Corn Irrigation and Water Use

Total corn water use in Missouri ranges from 20 – 35 inches depending on relative maturity of the hybrid, planting date, weather, and location. It is important to keep moisture adequate, but not excessive, even in the late stages of corn development because kernel weight continues to increase. From 3 weeks before silking to black layer, the corn plant will use 0.25 to 0.35 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 total water use based on the growth stages from seedling through maturity or black layer. **Table 2** provides a summary of water use in inches per day from emergence to maturity. **Table 3** gives a detailed estimate of water use for corn based on growth stages from research by Dr. Dewey Lee at the University of Georgia.

Table 1 Estimated Corn Water Use at Various Stages of Growth

Days After Planting	Growth Stage	Inches per Day	Total Water Use (inches)
0-20	seedling	.06	1.2
20-30	5”-10”	.09	0.9
30-40	10”-20”	.15	1.5
40-50	20”-50”	.20	2.0
50-60	50”-80”	.21	2.1
60-70	80”-silking	.25	2.5
70-100	silking-grainfill	.33	10.0
100-110	grainfill	.25	2.5
110-120	maturity	.23	2.3
0-120			25.0

Table 2 Summary Estimated Corn Water Use Days After Planting

Days After Planting	Growth Stage	Inches per Day
0-30	early plant growth	.05 - .10
30-60	rapid plant growth	.10 -.20
60-100	reproductive stage	.20 - .30
100-120	grain fill to maturity	.25 - .10

Table 3 Estimated Water Use of Corn in Georgia (115-119 day maturity) CREDIT: Dr. Dewey Lee, University of Georgia

Growth Stage	Days After Planting	Inches Per Day	Inches Per Week Equivalent
Emergence and primary root developing	0-7	.03	.21
	8-12	.05	.35
Two leaves expanded and nodal roots forming.	13-17	.07	.49
	18-22	.09	.63
Four to six leaves expanding. Growing point near surface.Other leaves and roots developing.	23-27	.12	.84
	28-32	.14	.98
	33-36	.17	1.19
Six to eight leaves.Tassel developing. Growing point above ground.	37-41	.19	1.33
	42-45	.21	1.48
Ten to twelve leaves expanded. Bottom 2-3 leaves lost. Stalks growing rapidly. Ear shoots developing. Potential kernel row number determined.	46-50	.23	1.61
	51-54	.25	1.75
Twelve to sixteen leaves. Kernels per row and size of ear determined. Tassel not visible but about full size. Top two ear shoots developing rapidly.	55-59	.27	1.89
	60-64	.29	2.03
Tassel emerging, ear shoots elongating.	65-69	.31	2.17
Pollination and silks emerging.	70-74	.32	2.24
	75-79	.33	2.31
Blister stage.	80-84	.33	2.31
Milk stage, rapid starch accumulation.	85-89	.34	2.38
Early dough stage, kernels rapidly increasing in weight.	90-94	.34	2.38
Dough stage.	95-99	.33	2.31
Early dent.	100-104	.30	2.10
Dent.	105-109	.27	1.89
Beginning black layer.	110-114	.24	1.68
Black layer (physiological maturity).	115-119	.21	1.48

Table 4 gives the water requirements based on growth stage and maturity beginning at blister kernel (R2) through maturity or black layer (R6). **Table 5** is a summary of water use in inches per day and per week from silking to maturity.

Table 4 Water Requirements for **Corn** Based on Various Stages of Growth and Maturity

Stage of Growth	Growth Stage	Approx. No. Days to Maturity	Water Use to Maturity in Inches
R2	Blister Kernel	45	12.0
R3	Milk	40	10.5
R4	Dough	33	8.0
R5	Beginning Dent	20	4.5
	¼ Milk Line	15	3.2
	½ Milk Line – Full Dent	10	2.0
	¾ Milk Line	5	1.0
R6	Physiological Maturity – Black Layer	0	0.0

Table 5 Summary Corn Water Use to Determine last Irrigation

Days after Planting	Growth Stage	Inches Water per Day	Inches Water per Week
60-70	Silking	0.25	1.75
70-100	Early Grain Fill	0.33	2.30
100-110	Mid Grain Fill	0.25	1.75
110-120	Maturity to Black Layer	0.23	1.60

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 6 gives the allowable moisture deficits based on various soil types, irrigation methods, and with and without hardpans. **Table 7** also gives the allowable moisture deficits for crops in addition to corn.

Table 6 Allowable moisture deficits in inches for corn on various soil types, irrigation methods, and with and without hardpans

	Without Hardpans		With hardpan above 10 inches	
Soil type	Pivot Deficit	Flood Deficit	Pivot Deficit	Flood Deficit
Coarse Sand	0.75	1.00	0.50	0.75
Fine Sand	1.00	1.50	0.75	1.00
Loamy Sand	1.00	1.50	0.75	1.00
Sandy Loam	1.25	1.75	1.00	1.25
Fine Sandy Loam	1.25	1.75	1.00	1.25
Very Fine Sandy Loam	1.25	1.75	1.00	1.25
Clay	1.25	1.75	1.00	1.25
Clay Loam	1.25	1.75	1.00	1.25
Silty Clay	1.50	2.00	1.00	1.50
Silty Clay Loam	1.50	2.00	1.00	1.50
Silt Loam	1.50	2.00	1.00	1.50

Table 7 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 1-5, and the allowable moisture trigger deficits from tables 6-7, an estimate can be made when the last irrigation should be applied, assuming no rainfall.

In most cases, the irrigation termination for corn should occur when the starch layer or milk line of a kernel of corn has moved over 50%. The milk line, begins to form in the kernels after denting begins.

The easiest way to determine the movement of the milk line is to pull off an ear, break the ear in half, take a kernel from the middle of the ear, and split the kernel with a sharp knife. The milk line is produced as hard starch is formed from the soft dough. The milk line begins to form in the kernels after denting begins. The milk line will start from the top of the kernel and move down toward the cob. The accumulated starch will be hard above the line but still soft below. Once the starch layer has moved over 50% down the kernel and the ground is moist, irrigation can be terminated in most cases. However, if the ground is dry (especially with pivot irrigation) one more irrigation is required.

Table 8 summarizes when this last irrigation should occur based on the movement of the milk line, in respect to soil type, irrigation method, and the presence of a hardpan.

Typically, black layer or physiological maturity occurs 7 to 14 days after 50% starch layer. However, this can vary depending on environmental conditions.

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

Table 8 Summary Corn Water Use to Determine last Irrigation based on Soil Type

	Without hardpan		With hardpan Above 10 inches	
Soil Type	Pivot	Flood	Pivot	Flood
Coarse Sand	½ Milk line	½ Milk line	¾ Milk line	½ Milk line
Fine Sand, Loamy Clay, Clay Loam	½ Milk line	¼ Milk line	½ Milk line	½ Milk line
Sandy Loam, Fine Sandy Loam, Very Sandy Loam	½ Milk line	¼ Milk line	½ Milk line	½ Milk line
Silty Clay, Silt Clay Loam, Silty Loam	¼ Milk line	Beginning dent	½ Milk line	¼ Milk line