

Fundamentals of Monitoring Soil Moisture with Surface Irrigation in Afghanistan



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Phases of Seedling Development that Require Different Watering Methods

1. Germination Phase (Seedlings begin to develop, moderate water need)

- If soil is too wet, seed will not germinate and rot
- If soil is too dry, seed will not germinate and dry out
- Check soil moisture depth at 0-3 cm
- Provide enough water to keep “seed zone” moist (soil will form a ball, but no wet outline of ball, and no water dripping)



Phases of Seedling Development That Require Different Watering Methods

2. Shoot Growth Phase (Seedlings actively growing, high water need)

- Too much water will drown seedlings
- Frequent, light irrigation will cause shallow root systems to develop
- Too little water will reduce shoot growth
- Too little water will kill seedlings
- Check soil moisture at depth of 0-30 cm
- Provide enough water to keep “root zone” moist (soil will form a ball, but no wet outline of a ball, and no water dripping)



Phases of Seedling Development that Require Different Watering Methods

3. Dormancy Phase (Seedling growth is slowing, moderate water need)

- Shoot growth is complete; buds are developing
- Roots and stem diameter are growing
- Plants are still using water; need to replace and store water
- Days are cooler and shorter
- Check soil moisture at depth of 0-30 cm
- Provide enough water to keep “root zone” moist (soil will form a ball, but no wet outline of a ball, and no water dripping)



Advantages of Surface Irrigation

- 1. Easy to install**
- 2. Easy to operate**
- 3. Provides uniform application of water**
- 4. Can provide good results**



Disadvantages of Surface Irrigation

1. May not be most efficient use of irrigation water for tree seedlings
2. Could increase root and foliar disease in tree seedlings
3. Could increase salt concentrations in the soil
4. Could create water-logged soil that could kill seedlings
5. If have clay soils, could reduce germination and seedling development
6. Field must be level for uniform application of irrigation water



Two common methods of surface irrigation in Afghanistan tree nurseries

1. Flood Irrigation



Advantages:

- Easy to install
- Easy to manage

Disadvantages:

- Uses much water
- Could drown seedlings
- Could drown seed

Two common methods of surface irrigation in Afghanistan tree nurseries

2. “Joya and Pushta” (Ditch and Mound)



Advantages:

- Uses less water than flood
- Seed is planted on raised beds (better chance to germinate and develop)
- Improved root development

Disadvantages:

- Requires more labor to prepare
- Requires more labor to maintain

Five Steps to Monitor Soil Moisture with Surface Irrigation

1. Insert Probe 30 cm into soil, and withdraw



Five Steps to Monitor Soil Moisture With Surface Irrigation

- 2. Squeeze the soil sample in your hand to form an irregularly shaped “ball.”**



Five Steps to Monitor Soil Moisture with Surface Irrigation

- 3. Squeeze soil sample out of your hand between thumb forefinger to form a ribbon.**



Five Steps to Monitor Soil Moisture with Surface Irrigation

4. Observe:

**soil texture, ability to ribbon,
firmness of soil ball, water shine,
soil/water stain on hand, soil color**



Five Steps to Monitor Soil Moisture Using Surface Irrigation

- 5. Compare observations with photographs
to estimate percent water available and
amount of irrigation needed**



Feel and Appearance of Clay Soil

<u>Degree of Moisture</u>	<u>Amount of Moisture</u>	<u>Description</u>	<u>Irrigation Needs</u>	
Low	0-25%	Crumbly; will not Hold together	3 – 6 cm	No photo
Fair	25-50%	Somewhat pliable, balls under pressure	2 – 4.5 cm	
Good	50-75%	Forms ball; ribbon between thumb and forefinger	1-3 cm	
Excellent	75-100%	Easily ribbons between fingers; has sticky or slick feeling	0-1.5 cm	
Wet (Field Capacity)	100%	Wet outline of ball is left on hand when squeezing	0 cm	No photo

Feel and Appearance of Loamy Soil

<u>Degree of Moisture</u>	<u>Amount of Moisture</u>	<u>Description</u>	<u>Irrigation Needs</u>	
Low	0-25%	Crumbly; will not Hold together	2.5 – 5.5 cm	No Photo
Fair	25-50%	Crumbly; hold Together with Pressure	2 – 4 cm	
Good	50-75%	Forms ball; somewhat Plastic; may stick Together with Pressure	1 – 2.5 cm	
Excellent	75-100%	Forms ball, pliable, Sticks if high in clay Content	0 – 1.5 cm	
Wet	100%	Wet outline of ball is Left on hand when squeezing	0 cm	No Photo

Feel and Appearance of Sandy Soil

<u>Degree of Moisture</u>	<u>Amount of Moisture</u>	<u>Description</u>	<u>Irrigation Needs</u>	
Low	0-25%	Crumbly; will not Hold together	1.5 - 3 cm	No photo
Fair	25-50%	Appears dry; will Not form ball with pressure.	.5 - 1.5 cm	
Good	50-75%	Appears dry; may form ball with pressure but seldom holds together	.75 – 2.5 cm	
Excellent	75-100%	Tends to stick together; may form weak ball, breaks easily, will not stick	0 - .75 cm	
Wet	100%	Wet outline of ball is left on hand when squeezing	0 cm	No photo

When to Determine Soil Moisture Levels

Using Feel and Appearance Method

Before Irrigation

- Take soil probe
- Determine soil moisture level by feel and appearance
- Soil moisture level should be “fair”
- Depth of irrigation water = enough water to reach 100% soil moisture

After Irrigation (1 hr > irrigation)

- Take soil probe
- Determine soil moisture level by feel and appearance
- Soil moisture level should be “excellent”





Example 1 (Clay Soil)



When (Before):
Morning soil probe

Feel/Appearance:
Somewhat pliable, balls under pressure

Moisture Level:
25-50%

Degree of Moisture:
Fair

Action:
Irrigate (2 – 4.5 cm depth)

When (After):
One hr > irrigation

Feel/Appearance:
Easily ribbons between fingers;
Has sticky or slick feeling

Moisture Level:
75-100%

Degree of Moisture:
Excellent

Action:
Irrigation complete

Example 2 (Clay Soil)

When:

Morning soil probe

Feel/Appearance:

Easily ribbons between fingers;
Has sticky or slick feeling



Moisture Level:

75-100%

Degree of Moisture:

Excellent

Action:

Irrigation not necessary

Regular Cultivation Will Improve Water Use in Nurseries

- Breaks soil crust for infiltration of water**
- Prevents run-off of irrigation water**
- Loosens soil for percolation of water**
- Removes competing vegetation**



With careful use of water and cultivation,
Afghanistan's Nurseries will make
Afghanistan Green Again

