by different planting dates, did influence many growth characteristics of pennycress. Plant height, plant shape, time and amount of flowering, number of seed pods, amount of seed produced, time of seed maturity, and winter survival were all affected by when seedlings started growth during the growing season. With pennycress plants that survived the winter, several growth characteristics the following year were also influenced by when those plants had started growth during the previous growing season. These variables included number of secondary stems produced, presence or absence of a main stem, time and abundance of flowering, number of seed pods produced, time of seed maturity, and amount of seed produced.

Several practical implications for control of field pennycress and prevention of seed production were learned from this study. Plants that emerged prior to early July produced mature seed as summer annuals - - these plants must be destroyed before they can produce mature seed in late August or September of the same growing season. Seedlings that emerged after mid-July did not produce mature seed during the same growing season; however, in protected sites these plants may live over winter and produce seeds the following growing season.

As calculated from numbers of pods per plant and numbers of seeds per pod, a single pennycress plant may produce near 22,000 seeds. This emphasizes the importance of preventing this prolific species from reaching seed maturity and building further the reservoir of weed seeds in the soil. Just as a prizefighter must avoid his opponent's most potent punch, or a football team attempts to prevent the other team from scoring, Alaskan farmers must seek to keep this pesky rival from producing seeds to reinfest their farm fields.

These results provide a considerable fund of information about growth characteristics of pennycress - - information that establishes a better basis for recommendations in the control of this weed. Continuing studies will seek more knowledge about the strengths, weaknesses, growth habits, and control efforts needed for other weed species that plague Alaska's farmers.

Cobalt's a Must In Cattle Diet

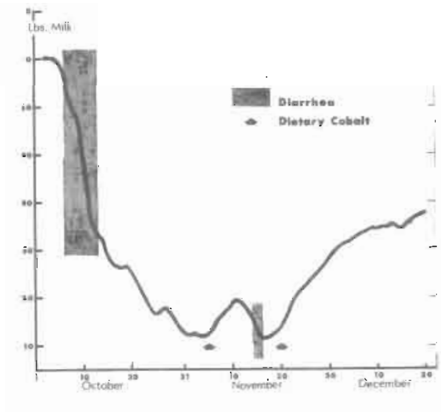
A. L. BRUNDAGE
Professor, Animal Husbandry

Vitamin B-12, the anti-pernicious anemia factor, is essential in the diet of non-ruminant animals such as swine. In dairy cattle, however, and other ruminant animals, cobalt, which is contained in the vitamin B-12 molecule, is limiting in the diet.

The bacteria in the ruminoreticulum of this class of animal utilize dietary cobalt to synthesize this vitamin. In many parts of the world plants contain insufficient cobalt and ruminants show the vague symptoms of cobalt deficiency - - loss of appetite, listlessness, lowered milk production, and emaciation. Vague symptoms because these also occur in many different forms of dietary insufficiency and disease. In the case of cobalt deficiency, however, the animal responds phenomenally to supplementation with minute quantities of cobalt.

The first response to cobalt supplementation in Alaska occurred in 1958 when a moribund heifer at the Matanuska Farm of the Alaska Agricultural Experiment Station responded dramatically to the administration of a "cobalt bullet." The cobalt bullet is a sustained release pellet of high specific gravity that sinks into the ventral portion of the ruminoreticulum, similar to ingested hardwear, and releases cobalt in minute quantities over an extended period of time. Further work did not show a consistent response to cobalt supplementation in animals not exhibiting deficiency symptoms. A few selected animals in Matanuska Valley dairy herds did show these symptoms and responded to cobalt. We concluded at that time that cobalt was marginal in ruminant diets in the Matanuska Valley. Cobalt was not expected to be limiting in the diet, but the possibility existed that a combination of circumstances could lead to insufficiency of dietary cobalt.

This appeared to happen in the case of Alaska Revelation Inka Aristo, a registered Holstein-Friesian in the dairy herd of the Matanuska Farm. This animal calved on Sept. 1, 1969, and was producing 70 pounds of milk per day by Oct. 1. She suffered a prolonged and very severe attack of diarrhea during the second week of October. In spite of treatment by mouth and systemically, daily milk production had declined to less than 15 pounds by the end of the month. She was given a cobalt bullet on Nov. 4, and seemed to respond in both appetite and milk production until Nov. 14, when she underwent another severe attack of diarrhea. Milk production and appetite failed once again and a second cobalt bullet was given on the assumption that the first one might have been lost during the attack of dysentery. She responded once again and milk production steadily increased.



Clinical history of a cow and the milk production response to dietary cobalt.

There is no certainty of a cause and effect in the treatment and response outlined here for one animal. However, it does lend further credence to the possibility of a combination of circumstances leading to insufficiency of dietary cobalt; in this case, severe and prolonged diarrhea.

If the diet is marginal in cobalt content and cobalt becomes insufficient for any reason, the reduction in appetite that results will serve to perpetuate that insufficiency.

Revegetation Problems and Progress

WILLIAM W. MITCHELL
Associate Professor, Agronomy

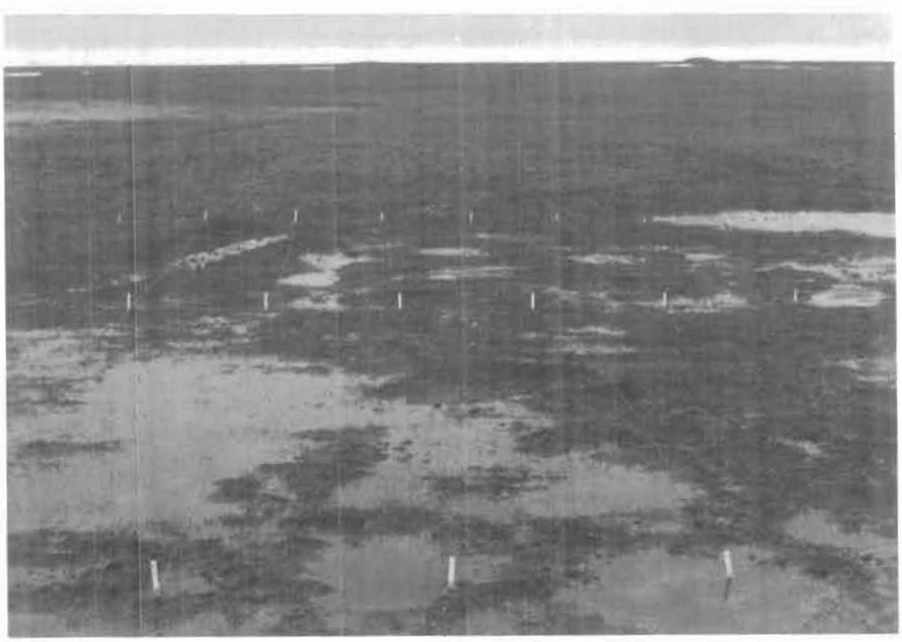
Man can undo in one pass of a bulldozer blade that which has required nature many, many years to accomplish. But we have learned not to be smug about this power, since nature's power of retribution can be even greater.

Problems of revegetation have become a matter of pressing importance in Alaska. The accelerated pace of developmental activities means an increasing disruption of natural covers. New roads, oil rigs, pipelines, airfields, building constructions, fires, etc., create scars that not only are unsightly, but also may threaten the very integrity of the structure or system occupying the disturbed ground.

Recently, revegetation problems on the North Slope in Arctic Alaska have been emphasized. Here, vegetation not only holds the surface against wind, water, and other eroding forces, but also insulates the substrate, thus preventing deep seasonal thaws of the permafrost. This was demonstrated quite clearly on a small area used for an experimental planting in the Prudhoe Bay coastal plain. Most of the surface cover had been bladed off in the course of constructing a gravel airstrip at a Mobil Oil Corp. drilling site. The Alaska Experiment Station, with the assistance of Mobil Oil, established a test planting of a number of grasses on the site in the first week of July. At the time of the planting the area was relatively dry. However, when viewed in early September, large portions of the experimental plot area were inundated, whereas adjacent well-vegetated areas that had not been disturbed were still relatively dry.

But the problems are not confined to the North Slope. They occur throughout Alaska, wherever vegetative covers are disrupted either by man or nature. Cuts and fills necessary for building roads incur many problems which may directly affect the integrity of the road system itself. Or some other system may be threatened; for instance, excessive runoff into fish-spawning beds may occur where roads parallel or cross streams.

The U. S. Fish and Wildlife Service has spent considerable effort and money on stabilizing some highway cuts overlooking the Kenai River. These cuts are on a clay substrate that is subject to excessive slippage and runoff, and therefore, is a particularly difficult medium for establishing plants. Revegetation also has figured in the operating integrity of FAA stations. Windblown grit and dust from ground denuded by construction activities has complicated the maintenance of delicate electronic equipment and aggravated living conditions for station personnel.



Bull-dozed area planted to grasses near Prudhoe Bay becomes inundated as premafrost thaws. A pingo is visible in the background.

Revegetation of the proposed Trans Alaska Pipeline route is a special situation that poses some particularly interesting problems. The 4-foot diameter pipe will transport oil purported to be sufficiently hot to prevent the overburden from freezing during the winter. This condition may have a significant effect on the winter survival of perennials growing over the pipeline.

Plants normally go dormant for the winter after making necessary physiological adjustments in response to the shortened day lengths and cooler temperatures of late summer and early autumn. If the unusual ground temperature over the pipeline disrupts this pattern, it may result in the winterkill of normally hardy perennials. Only trials under actual or duplicated conditions can answer this question.

Other effects that may complicate revegetation are excessive puddling due to thawing around the hot pipe and excessive drying where the pipe underlies dry slopes and well-drained uplands.

Warming of the soil quite likely will also produce some interesting beneficial effects. Wherever there is sufficient moisture, it should accelerate growth and permit the growth of some otherwise unadapted plants. For instance, this may permit the establishment of annuals for a quick cover in the Arctic and promote a more rapid migration of native plants from the edges onto the disturbed ground. Furthermore, trees occurring along the margins of the disturbed route may show accelerated growth due to improved drainage and warming of the soil. A really intriguing question that merits investigation is the possibility of growing certain agricultural crops that respond to increased soil temperatures. Thus, revegetation in some areas along the route conceivably could be accomplished by commercial ventures.

In other parts of the United States, solutions to problems of revegetation are more readily arrived at with the long tradition of gardening and agriculture providing a base. Also, in the more temperate regions a greater variety of plants, for which there are commercial quantities of seed available, can be applied with some possibility of success. However, vast areas in Alaska have had little or no experience in the establishment of plants normally used for revegetation. These areas include arctic, sub-arctic, and boreal regions. Materials that can be employed in the densely wooded boreal regions of Alaska are poorly suited for the tundra regions of the arctic, coastal, and alpine types. The summer temperatures and growing season of the tundra regions simply may average below the minima required for materials that have been selected primarily for northern temperate to boreal regions. Only a few tests of introduced plants have been made in the Arctic. Results of some tests are as yet inconclusive, but they have for the most part been unsuccessful.

Nature's own processes of revegetation may be painfully slow, or under favorable circumstances with appropriate materials at hand, quite rapid. There are ecological lessons to be learned from these natural processes, and roadsides present a good natural lab for study.

A common problem is the establishment of plants on the infertile subsoil of dry, often steep cuts. Plants that are very conservative in growth habit succeed the best on these less desirable sites. Initially they become thinly vegetated with mostly tufted plants that produce small basal clumps of foliage. Small tufted fescues, bluegrasses, wheatgrasses, foxtail barley, and alkali grasses are frequent colonizers of disturbed sites in Alaska. Wildryes are important in some areas.

Beach wildrye is an example of a special situation grass. It occupies thousands of miles of beach strand along the Alaska coastline, helps to stabilize the strand above the low-tide zone, and moves into some disturbed areas on more inland sites. This grass has achieved a preeminent position in extensive areas along the coast; it nevertheless is a poor seed producer and depends a great deal upon vegetative propagation through lateral growth of sturdy, underground stems called rhizomes. Its establishment would best be accomplished by vegetative means. Though capable of withstanding occasional inundation, subsidence following the 1964 earthquake resulted in a fatal shift in the ecological position of a number of tidal zone populations of this grass. Some alkali grasses and sedges are better suited to the saturated conditions of the low-tide zone.

Opportunism plays an important role in the natural processes of revegetation. The rate of colonization of a barren site depends on the availability of adapted materials and their means of seed dispersal. Plants with light-weight seeds or with special aids to seed dispersal tend to be the most widely distributed in the initial stages of vegetation. These eventually may be replaced by other, more enduring species. A barren site often becomes occupied by a variety of plants without any evident pattern in distribution. But occurrences sometimes are obviously related to environmental factors and thus indicate adaptive characteristics.

Work in Progress

Agricultural experience and associated research have provided some information on regional adaptations of certain species. Thus, timothy, red fescue, meadow foxtail, and Kentucky bluegrass have been shown to be adapted to the coastal southcentral region. The warmer summers of the more interior agricultural regions permit, in addition to the above, the use of bromegrass and certain wheatgrasses.

Most of the information gained on plants and their application has been obtained through agricultural research by the Alaska Experiment Station, the efforts of farmers and ranchers, plantings by various agencies at airfields and installations, and test plantings by the Soil Conservation Service on the lower Kenai Peninsula. The experience gained in the agricultural areas is of value, but it cannot provide all the answers needed for other areas of the state.

Plants from various physiographic regions of the northern latitudes will likely be necessary for really satisfactory solutions of some of the revegetation problems. Native plants are being evaluated at the Experiment Station for possible use in agriculture, turf plantings, and revegetation. In this program consideration must be given to adaptive characteristics, habit of growth, and seed production qualities. Both tufted and spreading types are included in the program.

The seed-producing ability of a plant and ease of harvesting and processing

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Potato Skin Spot — *(Continued from Page 15)*

means treat the seed. We have not found a treatment that prevents the disease 100%, but either Semesan Bel or Polyram has given very good control.

- If you intend to store your potatoes past January 1, then raise the temperature of your potatoes to 70° F for two weeks immediately after harvest. We have found that this treatment very drastically reduces the skin spot phase of the disease on stored tubers.

There are two reasons for the January 1 date. If the potatoes are to be marketed prior to that date, they will probably not have the black skin spot lesions anyway, and it costs money to heat the potatoes for two weeks. The second reason for the January 1 date is that heating potatoes immediately after harvest reduces their weight considerably because of moisture loss, so that during the first half of the storage period, untreated potatoes will weigh more. Heating, on the other hand, reduces the rate at which stored potatoes lose weight so that during the second half of the storage period, the heated potatoes will weigh more.

Potato skin spot seems to be one of those introduced plant diseases that has been able to establish itself in our environment, and unless it is brought under control, could be a much more serious problem in the future.

Potato growers need to be aware of the disease and make every effort not to infest clean land with the causal fungus. Badly infected potatoes should be sold for tablestock or destroyed. Known infested land should be planted to other crops where feasible. Seed should be treated before planting and potatoes from known infested fields should be heat-treated prior to storage.

To Interview A Cow

A. L. BRUNDAGE
Professor, Animal Husbandry

Keeping a sensitive finger poised on the pulse of public opinion is big and important business in the United States these days. There is always someone who wants to know what the public is thinking about something. That someone might be an individual, an arm of the government, a commercial survey, or a non profit organization, but the approach is often the same: what do you watch on TV, how do you live, whom will you vote for, how many wives do you have, etc.? These recorders of public opinion have one basic means of obtaining information: they ask - either by mail, on the telephone, or in person.

The livestock industry is also concerned about public opinion. At times it is concerned about the opinion of a unique public, the opinion of different kinds of farm animals about the conditions under which they live.

How does one obtain the opinion of a cow for the record? One could ask, but a communication gap exists between cows and most would-be interviewers, even more so than between different groups of people. A more rewarding approach is to assume that the opinion of an animal is reflected in its behavior, even as with humans.

Tom Compton, a graduate student in the biology department of the University of Alaska, was interested in recording the response of cattle to conditions on a subalpine range in boreal Alaska. He started with the assumption that their response would be reflected in their behavior.

Reasoning that the best way to study animal behavior was to live with the animals, carefully observing and recording, he spent the summer of 1968 in the picturesque and natural grazing area high up in the Talkeetna Mountains north of the Matanuska Valley that is leased by local dairymen for summer range. Similar to many such areas throughout the state, this one is used mostly for replacement females in the Matanuska Valley dairy herds at this time.

Little that happened on the range escaped Tom's notice. Once each week, for 12 weeks, he kept one animal under continuous surveillance for a 24-hour period. He recorded the behavior of this animal, and that of the group accompanying it, every 15 minutes during these periods. Animal behavior was divided into three basic activities: feeding, rumination, and idling. Both rumination and idling were subdivided into standing and lying down. But, he didn't stop there.

He also kept notes on how far and where the cattle walked, when they ate salt and drank water, when they fought, and anything else they did. The plants growing on the range also became a matter of record; the ones that were eaten, their relative importance in the diet, and the ones not eaten were all noted. Tom could have been cited for invasion of privacy at the end of the grazing season; he did his job well.

What did these animals do all summer? Tom used his master's dissertation and some very sophisticated graphs to describe all that he observed, but some of his findings can be summarized here. Their day started about the same time each morning; regardless of when the sun came up, they would be up and feeding at six a.m. The animals spent a greater proportion of their working day feeding as the summer advanced and the feeding periods became more intense and distinct. It seemed that they required more time to find and select their diet as the plant material available to them on the range matured and became less palatable. Their feeding habits were not appreciably affected by either insects or inclement weather. The animals traveled about 2.5 miles during a 24-hour period. Most of them assembled at a common bedding ground each evening to spend the night ruminating and resting after an initial period of threats and physical contact to reestablish their social position. Social attachments were not strong, however, for the cattle would start the next day in new groups with little regard for previous associations. Cattle are communal and conservative and the behavior of individuals differed very little from that of the groups.

Tom found that the cattle sought variety in their diet. Grasses, including mountain timothy, bluegrass, and bluejoint, were favorite selections. They also included shrubs on the menu, especially willow and to a lesser extent green alder; alder previously had been considered unpalatable to cattle. Other shrubs eaten included high-bush cranberry, mountain ash, northern red currant, and spiraea. They even sampled the flowering portions of devil's club.

Giant fireweed was very high on the gourmet list of forbs until it began to flower; then it was returned to the

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Lack of Sulfur Limits Plant Growth

W. M. LAUGHLIN
Research Soil Scientist

Several years of fertilization study at the Matanuska Experiment Farm have pointed up the importance of sulfur in Alaska plant life. In 1966, the second cutting from a field of bromegrass was short, spotted and yellow. A nitrogen top-dressing after the first cutting had no apparent effect on plant growth.

In 1967 a portion of the field where the grass was uniformly short and yellow the previous year was selected for an experiment involving application of increasing rates of potassium (K_2O). This test compared six K_2O rates (0, 40, 80, 120, 160 and 200 pounds per acre) supplied as either sulphate or muriate of potash.

All plots received 150 pounds of nitrogen and 100 pounds of P_2O_5 per acre. Annual observations were made and two cuttings were obtained, both in 1967 and 1968. In addition to checking harvest weights, samples were taken for determination of dry matter, nitrogen, phosphorus, potassium and sulfur.

The experiment indicated that when muriate of potash was used, the increasing applications of potassium produced only a slight increase in yield and had no influence on the sulfur content or the amount of sulfur removed in the hay.

On the other hand, where the sulfate of potash was applied, the increasing rates of K_2O resulted in dramatic yield increases, darker green color, and increased the sulfur content and the amount of sulfur removed in the hay. And although yields with sulfate of potash were one-and-a-half times greater than those with muriate of potash, winterkill of grass during 1968 and 1969 was noticeable only where the muriate of potash had been applied.

On two different soil types in the Matanuska Valley, two timothy fields made no recovery after the first cutting even though additional nitrogen had been applied. Both these fields were abnormally yellow. Application of sulfate of potash to small observational plots caused the timothy in each field to green up and resume growth within a week after application.

Bromegrass at Matanuska Experiment Farm Responds to Sulfur

These experiments have enabled us to determine that both bromegrass and timothy remove 200 lb K_2O and 28 lb of sulfur per acre under optimum conditions. Thus in grass fertilization at least this amount of these plant nutrients must be supplied to prevent eventual depletion of these elements from the soil. As our fertilizers become more concentrated, less sulfur is found in them as impurities.

The price of sulfate of potash as compared to muriate of potash has been increasing each year (1.7 times higher per pound of nutrient in 1969). Therefore we will conduct experiments this coming year to determine the relative effectiveness of sulfur sources on bromegrass. Ammonium phosphate (16-20-0) containing 14% sulfur, sulfate of potash (0-0-50) containing 17% sulfur, and elemental sulfur which contains 99.5% sulfur are the sulfur sources selected.

Sulfur is an essential element in the life processes of plants and animals. It is present in the soil in both organic and inorganic forms. The organic forms are parts of living and dead micoorganisms and remains of plants which make up the soil organic matter. The inorganic forms are minerals contained in the soil, the end-products of the microbial decomposition of sulfur-containing compounds in the soil organic matter, and that added in fertilizers. Up to 400 pounds of sulfur may be deposited per acre near industrial centers from sulfur bearing atmospheric pollutants. This source in Alaska is practically non-existent.

Touring Proposed Pipeline Route —

(Continued from Page 5)

cold soils. The tallest white spruce trees are found along river and slough banks where there is better drainage and warmer soils. The history of past fires is written in the occurrence of aspen and birch on spruce sites and of different aged spruce stands. The ubiquitous lingenberry is common in this region and throughout most of the route. Bluebunch wheatgrass and fringed sage, abundant in certain western U.S. and Canadian grasslands, and an attractive blue pentstemon prevail on extremely dry bluffs.

Through this interior region the pipeline traverses unglaciated terrain that remained vegetated during the Ice Ages. It enters glaciated terrain near Delta Junction when it crosses the Tanana River and heads south along the Richardson Highway. Low alpine tundra predominates along the route through the Alaska Range between Delta Junction and Paxson. Willows, dwarf birch, alpine bearberry, and blueberry are prominent in these tundra regions. The broad, gravelly river beds become ablaze with wild sweetpea in early to mid summer.

The pipeline reenters the interior forest near Paxson and descends into the Gulkana Basin and Copper River Valley. Small, inconspicuous orchids can be found on the mossy floor of black spruce forests in this region, along with hordes of mosquitoes. Wheatgrasses and sage occurring on dry bluffs and river beds are reminiscent of the western plains of the U.S. A creeping juniper, found only in the Copper River and upper Matanuska Valley region of Alaska, occurs on some high, dry mountain slopes. Deposits of fine silts and clay, laid down in a lake when the Copper River drainage was blocked by glaciers, present the pipeline with deep permafrost problems in this region.

Sudden changes of scenery take place in the last leg of the route as the pipeline ascends the Chugach Mountains and crosses Thompson Pass with its magnificent view of Worthington Glacier. Some areas in this region have only recently been deglaciated. The pipeline will make a difficult descent to the coast down steep slopes densely invested with Sitka alder, an important colonizer and soil builder on barren, rocky terrain. Newcomers working on the pipeline will learn to avoid the notorious devil's club, which forms thickets armed with thorns in moist places.

Upon crossing the pass, the pipeline leaves the interior forest and enters the narrow belt of coastal forest with Sitka spruce and hemlock as dominants. Balsam poplar gives way to black cottonwood, and green alder to Sitka alder. Lush stands of tall fern and bluejoint reflect the cool, moist growing conditions. Large white sprays of sea coast angelica and the deep red to violet flowers of beach pea adorn the beach meadows and coastline. The extensive ice fields verging on the bay at sea level are a contrast to the small remnant glaciers found only at high altitudes in the Brooks Range.

This survey provided the opportunity to explore for and find species of plants in areas where they had never before been reported. This, of course, points to an effect associated with the installation of the pipeline and the accompanying road system. It will provide access to areas that have had only rare to infrequent visitors. The region just north of the Yukon River, for instance, has received very little attention in botanical and zoological studies. Other areas, frequented only by air travellers now, will eventually yield to access by land. Possibilities for agricultural and other kinds of development will be enhanced.

In face of the certainty of large scale oil production in the Arctic and accompanying needs for development, the problem now confronting Alaskans is how to proceed with and assist this development while maintaining these areas with their natural qualities sufficiently intact. A system of land classification may be necessary, and exploratory, ecological studies will be basic to its implementation.

Cow Interview—

(Continued from Page 20)

kitchen. The cows also ate other forbs, cow parsnip, lady fern, oak fern, and spiny wood fern. Small groups of cattle would occasionally spend an entire morning feeding in clearings containing an abundance of cow parsnip; they especially relished the flowering heads.

At least two forbs found on the range, monkshood and false hellebore, are considered to be toxic to cattle. The cows did eat the flowering heads of false hellebore on numerous occasions and the leaves less frequently. Although they were not observed eating monkshood, several plants were found with the shoots clipped off. In spite of these indiscretions, no one complained of gastronomical distress during the observations.

How does all of this affect the life of the common cow? To interview is to record the opinion or response in a given situation. To record the behavior of the cow on subalpine range in boreal Alaska is to know the response of the animal to the environment under which it is expected to live for a period of time. To know animal response is to possess one key to successful range management.

Revegetation—

(Continued from Page 19)

require serious consideration in the evaluation of a species. Means necessary for producing large quantities of seed for large-scale plantings, as well as small quantities for specialized situations must be considered. It is hoped that development of Alaskan plants for particular needs will justify commercial seed production in Alaska. In some cases production by means not now available may be necessary. Some plants may produce little seed but have application in particular situations where they could be established and propagated by vegetative means. These will require special attention.

A working base is being established at the Alaska Experiment Station with the development of certain native grasses already well underway. A great deal more must be done, however, before solid recommendations and ample seed quantities can be made available for the various areas that have revegetation problems.

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