

## Appendix

### Supplementary data

**Table S1. Mean relative error (MR) of Asontem cowpea genotype under four different phosphorous fertilizer and water treatments [60P+NWS: 60P+No water stress (optimal condition), 60P+WS: 60P + water stress, 0P+NWS: 0P+No water stress and 0P+WS: 0P+No water stress] using 2017/18 field data for model calibration and 2018/19 field data for model validation. Negative values mean decreasing.**

Genotypes	Treatment levels	Mean residual error					
		LAI		TAGB		Grain yield	
		Calibration	Validation	Calibration	Validation	Calibration	Validation
Asontem	60P+NWS	5.58	19.72	-3.14	0.35	-3.55	15.87
	60P+WS	11.87	23.13	7.79	12.94	14.57	11.55
	0P+NWS	9.78	25.28	0.67	15.82	1.92	16.15
	0P+WS	11.11	14.65	9.54	13.93	1.22	18.79

LAI, leaf area index; TAGB, total above ground biomass.

**Table S2. Mean mean residual error (ME) of Asontem cowpea genotype under four different phosphorous fertilizer and water treatments [60P+NWS: 60P+No water stress (optimal condition), 60P+WS: 60P + water stress, 0P+NWS: 0P+No water stress and 0P+WS: 0P+No water stress] using 2017/18 field data for model calibration and 2018/19 field data for model validation. Negative values mean decreasing.**

Genotype	Treatment levels	Mean residual error					
		LAI		TAGB		Grain yield	
		Calibration	Validation	Calibration	Validation	Calibration	Validation
Asontem	60P+NWS	0.12	0.30	-11.02	7.03	-8.13	20.63
	60P+WS	0.26	0.57	21.42	44.69	15.33	16.64
	0P+NWS	0.13	0.44	2.25	30.31	3.23	22.66
	0P+WS	0.24	0.31	26.90	34.00	-1.80	21.53

LAI, leaf area index; TAGB, total above ground biomass.