# Richardson's Rainfall Analysis

## *–How Much Rain You're Likely to Get and When*

*By Sam Bingham*

"Well, we'd do all right if we just got the rain the way we used to." Old timers in agriculture were saying this long before scientists made any noise about global warming. But how much do you really know about the rainfall in your area?

In Holistic Management, we never fail to point out that much complaining is directed at "virtual droughts" caused by bad management that has rendered rain ineffective. Nevertheless, real droughts do happen, and, as in poker, knowing when to hold your cards and when to fold is the difference between winning and losing. Certified Educator Dick Richardson of South Africa has worked out a system for organizing local rainfall data in a graphical way that helps when making this call—when deciding whether to destock now or to pray for rain and wait till next week, for example.

Richardson advises reckoning your odds first, then acting, and *then* praying. At the very least, just going through his analysis will clarify your personal relationship with the rain gods, and pinning down your reasonable expectations improves planning of growing season recovery periods, allocation of dormant season forage, and animal days of drought reserve. As Dick puts it:

"I developed this rainfall analysis after burning my fingers in a serious drought while managing for my father in the Vryburg area of South Africa. I was chasing rainfall with my stock numbers—a mistake soundly warned against by Allan Savory. Also, I had no systematic way to correlate stock numbers and planning dates with rainfall. I was saved by selling stock and by being able to join together and carefully manipulate a large group of stock and thread it through the remaining food and actually gain condition and save the calf crop.

"We always face the possibility of being caught unawares by an unprecedented situation, so this analysis doesn't make you foolproof. This happened in South Africa's last drought where 13 months without rain topped the previous worst by about 75 days. Conversely, the exercise that follows would have allowed anyone to plan around the recent serious drought in neighboring Namibia. All the signs were there to be seen, and it wasn't as bad as 1945 when there were between 21 and 22 months without any rain sufficient to support growth. In Namibia in 1996 there was sufficient rain for growth in at least one month in most areas, and that would have produced adequate forage from the land had the soil been prepared, the management holistic, and the stock numbers right."

The charts used with this article were all done with Microsoft's Excel program, and a computer can save you time. On the other hand, I spent a full day relearning what I'd just forgotten about Excel and would have come out ahead with a few sheets of graph paper and a good eraser. Either way, just follow Dick's steps, and if you have problems, contact him at: Whole Concepts, P.O. Box 10440, Vorna Valley 1686, South Africa; e-mail: drichdsn@iafrica.com.

*continued on page 4*

# Richardson's Rainfall Analysis

*continued from page 3*

### Step 1 · Gather Records

You need good rainfall records, your own if possible, preferably daily and as far back as you can gather them, but anything is better than nothing. Different gauges on one farm can yield different data due to, for example, topographical features that cause minor rain shadows to occur at differing times of the year.

### Step 2 · Decide Parameters

Answer the following questions and think carefully when answering them. Being over-conservative or over-optimistic here affects the efficiency of the whole task. Also note that each area is so unique that for anyone to suggest guidelines here would be very dangerous.

1. How much rain within how many days will result in significant growth? You will need different parameters for different months depending on temperatures, wind, etc.

2. In most areas plants will stay dormant during some months even if it does rain (because of cold temperatures, for example). This rain counts, however, *if* it puts enough moisture in the ground to assure that significant growth starts when spring comes. If this can happen in your area, how much rain within how many days will it take to produce this effect?

3. When will spring growth start *if* moisture is present in the soil?

4. How long after a significant rain can you expect to have had significant growth?

### Step 3 · Draw up "Worksheet A"

Now, using a sheet of graph paper, create a worksheet like the one shown below in Step 4.

1. Across the top write the months of the year, starting with whatever month will put your main growing months in the middle of the chart. (The example in Step 4 is from South Africa. The chart starts with the month of September). Give each month two columns, each one representing half a month.

2. Put the seasons (not years) down the side.

3. Now put an X in each half-month in which sufficient rain fell in a short enough period to support significant growth, according to parameter 1 in Step 2. Leave all other months blank.

4. Where enough rain fell in the non-growing season to support significant growth when spring comes, according to parameter 2, put an X and extend an arrow from the X to the point where growth will start according to parameter 3.

5. Complete this for all the seasons for which you have records.

6. In the last column on the right, record total rainfall for the season.

### Step 4 · Graph the Odds

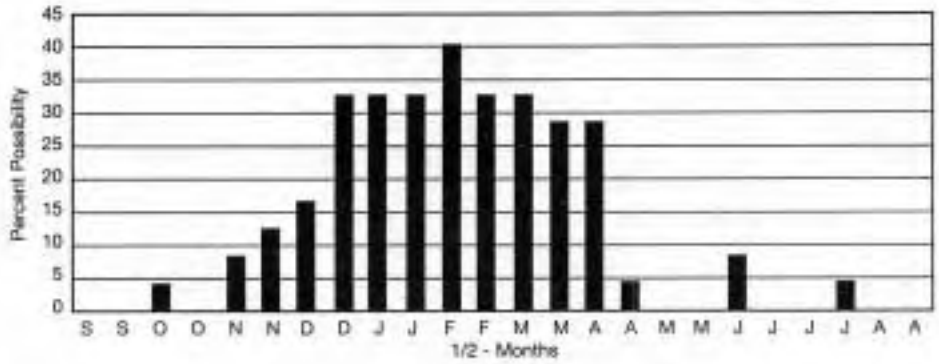
1. Total the number of X's in each half-month column in an empty row at the bottom of Worksheet A.

2. Below that, use these numbers to calculate what percentage of the half-months in the total record got growth-producing rain. In the example here the second half of December scored eight out of 25 times, which is 32 percent.

**Worksheet A**

| Season | S | S | O | O | N | N | D | D | J | J | F | F | M | M | A | A | M | M | J | J | J | J | A | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 71/72 | | | | | | | | | X | X | X | | | | | | | | | | | | | |
| 72/73 | | | | | | | | | | | | X | X | X | X | X | | | | | | | | |
| 73/74 | | | | | | | | X | X | | | X | | | | | | | | | | | | |
| | Calculations assume 25 years of data similar to the above | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 1 | | 2 | 3 | 4 | 8 | 8 | 8 | 10 | 8 | 8 | 7 | 7 | 1 | | | 2 | | | 1 | | |
| | | | 4 | | 8 | 12 | 16 | 32 | 32 | 32 | 40 | 32 | 32 | 28 | 28 | 4 | | | 8 | | | 4 | | |

3. Draw a bar graph of these percentages with the half-months along the horizontal axis and the percentage/odds up the vertical axis.



## Step 5 - Calculate the Length of the Dry/ Dormant Season

| Season | S | S | O | O | N | N | D | D | J | J | F | F | M | M | A | A | M | M | J | J | J | J | A | A | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 71/72 | | | | | | | | | X | X | X | | | | | | | | | | | | | | | 139 |
| 72/73 | | | | | | | | | | 12.5 | X | X | X | X | X | | | | | | | | | | | 218 |
| 73/74 | | | | | | 7.5 | X | X | | | X | | | | | | | | | | | | | | | 330 |
| 74/75 | | | | 8.5 | | X | X | X | X | X | | | X | | | | | | | | | | | | | 437 |
| 75/76 | | | | | | | | | | | | | | | | | | | | | | | | | | 77 |
| 76/77 | | | | | 20.5 | | X | X | | | | | | | | | | | | | | | | | | 165 |
| 77/78 | | | | | | 11.5 | X | X | | | | | X | | | | | | X | >>>>>>>>>>>> | | | | | | 240 |
| 78/79 | >6.5 | | | | | | X | X | X | X | X | X | | | | | | | | | | | X | >>>> | | 195 |
| 80/81 | >6.5 | | | | | | 3 | X | | | | | X | | | | | | | | | | | | | 328 |
| 81/82 | >6 | X | | | | | | | | | X | X | X | X | | | | | | | | | | | | 351 |

1. On Worksheet A, count up the months without X's between the last X in each season to the first X in the following season. Put the resulting number above (or before) the first X of the new season. *(Note that Excel doesn't let you record the number above the first X, so in the example shown here it appears just before the X).*

2. When you have an X in a non-growth month, count from the last X in a growth month to the end of the arrow where spring growth will start, thanks to the dormant season rain, and put your number there. [Note that in this example Dick has a second number for the 80/81 season, because in this case the off-season rain did not produce enough growth to last until the next rain. In later analysis he might decide to call this 9.5 months].

## Step 6 - Determine Your Planning Expectations

**Worksheet B**

| Col 1 | Col 2 | Col 3 | Col 4 |
|---|---|---|---|
| Months Dry | Number of times | Fraction | Cumulative Fraction (Threshold of "Normal") |
| 10.5 | 1 | 1/25 | |
| 11 | 2 | 2/25 | |
| 11.5 | 2 | 2/25 | 7/25 = 11.5 mo. dry less than 1 yr. in 4 |
| 12 | 2 | 2/25 | 1/5 = 12 mo. dry or worse about 1 yr. in 5 |
| 12.5 | 0 | 1/25 | 3/25 = 12.5 mo. dry or worse about 1 yr. in 8 |
| 13 | 1 | 1/25 | 2/25 = 13 mo. dry or worse about 1 yr. in 12 |
| 21 | 1 | 1/25 | 1/25 = 21 mo. dry one year out of 25 |

In this step you use information on Worksheet A to decide the levels of risk you want to govern your planning. Very brittle environments, by definition, will occasionally suffer very extreme droughts. If you planned enough reserve animal days every year to handle these cases (assuming this were possible) you would not be able to take full advantage of the average and better years.

A typical strategy is to allocate the standing forage in the dormant season to maximize animal performance during a "normal" season, and plan enough reserve capacity in animal days to hold you for some time after that without great loss in performance. Healthy land, with good litter cover and a diversity of species, will normally carry animals a considerable time after that, but both the land and the animals will suffer. Worksheet B helps you decide your own thresholds of "normal", "prudent reserve", and "survival" planning.

1. List the different rainless month totals from Worksheet A in ascending order in Column 1. Some totals will occur more than once, but you only enter them once.

2. Enter the number of times each total occurs in Column 2.

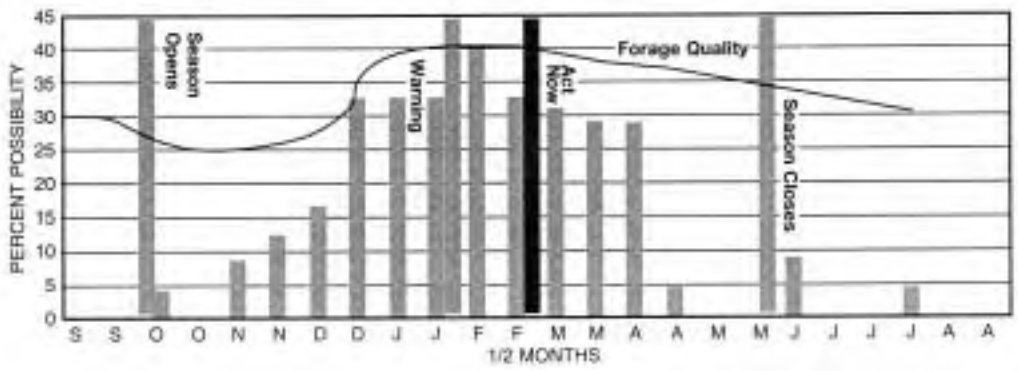
3. In Column 3 express the numbers in Column 2 as fractions of the total number of seasons on record. The example shown here covers 25 years. According to column 2, the dry season lasted 12 months two times. That is 2/25 of the seasons on record.

4. In Column 4, working from the bottom up, calculate the cumulative totals of the fractions in Column 3. This shows the proportion of years that go this long *or longer* without rain.

5. Study the scale of fractions (you might find it easier to compare them as decimals) until you can answer two questions.

A. What "normal" dormant season will I plan for? Is it the number of months I can count on three years in four? Four out of five?

B. What "time reserve" in animal days do I add to the plan? If I put in enough to carry my stock another month will I be covered seven years out of eight? Twenty-two out of 25? Do I plan two months of animal days?




## Step 7 - Plot the Forage Cycle

Now look carefully at the bar graph created in Step 4 and make some simple deductions, which you can draw in using different colors with a key underneath.

1. Draw a vertical line showing the most likely beginning of the growing season.

*continued on page 6*

# Richardson's Rainfall Analysis

*continued from page 5*

2. Draw a second vertical line showing the usual beginning of the dormant season.

3. Draw a curve showing the standard of available nutrition across the months. Don't worry too much about the scale. You will have to think in relative values rather than a fixed scale. This is best done by using overlays and creating a fodder flow diagram showing likely growth activity of your important fodder plants—grass, forbs, brush, and trees. You may want to show your grasses as two curves for warm and cool season plants. From the various overlays and personal knowledge of your land, finish up with your best estimation of a general available nutrition curve.

4. On an overlay, draw a curve that rises and falls according to the nutritional needs of the livestock throughout the year, and shift the curve along the graph to determine the best times to breed, calve, etc., so the available forage will complement the animals' needs.

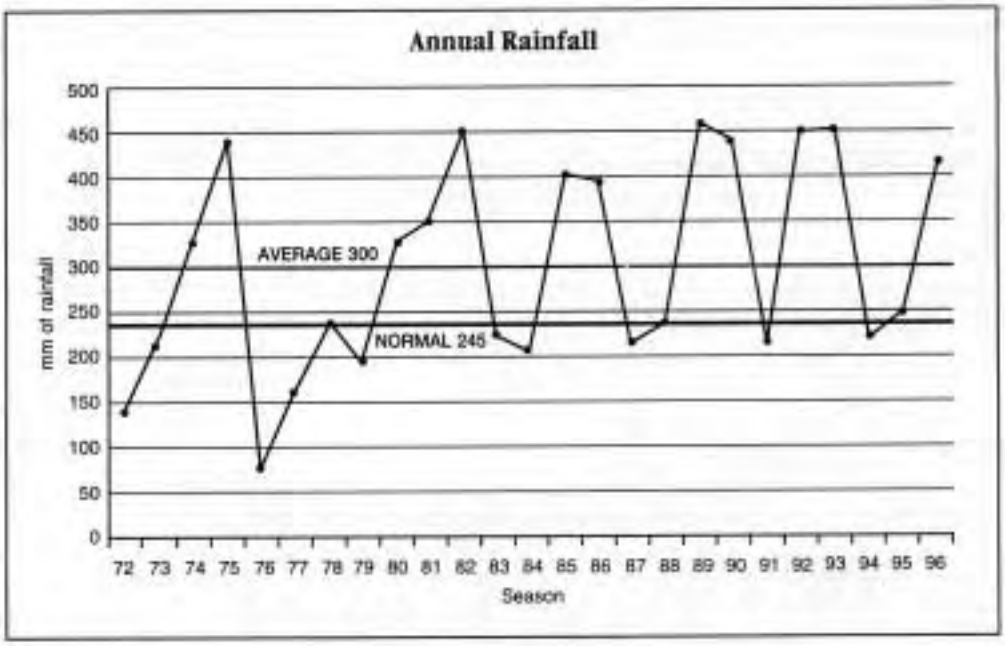
### Step 8 - Look for Patterns that Warn of Danger

Every region will have unique characteristics. Those with frost-free winters will differ considerably from colder climates. Monsoon areas may be easier to plot than others. Remember that the following observations come from one area in South Africa.

1. Using Worksheet A, find the latest month in which the dry/dormant season broke and mark it in color on the sheet. Check whether the total rainfall on the right was low. Go to the next latest, mark that, and check the total and so on until you find a point where it becomes obvious that if it hasn't rained (according to your parameters) by a certain date, it is going to be a poor season (late and low in total amount). Then you can mark on the graph a date that warns you that you must begin to reduce stock numbers for a poor season if it has not rained by that date. Remember that strategic destocking will allow you to a) carry more stock for longer, and b) sell that stock at a better price. The same advantages apply to leasing pasture, buying hay, etc.

2. You might also find some common denominator for long dry or dormant seasons (e.g., possibly a dry period in February/March) or long dry periods in the growing season (e.g., a dry November). For some areas, the rainfall bar graph may show two peaks—in late winter and mid summer, for example. Look carefully at individual years that failed to get the first peak. Next time that happens, is it a warning to plan for no rain until the second peak?

3. Step back and look at the whole picture created by the X's and blank spaces and look for important patterns and thresholds.




### Step 9 - Determine Your *Normal* (as opposed to *Average*) Rainfall

1. Draw a simple graph with the rainfall scale up the left axis and the seasons across the bottom, and plot each season's total rainfall. Cramming the seasons fairly close together will make the job easier.

2. Calculate the average and draw a horizontal line at that value.

3. Draw a second horizontal line that cuts through the greatest concentration of dots. That is "normal" and may differ substantially from the average if good years are very very good, or bad years very very bad.

4. Check your enterprise mix to make sure it fits in with your drought risk. For example, you may not want your breeding stock (or those animals you would not readily get rid of) to surpass what you can carry on this rainfall.

### Step 10 - Keep Up the Records

It is important to redo your analysis every season. You should not only update your database but also review your parameters (Step 2) according to your observations of actual growth following actual rainfall from each new season. Hopefully, the effectiveness of the rain and the ability of the land to respond will improve. Note that if you change your parameters, you must redo the whole exercise from scratch, because all the steps will change.