

Range Cattle Research and Education Center

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CLIMATOLOGICAL REPORT 2012
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 supplement cattle on pasture or range. Weather conditions influence seed germination, forage growth, palatability, and nutritive value.

This research report presents a summary of rainfall, air temperature, evapotranspiration, and solar radiation for 2012 obtained at the Range Cattle Research and Education Center (REC), Ona, Florida, and is compared to a 71-year summary of rainfall data and a 70-year summary of temperature data collected from this location. The center is located $81^{\circ} 56.406'$ W and $27^{\circ} 23.733'$ 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) from 1997 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 and was verified by comparing with rainfall measured using US Weather Service standard gauge. Measurements reported prior to 2006 were recorded at 0900 h; thus, data on a given day represented the previous 24-hour period. Beginning in 2006, measurements were recorded for an entire 24-h period beginning at midnight.

Rainfall

Annual rainfall for 2012 totaled 51.14 inches (Table 1), which was 2.49 inches (4.65%) less than the 71-year average of 53.63 inches (Table 1). The lowest annual total was observed in 2000 when 32.02 inches were measured, and the greatest annual rainfall total on record was in 1959 when 78.82 inches were recorded. Nine months of 2012 saw rainfall that fell below the 71-year average. Rainfall deficits exceeded two inches in February, March, and May, and exceeded one inch in August and November. Rainfall surpluses in excess of two inches were observed in March, August, and September. Daily rainfall equaled or exceeded 1 inch on 10 separate occasions, with daily rainfall exceeding 2 inches on 6 of these separate occasions (Table 2). The single greatest daily rain event was 6 September when 2.30 inches were recorded.

Table 1. Summary of rainfall by months. Range Cattle REC, 2012.

| Month | 1942 to 2012 | | 71-year average† | 2012 | Difference from 70-year average |
|------------|--------------------|--------------------|---------------------|-------|------------------------------------|
| | Maximum / month | Minimum / month | | Total | |
| | -----inches----- | | | | |
| January | 8.45 | 0.03 | 2.11 | 0.50 | -1.61 |
| February | 9.59 | 0.02 | 2.52 | 0.42 | -2.10 |
| March | 12.34 | 0.13 | 3.12 | 0.28 | -2.84 |
| April | 11.91 | 0.00 | 2.46 | 2.49 | 0.03 |
| May | 10.58 | 0.00 | 3.73 | 1.44 | -2.29 |
| June | 18.99 | 2.79 | 8.59 | 9.56 | 0.97 |
| July | 19.74 | 1.87 | 8.30 | 7.58 | -0.72 |
| August | 16.10 | 3.13 | 8.41 | 6.71 | -1.70 |
| September | 20.11 | 1.14 | 7.30 | 7.29 | -0.01 |
| October | 11.23 | 0.00 | 3.01 | 5.13 | 2.12 |
| November | 11.22 | 0.07 | 1.87 | 0.54 | -1.33 |
| December | 8.61 | 0.11 | 1.98 | 1.20 | -0.78 |
| Year total | | | 53.63 | 43.14 | |

*Inches x 2.54 = cm.

† Since rainfall records began in July 1942, means for January to June are 69-year means.

Evapo-transpiration

Evapo-transpiration is the total amount of water transferred from the earth to the atmosphere. Evapo-transpiration exceeded rainfall in January through May, November, and December during 2012 (Figure 2). Historically, evapo-transpiration generally exceeds rainfall in January to May and October to December, which are months with limited rainfall. Rainfall exceeded evapo-transpiration by 6.54 inches for the entire year.

Table 2. Daily maximum and minimum temperature, precipitation, and solar radiation for 2012, 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 | 80.80 | 47.62 | 0.00 | 15.63 | 82.83 | 51.62 | 0.00 | 17.87 | 85.73 | 59.47 | 0.00 | 22.98 | 86.68 | 57.83 | 0.00 | 26.91 |
| 2 | 70.21 | 38.31 | 0.00 | 10.30 | 83.52 | 53.89 | 0.00 | 13.96 | 85.69 | 58.12 | 0.00 | 19.92 | 88.38 | 55.47 | 0.00 | 25.94 |
| 3 | 52.47 | 30.18 | 0.00 | 18.77 | 75.45 | 58.69 | 0.00 | 6.15 | 85.48 | 63.93 | 0.00 | 20.78 | 90.68 | 53.98 | 0.03 | 27.71 |
| 4 | 64.42 | 25.55 | 0.00 | 16.96 | 83.1 | 59.52 | 0.00 | 14.47 | 76.30 | 47.34 | 0.00 | 22.32 | 89.55 | 54.57 | 0.00 | 28.59 |
| 5 | 69.28 | 25.57 | 0.00 | 17.77 | 82.65 | 61.72 | 0.00 | 12.26 | 75.99 | 35.19 | 0.00 | 27.47 | 86.40 | 65.03 | 0.61 | 26.91 |
| 6 | 74.44 | 36.81 | 0.00 | 16.86 | 81.25 | 60.04 | 0.00 | 8.21 | 77.63 | 44.54 | 0.00 | 22.89 | 85.75 | 59.11 | 0.00 | 27.30 |
| 7 | 78.08 | 41.43 | 0.00 | 15.27 | 75.33 | 62.04 | 0.00 | 5.76 | 81.09 | 56.16 | 0.00 | 19.45 | 83.64 | 55.53 | 0.00 | 27.42 |
| 8 | 80.46 | 43.14 | 0.00 | 16.59 | 50.78 | 56.70 | 0.00 | 18.33 | 83.75 | 59.97 | 0.00 | 17.73 | 83.75 | 51.17 | 0.00 | 31.07 |
| 9 | 81.93 | 45.45 | 0.00 | 14.55 | 75.07 | 50.09 | 0.00 | 11.44 | 80.46 | 62.56 | 0.11 | 12.55 | 85.71 | 50.99 | 0.00 | 29.33 |
| 10 | 81.66 | 51.55 | 0.00 | 16.06 | 84.18 | 55.78 | 0.31 | 14.19 | 82.35 | 61.02 | 0.03 | 14.71 | 86.22 | 53.65 | 0.00 | 29.27 |
| 11 | 75.13 | 54.46 | 0.08 | 5.51 | 66.20 | 45.88 | 0.08 | 13.99 | 82.69 | 65.88 | 0.00 | 17.46 | 85.51 | 55.99 | 0.00 | 27.96 |
| 12 | 78.84 | 50.32 | 0.01 | 16.40 | 55.67 | 32.04 | 0.00 | 20.92 | 82.20 | 60.55 | 0.00 | 23.17 | 86.23 | 53.92 | 0.00 | 30.65 |
| 13 | 70.41 | 48.61 | 0.00 | 17.02 | 70.05 | 30.40 | 0.00 | 20.45 | 82.31 | 56.79 | 0.00 | 23.39 | 87.48 | 58.30 | 0.00 | 21.36 |
| 14 | 62.91 | 36.31 | 0.00 | 16.05 | 78.67 | 43.60 | 0.00 | 19.04 | 83.46 | 52.54 | 0.00 | 21.79 | 78.69 | 64.06 | 0.00 | 13.68 |
| 15 | 71.47 | 26.38 | 0.00 | 19.48 | 85.14 | 50.41 | 0.00 | 19.80 | 83.95 | 57.42 | 0.00 | 21.00 | 83.52 | 61.05 | 0.00 | 21.95 |
| 16 | 74.50 | 36.93 | 0.00 | 18.78 | 83.01 | 53.15 | 0.00 | 16.95 | 84.85 | 56.35 | 0.00 | 22.97 | 85.68 | 58.42 | 0.00 | 23.31 |
| 17 | 78.82 | 42.13 | 0.00 | 17.69 | 79.02 | 56.57 | 0.00 | 6.95 | 84.13 | 52.11 | 0.00 | 26.21 | 86.67 | 55.15 | 0.00 | 26.37 |
| 18 | 80.51 | 44.78 | 0.18 | 12.71 | 81.07 | 60.91 | 0.00 | 9.24 | 84.56 | 51.04 | 0.00 | 24.33 | 86.56 | 61.75 | 0.00 | 20.76 |
| 19 | 73.83 | 44.20 | 0.00 | 19.37 | 81.43 | 60.96 | 0.00 | 9.20 | 84.00 | 56.25 | 0.00 | 26.72 | 82.99 | 65.46 | 0.00 | 14.74 |
| 20 | 79.61 | 41.27 | 0.00 | 18.45 | 73.78 | 50.76 | 0.00 | 20.40 | 84.54 | 57.07 | 0.00 | 21.93 | 88.41 | 65.80 | 0.00 | 24.73 |
| 21 | 80.17 | 44.91 | 0.00 | 17.31 | 81.21 | 46.90 | 0.00 | 20.65 | 86.25 | 59.18 | 0.00 | 20.46 | 78.67 | 63.59 | 1.69 | 13.23 |
| 22 | 82.08 | 44.10 | 0.00 | 16.85 | 82.56 | 53.17 | 0.00 | 17.45 | 86.86 | 63.46 | 0.00 | 19.48 | 77.99 | 57.88 | 0.10 | 23.37 |
| 23 | 83.28 | 54.39 | 0.04 | 15.03 | 84.27 | 63.19 | 0.00 | 19.10 | 87.26 | 62.71 | 0.00 | 20.03 | 75.06 | 51.44 | 0.00 | 32.86 |
| 24 | 84.33 | 52.36 | 0.00 | 14.98 | 87.37 | 65.19 | 0.00 | 21.09 | 85.50 | 58.35 | 0.00 | 23.86 | 72.57 | 46.40 | 0.00 | 34.37 |
| 25 | 84.45 | 59.59 | 0.00 | 15.20 | 74.79 | 59.59 | 0.00 | 13.30 | 82.35 | 53.87 | 0.08 | 21.22 | 82.60 | 41.82 | 0.00 | 33.92 |
| 26 | 84.74 | 58.28 | 0.00 | 14.68 | 72.39 | 59.36 | 0.00 | 8.56 | 84.06 | 53.92 | 0.00 | 28.41 | 87.19 | 49.84 | 0.00 | 33.43 |
| 27 | 72.73 | 60.08 | 0.19 | 5.51 | 84.95 | 63.54 | 0.03 | 12.02 | 85.32 | 48.40 | 0.00 | 26.86 | 88.00 | 50.05 | 0.00 | 32.81 |
| 28 | 73.42 | 47.17 | 0.00 | 17.56 | 83.75 | 64.65 | 0.00 | 19.83 | 84.29 | 56.43 | 0.00 | 24.57 | 89.05 | 62.02 | 0.00 | 23.93 |
| 29 | 76.71 | 52.07 | 0.00 | 17.61 | 86.77 | 63.21 | 0.00 | 17.45 | 85.91 | 55.22 | 0.00 | 24.81 | 83.62 | 64.22 | 0.06 | 16.21 |
| 30 | 76.39 | 48.42 | 0.00 | 19.70 | | | | | 86.22 | 55.44 | 0.00 | 26.83 | 86.36 | 65.98 | 0.00 | 25.40 |
| 31 | 79.56 | 48.97 | 0.00 | 19.60 | | | | | 84.51 | 61.16 | 0.06 | 19.40 | | | | |
| Avg | 76.05 | 44.56 | 0.02 | 15.94 | 73.11 | 51.41 | 0.01 | 13.84 | 83.54 | 56.21 | 0.01 | 22.12 | 81.92 | 55.18 | 0.08 | 25.02 |
| Max | 84.74 | 60.08 | 0.19 | 19.70 | 86.77 | 65.19 | 0.31 | 20.92 | 86.86 | 65.88 | 0.11 | 28.41 | 90.68 | 65.98 | 1.69 | 34.37 |
| Min | 52.47 | 25.55 | 0.00 | 5.51 | 50.78 | 30.40 | 0.00 | 5.76 | 75.99 | 35.19 | 0.00 | 35.19 | 72.57 | 41.82 | 0.00 | 13.23 |
| Total | | | 0.5 | 494.3 | | | 0.42 | 429.1 | | | 0.28 | 685.7 | | | 2.49 | 775.5 |

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 | 87.89 | 67.44 | 0.00 | 24.37 | 81.48 | 70.68 | 2.16 | 4.44 | 93.00 | 69.08 | 0.00 | 29.71 | 91.49 | 72.86 | 0.00 | 22.70 |
| 2 | 89.35 | 67.62 | 0.00 | 28.21 | 89.33 | 69.15 | 0.00 | 29.09 | 92.75 | 72.54 | 0.03 | 26.19 | 92.77 | 72.57 | 0.00 | 24.28 |
| 3 | 90.18 | 66.47 | 0.00 | 26.98 | 91.42 | 64.45 | 0.00 | 28.49 | 92.17 | 70.48 | 0.00 | 24.12 | 92.57 | 72.21 | 0.06 | 19.83 |
| 4 | 88.14 | 65.21 | 0.00 | 23.43 | 89.24 | 65.34 | 0.00 | 26.00 | 93.22 | 71.85 | 0.00 | 28.37 | 92.71 | 71.29 | 0.00 | 28.37 |
| 5 | 91.72 | 61.52 | 0.00 | 28.55 | 86.99 | 71.58 | 0.00 | 14.34 | 93.06 | 70.03 | 0.00 | 26.41 | 93.31 | 73.13 | 0.16 | 21.07 |
| 6 | 90.77 | 64.36 | 0.00 | 27.37 | 87.76 | 71.92 | 0.01 | 9.63 | 93.69 | 70.83 | 0.00 | 23.91 | 91.20 | 73.67 | 0.32 | 20.65 |
| 7 | 90.10 | 62.24 | 0.00 | 28.57 | 86.11 | 71.19 | 1.02 | 8.21 | 93.06 | 70.48 | 0.00 | 28.73 | 93.52 | 73.22 | 0.01 | 19.93 |
| 8 | 88.66 | 61.56 | 0.00 | 25.74 | 86.23 | 71.38 | 0.94 | 12.38 | 93.88 | 70.95 | 0.00 | 25.90 | 95.14 | 74.26 | 0.01 | 26.65 |
| 9 | 89.24 | 63.07 | 0.12 | 25.33 | 91.47 | 71.08 | 0.00 | 24.94 | 93.81 | 70.97 | 0.00 | 27.89 | 94.96 | 71.83 | 0.00 | 27.81 |
| 10 | 89.29 | 63.84 | 0.00 | 29.96 | 93.40 | 71.56 | 0.14 | 24.04 | 89.78 | 70.84 | 0.99 | 16.01 | 93.99 | 72.41 | 0.30 | 24.70 |
| 11 | 91.24 | 60.40 | 0.00 | 28.75 | 92.88 | 68.88 | 0.00 | 29.12 | 85.05 | 70.59 | 0.87 | 10.80 | 86.77 | 72.90 | 0.05 | 11.17 |
| 12 | 88.92 | 64.44 | 0.00 | 26.99 | 92.46 | 68.38 | 0.00 | 27.65 | 90.01 | 71.11 | 0.00 | 21.48 | 81.12 | 72.70 | 0.46 | 10.74 |
| 13 | 88.12 | 61.63 | 0.00 | 21.39 | 91.92 | 69.69 | 0.00 | 28.13 | 90.45 | 72.75 | 0.45 | 25.74 | 89.78 | 72.70 | 0.00 | 18.24 |
| 14 | 88.25 | 68.61 | 0.06 | 17.26 | 91.87 | 69.57 | 0.04 | 25.67 | 89.98 | 72.59 | 0.00 | 24.46 | 91.83 | 72.68 | 0.00 | 21.29 |
| 15 | 90.54 | 67.32 | 0.05 | 19.56 | 91.47 | 67.75 | 0.00 | 24.51 | 89.01 | 72.46 | 0.60 | 20.72 | 93.45 | 71.92 | 0.00 | 19.70 |
| 16 | 82.40 | 67.03 | 0.60 | 8.72 | 89.87 | 69.55 | 0.00 | 30.10 | 86.22 | 71.96 | 0.93 | 24.16 | 90.03 | 72.91 | 0.03 | 13.07 |
| 17 | 88.63 | 68.41 | 0.01 | 26.60 | 88.77 | 65.89 | 0.00 | 28.29 | 83.68 | 72.57 | 0.01 | 17.88 | 89.60 | 74.52 | 0.14 | 16.64 |
| 18 | 89.37 | 63.46 | 0.00 | 27.09 | 89.38 | 64.76 | 0.00 | 30.62 | 88.75 | 73.11 | 0.71 | 18.96 | 86.22 | 74.79 | 0.01 | 14.22 |
| 19 | 88.95 | 64.76 | 0.00 | 20.95 | 87.37 | 65.59 | 0.00 | 24.52 | 92.86 | 73.04 | 0.00 | 24.53 | 91.99 | 75.09 | 0.00 | 25.19 |
| 20 | 90.88 | 64.85 | 0.00 | 31.21 | 80.92 | 73.26 | 0.12 | 16.19 | 94.08 | 74.48 | 0.00 | 28.34 | 92.66 | 73.13 | 0.14 | 25.81 |
| 21 | 91.45 | 59.63 | 0.02 | 33.31 | 86.63 | 72.66 | 0.28 | 12.91 | 93.81 | 74.91 | 0.00 | 26.49 | 92.62 | 71.38 | 1.46 | 25.51 |
| 22 | 92.82 | 59.23 | 0.00 | 34.06 | 87.57 | 73.40 | 0.32 | 18.77 | 91.26 | 72.61 | 2.03 | 15.52 | 90.88 | 71.53 | 0.37 | 16.90 |
| 23 | 93.27 | 61.93 | 0.00 | 30.92 | 80.51 | 72.64 | 0.41 | 6.15 | 90.64 | 72.19 | 0.07 | 18.85 | 92.41 | 69.60 | 0.01 | 26.07 |
| 24 | 93.65 | 68.02 | 0.00 | 26.85 | 81.14 | 73.02 | 2.05 | 2.49 | 90.00 | 73.04 | 0.16 | 16.91 | 91.63 | 72.07 | 0.00 | 22.90 |
| 25 | 93.87 | 68.52 | 0.00 | 25.93 | 82.36 | 74.34 | 1.26 | 7.83 | 90.84 | 74.10 | 0.00 | 24.62 | 85.96 | 70.39 | 0.00 | 17.79 |
| 26 | 95.04 | 65.50 | 0.00 | 27.91 | 86.23 | 76.69 | 0.73 | 13.13 | 91.53 | 73.94 | 0.00 | 25.11 | 84.29 | 75.11 | 1.49 | 7.23 |
| 27 | 91.58 | 64.78 | 0.06 | 26.33 | 88.38 | 74.17 | 0.08 | 25.07 | 91.20 | 73.49 | 0.12 | 20.34 | 86.02 | 75.65 | 0.63 | 9.09 |
| 28 | 91.04 | 71.65 | 0.52 | 28.65 | 90.16 | 67.95 | 0.00 | 30.92 | 92.37 | 73.94 | 0.00 | 22.20 | 90.45 | 73.31 | 0.93 | 17.15 |
| 29 | 88.63 | 70.54 | 0.00 | 20.64 | 90.52 | 69.03 | 0.00 | 29.00 | 91.85 | 73.83 | 0.11 | 24.12 | 90.43 | 73.42 | 0.13 | 18.85 |
| 30 | 91.56 | 72.00 | 0.00 | 29.96 | 90.30 | 69.22 | 0.00 | 29.00 | 91.87 | 72.93 | 0.00 | 25.61 | 91.78 | 74.88 | 0.00 | 20.86 |
| 31 | 91.00 | 68.04 | 0.00 | 19.50 | | | | | 91.26 | 71.42 | 0.50 | 23.08 | 91.71 | 75.18 | 0.00 | 21.38 |
| <u>Avg</u> | 90.21 | 65.29 | 0.05 | 25.84 | 85.29 | 67.90 | 0.31 | 20.05 | 91.13 | 72.23 | 0.24 | 23.13 | 90.75 | 73.01 | 0.22 | 19.86 |
| <u>Max</u> | 95.04 | 72.00 | 0.60 | 34.06 | 93.40 | 76.69 | 2.16 | 30.92 | 94.08 | 74.91 | 2.03 | 29.71 | 95.14 | 75.65 | 1.49 | 27.81 |
| <u>Min</u> | 87.89 | 59.23 | 0.00 | 8.72 | 80.51 | 64.45 | 0.00 | 2.49 | 83.68 | 69.08 | 0.00 | 10.80 | 81.12 | 69.60 | 0.00 | 7.23 |
| <u>Total</u> | | | 1.44 | 801.1 | | | 9.56 | 621.6 | | | 7.58 | 717.1 | | | 6.71 | 615.7 |

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 | 91.56 | 73.96 | 0.00 | 24.17 | 89.28 | 73.24 | 0.11 | 17.84 | 76.57 | 54.39 | 0.00 | 10.72 | 79.43 | 52.29 | 0.00 | 13.95 |
| 2 | 90.45 | 70.77 | 0.00 | 26.53 | 86.18 | 73.27 | 0.28 | 11.62 | 79.11 | 52.3 | 0.00 | 19.89 | 80.89 | 60.21 | 0.00 | 15.20 |
| 3 | 90.19 | 68.74 | 0.00 | 26.27 | 89.56 | 73.31 | 0.47 | 13.43 | 82.87 | 50.86 | 0.00 | 19.08 | 80.51 | 59.45 | 0.00 | 16.02 |
| 4 | 91.40 | 70.86 | 0.00 | 22.98 | 89.91 | 71.17 | 2.08 | 12.83 | 82.78 | 56.39 | 0.00 | 17.14 | 78.03 | 55.99 | 0.00 | 13.47 |
| 5 | 89.17 | 70.63 | 0.08 | 19.45 | 91.18 | 71.69 | 1.07 | 18.31 | 77.34 | 59.99 | 0.00 | 9.71 | 77.59 | 55.74 | 0.00 | 10.18 |
| 6 | 90.79 | 70.50 | 2.30 | 16.03 | 88.77 | 72.39 | 0.35 | 15.83 | 75.90 | 57.99 | 0.51 | 9.41 | 80.67 | 60.31 | 0.00 | 13.57 |
| 7 | 90.61 | 70.83 | 0.02 | 19.80 | 88.29 | 70.79 | 0.01 | 16.56 | 68.05 | 49.77 | 0.00 | 17.38 | 79.57 | 58.14 | 0.00 | 11.98 |
| 8 | 90.68 | 72.14 | 0.00 | 24.38 | 87.46 | 71.67 | 0.00 | 11.60 | 67.42 | 46.98 | 0.00 | 19.33 | 82.89 | 63.77 | 0.26 | 10.94 |
| 9 | 83.26 | 75.56 | 0.26 | 9.17 | 89.20 | 70.88 | 0.00 | 19.53 | 74.53 | 43.36 | 0.00 | 19.29 | 83.16 | 62.31 | 0.01 | 13.57 |
| 10 | 85.95 | 73.29 | 0.18 | 10.01 | 87.12 | 68.74 | 0.00 | 19.32 | 76.77 | 51.35 | 0.00 | 15.49 | 82.72 | 63.18 | 0.01 | 7.48 |
| 11 | 88.90 | 72.72 | 0.00 | 16.14 | 85.62 | 65.07 | 0.00 | 21.75 | 80.64 | 55.22 | 0.00 | 16.68 | 81.36 | 66.61 | 0.12 | 6.51 |
| 12 | 86.92 | 71.17 | 0.00 | 21.13 | 84.49 | 65.73 | 0.00 | 20.46 | 82.83 | 59.95 | 0.00 | 14.76 | 81.93 | 65.82 | 0.04 | 7.80 |
| 13 | 83.52 | 73.08 | 0.46 | 9.00 | 85.96 | 65.62 | 0.00 | 21.00 | 79.93 | 60.06 | 0.00 | 12.42 | 71.56 | 55.76 | 0.00 | 8.46 |
| 14 | 88.79 | 72.36 | 0.80 | 15.04 | 87.71 | 68.23 | 0.01 | 16.93 | 79.59 | 61.75 | 0.00 | 11.95 | 73.18 | 55.36 | 0.00 | 10.12 |
| 15 | 86.92 | 73.67 | 0.02 | 20.54 | 86.59 | 72.39 | 0.32 | 12.92 | 74.61 | 62.08 | 0.00 | 8.87 | 77.90 | 55.83 | 0.00 | 9.86 |
| 16 | 88.70 | 73.53 | 0.47 | 15.44 | 87.17 | 69.08 | 0.00 | 19.71 | 68.81 | 58.23 | 0.00 | 6.08 | 80.06 | 57.90 | 0.00 | 12.21 |
| 17 | 89.55 | 72.32 | 0.01 | 21.32 | 82.06 | 68.74 | 0.00 | 9.03 | 79.66 | 57.7 | 0.00 | 15.27 | 81.01 | 58.57 | 0.00 | 12.82 |
| 18 | 87.24 | 73.67 | 0.36 | 11.31 | 87.73 | 68.18 | 0.26 | 15.59 | 75.49 | 55.24 | 0.00 | 12.49 | 81.16 | 56.75 | 0.00 | 10.76 |
| 19 | 87.22 | 72.14 | 0.01 | 17.51 | 88.48 | 68.54 | 0.00 | 19.61 | 65.84 | 50.45 | 0.00 | 13.55 | 78.93 | 43.86 | 0.00 | 15.85 |
| 20 | 88.97 | 72.05 | 0.00 | 17.40 | 84.16 | 69.87 | 0.00 | 19.59 | 75.25 | 53.65 | 0.00 | 17.15 | 83.25 | 51.98 | 0.00 | 13.79 |
| 21 | 88.54 | 71.53 | 0.04 | 12.64 | 82.42 | 59.70 | 0.00 | 22.18 | 72.91 | 50.43 | 0.00 | 17.11 | 62.94 | 39.82 | 0.04 | 16.18 |
| 22 | 86.67 | 71.33 | 0.01 | 13.54 | 85.12 | 63.03 | 0.00 | 19.92 | 73.24 | 47.82 | 0.00 | 18.34 | 64.62 | 35.18 | 0.00 | 17.73 |
| 23 | 90.41 | 71.60 | 0.00 | 23.00 | 81.37 | 63.28 | 0.00 | 12.80 | 72.36 | 42.08 | 0.00 | 19.23 | 71.60 | 30.98 | 0.00 | 14.19 |
| 24 | 83.84 | 70.02 | 0.00 | 11.87 | 86.79 | 66.31 | 0.00 | 18.19 | 74.86 | 44.98 | 0.00 | 15.22 | 72.37 | 46.26 | 0.00 | 7.01 |
| 25 | 86.22 | 66.96 | 0.00 | 14.83 | 83.16 | 70.75 | 0.17 | 9.62 | 71.71 | 40.60 | 0.00 | 18.74 | 77.22 | 50.99 | 0.00 | 10.15 |
| 26 | 89.60 | 70.23 | 0.00 | 13.54 | 85.01 | 70.86 | 0.00 | 16.75 | 79.81 | 44.42 | 0.00 | 16.75 | 79.83 | 52.66 | 0.12 | 8.46 |
| 27 | 91.13 | 70.97 | 0.02 | 22.69 | 77.92 | 64.80 | 0.00 | 12.69 | 80.28 | 55.60 | 0.03 | 13.83 | 66.85 | 43.05 | 0.00 | 16.59 |
| 28 | 90.52 | 70.79 | 2.22 | 20.62 | 76.78 | 61.02 | 0.00 | 15.14 | 75.76 | 55.51 | 0.00 | 10.52 | 73.72 | 41.60 | 0.59 | 10.40 |
| 29 | 91.19 | 71.71 | 0.00 | 21.82 | 68.47 | 50.88 | 0.00 | 22.68 | 78.39 | 52.63 | 0.00 | 14.65 | 77.61 | 52.03 | 0.01 | 7.54 |
| 30 | 90.68 | 72.52 | 0.03 | 18.98 | 67.41 | 46.06 | 0.00 | 22.41 | 78.10 | 55.81 | 0.00 | 12.56 | 58.17 | 39.71 | 0.00 | 17.22 |
| 31 | | | | | 72.95 | 48.16 | 0.00 | 19.65 | | | | | 75.22 | 44.55 | 0.00 | 15.36 |
| <u>Avg</u> | 85.79 | 69.41 | 0.24 | 17.33 | 84.33 | 66.56 | 0.42 | 16.95 | 73.59 | 51.21 | 0.02 | 14.31 | 76.64 | 52.80 | 0.04 | 12.11 |
| <u>Max</u> | 91.56 | 75.56 | 2.30 | 26.53 | 91.18 | 73.31 | 2.08 | 22.68 | 82.87 | 62.08 | 0.51 | 19.89 | 83.25 | 66.61 | 0.59 | 17.73 |
| <u>Min</u> | 83.26 | 68.74 | 0.00 | 9.00 | 67.41 | 46.06 | 0.00 | 9.03 | 65.84 | 40.6 | 0.00 | 6.08 | 58.17 | 30.98 | 0.00 | 6.51 |
| <u>Total</u> | | | 7.29 | 537.1 | | | 5.13 | 525.4 | | | 0.54 | 443.6 | | | 1.20 | 375.4 |

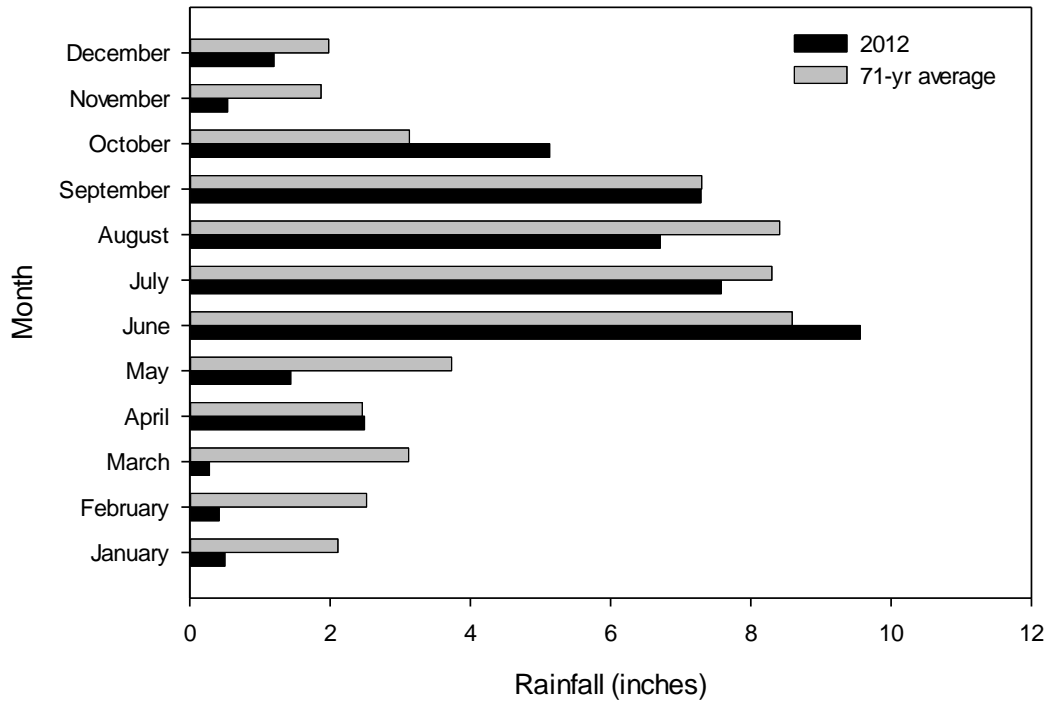


Figure 1. Monthly rainfall in 2012 compared with the 71-year average.

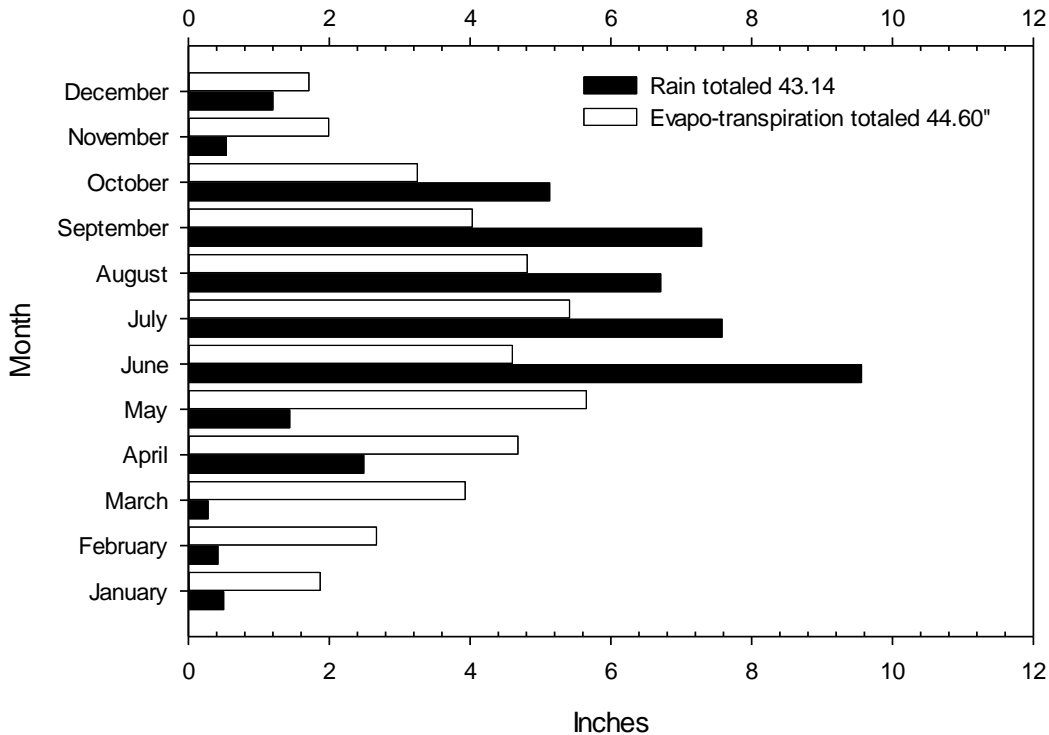


Figure 2. Monthly rainfall compared with evapo-transpiration during 2012. Cumulative rainfall = 43.14" and cumulative evapo-transpiration = 44.60".

Solar Radiation:

Daily solar radiation is shown in Table 2, and 2012 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 2012 (685.7 MJ) to produce approximately 9,806 lb/A of plant dry matter. Total solar radiation for 2012 was 7,022 MJ.

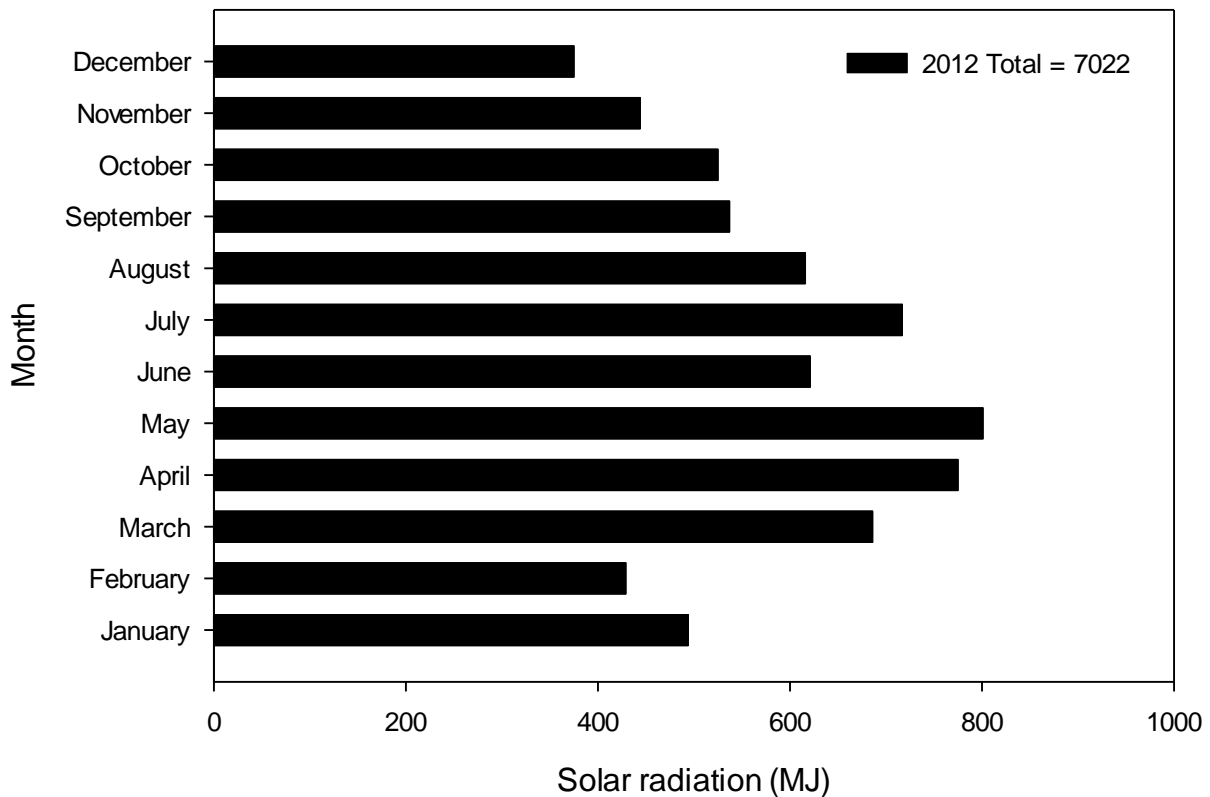


Figure 3. Total monthly solar radiation for 2012. Cumulative solar radiation in 2012 = 7,022 MJ (MJ = Joules x 1,000,000)

Temperature

Daily-low shelter temperatures at or below 32 °F were observed on seven days in 2012, with three events in January, two in February, and two in December (Table 3). The extreme low temperature for 2012 occurred on 4 and 5 January when shelter temperature reached 25.6 °F. on consecutive nights. Scattered frost begins when air temperature drops to 35 °F. Air temperatures at or below 35°F was observed only one additional day in 2012, resulting in widespread or scattered frost across the landscape (data not shown). Mean low

temperatures were lower than the 70-year means in January, April, and November in 2012 (Table 3). Overall, mean low temperature for 2012 was 0.6 °F higher than the 70-year mean.

Table 3. Summary of minimum temperature* for 2012 by month, Range Cattle REC.

| Month | Shelter† | | | | Ground level‡ | | |
|-----------|--------------------------|---------------------|-----------------------------|---------|------------------------|---------------------------------------|------|
| | 1944-2012 Avg. low | 2012 Avg. low | 1944-2012 Extreme low | Year | 2012 Extreme low | 2012 Avg. low Extreme low | |
| | -----°F----- | | | | | -----°F----- | |
| January | 49.0 | 44.6 | 18.0 | 1981 | 25.6 | 48.0 | 29.6 |
| February | 50.5 | 55.0 | 23.8 | 2009 | 30.4 | 58.5 | 33.3 |
| March | 54.3 | 56.2 | 26.0 | 1980 | 35.2 | 69.1 | 63.6 |
| April | 58.0 | 57.0 | 34.0 | 1971 | 41.8 | 70.9 | 64.5 |
| May | 63.3 | 65.3 | 43.0 | 1945 | 59.2 | 76.4 | 73.6 |
| June | 69.0 | 70.2 | 52.0 | 1984 | 64.5 | 77.7 | 75.2 |
| July | 71.3 | 72.2 | 62.0 | several | 69.1 | 80.1 | 77.7 |
| August | 71.9 | 73.0 | 61.0 | 1977 | 69.6 | 80.2 | 71.3 |
| September | 71.1 | 71.7 | 51.0 | 1962 | 67.0 | 78.9 | 77.0 |
| October | 64.7 | 66.6 | 37.5 | 2008 | 46.1 | 75.4 | 65.7 |
| November | 56.7 | 52.9 | 25.0 | 1970 | 40.6 | 64.7 | 32.9 |
| December | 51.2 | 52.8 | 20.0 | 1962 | 31.0 | 64.2 | 55.8 |
| Average | 60.9 | 61.5 | | | 48.3 | 70.3 | 66 |

*°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.

Freeze hazard

The fall and spring freeze hazards for the Range Cattle REC are shown in Figure 4. The spring freeze hazard estimates the likelihood of temperatures reaching below the critical temperature after a selected date, while the fall freeze hazard estimates the likelihood of experiencing the first attainment of a critical temperature before a selected date. Based on records from 1960 to 2011, 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, one should expect approximately a 50% chance of survival of a frost-susceptible crop (assuming 32 °F) planted before the 1st of February (Figure 4-B). A grower has a significant likelihood of experiencing five crop frosts over ten years by planting before the 1st of February.

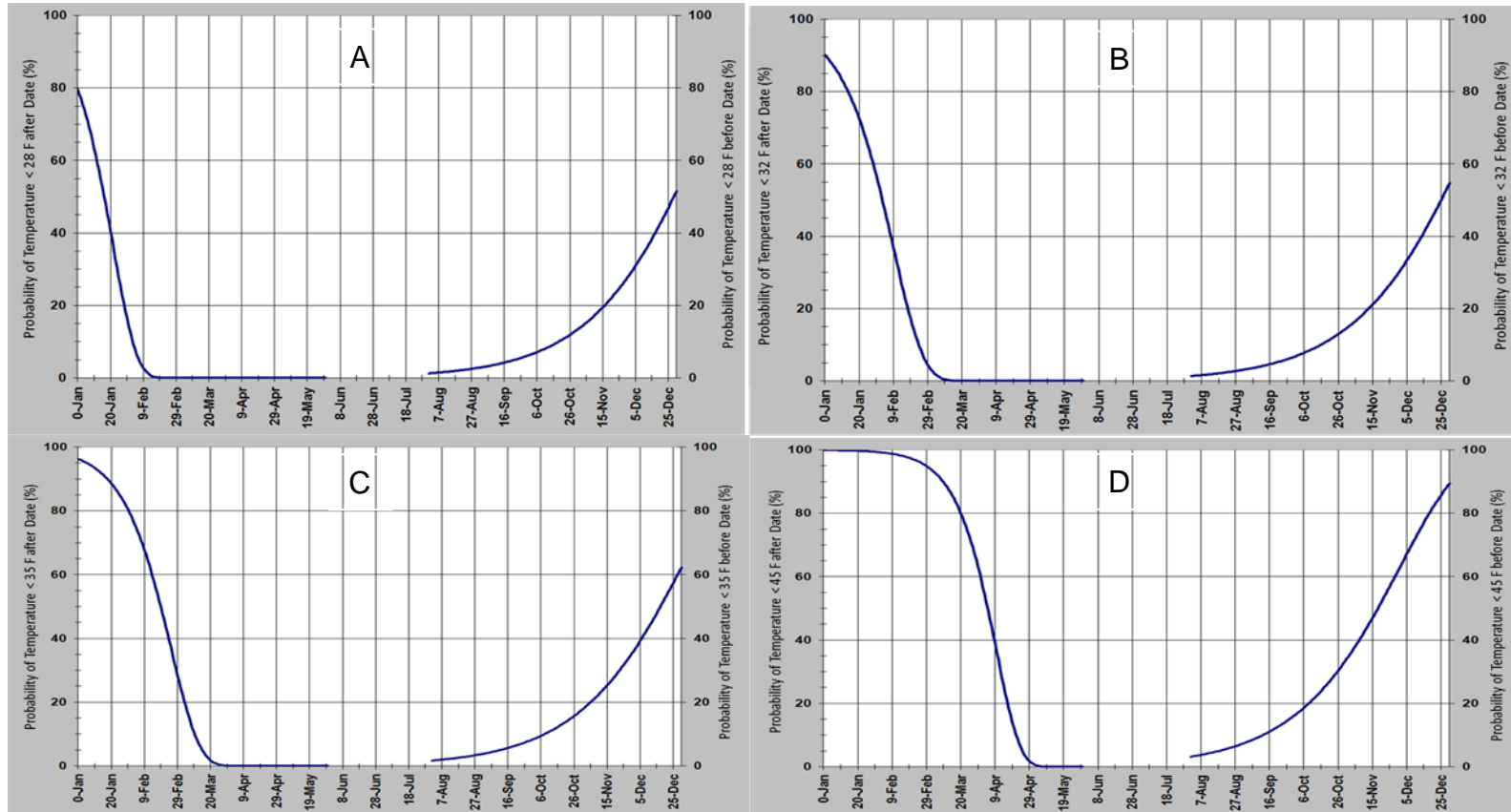


Figure 4. Spring and fall freeze hazard showing temperature probabilities after the spring date and before the fall date. Trend lines for temperature probabilities <28 °F (A), <32 °F (B), <35 °F (C), and <45 °F (D). Graphs were constructed using minimum temperature data from 1960 – 2010 using FRISKNH as developed by R. Snyder and J. Paulo de Melo-Abreu and can be accessed at <http://biomet.ucdavis.edu/frost-protection.html>

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