Use of Plastic Mulch

Black plastic mulch laid before planting helps control weeds, reduce root pruning, and give profitable increases in early yields of warm-season crops. Wavelength-selective and clear mulches typically lead to greater early yields than black plastic, but weed growth under these mulches may be a problem. This is particularly true for clear mulch. Because leaching is retarded, less fertilizer is lost, and nitrogen sidedressing is often unnecessary with the plastic mulch. If nitrogen needs to be added, it can be applied later through the irrigation system.

Try to lay plastic mulches as early in the season as possible. Mulches should be laid as soon as the ground can be worked after a heavy rain. Plastic mulches should be laid over moist soil. If the plastic is laid over dry soil, it will actually delay subsequent transplant growth. It is better to lay out plastic at midday so it can be stretched tight. However, do not overstretch the plastic because cool nights may actually cause it to tear.

The seedbed should be as fine as possible in order to get a good covering. The plastic is laid by burying about 6 inches of each edge. Black plastic mulch is most effective in warming the soil when it is in direct contact with the soil.

A disadvantage of plastic mulch is disposal at the end of the season. Many landfills do not accept plastic mulches. Photodegradable plastic mulches, which degrade into small pieces of plastic that remain in the environment, are available. Biodegradable plastic mulches that break down completely are available.

Irrigation and Water Management

Vegetables require an adequate supply of moisture throughout their entire growth. While the frequency and amount of water varies according to individual vegetable crop, its age, current soil moisture, soil type, and weather conditions, generally 1 to 1.5 acre inches of water are required each week.

Table 6. Effective Rooting Depth of Selected Vegetables

Shallow (6-12″)	Moderate (18-24″)	Deep (> 36″)
Beet	Cabbage, Brussels Sprouts	Asparagus
Broccoli	Cucumber	Lima Bean
Carrot	Eggplant	Pumpkin
Cauliflower	Muskmelon	Sweet Potato
Celery	Pea	Watermelon
Greens & Herbs	Potato	Squash, Winter
Onion	Snap Bean	
Pepper	Squash, Summer	
Radish	Sweet Corn	
Spinach	Tomato	

Table 7. Vegetable Crops and Growth Period Most Critical for Irrigation Requirements

Crop[1]	Most Critical Period
broccoli, cabbage, cauliflower, lettuce	head development
carrot, radish, beet, turnip	root enlargement
sweet corn	silking, tasseling, and ear development
cucumber, eggplant, pepper, melon, tomato	flowering, fruit set, and maturation
bean, pea	flowering, fruit set, and development
onion	bulb development
potato	tuber set and enlargement

[1] For transplants, transplanting and stand establishment represent a most critical period for adequate water.

The total available water holding capacity (AWHC) for a given location depends on soil texture, organic matter, and rooting depth. AWHC estimates are best obtained from the county soil survey or the local Soil and Water Conservation District office. Table 8 shows AWHC estimates for some typical soil textures in the upper Midwest. Irrigation should be initiated for most crops before 50 percent of the available water is removed by the plants in the active root zone. In most vegetable crops, the majority of the roots are usually within the top 6 to 18 inches of soil. When using a trickle irrigation system on shallow-rooted, water sensitive crops (lettuce, peppers, etc.), the allowable depletion is generally 20 to 25 percent of AWHC and the system is run more frequently. With deeper rooted, more drought-tolerant crops (tomatoes, melons), a higher depletion allowance can be used without loss of yield or quality.

Table 8. Available Water Holding Capacities for Several Soil Types

	Available Water Holding Capacity	
Soil Texture	**In Inches per Inch of Soil**	**In Inches per Foot of Soil**
Loamy fine sand	0.08-0.12	0.96-1.44
Sandy loam	0.10-0.18	1.20-2.16
Loam	0.14-0.22	1.68-2.64
Silt loam	0.18-0.23	2.16-2.76
Clay loam	0.16-0.18	1.92-2.16

Soil Water Monitoring

Two common ways of estimating soil water deficit to assist irrigation scheduling are:

1. Measuring soil water tension with soil moisture sensors
2. Measuring the feel and appearance of soil with a soil probe

Soil water tension can be monitored at a given point in the active root zone by electrical resistance moisture blocks or tensiometers. Soil tension or suction is a measurement usually expressed in centibars that describes how tightly water is held to the soil particles.

Tensiometers directly read soil tension between 0 and 80 centibars and work best in sandy loam or lighter textured soils. Resistance blocks work in a wider range of soil textures, and some types, such as Watermark sensors, work as well in lighter textured soils, as do tensiometers. If the soil texture is known, use Table 9 to estimate the inches of soil water deficit for a given tension reading; use Table 10 to estimate the point of 20 to 25 percent depletion.

For example, let's say you have a sandy loam soil that has an AWHC of 1.5 inches per foot. A tomato crop would be irrigated when 50 percent (or about 0.7 inch) has been depleted in the upper foot of soil, or when a 6-inch tensiometer reads 45 centibars (Table 9). If we use the same soil for another example, a trickle-irrigated pepper crop would be irrigated when 20 to 25 percent (or 0.3 inch) has been depleted in the upper foot soil, or a 6-inch tensiometer reads 22 centibars (Table 10).

To obtain representative soil tension readings with any sensor, the sensors should be left installed throughout the irrigation season and preferably at two or more locations in the field. Two depths are generally desired at each location. These depths should be about one-third and two-thirds of the active root zone, or about 6 and 12 inches.

The feel and appearance method involves collecting soil samples in the root zone with a probe or a spade. The soil water depletion of each sample can be estimated by feeling the soil and comparing its appearance to the description in Table 11. Soil samples should be taken from the top 6 to 12 inches in the root zone and at several locations in the field. Sum up the estimations from various depths for one location to estimate the total soil water depletion in the root zone. The operator must use this method frequently in order to perfect the art of consistently estimating soil water.

Your local Extension office will have more information on in-field soil moisture monitoring tools.

Table 9. Soil Water Deficit Estimates for Different Soil Textures and Selected Tensions

	Soil Tension in Centibars						
Soil Texture	**10**	**30**	**50**	**70**	**100**	**200**	**1,500**[1]
	Soil Water Deficit — Inches per Foot of Soil						
Coarse sands	0	0.1	0.2	0.3	0.4	0.6	0.7
Fine sands	0	0.3	0.4	0.6	0.7	0.9	1.1
Loamy sands	0	0.4	0.5	0.8	0.9	1.1	1.4
Sandy loam	0	0.5	0.7	0.9	1.0	1.3	1.7
Loam	0	0.2	0.5	0.8	1.0	1.6	2.4

[1] 1,500 cbs refers to the permanent wilting point and the soil deficit value is equal to the soil's total available water capacity.

Table 10. Soil Tension Values for Different Soil Textures For Use in Scheduling Trickle Irrigation

Soil Texture	0% Depletion of Available Water Holding Capacity (Field Capacity)[1]	20-25% Depletion of Available Water Holding Capacity[2]
	Soil Tension Values (in centibars)	
Sand, loamy sand	510	17-22
Sandy loam	10-20	22-27
Loam, silt loam	15-25	25-30
Clay loam, clay	20-40	35-45

[1] At field capacity the soil contains 100 percent of AWHC; any excess water in the rootzone has drained away.
[2] Start trickle irrigation for shallow-rooted crops at this point.

Information adapted from *New Jersey Commercial Vegetable Production Guide*, New Jersey Ag Expt. Station, Rutgers; and *Water Management in Drip-irrigated Vegetable Production* by T.K. Hartz, UC-Davis, Calif., Vegetable Research and Information Center.

Table 11. Guide for Judging Soil Water Deficit Based on Soil Feel and Appearance for Several Soil Textures

	Soil Texture Classification			
Moisture deficiency in./ft.	**Coarse (loamy sand)**	**Sandy (sandy loam)**	**Medium (loam)**	**Fine (clay loam)**
0.0	**(field capacity)** Leaves wet outline on hand when squeezed	**(field capacity)** Appears very dark, leaves wet outline on hand, makes a short ribbon	**(field capacity)** Appears very dark, leaves wet outline on hand, will ribbon out about one inch	**(field capacity)** Appears very dark, leaves slight moisture on hand when squeezed, will ribbon out about two inches
0.2				
0.4	Appears moist, makes a weak ball	Quite dark color, makes a hard ball	Dark color, forms a plastic ball, slicks when rubbed	Dark color will feel slick and ribbons easily
0.6	Appears slightly moist, sticks together slightly	Fairly dark color, makes a good ball	Quite dark, forms a hard ball	
0.8	Dry, loose, flows through fingers (wilting point)	Slightly dark color makes a weak ball		Quite dark, will make thick ribbon, may slick when rubbed
1.0		Lightly colored by moisture, will not ball	Fairly dark, forms a good ball	Fairly dark, makes a good ball
1.2			Slightly dark, forms weak ball	Will ball, small clods will flatten out rather than crumble
1.4		Very slight color due to moisture (wilting point)	Lightly colored, small clods crumble fairly easily	Slightly dark, clods crumble
1.6			Slight color due to moisture, small clods are hard (wilting point)	
1.8				Some darkness due to unavailable moisture, clods are hard, cracked (wilting point)
2.0				