Corn growth stages with estimated calendar days and growing-degree units

These tables illustrate that calendar days between corn growth stages often not only depends on years and environment; but also on the staging method used. The Iowa State University (ISU) method was proposed years ago. The Federal Crop Insurance Corp. (FCIC) has also proposed a method for staging corn. Table 1 illustrates the ISU staging method and the corresponding FCIC stage for each growth stage. Table 2 illustrates the vegetative (V) growth stages, the number of days and GDUs per stage, the days and GDUs since planting per stage, and the approximate leaf area accumulated per stage. Table 3 illustrates the reproductive (R) growth stages, the number of days and GDUs per stage, and the days and GDUs per growth stage, the number of days and GDUs per stage, and GDUs per stage, and the percent of total GDUs accumulated by growth stage. Note: These tables and estimated values are based on a 120-day hybrid grown in the Corn Belt. These estimation values may differ by environment and by the maturity of the hybrid. Therefore, evaluate growth stage values on a relative basis as opposed to absolute terms.

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	Days per	Days after	GDUs per	GDUs after	FCIC
Vegetative growth stage description –ISU method ¹	stage	seeding	stage	seeding	Stage ³
V0 Germination, seeding to emergence	5 - 10	5 - 10	100 - 150	100 - 150	-
VE Coleoptile opens, plumule emerges	2 - 4	7 - 14	66	166 - 216	-
V1 Collar of 1 st leaf visible	3	10 - 17	66	232 - 282	-
V2 Collar of 2 nd leaf visible	3	13 - 20	66	298 - 348	-
V3 Collar of 3 rd leaf visible	3	16 - 23	66	364 - 414	-
V4 Collar of 4 th leaf visible	3	19 - 26	66	430 - 480	-
V5 Collar of 5 th leaf visible	3	22 - 29	66	496 - 546	V7
V6 Collar of 6 th leaf visible	3	25 - 32	66	562 - 612	V8
V7 Collar of 7 th leaf visible	3	28 - 35	66	628 - 678	V9-10
V8 Collar of 8 th leaf visible	3	31 - 38	66	694 - 744	V11
V9 Collar of 9 th leaf visible	3	34 - 41	66	760 - 810	V12
V10 Collar of 10 th leaf visible	3	37 - 44	66	826 - 876	V13
V11 Collar of 11 th leaf visible	3	40 - 47	66	892 - 942	V14
V12 Collar of 12 th leaf visible	3	43 - 50	66	958 - 1,008	V15
V13 Collar of 13 th leaf visible	3	46 - 53	66	1,024 - 1,074	V16
V14 Collar of 14 th leaf visible	3	49 - 56	66	1,090 - 1,140	V17
V15 Collar of 15 th leaf visible	2	51 - 58	48	1,138 - 1,188	V18
V16 Collar of 16 th leaf visible	2	53 - 60	48	1,186 - 1,236	V19
V17 Collar of 17 th leaf visible	2	55 - 62	48	1,234 - 1,284	V20
V18 Collar of 18 th leaf visible	2	57 - 64	48	1,282 - 1,332	V21
V19 Collar of 19 th leaf visible	2	59 - 66	48	1,330 - 1,380	V21
V20 Collar of 20 th leaf visible	2	61 - 68	48	1,378 - 1,428	V21
V(n) Collar of n th leaf visible	-		-	-	-
VT Tassel -all branches visible, no silks	4	65 - 72	100	1,478 - 1,528	Tassel
 V17 Collar of 17th leaf visible V18 Collar of 18th leaf visible V19 Collar of 19th leaf visible V20 Collar of 20th leaf visible V(n) Collar of nth leaf visible 	2 2 2 2 - 4	55 - 62 57 - 64 59 - 66 61 - 68 65 - 72	48 48 48 48 - 100	1,234 - 1,284 1,282 - 1,332 1,330 - 1,380 1,378 - 1,428 - 1,478 - 1,528	V20 V21 V21 V21

Table 1. Corn vegetative growth stages along with estimated calendar days and growing degree units (GDUs), days after
seeding and the corresponding FCIC stage by growth stage for a typical 120-day hybrid in the corn belt.

* Values are approximations because they may vary over years, production environments, and locations.

Staging method			Approximate values* ^{1,2,3}				
	FCIC me	ethods ³					Pct.
	40 - 50%	Leaf	Days	Days		GDUs	total
	of leaf	tip	per	after	GDUs	after	leaf
Leaf collar visible – ISU method ¹	visible	visible	stage	seeding	per stage	seeding	area
V0 Germination, seeding to emergence	-	-	5 - 10	5 - 10	100 - 150	100 - 150	-
VE Coleoptile opens, plumule emerges	-	-	2 - 4	7 - 14	66	166 - 216	-
V1 Collar of 1 st leaf	V2	V3-4	3	10 - 17	66	232 - 282	-
V2 Collar of 2 nd leaf	V3	V4-5	3	13 - 20	66	298 - 348	-
V3 Collar of 3 rd leaf	V4	V5-6	3	16 - 23	66	364 - 414	-
V4 Collar of 4 th leaf	V5	V7	3	19 - 26	66	430-480	-
V4 Collar of 4 th leaf	V6	V8	3	19 - 26	66	430 - 480	-
V5 Collar of 5 th leaf	V7	V9	3	22 - 29	66	496 - 546	6
V6 Collar of 6 th leaf	V8	V10	3	25 - 32	66	562 - 612	10
V7 Collar of 7 th leaf	V9	V11	3	28 - 35	66	628 - 678	16
V7 Collar of 7 th leaf	V10	V12					23
V8 Collar of 8 th leaf	V11	V13	3	31 - 38	66	694 - 744	31
V9 Collar of 9 th leaf	V12	V14	3	34 - 41	66	76 0 - 810	41
V10 Collar of 10 th leaf	V13	V15	3	37 - 44	66	826 - 876	50
V11 Collar of 11 th leaf	V14	V16	3	40 - 47	66	892 - 942	60
V12 Collar of 12 th leaf	V15	V17	3	43 - 50	66	958 - 1,008	69
V13 Collar of 13 th leaf	V16	V18	3	46 - 53	66	1,024 - 1,074	77
V14 Collar of 14 th leaf	V17		3	49 - 56	66	1,090 - 1,140	84
V15 Collar of 15 th leaf	V18		2	51 - 58	48	1,138 - 1,188	94
V17 Collar of 17 th leaf			2	55 - 62	48	1,234 - 1,284	95
V18 Collar of 18 th leaf			2	57 - 64	48	1,282 - 1,332	96
V19 Collar of 19 th leaf			2	59 - 66	48	1,330 - 1,380	97
V20 Collar of 20 th leaf			2	61 - 68	48	1,378 - 1,428	98
V(n) Collar of n-th leaf			-		-	-	-
VT Tassel fully extended, no silks			4	65 - 72	100	1,478 - 1,528	99

 Table 2. Corn vegetative growth stages using the ISU and FCIC methods along with the estimated days and GDUs, days and GDUs after seeding, and percent total leaf area by stage for a typical 120-day hybrid in the Corn Belt.

* Values are approximations because they may vary over years, production environments, and locations.

 Table 3. Corn reproductive growth stages along with the estimated days and GDUs and the days after seeding by stage for a typical 120-day hybrid in the Corn Belt.

	Approximate values* ^{1, 2, 3}				
	Days			GDUs	
	per	Days after	GDUs	after	
FCIC ³ reproductive growth stage (R stage –ISU method ¹)	stage	seeding	per stage	seeding	
Silked (R1) - Silks emerged, tassel shedding pollen	4	69 - 76	100	1,578 - 1,628	
Silks brown - about 75% of silks have turned brown	5	74 - 79	125	1,703 - 1,753	
Pre-blister- silks brown, no fluid in kernels	4	78 - 85	100	1,803 - 1,853	
Blister (R2) - kernels are watery blisters with clear fluid	4	82 - 89	100	1,903 - 1,953	
Early milk - kernels begin to turn yellow	4	86 - 93	100	2,003 - 2,053	
Milk (R3) - full yellow kernels with milky fluid, no solids	5	91 - 98	100	2,103 - 2,153	
Late milk - butt-end kernels contain semi -solids	4	95 - 102	100	2,203 - 2,253	
Soft dough (R4) - most kernels pasty with semi-solids	5	100 - 107	100	2,303 - 2,353	
Early dent - kernels along entire ear begin to dent	5	108 - 115	100	2,403 - 2,453	
Dent (R5) - kernels dented, cut with fingernail	5	113 - 120	125	2,528 - 2,578	
Late dent - kernels dented, drying down from top	5	118 - 125	125	2,653 - 2,703	
Nearly mature - kernel shiny opposite embryo, not hard	5	123 - 130	125	2,778 - 2,828	
Mature (R6) - black layer, kernel moisture 25-35%	5	128 - 135	125	2,903 - 2,953	

* Values are approximations because they may vary over years, production environments, and locations.

	Approximate values* ^{1, 2, 3}				
	Days	Days to		Pct.	GDUs to
	per	black	GDUs	total GDUs	black
FCIS ³ reproductive growth stage (R stage – ISU method ¹)	stage	layer	per stage	accumulated	layer
Silked (D1) Silks amarged tassal shadding pollon	4	57	100	54 - 55	1 200
Silked (R1) - Silks emerged, tassel shedding pollen	4	÷.			1,300
Silks brown - about 75% of silks have turned brown	5	53	125	59	1,200
Pre-blister - silks brown, no fluid in kernels	4	48	100	62 - 63	1,075
Blister (R2) - kernels are watery blisters with clear fluid	4	44	100	66	975
Early milk - kernels begin to turn yellow	4	40	100	69 - 70	875
Milk (R3) - full yellow kernels with milky fluid, no solids	4	36	100	72 – 73	775
Late milk - butt-end kernels contain semi -solids	4	32	100	76	675
Soft dough (R4) - most kernels pasty with semi-solids	4	28	100	79 - 80	575
Early dent - kernels along entire ear begin to dent	4	24	100	83	475
Dent (R5) - most kernels dented (ing), cut with fingernail	5	20	125	87	375
Late dent - kernels dented, drying down from top	5	15	125	91	250
Nearly mature - shiny hull opposite embryo, kernel not hard	5	10	125	96	125
Mature (R6) - black layer, kernel moisture 25-35%	5	-	125	100	0

 Table 4. Corn reproductive growth stages with the estimated days and GDUs by stage, days and GDUs to black layer by stage and percent of total GDUs accumulated by stage for a typical 120-day hybrid in the Corn Belt.

* Values are approximations they may vary over years, production environments, and locations.

Information sources:

¹Ritchie, S.W. et al. 1997. How a corn plant develops. Special Report No. 48, Iowa State University, CES, Ames. IA.

² Flowerday, D. 1995. Corn morphology, development & stress response. Proc. NE Corn Expo, Kearney, NE, p. 33-41.

³ Federal Crop Insurance Corp. Corn Loss Adjustment Standards Handbook, FCIC-25080 (11-2006).

⁴ Tables compiled by R.G. Hall, Extension Agronomist-Crops, South Dakota State University, CES, Brookings, SD.