Introduction
To determine which alternative crop or crops are best suited to a particular producer, it is necessary to determine the soil and climatic conditions under which the crop will be grown. This will influence the amount of probable yield, which impacts the possible economic returns.

What alternative crops will grow in my region?
The first step in determining what crops may succeed in the region is to become familiar with the dominant soil types. The dominant soil on any given acreage can be found by utilizing a tool provided by the U.S. Department of Agriculture on the Natural Resource Conservation Service’s website. The Web Soil Survey provides a tool for general farm planning and is located at http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm.

After water rights, the land itself is probably the most valuable agricultural asset owned by producers. The main parameter shown on the soil survey report is the Official Soil Series Description name or names and the extent to which it occurs in the area of interest. By utilizing the Soil Data Explorer tab on the website, extensive information about all soils that occur in the area of interest can be found, including suitability for differing crops or uses, estimated yield for each crop on each type of soil, and numerous physical parameters including usual pH levels and percentage of sand content.

What are lacustrine soils?
Fine soils derived from lacustrine sediment (found in or near lakes) are common in the Great Basin and can be saline and alkaline. A large portion of the agricultural land in the Great Basin was once underwater. During periods of the late Pleistocene (1.6 million to 10,000 years ago) when the climate was cooler and wetter than today, pluvial lakes, or lakes caused by large amounts of rainfall, occupied most of the topographically closed valleys of the Great Basin. The two largest of these, Lake Bonneville and Lake Lahontan, formed on opposite sides of the Great Basin. These two lakes incorporated multiple valleys and covered areas greater than 19,923 and 8,417 square miles, respectively (Caskey, 2004).

What issues arise from saline and alkaline soils?
Most plants have a limited tolerance for salty soils, and there are no supplements that can be added to the soil that will counteract the effects. Even for species that tolerate some degree of salinity, yields may be reduced as salinity increases. The level of acidity or alkalinity in soils is measured by pH on a scale of zero to 14, with seven indicating a neutral soil, measurements above seven indicating alkaline soil, and measurements below seven indicating acidic soil. Seven, or neutral, is the preferred pH for most plants. Alkaline soils reduce available nutrients, especially micronutrients needed for plant germination and growth. The alkalinity of soil can be brought closer to neutral by addition of organic material, such as peat or sphagnum.
peat moss, or by adding elemental sulfur, but these are costly and time-consuming processes. It is usually preferable to grow crops that tolerate slightly alkaline conditions.

**How can the salinity and pH of soil be determined?**
For data on a finer scale than that offered by the Web Soil Survey, there are two alternatives. Testing soil to determine the pH level is relatively easy, with kits being available at most home and garden centers. The preferred alternative is to take soil samples from several sections of the land and have them analyzed by a laboratory. This can be done using a soil probe or a simple shovel. Laboratory analysis has several advantages over the do-it-yourself kit: the laboratory tests for several components of the soil; it displays the results on an easy-to-read graph that classifies levels as very low, low, medium, high or very high, in addition to reporting results in parts per million (ppm); and it is able to make recommendations as to the type and amount of amendments that should be added based on the crops desired to be grown and the tonnage goals (if appropriate).

**How should soil samples be collected, where can they be sent, and how much does it cost?**
The most efficient way to collect soil samples is with a hollow tube soil probe. These are available at low cost online or by loan from some Cooperative Extension offices. Soil probes may give a more precise reading than using a shovel because of the composite material of the probe. Soil probes are either made from chrome-plated molybdenum or stainless steel, or are nickel plated, unlike shovels which are usually made of iron that can interfere with laboratory results. The first step for most producers will be to contact their local Extension Educator. The Extension Educator should be able to provide a list of soil testing laboratories and help describe the process. A 2006 study in Pershing County used GPS technology to create a gridded sampling design for a two-acre parcel; the 15 soil samples were then lab analyzed, resulting in costs of $35 per acre (Breazeale, 2007).

**What climate information is needed to assess the viability of an alternative crop in an area?**
A short list of some of the necessary information, along with the rationale, is provided below:

- **Temperature** – average minimum and maximum during the proposed planting periods to be compared with the tolerance of the proposed crop
- **Precipitation** – when and how much to determine needed irrigation amounts
- **Snowfall** – amount and timing
- **Snow depth** – most surface water in the Great Basin is dependent on snowmelt so the amount and timing of snowfall, along with snow depth, will influence the amount of surface water available for irrigation
- **Growing degree days (GDD)(40 F & 50 F)** – relationship between air temperature and plant growth measured in heat units
- **Spring freeze probabilities** – restricts earliest planting date
- **Fall freeze probabilities** – restricts latest harvest date
- **Freeze free probabilities** – average “window” of time during which growing may be possible
- **Precipitation duration probabilities** – how long the precipitation will last
- **Precipitation quantity probabilities** – both duration and quantity may adversely affect certain crops during a particular growth stage
- **Wind** – some crops are adversely affected by intense or prolonged wind events
Where can this information be obtained?
Climate information is available online from the Western Regional Climate Center operated by the Desert Research Institute. It covers all western states and has a listing of more than 2,800 weather stations at http://www.wrcc.dri.edu/Climsum.html. For producers in northern Nevada, the U.S. Bureau of Reclamation operates an agricultural weather network website, AgriMet, available at http://www.usbr.gov/pn/agrimet/.

Example information for western Nevada

<table>
<thead>
<tr>
<th>Location</th>
<th>GDD (50 degree base)</th>
<th>Frost Free Period (28.5 degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lovelock</td>
<td>2839</td>
<td>108-206</td>
</tr>
<tr>
<td>Fallon</td>
<td>2671</td>
<td>115-196</td>
</tr>
<tr>
<td>Yerington</td>
<td>2647</td>
<td>92-236</td>
</tr>
<tr>
<td>Smith Valley</td>
<td>2592</td>
<td>87-139</td>
</tr>
<tr>
<td>Orvada</td>
<td>2351</td>
<td>97-188</td>
</tr>
</tbody>
</table>

GDD - See previous page
Frost-Free Period - Number of days of the year when the temperature stays continuously above a given temperature

Has the crop under consideration been grown in this area before?
Increased knowledge reduces the amount of risk associated with any new venture. If someone else has attempted to grow this crop, there is knowledge that can be gained from that experience. The crop under consideration may have been grown by other producers or as a field trial by Extension or other government personnel. The best source for determining if the alternative crop has previously been grown in the area is to search the Cooperative Extension online at http://www.unce.unr.edu/publications and/or consult with Extension personnel. Another source for listings of possible alternative crops by state is the USDA’s plant database at http://plants.usda.gov/alt_crops.html.

Conclusions
Alternative low-water-use crops may be an option for producers to remain solvent in regions where water is scarce and agriculture is under social pressure to reduce use. Western states can sustain economic viability through increased knowledge of alternative, low-water-use crops and the associated decision-making tools of efficient water-recourse use within agricultural communities. Additional fact sheets on water, financials and assistance with alternative crops are available through Cooperative Extension at http://www.unce.unr.edu/publications/.

References


