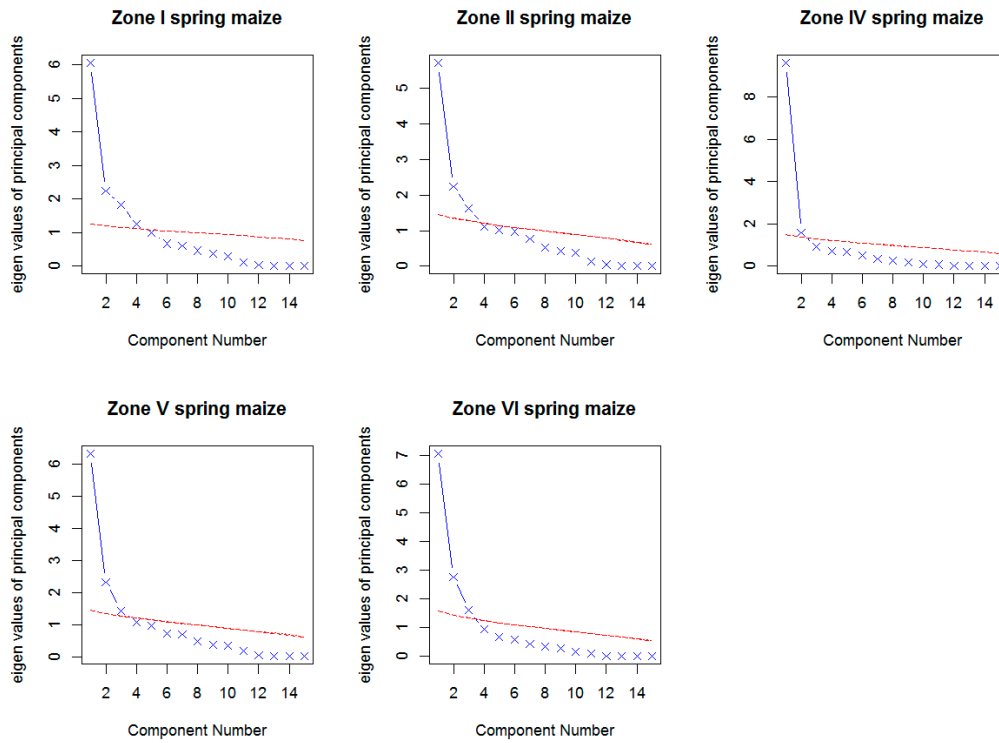**Appendix A**

Figure S1. Assessing the number of principal components to retain for the climate variables (15)

of spring maize in each zone. A scree plot (the blue line with x's) and parallel analysis with 100

simulations (red dashed line) suggest retaining the number of principal components.

Figure S2. Assessing the number of principal components to retain for the climate variables (15) of summer maize in each zone. A scree plot (the blue line with x's) and parallel analysis with 100 simulations (red dashed line) suggest retaining the number of principal components.
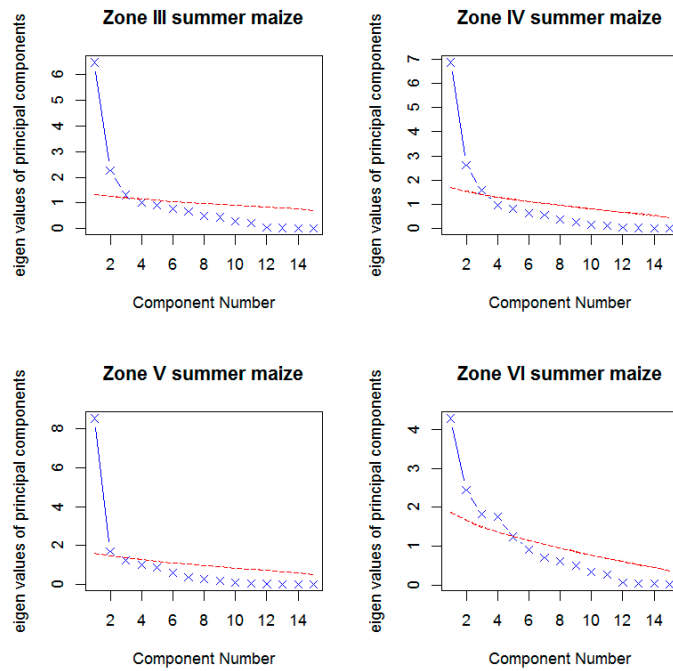
Table S1. Loadings of variables (15) on principal components for Zone II spring maize

variables	PC1	PC2	PC3
T2	**0.78**	0.22	0.45
$T_{min}2$	**0.8**	0.18	0.43
P2	0.07	0.41	0.05
T3	**0.81**	0.35	–0.07
$T_{min}3$	**0.85**	0.31	0.1
P3	0.03	0.15	**0.78**
T4	**0.75**	0.12	–0.37
$T_{min}4$	**0.84**	0.13	–0.34
P4	0.27	0.44	–0.06
T5	**0.78**	–0.27	–0.09
$T_{min}5$	**0.79**	–0.37	–0.06
P5	–0.14	–0.11	0.16
T6	0.43	**–0.81**	0.1
$T_{min}6$	<u>0.56</u>	<u>–0.72</u>	–0.06
P6	0.07	0.35	<u>–0.56</u>

Eigenvalues	5.71	2.24	1.63
% of Variance	38	15	11
Cumulative %	38	53	64

Bold and underline values indicate strong and moderate loadings, respectively.

Table S2. Loadings of variables (15) on principal components for Zone IV spring maize

variables	PC1	PC2
T2	**0.83**	−0.18
$T_{min}2$	**0.92**	−0.12
P2	0.41	0.57
T3	**0.89**	−0.2
$T_{min}3$	**0.95**	−0.11
P3	0.46	0.50
T4	**0.91**	−0.15
$T_{min}4$	**0.97**	−0.09
P4	0.5	0.44
T5	**0.91**	−0.22
$T_{min}5$	**0.96**	−0.12
P5	0.6	0.61
T6	**0.85**	−0.14
$T_{min}6$	**0.94**	−0.08
P6	0.53	0.45
Eigenvalues	9.6	1.57
% of Variance	64	10
Cumulative %	64	74

Bold and underline values indicate strong and moderate loadings, respectively.

Table S3. Loadings of variables (15) on principal components for Zone V spring maize

variables	PC1	PC2	PC3
T2	0.74	0.42	−0.17
$T_{min}2$	0.71	0.52	−0.18
P2	0.22	0.39	−0.31
T3	**0.85**	0.03	0.17
$T_{min}3$	**0.83**	0.31	0.18
P3	0.11	0.65	0.03
T4	**0.77**	−0.17	0.01
$T_{min}4$	**0.84**	0.1	0.15
P4	0.07	0.38	0.57
T5	0.71	−0.54	0.15
$T_{min}5$	**0.86**	−0.21	0.09

P5	0.16	<u>0.54</u>	–0.45
T6	<u>0.73</u>	–0.48	–0.3
T$_{min}$6	**0.82**	–0.33	–0.01
P6	–0.05	0.23	<u>0.74</u>
Eigenvalues	6.32	2.32	1.44
% of Variance	42	15	10
Cumulative %	42	58	67

Bold and underline values indicate strong and moderate loadings, respectively.

Table S4. Loadings of variables (15) on principal components for Zone VI spring maize

variables	PC1	PC2	PC3
T2	0.44	<u>–0.72</u>	0.42
T$_{min}$2	0.44	<u>–0.62</u>	0.53
P2	–0.34	0.41	<u>0.72</u>
T3	**0.79**	–0.32	0.08
T$_{min}$3	**0.82**	–0.15	0.19
P3	–0.34	0.43	<u>0.66</u>
T4	**0.85**	0.07	0.08
T$_{min}$4	**0.82**	0.23	0.18
P4	–0.49	<u>0.54</u>	0.21
T5	**0.85**	0.4	–0.16
T$_{min}$5	**0.79**	<u>0.53</u>	–0.09
P5	<u>–0.61</u>	0.3	0.14
T6	**0.81**	0.44	–0.02
T$_{min}$6	<u>0.71</u>	<u>0.56</u>	0.04
P6	**–0.79**	0.08	0
Eigenvalues	7.06	2.78	1.6
% of Variance	47	19	11
Cumulative %	47	66	76

Bold and underline values indicate strong and moderate loadings, respectively.

Table S5. Loadings of variables (15) on principal components for Zone IV summer maize

variables	PC1	PC2	PC3
T3	<u>0.53</u>	0.47	<u>–0.56</u>
T$_{min}$3	<u>0.63</u>	<u>0.63</u>	–0.31
P3	–0.11	–0.02	<u>0.75</u>
T4	**0.75**	0.21	–0.11
T$_{min}$4	**0.78**	0.45	0.06
P4	0.36	0.25	0.46

T5	**0.89**	−0.15	−0.02
T$_{min}$5	**0.91**	0.15	0.07
P5	−0.03	<u>0.67</u>	0.51
T6	**0.89**	−0.35	0.1
T$_{min}$6	**0.96**	−0.07	0.09
P6	−0.3	<u>0.65</u>	0.16
T7	**0.85**	−0.43	0.17
T$_{min}$7	**0.87**	−0.32	0.18
P7	−0.02	<u>0.61</u>	0.1
Eigenvalues	6.87	2.63	1.58
% of Variance	46	18	11
Cumulative %	46	63	74

Bold and underline values indicate strong and moderate loadings, respectively.

Table S6. Loadings of variables (15) on principal components for Zone V summer maize

variables	PC1	PC2
T3	**0.92**	−0.1
T$_{min}$3	**0.92**	0.03
P3	0.09	**0.78**
T4	**0.88**	0.16
T$_{min}$4	**0.91**	0.17
P4	0.21	−0.09
T5	**0.88**	−0.13
T$_{min}$5	**0.93**	0.01
P5	0.18	<u>0.59</u>
T6	**0.94**	−0.02
T$_{min}$6	**0.96**	−0.01
P6	0.11	−0.23
T7	**0.9**	−0.19
T$_{min}$7	**0.93**	−0.08
P7	0.01	<u>0.74</u>
Eigenvalues	8.54	1.7
% of Variance	57	11
Cumulative %	57	68

Bold and underline values indicate strong and moderate loadings, respectively.

Table S7. Loadings of variables (15) on principal components for Zone VI summer maize

variables	PC1	PC2	PC3	PC4	PC5
T3	<u>0.58</u>	<u>0.56</u>	−0.1	0.09	−0.25
T$_{min}$3	0.39	**0.82**	0.21	0.12	−0.13
P3	−0.22	0.26	<u>0.6</u>	−0.11	0.18
T4	<u>0.61</u>	0.22	−0.3	<u>−0.6</u>	−0.04

$T_{min}4$	<u>0.56</u>	0.43	–0.13	–0.48	0.04
P4	–0.41	–0.02	0.36	<u>0.5</u>	–0.12
T5	<u>0.71</u>	–0.15	–0.43	0.4	0.2
$T_{min}5$	<u>0.65</u>	0.28	–0.11	<u>0.52</u>	0.23
P5	–0.03	0.4	<u>0.59</u>	–0.15	–0.2
T6	<u>0.67</u>	–0.52	0.24	0.18	–0.11
$T_{min}6$	<u>0.72</u>	–0.05	0.52	0.24	–0.04
P6	–0.5	0.27	0.11	–0.26	<u>0.59</u>
T7	<u>0.54</u>	–0.58	0.24	–0.37	0.24
$T_{min}7$	<u>0.66</u>	–0.26	0.45	–0.16	0.34
P7	–0.1	0.37	–0.09	0.33	<u>0.66</u>
Eigenvalues	4.29	2.45	1.82	1.75	1.24
% of Variance	29	16	12	12	8
Cumulative %	29	45	57	69	77

Bold and underline values indicate strong and moderate loadings, respectively.

Table S8. Coefficients, standard error, and levels of significance for planting date (day of year), regressed against PCA in each zone for spring maize.

Zone	Variable	Coefficients	Standard error	P > |t|
I	Constant	122.13	0.245	0.000
	PC1	–4.24	0.246	0.000
	PC2	0.522	0.246	0.034
	PC3	0.694	0.246	0.005
	PC4	1.090	0.246	0.000
II	Constant	119.55	0.611	0.000
	PC1	0.358	0.613	0.559
	PC2	–2.238	0.613	0.000
	PC3	-0.651	0.613	0.289
IV	Constant	87.695	1.278	0.000
	PC1	–12.512	1.281	0.000
	PC2	–2.467	1.281	0.055
V	Constant	114.425	0.442	0.000
	PC1	0.497	0.443	0.262

PC2	−1.303	0.443	0.003
PC3	−0.377	0.443	0.395
Constant	114.551	0.743	0.000
PC1	−0.372	0.745	0.618
PC2	3.089	0.745	0.000
PC3	1.187	0.745	0.113

(VI spans the Constant / PC1 / PC2 / PC3 rows above.)

Table S9. Coefficients, standard error and levels of significance for planting date (day of year), regressed against PCA in each zone for summer maize.

Zone	Variable	Coefficients	Standard error	P > |z|
	Constant	165.171	0.325	0.000
III	PC1	−3.897	0.326	0.000
	PC2	−2.213	0.326	0.000
	PC3	0.153	0.326	0.638
	Constant	130.615	1.532	0.000
IV	PC1	15.084	1.540	0.000
	PC2	−10.006	1.540	0.000
	PC3	5.382	1.540	0.000
	Constant	163.522	0.476	0.000
V	PC1	−1.811	0.477	0.000
	PC2	0.272	0.477	0.570
	Constant	176.111	0.672	0.000
	PC1	0.467	0.677	0.493
	PC2	−2.887	0.677	0.000
VI	PC3	3.039	0.677	0.000
	PC4	0.565	0.677	0.407
	PC5	0.698	0.677	0.306