

CLIMATOLOGICAL REPORT 2006
Range Cattle Research and Education Center

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Weather conditions strongly influence agricultural operations from planting through harvesting. Knowledge of annual rainfall and temperature cycles along with their extremes help producers determine optimum times to prepare and plant seedbeds, fertilize pastures, apply herbicides, control water, and to supplement cattle on pasture or range. Weather conditions influence germination, forage growth, palatability, and nutritive value. A knowledge of weather cycles and extremes is helpful to a successful operation.

This research report presents a summary of rainfall, air temperature, evapo-transpiration, and solar radiation for 2006 obtained at the Range Cattle Research and Education Center (REC) Ona, Florida, and is compared to a 65-year summary of data collected from this location. The center is located 82° 55' W and 27° 26' N in south central Florida approximately 45 miles (72 km) east of the Gulf of Mexico and 100 miles (160 km) west of the Atlantic Ocean.

Weather observations were collected with a Weather Watch 2000 (Campbell Scientific, Inc) until 2005. Beginning in 2006, observations were collected using the Florida Automated Weather Network (FAWN). Accuracy of rainfall as measured by the Weather Watch 2000 or FAWN was checked by comparing with rainfall measured by a US Weather Service standard gauge. Measurements reported before 2006 were taken at 0900 h, thus data on a given day represent the previous 24-h period. Beginning in 2006, measurements were recorded for an entire 24-h period beginning at midnight.

Rainfall

Annual rainfall for 2006 was 35.86 inches (Table 1), which was 18.14 inches (33.5%) lower than the 65-year average of 54.00 inches (standard deviation 11.09 inches) (Table 1). The year with the least rainfall was 2000 when 32.02 inches were measured, and the year with the greatest rainfall was 1959 when 78.82 inches were recorded.

Monthly rainfall totals were below the 65-year average for all months except February, August, and December (Figure 1; Table 1). January, March, and April were excessively dry compared to the 65-year mean. The dry weather, which carried into June before rainfall exceeded the 65-year mean, prevented many common operations such as proper weed control timings and planting. Unless irrigation was provided, the spring hay harvest was poor.

There were 10 occurrences during 2006 when daily rain equaled or exceeded 1 inch, and one rain event that exceeded 2 inches (Table 2). The single greatest daily rain event was 12 June when 1.78 inches were recorded.

Table 1. Summary of rainfall by months. Range Cattle REC, 2006.

Month	1942 to 2006		65-year average†	2006	Difference from 65-year average
	Maximum / month	Minimum / month		Total	
	-----inches-----				
January	8.45	0.03	2.16	0.17	-1.99
February	9.59	0.02	2.63	3.65	+1.02
March	12.34	0.13	3.16	0.27	-2.89
April	11.91	0.00	2.49	0.06	-2.43
May	10.58	0.00	3.78	2.21	-1.57
June	18.99	2.79	8.70	6.42	-2.28
July	19.74	1.87	8.41	3.88	-4.53
August	16.10	3.13	8.25	10.41	+2.16
September	20.11	1.14	7.37	4.21	-3.16
October	11.25	0.04	3.09	1.15	-1.94
November	11.22	0.07	1.95	0.82	-1.13
December	8.61	0.16	2.01	2.61	+0.60
Year total			54.00	35.86	-18.14

*Inches x 2.54 = cm.

† Since rainfall records began in July 1942, means for January to June are 64-year means.

Table 2. Daily maximum and minimum temperature, precipitation, and solar radiation for 2006, Range Cattle REC.

Day	January				February				March				April			
	Max °F	Min °F	Rain inches	MJ/m ²	Max °F	Min °F	Rain inches	MJ/m ²	Max °F	Min °F	Rain inches	MJ/m ²	Max °F	Min °F	Rain inches	MJ/m ²
1	81	53	0.00	7.75	78	32	0.00	19.36	81	46	0.00	24.12	86	50	0.00	27.56
2	81	63	0.00	13.29	82	45	0.00	14.17	83	46	0.00	23.69	87	52	0.00	26.55
3	80	50	0.00	10.43	80	63	0.00	2.94	82	58	0.00	21.14	86	52	0.00	27.91
4	76	45	0.00	16.79	67	45	2.88	6.20	81	50	0.00	24.54	85	57	0.00	19.93
5	74	43	0.00	15.20	66	42	0.00	19.79	78	47	0.00	24.17	85	47	0.00	29.80
6	63	37	0.00	16.65	72	38	0.00	21.24	76	47	0.00	22.20	86	44	0.00	27.23
7	60	32	0.00	16.99	76	42	0.00	18.55	76	47	0.00	25.69	88	47	0.00	28.25
8	69	29	0.00	17.51	66	37	0.00	21.81	77	38	0.00	25.94	86	59	0.00	23.48
9	76	35	0.00	15.73	70	35	0.00	21.02	79	44	0.00	24.32	84	63	0.00	14.92
10	79	49	0.00	11.26	71	35	0.00	20.12	82	57	0.00	16.70	81	56	0.00	22.90
11	82	51	0.00	16.05	78	40	0.29	15.38	86	61	0.00	25.32	82	56	0.00	23.56
12	82	55	0.00	15.61	52	37	0.02	9.47	84	57	0.00	17.03	81	58	0.00	21.46
13	80	56	0.00	10.58	56	31	0.00	20.96	85	57	0.00	16.93	82	55	0.00	23.90
14	68	51	0.00	17.03	63	28	0.00	23.06	85	61	0.00	20.32	85	53	0.00	31.11
15	69	38	0.00	18.40	74	36	0.00	19.54	79	55	0.00	27.13	88	48	0.00	30.35
16	76	38	0.00	18.21	80	44	0.00	18.13	82	48	0.00	24.26	85	48	0.00	31.24
17	80	49	0.00	13.56	82	54	0.00	17.89	84	51	0.00	21.05	87	55	0.00	28.97
18	68	37	0.17	17.90	82	49	0.00	20.92	84	54	0.00	25.60	88	59	0.00	22.41
19	76	35	0.00	18.43	79	49	0.00	16.62	85	52	0.00	22.63	92	57	0.00	25.04
20	81	58	0.00	10.83	83	53	0.00	18.78	86	56	0.00	24.83	96	61	0.00	27.71
21	84	58	0.00	10.71	83	52	0.00	17.91	87	61	0.00	21.02	93	66	0.00	28.26
22	84	63	0.00	15.45	82	54	0.00	15.34	82	59	0.00	17.91	90	62	0.00	26.15
23	84	64	0.00	12.99	84	61	0.00	18.97	76	55	0.27	8.06	91	61	0.00	20.44
24	81	58	0.00	12.07	74	63	0.00	7.30	71	45	0.00	24.39	91	61	0.00	25.47
25	73	48	0.00	19.13	83	58	0.00	15.41	68	38	0.00	29.19	92	58	0.00	28.13
26	72	37	0.00	18.94	69	48	0.46	8.30	70	34	0.00	29.43	88	63	0.06	21.71
27	71	46	0.00	12.22	72	42	0.00	23.66	73	34	0.00	29.79	88	56	0.00	26.78
28	76	47	0.00	14.77	78	39	0.00	24.40	79	42	0.00	28.37	84	50	0.00	29.35
29	78	51	0.00	13.84					83	48	0.00	27.63	83	54	0.00	22.83
30	81	56	0.00	10.62					82	54	0.00	25.17	82	52	0.00	28.76
31	71	41	0.00	19.74					84	50	0.00	27.40				
<u>Avg</u>	76	47	0.01	14.80	74	45	0.13	17.15	80	50	0.01	23.42	87	55	0.00	25.74
<u>Max</u>	84	64	0.17	19.74	84	63	2.88	24.40	87	61	0.27	29.79	96	66	0.06	31.24
<u>Min</u>	60	29	0.00	7.75	52	28	0.00	5.94	68	34	0.00	8.06	81	44	0.00	14.92
<u>Total</u>			0.17	458.68			3.65	480.23			0.27	726.00			0.06	772.15

Table 2. Continued.

Day	May				June				July				August			
	Max °F	Min °F	Rain inches	MJ/m ²	Max °F	Min °F	Rain inches	MJ/m ²	Max °F	Min °F	Rain inches	MJ/m ²	Max °F	Min °F	Rain inches	MJ/m ²
1	85	51	0.00	30.87	84	69	0.00	16.50	92	71	0.00	26.48	93	69	0.00	27.81
2	87	46	0.00	31.21	91	67	0.66	22.13	92	72	0.27	15.25	94	68	0.00	28.73
3	91	48	0.00	32.12	90	65	0.00	29.46	95	71	0.20	23.51	96	69	0.43	24.35
4	92	56	0.00	32.02	92	66	0.00	25.95	92	68	0.00	26.53	91	68	0.00	21.79
5	89	53	0.00	31.23	92	64	0.00	28.23	92	67	0.00	25.74	94	69	0.00	24.73
6	91	54	0.00	31.68	93	60	0.00	30.08	89	72	0.32	18.71	91	71	0.56	20.83
7	94	54	0.00	30.33	91	66	0.00	21.28	82	71	0.09	11.08	90	72	0.28	20.08
8	93	62	0.00	26.52	95	66	0.00	29.11	88	72	0.10	18.03	92	70	0.00	26.37
9	90	61	0.33	23.43	97	64	0.00	29.26	89	71	0.00	20.40	93	65	0.00	28.53
10	92	62	0.00	25.48	93	65	0.00	21.58	90	71	0.00	22.04	94	68	0.00	27.17
11	90	65	0.00	22.79	83	68	0.47	10.55	88	70	0.43	12.02	92	70	0.15	22.94
12	86	57	0.00	32.86	80	72	1.78	3.64	87	69	0.10	21.36	94	70	0.00	27.07
13	87	47	0.00	31.87	83	72	0.75	12.24	86	71	0.05	14.19	95	70	0.11	25.36
14	93	50	0.00	31.95	89	69	0.02	24.27	91	71	0.09	21.72	94	71	0.00	23.99
15	88	54	0.00	20.82	92	68	0.00	29.90	94	68	0.00	28.68	96	69	0.62	26.45
16	71	64	0.42	4.60	96	68	0.00	30.68	95	65	0.00	27.69	90	70	0.00	17.59
17	82	56	0.04	30.22	90	71	0.06	18.21	95	70	0.00	25.80	92	70	0.90	15.62
18	84	52	0.00	29.00	91	69	0.00	23.41	94	69	0.00	21.12	93	70	0.18	24.57
19	89	55	0.00	30.09	94	69	0.00	28.29	91	70	0.89	12.59	89	68	0.00	13.65
20	95	56	0.00	31.33	94	69	0.00	28.33	90	68	0.37	15.21	91	67	0.89	19.63
21	95	56	0.00	29.23	94	70	0.00	27.07	91	68	0.00	27.78	90	69	1.18	17.74
22	93	65	0.00	15.66	94	66	0.00	28.11	87	70	0.00	16.75	93	70	0.57	23.94
23	87	68	0.00	10.59	94	64	0.00	27.17	88	71	0.55	18.52	91	71	0.59	18.91
24	92	68	0.00	20.98	93	65	1.02	19.65	91	70	0.02	21.98	87	71	0.89	8.66
25	94	62	0.00	23.06	85	69	0.81	12.23	95	70	0.00	27.83	90	71	0.09	16.69
26	89	63	1.42	17.80	89	71	0.00	21.72	96	72	0.00	27.12	90	70	0.29	15.86
27	93	66	0.00	27.72	91	71	0.00	27.45	92	72	0.06	21.68	87	71	1.17	12.00
28	97	64	0.00	31.39	95	67	0.15	28.51	91	70	0.32	15.59	94	71	0.39	27.18
29	94	66	0.00	28.87	94	67	0.00	25.81	93	70	0.00	27.13	93	71	0.01	22.32
30	93	64	0.00	26.29	93	68	0.70	23.79	93	71	0.00	25.81	86	73	1.09	7.08
31	93	61	0.00	27.90					96	70	0.02	25.49	88	73	0.02	10.59
<u>Avg</u>	90	58	0.07	26.45	91	67	0.21	23.49	91	70	0.13	21.41	92	70	0.34	20.91
<u>Max</u>	97	68	1.42	31.24	97	72	1.78	30.68	96	72	0.89	28.68	96	73	1.18	28.73
<u>Min</u>	71	46	0.00	14.92	80	60	0.00	3.64	82	65	0.00	11.08	86	65	0.00	7.08
<u>Total</u>			2.21	819.90			6.42	704.60			3.88	663.82			10.41	648.24

Table 2. Continued.

Day	September				October				November				December			
	Max °F	Min °F	Rain inches	MJ/m ²	Max °F	Min °F	Rain inches	MJ/m ²	Max °F	Min °F	Rain inches	MJ/m ²	Max °F	Min °F	Rain inches	MJ/m ²
1	88	74	0.73	14.77	89	63	0.00	23.91	87	65	0.00	14.53	86	65	0.00	12.18
2	90	71	0.00	21.24	90	63	0.00	23.42	78	63	0.00	7.83	87	62	0.00	15.15
3	89	72	0.42	13.44	88	66	0.00	17.66	82	61	0.00	17.59	86	59	0.00	14.42
4	90	71	0.11	21.38	86	66	0.00	21.55	81	61	0.00	18.40	73	59	0.00	7.24
5	90	70	0.00	20.89	88	65	0.00	19.74	82	60	0.00	15.63	76	52	0.00	13.84
6	88	73	0.03	13.17	89	65	0.00	23.59	83	61	0.00	15.68	77	50	0.00	12.67
7	92	71	0.00	20.59	89	61	0.00	21.30	79	64	0.11	6.89	74	58	0.00	6.01
8	93	70	0.25	19.60	88	63	0.00	18.83	75	53	0.01	13.31	64	45	0.00	12.77
9	94	71	0.12	19.95	83	58	0.00	22.89	78	48	0.00	18.86	73	45	0.00	14.87
10	92	70	0.02	20.44	85	57	0.00	22.91	81	45	0.00	18.21	78	49	0.00	14.29
11	91	70	0.00	24.11	86	56	0.00	19.47	83	52	0.00	17.07	.	.	0.00	.
12	90	71	0.16	21.37	89	66	0.00	16.78	81	51	0.00	13.78	79	58	0.03	18.07
13	87	71	0.18	16.56	89	66	0.00	19.88	76	50	0.00	13.38	78	62	0.08	5.24
14	89	72	0.01	18.79	83	56	0.00	18.60	79	44	0.00	15.17	75	65	0.59	4.04
15	93	71	0.04	23.08	85	55	0.00	20.45	85	49	0.00	5.89	77	63	0.00	9.51
16	92	72	0.00	21.29	86	58	0.00	19.88	76	63	0.70	5.97	73	62	0.00	4.36
17	91	70	0.01	22.07	85	64	0.00	12.83	72	50	0.00	17.19	81	63	0.00	11.35
18	89	71	1.76	17.58	89	67	0.00	15.15	69	40	0.00	18.20	83	60	0.00	12.97
19	89	72	0.05	14.15	91	67	0.00	17.47	71	37	0.00	18.30	81	58	0.00	15.26
20	87	67	0.00	16.31	90	67	0.00	16.06	64	41	0.00	12.33	80	56	0.00	14.51
21	91	63	0.00	25.33	92	66	0.00	17.03	62	67	0.00	17.23	79	58	0.00	10.28
22	91	70	0.00	21.84	92	67	0.00	20.69	66	65	0.00	16.18	81	65	0.05	0.00
23	89	67	0.00	25.21	94	57	0.00	15.33	73	68	0.00	17.41	81	66	0.38	11.03
24	93	67	0.00	22.55	70	43	0.00	22.26	77	68	0.00	16.08	82	67	0.15	8.17
25	91	66	0.16	23.56	78	39	0.00	21.36	78	53	0.00	14.09	77	65	1.29	1.47
26	89	70	0.00	14.36	82	51	0.00	19.25	79	58	0.00	10.77	65	52	0.04	3.91
27	85	66	0.00	15.42	86	58	0.00	17.91	81	58	0.00	11.84	63	39	0.00	16.62
28	85	62	0.00	21.70	77	56	1.15	13.04	83	63	0.00	12.48	77	43	0.00	15.46
29	89	59	0.00	22.90	80	47	0.00	20.85	84	64	0.00	10.39	82	52	0.00	15.38
30	88	64	0.00	23.71	83	56	0.00	18.75	87	67	0.00	13.81	82	60	0.00	12.71
31					86	59	0.00	16.67					83	65	0.00	13.38
<u>Avg</u>	90	69	0.14	19.98	86	60	0.04	19.22	78	52	0.03	14.13	78	57	0.08	10.90
<u>Max</u>	94	74	1.76	25.33	92	67	1.15	23.91	87	67	0.70	18.86	87	67	1.29	18.07
<u>Min</u>	85	59	0.00	13.17	70	39	0.00	12.83	62	35	0.00	5.89	63	39	0.00	0.00
<u>Total</u>			4.21	599.32			1.15	595.81			0.82	423.88			2.61	327.15

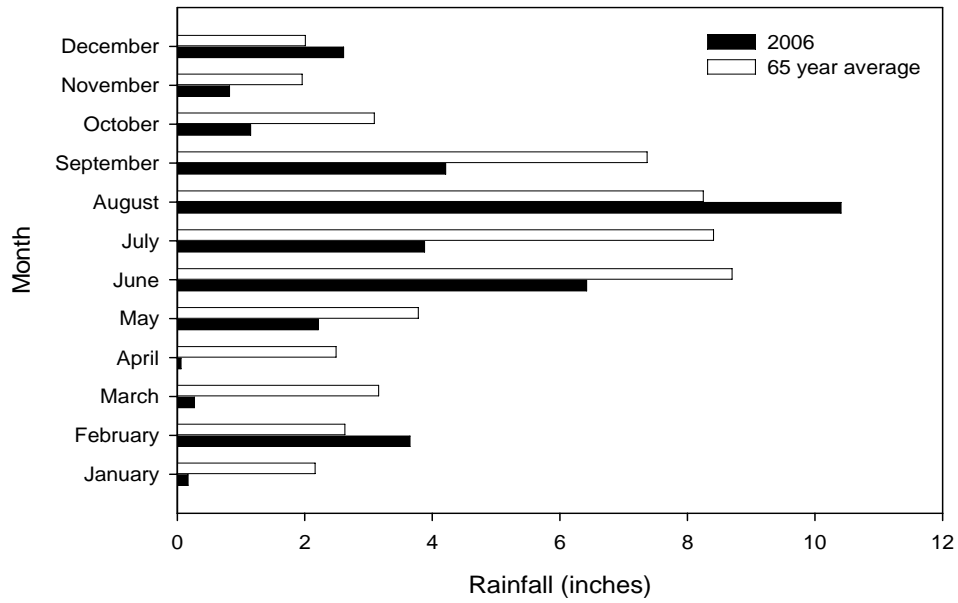


Figure 1. Monthly rainfall in 2006 compared with the 65-year average.

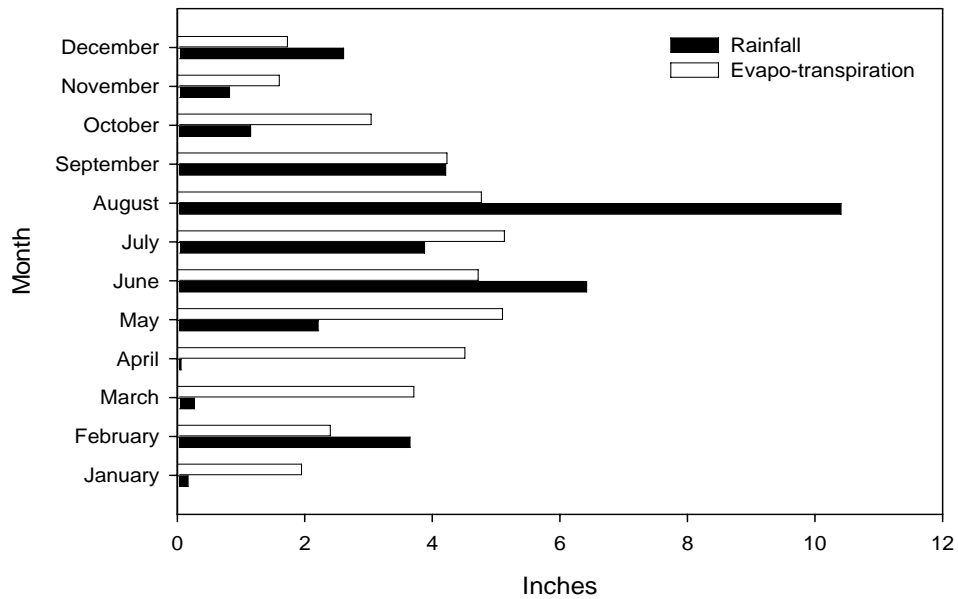


Figure 2. Monthly rainfall compared with evapo-transpiration during 2006. Cumulative rainfall = 35.86” and cumulative evapo-transpiration = 42.90”

Evapo-transpiration

Evapo-transpiration is the total amount of water transferred from the earth to the atmosphere. Evapo-transpiration exceeded rainfall in all but four months during 2006 (Figure 2). Evapo-transpiration generally exceeds rainfall in January to May and October to December, which are months with limited rainfall. For the year, evapo-transpiration exceeded rainfall by 7.04 inches.

Temperature

There was 3 days when daily-low shelter temperature was at or below 32 °F (Table 2). The extreme low temperature for 2006 occurred on 14 February when shelter temperature reached 27.7 °F. Scattered frost begins to occur when air temperature drops to 35 °F. Based on this fact, there were 11 incidences of frost (data not shown) in 2006. Except for December, all months in 2006 had lower mean low temperatures compared with the 64-year means (Table 3). Overall, mean low temperature for 2006 was 2.6 °F lower than the 64-year mean.

Table 3. Summary of minimum temperature* for 2006 by months, Range Cattle REC.

Month	Shelter†				Year	Ground level‡	
	1944-06	2006	1944-06	2006		2006	
	Avg. low	Avg. low	Extreme low	Extreme low		Avg. low	Extreme low
	-----°F-----					-----°F-----	
January	49.3	47.5	18	1981	29	62.5	57.3
February	50.6	44.7	26	1976	28	60.5	52.6
March	54.6	50.0	26	1980	34	65.7	60.9
April	58.1	55.3	34	1971	44	73.1	68.0
May	63.3	59.3	43	1945	46	76.4	71.1
June	69.0	67.4	52	1984	60	79.9	77.2
July	71.2	70.1	62	several	65	80.2	77.6
August	71.8	69.8	61	1977	65	80.9	79.1
September	71.1	69.2	51	1962	59	79.4	76.0
October	64.7	59.6	39	several	39	75.4	75.4
November	56.9	52.2	25	1970	35	67.0	58.5
December	51.3	57.3	20	1962	39	67.6	61.0
Average	62.1	59.5				73.3	68.9

*°C = (°F - 32) x 0.555

† Air temperature is measured using a thermometer in an instrument shelter designed to protect meteorological equipment from exposure to direct sunlight, precipitation, and condensations, while allowing for adequate ventilation so that the instruments measure environmental parameters accurately.

‡ Ground level temperature is measured with a soil probe, which measures the temperature 4 inches below the soil surface.

Solar Radiation:

Daily solar radiation is shown in Table 2, and 2006 total monthly solar radiation can be seen in Figure 3. For interpretation of solar radiation as it pertains to plant growth, 1 MJ results in about 14.3 lb/A of plant dry matter if soil water, temperature, and fertility are not limiting and vegetative cover is complete. Theoretically, enough solar radiation was received in April 2006 (480 MJ) to produce 6,864 lb/A of plant dry matter. Total solar radiation for 2006 was 7,220 MJ.

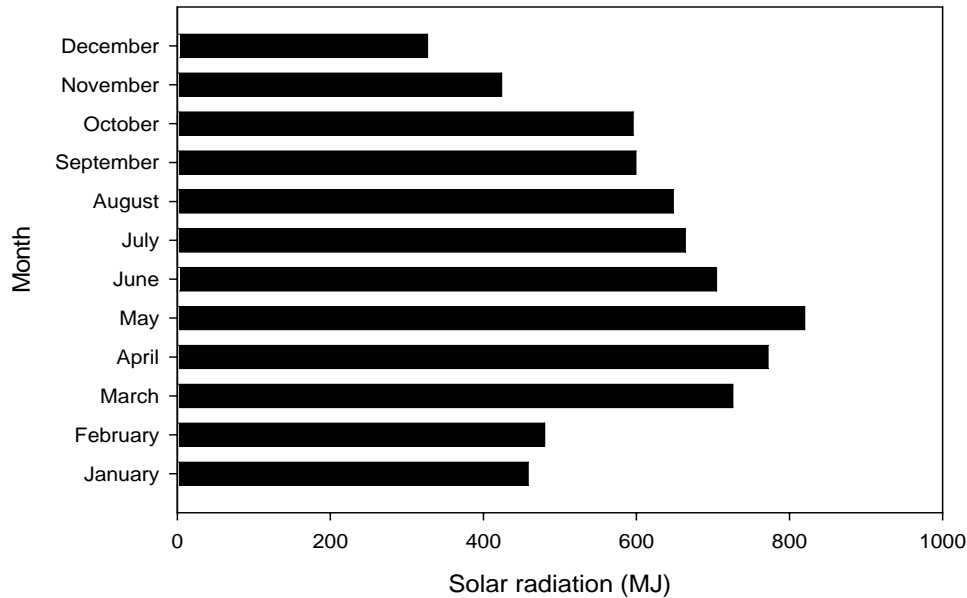


Figure 3. Total monthly solar radiation for 2006. Cumulative solar radiation in 2006 = 7220 MJ (MJ = Joules x 1,000,000)

Freeze hazard

The fall and spring freeze hazards for the Range Cattle REC are shown in Figures 4 and 5, respectively. The fall freeze hazard shows the chance of experiencing the first attainment of a critical temperature before a selected date, while the spring freeze hazard shows the chance of the last attainment of a critical temperature before a critical date. Based on records from 1944 to 1991, these data will not predict what will occur in a given year, but what can be expected over a period of years. In an example using the spring freeze hazard, a frost susceptible crop (assuming 32 °F) planted before the 1st of February would stand a 50% chance of survival (Figure 4). A grower would probably lose five crops over 10 years by planting before the 1st of February.

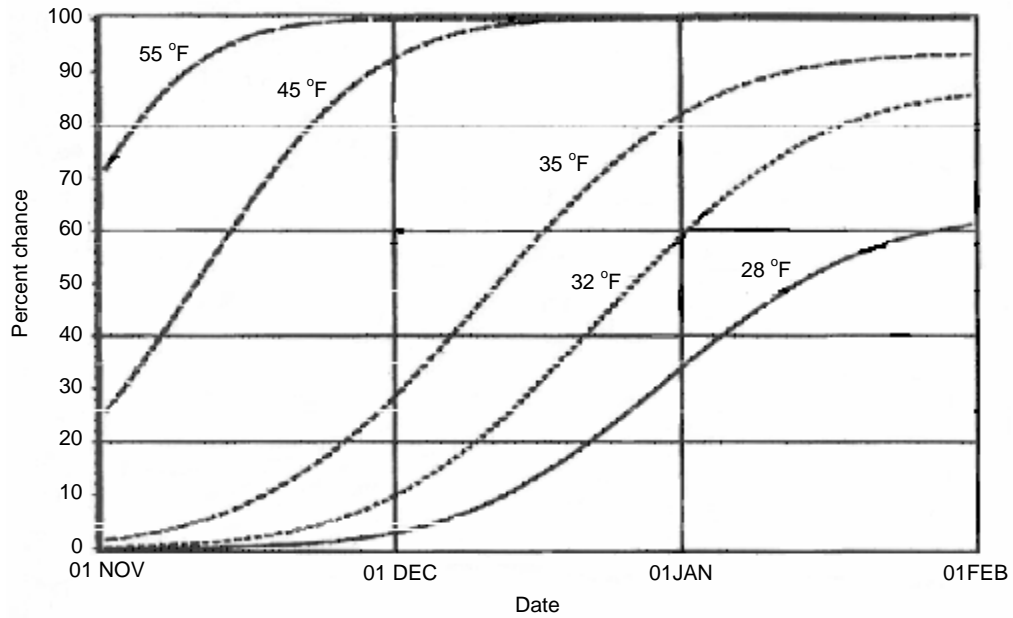


Figure 4. Fall freeze hazard showing the chance of the first attainment of a given temperature before a selected date.

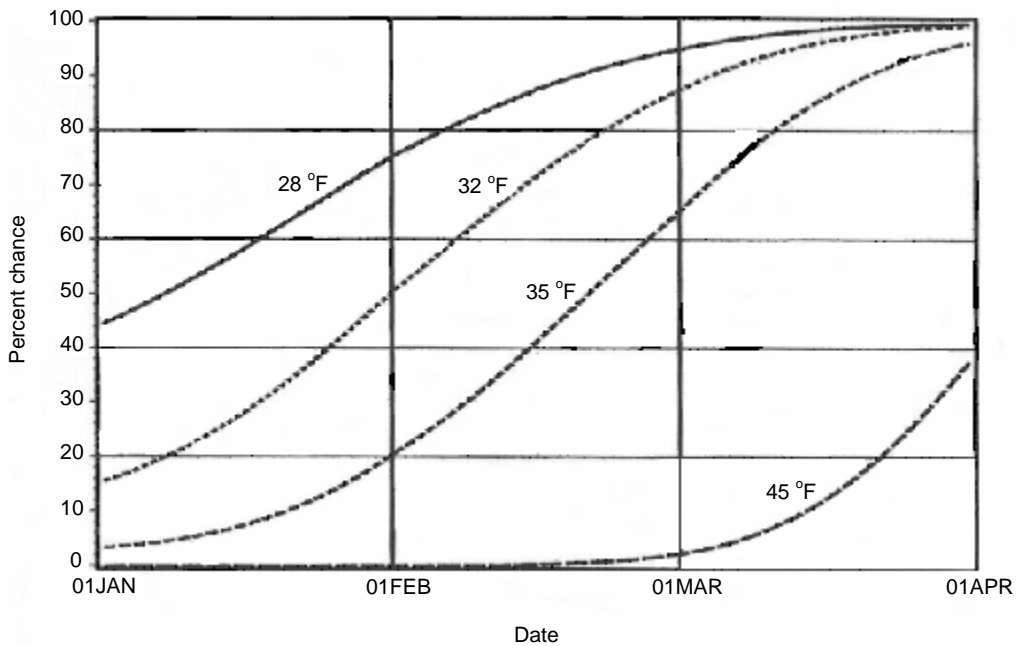


Figure 5. Spring freeze hazard showing the chance of the last attainment of a given temperature before a selected date.

Acknowledgements: The author wishes to thank Shirley Searcy for data collection as well as Andrea Dunlap, Toni Wood, and Walt Beattie for data preparation.