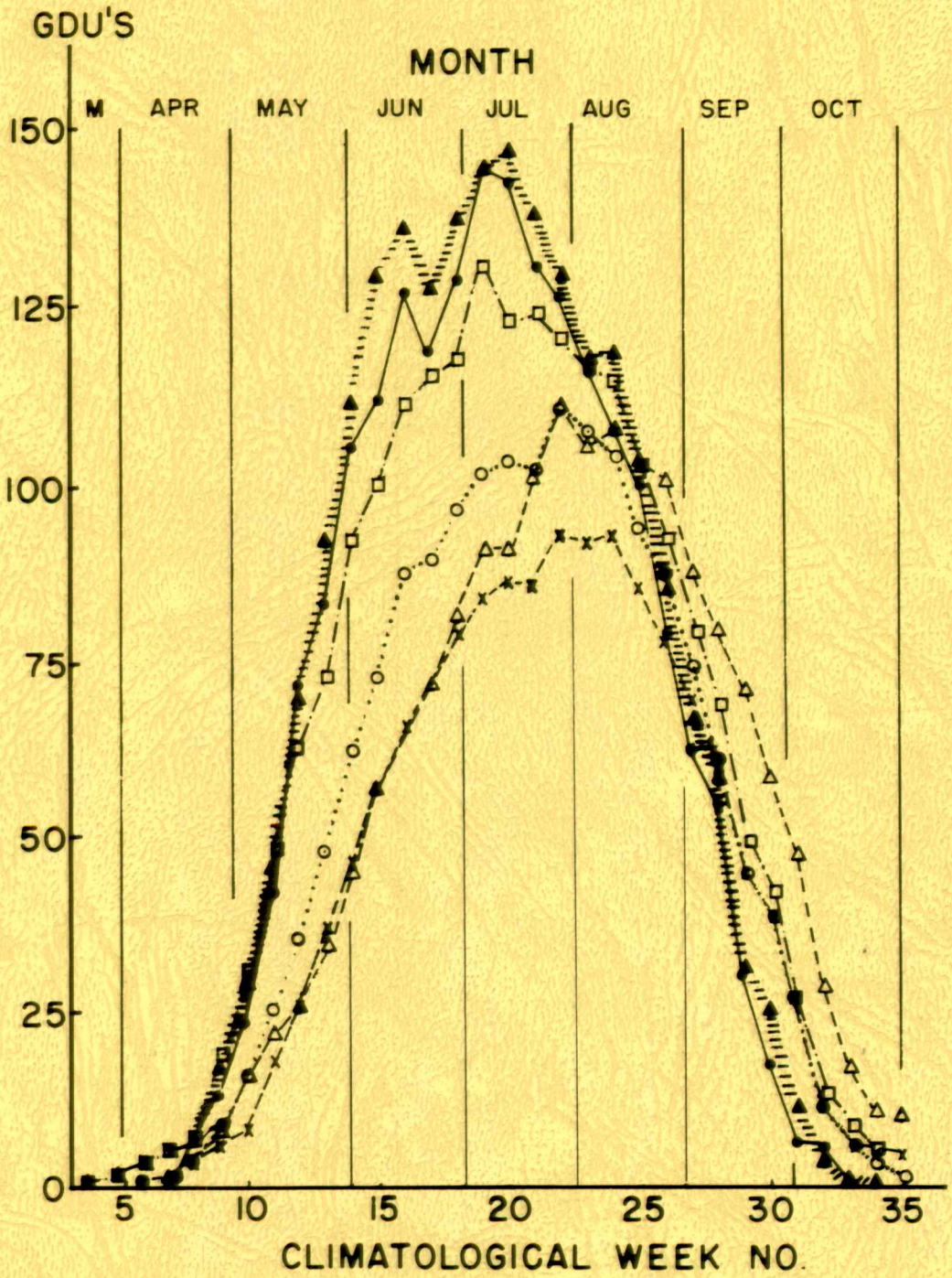
GROWING-DEGREE UNITS FOR SELECTED AGRICULTURAL LOCATIONS IN ALASKA

C. Ivan Branton

Robert H. Shaw



UNIVERSITY OF ALASKA

Institute of Agricultural Sciences

TECHNICAL BULLETIN NO. 4

June 1973

It is well known that the rate at which a plant grows is influenced by air temperature. The problem is to define this relationship in a quantitative manner so that the information can be applied to agricultural problems.

In places where growth of a particular crop is limited by the length of the growing season, an evaluation of the "heat-units" available is particularly important. Many heat-unit systems have evolved over the years, with certain advantages claimed for each. In crop production, heat-unit systems are used to estimate the time required for a crop to go from one stage of development to another, usually from planting to harvest. Each heat-unit system produces a particular set of values, the values being determined by the relationship between temperature and growth that is assumed in the calculations.

This paper lists heat-units available in six areas in Alaska, all having agricultural potential. The system used measures temperature in "growing-degree units" and is described in detail.

Recent comparative studies of growing season and growing degree days leads to the conclusion that the temperature records taken at Big Delta may have been favorablyaffected by the nearness of the weather recording station to an extensive coated runway. The "flywheel" effect of this large heat sink appear to have reduced the occurrence of 32°F. night temperatures in both the spring and fall, making the growing degree accumulation unrealistic.

CONTENTS

GROWING-DEGREE UNITS FOR SELECTED AGRICULTURAL LOCATIONS IN ALASKA

ROBERT H. SHAW
Professor of Agricultural Climatology
Iowa State University of Science and Technology

C. IVAN BRANTON
Research Agriculture Engineer

A relationship between temperature and the rate at which a plant grows has long been assumed; the problem has been to define this relationship in a quantitative manner so that the information can be applied to agricultural problems. Many "heat-unit" systems have evolved over the years, with certain advantages claimed for most of them. As used in crop production, a heat-unit or growing-degree unit system attempts to account for the variation in the time required for a crop to go from one stage of development to another. Most frequently the period of interest is from planting to maturity or harvest. Each growing-degree unit system will produce a particular set of values, the values being determined by the temperature-growth relationship assumed in the calculations.

In areas where the growing season and growing-degree accumulations tend to be limiting, an evaluation of the growing-degree units available is particularly important in planning agricultural practices. This paper relates the heat units available by one system for six areas in Alaska with agricultural potential.

Calculation Procedure

No attempt will be made here to review the different systems presented in the literature. Discussions of the various methods are presented by Arnold (1971), Newman (1971), Felch et al. (1972), and Aspiazu and Shaw (1972). Growing-degree units are generally calculated by a formula of the type:

$$GDU = \frac{\text{max temp} + \text{min temp} - \text{base temperature.}}{2}$$

This assumes no growth below the base temperature and linear growth above it. In recent years a method used by the U.S. Weather Bureau has been widely adopted for use in the other 49 states. In this method, any maximum temperature above 86 is considered as 86 and any minimum temperature below 50 is considered as 50. This takes into account a reduced rate of growth at high temperatures and some growth below the base temperature. This method was not considered suitable for use in Alaska because of the high base temperature. Data by Dethier and Vittum (1967) show a base temperature of 40°F as the best for peas, 37-40° for spring wheat, 43° for oats and 45° for potatoes. The base temperature for many of the vegetable crops grown in Alaska is near 40°F, with very few of the crops with a 50°F base (sweet corn, beans, and tomatoes) being grown. In addition, relatively few temperatures above 86° occur. For these reasons, equation 1 was used with no adjustment for maximum or minimum temperature and with a base temperature of 40°F.

Growing-degree units were computed for each day from March 1 through October 31 for Matanuska Experiment Station near Palmer (1936-65), Big Delta (1943-65), University Experiment Station, Fairbanks (1936-65), Homer (1940-65), Kasilof (1932-34, 36, 39-48, 51-64), and Kodiak (1931-65 excluding 46, 49).[1] Another Homer station with 16 years of record was analyzed, but it did not show significant differences from the 25-year station used, and it was not included in this paper.

Description of Stations

The Matanuska Valley in south-central Alaska is one of the prime agricultural areas in the state. Dale (1956) compared the weather observations for several stations in the valley including the Matanuska Experiment Station. Based on the average temperature for the period May through September, the Experiment Station data were very similar to data from stations located 4 miles

[1]The names Matanuska Experiment Station and University Experiment Station are used throughout the text, since this is the terminology appearing on the official weather record sheets. Current names are respectively, Matanuska Research Farm and Fairbanks Research Center.

south-southeast and 1 mile north of Palmer. Palmer is located in the eastern part of the Matanuska Valley, about 7 miles east-northeast of the Matanuska Experiment Station, and about 45 miles northeast of Anchorage. A station 5 miles northwest of the Matanuska Experiment Station averaged about 0.6°F cooler and the Eklutna station, about 8 miles southwest, averaged 1.1°F warmer. In general, the Matanuska Experiment Station data represents the Matanuska Valley and will be used to describe the growing-degree units available in the Matanuska Valley.

The Big Delta weather station is located at the Big Delta Airport, about 90 miles southeast of Fairbanks in the Tanana Valley. It was suggested by the former State Climatologist, C.E. Watson, that data from the Clearwater station would be more representative of the present areas of agricultural development in the Big Delta area. Data from Clearwater, however, are available only since 1965. These data were used to compare Big Delta and Clearwater for the May through September period for the years 1965-70. The ratios of growing-degree units between the two stations are shown in Table 1. The ratio for all months has ranged from 0.51 to 1.54, but for June and July has ranged only from 0.85 to 1.06. For the entire period, May 1 through September 30, the growing-degree units at Clearwater have averaged 90% of those at Big Delta. On the basis of this 5-year comparison, Big Delta will give about a 10% over-estimation of the average growing-degree units available in the agricultural areas being developed in that area.

The University Experiment Station, Fairbanks, is located on a south-facing slope with an elevation slightly higher than the broad valley floor. In such a location it may be warmer than much of the Valley. This is evidenced by the absence of permafrost on the aspen-covered sloping areas, such as the weather station location. Permafrost is present in forested areas on the valley floor. Much of the potential agricultural area is in the permafrost areas.

Homer station is located at the airport which is situated on a low bench (elevation 67 ft.) on the north shore of Kachemak Bay, somewhat east of its confluence with Cook Inlet. Agricultural activities are widely dispersed but generally divided between a south slope extending along the same general shoreline upon which the station is located and a bench on top of East Ridge. Several hundred feet in elevation difference exists between the areas.

Kasilof station is located on the east side of the new highway about one-half mile north of its intersection with the Kasilof River. A timbered ridge 100 to 150 feet higher than the station extends in a northeasterly direction about 300 feet away. Good natural air drainage exists toward Cook Inlet.

Observations from Kodiak have been made at the Kodiak Naval Station which is on the northwest side of Chiniak Bay. It is adjacent to a smaller "U" shaped bay partially divided by a peninsula extending 1½ miles to the southeast. Ranches are located considerable distances from the station and usually are at considerably greater elevations.

Results and Discussion

The growing-degree units for the stations will be presented for the weekly, monthly and seasonal patterns. Data was taken at six stations: the Matanuska Experiment Station, near Palmer; Big Delta, the University Experiment Station, near Fairbanks; and Homer, Kasilof and Kodiak in the area of the Kenai peninsula.

Weekly. The average growing-degree unit values for the different weeks are summarized in Figure 1. During much of the spring and summer period, the University Experiment Station, Fairbanks, has the highest average number. Second-highest, for much of the early part of the growing season, is Big Delta, with Homer having the lowest values. After mid-August, the values for the Matanuska Experiment Station are the highest of group 1, and are comparable to Homer and Kasilof but lower than at Kodiak.

The Kenai area stations show a low early-season accumulation which is probably too low and inconsistent to be of any agricultural significance. By late April the other stations show a higher accumulation, reaching a maximum in early July of 130 to 145 growing-degree units per week. The maximum for the Kenai group is only 95 to 110 units per week and is not reached until late July. By late August, accumulation of units at all six stations is about equal, with the Kenai group showing slightly higher values in the fall, particularly at Kodiak. Experiment Stations are the highest of group 1, and are comparable to Homer and Kasilof but lower than for Kodiak.

The highest, lowest, and average weekly values, and those which will be equaled or exceeded with selected probabilities are

summarized in Tables 2-7. Because of the extensive mass of data involved in the individual week values for each year, these are not presented. One fact of interest which can be obtained from the tables is the number of consecutive weeks that for all years have reported some growing-degree units. Fairbanks has such a period of only 15 weeks. This compares to 18 weeks for Big Delta and Homer, 19 weeks for Kasilof, 20 weeks for the Matanuska Experiment Station, and 21 weeks for Kodiak.

Monthly. The monthly values are summarized in Table 8. The data for individual years are given in Tables 1A-6A, Appendix. The monthly values show the same pattern as the weekly values, with the University Experiment Station, Fairbanks having the highest values for the summer months and Homer the lowest.

Seasonal. Although the weekly and monthly values are useful in explaining the distribution of growing degree units throughout the season, the most important value is the seasonal accumulation. This total is primarily what determines the crops that can be grown in a given area. The seasonal growing degree units are summarized in Table 9 and Figures 2 and 3. The values for each year are given in Appendix, Tables A-7 and A-8. The period used for the seasonal accumulation was from the average planting date for the stations at Matanuska, Big Delta and Fairbanks, May 15 to the date of the first freeze. An air temperature of 30°F or lower was assumed to cause a killing freeze. On a clear night this represents a plant tissue temperature of near 22-24°F, while on a cloudy night it represents a tissue temperature near 30°F. An examination of data for the first freeze showed an average of 8 years when the first 30°F or lower temperature occurred as a 30°F temperature, with almost half the years having an air temperature of 28°F or lower for the first freeze.

The seasonal growing degree units for the two groups of stations are very different with the Kenai area averaging over 20% less. For the Kenai area the stations in increasing order are Homer, Kasilof and Kodiak. Homer averages 159 growing-degree units less than Kasilof, which averages 139 less than Kodiak. This order is maintained at all probability levels.

For the southcentral and interior stations the highest average seasonal accumulation of growing degree units occurs at Fairbanks, the lowest at the Matanuska Experiment Station. If 10% is deducted from the Big Delta data to make it more comparable to the areas with agricultural potential, it then has the lowest average. As shown for the weekly data, however, it averages higher than the Matanuska Experiment Station in June and July, but lower in August.

Although Fairbanks has the highest individual seasonal value and the highest average, it also has the lowest individual seasonal value. In 1949, a 29° freeze occurred July 1, when 487 growing-degree units had accumulated. After July 1, 1153 units accumulated before the next freeze. Fairbanks has higher growing degree unit accumulations than the Matanuska Experiment Station over the entire range of probabilities used (90 to 10%). Big Delta generally has the lowest accumulation except for about 1/3 of the years. In good years it approaches the accumulation at Fairbanks. If discounted 10% to adjust for location, the values still exceed the Matanuska Experiment Station almost 20% of the years.

Summary

Growing-degree units were calculated for six stations in areas with agricultural potential: Matanuska Experiment Station, near Palmer; Big Delta; University Experiment Station, Fairbanks; Homer; Kasilof and Kodiak.

Weekly and monthly accumulations are higher at Matanuska, Big Delta and Fairbanks, and lower for the others which are in the Kenai area. Within the central Alaska group, weekly and monthly accumulations are highest early and late in the season at the Matanuska Experiment Station. Matanuska has the lowest values in mid-summer when the University Station, Fairbanks, has the highest. The maximum weekly accumulation in the Kenai area is in late July, compared to early July for the southcentral and interior group. For most weeks, and months, Homer has the lowest accumulations, with Kasilof higher than Kodiak up to late July. After early August, Kodiak is higher than Kasilof.

For seasonal values, Fairbanks is generally the most favorable, but there is a slight probability of an extremely low accumulation there due to a mid-summer freeze. A count of the 30 years of data showed seasonal sums at Fairbanks greater than at the Matanuska Experiment Station in 20 out of 30 years. If Big Delta data are discounted 10% to make them more representative of present and potential agricultural areas in the vicinity, this

station has the least favorable seasonal growing-degree units on the average, of the southcentral-interior group. In 20-30% of the warmest years, however, the growing-degree unit accumulation will approach that of Fairbanks. The minimum seasonal accumulations are not as low as at the Matanuska Experiment Station or the University Experiment Station, Fairbanks. For the Kenai area stations, Homer has growing-degree units over 10% less than Kasilof which is almost 10% less than Kodiak, which averages about 15% less than the southcentral-interior stations.

The growing-degree unit accumulations show the Kenai area stations are the least favorable for crop production, with the University Experiment Station, Fairbanks generally being the most favorable.

References

1. **Arnold, C. Y.** 1971. Heat units used in field corn production. Illinois Res. Spring, p. 6-7.

2. **Aspiazu, C.** and **R. H. Shaw.** 1972. Comparison of several methods of growing-degree unit calculations for corn (*Zea mays* L.). Iowa State J. Sci. 46:435-442.

3. **Dethier, B. E.** and **M. T. Vittum.** 1967. Growing-degree days in New York State. N.Y.S. Agr. Exp. Sta. Bul. 1017.

4. **Felch, R.E., R.H. Shaw,** and **E.R. Duncan.** 1972. The climatology of growing-degree days in Iowa. Iowa State J. Sci. 46:443-461.

5. **Newman, J. E.** 1971. Measuring corn maturity with heat units. Crops and Soils Mag., June-July, p. 11-14.

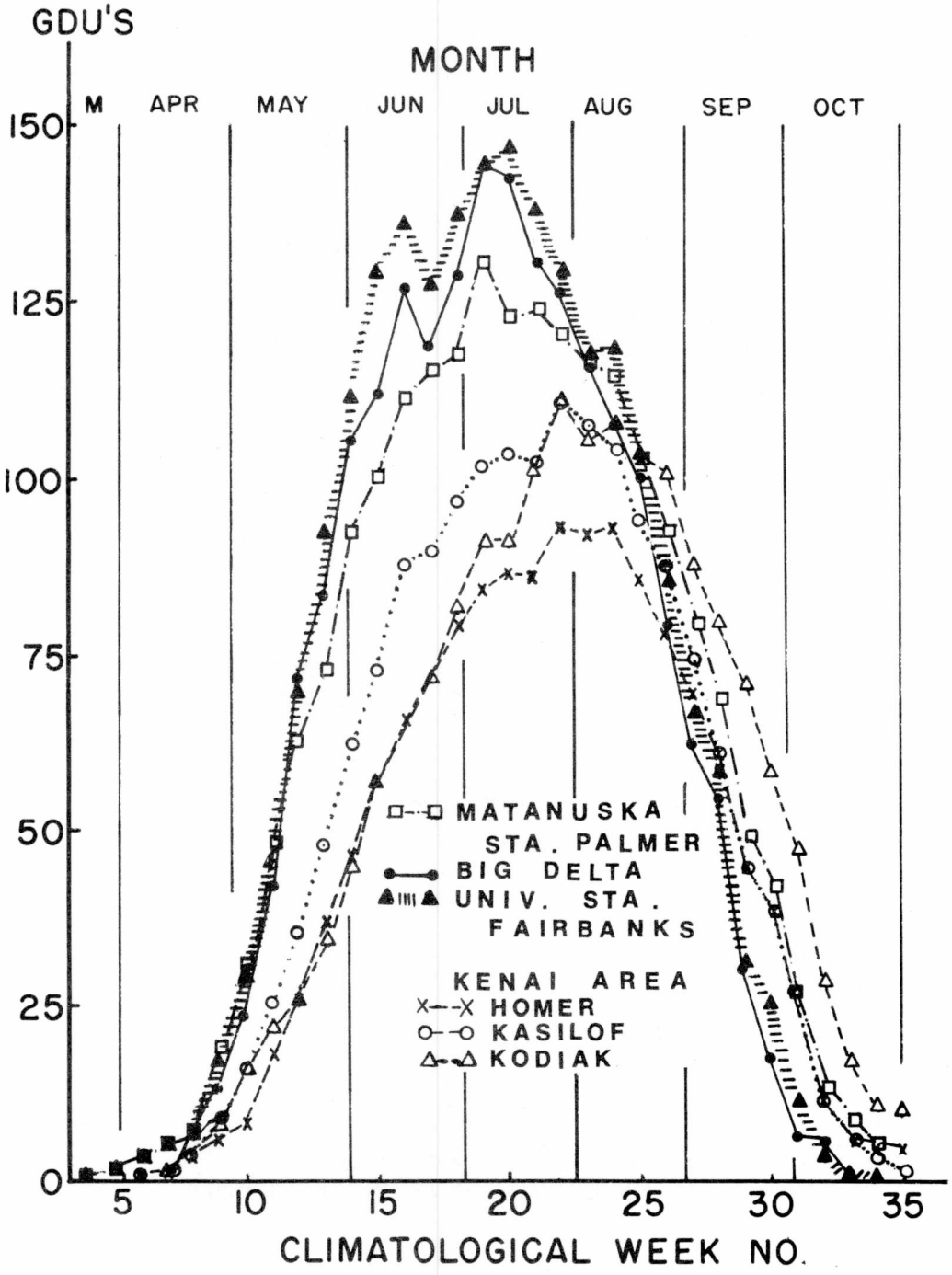


FIGURE 1

Average weekly growing-degree units for Matanuska Experiment Station, near Palmer; Big Delta; University Experiment Station, Fairbanks; Homer; Kasilof; and Kodiak.

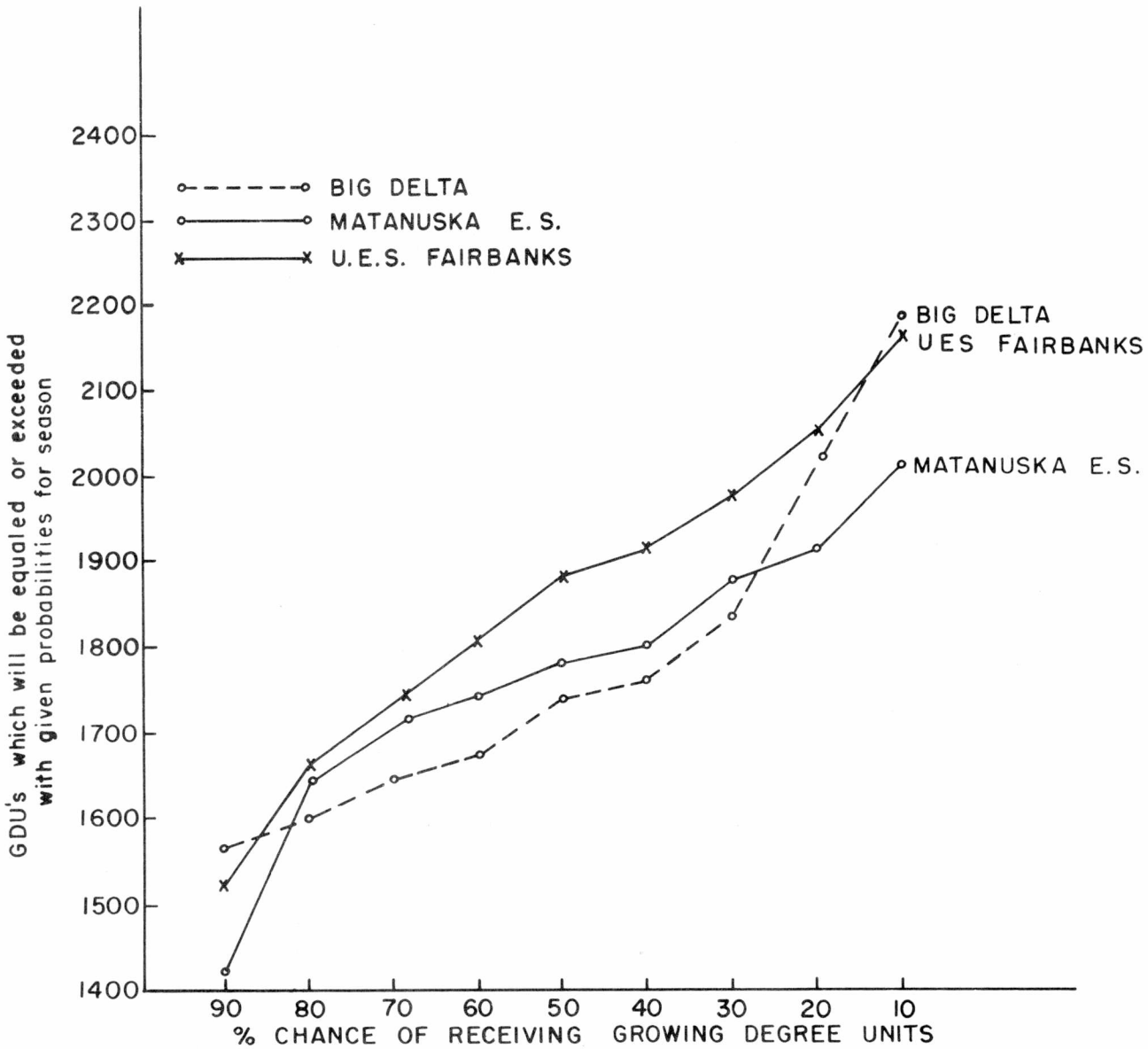


FIGURE 2

Seasonal growing-degree units (May 15 to 1st 30°F or lower temperature in fall) which will be equaled or exceeded for varying probability levels at Big Delta, Matanuska Experiment Station and University Experiment Station, Fairbanks.

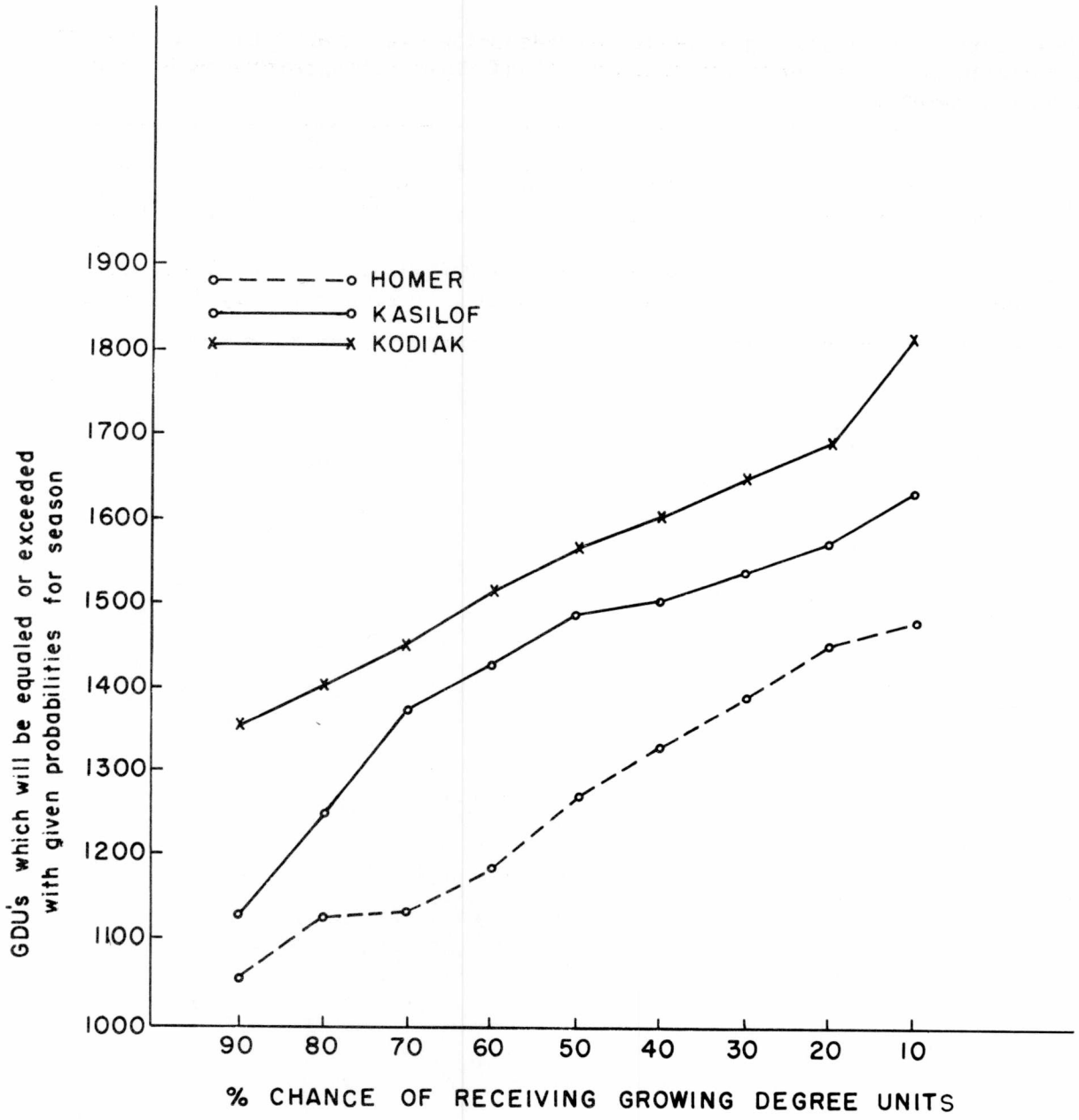


FIGURE 3

Seasonal growing-degree units (May 15 to 1st 30°F or lower temperature in fall) which will be equaled or exceeded for varying probability levels at Homer, Kasilof and Kodiak.

Table 1. Comparison of growing-degree (GDU) units for Clearwater and Big Delta from 1965-70. As is shown by the figures, summer temperatures at Big Delta are only approximately 10% warmer than those at Clearwater.

		Month				
Ratio:	GDU Clearwater / GDU Big Delta	May	June	July	Aug.	Sept.
		0.90	0.93	0.92	0.91	0.72
Range of ratio for individual years		0.51 to 1.54	0.86 to 1.06	0.85 to 1.06	0.71 to 1.11	0.52 to 1.05

Table 2. Highest, lowest and average weekly GDU values for Big Delta and values which will be equaled or exceeded for given probabilities.

Week no.	Date	Highest accum.	Lowest accum.	Av.	% chance of zero	GDU which will be equaled or exceeded with probability shown						
						90%	80%	60%	50%	40%	20%	10%
1	Mar. 1-7	2	0	0.1	95.6	0	0	0	0	0	0	0
2	Mar. 8-14	12	0	0.5	95.6	0	0	0	0	0	0	0
3	Mar. 15-21	5	0	0.2	95.6	0	0	0	0	0	0	0
4	Mar. 22-28	0	0	0	100.0	0	0	0	0	0	0	0
5	Mar. 29-Apr. 4	3	0	0.2	91.2	0	0	0	0	0	0	0
6	Apr. 5-11	7	0	0.5	91.2	0	0	0	0	0	0	0
7	Apr. 12-18	22	0	2.2	74.0	0	0	0	0	0	1	8
8	Apr. 19-25	16	0	4.3	39.6	0	0	1	1	3	9	14
9	Apr. 26-May 2	59	0	13.4	34.8	0	0	1	4	6	23	40
10	May 3-9	75	0	23.4	17.4	0	2	8	15	30	37	48
11	May 10-16	82	0	42.1	4.4	4	21	32	39	56	63	67
12	May 17-23	117	1	71.4	0	47	56	64	65	80	86	91
13	May 24-30	151	44	84.0	0	50	63	76	78	81	91	113
14	May 31-June 6	198	53	105.6	0	63	70	83	92	99	148	155
15	June 7-13	181	58	112.4	0	74	87	100	108	117	132	140
16	June 14-20	186	74	127.1	0	86	92	109	124	136	152	159
17	June 21-27	170	23	118.7	0	82	89	106	120	136	144	145
18	June 28-July 4	188	55	128.5	0	98	112	119	126	132	146	157
19	July 5-11	178	102	144.9	0	111	119	139	147	154	165	168
20	July 12-18	192	102	142.0	0	113	118	129	138	144	164	171
21	July 19-25	195	84	131.2	0	103	112	119	126	129	147	162
22	July 26-Aug. 1	210	76	126.4	0	88	109	116	123	124	132	152
23	Aug. 2-8	168	54	116.4	0	75	86	108	116	122	136	146
24	Aug. 9-15	172	68	106.5	0	68	84	92	111	115	137	148
25	Aug. 16-22	168	35	99.8	0	44	71	95	103	109	115	129
26	Aug. 23-29	137	22	78.7	0	37	46	63	77	82	100	128
27	Aug. 30-Sept. 5	134	14	62.0	0	21	27	38	62	65	82	113
28	Sept. 6-12	107	10	54.4	0	13	23	44	48	60	77	93
29	Sept. 13-19	77	1	29.6	0	6	8	15	28	32	44	58
30	Sept. 20-26	55	0	17.6	17.4	0	0	5	14	16	30	40
31	Sept. 27-Oct. 3	36	0	6.5	43.5	0	0	0	2	5	7	17
32	Oct. 4-10	34	0	5.7	56.6	0	0	0	0	0	10	17
33	Oct. 11-17	15	0	1.1	87.0	0	0	0	0	0	0	3
34	Oct. 18-24	2	0	0.1	91.4	0	0	0	0	0	0	0
35	Oct. 25-31	8	0	0.3	95.7	0	0	0	0	0	0	0

Table 3. Highest, lowest and average weekly GDU values for Homer and values which will be equaled or exceeded for given probabilities.

Week no.	Date	Highest accum.	Lowest accum.	Av.	% chance of zero	GDU which will be equaled or exceeded with probability shown						
						90%	80%	60%	50%	40%	20%	10%
1	Mar. 1-7	3	0	0.2	88.9	0	0	0	0	0	0	2
2	Mar. 8-14	4	0	0.2	92.6	0	0	0	0	0	0	0
3	Mar. 15-21	3	0	0.2	88.9	0	0	0	0	0	0	2
4	Mar. 22-28	4	0	0.1	96.3	0	0	0	0	0	0	0
5	Mar. 29-Apr. 4	8	0	0.5	85.2	0	0	0	0	0	0	2
6	Apr. 5-11	17	0	1.0	82.5	0	0	0	0	0	0	3
7	Apr. 12-18	17	0	2.2	48.1	0	0	0	1	1	4	8
8	Apr. 19-25	19	0	3.6	40.7	0	0	0	2	3	7	13
9	Apr. 26-May 2	28	0	6.1	29.5	0	0	2	3	4	11	23
10	May 3-9	37	0	9.5	7.4	1	2	6	8	9	16	21
11	May 10-16	87	0	18.2	3.7	4	6	14	16	19	27	36
12	May 17-23	72	1	25.5	0	8	12	23	25	27	35	47
13	May 24-30	64	13	37.0	0	20	24	34	38	42	52	56
14	May 31-June 6	81	13	45.6	0	28	30	43	45	49	60	70
15	June 7-13	76	28	57.6	0	39	45	57	61	65	70	74
16	June 14-20	90	40	65.5	0	48	51	65	67	71	79	82
17	June 21-27	137	44	70.9	0	47	53	65	74	76	84	94
18	June 28-July 4	107	55	79.0	0	65	65	78	79	83	94	102
19	July 5-11	102	59	84.8	0	70	81	83	87	89	94	99
20	July 12-18	111	65	86.6	0	71	74	89	90	92	95	103
21	July 19-25	108	67	86.0	0	74	77	87	89	93	103	107
22	July 26-Aug. 1	124	57	94.4	0	72	81	94	98	102	109	115
23	Aug. 2-8	120	63	92.5	0	75	78	92	95	98	106	112
24	Aug. 9-15	117	63	93.1	0	76	79	89	93	100	106	115
25	Aug. 16-22	112	60	85.5	0	70	71	83	84	88	99	105
26	Aug. 23-29	106	45	78.2	0	58	63	73	76	89	94	101
27	Aug. 30-Sept. 5	117	39	69.0	0	44	54	60	66	75	85	102
28	Sept. 6-12	101	30	61.3	0	34	49	57	63	67	79	90
29	Sept. 13-19	83	14	44.4	0	27	31	40	44	49	58	71
30	Sept. 20-26	105	0	40.4	3.8	15	31	36	40	42	51	72
31	Sept. 27-Oct. 3	77	4	26.4	0	5	9	23	26	29	44	52
32	Oct. 4-10	34	0	11.1	14.4	0	1	7	10	14	22	27
33	Oct. 11-17	22	0	6.9	23.1	0	0	4	5	6	16	20
34	Oct. 18-24	39	0	5.0	46.2	0	0	0	1	5	8	15
35	Oct. 25-31	31	0	4.0	49.9	0	0	0	0	2	10	11

Table 4. Highest, lowest and average weekly GDU values for Kasilof and values which will be equaled or exceeded for given probabilities.

Week no.	Date	Highest accum.	Lowest accum.	Av.	% chance of zero	GDU which will be equaled or exceeded with probability shown						
						90%	80%	60%	50%	40%	20%	10%
1	Mar. 1-7	0	0	0	100.0	0	0	0	0	0	0	0
2	Mar. 8-14	0	0	0	100.0	0	0	0	0	0	0	0
3	Mar. 15-21	1	0	0	96.8	0	0	0	0	0	0	0
4	Mar. 22-28	2	0	0.1	90.3	0	0	0	0	0	0	0
5	Mar. 29-Apr. 4	6	0	0.4	90.3	0	0	0	0	0	0	0
6	Apr. 5-11	14	0	1.4	66.5	0	0	0	0	0	2	3
7	Apr. 12-18	12	0	1.0	70.0	0	0	0	0	0	2	3
8	Apr. 19-25	38	0	4.6	38.5	0	0	0	2	4	8	10
9	Apr. 26-May 2	29	0	9.0	31.5	0	0	3	4	8	21	24
10	May 3-9	43	0	15.2	7.0	1	3	8	9	18	23	35
11	May 10-16	82	1	25.6	0	4	11	18	22	30	35	46
12	May 17-23	77	6	36.0	0	17	21	34	35	37	52	59
13	May 24-30	93	17	48.2	0	25	37	45	48	49	65	71
14	May 31-June 6	103	37	62.3	0	39	42	54	62	68	86	93
15	June 7-13	112	24	73.0	0	61	64	70	76	77	85	87
16	June 14-20	125	58	87.7	0	64	73	86	87	93	101	111
17	June 21-27	163	62	88.9	0	68	72	84	86	94	100	107
18	June 28-July 4	121	70	97.0	0	82	86	96	98	103	109	115
19	July 5-11	124	83	101.9	0	86	89	103	106	108	113	115
20	July 12-18	123	67	103.3	0	94	95	101	105	106	114	120
21	July 19-25	139	85	102.3	0	90	93	104	106	110	115	128
22	July 26-Aug. 1	141	77	111.2	0	94	99	108	115	117	124	133
23	Aug. 2-8	141	73	107.3	0	94	100	103	106	109	123	127
24	Aug. 9-15	131	79	103.8	0	82	89	102	105	107	119	126
25	Aug. 16-22	116	68	94.5	0	78	82	95	97	99	106	110
26	Aug. 23-29	122	49	87.5	0	65	72	83	85	87	113	118
27	Aug. 30-Sept. 5	124	45	74.2	0	53	58	67	74	78	89	102
28	Sept. 6-12	96	29	61.8	0	34	47	60	63	68	81	89
29	Sept. 13-19	89	20	44.6	0	25	34	41	45	46	59	65
30	Sept. 20-26	91	0	38.3	7.4	4	24	38	41	42	54	76
31	Sept. 27-Oct. 3	76	0	26.8	3.7	5	10	19	26	31	42	54
32	Oct. 4-10	32	0	11.7	22.2	0	0	9	13	14	23	28
33	Oct. 11-17	31	0	7.3	29.6	0	0	2	5	8	13	21
34	Oct. 18-24	53	0	3.4	59.2	0	0	0	0	1	5	8
35	Oct. 25-31	10	0	1.6	62.9	0	0	0	0	0	4	7

Table 5. Highest, lowest and average weekly GDU values for Kodiak and values which will be equaled or exceeded for given probabilities.

Week no.	Date	Highest accum.	Lowest accum.	Av.	% chance of zero	GDU which will be equaled or exceeded with probability shown						
						90%	80%	60%	50%	40%	20%	10%
1	Mar. 1-7	10	0	0.9	73.0	0	0	0	0	0	1	5
2	Mar. 8-14	5	0	0.4	84.8	0	0	0	0	0	0	2
3	Mar. 15-21	12	0	0.6	84.8	0	0	0	0	0	0	1
4	Mar. 22-28	8	0	0.9	73.0	0	0	0	0	0	2	4
5	Mar. 29-Apr. 4	17	0	1.7	66.9	0	0	0	0	0	4	7
6	Apr. 5-11	64	0	3.7	63.9	0	0	0	0	0	4	10
7	Apr. 12-18	82	0	4.6	47.8	0	0	0	1	2	4	10
8	Apr. 19-25	31	0	6.1	29.9	0	0	2	3	5	13	20
9	Apr. 26-May 2	38	0	7.8	15.0	0	1	4	6	7	12	22
10	May 3-9	49	0	15.2	3.0	3	5	10	13	15	24	37
11	May 10-16	111	4	22.1	0	6	8	14	15	20	29	46
12	May 17-23	62	6	25.9	0	10	17	21	23	26	41	51
13	May 24-30	84	9	34.5	0	18	23	30	32	37	48	55
14	May 31-June 6	98	19	44.0	0	27	31	38	40	43	54	67
15	June 7-13	116	26	57.5	0	37	43	47	51	65	73	84
16	June 14-20	136	40	72.1	0	46	52	63	67	74	99	102
17	June 21-27	230	42	78.3	0	52	60	67	74	78	88	103
18	June 28-July 4	138	49	82.2	0	56	68	80	84	94	102	119
19	July 5-11	136	50	90.6	0	57	79	91	92	92	110	119
20	July 12-18	136	60	91.1	0	73	81	86	92	93	106	112
21	July 19-25	186	28	101.0	0	78	87	95	97	101	116	144
22	July 26-Aug. 1	154	38	110.9	0	88	96	100	111	119	134	141
23	Aug. 2-8	166	26	105.3	0	86	95	104	106	110	117	126
24	Aug. 9-15	156	40	108.3	0	87	91	99	103	110	124	140
25	Aug. 16-22	137	30	103.2	0	85	89	94	99	110	126	131
26	Aug. 23-29	137	70	100.1	0	76	85	93	96	104	117	129
27	Aug. 30-Sept. 5	125	67	87.1	0	69	75	83	85	90	98	109
28	Sept. 6-12	117	53	79.8	0	63	67	75	81	84	91	101
29	Sept. 13-19	120	41	70.6	0	50	59	68	69	76	82	94
30	Sept. 20-26	95	16	58.4	0	38	41	57	60	66	74	86
31	Sept. 27-Oct. 3	75	18	47.6	0	24	28	48	50	57	64	70
32	Oct. 4-10	60	0	28.4	3.0	5	14	21	26	36	50	54
33	Oct. 11-17	49	2	17.2	0	3	7	13	16	19	29	33
34	Oct. 18-24	51	0	11.0	6.0	1	2	4	8	10	18	33
35	Oct. 25-31	51	0	10.0	20.9	0	0	4	7	11	16	29

Table 6. Highest, lowest and average weekly GDU values for the Matanuska Experiment Station and values which will be equaled or exceeded for given probabilities.

Week no.	Date	Highest accum.	Lowest accum.	Av.	% chance of zero	GDU which will be equaled or exceeded with probability shown						
						90%	80%	60%	50%	40%	20%	10%
1	Mar. 1-7	6	0	0.4	86.6	0	0	0	0	0	0	2
2	Mar. 8-14	5	0	0.2	93.3	0	0	0	0	0	0	0
3	Mar. 15-21	3	0	0.2	93.3	0	0	0	0	0	0	0
4	Mar. 22-28	4	0	0.2	86.6	0	0	0	0	0	0	1
5	Mar. 29-Apr. 4	12	0	1.5	70.0	0	0	0	0	0	3	7
6	Apr. 5-11	29	0	3.4	43.3	0	0	0	1	2	5	10
7	Apr. 12-18	28	0	5.4	33.3	0	0	2	4	5	6	20
8	Apr. 19-25	54	0	5.4	13.3	0	2	6	7	8	18	28
9	Apr. 26-May 2	53	0	18.2	13.0	0	3	12	14	17	32	48
10	May 3-9	64	2	30.4	0	4	9	24	28	35	48	56
11	May 10-16	126	9	47.6	0	21	33	41	45	48	61	72
12	May 17-23	104	16	62.0	0	44	47	60	62	64	71	90
13	May 24-30	107	46	72.4	0	56	58	66	72	76	86	93
14	May 31-June 6	162	60	91.7	0	62	71	81	84	94	113	130
15	June 7-13	151	64	99.9	0	76	86	94	96	100	118	122
16	June 14-20	185	68	111.0	0	81	94	105	110	120	135	155
17	June 21-27	192	78	114.7	0	87	96	107	114	117	129	143
18	June 28-July 4	164	92	117.5	0	98	102	109	117	120	132	140
19	July 5-11	170	104	130.9	0	105	112	126	127	129	134	145
20	July 12-18	156	92	122.9	0	102	110	121	123	128	134	144
21	July 19-25	165	100	123.4	0	104	108	118	121	124	132	154
22	July 26-Aug. 1	164	89	120.6	0	98	104	114	122	127	136	144
23	Aug. 2-8	148	74	115.4	0	96	104	112	114	117	128	135
24	Aug. 9-15	154	78	113.8	0	93	96	112	115	119	127	132
25	Aug. 16-22	142	68	102.3	0	84	90	100	102	104	113	118
26	Aug. 23-29	129	57	92.4	0	72	82	86	90	95	104	119
27	Aug. 30-Sept. 5	126	44	78.2	0	52	56	68	80	85	100	107
28	Sept. 6-12	116	6	68.1	0	28	47	65	70	76	82	101
29	Sept. 13-19	92	16	48.7	0	20	28	44	48	57	66	74
30	Sept. 20-26	101	0	41.5	3.3	13	26	33	42	44	57	72
31	Sept. 27-Oct. 3	84	0	26.5	3.3	3	9	18	26	30	43	50
32	Oct. 4-10	51	0	12.7	20.0	0	0	4	7	10	28	37
33	Oct. 11-17	30	0	7.6	33.0	0	0	2	4	6	14	22
34	Oct. 18-24	48	0	5.5	50.0	0	0	0	0	3	4	13
35	Oct. 25-31	20	0	1.3	66.7	0	0	0	0	0	3	6

Table 7. Highest, lowest and average weekly GDU values for the University Experiment Station, Fairbanks and values which will be equaled or exceeded for given probabilities.

Week no.	Date	Highest accum.	Lowest accum.	Av.	% chance of zero	GDU which will be equaled or exceeded with probability shown						
						90%	80%	60%	50%	40%	20%	10%
1	Mar. 1-7	0	0	0	100.0	0	0	0	0	0	0	0
2	Mar. 8-14	0	0	0	100.0	0	0	0	0	0	0	0
3	Mar. 15-21	0	0	0	100.0	0	0	0	0	0	0	0
4	Mar. 22-28	0	0	0	100.0	0	0	0	0	0	0	0
5	Mar. 29-Apr. 4	2	0	0.3	83.7	0	0	0	0	0	0	0
6	Apr. 5-11	13	0	0.9	76.9	0	0	0	0	0	1	5
7	Apr. 12-18	25	0	2.5	69.9	0	0	0	0	0	5	10
8	Apr. 19-25	54	0	6.5	36.6	0	0	1	2	5	11	16
9	Apr. 26-May 2	74	0	16.5	33.3	0	0	3	9	15	31	46
10	May 3-9	82	0	28.5	13.3	0	7	19	24	36	48	54
11	May 10-16	110	0	45.8	3.3	7	27	39	44	52	67	74
12	May 17-23	121	1	70.9	0	50	54	62	70	76	93	104
13	May 24-30	137	58	92.0	0	60	75	86	90	92	107	125
14	May 31-June 6	192	56	111.9	0	73	78	98	102	113	152	168
15	June 7-13	193	80	128.2	0	92	101	116	129	138	150	159
16	June 14-20	196	74	136.4	0	86	106	127	137	148	171	177
17	June 21-27	166	29	127.6	0	100	104	124	130	139	153	160
18	June 28-July 4	186	64	137.4	0	102	115	131	140	143	157	168
19	July 5-11	180	91	145.3	0	116	120	143	146	154	168	175
20	July 12-18	187	86	147.6	0	116	130	142	145	153	166	177
21	July 19-25	194	100	137.6	0	114	122	132	134	140	152	166
22	July 26-Aug. 1	210	83	129.5	0	90	112	118	127	128	146	165
23	Aug. 2-8	162	54	118.4	0	69	99	112	118	125	137	152
24	Aug. 9-15	168	67	119.7	0	78	92	110	124	130	146	156
25	Aug. 16-22	156	44	103.2	0	58	78	96	106	110	122	137
26	Aug. 23-29	146	22	85.5	0	56	68	78	82	89	102	122
27	Aug. 30-Sept. 5	124	22	66.5	0	32	36	58	60	75	98	110
28	Sept. 6-12	116	0	57.6	3.3	18	25	56	61	64	78	87
29	Sept. 13-19	92	1	30.8	0	2	9	26	30	36	48	58
30	Sept. 20-26	92	0	25.0	9.9	0	6	20	24	25	37	52
31	Sept. 27-Oct. 3	64	0	11.0	23.3	0	0	4	6	9	21	31
32	Oct. 4-10	22	0	3.3	56.6	0	0	0	0	1	6	14
33	Oct. 11-17	10	0	0.8	79.9	0	0	0	0	0	1	2
34	Oct. 18-24	38	0	1.3	93.2	0	0	0	0	0	0	0
35	Oct. 25-31	2	0	0.1	96.4	0	0	0	0	0	0	0

Table 8. Highest, lowest and average monthly GDU values and values which will be equaled or exceeded for given probabilities at 6 Alaska locations.

Month	Highest accum.	Lowest accum.	Av.	% chance of zero	GDU which will be equaled or exceeded with probability shown						
					90%	80%	60%	50%	40%	20%	10%
BIG DELTA											
March	13	0	0.9	82.6	0	0	0	0	0	0	0
April	100	0	17.1	21.8	0	0	4	7	13	30	57
May	358	112	237.4	0	142	182	221	248	256	292	301
June	676	255	502.0	0	370	430	472	474	530	587	651
July	692	468	603.4	0	535	555	591	600	612	658	691
Aug.	610	293	445.8	0	325	392	412	442	473	514	562
Sept.	268	76	148.3	0	81	92	119	138	156	219	245
Oct.	41	0	8.6	43.5	0	0	0	1	10	18	32
HOMER											
March	6	0	0.8	76.9	0	0	0	0	0	2	4
April	53	0	11.6	3.8	1	2	4	7	8	21	26
May	252	30	100.0	0	53	67	78	95	102	133	146
June	373	124	263.3	0	174	206	243	272	286	320	333
July	440	314	383.8	0	329	347	369	382	398	417	434
Aug.	540	286	386.7	0	335	342	374	386	392	412	462
Sept.	360	134	212.9	0	146	170	192	208	215	252	290
Oct.	82	2	34.9	0	10	15	22	29	34	51	73
KASILOF											
March	4	0	0.3	85.9	0	0	0	0	0	0	1
April	78	0	13.1	10.7	0	1	4	6	10	18	30
May	236	44	133.8	0	67	88	116	131	145	172	204
June	427	238	340.0	0	275	284	320	335	360	383	422
July	531	362	463.5	0	420	450	466	469	471	482	490
Aug.	540	304	430.3	0	344	386	410	436	454	470	490
Sept.	328	120	216.8	0	149	189	201	215	217	249	299
Oct.	74	0	31.0	7.6	2	11	24	34	35	50	61

Continued on next page.

Table 8 — Continued.

Month	Highest accum.	Lowest accum.	Av.	% chance of zero	GDU which will be equaled or exceeded with probability shown 90%	80%	60%	50%	40%	20%	10%
				KODIAK							
March	20	0	3.2	45.0	0	0	0	1	2	4	12
April	112	0	21.2	9.2	1	3	8	11	17	34	50
May	247	36	108.4	0	44	71	92	97	112	152	173
June	496	166	288.1	0	202	220	255	280	295	346	383
July	633	340	433.4	0	366	380	417	440	449	467	486
Aug.	572	360	463.5	0	397	416	443	459	468	525	546
Sept.	407	219	297.8	0	225	244	295	304	312	333	375
Oct.	220	15	86.6	0	31	47	68	80	92	117	149
				MATANUSKA EXP. STA.							
March	14	0	1.6	56.6	0	0	0	0	1	3	5
April	126	2	33.0	0	5	7	13	26	40	53	67
May	362	115	230.2	0	156	189	222	230	245	273	300
June	716	334	466.7	0	360	398	450	455	471	514	584
July	676	494	544.1	0	498	513	527	531	539	572	606
Aug.	588	383	464.9	0	392	411	451	463	474	497	555
Sept.	360	136	228.2	0	168	187	201	212	234	284	318
Oct.	116	0	36.4	3.3	6	13	17	24	34	61	89
				UNIVERSITY EXP. STA., FAIRBANKS							
March	0	0	0	100.0	0	0	0	0	0	0	0
April	120	0	21.4	16.7	0	1	6	10	15	38	53
May	394	124	257.4	0	171	198	244	255	262	304	365
June	700	292	548.4	0	451	475	526	545	558	640	653
July	724	469	621.2	0	550	582	620	626	639	657	684
Aug.	619	316	465.2	0	371	425	439	470	487	521	540
Sept.	309	91	164.8	0	93	105	145	152	167	222	253
Oct.	56	0	7.8	30.0	0	0	2	3	4	15	20

Table 9. Highest, lowest and average seasonal GDU values and values which will be equaled or exceeded for given probabilities for the period May 15 to date of first 30°F or lower temperature in the fall at 6 Alaska locations.

Location	Highest accum.	Lowest accum.	Av.	GDU which will be equaled or exceeded with probabilities shown						
				90%	80%	60%	50%	40%	20%	10%
Big Delta	2318	1544	1791	1569	1606	1672	1742	1765	2040	2190
Homer	1768	990	1274	1059	1123	1185	1272	1331	1449	1478
Kasilof	1665	1095	1433	1134	1246	1424	1484	1500	1573	1634
Kodiak	2197	1284	1572	1355	1400	1516	1567	1605	1688	1818
Matanuska Exp. Sta.	2180	1260	1763	1421	1643	1742	1784	1803	1910	2014
Univ. Exp. Sta., Fairbanks	2430	1153	1852[1]	1521	1662	1810	1884	1912	2052	2168

[1] In 1949 a 29° freeze occurred July 1 when 487 GDU had accumulated. The value used for 1949 was the total of 1153 GDU accumulated from July 1 to the first fall freeze on Sept. 9. The average using the value up to July 1 would be 1830.

APPENDIX

Table A-1. Accumulated monthly growing-degree units for Big Delta.

Year	March	Apr.	May	June	July	Aug.	Sept.	Oct.
No data prior to 1943	-	-	-	-	-	-	-	-
1943	0	38	250	586	600	397	158	20
1944	0	14	268	556	608	393	102	14
1945	0	0	198	402	532	442	104	11
1946	0	12	276	619	631	390	151	23
1947	5	10	286	442	688	308	78	0
1948	0	0	237	544	543	293	90	1
1949	0	2	194	254	546	488	263	0
1950	0	6	216	589	612	537	210	12
1951	0	26	286	472	624	574	235	0
1952	0	3	132	474	591	400	94	41
1953	0	100	302	578	692	474	172	17
1954	0	0	300	507	572	492	125	0
1955	0	0	164	430	651	368	140	0
1956	0	26	229	470	639	475	172	0
1957	0	1	251	675	604	610	232	1
1958	0	58	300	666	692	516	118	0
1959	0	7	220	584	468	408	114	0
1960	0	52	358	442	600	448	76	1
1961	0	7	248	473	562	442	126	0
1962	2	1	163	472	672	472	86	0
1963	0	15	268	356	576	496	160	14
1964	0	0	112	526	682	480	138	36
1965	13	14	201	430	594	401	268	0
Av.	0.9	17.1	237.4	502.0	603.4	445.8	148.3	8.6

Table A-2. Accumulated monthly growing-degree units for Homer.

Year	March	Apr.	May	June	July	Aug.	Sept.	Oct.
1940	0	53	141	286	428	430	249	38
1941	5	36	102	327	315	541	210	24
1942	0	9	252	330	440	459	361	82
1943	0	26	78	316	385	347	175	67
1944	6	28	136	338	440	469	219	51
1945	0	6	124	306	421	399	183	35
1946	0	1	77	233	359	335	189	50
1947	0	15	121	125	360	335	173	27
1948	0	5	91	247	322	286	135	18
1949	2	4	71	206	329	358	217	19
1950	0	4	44	221	330	395	218	34
1951	0	11	79	250	380	400	213	17
1952	0	0	30	166	374	385	197	74
1953	0	21	77	373	434	404	206	31
1954	0	1	122	275	400	381	256	64
1955	0	3	60	202	361	351	181	5
1956	0	8	60	206	354	357	168	2
1957	2	3	108	323	404	414	260	73
1958	0	23	136	326	418	388	164	15
1959	0	1	103	287	368	380	196	28
1960	0	16	154	242	415	329	170	19
1961	0	8	101	294	395	371	225	12
1962	0	4	70	270	405	394	134	22
1963	2	2	118	222	433	422	280	38
1964	0	2	67	301	371	388	256	52
1965	5	20	84	181	346	341	308	14
Av.	.79	11.6	100.0	263.3	383.8	386.7	212.9	34.9

Table A-3. Accumulated monthly growing-degree units for Kasilof.

Year	March	Apr.	May	June	July	Aug.	Sept.	Oct.
1931	-	-	-	-	-	-	-	-
1932	0	3	88	275	460	362	137	50
1933	0	0	99	293	453	305	120	0
1934	0	6	64	238	362	384	215	42
1935	-	-	-	-	-	-	-	-
1936	0	2	44	435	-	-	-	-
1937	-	-	-	-	-	-	-	-
1938	-	-	-	-	-	-	-	-
1939	1	4	96	-	-	-	202	14
1940	2	78	-	-	456	429	216	28
1941	0	44	-	378	466	541	261	37
1942	0	15	236	384	477	478	328	50
1943	0	24	155	383	449	414	200	74
1944	0	27	139	333	471	462	215	41
1945	0	6	121	337	471	406	189	35
1946	0	0	118	323	474	379	234	55
1947	1	17	174	281	472	415	193	35
1948	0	1	134	294	402	339	-	-
1949	-	-	-	-	-	-	-	-
1950	-	-	-	-	-	-	-	-
1951	0	10	129	319	487	471	207	5
1952	0	4	70	279	455	444	219	64
1953	0	45	167	419	531	460	224	35
1954	0	4	192	326	470	446	287	50
1955	0	1	106	283	466	409	191	4
1956	0	12	91	320	433	464	200	0
1957	0	9	203	427	491	515	279	60
1958	0	19	191	389	466	461	194	15
1959	0	0	164	376	440	469	219	18
1960	0	19	205	350	474	402	171	25
1961	0	7	147	376	488	397	253	9
1962	5	6	115	352	484	471	155	10
1963	0	11	168	293	490	471	319	23
1964	0	1	70	384	469	401	220	35
Av.	.27	13.1	133.8	340.0	463.5	430.3	216.8	31.0

Table A-4. Accumulated monthly growing-degree units for Kodiak.

Year	March	Apr.	May	June	July	Aug.	Sept.	Oct.
1931	0	52	130	290	408	555	323	118
1932	0	10	102	215	465	418	228	132
1933	1	13	97	325	436	360	234	37
1934	3	9	139	251	452	459	354	85
1935	12	29	116	299	458	467	330	117
1936	0	47	76	489	633	530	308	221
1937	0	29	82	238	374	540	297	202
1938	0	8	78	207	365	525	325	144
1939	2	3	93	287	411	401	319	67
1940	3	45	182	257	473	454	308	111
1941	2	6	73	167	340	550	407	109
1942	0	26	248	307	451	484	391	74
1943	12	5	152	367	407	440	219	70
1944	11	4	94	316	444	573	294	83
1945	3	8	92	268	431	425	277	67
1946	-	-	-	-	-	-	-	-
1947	0	7	73	249	-	523	296	68
1948	2	112	89	330	378	439	223	40
1949	-	-	-	-	-	-	-	-
1950	0	1	41	232	368	467	234	68
1951	0	4	69	242	510	449	305	46
1952	0	0	40	219	405	475	253	101
1953	0	11	97	497	492	491	276	47
1954	9	1	99	238	460	463	368	110
1955	4	0	50	222	441	424	247	15
1956	0	14	37	199	382	445	254	26
1957	2	16	167	375	480	437	319	153
1958	4	35	133	281	388	396	296	56
1959	1	33	174	388	407	526	308	108
1960	1	0	154	290	449	432	261	89
1961	0	34	171	374	463	394	318	48
1962	0	17	108	340	422	476	223	50
1963	17	23	127	277	477	469	347	80
1964	0	7	137	299	443	410	315	96
1965	20	96	65	181	365	406	380	27
1966	-	-	-	-	-	-	-	-
Av.	3.2	21.2	108.4	288.1	433.4	463.5	297.8	86.6

Table A-5. Accumulated monthly growing-degree units for Matanuska Experiment Station.

Year	March	Apr.	May	June	July	Aug.	Sept.	Oct.
1936	0	25	262	660	610	515	91	2
1937	0	0	153	637	585	360	221	18
1938	0	18	255	508	578	440	250	56
1939	0	1	247	526	572	382	102	1
1940	0	102	258	542	625	476	173	2
1941	0	38	194	591	538	583	142	8
1942	0	16	384	632	635	496	272	15
1943	0	53	304	646	654	438	164	27
1944	0	14	304	552	676	429	150	4
1945	0	0	236	442	626	427	132	4
1946	0	5	286	642	660	424	170	12
1947	0	0	242	460	648	324	94	0
1948	0	0	256	545	544	316	90	1
1949	0	6	215	292	588	472	230	0
1950	0	9	228	545	644	535	186	12
1951	0	40	324	508	626	542	224	0
1952	0	6	149	558	623	425	123	23
1953	0	120	376	644	692	508	196	16
1954	0	4	353	558	568	527	154	3
1955	0	2	202	460	660	408	147	0
1956	0	31	246	516	634	494	159	0
1957	0	6	262	700	644	619	256	1
1958	0	54	296	668	710	503	138	0
1959	0	2	228	608	469	428	132	2
1960	0	48	394	480	647	468	102	0
1961	0	12	278	526	586	450	148	2
1962	0	2	194	525	724	538	90	0
1963	0	17	286	401	601	480	108	11
1964	0	0	124	610	618	512	191	15
1965	0	10	186	470	650	438	310	0
Av.	0	21.4	257.4	548.4	621.2	465.2	164.8	7.8

Table A-6. Accumulated monthly growing-degree units for University Experiment Station, Fairbanks.

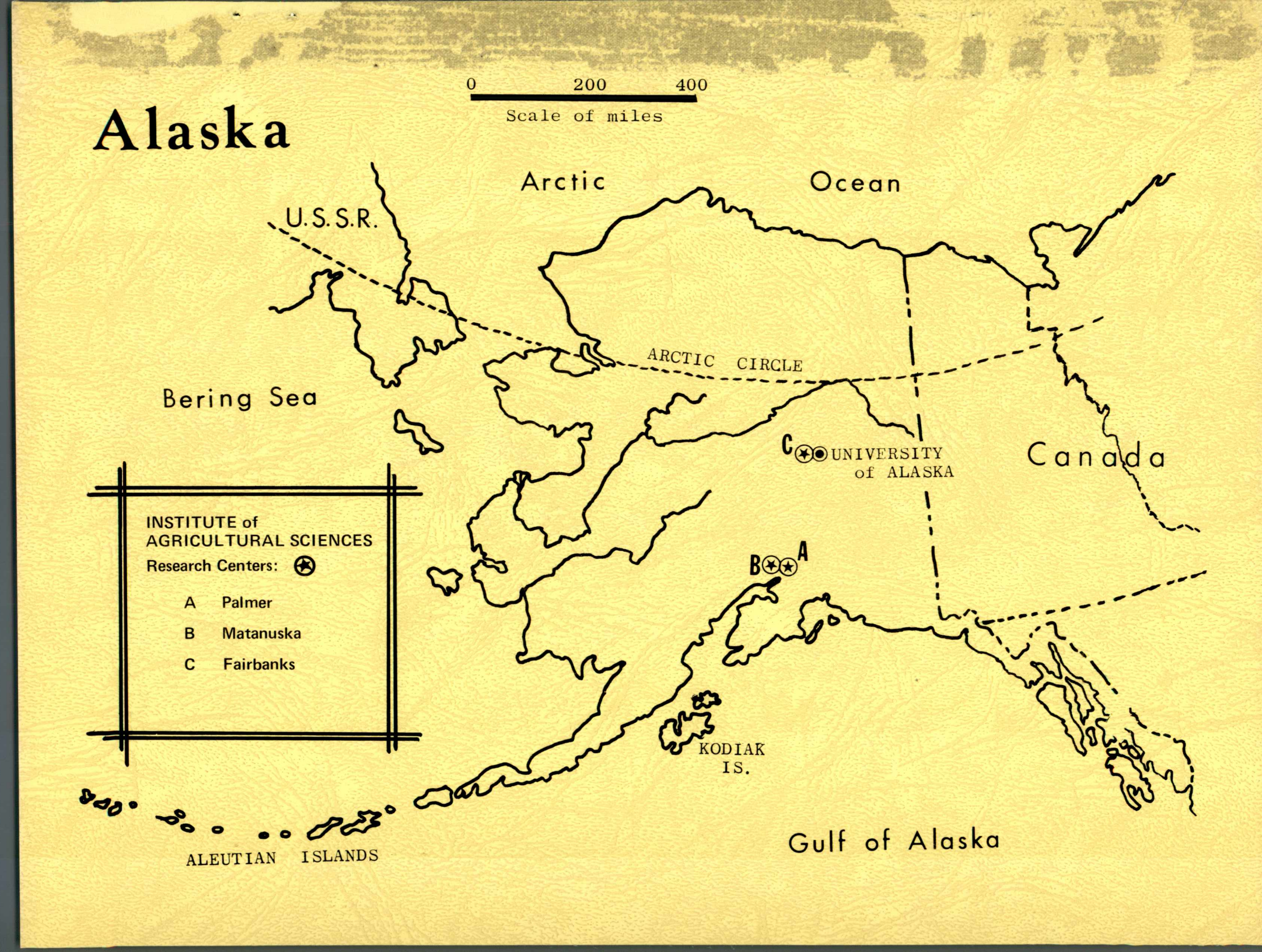
Year	March	Apr.	May	June	July	Aug.	Sept.	Oct.
1936	0	46	222	716	676	548	194	87
1937	0	2	201	451	523	406	282	84
1938	2	64	231	392	497	524	309	116
1939	1	26	200	452	538	383	208	14
1940	6	126	282	473	564	486	212	38
1941	4	84	222	493	508	588	246	16
1942	0	44	362	496	606	506	360	45
1943	0	54	264	528	528	457	235	100
1944	1	57	228	497	524	476	237	30
1945	0	7	200	405	498	394	144	23
1946	0	7	183	414	528	402	198	25
1947	3	22	223	376	513	386	165	8
1948	0	16	262	491	512	391	170	15
1949	2	2	238	351	494	472	182	12
1950	0	16	178	413	535	562	234	32
1951	1	43	260	426	604	482	233	4
1952	0	7	115	460	554	452	199	92
1953	0	70	262	582	620	467	196	41
1954	0	10	286	455	514	459	220	50
1955	2	3	163	366	564	422	196	3
1956	0	52	194	404	554	483	202	0
1957	2	28	314	586	556	568	298	83
1958	0	52	245	468	520	450	178	13
1959	0	9	284	562	498	468	250	16
1960	0	46	316	448	540	448	196	21
1961	3	27	244	454	530	442	212	9
1962	7	13	195	670	580	481	136	17
1963	0	13	258	354	588	488	326	38
1964	0	8	126	484	526	439	287	46
1965	14	36	148	334	532	416	340	14
Av.	1.6	33.0	230.2	466.7	544.1	464.9	228.2	36.4

Table A-7. Total growing-degree units from May 15 to date of first 30°F or lower in fall for each year at 3 Alaska locations in southcentral-interior Alaska.

Year	Big Delta	Matanuska Exp. Sta.	Univ. Exp. Sta. Fairbanks
1936	--	2112.5	1976.5
1937	--	1785.5	1385.5
1938	--	1796.0	1920.5
1939	--	1636.5	1637.0
1940	--	1894.0	1817.0
1941	--	1876.5	1904.0
1942	--	1979.0	2119.0
1943	1888.0	1994.0	2078.0
1944	1742.5	1649.0	1877.5
1945	1596.0	1520.0	1748.5
1946	1684.0	1260.0	2097.0
1947	1670.0	1283.0	1470.5
1948	1544.0	1725.0	1572.5
1949	1674.5	1702.0	487.5 or (1153.0)
1950	2031.0	1894.0	1904.5
1951	2085.0	1881.0	2026.5
1952	1608.5	1383.5	1684.5
1953	2078.0	2035.0	2217.0
1954	1854.0	1725.5	1978.0
1955	1564.5	1458.0	1802.0
1956	1812.0	1781.5	1964.0
1957	2318.0	2180.0	2430.5
1958	2235.0	1760.0	2252.5
1959	1637.5	1788.0	1699.5
1960	1745.0	1692.0	1877.0
1961	1670.0	1810.5	1782.0
1962	1764.0	1722.0	1967.5
1963	1766.5	1927.0	1640.0
1964	1656.5	1890.0	1889.5
1965	1575.5	1759.5	1692.0
Av.	1791.3	1763.3	1829.9 or 1852.0

Table A-8. Total growing-degree units from May 15 to date of first 30°F or lower in fall for each year at 3 Alaska locations in the Kenai area.

Year	Homer	Kasilof	Kodiak
1931	--	1540.5	1703.0
1932	--	1255.5	1432.0
1933	--	1143.5	1408.5
1934	--	1095.0	1602.0
1935	--	--	1670.0
1936	--	--	2196.5
1937	--	--	1665.5
1938	--	--	1573.5
1939	--	--	1493.5
1940	1461.0	--	1607.5
1941	1393.0	--	1550.0
1942	1767.5	1618.5	1681.0
1943	1193.0	1492.0	1525.0
1944	1331.0	1487.0	1719.0
1945	1309.5	1389.5	1461.5
1946	1173.0	1504.5	--
1947	1122.5	1127.0	--
1948	1043.5	--	1284.5
1949	1171.5	--	--
1950	1092.0	--	1368.0
1951	1286.5	1559.0	1533.5
1952	989.5	1290.5	1443.0
1953	1477.0	1645.0	1833.0
1954	1330.5	1481.5	1610.5
1955	1069.0	1218.0	1360.5
1956	1130.0	1497.0	1310.0
1957	1480.0	1568.0	1899.0
1958	1353.5	1594.0	1395.0
1959	1128.0	1467.0	1755.5
1960	1126.0	1412.0	1481.0
1961	1359.5	1528.0	1590.5
1962	1197.0	1431.5	1522.5
1963	1454.5	1665.0	1647.0
1964	1425.0	1373.5	1604.0
1965	1258.0	--	1354.0
Av.	1273.9	1432.6	1571.8


Alaska
0 200 400
Scale of miles
Arctic Ocean
U.S.S.R.
ARCTIC CIRCLE
Bering Sea
Canada
C UNIVERSITY of ALASKA
INSTITUTE of AGRICULTURAL SCIENCES
Research Centers:
A Palmer
B Matanuska
C Fairbanks
B A
KODIAK IS.
ALEUTIAN ISLANDS
Gulf of Alaska