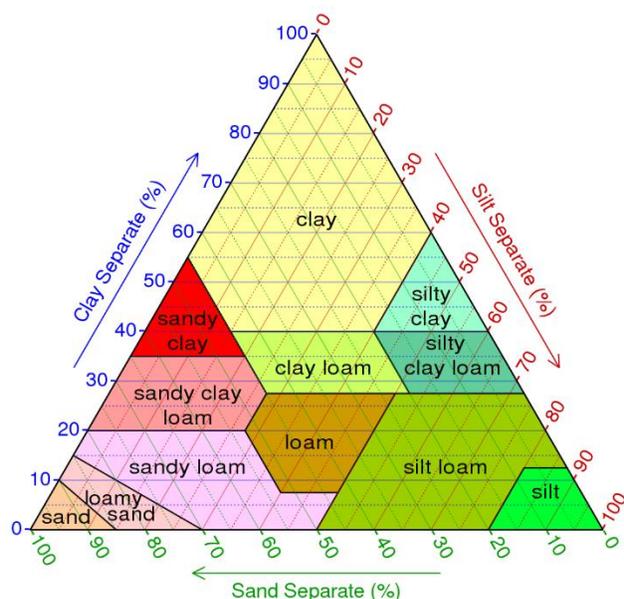


# Maximizing Irrigation Effectiveness – The Soil Connection

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Most vegetable growers, even those in high water states like Michigan, have learned the value of irrigation. It is one of the primary ways to reduce production risks, maximize yield, and stabilize year-to-year product output. Many Michigan fresh vegetable producers have utilized the combination of raised, plastic mulched beds with drip irrigation (plasticulture). These steps go a long way in helping maximize water and nutrient use efficiency. It is good to remember that water and nutrients cannot be separated, since wherever water goes so do the nutrients it carries.

Another important aspect to consider in any irrigation system is soil type. Unless you are growing hydroponically, water goes through soil first before the plant takes it up. Therefore, it is important to understand that in the process of irrigating, you are directly irrigating the soil and indirectly irrigating the plant, and how you irrigate soil depends on soil type.



[https://commons.wikimedia.org/wiki/File:SoilTexture\\_USDA.svg](https://commons.wikimedia.org/wiki/File:SoilTexture_USDA.svg)

As you move through the soil triangle from sand to silt to clay, how water behaves varies greatly. There are different rates of penetration, absorption, and retention. A dry clay can actually have more water than a wet sand; it is just not available to the plant. Soil and plants compete for water, and the soil will only allow the plant to have a certain amount before the soil's physical and chemical properties kick in and say, "Enough. You can't have anymore." A good indicator of how water will behave in soil is the soil's Cation Exchange Capacity (CEC).

Soil CECs range from near 1 for coarse beach sand (the lowest I have ever seen is 0.9) and goes up from there as the soil contains more silt, clay, and organic matter. Pure organic soils can have CECs over 100. This CEC number tells you a lot. It lets you know how anything you put in that soil will behave. This includes water, nutrients, herbicides, and other products. Low numbers mean there are fewer binding sites and anything you add to a soil having a lower number will move quickly into, through, and out of the soil. Higher numbers mean more binding sites and therefore slower penetration, and greater retention.

So how does this affect irrigation strategy and effectiveness? Water penetrates quickly in low CEC soils and therefore has little horizontal movement before moving vertically (down). In higher CEC soils, water will have greater horizontal movement before moving vertically. Irrigators should consider the following general irrigation strategy:

**Irrigating low CEC soils:**

- Apply water quickly
- Apply water for shorter times
- Apply water more often
- Use higher flow drip tape
- Use 12" emitter spacing

**Irrigating high CEC soils:**

- Apply water slowly
- Apply water for longer times
- Apply water less often
- Use low flow drip tape
- Use 16" or greater emitter spacing

The question then becomes, "At what number do I make the switch between irrigating for low CEC and high CEC?" Certainly, from an irrigation standpoint any soil with a CEC of 10 or below would be a low CEC soil and anything 20 or above would be a high CEC soil. The transition zone between 10 and 20 becomes difficult. Generally in glaciated states like Michigan, any field over five acres is rarely one soil type and, therefore, not one CEC number. So getting an average CEC might be helpful in making your irrigation decision. NRCS soil surveys can be of some help since they include percolation rates for various soil types ([websoilsurvey.sc.egov.usda.gov/App/HomePage.htm](http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm)).

My experience is that most producers tend to over irrigate just to be safe since they know under irrigating can lead to economic loss. However, over irrigating produces losses in other areas, such as nutrients leaching beyond the root zone, extra expense and wear on irrigation systems, and excess use of one of Michigan's most valuable assets – water. So, irrigate wisely and everyone benefits.

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