SOIL WATER BALANCE SHEET

MICHIGAN STATE UNIVERSITY Extension

PURDUE UNIVERSITY

Field:_____Crop:_____Emergence date:_____

Pumping capacity:_____gpm per acre = _____net application inches per day

Available Water Capacity:_____inches in root zone of _____inches

Growth Stage:	Vegetative	Critical Growth	Maturing
Allowable Soil Water Deficit:	_____ % _____ inches	_____ % _____ inches	_____ % _____ inches

Starting Soil Water Deficit		SWD - CWU + Rainfall + Net Irr = New SWD

Date	Kc	Potential ET (PET)	Crop Water Use (CWU)= PET*Kc	Rainfall	Net Irri-gation (Net Irr)	Soil water deficit (SWD)	Notes

Continue on other sheets as necessary (make copies as needed)

Extra sheet Field:_____Crop:_____Page _____

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Background and Instructions Eniroweather has ET values by 6:00 AM each day to irrigators providing values of potential Evapo-transpiration (ET) for previous days and estimated values the current day and 7 days into the future.

Enviro-weather (*www.**enviroweather**.**msu**.edu*) can provide "potential ET" from your selected weather station, (look under water use tools low on the page for each individual station). The potential ET (PET) is based on how much water a well-watered grass would use each day. The amount of water used by the crop will depend on its stage of development (this is called the Kc values and are found on charts below The crop ET (Crop Water Use - CWU) is the potential ET x Kc which is added to the soil water deficit (SWD). By subtracting effective rainfall and net irrigation (Net Irr) and adding crop ET the current and projected soil water deficit can be estimated: SWD - CWU + Rainfall + Net Irr = New SWD. To complete the first row use the starting soil water deficit. Note that net irrigation should be adjusted for systems efficiency – set chart below. Correction to the checkbook will need to be made based on observations of soil moisture (at depth not just a t the surface) and the condition of the crop. **General irrigation management.**

* Early season irrigation checkbook style scheduling can be difficult due to the limited area that young roots can retrieve water, consider monitoring soil moisture using a soil probe ,to assure root are growing into moisture.
* Often early season irrigation is more driven by the need for water to: reduce issue of crop germination, soil applied herbicide activation, nitrogen fertilizer volatilization, soil crusting problems. Small applications of water 0.2 to 0.3 inch is needed is sandy loams and 0.4 to 0.7 inch in heavier soils.
* The chances of rainfall meeting crop are much higher at the beginning and the end of the growing season. Early and late season irrigation application amount of 0.3" to 0.5" allows irrigator to maximize the benefit of rainfall that commonly meet crop needs at this point in the season.
* Larger irrigation applications are more effective at peak water use of the crop, consider applications of 1.0" to 1.5" to reduce disease pressure.

Effective Water Reaching Root Zone

Miller, MSU/BAE—2014

	Effective water reaching root zone for given percentage					
Water Applied	0.95	0.9	0.85	0.8	0.75	0.7
1.50	1.43	1.35	1.28	1.20	1.13	1.05
1.40	1.33	1.26	1.19	1.12	1.05	0.98
1.30	1.24	1.17	1.11	1.04	0.98	0.91
1.20	1.14	1.08	1.02	0.96	0.90	0.84
1.10	1.05	0.99	0.94	0.88	0.83	0.77
1.00	0.95	0.90	0.85	0.80	0.75	0.70
0.90	0.86	0.81	0.77	0.72	0.68	0.63
0.80	0.76	0.72	0.68	0.64	0.60	0.56
0.70	0.67	0.63	0.60	0.56	0.53	0.49
0.60	0.57	0.54	0.51	0.48	0.45	0.42
0.50	0.48	0.45	0.43	0.40	0.38	0.35
0.40	0.38	0.36	0.34	0.32	0.30	0.28
0.30	0.29	0.27	0.26	0.24	0.23	0.21
0.20	0.19	0.18	0.17	0.16	0.15	0.14

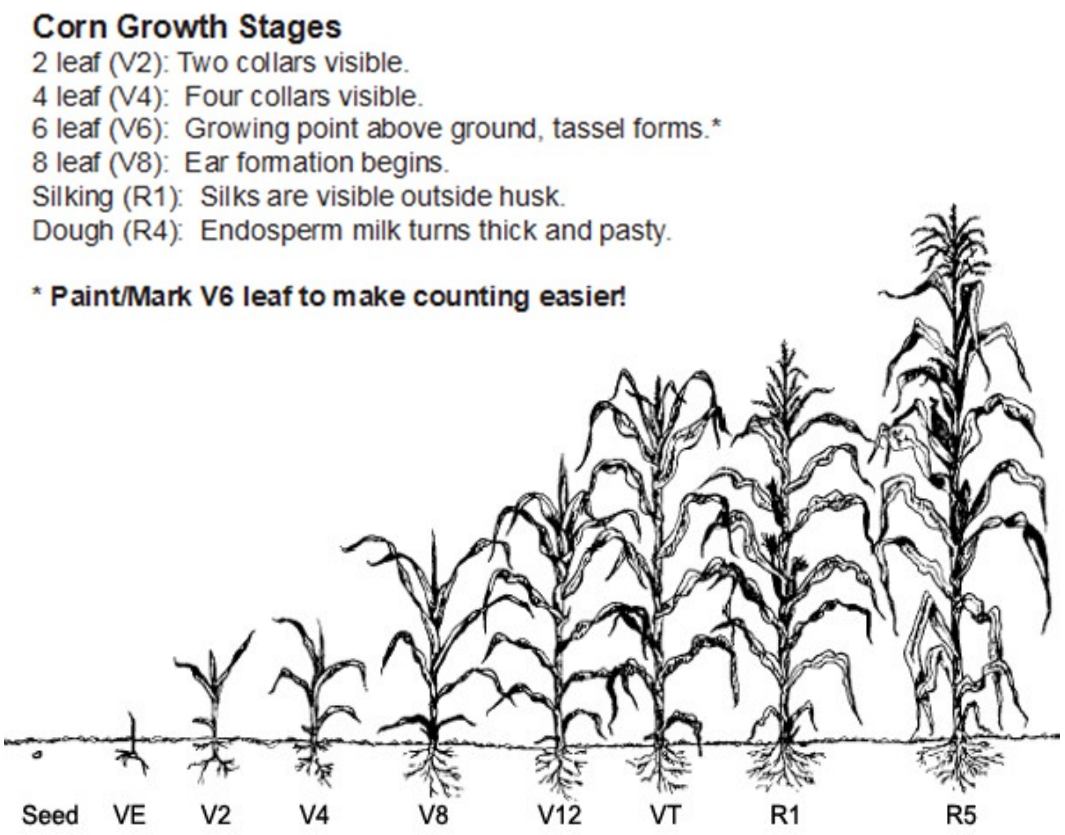
Corn irrigation management

- By corn growth stage V10 or row closure checkbook style irrigation scheduling become more feasible as plant nears full root depth, normal rainfall is less likely to meet crop need and crop Evapotransporation (E.T.) become larger and more predictable.
- Irrigation is crucial the week before tassel and two weeks after tassel, rainfall in excess of weekly crop water is not common. Consider managing irrigation to maintain soil water holding capacity 1.0" from full for this critical stage of development.
- Corn test weight can be reduced in dry late summer conditions. Irrigate to maintain available soil moisture above 40% available water holding capacity until black layer stage.

Average water use for CORN in inches/day –adapted From " Irrigation Scheduling Checkbook Method, Jerry Wright, University of Minnesota, 2002

	Week after emergence																	
Temperature	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
50-59	.01	.02	.03	04	.05	.06	.08	.09	.09	.10	.10	.10	.09	.07	.06	.05	.04	.03
60-69	.02	.03	.04	.06	.08	.09	.11	.12	.13	.15	.14	.14	.13	.11	.09	.07	.06	.04
70-79	.03	.04	.05	.07	.10	.12	.15	.16	.17	.19	.19	.18	.17	.14	.11	.09	.07	.05
80-89	.03	.05	.07	.09	.13	.15	.18	.20	.22	.24	.23	.22	.21	.17	.14	.11	.09	.06
90-99	.04	.06	.08	.11	.15	.18	.21	.24	.26	.28	.27	.26	.25	.20	.17	.13	.11	.07
Corn growth stages		3 leaf			8 leaf			1st tassel	silk		blis-ter ker-nel			ear-ly dent	dent			

Crop Stage	K_c	Rooting Depth	% Growing Sea-son
V2	0.2	6	10
V4	0.20	10	15
V6	0.39	15	20
V8	0.56	20	27
V10	0.76	23	34
V12	1.0	26	50
V14	1.1	28	55
V16-VT	1.2	30	60
Silking	1.2	30	65
Blister	1.2	30	70
Dough	1.2	30	75
Begin Dent	1.2	30	80
Full Dent	1.0	30	85
Black Layer	0.66	30	90
Full Maturity	0.11	30	100



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Beans irrigation management

- Checkbook style soybean irrigation scheduling become more feasible as plant nears full root depth and crop Evapotranspiration (E.T.) become larger and more predictable.
- Soybeans can be allowed to deplete to as low as 30-40% of available water holding capacity during the V stages of growth. Many irrigators with experience will allow beans to grow well into the summer with only rainfall as long as near normal growth continues.
- Over watering prior to R3 stage increases chance of white mold, lodging and the resulting bigger plant requiring more water in late summer with often little to no yield increase and sometimes lower yields than dry-land production
- Following the R3 growth stage through bean sizing, the soil moisture should be maintained at 60% to 70% of available soil water holding capacity.
- Maintain late season soybean field above 50% of available water holding capacity until 70% of pods have yellowed.

Average water use for Soybeans in inches/day –adapted From " Irrigation Scheduling Checkbook Method, Jerry Wright, University of Minnesota, 2002

	Week after emergence																
Temperature	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
50-59	02	02	.04	.04	.06	.07	.08	.09	09	09	09	08	.07	.05	.05	.03	.02
60-69	.02	.03	.05	.07	.09	.10	.11	.13	.13	.13	.13	.11	.10	.08	.07	.04	.02
70-79	.03	.05	.07	.09	.12	.13	.15	.17	.18	.18	.17	.15	.13	.10	.09	.05	.03
80-89	.04	.06	.10	.13	.16	.19	.20	.21	.22	.22	.21	.18	.16	.13	.11	.06	.03
90-99	.05	.07	.11	.14	.17	.20	.22	.25	.26	.26	.25	.22	.19	.16	.13	.08	.05
Soybean growth stages				2nd trifoli-ate		1st flower			seed filling			leaves yel-lowing					

Crop Water Use by Growth Stage — Soybeans

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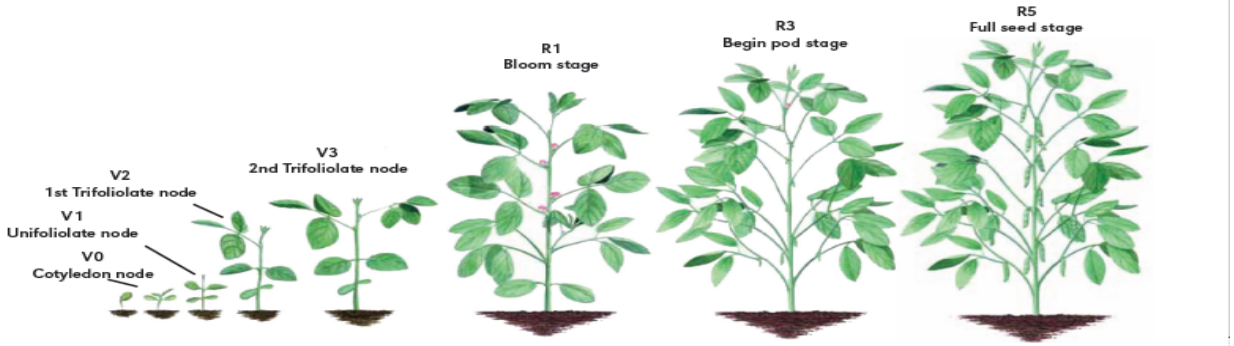
Soybean Growth Stages

V0	Cotyledon node 0 — cotyledons extended
V1	Unifoliolate node 1 — unifoliolate leaves expanded
V2	1st Trifol node 2 — trifoliolate leaves expanded
V3	2nd Trifol node 3 — trifoliolate leaves expanded
R1	Begin bloom — one flower any node
R2	Full bloom — flowers at top 2 nodes
R3	Begin Pod — A pod 3/16 inch long in any of the top 4 nodes
R4	Full Pod — A pod 3/4 inch long in any of the top 4 nodes
R5	Full Seed — A seed 1/8 inch long in any of the top 4 nodes
R6	Full Seed — A seed filling a pod cavity in 4 top nodes
R7	Begin Pod Mature (leaf fall) — one brown pod anywhere on plant
R8	95% pods mature
Mature	Harvest-ready



Crop Stage	Crop coeffient Kc	Root Depth (in)	% of Growing Season
V0 Cotyledon	0.2	6	0
V1 1st Node	0.3	9	4
V2 2nd Node	0.5	12	8
V3 3rd Node	0.6	16	11
R1 Begin Bloom	1.0	24	26
R2 Full Bloom	1.1	24	32

Crop Stage	Crop coeffient Kc	Root Depth (in)	% of Growing Season
R3 Begin Pod	1.2	24	41
R4 Full Pod	1.2	24	50
R5 Begin Seed	1.2	24	63
R6 Full Seed	1.2	24	80
R7 Begin Pod Mature	1.0	24	89
R8 95% Pods Mature	0.2	24	100