joint research program with the

AGRICULTURAL RESEARCH SERVICE

Crops Research Division
Tropical and Subarctic Research
United States Department of Agri-

Alaska FARM & CONSUMER Research

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University of Alaska
ALASKA AGRICULTURAL EXPERIMENT STATION

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AGRICULTURAL RESEARCH HAS PLAYED A MAJOR ROLE in developing the productive efficiency of the United States. Ours is a strong nation because, alone among the world powers, it is self-reliant with respect to food and fiber.

The industrial strength and standard of living enjoyed by the United States rests on less than 10 per cent of its labor force which grows more than enough food and fiber for the rest of the population. One farmer in this country today feeds 23 people at home and three more abroad. This astonishing productivity has released the remaining 90 per cent of the labor force for industrial and service jobs.

While Russia and China demonstrate that large agrarian populations can subsist in this modern world, they also demonstrate that urban welfare depends on the skill of rural workers in growing more than enough for their own needs.

The fundamental dependence of urban populations is often overlooked -- especially here in Alaska -- where most people take for granted a sophisticated and complex food production system envied by all other countries.

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An issue honoring the centennial of the land-grant colleges and the United States Department of Agriculture

Formal institutional research preceded much of Alaska's settlement. Initiated to demonstrate nationally that Seward's Icebox might develop some degree of self-sufficiency, this advance into new lands was unique, totally unlike the history of the other states. Early settlement was justified in part on farm research findings. Agricultural progress today -- and the rural development of new areas -- is equally dependent on the results of research. This is evident now in requests to evaluate further the Kenai Peninsula, Kodiak Island, areas along the railbelt, and portions of the Copper River Valley.

The Territory's first experiment station was established by the United States Department of Agriculture at Sitka in 1898. Copper Center is clustered around the buildings of an old experiment station closed in 1908. An old experiment station site at Kodiak is pointed out to tourists, while the Kenai farm is now a suburb of a fast growing community. Fields of the Rampart station, unused since 1921, still persist on the banks of the Yukon. Service roads and lanes of these USDA farms marked the start of local road nets.

The Fairbanks Experiment Station was founded in 1908, based on the equipment, staff, and machines moved north from Copper Center. Professional workers residing at this station conceived the idea of an agricultural land-grant college for the Territory. They helped justify additional land grants that -- together with the adjoining farm reservation -- now comprise the University campus.

HISTORY

The Matanuska Experiment Station was established in 1917, some buildings being moved there from the Kodiak farm after Katmai's eruption in 1912 covered that site with volcanic ash. The Matanuska Station provided a nucleus around which the valley was later permanently settled. Out of studies at this site came evidence justifying decisions to colonize the valley in 1935.

By the early 1930's, Departmental objectives had been largely accomplished. A small food production potential had been demonstrated. The Matanuska and Fairbanks stations were then transferred to the Alaska Agricultural College and School of Mines. Territorial enabling legislation was soon enacted, accepting participation in the national land-grant acts. In 1937, the Petersburg Fur Farm was established by the University to delve into free fox farming disease problems then threatening a prosperous ranch fur industry.

Agricultural research in Alaska is now jointly conducted by the University of Alaska and the United States Department of Agriculture. Responding to Public Law 266 (1947) the federal government again assumed major responsibility and leadership in this field after a lapse of some 18 years. Since then the Department has contributed generously to its financial support and technical direction, over and above traditional Hatch Act participation in agricultural research common to all land-grant institutions.

Reawakening of federal interest in the food production potential of subarctic regions was rooted in both the rapid world-wide population explosion and in national security considerations. The present joint agricultural research program reflects this national interest. It was stimulated by conclusions that world tensions stress the strategic importance of Alaska, and that the state's defensive role can be improved by a better degree of economic self-sufficiency. During times of world stress, Alaska's position is weak so long as its population must depend on long overseas supply lines. Living costs in Alaska will remain high so long as its population depends on importing a major portion of food and building supplies.

Largely developmental in character, food production and marketing research is administered from the Experiment Station headquarters at Palmer -- an installation maintained by the Agricultural Research Service -- rather than from the College campus. The Palmer headquarters is located on a 23-acre tract within the city limits. This site is devoted chiefly to small plot investigations dealing with plant breeding, plant pathology, response of plants to nutrition and supplemental water, insect pests and controls, and measurement of environmental parameters (including photoperiod and light quality), soil and air temperatures, moisture and temperature gradients, and moisture relationships. The headquarters building provides about 8,000 square feet of offices, laboratories, and workrooms. This installation includes greenhouses and cold storage facilities. All equipment is modern, having been acquired since 1950.

FACILITIES

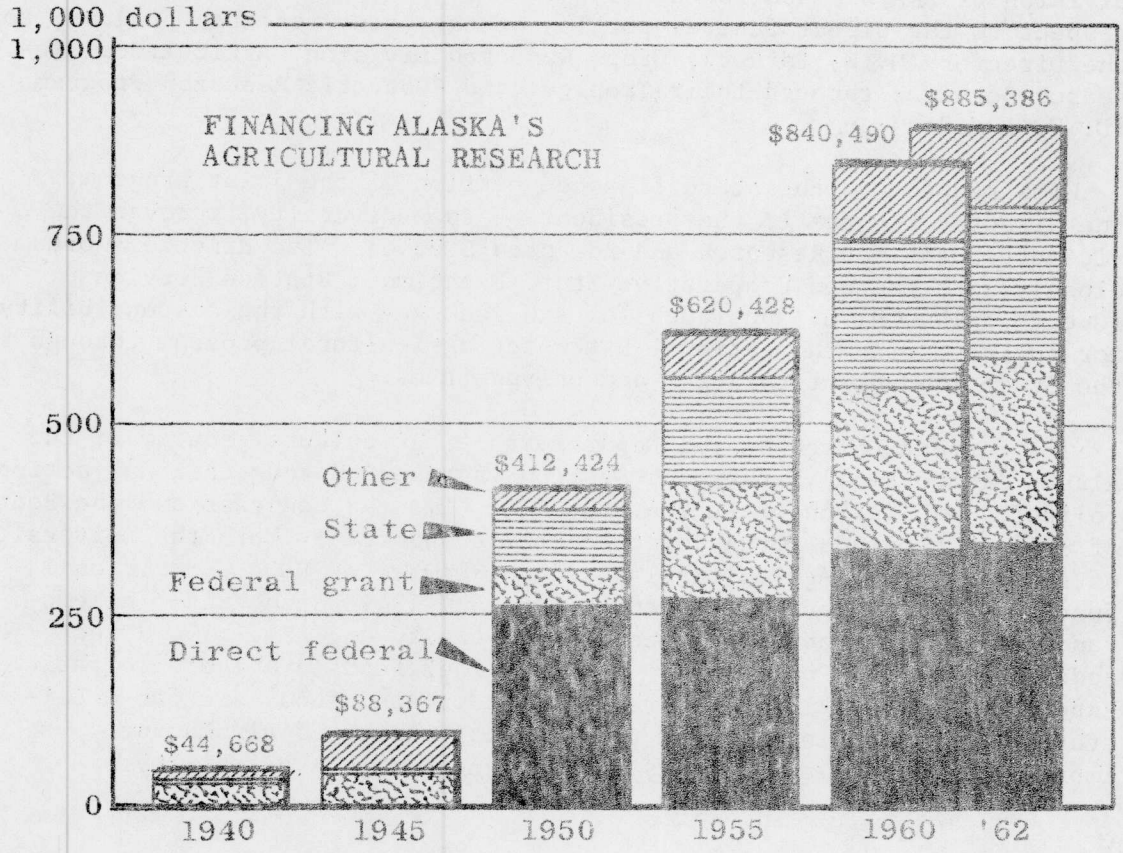
Parental stocks of especially adapted lines of plants and animals are collected and maintained at three experiment station farms - one adjoining the University campus at College, one in the Matanuska Valley, and the third near Petersburg in southeastern Alaska. The first two farms are devoted to developing an economic animal feed base, and to devising improved husbandry and management practices with special emphasis on dairy and beef production. Supplemental studies are focused on root and vegetable crops consumed by man. Of a total of nearly 1,600 acres, about 500 is under cultivation. Nearly a hundred acres are in small plot comparisons and nurseries devoted to perpetuation of plant lines, and evaluation of responses and variability. The Petersburg farm is devoted exclusively to fur production investigations, including the evaluation of fish waste, bottom fish, and sea lion meat as fur animal feeds.

Somewhat over a third of all agricultural research is accomplished in cooperation with farmers, with retail outlets, and in evaluating market potentials. All studies are administered and reported as line projects, coordinated nationally by the Cooperative State Experiment Station Service of the U. S. Department of Agriculture. Liaison is maintained with similar research undertaken in Canada and the Scandinavian countries. Alaska is affiliated with the North Central States in regional research, receiving through this channel some additional financial support.

During 1961, the Alaska Agricultural Experiment Station conducted 73 project studies, 66 of which were active at the close of the calendar year, while six new projects were under preparation or consideration.

Considerable basic research has been undertaken in an effort to develop new knowledge on which further applied and developmental gains might be made. Estimated at some 18 per cent of the total program, this effort has intensified in recent years. Of special interest is the response of both plants and animals to photoperiod, light quality and low temperatures. Subarctic plant populations reflect a high degree of variability and remarkable proclivity toward hybridizing, the reasons for which are not yet clear. In these fields, and in winter hardiness and cold adaptation responses, subarctic environments offer unique opportunities for pioneer basic studies to expand general knowledge.

A wide variety of interdisciplinary techniques are employed, ranging from biometrics, genetics and meterology to colorimetric and chromotographic chemistry. Comparisons, differences and trends are developed by applying standard statistical procedures including population sampling, probabilities, analysis of variance and correlation, and by utilizing a wide variety of calculating tools. Data processing systems are available in Anchorage, at the University campus, and at Beltsville, Maryland.



ORGANIZATION

Within the experiment station the professional staff is formally organized into research teams generally following traditional agricultural subject matter patterns. Specific organization is documented in terms of research projects which normally run for two or more years but are usually revised after four or five years if original objectives have not been attained in that time. Professional staff members serve as project leaders. They define problem areas, devise projects within these areas, supervise research activities, interpret and report results. All are actively engaged in the conduct of research work.

Since 1950 the scope of the overall program has covered nine agricultural subject matter areas -- soil science, agronomy, horticulture, animal husbandry, agricultural engineering, entomology, plant pathology, agricultural economics (management, statistics, marketing), and fur production. All of these research areas are interdisciplinary, requiring both specialization and a broad knowledge of working tools and techniques.

As specified in the 1949 Memorandum of Understanding project leaders are, with three exceptions, joint employees holding appointments with both the University and the Department of Agriculture. The exceptions are University employees, not holding USDA appointments.

In late 1961, following emergence of the old State Experiment Station Division as a full fledged service, the Territorial Experiment Station Division of ARS was abolished. The station director now reports, with respect to the direct federal portion of the joint research program, to the Director (M. W. Parker), Crops Research Division, Agricultural Research Service, through their Tropical and Subarctic Research Program (D. V. Lumsden).

With respect to the state financed portion of the joint program, the director reports to the president of the University, through the vice-president for Research and Advanced Studies. The director works closely with the new Cooperative State Experiment Station Service (George Selke, H. C. Knoblauch) of ARS, charged with the responsibility for administering the national Hatch Act agricultural program through the State land-grant colleges and universities.

The current United States Department of Agriculture program at the Alaska Agricultural Experiment Station is based on congressional action following expiration of PL 266. At that time the Congress and the Board of Regents provided for a joint program sponsored by both the University of Alaska and the Agricultural Research Service of USDA. Additional funds have been appropriated annually since 1949 which, under a Memorandum of Understanding between the University and ARS, give direct federal support in addition to federal grant funds available to the Experiment Station. These directly appropriated funds are for accelerating and strengthening the agricultural status of Alaska and improving its self-sufficiency in food and forage availability.

Research opportunities in Alaska as seen by ARS are twofold. One is that of utilizing the unique environment of a subarctic location to contribute to the nation's fund of basic scientific knowledge. The other is to further research that will contribute to the economic well-being of Alaska's agriculture and improve the self-sufficiency of a strategically important part of the North American continent.

CURRENT USDA PROGRAM IN ALASKA

Insofar as possible the joint program has been separated below into its two component parts, each being described. In a sense this attempt is not valid since the whole program is fully integrated as specified in the 1949 Memorandum. It does, however, serve to point out the emphasis attributed to contributions of each partner.

Soil and Water Utilization (1.2 professional man-years) -- Evaluation of subarctic soil resources and their inherent productivity is a major and fundamental effort underlying the development of land and water utilization programs for Alaska. Information of this kind is basic to an understanding of subarctic and arctic food and fiber production potentials. Water resources are being defined, together with the moisture, physical and chemical characteristics of the various soil resources. Classification systems are devised in a coordinated program involving the Soil Conservation Service as a survey agency.

Crops Research (4.1 professional man-years) -- Fully integrated with state supported research, these studies are generally more basic in nature and of national significance. They are designed to develop new knowledge about the roles of low temperatures and long photoperiod on plant life, new germ plasm resources characterized by extreme winter hardiness, superior agronomic features such as frost and disease resistance, and the role of photoperiod in plant reactions to growth regulators.

Breeding new varieties of cereal and roughage crops especially adapted to subarctic environments supports a related state research effort. Also involved is the response of crops to soil-water-nutrition interactions, and their relation to water consumption.

Of special significance is the physiology of weed control, an evaluation of systemic agents in subarctic environments, and the design of improved methods. Also significant is the possible role of subarctic regions for growing virus free nursery stocks and foundation seed stocks.

Entomology (0.5 professional man-years) -- This effort is comprised of identifying and evaluating subarctic insects significant or of possible significance to a subarctic feedbase industry, together with

assessing their environmental checks and controls, both physical and biological. Also under investigation is the role of insects as pollinators. Low activity of insect vectors promises a possibility of virus-free production of some crops.

Marketing, Management, Economics (1.0 professional man-years) -- Supplementing state efforts, this program is concerned with accumulating basic statistical time series, and with market structures, practices and prices. Investigations of the marketing aspects of rural development and of interregional and intermarket competition as related to farm population changes and migration patterns are conducted in an effort to devise guide lines for future development.

Machinery, Structures, Material Handling (0.8 professional man-years) -- Integrated with the state research program, these studies provide basic information leading to developmental studies. Accumulating statistical time series of static and wind pressures, of vapor pressure factors, and of total and net solar radiation are among the more significant activities. Definition of major problems involved in feed storage and materials handling in cold temperatures is also under way.

Animal Husbandry (1.4 professional man-years) -- Of fundamental significance are studies of adaptive animal biology, nutrition, and reproduction in subarctic environments. These are confined to dairy cattle. Of equal significance is the efficiency of feed utilization and milk production in cold climates, with some attention focused on methods of reducing summer milk flow peaks and raising winter lows in isolated milksheds where alternate markets do not exist.

CURRENT STATE PROGRAM

An arbitrary system of weighting the federal program -- recently developed on a national scale for presenting a comprehensive picture of agricultural research to the next Congressional session -- has also been followed in describing the University's program. Where the direct federal program underwrites 9.0 professional research man-years in Alaska and maintenance of the headquarters at Palmer, the state supported program maintains the three University-owned farms, underwrites a major portion of subprofessional assistance and labor, and provides 9.4 professional man-years. This effort supports the following program.

Soil and Water Utilization (1.3 professional man-years) -- Estimating soil fertility and productivity is a basic effort underlying definition of land and water use potentials. This effort depends in turn on the definition of plant nutritional needs, water use requirements of plants and cropping systems, and basic relationships between climatic factors and

vapor loss from soil and cropped surfaces. Fertilizer needs are related to crop responses for both macro and micro nutrients. Associated with crops research are soil and water use management studies. Soil surveying responsibilities are confined to planning and review, the mapping functions having been assumed by the State Division of Lands.

Crops Research (3.9 professional man-years) -- Integrated with federally supported studies, these investigations are designed to strengthen Alaska's agricultural industry. Major emphasis is on improving Alaska's animal feedbase by providing better cereal varieties and strains and better grasses and legumes. Cereal studies are focused chiefly on barley and oats although wheat receives some attention. Early maturity, resistance to both disease and lodging, and improved yields are sought. Better grasses and legumes are also sought to lengthen the pasture season, and to provide better assurance of winter survival. An evaluation of Alaska's native grasses and legumes is underway, promising a better bromegrass strain, possible managed utilization of Calamogrostis, and improved turf grasses for use in Alaska and in other areas.

Management and cultural aspects being investigated involve seedbed preparation, planting methods and dates, weed control by culture and chemicals, response to irrigation and fertilizers, and methods of harvesting, storing and drying. To reduce labor and machine costs, pasture management is emphasized.

A somewhat smaller effort is focused on crops for human consumption. This is directed toward strengthening Alaska's potato and vegetable industries. Better quality potatoes with improved frost resistant foliage are being developed. Cultural practices, weed control, responses to fertilizer and supplemental water all receive attention as well as harvest and storage management. Better vegetable varieties, strains and lines are sought chiefly through evaluating new releases from other states and countries. In this area breeding special strains for Alaska is confined to crucifers and tomatoes. Vegetable culture, weed control, nutrition, and response to supplemental water are studied.

A minor effort is directed toward selecting improved tree and small fruits (raspberries, strawberries, currants) for Alaska, chiefly for home gardens. Closely associated with this work is the collection of native small fruits, especially blueberries, containing special genetic attributes for later use in national breeding programs.

Agricultural meteorology, with special attention to accumulating time-series of major parameters and better definition of microclimatic differences, is being stressed. The most extensive time series in Alaska has been collected in this field, records for College and Matanuska extending back over 30 years.

Entomology (0.5 professional man-years) -- Studies are directed toward developing improved insect control practices and toward collecting

information concerning pesticide hazards. Attention is given livestock insects and their control, with special emphasis on reducing the significance of warble infestations of reindeer. Improved insecticidal and sanitation measures in Alaska's dairy industry are sought.

Marketing, Management, Economics (2.0 professional man-years) -- Supplementing federal marketing studies, this program is concerned with developing specific enterprise costs and returns; farm organization and management; capital, credit, and financial condition; farmer's bargaining power; market structure and practices, especially in dairying and poultry enterprises; interregional and intermarket competition; and consumer acceptance, preference and satisfaction. Since mid-1960 major responsibility for time series agricultural statistics has been largely assumed by the Statistical Reporting Service, U.S.D.A.

Machinery, Structures, Material Handling (0.8 professional man-years) -- Generally dealing with applied and development studies, the State's effort in this field has been devoted to improved land clearing and preparation practices, to grain drying, crop handling, and to the development of adapted farm buildings and residences based on maximum utilization of native materials. Manure and waste disposal problems encountered in farmstead planning and husbandry are also of concern.

Animal Husbandry (0.9 professional man-years) -- Integrated with federal studies, state contributions are chiefly in the area of furnishing quarters and facilities at three University farms at Matanuska, College and Petersburg. The state supported effort provides shelters, machine complements, storage facilities for equipment and feedstuffs and cropland developed from the original landgrants at Matanuska and College.

Somewhat over a half of a professional man-year is focused on nutritional studies of dairy and beef animals, on improving management practices to strengthen Alaska's dairy industry, and on herd improvement through breeding and record keeping. Management practices for swine and maintenance of adapted germ plasm are minor efforts at the College Farm.

Recognized as a full partner in fur animal nutrition studies conducted at Petersburg, the State's contribution is in maintaining a physical plant. All professional supervision is contributed by the U. S. Department of Agriculture.

PROGRAM OF INDUSTRY AND OTHER AGENCIES

Although Alaska's food production industry is so small that it offers no economic motivation for the development of organized industrial research in the state, there are from time to time minor efforts in testing the cold weather performance of machines, equipment, fuels and lubricants. Many short-term military research contracts have been focused on exploiting subarctic environments for this purpose. Others have emphasized human performance and metabolic requirements, sanitation, and survival under extreme climatic pressures.

Several federal agencies other than military and foundations also have conducted or underwritten research studies in soil and air pollution, waste disposal, soil trafficability, plant and animal ecology, and so forth. The results of these studies are utilized in subarctic agriculture.

The combined annual agricultural research effort of industry and other agencies probably does not exceed 1 professional man-year.

PROPOSALS FOR ADDITIONAL RESEARCH

A decade of fairly intensive research effort has revealed rather extensive food production potentials in subarctic regions, much larger than anticipated when the present Alaska program was established in 1947. Also revealed are certain unique advantages of Alaska's natural environment which have so far been little exploited in expanding basic knowledge of national interest. The following proposals are offered as examples of approaches that can yield fundamental information of both local and national concern.

Winter and Frost Hardiness -- To enlarge basic studies designed to advance general understanding of mechanisms initiating and controlling winter hardening and winter survival of plants, and of frost resistance in foliage (Senate Document No. 91, 86th Congress, 2nd Session, March, 1960).

Photoperiod and Light Quality -- To initiate studies of the role of long photoperiod, low incident light intensity and spectrally modified light quality on the growth and development of economic crop plants in subarctic regions (Senate Document No. 91, 86th Congress, 2nd Session, March, 1960).

Microbiology -- To establish basic studies of the interrelationships between soil microbiological activity and plant nutrition and diseases in environments characterized by low soil temperatures (Communication of J. H. Dickson, President, American Institute of Biological Science, 1960).

Virus-free Plant Materials -- To expand and expedite the definition of potentials for producing and perpetuating virus-free plant materials in subarctic regions where insect transmission vector activity is repressed by cold temperatures and physical barriers (Based on potential application of recent discoveries).

CLIMATE (103, 109)* - The old USDA experiment stations initiated weather recording in many parts of Alaska. One of the longest continuous records in interior Alaska is that accumulated at the Matanuska Farm which now covers 45 years. This record is now nearly long enough to enable calculation of prediction probabilities.

Meteorological series maintained during the year include humidity, air temperatures, precipitation (total and intensity), subsurface soil temperatures from 1 inch to 10 feet, wind direction and velocity, total radiation and net radiation. Radiation records have been transferred to punch cards for analysis and correlation by the 1620 data processing system.

Techniques and instrumentation for analyzing subarctic light quality are being reviewed. Instruments will be designed to yield data similar to that being collected in southern latitudes. Foundation underwriting is anticipated for this phase of the study.

AGRICULTURAL CREDIT (89) - A preliminary study of available credit for Alaska farmers revealed approximately 72 per cent is held by government owned or sponsored agencies while only 28 per cent of the debt is held by banks, individuals and private creditors. This ratio between public and private creditors is directly opposite that found in the south 48 states.

Individuals, the leading source of farm credit in the other states, play a very minor role in Alaska. Farm loans by insurance companies are practically non-existent. There were no direct farm loans made by insurance companies and only two cases were found where insurance companies held bank paper. The debt held by these two sources amounted to less than 5 per cent of Alaska's total outstanding farm credit. The Federal Land Bank (which has been operating in Alaska slightly over a year) held 16.9 per cent of the farm debt which is approximately the same as the national average. FHA's share of the farm debt was more than double the national average at 22.6 per cent.

Three loan funds unique to Alaska provide approximately a third of all credit available to farmers. The Alaska Agricultural Revolving Loan Fund (a state fund) and the Alaska Rural Rehabilitation Corporation (originally an agency of the Matanuska Colony) each held approximately 15 per cent of the farm debt, while a state veteran loan fund accounted for approximately 2.5 per cent of the debt.

The interest rates usually ran from 5 to 8 per cent on both real estate and chattel loans. Approximately 40 per cent of the loans were for a period of less than three years but only 40 per cent were for a period of more than 10 years. Dairy farmers held approximately

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* Numbers in parentheses refer to the Experiment Station's serial registration system. A complete list of projects is attached.

75 per cent of the credit extended and poultry farms about 2 per cent. The balance of the outstanding credit was fairly evenly divided between potato-vegetable farms and general grain, hay and livestock farms. Distribution of farm loans by area showed approximately 80 per cent were in the Matanuska-Anchorage area, 13 per cent in the Tanana Valley, and the remaining 7 per cent scattered over the rest of the state.

AGRICULTURAL LANDS (72) - Activity was limited to reviewing field survey programs conducted by the Soil Conservation Service and partially supported this year for the first time with a $10,000 contract allotment by the Alaska Division of Lands. Detailed soil surveys of the Salcha-Big Delta area (74,560 acres), Goldstream-Nenana area (62,660 acres), and the Wasilla area (91,170 acres) were approved for a total of 228,390 mapped acres. In addition reconnaissance surveys in the Montana railbelt area (232,740 acres), and the southeastern Kenai Peninsula (670,000 acres) were also approved.

Program priorities for the 1962 field season were established, based on a 8 to 10 man survey party. These include --

- Copper River Valley and Chitina Valley, Gakona to McCarthy
- West side of Susitna Valley, Deshka river to Petersville Road
- South part of Salcha-Big Delta subdistrict (reconnaissance)
- Additional area in new Montana subdistrict
- Western portion of Wasilla subdistrict
- Goldstream-Nenana region in vicinity of Nenana and Clear

FARM DEVELOPMENT

LAND PREPARATION (31) - A heavy disc (Rome trade-name) again proved satisfactory as an initial land breaking implement. Disking newly cleared land is now preferred over breaking with a plow. Some operators prefer an integrally mounted offset disk because of its greater simplicity. Trials were conducted in the newly settled Clearwater district, 110 miles southeast of Fairbanks.

At the College Farm land underlaid with permafrost was sheared with a special Canadian built dozer blade (Hoover trade-name) three and four years ago. By 1961 vertical drainage, formerly impeded by frost, had developed sufficiently to permit further work. Fall-sheared light forest and shrub cover four inches or less in diameter did not require additional heavy equipment time. A field cultivator and spring tooth root rake pulled by a farm tractor did an adequate job. Where the original stand was heavy (spruce 8 to 14 inches in diameter) a bulldozer was needed to pile debris for burning. Operating records provide cost estimates for later economic comparisons.

BUILDING MATERIALS & STRUCTURES (28, 63) - Surface mantle materials suitable for construction purposes were found in the vicinity of many remote village sites. Others were so situated on coarse gravelly

sites, deliberately selected for their good drainage, that only conventional concrete aggregates are immediately available. Most surface mantle materials must be modified by the addition of coarse aggregates before they can be used for pressure-bonded blocks, or otherwise stabilized. Proportions are not critical. Satisfactory cement stabilized blocks can be made of soil materials containing a high proportion of silt.

Treated fence posts of native species were still functional after nine years. Green birch poles 25 feet long were readily treated with water soluble double diffusion preservative chemicals.

Findings of these studies are extensively utilized by Alaska's enlarged Farm Home Administration program. To obtain FHA financing, farmers are required to follow Experiment Station recommendations derived from this research.

CROP PRODUCTION PRACTICES

IRRIGATION (113) - Irrigation is profitable in promoting early germination of small seeded crops, even in so-called wet years. Better weed control is an added benefit. Extra water after planting offsets surface drying during tillage operations.

Although nearly adequate rainfall during the 1961 crop season reduced total responses to supplemental water, irrigation again proved helpful in obtaining early stands of annual forages. Extra water after seeding promoted germination and weed control.

One early irrigation of annual forages gave yields up to 40 per cent more than where no extra water was applied. Irrigated ryegrass-clover mixtures responded to heavy nitrogen and phosphate applications, yielding up to 30 per cent more forage. A stand of Engmo timothy-Siberian alfalfa was established for intensive production studies.

Third-year bromegrass yields dropped nearly a third under intensive management while second year timothy-clover dropped only 12 per cent at low fertility levels. Heavy fertilization improved bromegrass yields up to 40 per cent, timothy-clover up to 20 per cent. Broadleaf weeds have not infested irrigated perennial forage stands.

Lactating cows again utilized irrigated bromegrass pasture under rotational and strip grazing. Fluctuations in growth were successfully anticipated for the first time, providing eight cows uninterrupted grazing on six acres. Daily fecal samples were accumulated under each grazing system, one being analyzed for plant pigments to give daily estimates of digestibility.

Evaporation from a Bellani plate instrument showed response variations closely resembling those noted in evaporation from a free water surface.

WATER INFILTRATION (112) - Water intake controls the rate at which soils may be irrigated. Basic data defining this characteristic is also utilized in watershed hydrology, in highway engineering, and in forest utilization.

An allocation of funds from the North Central technical committee (NC-40) was used to purchase a Purdue infiltrometer. This equipment was assembled, field tested, and placed in operation. Infiltration rates were determined for two Matanuska soil series under sod, row crop, and cereal cover. Soil horizons at each site were sampled to permit correlating data with a nation-wide series.

SOIL AMENDMENTS (1) - Lime is needed for satisfactory gardens on some of the podzols in the Willow, Big Lake, and Kenai Peninsula areas. Excellent growth on some of these problem soils is obtained by combining high fertilization rates with lime applications.

Ammonium polyphosphate (16-60-0), a high analysis TVA experimental fertilizer, gave similar responses to the same nutrients provided by ammonium nitrate and treblesuperphosphate in the Fairbanks area. In the Matanuska Valley this new fertilizer seemed inferior and more evaluation is needed.

Boron markedly decreased "girdle" of table beets in an experiment near Big Lake. Boron deficiency in beets also has been observed in the Willow and Kenai Peninsula areas. Symptoms are intensified by liming and high fertilization. Since small quantities of boron have been demonstrated to be toxic on Bodenburg and Knik silt loam, extreme care should be exercised in making recommendations until more work has been done.

Mixed fertilizers containing nitric phosphates are quite satisfactory for lawns. For many crops they are inferior to the ammonium nitrate and treblesuperphosphate or ammonium phosphate now purchased.

A brief survey of non-farm fertilizer use in the Palmer and Anchorage areas was made. In Anchorage, lawns account for a large amount of fertilizer use. Large quantities of low analysis expensive mixtures are fairly popular and widely sold. In Palmer a higher percentage of fertilizer is used on gardens and in greenhouses than in Anchorage. Higher analysis materials predominate in the latter area.

POTASSIUM NUTRITION (53, NC-16) - In both Tanana and Matanuska Valleys, bromegrass responded to all levels of potash applied to the soil. Nitrogen, phosphorus and magnesium content of bromegrass harvested from plots in 1960 proved unrelated to potassium level or carrier. An intensive study of nutrient balance in a Tanana Valley soil showed that --

- By spring, 75 per cent of the available nitrogen, phosphate and potash in the soil the preceding fall has been lost or fixed
- Crops recovered 40 per cent of nitrogen applied in the spring
- 60 per cent of phosphates applied in the spring were fixed by fall
- 200 pounds of potash per acre were released by the soil during the growing season

While additional studies are needed to define the potash requirements of crops growing on Alaskan soils and the potash status of major

soil types, it is apparent that intensive cropping practices remove more potash than has been returned in fertilizers. Recommendations for potash fertilizer practices must be adjusted upwards.

EXTENDED PASTURES (94) - Four grasses -- tall oatgrass, orchard grass, timothy and ryegrass -- were seeded in half-acre plots, with and without alfalfa (randomized block with two replications). Weeds were controlled by sprays. Plots were irrigated 1/2-inch to promote early emergence and 2 inches in mid-season. All were cut for silage in late July, yielding dry matter ranging from a high of 2.8 (ryegrass) to a low of 1.9 (orchard grass) tons per acre. Cows grazing regrowth in late August and September preferred tall oatgrass whereas ryegrass was the least palatable. Orchard grass and alfalfa (which ranked third in yield at 2.4 tons per acre) ranked third in palatability, insignificantly different from tall oatgrass and alfalfa which was second in palatability and seventh in yield.

Annual forages are thus shown to provide a first cutting of excellent quality hay or silage and excellent grazing or green chop in late summer and early fall when perennials are entering their dormant stage. Ryegrass yields maximum herbage for hay, silage and soilage. For pasture, orchard grass and alfalfa are recommended due to superior palatability and satisfactory yield.

Fecal samples from the bromegrass experiment will be analyzed and digestibility and production data programmed through a 1621 computer to compare the two grazing systems. Evaluation of annual grass and alfalfa mixtures under irrigation will be continued. (See also FORAGE PRODUCTION, next page).

CEREALS (97) - Studies of rate and date of seeding have contributed to the establishment of a grain industry in Alaska. Factors currently under investigation are designed to improve yields and quality of grain and grain forage produced by Alaska's farmers.

Forage production of early maturing oat varieties, seed of which can be readily produced in Alaska, was compared with that of later maturing varieties commonly grown but for which seed is imported. Yields and quality have not yet been completely evaluated for the 1961 crop year. Previous results have indicated that early oat varieties produce nearly as much forage as later varieties when harvested at comparable maturity stages. Satisfactory data were not obtained in a barley evaluation designed to compare yield, germination, and protein trends at varying harvest dates because of poor stands and uneven growth. Protein levels of grain are again being determined for a series of experimental and commercial varieties.

Further investigations will focus on the use of early oat varieties for forage. Studies concerning yield, germination and quality of grain harvested at varied stages of maturity, and interactions between fertility levels, plant populations and plant spacings will be continued.

FORAGE PRODUCTION (41) - Incorporation of winter rye into existing crop rotations on Alaska's dairy farms shows promise of providing herbage for early spring grazing in advance of the time that bromegrass can be pastured. Several varieties of winter rye were compared. All demonstrated satisfactory winter survival when planted sufficiently early the previous summer. These investigations are continuing. It is anticipated that winter rye could be planted in August following early oat-pea harvest and that a late planting of oats and peas or other crop could effectively utilize the following growing season after harvest of winter rye forage in spring. The economics of this practice have not been evaluated.

Management of bromegrass involving two levels of nitrogen fertility and different schedules of harvest resulted in drastic stand deterioration under the most frequent defoliation and at the higher fertility level. Inasmuch as high soil fertility is tantamount to maximum productivity of bromegrass, there are apparently critical considerations in harvest scheduling that require intensive investigation. This is of real concern in view of the extensive acreages of bromegrass and the dependency of dairymen upon this grass. Whether the frequency of defoliation or defoliation at a critical time or times during the year contributed most to stand deterioration is at present obscure and will be studied.

Heretofore, culture of variegated alfalfa in the Tanana Valley was regarded as an impossibility owing to the marginal productivity of stands, and also the rapid deterioration of stands as a result of winter-killing. Recent experimental evidence indicates that addition of potassium in sufficient quantities and at the proper time vastly improves yields. Winter survival of alfalfa has been improved somewhat by high levels of potassium fertilization.

A THRESHER FOR BLUEJOINT (105) - Bluejoint (Calamagrostis canadensis) is a tall-growing, winterhardy, perennial range grass occurring widely throughout Alaska, Canada and all but the southeastern portion of continental United States. This grass has certain characteristics that are undesirable from the standpoint of use as a forage species such as rapid maturation with attendant loss of forage quality, slow regrowth after harvest, and stand deterioration if harvested too frequently. However bluejoint also possesses desirable characteristics from several standpoints. Forage quality is satisfactory to good if harvested at an early stage of development. Bluejoint performs an invaluable function in stabilizing soils and preventing erosion. It is extremely widespread and its performance on soils of low fertility far surpasses that of many cultivated grasses.

An effort has been made to develop a method of threshing and recovering the extremely small seeds of bluejoint to obtain seed supplies for the purpose of establishing artificial plantings. Successful means have been discovered by using recently developed equipment located at the USDA seed laboratory in Corvallis, Oregon, for effectively threshing bluejoint seed and separating seeds from their

persistent but undesirable hairlike appendages. Only limited experimental quantities of seed were threshed in the course of the experimental trials. Consequently effort has been directed toward acquiring machinery to be used locally for processing larger amounts of seed. Threshing seed from native stands of bluejoint will provide practical amounts of seed for evaluating the agricultural potential of this grass, following artificial establishment, in uniform, accessible stands.

Results of these studies will define the merits and limitations of bluejoint for soil stabilization, erosion control, regrassing burned areas, and forage production.

POTATO SCAB (100) - The increase in prevalence and severity of potato scab and its rapid increase in certain newly cleared fields led to work designed to test in Alaska those control measures developed elsewhere. Reduction of scab by the application of manure and potash seemed to indicate the importance of nutrition of the scab organisms and those soil microorganisms growing in association with S. scabies. Attempts are now being made to reduce variability of S. scabies so that more accurate determinations may be made of the relations between S. scabies and other soil organisms. Concurrent studies are in progress to determine the sources of variability in this pathogen.

Definition of the factors contributing to variability in the scab organism may explain the apparent discrepancies found in the reaction of potatoes to the disease under different environments and with different control methods.

POTATO HOLLOWHEART & POTASH (117) - Consumer acceptance of Alaskan grown fresh potatoes depends upon a high quality product to compete with imported fresh potatoes and the many attractively packaged processed products. Research is being conducted toward increasing the production and quality of Alaskan potatoes, and at the same time to make use of Alaska's unique climate potential to study problems basic to the whole potato industry.

Hollow heart continues as one of the more serious problems confronting potato producers. Hollow heart studies with Alaska 114 and Kennebec potatoes were continued, again using all possible combinations of two moisture levels, three potash levels and two nitrogen levels. Five inches of added irrigation water increased the total weight of tubers 11 per cent, number of tubers 3 per cent, and the number of hollow heart tubers 10 per cent. Increasing the nitrogen from 40 to 120 lbs/acre increased the number of hollow heart tubers 93 per cent with an accompanying 5 per cent increase in total tuber weight.

Increasing levels of potassium were accompanied by small increases in total tuber weight and small decreases in the number of hollow heart tubers. Further evidence was obtained associating the early development of small brown necrotic patches in tubers with the later development of hollow heart. A rapid histochemical test was

developed which clearly shows the presence of many small necrotic areas in some tubers. It was determined chromatographically that chlorogenic acid was found in much greater concentration around necrotic spots than in healthy tuber tissue.

As a result of the data obtained from hollow heart studies, it will be recommended that growers severely troubled with hollow heart decrease the amount of nitrogen and increase the potassium used.

POTATO DORMANCY (117) - Dormancy of potato tubers has effectively been broken by centrifugation of tubers. Evidence also suggest that dormancy in Alaska 114 is light controlled. Centrifugation of tubers to break dormancy and the possibility of light controlling this dormancy should add greatly to a better understanding and consequential control of sprouting.

PHOTOPERIOD & POTATO HOLLOW HEART (117) - At the College Experiment Station Farm in the Tanana Valley, attempts were made to relate photoperiod to hollow heart incidence. In 1961 as in the past, hollow heart was correlated with high nitrogen and low potash. The highest level of N and the lowest level of K induced 93 per cent hollow heart.

Effect of photoperiod on the incidence of hollow heart in the variety Alaska 114 was investigated An 8-hour photoperiod begun at tuber initiation and carried on for 21 cycles, reduced hollow heart 29 per cent when compared to normal photoperiod. An 8-hour photoperiod begun when tuber initiation was at maximum and carried on for 21 cycles, reduced the incidence of hollow heart by 25 per cent.

PHOTOPERIOD & TUBER INITIATION (117) - Tuber initiation was induced in rooted sprouts of Kennebec, Triumph, and Solanum curtilobum by exposure to 30 photoperiods of 8 hours. No tubers were formed on plants grown under continuous light for 30 days. Tuberization of the Triumph variety appeared to be least affected by long photoperiods and S. curtilobum appeared to be the most sensitive.

FROST TOLERANT POTATO FOLIAGE (120) - Successive plantings of susceptible and frost resistant potatoes showed frost resistant clones possess resistance at various physiological stages of growth which means they might survive light frosts in July or August. This is valuable in marginal frosty areas. Alaska's production potential is significantly reduced each year by midseason frosts.

Potato tops are damaged by frost first in the uppermost growing point. While potatoes from the high Andes plateaus are quite frost resistant and tuberize in response to the long nights of the equitorial region, they do not tuberize in Alaska's growing season of short nights and long days.

Offspring from crosses of Alaskan with non-tuberizing types have segregated into frost resistant types that produce tubers in Alaska. These early selections reflect peculiarities of their ancestors such as colored skin, colored flesh, second-growth tubers and other

undesirable characteristics, yet they demonstrate that a good frost resistant potato can be developed through crossing and intensive selecting for desirable types. Commercial potato production along the Yukon and Kuskokwim Rivers could become a reality with a good frost resistant potato. Many other regions throughout the world might benefit from germplasm selected in Alaska.

FREEZING PEAS (106) - Evaluation of quick frozen samples showed a color preference for shiny, plump, dark green peas. Viking ranked first, followed by Hyalite, Laxton 8, Jade, Midfreezer, Small Sieve Freezer, Freezer 37, Freezer 626, Victory Freezer and Perfected Freezer. In texture, Viking and Hyalite were followed by Small Sieve Freezer, Victory Freezer, Midfreezer and Perfected Freezer. For flavor, Victory Freezer and Midfreezer were equal, followed by Hyalite, Viking and Small Sieve Freezer. Split pericarps and yellow cotyledons were the most objectionable defects.

Peas planted May 16 were irrigated July 27 when soil moisture in the plow layer dropped to half of field capacity. Pea varieties and dates when they were considered mature for freezing were: Freezer 37 - August 4-7; Midfreezer and Viking - August 15; Small Sieve Freezer - August 18; Perfected Freezer - August 29; Hyalite - September 1. Cool, cloudy, wet weather delayed maturity. Weeds were effectively controlled with Premerge. Acre yields of 3500 to 4000 pounds of shelled peas are projected from this year's performance.

BETTER COLE CROPS (7) - One and a half pounds of boron per acre did not improve head density or yield of Baby Head cabbage. Twelve-inch spacing of cabbage plants in the row reduced head size and total yield of Slow Bolting Green, Bonanza, and Ferry's Round Dutch. Fertilizer levels used did not significantly influence total yield. Slow Bolting Green produced the highest yields while Ferry's Round Dutch produced the lowest.

Twelve varieties of cabbage comprising early, midseason, and late varieties were evaluated. Sidel Ballhead, Gills Oregon Ballhead, Badger Ballhead, Badger Market, Early Round Dutch and three introductions from Holland warrant further study. Cabbage improvement work was continued by collecting seed from selections made in 1960.

Two cauliflower introductions (PI 264653, PI 264658) warrant further testing. Broccoli (Atlantic, Coastal, Early Spartan) all lacked uniformity of size and color of individual flowers in terminal and lateral florets.

GROWTH REGULATORS (91) - Lettuce and cabbage hold a prime condition in the field for only a few days, then deteriorate steadily after harvest. Prolonging either the length of the storage season or the length of time they remain in a marketable condition in the field would be desirable.

Field seeded Bonanza and Golden Acre cabbage and Pennlake and Great Lakes 659 lettuce were sprayed with various growth regulators

just before their heads reached market size in an effort to prolong the market season by retarding development. Chemicals used were 2-chloroethyl-timethyl ammonium chloride (CCC), maleic hydrazide (MH), 3 indoleacetic acid (IAA), 2, 3, 5-triodobenzoic acid (TIBA), 3-indole-butyric acid (IBA) and N^6-benzyladenine. None of these chemicals slowed growth in the field sufficiently to prolong the market season of either cabbage or lettuce.

Cabbage and lettuce heads cut from plots sprayed with 0, 5, 10 and 20 ppm N^6-benzyladenine three hours prior to harvest and heads which were dipped for five minutes in a 0, 5, 10 and 20 ppm N^6-benzyl-adenine were also placed in storage at 40°F. These treatments preserved the green color and kept lettuce in a marketable condition up to two weeks longer than untreated lettuce. They were effective in maintaining the green, attractive appearance of cabbage for periods of more than one month longer than untreated cabbage. N^6-benzyladenine was also effective on kale and broccoli for maintaining the green color and reducing loss of quality during storage.

None of the new growth retardants or other chemicals tested, other than N^6-benyzladenine show potential in this environment for extending the market season of cabbage and lettuce. Limited FDA clearance now exists for the use of N^6-benzyladenine on lettuce.

ADAPTED VEGETABLES (13) - Nearly 150 varieties, strains and lines of 15 species of vegetables were compared and evaluated in 1961. These included standard varieties together with new domestic and foreign introductions. Well adapted materials for which commercial seed sources are available will be included in the next issue of VEGETABLE RECOMMENDATIONS.

HASTENING EMERGENCE (13) - Clear plastic mulch placed over seeded rows immediately after planting encouraged emergence and improved stands of both cool and warm season vegetables. Black plastic reduced soil temperatures, retarded emergence and reduced stands and yields.

Gibberellic acid (10 ppm) hastened emergence and improved stands of peas and beans, while 20 ppm was not as good although better than check plots.

POLLINATION (76) - The Hymenoptera to which the bees belong is one of the largest groups of insects in Alaska. Most of these are parasitic on other insects, being one of the most important groups in biological control. The pollinators are not as numerous but are an exceedingly important group in the production of seeds and fruit. The experiment station collection is nearly complete with respect to known species of bumble bees and parasitic bumblebees (which behave as the cowbirds and cuckoo birds do to other birds).

While native pollinators are present in sufficient numbers to set small fruits, crab apples and berries, increased production is obtained by use of honeybees which are normally introduced each year. It has not proved worthwhile to overwinter bees in Alaska if any honey is to be utilized by the beekeeper. In late summer when legumes bloom the native bees are relatively inactive. Honeybees help even though they do not like to work some of our legumes under our cool wet conditions. Their large numbers are of considerable assistance though alfalfa is not a preferred pollen source. Importation of alkali bees, an excellent pollinator, was unsuccessful.

Interest in honeybees and honey production has increased greatly in the past few years. In 1961 there were 35 individuals with 135 hives in the state. Greatest yield known so far is 125 pounds of honey. Most Alaskan honey is light amber in color and has an excellent flavor.

WEED CONTROL

CEREALS & FORAGES (64) - With present serious weed seed infestation in most of Alaska's cropland soils, effective weed control measures are extremely important because farmers can be assured that weeds will develop to accompany any crop they plant. Weed control is important because it prevents further build-up of weed seed populations in soils, prevents reduced crop yields, prevents downgrading of crop quality due to the presence of weeds or weed seeds and, in certain cases, prevents total crop losses.

Five selective herbicides to which red clover has demonstrated a measurable tolerance were used at several rates both individually and in various combinations for weed control of seedling stand. Excellent results were obtained with certain of the 33 treatments that included three of the herbicides used in combination. These treatments gave effective control of wild buckwheat, lambsquarters and spurrey with negligible damage to red clover.

Isolated, persistent small stands of Canada thistle have been treated annually in cooperation with the Alaska Division of Agriculture to prevent the spread of, and eventually eradicate, this extremely noxious weed. During 1961 three herbicidal formulations, amitrole-T, Amino triazole and 2, 4-D, were compared for effectiveness on one stand of Canada thistle. Treatment with 2, 4-D produced the most rapid top kill; although at the end of the growing season there was considerable regrowth on these plots. Amitrol-T appeared to be somewhat superior to amino triazole in overall herbicidal effect. Final evaluation of this test will be made in summer of 1962.

HORTICULTURAL CROPS (118) - New chemicals, appearing at an increasingly rapid rate, offer cheaper and more effective weed control. Some of these chemicals do not perform in subarctic environments as they do in more temperate regions. For these reasons 33 herbicides selected as the most promising for a particular crop from the evaluations of

research workers in Alaska and in other areas were tested during 1961. Horticultural crops on which herbicides were screened were carrots, potatoes, parsnips, sugarbeets, peas, cabbage, cauliflower, broccoli, celery, radishes, beans, tomatoes, beets, gladioli, raspberries and strawberries.

Herbicides showing outstanding selective herbicidal potential for a specific crop are as follows: ipazine, N-(3,4-dichlorophenyl) methacrylamide (Dicryl), propazine, N-(3-chloro-4-methylphenyl)-2-methylpentanamide (Solan) and N-(e,4-dichlorophenyl)-2-methylpentanamide (Karsil), both pre and post-emergence for carrots; simazine and trietazine pre-emergence for strawberries and raspberries; Dicryl and Solan for parsnips, pre and post-emergence; 2-ethylamino-4-isopropylamino-6-methylmercapto-s-triazine (Atrametryne), 2,4-bis (isoprophyamino)-6-mercapto-s-triazine (Prometryne), Solan and ipazine pre-emergence for potatoes; and Solan and propazine post-transplant for celery. SMDC (Vapam) proved effective as a soil sterilant on which late garden crops were grown unharmed. Dalapon and a mixture of atrazine + amitrol T showed potential for use against quackgrass infested land.

Data are published annually so that weed researchers in this rapidly moving field can evaluate the response of crops and weeds to herbicides in Alaska's cool, long-photoperiod environment. FDA clearance efforts are either strengthened or discontinued according to reports of tests from a wide range of environments. Several effective and economical herbicides for Alaska now await FDA clearance for recommendation.

IRRIGATION(113, 94) - Small seeded crops requiring a fine seed-bed suffer severe weed competition. In both the Matanuska and Tanana Valleys, silty surface soils dry rapidly during tillage. Powdery, dusty surfaces are not readily wetted by herbicidal sprays applied at standard rates. Droplets do not spread on the soil surface. Instead they retain their drop characteristics so that a continuous film is not formed. For this reason a light irrigation vastly improves the efficiency of pre-emergence sprays. Not only are weeds repressed but the additional moisture encourages better germination of crop seeds thus improving the crop's competitive position.

CROP INPROVEMENT

MUTAGENIC AGENTS (43) - Various treatments have been employed in an attempt to induce favorable mutations in cereal crops. Of particular interest in Alaska would be improvements in maturity and lodging characteristics, which are unsatisfactory in many introduced varieties. Despite the many undesirable mutations induced by radiation and chemical treatments, some progress has been recorded in obtaining cereal strains possessing earlier maturity and improved lodging resistance for use in the breeding program. Radiation treatments appear more useful than chemical treatments at present.

NEW CEREALS (114) - Material tested in field trials has consisted chiefly of varieties introduced from other areas. Strains from the breeding program are becoming increasingly important as favorable characteristics of introduced varieties are combined. Approximately 40 per cent of the strains tested trace to the current hybridization program, with several hundred additional selections made this season for entry into yield evaluation. Uniform evaluation trials were conducted in cooperation with stations in the United States and Canada in order to maintain a continuous evaluation of varieties available commercially in other areas. Foundation seed of the recommended varieties -- Nip oats, Golden Rain oats, Edda barley and Gasser wheat -- were maintained for distribution through the Alaska Crop Improvement Association. These varieties are the foundation of the successful grain industry in Alaska. Continued breeding, selection and testing should help develop varieties even better suited for production in Alaska, thereby contributing to the continued growth of the grain industry.

NEW FORAGES FOR ALASKA (115) - A new experimental synthetic variety of bromegrass bred for performance in Alaska was seeded in comparative trials with the varieties now recommended. If performance of this variety meets expectations during these comparative tests over the next few years it will be released to Alaskan farmers. A foundation seed block of the variety was established in 1961. One of the outstanding attributes of this variety is its considerable resistance to lodging during the wet season in Alaska. Continued selection is underway to further improve bromegrass.

Engmo timothy which has been so enthusiastically received by Alaskan farmers has a limited second crop production. Selection is underway to combine high first cutting yields with greater second cutting yields without sacrificing the high quality of forage produced by Engmo.

Very limited success was experienced in seed increase of two potential alfalfa varieties sufficiently hardy to be of value in Alaska. A very cool, wet season reduced insect pollination and was decidedly unfavorable to maturation of seed. Production of seed in sufficient quantity for establishing fields in other areas for production of certified seed is a major problem.

Selection and testing work continued with red clover and other legumes and grasses with the ultimate goal of developing suitable varieties for Alaskan farmers.

BREEDING ALFALFA VARIETIES RESISTANT TO BLACKSTEM (44r) - Progress on this project was limited to extensive hand pollinations to produce quantities of seed adequate for studying the genetics of resistance to the blackstem disease next year. For each F_1 hybrid between supposedly resistant and susceptible varieties an attempt was made to produce at least 100 seeds of each of the following - F_2 seed, backcross to each parent, and S_1 seed of each parent. Self fertility problems were encountered with some plants.

QUALITY POTATOES (17) - Quality of Alaskan potatoes is high and varies from variety to variety. It is unlikely that one variety can be developed that is suitable for baking, boiling and frying because the characteristics that make a baked potato fluffy increase the degree of sluffing of the same variety when boiled.

A red-fleshed potato has been developed that yields good quality red chips. It is so new that its productive capacity or public acceptance is unknown.

BETTER STRAWBERRIES (11) - An understanding of the effects of sub-arctic environment on the survival and development of small fruits is an invaluable aid in selecting new varieties and improving cultural practices. The present repository of indigenous Fragaria species and selected hybrid material represents a gene bank of frost tolerant material.

Root and crown temperatures of two strawberry varieties (Sitka Hybrid, Empire) were measured in the field throughout their dormant season (October - April). Lowest temperatures were recorded during February and March when crown temperatures averages 13° F. Root temperatures averaged 10° F for the month of February. Empire plants failed to survive, while Sitka hybrids were not injured.

A systematic strawberry survival study was initiated. Thermo-couples were placed in crown and root zones of plants to record temperatures throughout the dormant season. Strawberry selection work was with seedlings planted in 1959. Hybridization was carried on in the greenhouse throughout the winter to improve previously selected seedling material.

Preliminary studies were conducted to determine the best procedure of germinating and growing red raspberry seedlings.

INDIGENOUS ALASKAN FRUITS (74) - Plant breeders in Alaska and other states are interested in obtaining native Alaskan fruits because of the early and hardy germplasm they cay contain. Collection and evaluation of native small fruits are being made through a three-way arrangement with the Alaska Station, NC-7, and the Plant Introduction Station, New Crops Research Branch, ARS, all participating.

Systematic collection, establishment and evaluation of collected indigenous materials which began in 1960 were continued in 1961 with collections made from Southeastern Alaska, Point Barrow, Copper River and McKinley Park areas. Evaluation of previously collected material showed that survival rates of the smaller cuttings were low. An outdoor misting bed was established in an effort to increase the survival percentage of the cuttings and plants.

Survival of Fragaria and Rubus collections was good while Ribes and Vaccinium survival was poor. Collected material is being maintained at the College and Matanuska Farms using artificial protection such as mulch and windbreaks until it is established and sufficient material is available for accurate evaluation of inherent characters.

Further collections are planned for the 1962 season and evaluations of previously collected material will be continued. Where ample material is available it will be distributed to interested plant breeders .

INDIGENOUS FORAGE PLANTS (121) - Laboratory and literature study pertinent to this project proceeded during the winter, 1961. Herbarium and seed collections were organized and determinations were made on the herbarium specimens collected the previous summer. Seed samples were selected for planting during the 1961 growing season. Taxonomic analyses of Bromus material continued.

Field collections were made in many parts of Alaska ranging from Juneau to Barrow during the months of May through September. Coastal collection sites included Seward, Valdez, Cordova, Yakutat, and Juneau. Plant and seed collections were also made in the Interior along the Glenn, Richardson, and Alaska Highways as far south as Haines. Collections were made in arctic Alaska at Barrow, Atkasuk, Umiat, and Anaktuvuk Pass. Nurseries were reorganized, mapped, and new plantings made of Bromus and various legues.

Seeds of Bromus hybrid were sent to various organizations for testing under different environmental conditions. Selections made in the nurseries of indigenous Poa and Festuca are now being evaluated in a turf grass program.

INSECT & DISEASE CONTROL

INSECT PROBLEMS (75) - Alaska is fortunate in some ways in its scattered development of agriculture. Isolation is one of the main reasons there are so few consistently serious insect problems. In spite of this there are many insect troubles as serious to the individual concerned as extensive monetary losses may be to large scale agriculture in other areas. Among the problems which stood out in 1961 were aphids of numerous species, colors and habits. Birch aphids produced much leaf shedding and sooty fungus on birch and some poplars. Continued defoliation resulted in serious vitality losses. Cottony forms of aphids distorted many spruce terminals in

their gall formation and were an unsightly mass on many alders. Almost all the ornamentals, herbaceous or woody, had their aphid problems.

Mites attacking spruce, stink bugs on poplars, and a relative of the willow leaf beetle injuring willow near Manley Hot Springs were other serious ornamental pests of this season.

Red turnip beetle, especially in the Kenny Lake area, and other parts of the interior of Alaska were very severe on all crucifers. Flea beetles, thrips and springtails were other serious vegetable problems in many areas.

Household insects appear to be on the increase. Each year there are move invasions of clover mites which may be present in thousands but whose damage is mainly psychological. If crushed they may leave a red spot but there is the only harm they do. Cockroaches of various types, even the large American several inches long, are beginning to appear. The german and brown-banded are much more common and are often brought back in grocery purchases. Beetles of various types are often unwelcome additions to package mixes. Householders using green spruce timbers have been surprised with large long-horn beetles and horn-tail wasps emerging into rooms leaving round holes in walls and ceilings. Clothes months and carpet beetles seem to cause more trouble each year.

It appears that the wild native legumes and grasses which appear to be very promising sources of germplasm for breeding or as turf grasses or forage plants themselves have serious insect problems not previously recognized in Alaska. Seedpods of many wild lupines and oxytropes are heavily infested by an as yet unidentified maggot. Some selections of wild bluegrass had almost 75 per cent f their inflorescences damaged enough to prevent seed production.

Cattle grubs have appeared in a number of dairy animals in the Matanuska Valley as a result of a number of importations of dairy stock from the south 48. Previous introductions have not survived.

TURNIP MAGGOTS (119) - The turnip maggot, Hylemya florialis, continues to be the most consistently serious insect problem in Alaska as to distribution, variety of crops injured as well as total amount of damage done. Increasing amounts of weedy mustards on roadsides and in hay and grain fields aid materially in increasing populations.

Weekly applications of Bacillus thurinigensis (commonly known as the microbial insecticide) had no apparent effect in decreasing maggot populations or in producing control in radishes, turnips, broccoli, cauliflower or cabbage. A number of materials gave good control in radishes applied as area coverage in sprays. These included dibrom, zectran, phosphamidon and malathion. None give satisfactory control in turnips. Dibrom gave the best control in turnips followed by phosphamidon and malathion with zectran the heavies infested.

In a maggot resistance trial with 13 varieties of rutabagas and 5 varieties of turnips none were completely resistant. Nepe Milan Hundercup and Nepe Snowball Dommesmoen were lesser damaged among the

turnips and Lord Derby and Westbury Swede were least infested of the rutabagas.

Pre-emergence treatment with granular trithion at rates of 1 to 32 pounds per acre all gave good control of maggots in radishes, with better control above 1 pound per acre. In turnips, none gave complete control but all rates showed lower infestations than check plots. In comparison of endrin, chlordane and heptachlor granular at 1 to 32 lb. rates in radishes, all rates were better than untreated in production of maggot-free radishes but none gave complete season free control. Deptachlor at 4 pounds or more, chlordane at 15 pounds and above gave least damaged roots than endrin at any rate.

GRASSHOPPERS (107) - Grasshoppers in Alaska are widely distributed and under the right climatic conditions have in the past been very serious problems in limited areas. In fact, they have required airplane spraying for relief. This project will help tell why and under what conditions the same type of outbreak may occur in the future. It is generally considered that minimum of 60°F is needed to initiate grasshopper development and promote growth. This season there were only 75 days in which the temperature exceeded the supposed minimum. Undoubtedly the minimum for our grasshoppers is lower. The first grasshoppers were noted May 26th as a 2nd instar and the first adult on July 14th. Grasshoppers are found from Ketchikan in Southeast Alaska to Circle on the Yukon River, although many Alaskans do not believe they can occur under our climatic conditions.

EMERGENCY DISEASES (83) - Only a limited amount of information is available on indigenous plant diseases affecting crops. Introduction of new crops, planting of crops in new areas, importation of plant materials with attendant diseases has led to serious although usually isolated outbreaks of various diseases. Identification and suggestions for control measures and introduction of control programs delays the establishment and spread of new diseases throughout Alaska's infant agriculture.

CARROT ROT (82) - Breakdown of stored Alaskan carrots can be attributed to a number of fungi. One of these is Stemphyllium radicinum which not only causes black rot, but which also provides an infection through which Botrytis cinerea can attack. The seed-borne phase of the disease can be controlled very effectively with rimocidin seed-soak, but little is known in Alaska about the soil-borne phase of the disease. Studies of self-inhibition of this fungus in culture may lead to the development of better control methods in the field and in storage and may contribute to a better understanding of the nature of pathogenicity displayed of this fungus.

POTATO VIRUS (116) - Alaska appears ideally situated for the production of virus-free plant materials because of its geographic

isolation from areas of major production in the other states and because of the isolation within Alaska of one field from another. No information is available, however, on the rate with which viruses will spread. To gain this information, virus-x-free Kennebecs were grown at Palmer and each hill indexed to determine if they picked up the virus during the growing season. Other virus diseases were watched for and the area was systematically sampled for insects which could be potential vectors. One year's results indicate that potatoes can be kept free of mechanically transmitted viruses by the application of simple sanitary precautions.

WARBLE CONTROL IN REINDEER (84) - More reindeer meat than beef is grown and sold in Alaska. Some meat and a few animals are exported to other states. A major pest of reindeer is the warble fly which lays its eggs in the animal's hair. Grubs later migrate through muscular tissue to emerge through the back hide leaving a scar or hole. Most adult hides are worthless, some being marked by over 1000 scars. At egg laying time, warbles may incite frenzy in a herd, although apparently no pain is caused by an egg laying fly which merely glues its eggs to the hair. Little meat loss is caused by grubs which are usually not in muscular tissues at slaughter time. Warble control will make reindeer easier to herd and manage, and will improve hide quality. A $2 premium for a scar-free hide may pay treatment costs.

This study was initiated three years ago to explore the feasibility of controlling warbles with systemic poisons. There were no estimates of how lethal the proposed treatments might prove to reindeer, although the control materials are utilized in dairy and beef cattle. For this reason, initial evaluations were conducted at Nunivak Island, utilizing the federally-owned breeding herd.

Of four treatment techniques, hypodermic injection has proved simpler than spraying the animals, pouring a dose on a localized hide area from which it is later absorbed by the body, or by forced oral ingestion (bolus). Spraying is not satisfactory because of power equipment needed to set the animals' moisture repellent coat. Many herds are corralled only after freeze-up when pumps and water solutions are difficult to handle. Reindeer are able to regurgitate bolus pills, of which the standard cattle design is too large to administer without halving or quartering. "Pour-on- treatments irritate the skin and loosen the hair. Although hypodermic injection requires a squeeze-chute for restraining the animal, the technique is simple enough to be learned by most herdsmen.

Of several systemic chemicals so far tried, Ruelene has given considerable control. This year 824 fawns in the Nunivak herd were treated. Over half were given Ruelene, applied to a local area of the back, with and without first clipping away all hair. The remainder were given either Bayer 29493 (in corn oil) or American Cyanamid 38023 (in diethylsuccinate).

Since no chemical proved lethal, a cooperating herdsman on the mainland will be sought next year. Evaluation of injected chemicals during a winter round-up will be obtained, where there is little chance of confounding by late season egg laying.

DAIRYING & DAIRY MANAGEMENT

FROZEN SEMEN (100) - Availability of liquid nitrogen refrigerant in the Matanuska Valley has stimulated the use of frozen semen during the past two years. Frozen semen is becoming more popular as an economical means of introducing new blood lines into Alaska's milksheds. The growing scope of artificial insemination in the Matanuska Valley milkshed is seen in the table at the right. Total first services were up some 65 per cent over 1959's. Moreover, first services to frozen semen accounted for nearly a fifth of all first services in 1961. Semen held at dry ice temperatures is used only in an emergency when liquid nitrogen is not available.

Year	Number of first services by semen class 1	2	3	Total
1954	688	---	---	688
1955	709	---	---	709
1956	1059	---	---	1059
1957	1177	---	---	1177
1958	1173	---	---	1173
1959	935	---	---	966
1960	977	109	93	1179
1961	1286	252	27	1575

1 Fresh semen
2 Frozen semen in liquid N
3 Frozen semen in dry ice

HOLSTEIN SIRES GIVING frozen semen now used in the Matanuska Valley

95 daughters (131 records)	15,450 milk	599 fat
95 dams (387 records)	13,217 milk	489 fat

THREE SIRES in Matanuska Valley breeding stud (fresh semen)

29 daughters (55 records)	14,605 milk	532 fat
29 dams (87 records)	12,208 milk	479 fat

Daughters better than dams	frozen semen bulls	2,233 milk	110 fat
	fresh semen bulls	2,397 milk	53 fat

Both groups of bulls possess about the same ability to improve milk production. Bulls of the local stud have served a wide variety of cows which probably is the reason their daughters did not greatly improve in butter fat production as compared to their dams. In contrast, frozen semen bulls were used only on purebred Holstein dams. Judging by advertized claims made in behalf of the frozen semen bulls, the local sires have been doing a good job, fully in line with their careful selection.

Frozen semen conception rates in Alaska's Matanuska Valley by month and service, from May 1960 through April 1961. B means number of cows bred and NR means the number that conceived.

Month	Service: First B	First NR	Second B	Second NR	Third B	Third NR	Fourth B	Fourth NR	Fifth B	Fifth NR	Total B	Total NR	Per cent
May 60..	17	7	9	5	8	4	3	1	3	1	40	18	45
Jun	31	16	6	3	2	0	1	1	4	0	44	20	46
Jul	25	12	10	4	1	0	3	3	3	0	42	19	45
Aug	17	8	7	5	4	1	3	2	2	2	33	18	55
Sept ...	18	6	6	1	2	1	1	0	1	1	28	9	32
Oct	13	3	13	9	3	1	2	0	1	0	32	13	39
Nov	28	17	10	7	4	2			1	0	43	26	61
Dec	15	10	7	4	1	1	1	0	1	1	25	16	64
Jan 61 .	17	11	8	5	4	2	2	2			31	20	65
Feb	22	13	6	5	4	2	1	0			33	20	61
Mar	18	16	4	2	7	4	4	3	3	1	36	26	72
Apr	31	19	15	9	5	3	1	1	1	0	53	32	60
Totals	252	138	99	59	45	21	22	13	20	6	440	237	
Per cent	54.8		59.6		46.7		59.1		30.0		53.9		

First ... 54.8
Second service 23.4
Third service ..... 8.3 Total for three services.. 86.5

Although frozen semen conception rates improved, almost three services were needed to get cows with calf, as against only two for fresh semen. The proportion of all cows conceiving on three frozen semen services was 86.5 per cent, compared to 84 per cent conceiving after only two services of fresh semen.

The Matanuska Valley milkshed has now had nearly two years experience with frozen semen shipped and stored at liquid nitrogen (-320°F) temperature. During this period 508 first services have given a conception rate of 52.8 per cent, equal to that of three-day old fresh semen (415 first services). Frozen semen held at dry-ice temperature (-110°F) was used in 182 services to give a conception rate of 38.5 per cent. This poor performance discourages its wide use. The number of cows bred with semen held at dry ice temperature is too small to be assigned statistical significance. Fresh semen used the same day it is collected gives a conception rate of 64.2 per cent (1451 first services). For 2-day old unfrozen semen, a conception rate of 58.9 per cent has been obtained.

CROSSBREEDING (20, 81) - This study uses as a benchmark the 1949-1953 five year production record of the Matanuska Experiment Station Farm herd. Dominated by grade Guernseys, this herd averaged 16.5 animals in size and produced an average of 15,864 pounds of milk per cow annually during the base period. During the next seven years, a 3-way crossbreeding program injected both Red Dane and Holstein bloodlines so that by 1960 the herd was dominated by crosses. During the seven years from 1954 through 1960 this herd's average production was 10,282 pounds of milk annually, containing 412 pounds of fat. Records of crosses compared to their dams are shown in the table at the left.

Crosses	Number of cows	Production, lbs/cow/year of- Daughters Milk	Daughters Fat	Dams Milk	Dams Fat
D-H	11	10,205	440	6,935	358
H-G	7	10,941	477	6,434	335
H-DG	19	12,792	516	9,957	420
D-HG	5	12,127	503	10,935	473
H-HDG	3	15,123	545	13,354	505
G-HDG	4	9,999	456	13,034	504
G-H	2	11,944	558	14,161	486

The Dane-Holstein crosses are of special significance. Performance by generations is summarized below:

Crosses	Number of cows	Production, lbs/cow/year of- Daughters Milk	Daughters Fat	Dams Milk	Dams Fat	Generation
H	11	13,189	449	No records		Foundation
H	15	13,250	487	13,664	471	First
D-H	2	16,906	622	11,365	390	First
H	20	13,882	507	12,678	473	Second
H-DH, D-DH	2	14,345	586	16,906	622	Second
H	9	14,879	558	13,875	505	Third
D-H, H-HDH	3	16,686	615	13,767	533	Third

RAISING REPLACEMENTS (98) - Seventeen calves were randomly assigned at birth to one of four feeding schedules. A commercial milk replacer (reconstituted to 10 per cent solids) was fed at 12 1/2 per cent of body weight for either the first 25 or 60 days. After weaning, hay and grain or silage and grain constituted their ration.

At 60 days, full feeding gave heavier calves (170 pounds at a cost per calf of $26) than early weaning (145 pounds for a cost of

about $15). Hay was better than silage as an after-weaning roughage. Calves weaned at 25 days consumed about 28 pounds of milk replacer. Offered free access to good quality hay, they made rapid gains. At six months they were heavier than full-fed calves given free access to silage as their post weaning roughage. Savings in milk replacer costs more than offset the additional cost of hay over silage.

HEIFER MANAGEMENT (62) - Although heifers wintered outside consumed 12 per cent more feed than a similar group wintered inside, they gained no more weight despite a mild winter. Heifers wintered outside are difficult to catch in heat. For this reason, they usually calve five months later than heifers wintered inside. Perhaps a mild winter encouraged better estrus symptoms or better conception, since this year the two groups conceived about the same time.

Over the years milk production of the two groups was essentially equal, no significant differences being apparent. Two heifers in the outside group were notably poor, one having growth plugs in all four teats, the other dying at second calving.

VEAL PRODUCTION (90) - Ten bull calves were fed limited milk-buttermilk rations at 12 1/2 and 15 per cent of live weight, with and without a high energy oil additive (Marcol B-75, Marcol Chemical Company, Fort Worth, Texas). Animals were fed to 200 pounds live weight, from eight to ten weeks of age, and vealed. Average feed cost per 100 pounds of veal was: 12 1/2% buttermilk - $28.39, 12 1/2% buttermilk & oil - $29.94, 15% buttermilk - $34.64, 15% buttermilk & oil - $32.46. Consumers acceptability of the veal was as follows: flavor - 2 good, 6 excellent; tenderness - 5 excellent, 2 good, 1 fair; fat to lean ratio - 1 excellent, 5 good, 2 fair; color - 2 excellent, 6 good.

High level feeding increased the cost of veal with limited improvement in growth rate. High level feeding also increased digestive distrubances during the first two or three weeks of life.

ESTRUS SYMPTOMS (71) - This project was terminated, being unproductive because so few females available susceptible to treatment. The number of females subject to treatment was so small that significant analysis of results could not be obtained.

LOOSE HOUSING (111, 28, 122) - Dividing the dairy herd so that a switch-back design could be used meant starting a new experiment this season. In the previous year the entire herd was given unrestricted access to both heated and unheated bedding areas, and overcrowding resulted in the heated manure pack to the extent that only 30 square feet per cow was available. In the current year there were no particular mastitis problems with either pack, whereas in the previous season considerable trouble was experienced. Individual production records were kept on each cow. Groups of cows were

shifted at six week intervals. Production differences were not significant, although performance was greatly affected by several low producing animals.

Oil required to heat the 60 square feet of bedded area for one cow averaged .83 gallons per day. About 10 kilowatt hours of electrical energy was required per day. Temperatures over the heated pack were 10 to 26 degrees warmer than outside temperatures. The 4.62 pounds of straw per animal per day used for bedding during the 1959-60 season proved inadequate. In the 1960-61 season, straw usage was 9.1 pounds per day from November through January and 6.8 pounds per day thereafter. This amount of straw was adequate under both conditions. The manure pack accumulated to a depth of 2 1/2 feet.

OTHER ANIMAL STUDIES

SWINE (99) - Major contribution is maintaining a breeding nucleus of Hamprace swine at the College Farm. A small increase each year is utilized in management comparisons. For example, four feeder pigs fed outside and housed under cold conditions took 155 days to get from weaning age to 200 pounds on a local grain ration. In a previous year a similar group housed in a well insulated, unheated small area required only 106 days.

REINDEER - See page 30.

MINK DIETS (52) - Turbot is an abundant scrap fish in the Alaska area and offers possibilities as an ingredient of mink diets. An experiment was designed to test diets containing 25 per cent of turbot in combination with other fish products. Six equalized treatment groups of 20 females each were fed through the reproductive cycle until weaning of their young in June. A basic ingredient in the diets was 50 per cent of salmon heads from cannery wastes. Other treatment variables were combinations of turbot with sea lion meat, whale meat and phonolic antioxidants.

Approximately 100 bred females produced a total of 365 kits which is considered rather poor production compared with that obtained on other rations fed in previous years. Conclusion from the one breeding season is that the rations containing 25 per cent turbot in combination with 50 per cent salmon heads are not up to standard for mink when fed during the breeding and reproduction period.

In previous years variable numbers of the mink kits fed through to pelting on fish waste diets have developed "wet belly" disease. The kits obtained from the feeding experiment described above were used to study the effects of various feed additives on incidence of this disease. Eight equalized treatment groups were fed from mid-August until December. The treatment variables were (1) control diet, (2) high level of carbohydrate, (3) high level of fat, (4) and (5)

two levels of sodium phosphate, (6) an antibiotic, (7) diethylstilbestrol, and (8) ammonium chloride. Results of this study will be available when the animals are pelted and the skins examined for evidence of "wet belly" disease.

BLUE FOX (50) - After four years of poor fox production, believed due to inbreeding of the small station herd or continual feeding of a diet composed chiefly of raw salmon waste high in unsaturated fatty acids, the antioxidant BHT was added to the fox diet as of June 1, 1960. No beneficial effects were observed in general health, growth, or fur quality in 1960.

Eleven females and five males were available for breeding in 1961. An effort was made to breed each female every day she would accept service. Ten were mated a total of 20 times. Eight produced, one destroyed her litter, and 33 pups were raised to pelting. These results were much better than that obtained in 1960 when 12 females were mated a total of 31 times and only six produced. Antioxidant BHT seems a beneficial addition to the diet.

The antioxidant may also be responsible for better fur quality observed in the fox herd this year. Shedding and furring out was much more uniform and there was a decided absence of matted hips, rubbing, and tail chewing as compared with the past few years.

MARTEN (51) - Feeding and management practices have been very good from a health, growth, and fur production standpoint but consistant reproduction continued to be the paramount problem in the successful raising of marten in captivity.

The 1960 marten breeding season was started on July 10 and terminated September 2. Because of previous fighting and loss of 3 females, males were placed with females housed in adjacent pens every other morning, observed closely to insure compatibility and separated the same afternoon. The animals were only under observation for the first hour they were together and occasionally during the day. At least seven different females were noted mating a total of 15 times. Three litters were born in 1961, one being destroyed after birth.

The animals were handled in the same manner during the 1961 breeding season which started July 6 and terminated September 5. Twenty-three matings and 21 attempted matings were observed on 12 different females, only 2 of which were known producers. This increased breeding activity may be due to the addition of the 3 and 4 year old females are just reaching sexual maturity.

UTILIZATION

FERMENTED GRAIN (87) - Methods of handling, storing, and feeding wet grain may help dairy farmers reduce their production costs by avoiding large cash outlays for drying grain.

Damp grain was packaged in bags made of 60 inch plastic tubing, the bags being stored on pallets for easy mechanized handling. Fermentation was satisfactory and calves exhibited a preference for fermented overdry oats. They did well on fermented grain as a major part of their concentrate ration. Milking cows produced well on fermented barley fed over a three week period although it did not seem as palatable as commercial dairy ration. To avoid grain losses to rodents, 30 per cent moisture barley harvested in 1962 is being stored in sealed steel tanks, where satisfactory fermentation has been obtained. Rolled barley will be compared with whole barley during the 1961-62 winter.

MEAT MEAL (108) - Alaska's major grain crops, oats and barley, are excellent sources of energy in dairy cattle rations but are inadequate in protein for a balanced ration. Conventional sources of protein, such as oil meals are expensive ingredients in any ration and are further inflated in price by high transportation charges to Alaska.

Meat meal was completely satisfactory as the only high protein source in the ration and was economically competitive under Alaskan conditions. Ground barley alone was not a satisfactory concentrate ration in this experiment, depressing milk yield, silage intake, and causing marked weight losses.

Meat meal evaluated in this trial was produced in an Anchorage meat rendering plant at prices competitive with imported plant proteins. This meal has proved an acceptable source of protein for dairy cattle, even when comprising 17 per cent of the total ration.

This conclusion was reached after comparing four concentrate rations fed to 24 milking cows in a switch-back feed experiment during the winter of 1960-61. The four concentrate rations were (a) a commercial 18% protein dairy ration, (b) oats and barley supplemented with plant proteins, (c) oats and barley supplemented with meat meal as the only high protein source, and (d) ground barley alone. Silage was the only roughage fed.

MARKETING

CONDITIONING POTATOES (68) - Potato grades are affected by tuber cracks and ruptured skin that may occur in the harvesting, storaging, grading or distributing process. Cracking of undisturbed tubers in the hill during growth appears to be identical with shatter cracking in storage bins or on the grading table. Irrigation reduced cracking in the hill which may mean that sugars destined to build up pressures in the tubers were diverted temporarily to additional top growth by the abundant water. Susceptibility to cracking in storage may be due to high humidity and low storage temperatures that accelerate conversion of starch to sugar.

Studies on potato storage losses indicated that mechanical damage is the major cause of grade-outs in Alaskan potatoes. An

attempt to promote healing of mechanical damage by pre-storage treatments has led to the discovery that heat treatment of tubers prior to the end of their rest period decreases the rate at which water is lost from the tubers during the subsequent storage at 38°F. Suberized or partially suberized tubers respond more readily to treatment than freshly dug potatoes.

MILK PRODUCTION (102) - Development of a military troop mess market for local milk in early 1960 demanded a rapid but unknown increase in Alaska's milk cow population. Estimates determined under this project contributed to a planned expansion through (1) initiating an upswing in locally grown herd additions, and (2) in-shipment of additional mature cows from other milksheds. Imports were held to a minimum. Needed adjustments foreseen in this study have been largely accomplished. Still needed is an improved balance in seasonal production.

MILK CONSUMPTION (61) - Several factors combine to make the sale of fresh milk to schools an important facet of the civilian market: (1) low winter temperatures and prolonged darkness means the nutritional needs of school children are high, (2) the high nutritional value of milk plus its availability recommends it as the most probable source of supplying the needs of school children, and (3) milk drinking habits established in school aid in establishing lifelong consumption patterns.

Research conducted in the Anchorage-Palmer schools on the daily consumption of fresh milk shows that only a quarter of a pint is being consumed per student per day. These data show extreme variation between the lower grades and high school. In pointing up problems encountered in administration, it was suggested that closer supervision of younger students accounts for some of the differences in per capita consumption. Milk was purchased from local processors at 11¢ per half pint. The government paid 4¢, of which one cent was used to pay the costs involved in administering the program. This left 8¢ to be assumed by the student. Less than 50 per cent of the total school population of Alaska is now being offered the special school milk program. Suggestions to increase consumption most commonly given by school officials were (1) lower the price of milk to the student, and (2) broaden selection by adding chocolate milk.

EGGS (88) - A retailer and wholesaler study giving information on pricing and selling practices was completed. Consumer attitudes and preferences relative to eggs were determined by a household survey involving 600 families in Anchorage, Fairbanks, and Juneau. An exploratory survey of egg quality comparisons between Alaskan and imported eggs was completed with results indicating that there is little quality difference between local and imported eggs.

The tabulation and analysis of the household survey and the retailer-wholesaler survey have been started. This tabulation

indicates that Anchorage consumers are using about 355 eggs per person per year compared to a 1959 national per capita consumption of 347 eggs. Results of the egg quality comparisons are being presented to egg producers and to the State Division of Agriculture with recommendations of ways to improve egg quality.

At the completion of further egg quality determinations the information will also be made available to Alaskan consumers and to egg marketing personnel in other states to assist in the development of better techniques for quality determination of market eggs.

ALASKA'S MARKETS (34) - Work under this project involved special studies to explore market potentials and alternative ways of maintaining and expanding the market for Alaska's agricultural products. Upon request by several agencies and groups a study was made and report published of the market and farm potential of the Tanana Valley. Feasibility projections for marketing dairy, poultry, grain, potato and vegetable products were made.

Another request to explore the possibilities for processing and freezing potatoes and vegetables was answered. An information circular entitled "Alaska's Potatoes - Can Maid Service Be Built In?" was published. This circular emphasizes that civilian use of processed potatoes is on the increase in Alaska. Since all processed potato products are imported this portion of the Alaska market is escaping Alaska's producer. No attempt has been made to supply Alaska's restaurant or civilian trade with local frozen potato products. Because of the high investment and processing costs and the limited Alaska market it is unlikely that proprietory plants can be attracted to Alaska. If a processing plant for potatoes or vegetables is established it will probably be done through the cooperative efforts of the producers themselves.

This project continues to answer special study requests which are not directly related to current projects. Farm products will be studied relative to use and market development. Market structure and organization in the marketing of farm products is changing rapidly. New methods and techniques in marketing are being introduced every day. If Alaska farmers are to maintain a competitive position in the market place the most efficient marketing techniques must be used and the full potential of the Alaska market developed.

GRAIN (104) - A significant accomplishment was confirmation of the fact that grain seed of 22 per cent moisture exposed to $-150^{\circ}F$ did not suffer viability reduction. This confirms previous deductions that viability losses in wet grain seed are caused by low temperature biological activity rather than by freezing in itself. High moisture creates a favorable environment for storage molds and possible enzymatic deterioration.

Valley-wide sampling of oats and barley in marketing channels for moisture and protein content was continued. Grain tonages

received at the central Palmer elevator were less than in 1960. This is attributed to unfavorable harvest conditions, an increase in the number of on-farm driers, and diversion of cleared land to roughage crops.

STATISTICS & MANAGEMENT

MARKET STATISTICS (37) - Under this project the Experiment Station assisted the Alaska Cooperative Crop Reporting Service and Alaska Division of Agriculture in planning for and publishing the annual farm production survey. This report of the production and value of Alaska farm output was the first to be prepared by the Agricultural Estimates Division of USDA since establishing the service last year in Alaska. The project leader also cooperated with Agricultural Estimates representatives on planning other surveys and statistical reports such as: "Livestock and Poultry Inventory, January 1, 1961", "Prospective Plantings in Alaska for 1961", "Alaska Annual Crop Summary, 1960", and "Agricultural Prices and Farm Labor".

Another phase of this project again involved compiling and publishing retail food price data which is utilized by labor and management, merchandisers and consumers and a variety of public agencies throughout Alaska and the other states. Volunteer reporters in 10 Alaska cities collect food prices on 50 food items four times during the year. The information is tabulated, analyzed and published quarterly. Over 16,000 copies were distributed in 1961. The Quarterly food price reports are very popular and many requests are received for this publication.

A five-year summary of production, price and income statistics was published. This publication should be a useful reference for those working with or interested in Alaska Agriculture.

The survey of agricultural prices and farm labor showed that wage rates on Alaska farms are the highest in the nation. The average rate by the month with house furnished was $374. A hired man was paid $284 with board and room. Hourly wage rates on Alaska farms during the September harvest period (without board and room) averaged $2.12.

The project is now being revised with objectives aimed at the analysis and interpretation of basic livestock, crop and market statistics. Data received from the Alaska Cooperative Crop Reporting Service and other sources will be analyzed and interpreted in the light of current trends and national outlook. Outlook information indicating trends and developments in producing and marketing farm products will be published periodically. This outlook information will guide farmers in planning their production and marketing programs.

MANAGEMENT (124) - During 1961, work was continued on the investment, cost and income study of 15 dairy farms in the Anchorage-Palmer area. This was the fourth in a five year study designed to provide

information concerning input-output cost relationships, investment costs per acre, costs per animal unit and per unit production costs. Changes in overall capital structure involving yearly changes in indebtedness, debt retirement and owners equity are likewise considered. Special emphasis will be given to the efficient producer.

In broadening the scope of agricultural research, vegetable and poultry farmers have been included. Information has been developed and published showing basic patterns followed in determining costs of owning, operating and maintaining farm machinery. Assistance has been given as farmers were involved in problems of exchange machine labor and custom work. Budgets have been prepared which will serve as guides in the production of potatoes, grain and oat and pea silage. Similar budgets have been drawn up to aid in establishing bench marks from which to study the feasibility of raising and processing green peas in Alaska.

Revision was completed of the "Settlers' Handbook" and a letter-press edition (25,000 copies) of this publication was issued by the Bureau of Land Management under the title ESTABLISHING A FARM IN ALASKA. . . . .

University of Alaska
ALASKA AGRICULTURAL EXPERIMENT STATION

January 5, 1962
Palmer, Alaska

PROJECT LIST

Replaces list of May 1, 1961

			Approximate termination date
1	S	Estimating soil productivity and devising fertilizer amendments	May 63
7	H	Improving the cole crops for Alaska	May 62
11	H	Improving Alaska's fruit industry	Jun 62
13	H	Improving Alaska's salad and vegetable crops	May 63
17m	H	Quality potatoes for Alaska's consumers	Mar 62
20	D	Improvement of milk production through crossbreeding	Feb 62
28r	E	Alaskan materials for farm and home construction (NC-9,$3,800)	May 62
31	E	Methods for developing Alaska's new land	Mar 63
34m	O	Markets for Alaska's agricultural products	Jun 65
37m	O	Crop livestock and related market statistics	May 63
41	A	Forage crop production	Feb 62
43	A	Use of mutagenic agents in cereal crop improvement	May 65
44r	A	Breeding alfalfa varieties resistant to blackstem (NC-37, $1,000)	Feb 62
50t	F	Superior strain of blue foxes	Con
51t	F	Marten mating systems to increase breeding regularity and prolificacy	Con
52t	F	Development of diets...for fox, mink and marten	Con
53	S	Influence of potassium fertilizers on Alaskan crops (NC-16)	Jun 64
61r	O	Methods to increase consumption of dairy products (WM-36, $5,000)	Sep 62
62	D	Effect of two management systems...(on) heifers raised in Alaska	Oct 62
68III	H	Effect of handling, maturity & conditioning...(on) potatoes(728,$3450)	Jun 62
72	S	Evaluation of Alaska's land capability potential	Mar 63
74r	H	Indigenous Alaska rubus, ribes, vaccinium & fragaria (NC-7, $1,000)	Feb 64
75	B	Emergency insect control measures for Alaska.	May 63
76	B	Insect pollination in Alaska.	Mar 62
81r	D	Improving dairy production by crossbreeding (NC-2)	Feb 62
82m	P	Pathogenic decomposition of stored Alaskan vegetables	Jan 64
83	P	Emergency disease problems in Alaska	Jan 64
84	D	Warble control in reindeer	Jul 62
87	D	Utilizing fermented grain in Alaska	Jul 62
88III	O	Marketing eggs in Alaska (ES-600, $2,750)	Jun 62
89	O	Agricultural credit in Alaska	Jul 62
90III	O	Marketing calves as veal in Alaska (ES-648, $1,800)	Jun 63
91III	H	Prolonging the marketing...of head lettuce (ES-393, $2,400)	Jun 62
94	D	Improved pasture management in Alaska	Jul 64
95III	O	Evaluation of Alaska's railbelt meat market (ES-665)	pend
96III	O	Economic potential of Alaska's recreation industry (ES-666)	pend
97	A	Cereal production in Alaska	Jul 62

. . . . . Subject matter designations indicate assignment of major responsibility--

Agronomy	A	Agricultural engineering	E	Fur production	F
Entomology	B	Agricultural economics	O	Horticulture	H
Dairy husbandry	D	Plant pathology	P	Soil science	S

98	D	Raising dairy replacements in Alaska	Aug 62
99	D	Hog management systems...related to feed efficiency & growth rates	Dec 64
100	P	Potato scab control with potash and manure in Alaska	Mar 63
101	D	Frozen semen for Alaska's dairy industry	May 65
102	D	Increases in cow numbers necessary to expand milk production	Jun 63
103	E	Climate related to plant response in the Matanuska Valley	May 65
104m	E	Some factors involved in marketing Alaska's grains	May 63
106m	H	Freezing peas for Alaska's markets	Jun 63
107r	B	Some factors influencing...grasshoppers (NC-52, $1,000)	Jun 65
108	D	Supplementing silage rations with local grains	Jan 63
109	H	Characteristics of subarctic solar energy	Mar 66
112	S	Water infiltration rates (NC-40, $4,000)	Mar 65
113	E	Cost and management of irrigation systems	Jan 64
114	A	New cereals for Alaska	Jan 66
115	A	New forages for Alaska	Feb 66
116	P	Alaska's potato virus dispersion rate	Mar 66
117	H	Response of potatoes to a subarctic environment	Mar 65
118	H	Herbicides for Alaska's horticultural crops	Mar 64
119	B	Life cycle of H. florialis related to improved controls for Alaska	Mar 64
120	H	Frost resistant foliage for Alaska's potatoes	Mar 66
121	A	Indigenous forage plants of Alaska (Rockefeller)	May 64
122	E	Loose housing for Tanana Valley dairies	Jun 64
124	Q	Progressive economic analysis of Alaska's farms	May 64
126II	O	Maintaining and expanding markets for Alaska's dairy products	pend
64	A	Controlling weeds in Alaska's cereals and forages	Apr 63

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NORTHCENTRAL REGIONAL COMMITTEES

representation for 1961 and 1962

Committee	Representatives	Advisor
Technical Committees		
NC-1 Beef Cattle Breeding	None	Kottman (Ohio)
NC-2 Dairy Cattle Breeding	W. J. Sweetman	Krause (Ohio)
NC-6 Poultry Respiratory Diseases	None	Sloan (Minn)
NC-7 Plant Introduction	C. E. Logsdon	Frolik (Neb)
Fruits-Dinkel, Vegetables & Ornamentals-Kallio Forages-Klebesadel, Cereals-Taylor		
NC-9 Farm Housing	C. I. Branton	Hazen (N Dak)
NC-10 Weed Control	L. Klebesadel	Volk (Ind)
NC-11 Forage Crop Evaluation	R. L. Taylor	Volk (Ind)
NC-13 Death Losses in Young Pigs	S. Restad	Hamilton (Ill)
NC-14 Stone & Pome Fruit Viruses	None	Kernkamp (Minn)
NC-16 Soil Mineral Deficiencies	W. M. Laughlin	Browning (Iowa)
NC-17 Role of Organic Matter	N. Michaelson	Browning (Iowa)
NC-18 Population Changes	None	Turk (Mich)
NC-19 Pesticide Hazards	R. H. Washburn	Andre (Iowa)
NC-20 Corn Borer	None	Andre (Iowa)
NC-22 Oak Wilt	None	Kernkamp (Minn)
NC-23 Farm Structures	C. I. Branton	Hazen (N Dak)
NC-24 Wearing Apparel	None	Shirky (Mo)
NC-25 Feed Utilization by Ruminants	A. L. Brundage	Hamilton (Ill)
NC-26 Weather Information	C. H. Dearborn	Muckenhirn (Wis)
NC-27 Bloat in Ruminants	None	Beck (Kan)
NC-29 Potato Leafhopper	R. H. Washburn	Callenback (N Dak)
NC-31 Quantity Food	None	Hamilton (Ill)
NC-32 Financial Security	None	Bentley (S Dak)
NC-33 Pesticide Residues	R. H. Washburn	Andre (Iowa)
NC-34 Mucosal Diseases	A. L. Brundage	Merchant (Iowa)
NC-35 Potato Breeding	C. H. Dearborn	Ellis (Ind)
NC-37 Black Stem Legumes	R. L. Taylor	Volk (Ind)
NC-38 Spotted Alfalfa Aphid	None	Callenback (N Dak)
NC-39 Parasitic Nematodes	R. H. Washburn	Kernkamp (Minn)
NC-40 Water Infiltration	N. E. Michaelson	Browning (Iowa)
NC-42 Winter Injury to Crops	L. J. Klebesadel	Frolik (Neb)
NC-43 Environment for Laying Hens	C. F. Marsh	Sloan (Minn)
NC-44 Shipping Fever of Ruminants	None	Hamilton (Ill)

NC-47 Chicken Breeding	None	Sloan (Minn)
NC-48 Materials Handling	C. I. Branton	Hazen (N Dak)
NC-49 Proteins and Amino Acids	None	Krauss (Ohio)
NC-50 Sheep Breeding	None	Kottman (Ohio)
NC-51 Forest Tree Improvement	None	Jugenheimer (Ill)

Marketing Committees

WM-36 Dairy Consumption	C. F. Marsh	Sharp (Cal)
NCM-7 Quality of Poultry Products	None	Sloan (Minn)
NCM-11 Price & Income Policy	None	Wilson (Kan)
NCM-18 Patterns of Livestock Markets	None	Wilson (Kan)
NCM-19 Pricing Practices for Grain	None	Wilson (Kan)
NCM-22 Horticultural Grades & Standards	None	Ellis (Ind)
NCM-23 Seed Marketing	R. L. Taylor	Frolik (Neb)

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NCT-41 Efficiency of Dairy Cattle	None	Beck (Kan)
NCT-43 Energy Requirements	None	Krauss (Ohio)
NCT-44 Economics & Legal Aspects of Water	None	Muckenhirn (Wis)
NCT-45 Beef Carcass Research	None	Hamilton (Ill)
NCT-46 Agricultural Programs & Horticultural Markets	None	Ellis (Ind)
NCT-47 Communications	None	Clark (Wis)
NCT-48 Improvement of Forest Tree Species	None	Aldrich (Mich)
NCT-49 Changing Markets - Fruits & Vegetables	None	Ellis (Ind)
NCT-53 Management Resource in Farming	None	Beck (Kan)

Service Committee

NCS-1 Seed Practices	R. L. Taylor	Frolik (Neb)

Interregional Committees

IR-1 Potato Introduction	None	Kernkamp (Minn)
IR-2 Fruit Viruses	None	Kernkamp (Minn)
IRM-1 Agricultural Price Policy	Halverson (regional representative)	

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NCA-1 Soil Research	W. M. Laughlin	Browning (Iowa)
NCA-2 Animal Diseases	A. L. Brundage	Merchant (Iowa)
NCA-3 Watersheds	N. E. Michaelson	Volk (Ind)
NCA-4 Horticultural Crops	C. H. Dearborn	Shirky (Mo)
NCA-5 Home Economics	None	Howard (Ill)
NCA-6 Meat Animals	W. J. Sweetman	Kottman (Ohio)
NCA-7 Dairy Production	W. J. Sweetman	Krauss (Ohio)
NCA-8 Poultry Production	None	Sloan (Minn)
NCA-9 Field & Forage Crops	R. L. Taylor	Frolik (Neb)

NCA-10	Forestry	None	Aldrich (Mich)
NCA-11	Food Technology	None	Hamilton (Ill)
NCA-12	Agricultural Economics	C. F. Marsh	Clark (Wis)
NCA-13	Rural Socialogy	None	Turk (Mich)
NCA-14	Plant Pathology	C. E. Logsdon	Kernkamp (Minn)
NCA-15	Entomology & Zoology	R. H. Washburn	Andre (Iowa)
NCA-16	Agricultural Engineering	C. I. Branton	Browning (Iowa)
NCA-17	Mass Communications	None	Clark (Wis)
NCA-18	Agricultural Products	None	Volk (Ind)

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NCR-2	Corn Breeding	None	Volk (Ind)
NCR-3	Soil Survey	None	Muckenhirn (Wis)
NCR-4	Farm Management	None	Turk (Mich)
NCR-5	Rural Socialogy	None	Turk (Mich)
NCR-6	Land Tenure	None	Clark (Wis)
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NCR-9	Midwest Plan Service	L. Allen	Hazen (N Dak)
NCR-10	Turf Research	R. L. Taylor	Shirky (Mo)
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NCR-15	Oat Improvement	R. L. Taylor	Aldrich (Mich)
NCR-17	Rural Economic Development	C. F. Marsh	Clark (Wis)
NCR-18	Water Needs & Utilization	None	Muckenhirn (Wis)
NCR-19	Meat Tenderness	None	Hamilton (Ill)
NCR-20	Economics of Marketing	None	Wilson (Kan)
NCR-21	Population Genetics	None	(Neb)
NCR-22	Small fruits	D. H. Dinkel	( )
NCR-23	Agricultural Policy	C. F. Marsh	Wilson (Kan)