# Agronomic Principles to Help with Farming During Drought Periods

Guide A-147

**John Idowu, Mark Marsalis, and Robert Flynn**

Cooperative Extension Service • College of Agricultural, Consumer and Environmental Sciences

## INTRODUCTION

Drought is defined as "a period of abnormally dry weather, sufficiently prolonged for the lack of water to cause serious hydrologic imbalance in the affected area" (Huschke, 1959, p. 180). Agriculturally, this means that the amount of water available can no longer meet the needs of the crops that are being grown.

Without enough water, there will be reduced yield or even total yield loss. Water allocations and usage will continue to be important issues that will likely hinder agricultural production in many regions of the Southwest in the short- and long-term future (Figure 1). In regions of New Mexico that depend solely upon underground water for irrigation (e.g., eastern plains), water resources are declining at an alarming rate and well capacity is becoming more and more restricted and limiting for crop production. Drought situations can be made worse by high temperatures like those experienced during the 2011 growing season. During 2011, New Mexico experienced an unusual number of days with high temperatures and no rain. High temperatures will lead to high amounts of evapotranspiration, requiring the need for more irrigation for crop use. If enough moisture is not available during such hot days, the crop becomes more stressed, and this can lead to severe yield reductions.

Incidences of drought have become more recurrent in the Southwest over the past decades. Therefore, farmers across New Mexico need to be prepared to effectively cope with drought in order to remain productive and profitable. This publication offers some suggestions that can help farmers develop strategies to cope with drought.

***Figure 1.* A lack of available water combined with high temperatures can cause severe problems for agricultural production.**

## GOOD PLANNING

Since a drought situation is not "business as usual," there is a need for a carefully planned strategy on how best to utilize the water that is available. An important consideration is to analyze the economics of the situation since it is different from normal years. The focus should be to optimize your economic returns with the water that is available. Don't be too ambitious, hoping that the situation will improve through in-season rainfall. Plan **ONLY** for the water that you have or are assured of receiving. It is critical that you know exactly how much water you are capable of applying at any one time and over the duration of the growing season. This may involve a re-evaluation of your irrigation system (e.g., well capacity and nozzle package for sprinkler systems). It is also very important to know how much economic return will come from each inch of water that is applied. This will vary by crop grown and the market available for that crop in your region. If you need help with your plan, contact your county Cooperative Extension Agent, certified crop adviser (www.certifiedcropadviser.org), or irrigation specialist who

[1]Respectively, Extension Agronomist, Department of Extension Plant Sciences; Interim Superintendent, Agricultural Science Center at Clovis; and Extension Agronomist, Agricultural Science Center at Artesia, New Mexico State University.

can provide you with more information on crop selection and other inputs required for production.

## SCALE BACK ON ACREAGE TO BE PLANTED

One of the ways to cope with drought is by scaling back on the acreage to be planted during the season. Calculate the amount of acres that your water allotment can successfully support and limit your production to that acreage. Know what the maximum water use for your crop is during the peak water demand time of the season and adjust acres down to meet this demand (e.g., minimum gallons per minute/ac to replenish amount used daily). Research at NMSU's Agricultural Science Center at Artesia has shown that providing water for longer periods of time (e.g., reducing irrigated acres in order to move sprinklers less frequently) and giving the plants optimal water resulted in higher water-use efficiency and gross returns per acre. In contrast, by spreading out the water over more acres (e.g., having to move the water more frequently), alfalfa was less productive on those acres and total yields and returns decreased (Flynn and Marsalis, 2012).

After scaling back the acreage, the rest of the land that is not used for farming can be left to fallow until the water situation becomes better. This period can also be used to control stubborn weeds present in the unutilized field. Make sure that you concentrate your farming on the most productive fields on your farm, since such lands are likely to be more resilient against drought conditions and will give you the best possible chance of success. Non-sandy and non-clay soils that are deep (>24 inches) may have the capacity to store sufficient water for plant growth depending on individual circumstances. The web soil survey can give you an initial idea of the water storage capacity you may have in the soil (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm). A loamy soil, for example, can hold 1.58 inches of plant-available water in the top 12 inches with 1% organic matter and 1 mmhos/cm salinity. A sandy loam soil, on the other hand, has approximately 1.06 inches of plant-available water under the same organic matter and salinity conditions.

## MOVE AWAY FROM WATER-INTENSIVE CROPS

Forage crops such as alfalfa and corn have very high demands for water. In situations with limited water, it becomes difficult to raise these crops with a high level of output. An alternative is to transition temporarily to crops that consume less water and are more drought-tolerant, such as sorghum and millet (Table 1). When water conditions become favorable again for high water-use crops, acreage of those can be increased.

This can be done with alfalfa without much problem. For example, a study at Tucumcari, NM, showed that alfalfa can recover fully after more than a year of no irrigation to a level similar to what it was before irrigation was halted (Lauriault et al., 2009). Alfalfa is a cool-season crop and, as such, is more water-use efficient early in the growing season before extreme temperatures occur (e.g., cuts 1 and 2). Limited water should be focused on these early cuts to maximize yield and nutritive value of the alfalfa. Later in the summer, water can be shifted to other land for irrigating a crop such as sorghum x sudangrass (SxS) or millet, which will be more efficient at converting the water into yield. (For more information on these crops, see Guides A-332, *Sorghum Forage Production in New Mexico* [http://aces.nmsu.edu/pubs/_a/a-332.pdf], and A-417, *Millets for Forage and Grain in New Mexico and West Texas* [http://aces.nmsu.edu/pubs/_a/A-417.pdf].) Other studies have shown that with limited irrigation, alfalfa yields decline as the season progresses in a 6-cut system. During times of high hay/feed prices, even growing a lower-valued crop such as SxS can be profitable. At 2012 prices, in fact, the return per inch of applied water in mid-summer is greater per acre on SxS or millet strictly due to their greater water-use efficiency. This is just one example of how using multiple crops can help spread out risk and provide flexibility during drought. Cotton also consumes less water and is drought-tolerant (Table 1). It is important to note that some crops may consume less water but may not be drought-tolerant (Table 1). Crop water needs can vary within a wide range and are often dependent on location, crop variety, soil conditions, pests, and weed and disease pressure.

## SELECT EARLY MATURING AND DROUGHT-TOLERANT VARIETIES

Early maturing and drought-tolerant varieties can also help growers cope with drought. It is good to carefully select crop varieties that will mature earlier in the growing season. Although varieties that mature later tend to have higher yields, during a drought the yield advantage may be lost due to insufficient water. In fact, total yield failure can occur if water is not available during the critical stages of growth (Table 1). In addition, planting dates can be adjusted so that plants are not going through critical growth stages during periods of extreme heat and wind. Examples of critical growth stages are during flowering and seed filling (Table 1). Another option is to select crop varieties that are drought-tolerant. Drought tolerance indicates the ability of a crop to withstand moisture stress and still be able to produce yield, although the yield may be lower than expected under normal moisture conditions. Currently, varieties

**Table 1. Critical Periods for Irrigating Different Crops and Their Levels of Sensitivity to Drought**

| Crop | Critical Period for Irrigation | Sensitivity to Drought* |
|---|---|---|
| Alfalfa | Entire season; early spring water use most efficient | low-medium |
| Barley/Oats/Wheat | Boot to early grain fill | medium |
| Peas/Beans | Flowering and pod fill | medium-high |
| Cotton | Bloom and boll maturation | low |
| Corn | Tasseling through early grain fill | medium-high |
| Peanuts | Flowering/pegging to pod formation | medium |
| Peppers/Chile | Flowering and fruit development | medium-high |
| Sorghum/Millet | Just prior to boot through flowering | low |
| Sunflower | Heading, flowering, and pollination | low-medium |

*Adapted from Brouwer and Heibloem (1986).

of alfalfa and corn are available on the market that have exhibited better performance under dry conditions than many of their earlier released counterparts. It is also important to know which varieties perform best in your part of the state. Variety trial results are available for various crops grown throughout New Mexico (http://aces.nmsu.edu/pubs/variety_trials/welcome.html).

## WATCH OUT FOR SALINITY

Because available water is scarce during a drought, there is tendency to irrigate without also thinking about leaching the accumulated salts from the soil surface. It is important to note that a build-up of salts can occur on the farm if insufficient water is applied to leach out the excess salts. Salt accumulation can affect yields and crop quality. To avoid soil salinity issues you should know the quality of your water and calculate the leaching requirement along with the crop demands for water. Soil and irrigation water testing can help to estimate the amount of extra water needed to prevent salt accumulation in the soil surface. When testing for soil salinity, be sure to ask for a salinity assessment test. The assessment will usually include the saturated paste extract for determining salinity and soil pH. The sodium adsorption ratio is also determined from this extract and is useful for making management decisions. More detail on salinity and sodicity can be found in Circular 656, *An Introduction to Soil Salinity and Sodium Issues in New Mexico* (http://aces.nmsu.edu/pubs/_circulars/CR656.pdf).

Testing for irrigation water quality is also important because it can affect soil characteristics in the long term and consequently affect crop growth and yields. More information on water quality testing to assist with evaluating irrigation water can be found in Guide W-102, *Irrigation Water Analysis and Interpretation* (http://aces.nmsu.edu/pubs/_water/Guide_W-102.pdf).

## PROPERLY SCHEDULE IRRIGATION

If possible, schedule your irrigation during early morning or late evening (between 7p m and 7a m) to avoid evaporation losses. Temperatures are higher during the day, and this can lead to excessive water losses, thus reducing the overall efficiency of the irrigation system. However, scheduling irrigation during early morning or late evening may not be practicable for some production systems due to crop type and logistics of operation.

## USE REDUCED TILLAGE PRACTICES

Compared to conventional plowing and disking, reduced tillage has been shown to help conserve soil moisture and improve soil health (Magdoff and van Es, 2009). Reduced tillage emphasizes a reduction in the depth and total area of the farmland that is being intensively tilled. For example, in strip- or zone-till systems, only the planting rows are intensively broken up by tillage tools, while the soil in between the strips or zones is left intact. Since only the strips are tilled, this effectively reduces the total area of the field that experiences intensive tillage (Magdoff and van Es, 2009), leaves more residue on the soil surface, and reduces the number of field passes. The driving force behind the benefits of the reduced tillage system is the increase in the soil organic matter content that occurs over time, and this in turn affects many important soil functions and processes (Reicosky et al., 1995). There are many reduced tillage options available to farmers, such as strip-till, no-till, zone-till, chiseling, and permanent beds. The type of reduced tillage that will fit each farming operation will vary. Some reduced tillage methods may involve acquiring new tillage tools. Therefore, reducing tillage should be seen as a long-term strategy to conserve moisture and improve soil quality (Magdoff and van Es, 2009).

## CONCLUSION

New Mexico's climate is normally hot and dry, but drought conditions and higher-than-average temperatures can make farming even more challenging. A variety of strategies can be used to ensure that your farm remains productive during drought.

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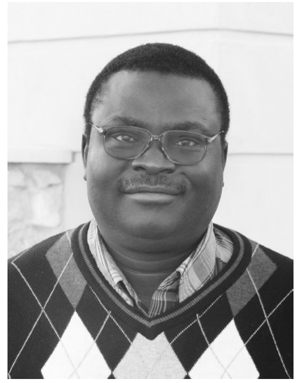


***John Idowu*** *is an Extension Agronomist in the Department of Extension Plant Sciences at NMSU. He earned his master's in agronomy from the University of Gottingen in Germany and his Ph.D. in land management from Cranfield University in the UK. His research and Extension activities are focused on sustainable crop production and soil management in New Mexico.*





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