Range Cattle Research and Education Center
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CLIMATOLOGICAL REPORT 2002

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 cattle operation.

This research report presents a summary of rainfall, air temperature, evapotranspiration, and solar radiation for 2002 obtained at the Range Cattle Research and Education Center (REC) Ona, Florida. The center is located 82^{o} 55' W and 27^{o} 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). Accuracy of rainfall as measured by the Weather Watch 2000 was checked by comparing with rainfall measured by a US Weather Service standard gauge.

Rainfall:

Annual rainfall for 2002 was 69.15 inches, which was 15.53 inches (29%) greater than the 61-year average of 53.62 inches (standard deviation 11.09 inches) (Table 1). The driest year had been 2000 when 32.02 inches were measured, and the year with the greatest rainfall was 1959 when 78.82 inches were recorded.

Table 1. Summary of rainfall by months. Range Cattle REC, 2002.

	1942 to 2002			2002	
	Maximum	Minimum	61-yr	Total	Diference

	month	month	Average		from 60-yr average
	- - - - - - - - - - - - - - - - - - inches* - - - - - - - - - - - - - - - - - - -
January	8.45	0.03	2.23	1.86	-0.37
February	9.59	0.02	2.57	6.20	+3.63
March	12.34	0.13	3.20	0.42	-2.78
April	11.91	0.00	2.50	2.56	+0.06
May	10.58	0.00	3.68	1.28	-2.40
June	18.99	2.79	8.46	13.85	+5.39
July	19.74	1.87	8.57	11.05	+2.48
August	15.72	3.13	8.07	12.25	+4.18
September	20.11	1.14	7.28	5.46	-1.82
October	11.23	0.04	3.14	2.42	-0.72
November	11.22	0.07	1.94	4.74	+2.80
December	8.61	0.16	1.98	7.06	+5.08
Year total			53.62	69.15	+15.53
*Inches x 2.54 = cm.					

Table 2. Weather at Range Cattle REC, 2002. (Following four pages)

	January				February				March			
	Max	Min	Rain	MJ/	Max	Min	Rain	MJ/	Max	Min	Rain	MJ/
Day	°F	°F	inches	m^2	°F	°F	inches	m^2	°F	°F	inches	m^2
1	62	43	0.02	4.32	85	59	0.00	15.55	63	43	0.00	20.74
2	70	49	0.00	13.82	85	59	0.00	14.69	72	57	0.00	9.50
3	67	51	0.37	2.59	81	55	0.00	12.10	85	67	0.00	16.42
4	53	31	0.00	4.32	80	50	0.00	14.69	84	53	0.01	17.28
5	53	31	0.00	16.42	70	41	0.00	17.28	54	40	0.00	7.78
6	68	45	0.01	12.10	73	50	0.00	18.14	65	46	0.00	19.01
7	72	45	0.11	8.64	78	63	0.00	15.55	74	55	0.01	11.23
8	64	34	0.00	8.64	78	43	0.51	6.05	72	56	0.00	7.78
9	56	28	0.00	16.42	67	48	0.00	18.14	85	57	0.00	20.74
10	65	32	0.00	16.42	76	58	0.01	9.50	84	56	0.00	21.60
11	72	40	0.00	16.42	75	56	0.48	6.91	85	54	0.00	20.74
12	74	43	0.00	13.82	73	49	0.00	13.82	84	61	0.00	21.60
13	76	54	0.11	13.82	76	51	0.00	14.69	84	67	0.00	18.14
14	73	55	0.17	15.55	70	50	0.25	12.10	79	51	0.00	19.01
15	71	63	1.06	2.59	70	48	0.00	11.23	81	57	0.00	19.87
16	70	49	0.00	10.37	80	59	0.00	15.55	89	61	0.00	22.46
17	77	55	0.00	15.55	74	51	0.00	13.82	89	61	0.00	21.60
18	78	56	0.00	12.10	72	38	0.00	20.74	87	60	0.00	23.33
19	75	49	0.00	16.42	74	45	0.00	20.74	89	62	0.00	21.60
20	82	62	0.00	14.69	75	54	0.00	18.14	85	62	0.00	23.33
21	84	60	0.00	12.96	82	60	0.00	16.42	86	60	0.00	19.87
22	83	67	0.00	13.82	81	65	1.61	13.82	84	61	0.00	17.28
23	79	66	0.01	6.91	68	63	2.80	1.73	79	52	0.00	25.06
24	85	63	0.00	14.69	65	47	0.54	3.46	81	58	0.00	23.33
25	85	57	0.00	16.42	71	47	0.00	21.60	83	60	0.00	20.74
26	83	61	0.00	13.82	76	53	0.00	19.01	88	63	0.00	18.14
27	86	64	0.00	13.82	76	53	0.00	18.14	88	60	0.01	18.14
28	81	65	0.00	10.37	57	34	0.00	21.60	84	51	0.01	20.74
29	84	63	0.00	12.96					86	60	0.00	25.06
30	84	62	0.00	12.96					86	62	0.00	22.46
31	86	64	0.00	12.96					88	64	0.38	20.74
Avg	74	52		12.15	75	52		14.47	81	58		19.20
Max	86	67	1.06	16.42	85	65	2.80	21.60	89	67	0.38	25.06
Min	53	28	0	2.59	57	34	0	1.73	54	40	0	7.78
Total			1.86	376.71			6.20	405.21			0.42	595.32

	April				May				June			
Day	Max °F	Min °F	Rain inches	MJ/ m²	Max °F	Min °F	Rain inches	MJ/ m²	Max °F	Min °F	Rain inches	MJ/ m²
1	85	63	0.00	21.60	90	63	0.00	24.19	91	68	1.18	17.28
2	85	61	0.00	20.74	88	61	0.00	25.92	91	68	0.00	25.06
3	86	62	0.00	19.01	90	65	0.00	25.06	94	69	0.00	24.19
4	85	57	0.26	14.69	95	67	0.00	26.78	95	71	0.00	24.19
5	83	61	0.00	22.46	95	64	0.00	24.19	88	73	0.00	13.82
6	82	58	0.00	23.33	93	70	0.00	22.46	91	72	0.00	15.55
7	78	52	0.00	25.92	92	69	0.00	20.74	93	70	0.06	21.60
8	79	55	0.00	22.46	93	68	0.00	24.19	91	71	0.90	15.55
9	83	61	0.00	24.19	93	61	0.00	25.06	88	68	0.95	18.14
10	86	60	0.00	23.33	95	65	0.00	27.65	90	66	0.08	25.06
11	84	64	0.00	18.14	93	66	0.00	25.92	91	71	0.02	22.46
12	84	59	0.00	21.60	92	66	0.00	25.06	90	70	1.05	19.87
13	85	63	2.15	16.42	93	63	0.00	25.92	92	71	0.77	20.74
14	82	62	0.00	19.01	91	66	0.00	23.33	90	72	0.01	20.74
15	82	59	0.11	15.55	91	65	0.00	24.19	86	73	0.53	15.55
16	88	66	0.01	25.92	86	66	0.00	23.33	89	72	0.29	19.87
17	89	64	0.00	22.46	90	69	0.05	14.69	87	73	0.31	18.14
18	87	64	0.00	20.74	93	68	0.00	26.78	85	69	1.47	12.10
19	88	63	0.03	25.92	91	68	1.04	21.60	87	72	0.09	15.55
20	88	60	0.00	24.19	75	66	0.19	10.37	90	71	0.29	17.28
21	89	63	0.00	25.92	82	63	0.00	22.46	85	71	0.14	12.10
22	90	63	0.00	24.19	84	63	0.00	25.92	86	71	2.29	15.55
23	91	61	0.00	24.19	84	63	0.00	25.06	79	71	0.17	7.78
24	88	66	0.00	20.74	86	61	0.00	26.78	87	72	0.99	12.96
25	88	65	0.00	23.33	86	58	0.00	27.65	88	72	0.39	12.96
26	90	66	0.00	25.06	85	61	0.00	25.92	86	74	0.85	16.42
27	90	67	0.00	24.19	86	67	0.00	20.74	88	73	0.06	16.42
28	90	62	0.00	25.92	90	67	0.00	20.74	90	71	0.79	15.55
29	90	64	0.00	26.78	90	59	0.00	25.92	89	72	0.17	17.28
30	87	62	0.00	24.19	91	68	0.00	25.06	90	73	0.00	20.74
31					93	63	0.00	22.46				
Avg	86	62		22.41	90	65		23.75	89	71		17.68
Max	91	67	2.15	26.78	95	70	1.04	27.65	95	74	2.29	25.06
Min	78	52	0	14.69	75	58	0	10.37	79	66	0	7.78
Total			2.56	672.19			1.28	736.14			13.85	530.50

	July				August				September			
Day	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	89	71	0.32	14.69	94	74	0.00	23.33	92	75	0.22	17.28
2	86	70	1.41	12.96	92	68	2.79	22.46	93	74	0.00	21.60
3	87	72	1.46	17.28	85	73	2.59	11.23	92	74	0.01	15.55
4	91	73	0.00	25.06	85	72	0.28	13.82	90	73	0.03	17.28
5	90	71	0.01	19.01	93	73	0.28	20.74	91	74	0.00	22.46
6	88	71	0.48	19.55	93	74	0.00	23.33	87	72	0.07	9.50
7	91	72	0.07	21.60	90	74	0.15	15.55	90	73	0.18	19.01
8	86	72	0.02	15.55	86	71	1.37	8.64	90	74	0.05	19.01
9	86	71	0.58	19.01	91	71	0.00	25.92	91	73	0.00	19.01
10	83	72	0.06	11.23	89	70	0.01	19.01	92	73	0.00	16.42
11	86	71	0.00	19.01	90	73	0.00	24.19	91	72	1.73	14.69
12	87	74	1.04	16.42	88	73	0.02	17.28	84	71	0.29	6.05
13	84	73	1.67	9.50	90	73	0.00	17.28	81	73	0.00	8.64
14	85	73	0.06	15.55	90	72	0.11	15.55	86	74	0.01	11.23
15	90	74	0.00	24.19	92	74	0.07	15.55	91	73	0.03	13.82
16	93	75	0.00	22.46	92	74	0.00	23.33	93	74	0.00	19.01
17	95	77	0.00	23.33	91	75	0.00	20.74	93	74	0.00	19.01
18	95	76	0.00	23.33	95	72	0.37	22.46	92	73	0.00	20.74
19	97	74	0.00	22.46	92	72	0.21	19.87	93	75	0.00	21.60
20	92	75	0.00	17.28	92	72	0.00	22.46	93	76	0.00	16.42
21	92	73	0.00	20.74	92	71	0.11	23.33	92	75	0.17	16.42
22	92	71	1.99	17.28	92	71	1.06	19.87	91	74	0.00	18.14
23	91	74	0.00	19.87	91	73	0.00	21.60	91	73	1.04	19.87
24	92	76	0.01	21.60	92	72	0.00	20.74	87	75	0.16	15.55
25	92	76	0.16	24.19	92	72	0.00	22.46	90	75	0.09	12.96
26	93	74	0.30	20.74	94	74	0.24	19.87	90	76	0.68	13.82
27	94	72	1.35	22.46	89	73	0.40	15.55	90	76	0.18	15.55
28	93	74	0.00	19.87	84	71	0.44	14.69	90	73	0.00	19.01
29	95	73	0.00	25.92	88	72	0.04	16.42	92	76	0.00	19.01
30	92	72	0.06	18.14	90	72	1.04	19.87	92	75	0.52	18.14
31	91	72	0.00	19.01	88	72	0.67	15.55				
Avg	90	73		19.20	90	72		19.11	90	74		16.56
Max	97	77	1.99	25.92	95	75	2.79	25.92	93	76	1.73	22.46
Min	83	70	0	9.50	84	68	0	8.64	81	71	0	6.05
Total			11.05	595.29			12.25	592.69			5.46	496.80

	October				November				December			
	Max	Min	Rain	MJ/	Max	Min	Rain	MJ/	Max	Min	Rain	MJ/
Day	°F	°F	inches	m^2	°F	°F	inches	m^2	F	F	inches	m2
1	88	75	0.09	16.42	82	67	0.00	11.23	71	52	0.00	12.96
2	90	74	0.01	16.42	80	62	0.23	8.64	69	44	0.00	7.78
3	90	71	0.00	17.28	81	59	0.00	16.42	74	44	0.00	15.55
4	90	68	0.00	17.28	81	63	0.00	14.69	73	53	0.00	15.55
5	90	70	0.00	16.42	85	65	0.00	16.42	80	65	0.00	9.50
6	89	68	0.00	17.28	87	73	0.02	11.23	84	66	0.66	8.64
7	89	68	0.00	19.87	86	49	0.09	12.10	67	49	0.04	2.59
8	89	70	0.18	18.14	71	52	0.00	18.14	74	54	0.00	12.96
9	89	70	0.01	16.42	82	60	0.00	15.55	77	62	0.03	8.64
10	90	72	0.00	17.28	85	65	0.00	16.42	70	63	2.48	2.59
11	90	70	0.00	16.42	87	68	0.00	15.55	79	66	0.09	8.64
12	93	72	0.00	18.14	88	66	0.00	14.69	74	57	0.00	12.10
13	92	73	0.15	19.01	86	60	0.02	13.82	74	61	0.55	4.32
14	91	69	1.68	17.28	73	50	0.00	17.28	71	57	0.34	3.46
15	87	70	0.00	13.82	77	59	0.00	14.69	63	46	0.00	8.64
16	86	71	0.26	15.55	78	68	1.51	7.78	61	38	0.00	12.96
17	81	60	0.01	15.55	70	58	2.85	0.86	65	40	0.00	15.55
18	80	57	0.00	20.74	65	43	0.00	11.23	70	52	0.00	12.10
19	83	60	0.00	19.01	66	49	0.00	17.28	77	56	0.00	12.10
20	86	65	0.00	17.28	74	57	0.00	15.55	81	63	1.17	12.96
21	87	67	0.00	13.82	80	63	0.00	12.10	72	44	0.01	10.37
22	87	68	0.00	15.55	76	61	0.02	6.05	64	45	0.00	15.55
23	89	69	0.03	12.96	72	43	0.00	13.82	71	51	0.00	12.96
24	89	68	0.00	13.82	65	44	0.00	16.42	76	59	0.00	13.82
25	89	67	0.00	17.28	76	51	0.00	15.55	73	49	1.69	6.91
26	89	69	0.00	16.42	80	57	0.00	14.69	75	45	0.00	12.96
27	88	71	0.00	17.28	73	52	0.00	10.37	64	48	0.00	14.69
28	89	72	0.00	17.28	74	54	0.00	13.82	63	47	0.00	8.64
29	89	68	0.00	17.28	73	39	0.00	12.10	63	36	0.00	15.55
30	89	72	0.00	15.55	66	37	0.00	16.42	71	40	0.00	16.42
31	87	68	0.00	12.10					75	53	0.00	14.69
Avg	88	69		16.61	77	56		13.36	72	52		11.04
Max	93	75	1.68	20.74	88	73	2.85	18.14	84	66	2.48	16.42
Min	80	57	0	12.10	65	37	0	0.86	61	36	0	2.59
Total			2.42	514.95			4.74	400.91			7.06	342.15

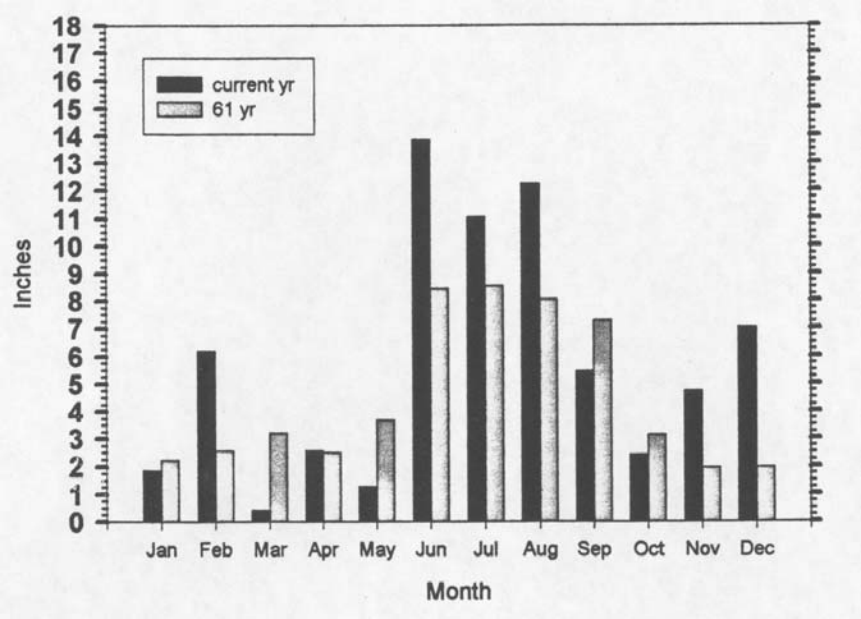

Figure 1. Monthly 2002 rainfall at the Range Cattle REC compared to the 61-year mean rainfall at Range Cattle REC.

There were 28 occurrences during 2002 when daily rain equaled or exceeded 1 inch and seven events that exceeded 2 inches (Table 2). The single greatest daily rain event was on 17 November when 2.85 inches were recorded. This is noteworthy because November is historically the month with the least rainfall at the Range Cattle REC. Eleven (39%) of the > 1 inch events occurred outside of the June to September rainy season. Above average rain in June to August and November to December resulted in typical flooding of pastures at Ona (Fig.1).

Evapo-transpiration

Rainfall exceeded evapo-transpiration in 7 months during 2002 (Figure 2). Only in March through May, the typical dry season, did evapo-transpiration exceed rainfall. For the year, rainfall exceeded evapo-transpiration by 31.83 inches. Historically, pan evaporation and evapo-transpiration have exceed rainfall at the Range Cattle REC.

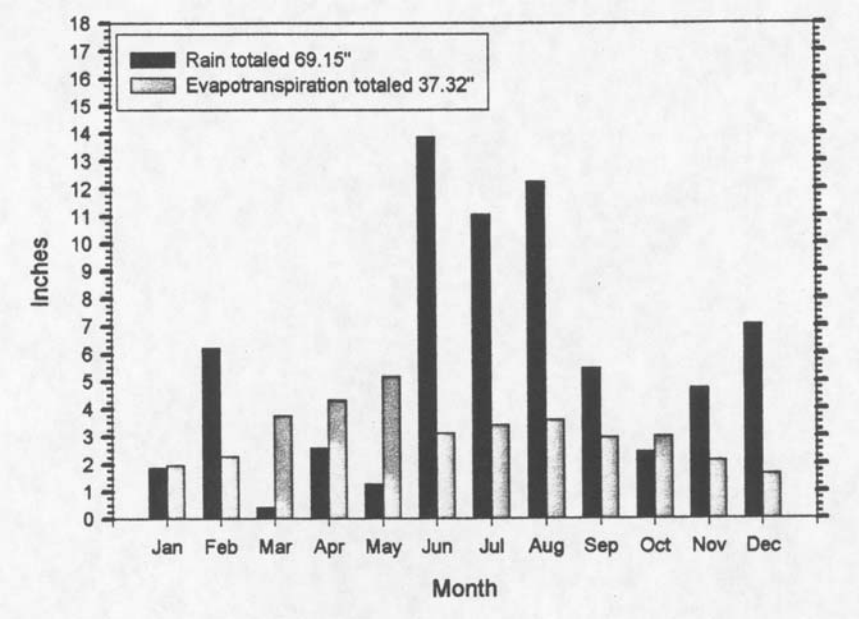

Figure 2. Monthly rainfall compared with evapo-transpiration during 2002.

Temperature:

There were four and six days when daily low-shelter and daily low ground-temperatures, respectively, were at or below 32 °F (Table 2). The extreme low temperature for 2002 occurred on 9 January when shelter and ground temperature reached 28 and 25 °F, respectively. Scattered frost occurs when ground temperature reaches 34 °F. Based on this observation, there were nine incidences of frost (data not shown). In spite of a few cold days, only November had a mean-montly low shelter-temperature near the 59-year mean for that month (Table 3). Mean minimum shelter shelter temperatures for all other months in 2002 exceeded the respective 59-year mean. Overall, mean temperature for 2002 was 2 °F higher than the 59-year mean.

Table 3. Summary of minimum temperature (°F)* by months, Range Cattle REC, 2002.

	Shelter Temperature					Ground Temperature	
	1944-02	2002	1944-02		2002	2002	
	Avg. Low	Avg. Low	Extreme Low	Year	Extreme Low	Avg. Low	Extreme Low
January	49.4	51.8	18	1981	28	49.8	25

February	50.6	51.8	26	1976	34	49.4	30
March	54.4	57.6	26	1980	40	55.1	39
April	58.2	61.8	34	1971	52	59.1	48
May	63.3	64.8	43	1945	58	62.3	55
June	68.9	71.0	52	1984	66	69.1	64
July	71.1	73	62	several	70	71.6	68
August	71.7	72.4	61	1977	68	70.7	68
September	71.0	73.9	56	1962	71	72.3	70
October	64.7	68.8	42	several	57	66.3	54
November	56.8	56.5	25	1970	37	54.0	34
December	51.2	51.8	20	1962	36	50.0	34
Avg.	60.9	62.9			51.4	60.8	49.1
* °C = (°F - 32) x 0.555							

Solar Radiation:

Daily solar radiation is shown in Table 2, and 2002 total monthly solar radiation can be seen graphically 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 May 2002 (746 MJ) to produce 10,670 lb/A of plant dry matter. Total solar radiation for 2002 was 6259 MJ.

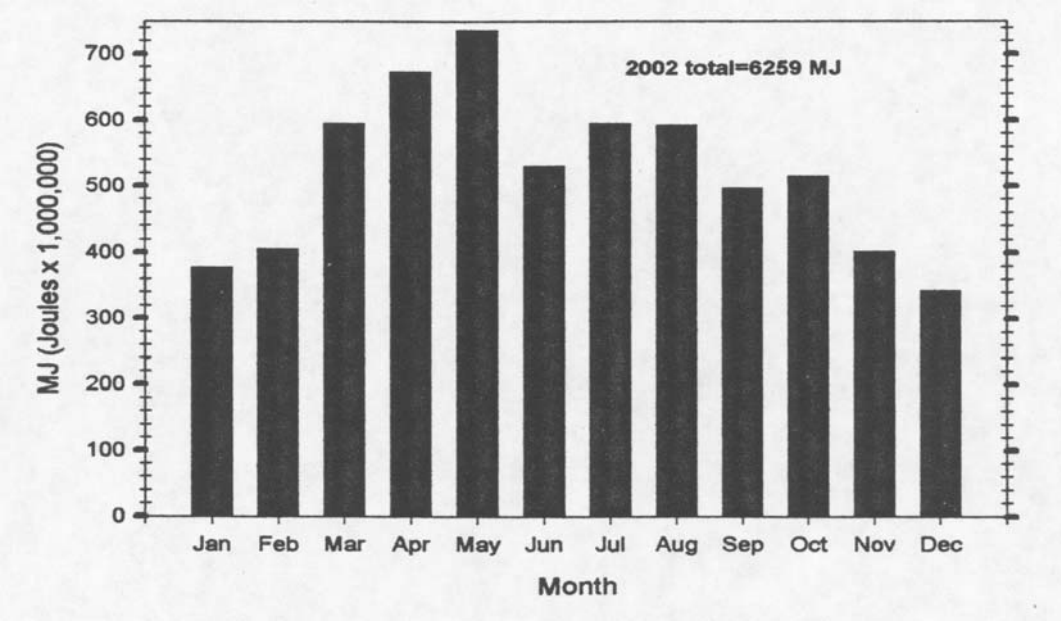

Figure 3. Total monthly solar radiation for 2002.

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.

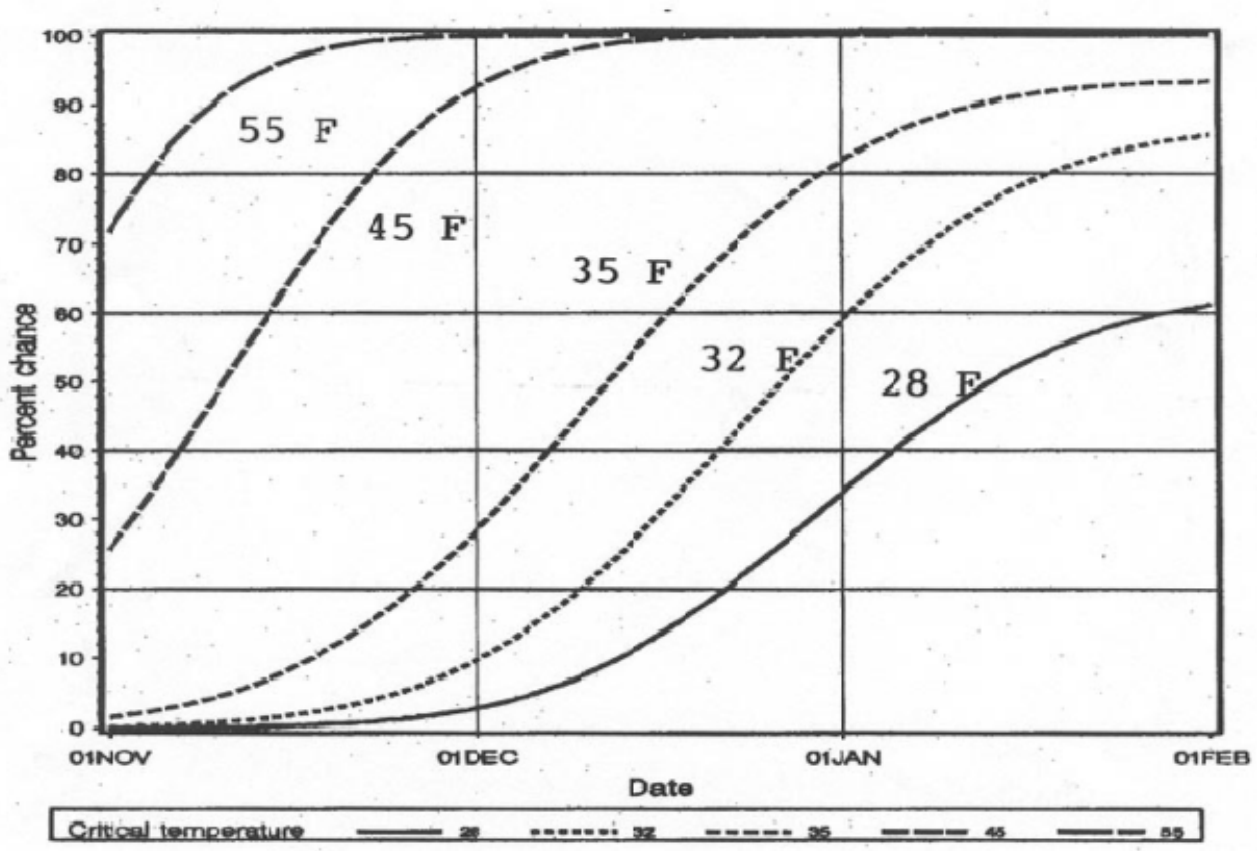

Figure 4. Fall freeze hazard showing the chance of the first attainment of a given temperature before a selected date.

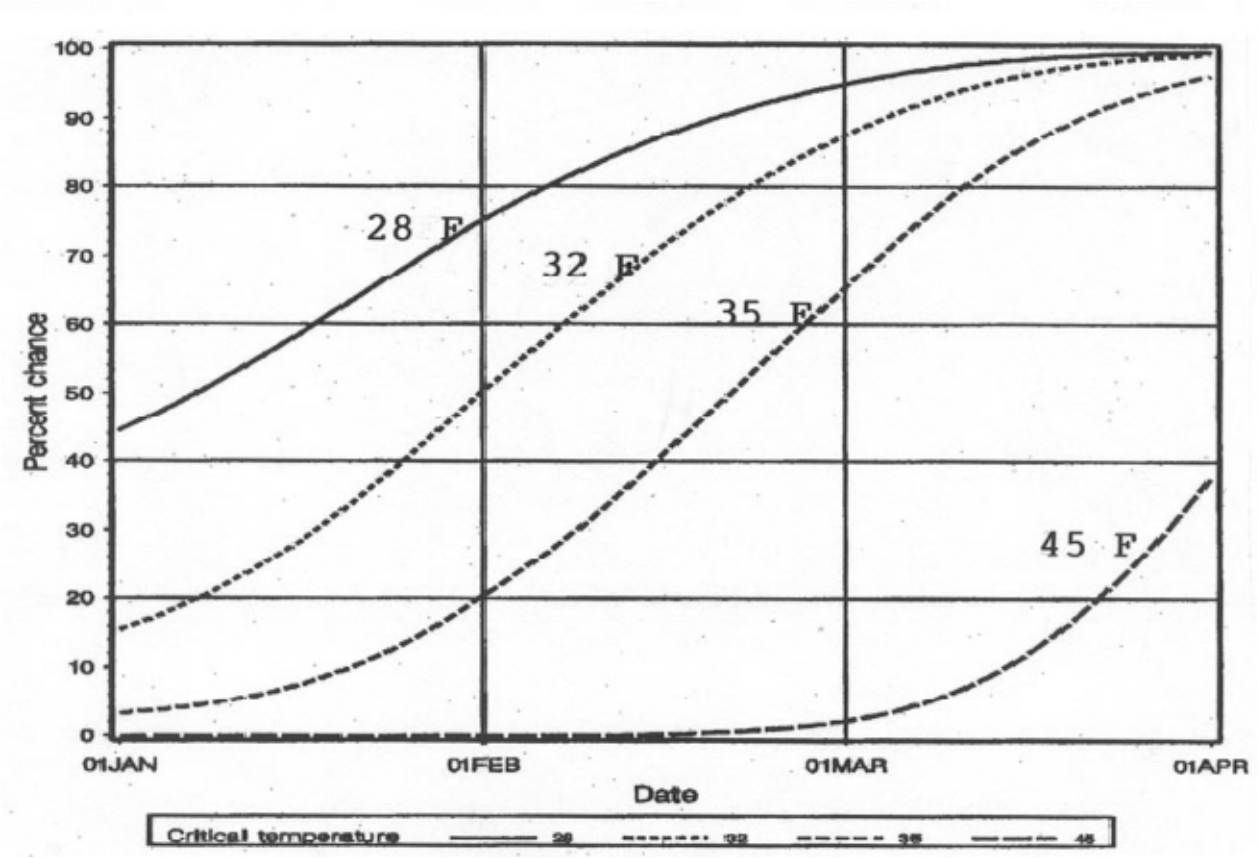

Figure 5. Spring freeze hazard showing the chance of the last attainment of a given temperature before a selected date.

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