

Appendix

Table A1. ALMANAC Parameters^A

Variable	Description	Units	Plant				
			Wheat	Soybean	Sorghum	Palmer Amaranth	Horseweed
WA	Energy to biomass conversion factor. Potential growth rate per unit of intercepted photosynthetically active radiation.	kg/ha per MJ/m ²	35.00	25.00	37.20	33.00	37.00
HI	Harvest index. crop yield/above ground biomass	NA	0.42	0.41	0.45	0.05	0.10
TB	Optimal temperature for plant growth	°C	15.00	25.00	30.00	25.00	25.00
TG	Minimum temperature for plant growth	°C	0.00	10.00	8.00	10.00	0.00
DMLA	Maximum potential leaf area index	NA	5.00	7.00	3.50	2.7	1.50
DLAI	Fraction of growing season when leaf area index starts declining	NA	0.60	0.60	0.64	0.60	0.60
LAP1	First point on optimal leaf area development curve. Numbers before decimal are % of growing seasons. Numbers after decimal are fractions of maximum potential leaf area index.	NA	31.07	15.05	20.05	15.05	15.05
LAP2	Second point on optimal leaf area development curve. Numbers before decimal are % of growing seasons. Numbers after decimal are fractions of maximum potential leaf area index.	NA	57.95	50.95	60.95	50.95	54.95
PPL 1	Plant population parameter. Number before decimal is plants/m ² . Number after decimal is fraction of species leaf area index (LAI) at that population.	NA	125.6	30.43	5.43	1.12	1.12
PPL 2	Second plant population parameter. Number before decimal is plants/m ² (at a higher density). Number after decimal is fraction of species LAI at that population.	NA	250.95	50.71	25.88	8.95	8.95

FRS1	First point on the frost damage curve. Numbers before decimal are the minimum temperatures (°C) and numbers after decimal are the fraction of biomass lost when specified minimum temperature occurs.	NA	5.001	5.01	5.01	5.01	5.01
FRS2	Second point on the frost damage curve. Numbers before decimal are the minimum temperatures (°C) and numbers after decimal are the fraction of biomass lost when specified minimum temperature occurs.	NA	15.01	15.05	15.05	15.05	15.05
RLAD ¹	Leaf area index decline rate parameter. Estimated LAI decline between declining leaf area index (DLAI) and harvest.	NA	1.00	0.10	0.50	0.50	2.00
RBMD	Biomass energy ratio decline rate parameter. Reduces efficiency of biomass-energy conversion due to creation of seeds or N translocation	NA	10.00	0.10	0.50	1.00	1.00
ALT	Index of crop tolerance to aluminum saturation (1-5; 1=sensitive, 5=tolerant)	NA	2.00	3.00	2.00	3.00	3.00
CAF	Critical aeration factor- fraction of soil porosity where poor aeration starts limiting plant growth.	NA	0.85	0.85	0.85	0.85	0.85
GSI	Maximum stomatal conductance at high solar radiation and low vapor pressure deficit.	ms ⁻¹	0.0007	0.007	0.0074	0.007	0.007
WAC2	S curve that describes CO2 concentrations effect on WA.	NA	660.46	660.34	660.36	660.45	660.43
CLAIY R	The number of years until maximum LAI can be attained.	Years	1.00	1.00	1.00	1.00	1.00
VPTH	Threshold VPD	kPa	1.00	1.00	1.00	1.00	1.00

VPD2	Slope of WA:VPD relationship above VPTH	kg/ha per MJ/m ² per kPa	-6.50	-6.50	-9.40	-32.30	-6.50
SDW	Normal seeding rate	kg/ha	90.00	35.00	5.00	35.00	35.00
HMX	Maximum crop height	m	0.90	0.80	1.20	1.50	1.00
RDMX	Maximum root depth	m	2.00	1.70	2.00	2.00	2.00
CVM	Minimum value of water erosion C factor	NA	0.03	0.20	0.20	0.20	0.20
CNY	Normal fraction of N in yield	g/g	0.0234	0.065	0.02	0.065	0.065
CPY	Normal fraction on P in yield	g/g	0.0033	0.0091	0.0028	0.0091	0.0091
WSYF	Coefficient of crop yield sensitivity to water stress at the most critical stage of growth	NA	0.35	0.30	0.44	0.01	0.01
PST	Pest damage factor (insects, weeds, disease) – fraction of yield remaining after damage	NA	0.95	0.95	0.95	0.95	0.95
TREE1	Tree parameter, listed in interface as COST. First point on multi-year s-curve function for tree LAI and height increase.	NA	NA	NA	NA	NA	NA
TREE2	Tree parameter, listed in interface as PRY. Second point on multi-year s-curve function for tree LAI and height increase.	NA	NA	NA	NA	NA	NA
BN1	Normal fraction of N in crop biomass at emergence	NA	0.06	0.0524	0.044	0.0524	0.0524
BN2	Normal fraction of N in crop biomass at midseason	NA	0.0231	0.0365	0.0164	0.0265	0.0265
BN3	Normal fraction of N in crop biomass at maturity	NA	0.0134	0.0258	0.0128	0.0258	0.0258
BP1	Normal fraction of P in crop biomass at emergence	NA	0.0084	0.0074	0.006	0.0074	0.0074
BP2	Normal fraction of P in crop biomass at midseason	NA	0.0032	0.0037	0.0022	0.0037	0.0037
BP3	Normal fraction of P in crop biomass at maturity	NA	0.0019	0.0035	0.0018	0.0035	0.0035

BW1	Wind erosion factor for standing live biomass	NA	33.39	1.266	0.657	1.266	1.266
BW2	Wind erosion factor for standing dead crop residue	NA	3.39	0.633	0.657	0.633	0.633
BW3	Wind erosion factor for standing flat residue	NA	1.61	0.729	0.32	0.729	0.729
IDC ²	Crop category number (integer)	NA	5.00	1.00	4.00	4.00	5.00
EXT	Extinction coefficient for calculating light interception	Kc	0.65	0.45	0.47	0.90	0.65
DORM NT ³	Defines the day length in the fall when dormancy begins	Hours	0.00	0.00	0.00	0.00	0.00
DMPHT	Tree parameter, minimum grams of biomass per meter of height.	g/m	NA	NA	NA	NA	NA
CHTYR	Tree parameter, number of years to maximum height.	Years	NA	NA	NA	NA	NA
Rtprt1	Fraction of weight portioned to roots for young plants	NA	0.00	0.00	0.00	0.00	0.00
GZPAL ⁴	Grazing palatability index.	NA	NA	NA	NA	NA	NA
Rtprt2	Fraction of weight portioned to roots for plants near maturity	NA	0.00	0.00	0.00	0.00	0.00
DMLA	This DMLA is the maximum leaf area index reached in the simulation	NA	5.00	7.00	3.5	2.70	1.50
PHU	Potential heat units from planting to physiological maturity	°C	1800.00	1500.00	1500.00	1400.00	1400.00

^A Parameter names and descriptions can be found at: <https://www.ars.usda.gov/plains-area/temple-tx/grassland-soil-and-water-research-laboratory/docs/193226/>

¹ 1 is linear, >1 accelerated decline, <1 retards decline rate.

² Crop Categories: (1) Warm-season annual legume, (2) Cold-season annual legume, (3) Perennial legume, (4) Warm-season annual, (5) Cold-season annual, (6) Perennial, (7) Tree crop, (8) Deciduous tree

³ One hour greater than the minimum for the latitude. Value is hours of day length which is added to the minimum day length of the year for that location.

⁴ Grazing Palatability Index: (0) Not grazed/poisonous, (1) Grazed if starving, (2) Low palatability/grazed last, (3) Palatable, (4) Highly palatable/first eaten

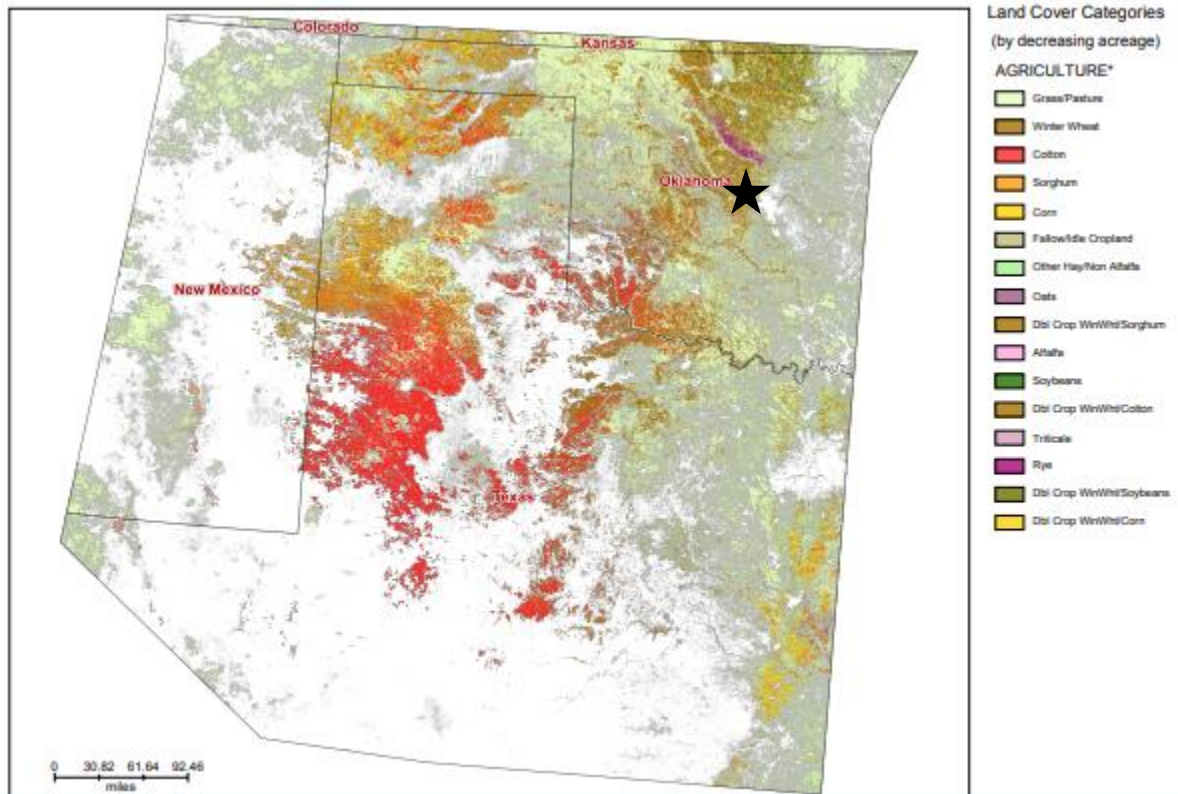


Figure A1. Southern Great Plains Region

Notes: The star indicates the approximate location of El Reno, Oklahoma. The geographical area circled is similar to the area indicated in Kumar et al., 2019. The map was created from the USDA Cropland Data Layer (USDA-CDL, 2022).