
Climate and Its Relation to Agriculture

Corvallis, Oregon, Area—1889-1950

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By

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Weather refers to local meteorological conditions at a particular time. Climate is a summary or average of weather for a long period of time.

Of interest to everyone, climate has special importance for farmers and agricultural research workers. The weather affects the choice of crops, time of planting, harvest, crop composition and quality. Weather records are used to help determine the irrigation requirements, drainage coefficients, and seasonal effects on crops.

Storm losses in the nation last year were reported by the U.S. Weather Bureau at nearly 82 million dollars. Annual flood damage for the Willamette Valley runs more than 6 million dollars and considerable damage was caused by the severe weather of last winter.

Weather records have been kept at Oregon State College since 1889. The information gathered during that period on the climate and its relation to agriculture in the Corvallis area will be outlined in this publication.

Weather instruments located atop Agriculture Hall

The College Weather Station instruments are exposed on the turret of Agriculture Hall, situated on the main valley floor a few miles to the east of the Coast Range foothills. The elevation is 266 feet above sea level at latitude 44° 25' N. and longitude 123° 15' W.

The Cooperative Weather Station was established by Captain E. Grimm of the U. S. Army Signal Corps in October 1889. When the U. S. Weather Bureau was set up and took charge in 1891, John Fulton assumed the duties of observer. He made weather and special soil temperature observations until 1895. Ellsworth Erwin carried on the work until January 1910 when W. L. Powers was assigned to this duty and the work expanded to include evaporation and other observations related to drainage, irrigation, and soil-moisture investigations. E. F. Torgerson kept the weather record from 1918 to 1946 and R. O. Swan has assisted in taking records since 1946.

Present equipment includes the standard maximum and minimum thermometers and rain gauge and a quadruple register for continuous records of sunshine, rain, wind direction, and velocity. Other instruments in use are standard mercurial barometer, barograph, wet and dry bulb or sling psychrometer, hygrothermograph, distance thermograph, portable recording rain gauge, evaporation pan, hook gauge, still well, and water-level recorder. The evaporation station is located near the College greenhouses.

Corvallis climate designated as mild, subcoastal type

The climate at Corvallis, which is fairly representative of the Willamette Valley, may be designated as a mild subcoastal type with moist, open winters, a dry harvest period in late summer, and a remarkably long growing season. There is comparative freedom from strong winds, hail, and electrical storms.

Prevailing westerly winds bring the modifying effect of the ocean. According to Keith Butson, climatological service aide for the U. S. Weather Bureau in Portland, the coldest winter weather and warmest summer weather are associated with the advent of a continental air mass from the north or east. This condition brings the very cold air from the eastern Oregon and Washington plateau over the Cascade Mountain Range or down the Columbia River Gorge in winter. In summer, the air which prevails over the eastern Oregon and Washington plateau is extremely dry and warm. Its eastward movement across the Cascades or down the Columbia Gorge brings the hottest weather to the Willamette Valley and increases the fire danger in the forests west of the Cascades.

These extreme conditions are terminated in both summer and winter by the change in air circulation to a westerly component and the modifying effect of the Pacific Ocean is realized. These east wind regimes of extreme temperature conditions vary in length from one to as high as 8 to 10 days. In both winter and summer, clear skies and low relative humidities are associated with the east wind.

Annual temperature averages 52.4 degrees

The average annual temperature at Corvallis is 52.4 degrees Fahrenheit and ranges from 66.2 for July and August to 39.3 for January. The average maximum temperature is 74.7 in September and 45.4 in January, while the average minimum temperature ranges from 32.9 for January to 51.3 for August.

Even in the warmest summer weather, the nights are cool. The climate permits production of a wide range of specialty crops that require a mild, moist condition.

The highest temperature--107 degrees--was recorded July 20, 1946, while the lowest--14 below zero--occurred December 13, 1919. The thermometer has dropped below zero only 4 times and has exceeded 100 some 16 times in the past 60 years.

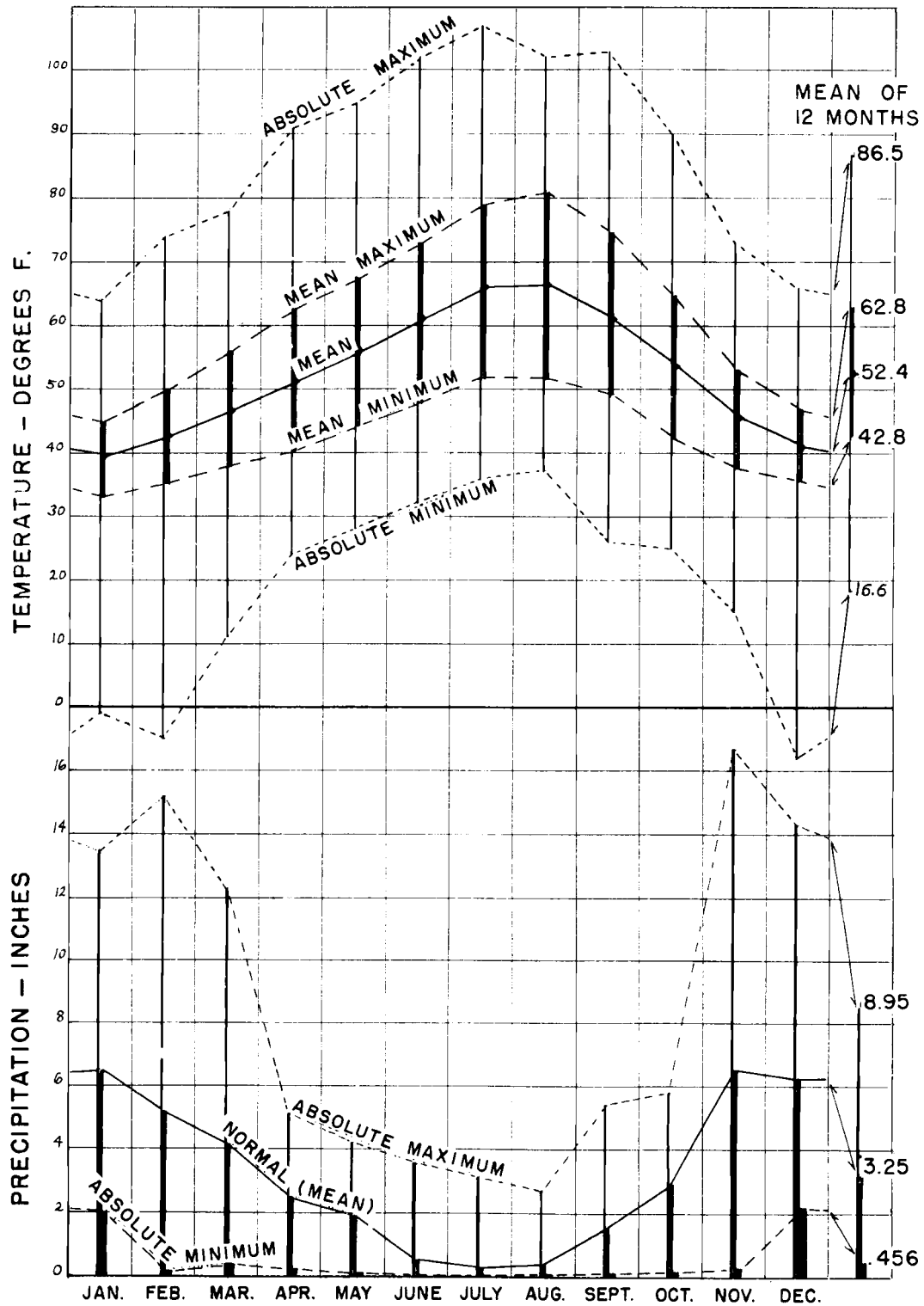
The mean relative humidity taken at 5 p.m. is 64.4 per cent and mean wind movement, 5.4 miles per hour. Prevailing winds are from southwest to west.

Table 1. Temperature, Relative Humidity, and Wind Movement, Corvallis, 1889 to 1950.

Month	Temperature					Average relative humidity (5:00 p.m.)	Hourly wind velocity	
	Monthly average	Average maximum	Average minimum	Highest	Lowest		*Average	Highest
	Degrees	Degrees	Degrees	Degrees	Degrees	Per cent	Miles	Miles
December	40.8	62.8	41.8	65.0	-14	83.9	4.60	25**
January	39.3	45.4	32.9	64.0	-1	83.3	4.24	25
February	42.3	50.1	35.0	69.0	-5	76.2	4.76	24
Winter	42.1	52.8	36.6	-	-	81.1	4.53	
March	46.2	55.5	37.0	79.0	13	67.8	5.35	24**
April	50.9	61.8	40.0	89.0	24	60.8	5.65	29
May	55.7	67.8	44.0	95.0	28	55.4	5.83	25
Spring	50.9	61.7	40.3	-	-	61.3	5.61	
June	60.9	73.4	48.0	102.0	32	54.1	5.97	30
July	66.2	80.6	51.2	107.0	36	47.5	5.97	25**
August	66.2	81.3	51.3	102.0	37	47.4	5.62	26
Summer	64.4	78.4	50.2	-	-	49.7	5.85	
September	61.0	74.7	47.1	103.0	26	49.5	4.75	25
October	53.6	64.8	42.2	90.0	13	65.8	3.75	20**
November	45.4	53.0	37.8	73.0	10	79.5	4.02	32
Autumn	53.3	64.2	32.4	-	-	58.3	4.17	
Average 60 years	52.4	62.8	41.8	-	-	64.4	5.04	

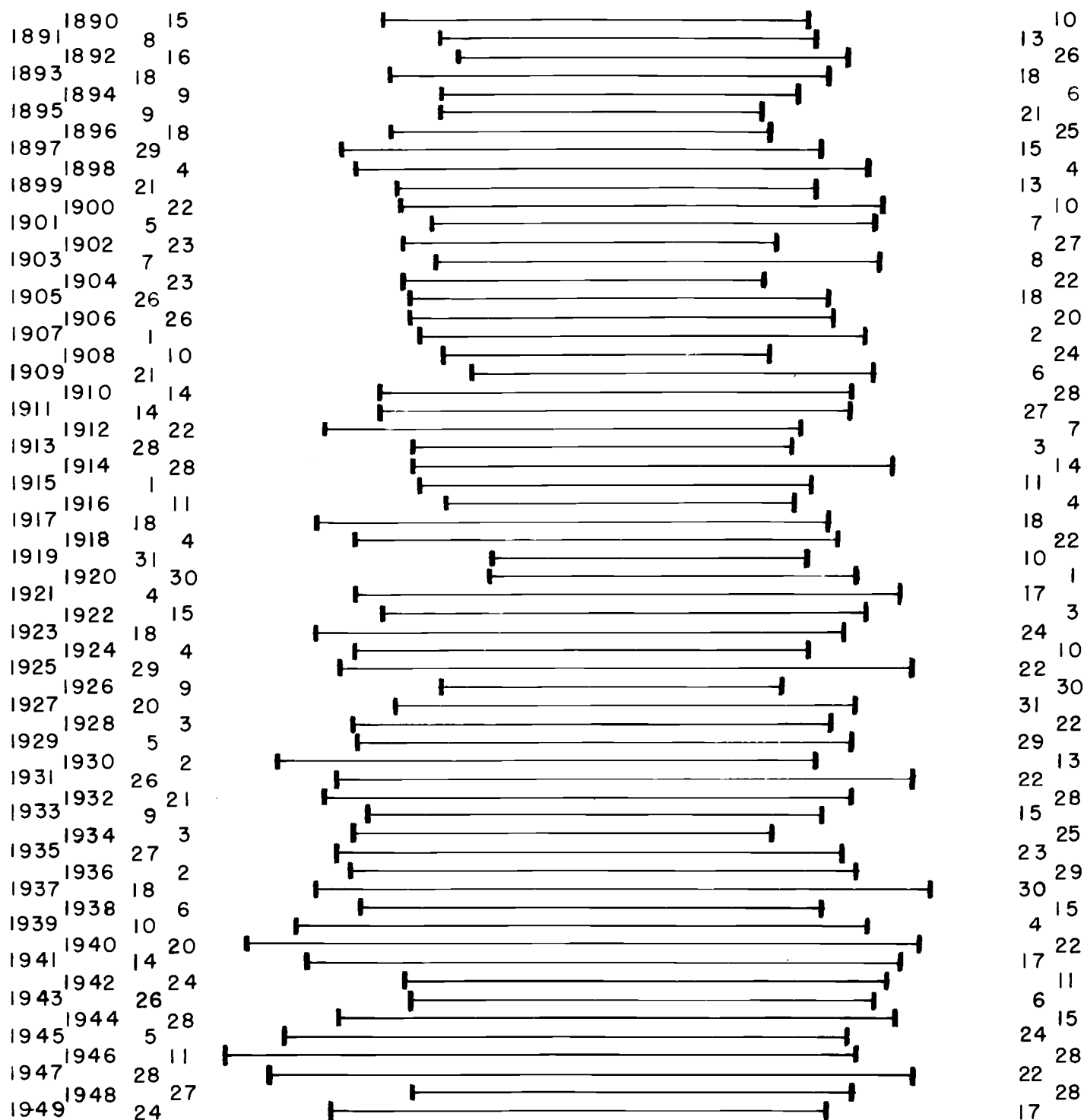
* 1934 to 1943. ** More than once.

CLIMATE AT CORVALLIS, ORE. - 60 YEARS - 1889 to 1950



KILLING FROST FREE PERIOD AT CORVALLIS, ORE. 1889 TO 1950

Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.



Ave. April 12

60 Yr. Ave. — 195 Days

Oct. 25

Growing season extends average of 195 days

The average date of the last moderate spring frost--or day with a minimum of 30 degrees Fahrenheit or lower--is April 12 here. The average date of the first such frost in autumn is October 25. This gives an average season of growth of 195 days. The lowest May temperature recorded here is 28 degrees on May 1, 1915. The three summer months have been frost-free. The September low of 26 degrees was registered September 29, 1919.

Annual precipitation averages 39.06 inches

The normal precipitation for the 60 years of record at the College station is 39.06 inches. The wettest year was 1937 with 58.06 inches; the driest was 1944 with 23.99 inches precipitation. During the three winter months, 17.76 inches or 45.5 per cent of the year's total occurs while only 1.85 inches or 4.7 per cent falls in the summer months. With May and September rainfall added to the three summer months, the 5-month normal is 7.55 inches or 19 per cent of the year's total.

This uneven distribution of precipitation indicates why attention must be paid to drainage, erosion and flood control, and irrigation practices.

Intensity of precipitation is most important in drainage design or erosion control. The highest monthly precipitation on record is the 16.69 inches of November 1896. Monthly precipitation has exceeded 10 inches 34 times in 60 years. The highest daily precipitation was 3.43 inches in January 1907. The highest hourly precipitation recorded in the last 20 years in the tipping-bucket rain gauge was 0.71 inch, September 20, 1944.

Tile outlet drains with capacity to remove one-half inch an acre each 24 hours have proved to be adequate in this area.

ANNUAL PRECIPITATION AT CORVALLIS, OREGON 1890 - 1950

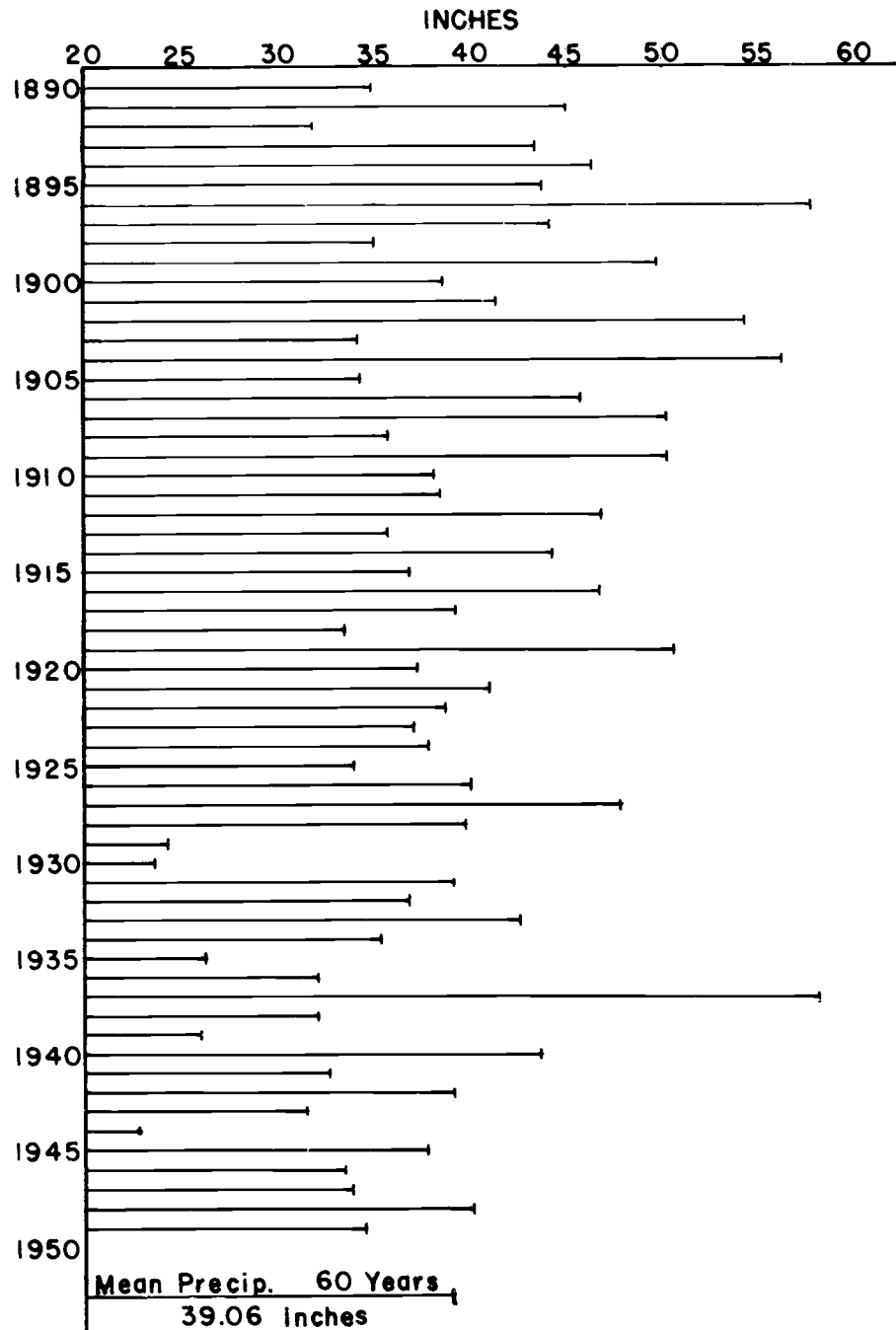


Table 2. Precipitation Normals and Extremes, Also Evaporation, OSC Department of Soils, Drainage and Irrigation, Corvallis, 1889-1950.

Month	Precipitation					Snowfall		Evapora- tion, Tank loss average month
	Average precip- itation	Wettest month	Driest month	Maximum		Average	Highest snowfall	
				24 Hours	1 Hour			
	<u>Inches</u>	<u>Inches</u>	<u>Inches</u>	<u>Inches</u>	<u>Inches</u>	<u>Inches</u>	<u>Inches</u>	<u>Inches</u>
December	6.14	14.15	2.33	2.78	.28	1.10	20.0	-
January	6.47	13.61	1.99	3.43	.21	3.84	23.0	-
February	5.15	15.23	0.12	2.56	.35	.95	12.0	-
Winter	17.76	-	-	-	-	5.89		
March	4.13	11.70	0.43	1.89	.29	.10	6.5	-
April	2.56	7.99	0.22	1.44	.21	Trace	1.5	2.88
May	1.88	5.71	0.16	1.30	.18	0	0	4.16
Spring	8.57	-	-	-	-	0.10		
June	1.14	3.58	0.00	1.68	.34	0	0	5.90
July	0.28	2.72	0.00	1.08	.20	0	0	6.44
August	0.43	2.76	0.00	0.70	.13	0	0	6.06
Summer	1.85	-	-	-	-			
September	1.57	5.40	Trace	1.57	.71	0	0	3.89
October	2.88	9.05	Trace	2.26	.26	0	0	-
November	6.43	16.69	0.22	3.16	.28	Trace	2.5	-
Autumn	10.88	-	-	-	-			
Average								
60 years	39.06	-	-	-	-	5.99	-	29.33

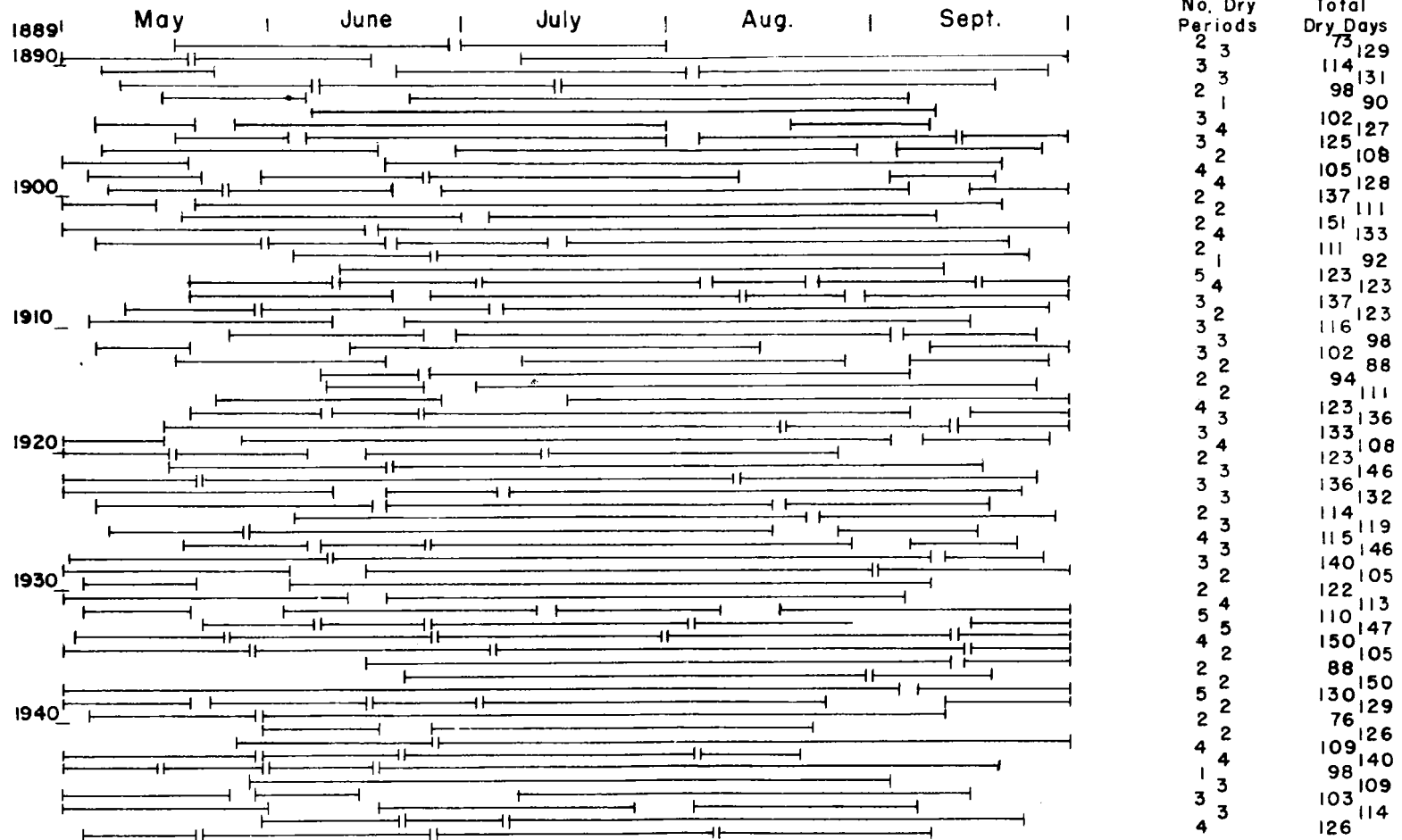
July driest month; January wettest

July is the driest month with a normal precipitation of only 0.28 inch. January is the wettest with average precipitation of 6.47 inches.

In the preparation of the study of droughtiness on the next page, it was assumed that two weeks in the warm growing season without effective rainfall would be a dry period. One-fifth inch rainfall within any 24-hour period was assumed to be necessary to be effective. On this basis the last half of July has been dry in all except one of the 60 years of record, making it a relatively safe harvest period and the period of peak demand for irrigation water.

The average number of dry periods per growing season has been 3 including 119 days as an average for these periods.

A STUDY OF DROUGHTINESS AT CORVALLIS-1889 TO 1950



January 1950 breaks snowfall records

Snowfall for the 60-year period averaged 5.99 inches a year. The previous yearly maximum of 29 inches for the period was exceeded in January 1950 when 51.75 inches was recorded for that month alone. Snowfall has occurred 44 years during the 60-year record in measurable amount. It usually melts away within one or a few days.

The weekly Corvallis Gazette of March 24, 1882, recorded a memorable snowstorm which came March 18 and 19 of that year. The season had opened early and cattle had been turned out. The heavy snow covered the new grass so oak trees were cut down to let the stock browse on the buds.

The relative humidity usually taken at 5 p.m. has ranged from 83.9 per cent in January to 47.4 in August with an all-year average of 64.4. Until 1929 relative humidity determinations were made morning and evening. A hygrograph has been in operation in recent years. In forest "fire weather" of late summer relative humidity may drop below 20 per cent in the afternoon.

130 clear days each year

Based on daily observations the state of sky for the all-year average appears to be rather evenly balanced with 130 clear, 100 partly cloudy, and 135 cloudy days. Yet, there is a preponderance of clear days in late summer and of cloudy or partly cloudy days in winter with 21 clear days in July and 18 cloudy days in January as the average.

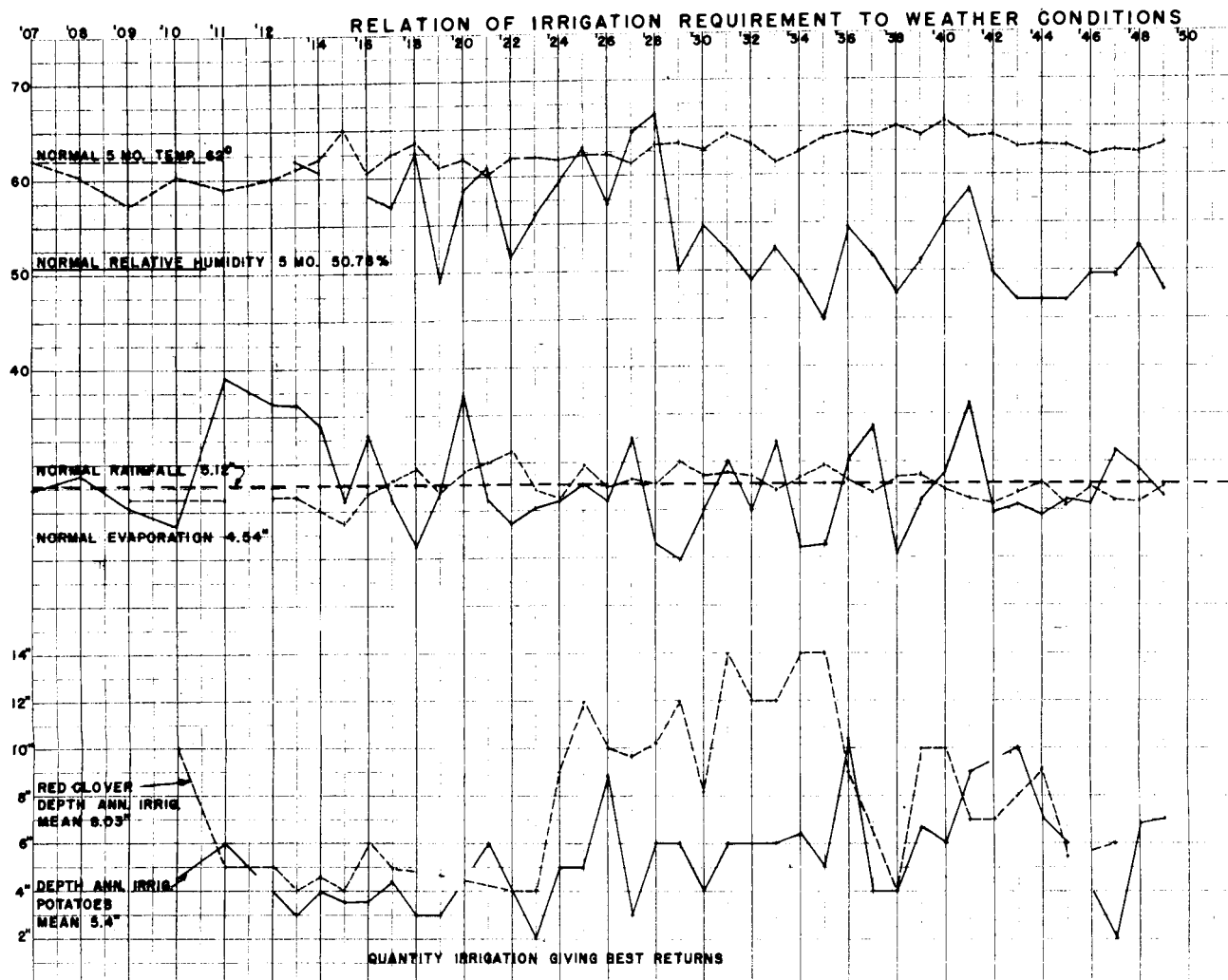
Average evaporation totals 29.33 inches

Evaporation is measured from a class A weather bureau pan for the period March 31 to October 1. The 40-year average evaporation for this period is 29.33 inches. At the beginning of this period the weekly evaporation loss may be 0.5 inch a week. When the sea breezes come in in the afternoons of the long summer days the loss may be 1.5 to 1.6 inches a week. The highest monthly evaporation occurs in July and averages 6.44 inches as compared to only 2.88 inches for April.

The evaporation from a standard pan gives the combined effect of the drying elements of the atmosphere. It is useful in predicting the time to irrigate or in estimating irrigation requirements.

Weather conditions affect irrigation requirements

Weather conditions for the five-month period, April 15 to September 15, are compared with the irrigation requirement for maximum net profit in the figure on the following page. The evaporation is plotted as the mean monthly value. The most obvious relation is that shown between the low relative humidity and higher irrigation requirement values. Evaporation shows the combined influences of the drying effect of the weather and is suggested as a more accurate guide to the irrigation requirement when available than the much used total heat curve.



Crops grown in rotation in the irrigation experiment field at the Oregon State College farm show yearly variation of 10 to 15 per cent in yield and water requirement. This is due largely to difference in the seasons. The high yields give the more efficient water use or requirement.

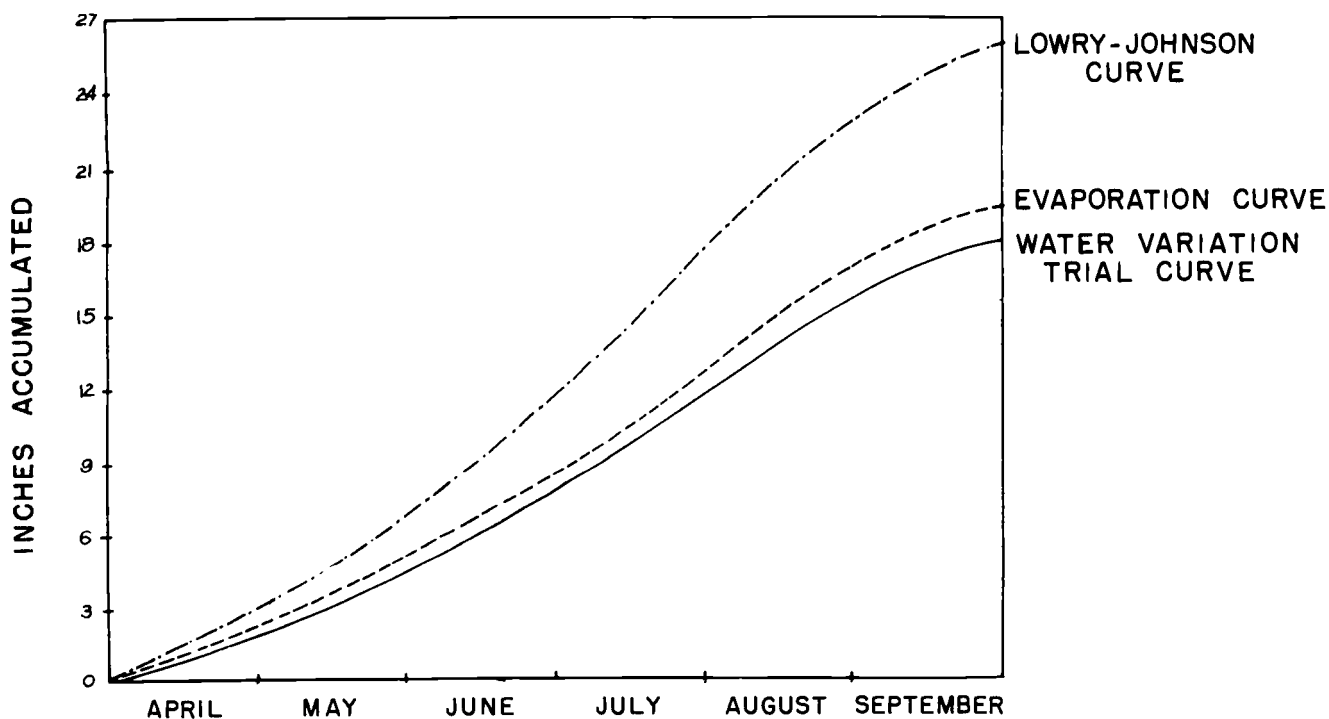
A comparison has been made in the figure on the next page between the total heat units (sum of degrees above 32 for the frost-free period) of Lowry and Johnson* and evaporation with relation to weighted net duty or irrigation requirement. Evaporation data at Corvallis give values somewhat lower than the total heat method and closer to the irrigation requirement as determined by water variation trials on small field plots during the past 50 years.

* Lowry, R. L. and Johnson, A. F., "Consumptive Use of Water for Agriculture." Am. Soc. C.E. Trans. 5:1243, Paper 2158. 1942.

The figure below, redrawn from a master's thesis by Julio Lugo Blanco, "Evaporation as an Aid in Calculating Irrigation Requirements," Oregon State College, 1948, shows the accumulated depth of irrigation required in inches during the summer months here. When the farm distribution loss is added, it has been estimated some 18 inches depth an acre may need to be delivered to each 40-acre area.

The climate of the Willamette Valley permits wide diversification of crops which helps to stabilize agriculture. A suitable climate is a major consideration in choice of type of farming or land use capability for special crops. Weather influences seedbed preparation, crop pest activity, and harvest. The moist, mild climate of the area is well suited to forest growth and protection. Fiber flax needs a moist, cool climate with maximum day length at the grand period of growth as found here. Other especially adapted crops are hops, mint, sugar beet seed, strawberries, filberts, walnut, grass and legume seed.

ACCUMULATIVE DISTRIBUTION OF NET DUTY OF WATER



SUMMARY—1889-1950

60-year average temperature	52.4° F.
Average maximum temperature, September	74.7° F.
Average maximum temperature, January	45.5° F.
Average minimum temperature, January	32.9° F.
Average minimum temperature, August	51.3° F.
Highest temperature, July 20, 1946	107.0° F.
Lowest temperature, December 13, 1919	-14.0° F.
Number of times below zero	4
Number of times above 100°	16
Average frost-free period, April 12 to October 25	195 days
Average relative humidity, 5 p.m.	64.4 per cent
Average wind movement	5.4 miles per hour
Prevailing wind direction	West-Southwest
Average annual precipitation	39.06 inches
Wettest year, 1937	58.06
Driest year, 1944	23.99
Winter months average, 45.5 per cent or	17.76
Summer average, 4.7 per cent or	1.83
Highest monthly precipitation, November 1896	16.69
Greatest monthly average, January	6.47
Least monthly average, July	0.28
Highest maximum daily, January 1907	3.43
Highest maximum hourly, September 10, 1944	.71
Number of droughty periods per summer	3
Number of droughty days	119
Average annual snowfall	5.99 inches
Greatest snowfall (to 1950)	29.0
Snowfall, January 1950	51.75
Evaporation average, April to October	29.33 inches
Sky condition: 130 days clear, 100 partly cloudy, 135 cloudy	