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Drying conditions in much of the fruit growing region sparks need to begin watering using micro-irrigation systems. Growers need to review the MSU Enviro-Weather website to collect valuable data for your area to determine irrigation scheduling.

A large area of Michigan is experiencing a below normal amount of precipitation that is supposed to last for a few weeks. Combined with low humidity, high winds and the beginning of canopy development, trees will be experiencing high stress. Fruit growers in Northern and Mid-Michigan are advised by Michigan State University Extension to begin irrigation due to the soil moisture status. The coarse droughty soils of many fruit growing sites are very dry. We are in the beginning stages of fruit development of apples and stone fruit. Moisture stress experienced at this time period can affect fruit thinning effectiveness and fruit set.

Fruits are in the cell division stage, which is critical to final fruit size. Moisture stress during cell division stage will limit numbers of cells and eventual fruit size, no matter how much water is given to trees later in the season. Also, moisture stress in this early period has an adverse effect on fruit set and drop (increases), which limits yield and tree vigor.

Determining when to irrigate

A grower can depend on determining when to water based on the feel of the hand method. Simply dig down to a depth of 12-16 inches. If the soil is still moist and you can readily ball soil up in the hand, there is probably adequate moisture.

There are many new electronic sensors which can be used to monitor soil moisture. Still, many folks like to use a combination of the soil feel method and soil tensiometer. Tensiometers, such as those sold by Irrometer Company and others, measure the amount of soil tension registered by the instrument; more tension – up to 1 atmosphere – would indicate more dryness. The tensiometer is used worldwide and works well for many soils. Not so reliable readings are experienced in soils that are extremely coarse or those that are extremely heavy, i.e., cracks in clay soil.

Generally, you can set up stations of tensiometers at different locations in your orchards at preferably 12 and 18 inches in depth to monitor soil moisture on a daily or weekly basis. The

tensiometers should be set half-way between the outer edge of the wetting zone of an emitter or sprinkler pattern, and the emitter. Many growers will begin watering and consider it critical when the tensiometer reads 0.30-0.40 atms. The type of irrigation system, soil conditions such as heavy versus light, and the crop will dictate the best point at which to initiate irrigation.

How much water to apply

How much water should you be applying to trees? If growers are using trickle irrigation, you can rely on a formula that is very useful in determining irrigation. Remember that trickle irrigation is a slow methodical means to supplying water and is not built for catch up. A useful formula for growers to use in combination with tensiometers and hand feel (soil moisture) is:

Water use per acre = Evapotranspiration x crop coefficient x area covered x 1 acre inch (gallons; 27,154)

There are different formulas used which all have their benefits and their faults. Two components of the formula are used in all; **Evapotranspiration** (PET) and **1 acre inch** (27,154 gallons). Evapotranspiration is the most critical value. The traditional method is to make daily measurements of a “Class A” pan and the amount of water that actually evaporates each day.

Peak ET during the growing season can be used to design irrigation systems. The values are estimated using an the modified Penman equation which considers sun, wind, temperature and humidity, according to Kincaid and Heermann, 1974. These values are known as Potential ET (PET) and are made available on the MSU Enviro-weather website for many of our fruit growing areas. The values are reported in PET in inches daily and cumulative. As a grower, you goal is to replace what is being lost via evapotranspiration.

The second component of the formula is **crop coefficient (CC)**. Each plant species differs in water uptake and also according to time of season. Values for each of the plant species are published by the Food and Agriculture Organization. Deciduous orchards are 0.70 early season, 0.90 mid-season and 0.30 late season. Grapes are 0.40 early season, 1.20 mid-season and 0. 60 late season. These values can be adjusted according to fruit stage development. For example, stone fruit need relatively little water during pit hardening (stage II). Providing excess water has little effect on fruit size, but encourages excessive shoot growth. Therefore, replace ET only at a 50-70 percent level, rather than 100 percent, during this period. Resume near 100 percent with stone fruit in the start of final fruit swell

(stage III).

Orchards and vineyards in Michigan often maintain a sod alleyway of grass. This formula takes into account the age of the trees and the amount of grass and other plant materials that cover the surface. The other plant materials are transpiring and using soil moisture. The formula then asks how much of the surface area is covered by plant material and identified as **area covered (AC).** The values are presented as per cent of area covered with plant material:

Young orchard completely tilled: 0.30-0.50
Young orchard with grass alleyway: 0.50-0.60
Orchard with only four to five wide herbicide strip over five years of age: 0.70-0.80
Mature orchard with minimal herbicide strip: 1.00

To show how this formula works, we can plug in some figures for an example orchard:

We have a young tall spindle apple orchard three to four years of age near Sparta, Michigan. Our current or predicted PET values according MSU Enviro-weather for June 12-17, 2014, are 0.18, 0.19, 0.15, 0.23, and 0.19 each day. So if we use 0.23 (highest ET) then:

0.23 (PET) x 0.80 (CC) x 0.50 (AC) x 27,154 = 2,498 gallons needed per acre

To calculate need per tree, divide by numbers of trees per acre at 1,210 trees per acre = 2.06 gallons per tree per day. You can calculate then how long to run your emitters to satisfy 100 percent of ET based on output of water per tree or emitter. **If** this were a case of cherries or peaches in pit hardening, such as in Southwest Michigan today, June 12, then we supply 50 percent of the this amount over the next couple weeks until stage III begins.

Comments

The daily evaporation rate can fluctuate. Many growers underestimate evapotranspiration rates in Michigan, likely due to windy conditions which can drive the system even under cool temperatures, in comparison to the West. Check irrigation systems to determine their actual output. Don't rely on literature or past collections for scheduling, regardless of the delivery system. Collect water in a container for a sample emitter or sprinkler over a predetermined time period and then extrapolate to gallons of water produced over a period of one hour. Do this for different parts of the system to determine variability. It is especially important to know exactly how much water is being delivered during this critical time.

Drought stress and its critical impact are accentuated for stone fruit and apple high density orchards. Trees on dwarfing stocks such as M.9 have concentrated (non-extensive) root systems that don't fully explore the soil profile for water. Secondly, we have found that these root systems are inefficient in absorbing soil moisture.

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