Estimating Water Needs for Pecan Trees

Cooperative Extension Service
College of Agriculture and Home Economics

Guide H-636 • PH 4-200

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This publication is scheduled to be updated and reissued 4/05.

SOIL WATER-HOLDING CAPACITY

The first step in understanding the water needs of a pecan orchard is knowing how much water can be stored in the root zone of the tree. If you are not sure of the water-holding capacity of your soil, contact your local Soil Conservation Service work unit for an evaluation. They can furnish you with a reliable estimate after a field visit, or by using existing soil survey maps.

Generally, sandy soils can store only about 1 inch of water per foot of depth. Heavy soils, such as clays, can store more than twice that much, or 2.7 inches per foot of depth. Loams, which are mixtures of sands, clays, and silts in varying proportions, will fall in a range between 1 and 2.7 inches per foot of depth.

Information on soil types and root zone depth of your trees will give a realistic amount of water that can be applied at any one irrigation without causing water to be lost by seeping to depths deeper than the roots can reach. Growers should check the soil moisture depth after each irrigation. Water should penetrate at least three feet.

TREE WATER USAGE

Pecan trees extract the moisture they need from soil in the root zone daily during the growing season. The amount a tree withdraws may vary from a gallon or less for a young tree to as much as 150–250 gallons per day in a fully mature tree. This water demand is the tree's peak (maximum) water use on the hottest day of the summer. Water consumption is decreased before and after this maximum use. "Consumptive use" is generally expressed in a withdrawal rate of a fractional amount of an inch of water per day for an area, enclosed by the drip line for a small tree or the total field for a mature orchard. Consumptive use varies with the tree's growth and its stage of the nut-bearing cycle, but it generally falls in a range of 1/4" per day in the early season to a maximum of 1/2" per day during the month of August in Las Cruces area, which occurs at the nut's watery stage.

Consumptive use by pecans varies with different geographic areas and climate conditions, but growers should plan for the possibility of applying the maximum amount which might be needed at the most critical time.

As soil moisture is depleted, it becomes more difficult for plant roots to extract needed moisture. When about 50% has been depleted, soil moisture must be replaced. In addition to reducing plant stress, this also gives leeway in watering operations with respect to the time required to cover the orchard.

CALCULATING WATER NEEDS

To illustrate the calculation of water needs, assume that you have a fully mature orchard using 0.4" of water per day on a 10–acre plot of loamed ground that can hold 2" of water per foot of depth. The effective root zone is 3 feet.

If the field has been irrigated to a depth of 3 feet, it contains (3) × (2) = 6" of available moisture that is being extracted at the rate of 0.4" per day. To re-irrigate when about 50% of the soil moisture has been depleted, schedule an irrigation 8 days later, when 3" or more would have been depleted and should be replaced.

This example assumes 100% application efficiency, which is only theoretically possible. If your application efficiency is 60% (which is more realistic for a flood system), apply 3" ÷ 0.6, or 5" of water, to supply the required amount to the soil. Irrigation efficiencies are site-specific, but they must be determined in calculating water needs.

The ideal water management efficiency for a pecan orchard, which calls for optimum water moisture available (no stresses), leading to maximum protection potential is difficult to achieve in practice. Stresses are often not visible and damage can occur. Using an infrared thermometer could help detect water stresses at an early stage. These stresses can then be corrected before any harm can occur.

Summer rainfall sometimes helps satisfy the water requirements, but most of the time in the arid Southwest, water from rainfall does not amount to much; growers, therefore, should not reduce the quantity of irrigation water needed.

Do not forget to allow extra water if it is salty. This is commonly referred to as the "leaching percentage:" the amount of extra water needed to flush salts out of the root zone. This amount also is site-specific, but it should be included in your calculations. Ten percent is a rough estimate for moderately saline water, but the amount should be calculated from the results of an irrigation water analysis.

To illustrate the best way to calculate water needs for a specific pecan orchard:

Question: *How many acres maximum can be watered with an 8" well if a pecan orchard needs about 4.5 acre feet of water (54")?*

Use the formula: $QT = a\,d$

where:

Q = ft^3/sec of water coming from the pump
T = hours to irrigate during the day
a = acres
d = depth (maximum irrigation needs during the year)

Assume a discharge of 1000 gallons per minute (GPM) (for an 8" well); knowing that 450 GPM = 1 ft^3/sec;
then 1000 GPM/450 GPM = 2.22 ft^3/sec for this well.

Q = 2.22;
T = 18 hours;
d = 0.4 inches
a = ?

To find a (acres), use the formula $QT = ad$:

$$2.22\ ft^3/sec \times 18 = a \times 0.4"$$

$$\frac{2.22 \times 18}{0.4} = 99.9\ (100\ acres)$$

Note: A general rule of thumb used by some growers is 10 GPM per acre.

To find more resources for your home, family, or business, visit the College of Agriculture and Home Economics on the World Wide Web at aces.nmsu.edu.

Reprinted April 1999 **Las Cruces, NM**
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