

## Soybean Irrigation and Water Use

Total soybean water use in Missouri ranges from 15 – 25 inches depending on maturity group, planting date, weather, and location. It is important to keep moisture adequate, but not excessive, even in the late stages of soybean development because seed size and weight continues to increase. From beginning bloom to full seed in the pod the soybean plant will use 0.20 to 0.30 inches of water per day. Therefore, it is important to supplement any deficit in rainfall with irrigation.

**Table 1** gives the estimated water use per day and week based on the growth stages from germination through full maturity. **Table 2** provides a summary of water use in inches per day from bloom to maturity.

<b>Table 1</b> Estimated Soybean Water Use Various Stages of Growth		
Growth Stage	Inches Water per Day	Inches Water per Week
Germination & seedling	.05 - .10	0.35 – 0.70
Rapid Vegetative Growth	0.10 – 0.20	0.70 – 1.40
Flowering (R1) to Early Pod (R3)	0.20	1.40
Pod Development to pod fill (R4-R6)	0.25 – 0.35	1.75 – 2.45
Maturity (R7) to Harvest	0.05 – 0.20	0.3 – 1.40

<b>Table 2</b> Summary Soybean Water Use to Determine last Irrigation			
Days after Planting	Growth Stage	Inches Water per Day	Inches Water per Week
30 – 40	Bloom (R1-R2)	0.20	1.40
50-60	Early Pod (R3)	0.20	1.40
65-75	Elongated Pods (R4)	0.25	1.75
90-105	Seed Development (R5-R6)	0.30	2.10
102-116	Pods Change color (R7)	0.20	1.40
113-130	Mature (R8)	0.05	0.35

**Table 3** gives the water requirements based on growth stage and maturity beginning at full pod (R4) through maturity (R8).

<b>Table 3 Water Requirements for Soybeans Based on Various Stages of Growth and Maturity</b>				
Stage of Growth	Stage Title	Stage Description	Approx. No. Days to Maturity	Water Use to Maturity in Inches
R4	Full Pod	Pod $\frac{3}{4}$ " long on at least <u>one</u> of the four uppermost nodes with a fully developed leaf	50	8.5
R5	Beginning Seed	Beans can be felt when squeezing pods on any <u>one</u> of the four uppermost nodes with a fully developed leaf	40	5.5
R6	Full Seed	Beans are touching in any pod on <u>one</u> of the four uppermost nodes with a fully developed leaf	30	3.5
R6+		One-third of pods have touching beans	25	2.8
R6++		Two-third of pods have touching beans	20	2.2
R6+++		All pods have touching beans	15	1.6
R7	Beginning Maturity	Pod have reached its normal mature color on <u>one</u> of the four uppermost nodes with a fully developed leaf: 50% of the leave have turned yellow	10	1.0
R8	Full Maturity	95% of the pods have reached their full mature color	0	0.0

Soil moisture accounting is used to calculate the soil-water balance in the root zone throughout the growing season. This checkbook procedure keeps track of the water that enters and leaves the soil like an account balance is maintained in a checkbook. This procedure helps in scheduling supplemental irrigation. Several water use scheduling programs are available at the University of Missouri Extension Irrigation web site. <http://crops.missouri.edu/irrigation/>

**Table 4** gives the allowable moisture deficits based on various soil types, irrigation methods, and with and without hardpans. **Table 5** also gives the allowable moisture deficits for crops in addition to soybeans.

<b>Table 4</b> Allowable moisture deficits in inches for soybeans on various soil types, irrigation methods, and with and without hardpans				
Soil type	Without Hardpans		With hardpan above 10 inches	
	Pivot Deficit	Flood Deficit	Pivot Deficit	Flood Deficit
Coarse Sand	1.00	1.50	0.50	1.00
Fine Sand	1.50	2.00	1.00	1.50
Loamy Sand	1.50	2.00	1.00	1.50
Sandy Loam	1.75	2.25	1.00	1.50
Fine Sandy Loam	1.75	2.25	1.00	1.50
Very Fine Sandy Loam	1.75	2.25	1.00	1.50
Clay	1.50	2.00	1.00	1.50
Clay Loam	1.50	2.00	1.00	1.50
Silty Clay	2.00	2.50	1.25	1.75
Silty Clay Loam	2.00	2.50	1.25	1.75
Silt Loam	2.00	2.50	1.25	1.75

<b>Table 5</b> Allowable moisture deficits in inches for various crops and soil types for flood and center pivot irrigation with and without hardpans								
Soil type	Soybeans		Cotton		Milo		Corn	
	Flood	Pivot	Flood	Pivot	Flood	Pivot	Flood	Pivot
Sandy	2.00	1.50	2.00	1.50	2.00	1.50	1.50	1.00
Sandy Loam	2.25	1.75	2.50	2.00	2.50	2.00	1.75	1.25
Silt Loam wo/pan	2.50	2.00	2.50	2.00	3.00	2.50	2.00	1.50
Silt Loam w/pan	1.75	1.25	2.00	1.50	2.00	1.50	1.50	1.00
Clay	2.00	1.50	2.00	1.50	2.50	2.00	1.75	1.25
Wo/pan – without pan, without shallow restrictive layer								
W/pan – with pan, shallow restrictive layer at 10 inches or less below soil surface								

By combining end-of-season water requirements from tables 1-3, and the allowable moisture trigger deficits from tables 4-5, an estimate can be made when the last irrigation should be applied, assuming no rainfall.

In most cases the irrigation termination for soybeans should occur at full seed or growth stage R6. R6 can be identified by checking the pods at the four uppermost nodes on the main stem with a fully developed leaf. In general, if 2/3's of the pods have full-size "green beans" that are touching in the pods, then irrigation can be terminated. For clay loam soils, termination should occur when 1/3 of the pods have touching beans, and for coarse sands, when all the pods have touching beans.

**Table 6** summarizes what physiological stage soybeans should be at when the last irrigation should be applied based on soil type, irrigation method, and the presence of a hardpan.

Additional information on corn irrigation can be found at the University of Missouri Extension Irrigation web site. <http://crops.missouri.edu/irrigation/>

<b>Table 6 Summary Soybean Water Use to Determine last Irrigation based on Soil Type</b>				
	Without hardpan		With hardpan Above 10 inches	
Soil Type	Pivot	Flood	Pivot	Flood
Coarse Sand	R6 <sup>+++</sup>	R6 <sup>+</sup>	R7	R6 <sup>++</sup>
Fine Sand, Loamy Clay, Clay Loam	R6 <sup>+</sup>	R5 <sup>++</sup>	R6 <sup>++</sup>	R6 <sup>+</sup>
Sandy Loam, Fine Sandy Loam, Very Sandy Loam	R6 <sup>+</sup>	R5 <sup>++</sup>	R6 <sup>++</sup>	R6 <sup>+</sup>
Silty Clay, Silt Clay Loam, Silty Loam	R5 <sup>++</sup>	R5 <sup>+</sup>	R6 <sup>++</sup>	R6