by John Goeser

Forage for when the water runs out

THE environment and ground we grow forage on continue to change each year. If the United States could allocate moisture from rainfall throughout the continent, growers would be in fantastic shape. Yet, this utopian idea is far from reality, as there is disproportionate rainfall from the East to West coasts.

This insight is far from newsworthy. Yet, the ways growers are adapting is. Growers in the central and eastern U.S. have experienced tumultuous growing seasons over the past five years. With excessive moisture, plant health and feed hygiene have suffered, but hybrid disease resistance and crop protection are further coming into focus for agronomists and growers. Turning our attention to the South and West, the growing environment has been a stark contrast.

Maximize efficiency

In these arid regions, growers rely on irrigation through the heart of the season. Corn grows well, but it carries a substantial water need. In some areas, water is available at a cost. In other regions, water is running out and may not be available at any price. As a result, progressive growers are seeking more water efficient crops that also can yield dairy-quality forage.

Water-use efficiency can be thought of like the appliance efficiency rating on your water heater or other home appliances. An appliance's efficiency rating relates to the energy required to get the job done. With forage, water-use efficiency ratings equate to the amount of water needed to grow the crop to harvest maturity.

Efficiency discussions are catching on with agribusinesses. For example, my Google news feed routinely suggests popular press articles exploring efficiency opportunities in farming. Efficiency in grain production is commonly discussed, but, with grain discussions, quantifying efficiency is much easier than with dairy forage production. This is because the yield for grain is quantified in bushels. Dairy or beef total yield at harvest maturity is also relatively simple to determine, but growers need to consider quality with their partial budgets and make decisions based upon digestible yield. More on this shortly.

Putting my University of Wisconsin academic hat on and searching through scientific published articles instead of the popular press, I found many useful references. To aid this discussion, I centered on one review article discussing pearl millet relative to corn and sorghum, which was published by Bishwoyog Bhattarai and his colleagues at Texas Tech University. The article discussed how the Ogallala Aquifer, which is tapped to irrigate crops in the Texas Panhandle, is rapidly drying up.

Grow forage with less water

Back to my earlier point — if growers continue with their current practices, irrigation will not be an option. The authors focused on water-use efficiency, recognizing that corn for silage requires 27 to 35 inches of water, whereas sorghum and pearl millet require 13 to 27 inches and 15 to 23 inches of water, respectively. Put differently, sorghum or pearl millet use less than two-thirds the amount of water relative to corn.

So, sorghum or pearl millet are more efficient with water, but does this translate into an economically efficient alternative forage? This has been the topic of interest in quite a few discussions involving growers and dairy producers.

In one exemplary discussion with a

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progressive grower, a couple of dairy producers, and a nutrition consultant, we brainstormed ways to better assess which alternative forages might be more economically sustainable for both the dairies and the grower. We had reasonable numbers on yield and crop production costs per acre, but we needed to estimate digestible yield per acre.

Consider nutrient yield

We mapped out how to calculate total digestible nutrient (TDN) value per ton, and then multiplied this by yield to determine "TDN yield" while using today's advanced forage analysis. This is the same basic approach taken in determining milk per acre with the Milk2006 spreadsheet. However, Milk2006 is now dated and does not consider the more accurate nutrient digestion measures today's nutritionist uses, such as total tract neutral detergent fiber (NDF) digestibility (TTNDFD), which was developed over the past decade by David Combs with the University of Wisconsin.

Work with your nutritionist to estimate TDN with each forage you are considering, and follow The Ohio State University's road map from Bill Wiess using summative energy equations. There are a few different ways to go about this, but the basic approach equates to summing up digestible nutrient amounts.

In our discussion, my crude approach was to use constant digestion coefficients for crude protein, sugar, and fat. Then we used in situ rumen starch digestibility at 7 hours (isSD7) and TTNDFD to determine total tract digestible starch and fiber, respectively. The resulting TDN% equated to summing these fractions:

- Digestible crude protein
- Digestible sugar
- Digestible fat
- NDF x TTNDFD (percent of NDF)
- Starch multiplied by total tract starch digestibility (percent of starch, determined from isSD7).

The TDN% values were all in the 60s, meaning that a little more than 6 tons out of every 10 tons of forage were actually digestible by high-performing cows. We then multiplied TDN% by yield (tons of dry matter) to robustly compare our options. We recognized that sorghum fell short of corn silage in TDN yield per acre.

Next, we considered production cost per acre and determined cost per ton of TDN. Here is where the gap narrowed, with alternatives costing considerably less per acre than corn. We only included corn for a benchmark in this exercise. We set out to determine the best corn alternative, recognizing that water availability was waning.

This is a fairly complex approach, but, in summary, make sure you cover these points in your discussion and budgeting:

- Production cost per acre
- Dry matter yield
- Total digestible nutrient percentage
- Calculated TDN yield
- Calculated cost per ton of TDN

The last bullet point is the key metric to compare your forage options, putting different options on the same playing field. Work with your nutritionist, agronomist,