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A framework for irrigation performance assessment using WaPOR data: the case of a sugarcane estate in Mozambique

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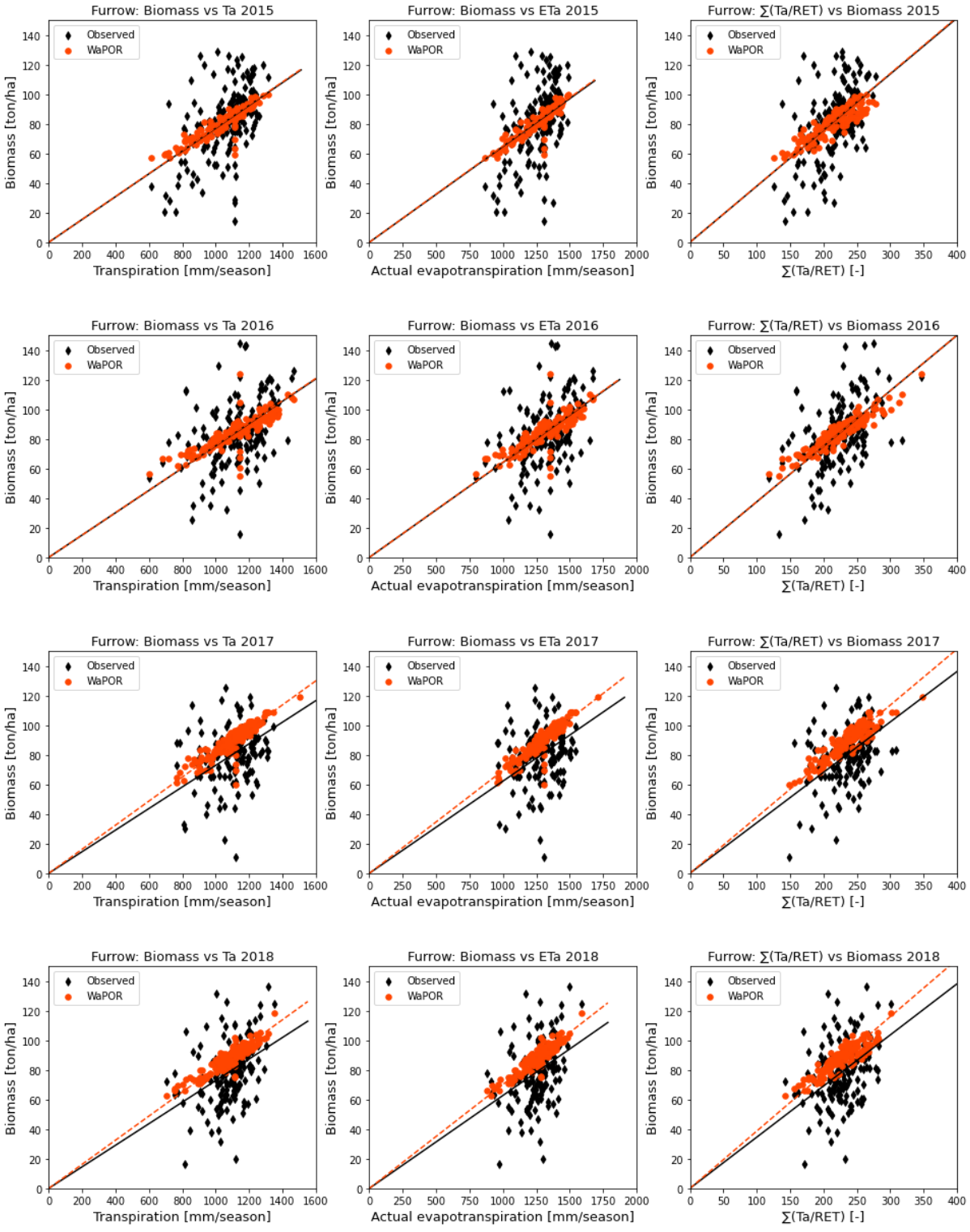
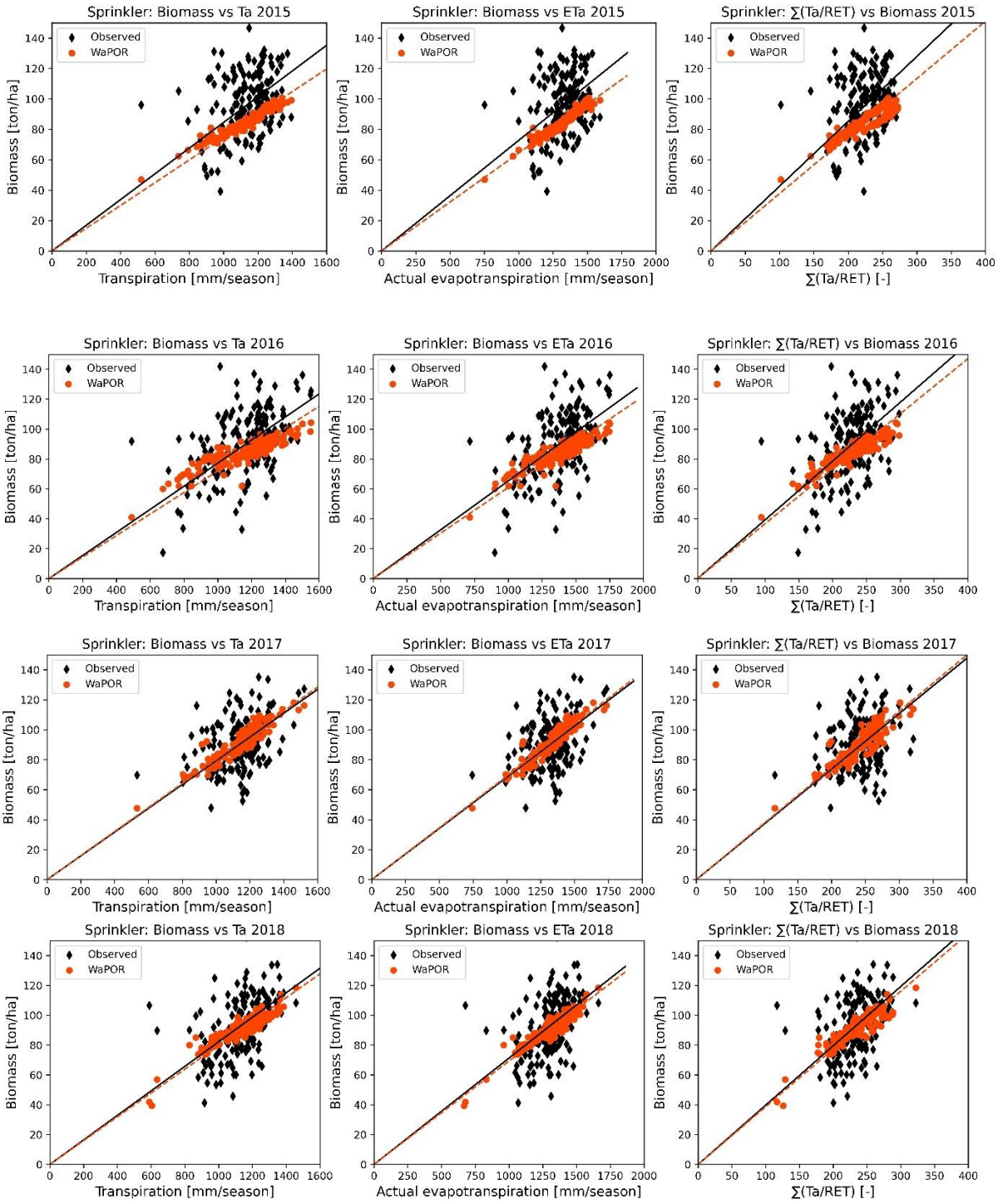
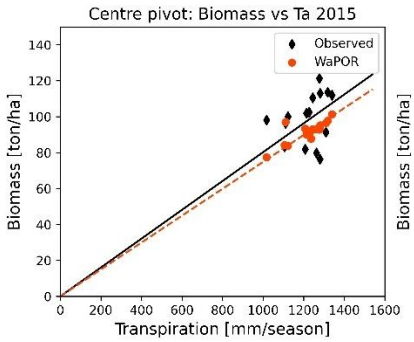
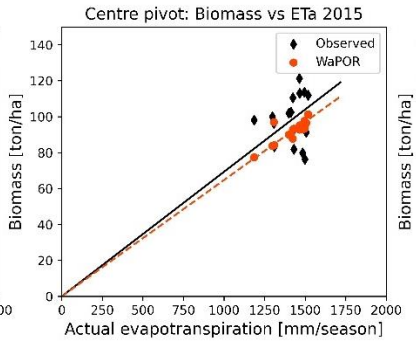
Supplementary Material

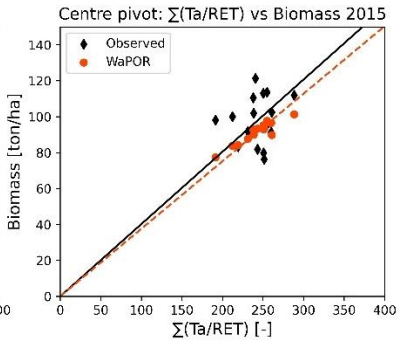
Figure S1. *The relationship between biomass and transpiration, biomass and evapotranspiration and biomass and normalized transpiration of furrow, sprinkler and centre pivot irrigated fields at Xinavane in 2015-2018.*

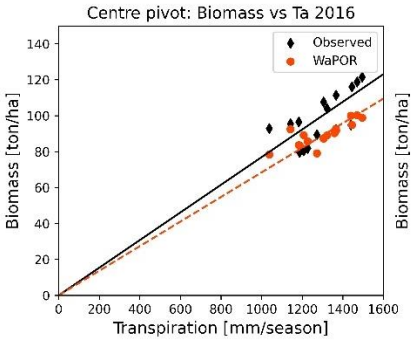


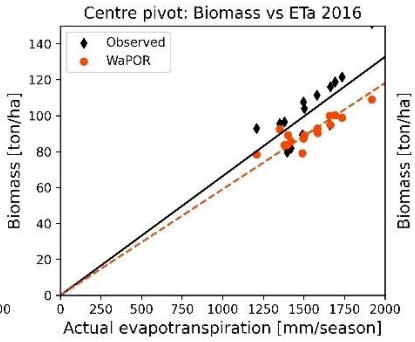

Sprinkler: Biomass vs Ta 2015
Sprinkler: Biomass vs ETa 2015
Sprinkler: ∑(Ta/RET) vs Biomass 2015
Sprinkler: Biomass vs Ta 2016
Sprinkler: Biomass vs ETa 2016
Sprinkler: ∑(Ta/RET) vs Biomass 2016
Sprinkler: Biomass vs Ta 2017
Sprinkler: Biomass vs ETa 2017
Sprinkler: ∑(Ta/RET) vs Biomass 2017
Sprinkler: Biomass vs Ta 2018
Sprinkler: Biomass vs ETa 2018
Sprinkler: ∑(Ta/RET) vs Biomass 2018
Observed
WaPOR
Biomass [ton/ha]
Transpiration [mm/season]
Actual evapotranspiration [mm/season]
∑(Ta/RET) [-]

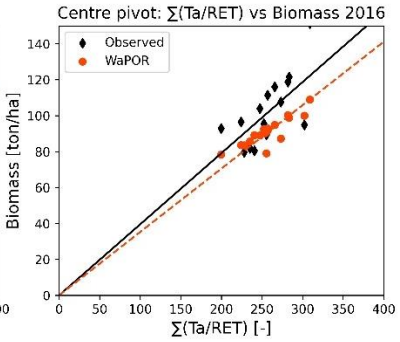

Centre pivot: Biomass vs Ta 2015
Observed
WaPOR
Biomass [ton/ha]
Transpiration [mm/season]

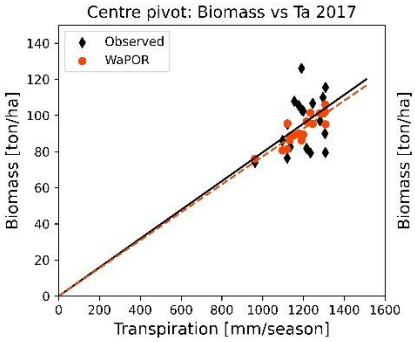

Centre pivot: Biomass vs ETa 2015
Observed
WaPOR
Biomass [ton/ha]
Actual evapotranspiration [mm/season]

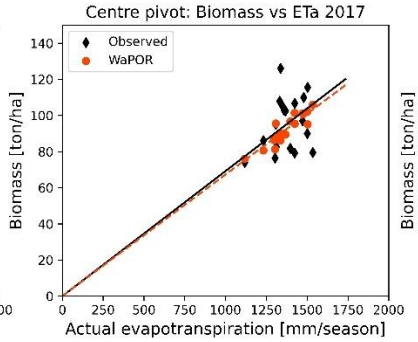

Centre pivot: ∑(Ta/RET) vs Biomass 2015
Observed
WaPOR
Biomass [ton/ha]
∑(Ta/RET) [-]

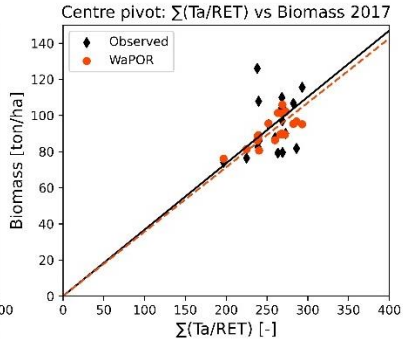

Centre pivot: Biomass vs Ta 2016
Observed
WaPOR
Biomass [ton/ha]
Transpiration [mm/season]

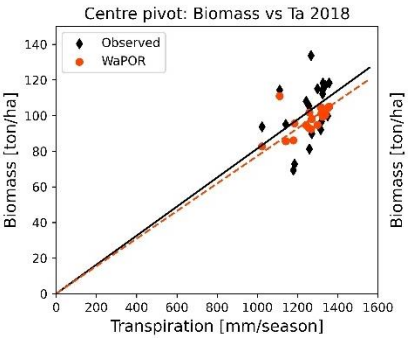

Centre pivot: Biomass vs ETa 2016
Observed
WaPOR
Biomass [ton/ha]
Actual evapotranspiration [mm/season]

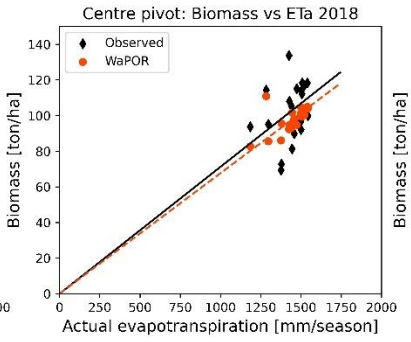

Centre pivot: ∑(Ta/RET) vs Biomass 2016
Observed
WaPOR
Biomass [ton/ha]
∑(Ta/RET) [-]


Centre pivot: Biomass vs Ta 2017
Observed
WaPOR
Biomass [ton/ha]
Transpiration [mm/season]


Centre pivot: Biomass vs ETa 2017
Observed
WaPOR
Biomass [ton/ha]
Actual evapotranspiration [mm/season]


Centre pivot: ∑(Ta/RET) vs Biomass 2017
Observed
WaPOR
Biomass [ton/ha]
∑(Ta/RET) [-]


Centre pivot: Biomass vs Ta 2018
Observed
WaPOR
Biomass [ton/ha]
Transpiration [mm/season]


Centre pivot: Biomass vs ETa 2018
Observed
WaPOR
Biomass [ton/ha]
Actual evapotranspiration [mm/season]

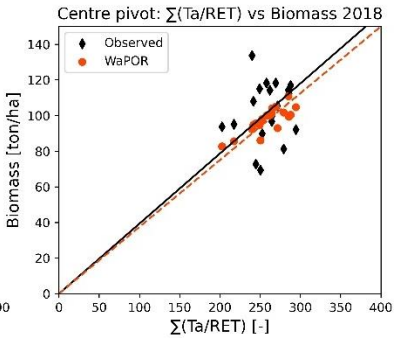

Centre pivot: ∑(Ta/RET) vs Biomass 2018
Observed
WaPOR
Biomass [ton/ha]
∑(Ta/RET) [-]

Table S1. *The statistical parameters of the relationship between biomass and water consumption of furrow, sprinkler and centre pivot irrigated fields from 2015 to 2018.*

Furrow irrigated fields

Line	**Regression parameters**	**2015 (n=175)**	**2016 (n=153)**	**2017 (n=152)**	**2018 (n=149)**
B vs. T_a	Slope of the regression line	0.077	0.076	0.081	0.081
	intercept	0.0	0.0	0.0	0.0
	r^2	0.828	0.617	0.79	0.802
B vs. ET_a	Slope of the regression line	0.065	0.064	0.069	0.07
	Intercept	0.0	0.0	0.0	0.0
	r^2	***0.856***	***0.641***	***0.815***	***0.833***
B vs. $\sum T/RET$	Slope of the regression line	0.0.38	0.376	0.379	0.387
	Intercept	0.0	0.0	0.0	0.0
	r^2	0.739	0.78	0.806	0.711

Sprinkler irrigated fields

Line	**Regression parameters**	**2015 (n=160)**	**2016 (n=180)**	**2017 (n=161)**	**2018 (n=149)**
B vs. T_a	Slope of the regression line	0.075	0.072	0.08	0.08
	intercept	0.0	0.0	0.0	0.0
	r^2	0.87	0.427	0.86	0.813
B vs. ET_a	Slope of the regression line	0.064	0.061	0.069	0.069
	Intercept	0.0	0.0	0.0	0.0
	r^2	***0.939***	***0.651***	***0.884***	***0.87***
B vs. $\sum T/RET$	Slope of the regression line	0.0.378	0.376	0.375	0.387
	Intercept	0.0	0.0	0.0	0.0
	r^2	0.737	0.658	0.808	0.772

Centre pivot irrigated fields

Line	Regression parameters	2015(n=16)	2016(n=17)	2017(n=19)	2018(n=19)
B vs. T_a	Slope (ton/ha)	0.075	0.068	0.077	0.077
	intercept	0.0	0.0	0.0	0.0
	r^2	0.538	0.558	0.757	0.123
B vs. ET_a	Slope (ton/ha)	0.065	0.059	0.067	0.068
	Intercept	0.0	0.0	0.0	0.0
	r^2	***0.606***	***0.608***	***0.817***	***0.2***
B vs. ∑*T*/	Slope (ton/ha)	0.376	0.353	0.357	0.375
	Intercept	0.0	0.0	0.0	0.0
	r^2	0.643	0.621	0.444	0.486

Table S2. *The statistical parameters of the linear regression lines for the relationship between biomass versus seasonal actual water consumption (ETa), and biomass versus normalized actual water consumption accumulated over the cropping season (∑(ETa/RET). The normalization is done for climate using reference evapotranspiration (RET).*

The slope and correlation coefficient of a linear regression lines passing through the origin for the relationship between (i) biomass vs. ETa, and (ii) biomass vs. ∑(ETa/RET) of sugarcane at Xinavane

Line	Regression parameters	2015	2016	2017	2018
B vs ETa	Slope (ton/ha)	0.065	0.061	0.069	0.068
	Correlation coefficient	0.925	0.657	0.815	0.863
B vs ∑(ETa/RET)	Slope (ton/ha)	0.327	0.318	0.329	0.339
	Correlation coefficient	0.946	0.845	0.907	0.934

The slope (a) and correlation coefficient (r^2) of a linear regression lines passing through the origin for the relationship between (i) biomass vs. seasonal actual water consumption, and (ii) biomass vs. normalized water consumption ∑(ETa/RET) of sugarcane categorized by irrigation methods at Xinavane

Line	Irrigation methods	Regression parameters*	2015	2016	2017	2018
		a	0.066	0.064	0.07	0.069
B vs. ETa	Furrow	r^2	0.94	0.76	0.89	0.88
		a	0.064	0.06	0.069	0.068
B vs. ETa	Sprinkler	r^2	0.93	0.69	0.78	0.87
	Centre	a	0.065	0.058	0.068	0.066
B vs. ETa	pivot	r^2	0.93	0.65	0.73	0.77
		a*	0.328(**32.8**)	0.326(**32.6**)	0.329(**32.9**)	0.341(**34.1**)
B vs. ∑(ETa/RET)	Furrow	r^2	0.94	0.80	0.928	0.93
		a*	0.326(**32.6**)	0.315(**31.5**)	0.329(**32.9**)	0.339(**33.9**)
B vs. ∑(ETa/RET)	Sprinkler	r^2	0.95	0.89	0.89	0.93
	Centre	a*	0.326(**32.6**)	0.309(**30.9**)	0.326(**32.6**)	0.337(**33.7**)
B vs. ∑(ETa/RET)	pivot	r^2	0.94	0.84	0.88	0.89

*a in ton/ha (**g/m^2**). The crop productivity-normalized for climate of C4 crops (e.g. sugarcane) ranges from 30-35 g/m^2 (Steduto et al., 2007; Steduto et al., 2009).

Steduto, P., Hsiao, T. C., and Fereres, E.: On the conservative behavior of biomass water productivity, Irrigation Science, 25, 189-207, 2007.
Steduto, P., Hsiao, T. C., Raes, D., and Fereres, E.: AquaCrop—The FAO crop model to simulate yield response to water: I. Concepts and underlying principles, Agronomy Journal, 101, 426-437, 2009.