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REVIEW ARTICLE

Comments on a paper published by Ali Shabani et l. 2024.: how accurate is the SALTMED model in simulating rapeseed yield and growth under different irrigation and salinity levels? Modeling earth systems and environment. Published on line 03 february 2024

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Abstract
The SALTMED model employs the well-known physically based equations. It is a comprehensive integrated management tool for water, crops, farmland and fertilizers. The model was initially developed in 2002 under the SALTMED EU Funded Project and has been subjected to further developments over four EU funded Projects until 2019. In 2020, Wiley dedicated a special issue to SALTMED, compiling 17 papers on SALTMED applications worldwide, as acknowledgement and testimony to SALTMED's valuable contribution to improve water productivity (Ragab 2020). SALTMED users, and they are many across the world, reported good model results, and currently the model is adopted by many organizations across the world as a reliable management tool. This paper is focused on the only case of wrong application of the SALTMED model in Iran based on the misunderstanding of the model processes. This paper aims to clarify where the authors incorrectly applied the model and how it should have been applied.

Keywords SALTMED Model · Accurate Yield Prediction · Simple Relative Yield prediction · Photosynthesis based yield

General comment

The paper is only based on a two-season study, one season is used for calibration and other for validation of SALTMED model.

To properly evaluate a model, test its accuracy and reach concrete conclusions, one needs:

1. A long-term experiment, running over a good number of years.
2. A comprehensive data collection program through field measurements.
3. To only use measured values, literature-based data should not be used.
4. To use several years for validation, e.g., dry, wet, and average years.

However, some researcher used two seasons to calibrate/validate the SALTMED model to study the impact of a certain treatment (irrigation level or N-level) or management (surface mulching). This is different from conducting a model evaluation which requires several years to obtain concrete results. One should not evaluate a comprehensive model, such as SALTMED, using one validation season and using assumed/imported parameter data from literature.

The authors had several comments on SALTMED which are listed here and commented on:

Abstract: Page 1. The last 6 lines: the authors wrote "The results showed that the accuracy of the model was satisfactory and acceptable in simulating the grain yield and dry matter of rapeseed, as well as the soil water content and soil salinity. However, there were some discrepancies observed between the measured and estimated data for soil water content simulation. Some possible defects in the model theory that may contribute to its inaccuracy."

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Comment

The statements above are in contradiction. One part says the model accuracy was acceptable and the last part says there are possible defects in the model theory. The SALTMED model (Ragab 2015) has no defects in its theoretical basis for calculating soil moisture as it is based on Richards Equation for soil moisture dynamics and employs the Convection Dispersion Equation for solute flow. Neither of these two equations is superseded by new equations and they are still the only standard, physically based equations used in modelling. The comment by the authors is baseless, misleading, not proven and contradicts the good results they obtained. Saying the model possibly has defects after using one season of data, and taking parameters values from literature, is quite unacceptable and unprofessional.

Introduction: Page 2. In the last paragraph the authors wrote “Therefore, this study aims to model the growth and yield of rapeseed using the SALTMED model under different levels of irrigation water and salinity”.

Comment

The authors did not use the SALTMED model to model the growth and yield. They used the option of calculating the relative yield as a ratio of actual seasonal water uptake to the seasonal water uptake optimum /maximum uptake then multiplied the relative yield by the maximum yield observed in the region under optimum condition. The option selected by the authors is for predicting relative yield, relative to a reference yield usually selected to run the model with hypothetical “what if scenarios” of climate change or water and field management. In presence of field yield observations, the CROP Growth module is the option to use. The authors did not use the CROP Growth module (Fig. 1) but used the ‘what if scenarios’, which was the wrong option.

Materials and Methods: Page 3. The authors wrote “The method described by the U.S. Salinity Laboratory Staff (USDA 1954) was used to determine the electrical conductivity of the soil saturated extract”. “However, to obtain the electrical conductivity of soil saturated extract, the following calculation was performed (Smedema and Rycroft 1983):

$$\theta s \times ECe = ECsw \times \theta m \quad (1)$$

where ECsw is the electrical conductivity of soil water solution (dS m^{-1}), ECe is the electrical conductivity of soil saturated extract (dS m^{-1}), θs is the soil water content at saturation (cm3 cm^{-3}) and θm is the soil water content at which ECsw is derived (cm^3 cm^{-3}). The neutron scattering method was used for measuring soil water content at depths of 0.2, 0.3, 0.6, 0.9, 1.2, and 1.5 m.

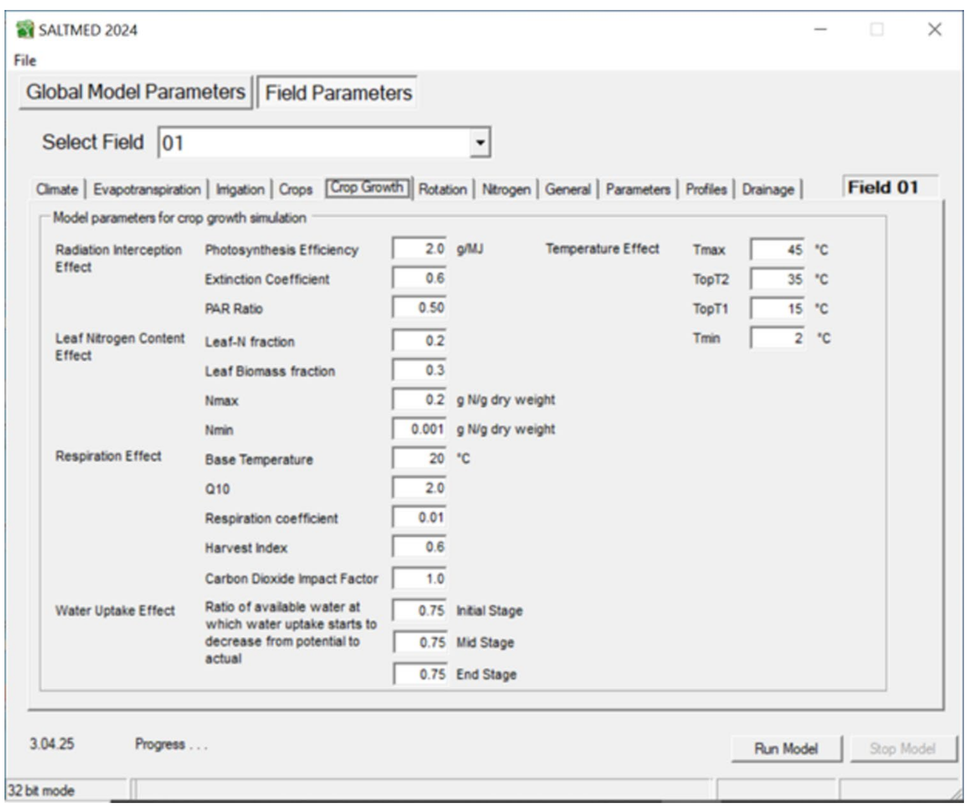

Fig. 1 Crop growth sub-model parameters in SALTMED

Comment

1. The procedure of the U.S. Salinity Laboratory Staff (USDA 1954) is a 70-years-old method of soil salinity measurements and is almost obsolete. Field salinity is associated with a concurrent soil moisture content. As the laboratory measurements dilute the field salinity and bring the soil moisture content to saturation, this is different from the field soil moisture. Over the past years, several new sensors for in-situ field measurements have been developed at affordable costs. In situ soil moisture and soil salinity using sensors are the current common practice. New guidelines by FAO, and other organizations, are available as upgrade to US Salinity Laboratory method. The advantage is the sensors measure directly the salinity at the concurrent field soil moisture.
2. Eq. 1 above, introduces three sources of inaccuracy. The first is the ECe which is a diluted field salinity that has no relation with field salinity. The second is the field soil moisture value that is measured by the Neutron Probe (NP). This is another old technology that is obsolete nowadays. This method is not the most accurate one for small depth intervals as it measures larger volumes of the soil based on how far the neutrons would travel depth wise. The method is not accurate, especially not for surface layers. It is not suitable in presence of cracks in the soil and in general is not suitable for irrigation scheduling, as stated by Gaze et al. (2002) who stated: "The value of the NP for monitoring soil moisture deficit (SMD) where there is irrigation, or substantial rain, must be seriously doubted. Consequently, its limitations for scheduling irrigation, testing models, or quantifying the effects of treatments on crop water use in potatoes must be appreciated."

The third source of error is the laboratory measured saturated soil moisture. It is well known that the field saturated soil moisture is not the same as the laboratory value due to the presence of air in the field soil pores. Subsequently, field saturated soil moisture is lower that the laboratory value. The consequence of using equation 1 and the diluted salinity of the laboratory is that the field soil salinity from Equation 1 will be lower than the real field salinity value and that explains why the authors mentioned the model slightly overestimated the salinity, but, in reality, it is the laboratory dilution of field salinity and the calculation using inaccurate soil moisture in Equation 1 that led to the underestimation of salinity. This issue of laboratory versus field salinity is discussed in a recent paper by Ragab (2024).

Materials and methods: Pages 5/6. The authors wrote "The root depth, which varied during the growing season, was estimated as follows: Borg and Grimes, 1986".

Comment

In a field experiment, the root depth is measured not estimated, as done by the authors. The SALTMED model calculates the daily root depth and also the root zone width and calculates the daily uptake from the area occupied by roots. There is no indication that the authors are aware of the root width parameter input and how the model calculates the width, as they only focused on the root depth formula.

Page 6 "The authors wrote "A leaching fraction of 20% was used to reduce salt build-up in the root zone".

Comment

A routine addition of 20% extra water is not good management as the leaching fraction varies and should be based on two factors: salinity level of the soil and the plant salt tolerance level. This issue of leaching fraction mismanagement is discussed in a recent paper by Ragab (2024).

Calibration of SALTMED model: Page 7. The authors wrote "The SALTMED model's parameters were calibrated using a trial-and-error method to achieve the best agreement between the measured and simulated data for soil water content, dry matter, and crop yield." "Photosynthesis efficiency, harvest index and CO2 factor were determined by a fine-tuning process in the calibration stage. Other necessary parameters such as basal crop coefficient (Kcb), pore size distribution index (lambda), and bubbling pressure were obtained from the model's database as default values."

Comment

In order to evaluate the accuracy of a model, such as SALTMED model, field measurements, not literature-based values must be used. True field data versus simulated data is the correct way to evaluate the accuracy of a model.

Results: pages 8&10: The authors wrote "According to the results it can be said that the accuracy of the SALTMED in simulating the amount of grain yield is excellent. However, as shown in Fig. 4 and Table 5, the SALTMED model has slightly overestimated the grain yield. Therefore, higher levels of salinity and drought stress resulted in a higher overestimation of the model. Table 5 showed that the model's accuracy was slightly decreased by increase in salinity of irrigation water and decrease in applied water and increase in stress levels".

Comment

Above are two contradicting statements. In addition, Fig. 4 and Table 5 did not show any noticeable difference at higher salinity levels. The figure shows perfect agreement at all salinity levels with R^2 for calibration 0.89 and for validation 0.95. Table 5 shows that the validation process produced a value of R^2 equal to 1.00 for the highest salinity level 10 dS/m (an exact match), 0.96 for 7 dS/m, 0.99 for 4 dS/m, and 1.0 for 0.6 dS/m. The authors wrongly interpreted their own results. It is clear the statement above is incorrect and misleading.

Page 9: The authors wrote "Dry Matter" "According to the results, the accuracy of the SALTMED model in simulating the amount of dry matter is acceptable. However, as shown in Fig. 5 and Table 5, like for the grain yield, the model has slightly overestimated the dry matter."

Comment

The SALTMED simulated dry matter includes the whole plant, including the roots. There is no indication that the root biomass was considered at all by the authors. The authors only used the above ground biomass. In addition, the parameters included in the biomass production were assumed, or taken from the literature. The authors should not consider the model to be inaccurate for these reasons.

Page 10. The authors wrote "Therefore, the soil water content has been simulated less accurately by SALTMED at severe water deficiency." "According to the results the accuracy of the model in simulating the soil water content is acceptable."

Comment

Again, these are two contradicting statements. The Neutron Probe used is an old method that is inaccurate for exact depth measurements. It measures soil moisture of a certain volume while the model calculates the soil moisture at an exact depth. The current sensor technology gives the exact depth soil moisture and that is compatible with the model values.

Page 10: The authors wrote "Kaya et al., (2015), Pulvento et al. (2013), Hirich et al. (2012), Silva et al. (2013), Hirich et al. (2014) reported that the SALTMED model accuracy decreased with water stress/deficit irrigation".

Comment

The authors reported that the following papers indicated that SALTMED accuracy in simulating soil moisture decreases under water stress and deficit irrigation. In reality, this is not true given the following extracts from the listed publications mentioned by the authors: Kaya et al. (2015) in Turkey say in the abstract: "The model was able to simulate *with good precision, soil moisture values, total dry matter and grain yield* for quinoa under various irrigation strategies, irrigation methods, and different water quality conditions for quinoa grown in the Mediterranean environment. ". Pulvento et al. (2013) say in their abstract "The *results indicated the model's ability to simulate with good precision, soil moisture values, total dry matter and grain yield for quinoa under different irrigation strategies with saline and fresh* water". Hirich et al. (2012) say in their abstract "the SALTMED *model proved its ability to predict soil moisture, yield and total dry matter for three growing seasons under several deficit irrigation strategies using treated wastewater*." Silva et al. (2013) wrote in their abstract "The results of calibration and validation of the *SALTMED model showed that the model can simulate very accurately soil moisture content, grain yield, and total dry biomass of different chickpea varieties, in both wet and dry years."* Hirich et al. (2014) say in the abstract "The *model proved its ability to predict* soil moisture availability, yield, water productivity and total dry matter for three growing seasons under *several deficit irrigation strategies* using treated wastewater. The high values of the coefficient of determination R^2 *reflected a very good agreement* between the model and observed values."

Discussion: Pages 10 to 12

I. The authors wrote "as mentioned above, similar to other crop models such as AquaCrop (Ahmadi et al. 2022) and ET-HS model (Soleymani 2022), the accuracy of this model decreases under the conditions of severe salinity and water stresses.

Comment

The two references given by the authors both refer to AquaCrop & ET-HS model. The statement does not apply to the SALTMED model. Ragab (2020) reviewed seventeen papers on SALTMED, none of them reported that the accuracy of SALTMED Model decreases with increasing water and salinity stress. The statement made by the authors that the accuracy of models decreases under severe salinity and water stress is not correct for SALTMED.

II. The authors wrote "The greatest discrepancy between the measured and estimated data was observed for the soil water content simulation. Following this, it reduces the accuracy of the model to **simulate evapotranspiration**, dry matter, and yield."

Comment

This is untrue, as the authors declared using the R^2 values that the dry matter and yield were simulated with good accuracy. Moreover, the evapotranspiration, was not included in the comparison. The authors calculated the evapotranspiration from the weather data and an unmentioned equation, as mentioned in their paper under Materials and Methods. The authors did not make a comparison between the evapotranspiration they obtained this way with the evapotranspiration simulated by the SALTMED model.

III. The authors wrote "Some possible defects of the model theory that may contribute to this inaccuracy."

Comment

The model employs the well-known physically based equations, Richards' equation for soil moisture dynamics and the Convection–Dispersion equation for solute flow. Therefore, soil water content and soil salinity undoubtedly are calculated with the most accurate equations that are proven to be the best available. None of the SALTMED users, and they are many across the world, casted any doubt on the theories, processes and equations used in the SALTMED model. The statement by the authors is baseless, unfounded, unsupported by findings and is absolutely wrong.

IV. The authors wrote "In this model, grain yield is obtained from the product of the maximum yield value (Ym) by the yield ratio (RY) based on Eq. (5) (of their paper). The fact that the maximum yield is one of the input parameters of the model has both an advantage and a disadvantage. If the maximum yield data is available, its advantage is an increase in the accuracy of the model for simulating the bred cultivars at each region and local climatic conditions. Its disadvantages are (1) this parameter is not available in all regions; (2) the maximum crop yield obtained in a region cannot be used for other regions."

Comment

This is a wrong statement and shows that the authors did not understand the SALTMED model. SALTMED Model has two sub-models to obtain the yield. The authors focused on the simple relative yield sub-model, which is designed for "what if" hypothetical scenarios to assess the relative changes in yield under climate change scenarios, different water applications, different salinity water levels, etc. instead of focusing/using the CROP Growth sub- model.

The maximum yield value is only used if the relative yield option is considered and if someone is interested to know what the relative change in yield means in terms of ton/ha. In such case, the relative yield can be multiplied by the maximum obtainable yield of the region. However, this option is to assess the impact of scenarios on yield relative to a reference yield and the results are hypothetical and not intended to be compared against field yield measurements. However, to compare model yield with field measured yield, the crop growth sub-model is the option to consider (Fig. 1) as it calculates the simulated yield from daily biomass accumulation and harvest index. The simulated yield by this sub-model is saved during the model run as output excel file for comparison against the observed yields (example given in Table 1 hereunder).

For research work, and in the presence of measured yield values, SALTMED model calculates the yield based on daily crop growth which is based on the photosynthesis process taking into consideration the photosynthesis efficiency factor, daily values of temperature, radiation, water, fertilizers and stress factors related to soil water availability, soil salinity, crop tolerance to salinity, CO_2, temperature threshold, and water uptake stress factors. The authors did not refer to this crop growth sub-model. Instead, they wrote pages on how to improve the simple "what if" scenario relative yield model, without any reference to the option of the crop growth sub-model, which is shown below.

In SALTMED, the crop growth rate simulation is based on the work of Eckersten and Jansson (1991):

The assimilation rate,"A", per unit of area = E* I* f (Temp)* f (T)*f (Leaf-N).

Where E is the photosynthetic efficiency (g dry matter MJ^{-1}), I is the radiation input = Rs (1- e^{-k*LAI}), Rs is global radiation (MJ m^{-2} day^{-1}), k is extinction coefficient and LAI is the leaf area index (m^2 m^{-2}). Rs is given in climate data, LAI is interpolated in SALTMED.

The transpiration stress factor is taken as a ratio of actual plant water uptake to the potential water uptake. The temperature stress is taken as the deviation of the average temperature of a given day from the optimum temperature for the growth. The leaf nitrogen stress is taken as the deviation of the leaf nitrogen content of a given day from the optimum leaf nitrogen content. Figure 1 shows the crop growth dialogue of the SALTMED model. This sub model was not mentioned at all by the authors as they used wrongly the relative yield that is intended for "what if" hypothetical scenarios simulation which does not simulate the crop growth at all. In this dialogue below, there is no

Table 1 Simulated daily dry matter, and yield (top), and simulated rooting depth (bottom)

SALTMED Irrigation	Version 3—2021		
Date	Daily_DM [t/h	Total_DM[t/h]	Yield_DM[t/h]
01/03/1999	0	0	0
02/03/1999	0	0	0
03/03/1999	0	0	0
04/03/1999	0	0	0
05/03/1999	0.019027	0.019027	0.011416
06/03/1999	0.010414	0.029441	0.017664
07/03/1999	0.010321	0.039762	0.023857
08/03/1999	0.010591	0.050353	0.030212
09/03/1999	0.009339	0.059692	0.035815
10/03/1999	0.010312	0.070003	0.042002
11/03/1999	0.013196	0.0832	0.04992
12/03/1999	0.013803	0.097002	0.058201
13/03/1999	0.011737	0.108739	0.065244
14/03/1999	0.010871	0.11961	0.071766
15/03/1999	0.011593	0.131203	0.078722
16/03/1999	0.020591	0.151794	0.091077
17/03/1999	0.024314	0.176109	0.105665
18/03/1999	0.025985	0.202093	0.121256
19/03/1999	0.010793	0.212887	0.127732
20/03/1999	0.018222	0.231109	0.138665
21/03/1999	0.027775	0.258884	0.155331
22/03/1999	0.029765	0.28865	0.17319
23/03/1999	0.031576	0.320225	0.192135
24/03/1999	0.028207	0.348433	0.20906
25/03/1999	0.017094	0.365526	0.219316
26/03/1999	0.041754	0.40728	0.244368
27/03/1999	0.036005	0.443285	0.265971
28/03/1999	0.031623	0.474908	0.284945
29/03/1999	0.042857	0.517766	0.310659
30/03/1999	0.049396	0.567162	0.340297
31/03/1999	0.026472	0.593634	0.35618
01/04/1999	0.032675	0.626308	0.375785
02/04/1999	0.056305	0.682613	0.409568
03/04/1999	0.033606	0.716219	0.429732
04/04/1999	0.073549	0.789768	0.473861
05/04/1999	0.072648	0.862416	0.51745
06/04/1999	0.072264	0.934681	0.560808
07/04/1999	0.045099	0.979779	0.587868
08/04/1999	0.059193	1.038972	0.623383
09/04/1999	0.080875	1.119848	0.671909
10/04/1999	0.080102	1.19995	0.71997
11/04/1999	0.079334	1.279284	0.76757
12/04/1999	0.058884	1.338168	0.802901
13/04/1999	0.079069	1.417237	0.850342
14/04/1999	0.083003	1.50024	0.900144
15/04/1999	0.083632	1.583872	0.950323
16/04/1999	0.087415	1.671287	1.002772
17/04/1999	0.088926	1.760214	1.056128
18/04/1999	0.080029	1.840243	1.104146
19/04/1999	0.049386	1.889629	1.133777
20/04/1999	0.054621	1.944251	1.16655
21/04/1999	0.086502	2.030753	1.218452
22/04/1999	0.069099	2.099852	1.259911

Table 1 (continued)

SALTMED Irrigation	Version 3—2021		
Date	Daily_DM [t/h	Total_DM[t/h]	Yield_DM[t/h]
23/04/1999	0.090174	2.190026	1.314016
24/04/1999	0.072777	2.262803	1.357682
25/04/1999	0.076906	2.339709	1.403826
26/04/1999	0.087486	2.427195	1.456317
27/04/1999	0.075206	2.502401	1.501441
28/04/1999	0.085549	2.587951	1.55277
29/04/1999	0.09194	2.67989	1.607934
30/04/1999	0.092083	2.771973	1.663184
01/05/1999	0.089931	2.861903	1.717142
02/05/1999	0.079456	2.941359	1.764815
03/05/1999	0.083347	3.024706	1.814824
04/05/1999	0.083836	3.108541	1.865125
05/05/1999	0.095166	3.203707	1.922224
06/05/1999	0.085598	3.289305	1.973583
07/05/1999	0.087224	3.376528	2.025917
08/05/1999	0.09553	3.472058	2.083235
09/05/1999	0.077338	3.549396	2.129638
10/05/1999	0.090156	3.639552	2.183731
11/05/1999	0.091307	3.730859	2.238516
12/05/1999	0.070747	3.801606	2.280964
13/05/1999	0.054946	3.856552	2.313932
14/05/1999	0.093905	3.950458	2.370275
15/05/1999	0.090652	4.04111	2.424666
16/05/1999	0.089779	4.130888	2.478533
17/05/1999	0.087946	4.218834	2.531301
18/05/1999	0.083201	4.302035	2.581221
19/05/1999	0.079393	4.381428	2.628857
20/05/1999	0.06836	4.449788	2.669873
21/05/1999	0.101116	4.550905	2.730543
22/05/1999	0.09465	4.645555	2.787333
23/05/1999	0.093139	4.738694	2.843216
24/05/1999	0.093853	4.832546	2.899528
25/05/1999	0.081188	4.913734	2.948241
26/05/1999	0.081022	4.994757	2.996854
27/05/1999	0.090339	5.085095	3.051057
28/05/1999	0.056279	5.141374	3.084825
29/05/1999	0.07283	5.214204	3.128523
30/05/1999	0.096075	5.31028	3.186168
31/05/1999	0.089522	5.399802	3.239881
01/06/1999	0.086561	5.486363	3.291818
02/06/1999	0	0	0
03/06/1999	0	0	0
04/06/1999	0	0	0

SALTMED Irrig	Version 3—2021		
Date	Kc	Kcb	Root_Depth [m]
	dimensionle	dimensionl	m
01/03/1999	0.00	0.00	0.00
02/03/1999	0.00	0.00	0.00
03/03/1999	0.00	0.00	0.00
04/03/1999	0.00	0.00	0.00
05/03/1999	0.70	0.18	0.40

Table 1 (continued)

SALTMED Irrig	Version 3—2021		
Date	Kc	Kcb	Root_Depth [m]
06/03/1999	0.70	0.18	0.40
07/03/1999	0.70	0.18	0.40
08/03/1999	0.70	0.18	0.40
09/03/1999	0.70	0.18	0.40
10/03/1999	0.70	0.18	0.40
11/03/1999	0.70	0.18	0.40
12/03/1999	0.70	0.18	0.40
13/03/1999	0.70	0.18	0.40
14/03/1999	0.70	0.18	0.40
15/03/1999	0.72	0.22	0.41
16/03/1999	0.74	0.26	0.42
17/03/1999	0.75	0.30	0.43
18/03/1999	0.77	0.33	0.44
19/03/1999	0.79	0.37	0.45
20/03/1999	0.81	0.41	0.46
21/03/1999	0.82	0.45	0.47
22/03/1999	0.84	0.49	0.48
23/03/1999	0.86	0.53	0.49
24/03/1999	0.88	0.57	0.50
25/03/1999	0.89	0.60	0.51
26/03/1999	0.91	0.64	0.52
27/03/1999	0.93	0.68	0.53
28/03/1999	0.95	0.72	0.54
29/03/1999	0.96	0.76	0.55
30/03/1999	0.98	0.80	0.56
31/03/1999	1.00	0.83	0.57
01/04/1999	1.02	0.87	0.58
02/04/1999	1.03	0.91	0.59
03/04/1999	1.05	0.95	0.60
04/04/1999	1.05	0.95	0.60
05/04/1999	1.05	0.95	0.60
06/04/1999	1.05	0.95	0.60
07/04/1999	1.05	0.95	0.60
08/04/1999	1.05	0.95	0.60
09/04/1999	1.05	0.95	0.60
10/04/1999	1.05	0.95	0.60
11/04/1999	1.05	0.95	0.60
12/04/1999	1.05	0.95	0.60
13/04/1999	1.05	0.95	0.60
14/04/1999	1.05	0.95	0.60
15/04/1999	1.05	0.95	0.60
16/04/1999	1.05	0.95	0.60
17/04/1999	1.05	0.95	0.60
18/04/1999	1.05	0.95	0.60
19/04/1999	1.05	0.95	0.60
20/04/1999	1.05	0.95	0.60
21/04/1999	1.05	0.95	0.60
22/04/1999	1.05	0.95	0.60

Table 1 (continued)

SALTMED Irrig	Version 3—2021		
Date	Kc	Kcb	Root_Depth [m]
23/04/1999	1.05	0.95	0.60
24/04/1999	1.05	0.95	0.60
25/04/1999	1.05	0.95	0.60
26/04/1999	1.05	0.95	0.60
27/04/1999	1.05	0.95	0.60
28/04/1999	1.05	0.95	0.60
29/04/1999	1.05	0.95	0.60
30/04/1999	1.05	0.95	0.60
01/05/1999	1.05	0.95	0.60
02/05/1999	1.05	0.95	0.60
03/05/1999	1.05	0.95	0.60
04/05/1999	1.05	0.95	0.60
05/05/1999	1.05	0.95	0.60
06/05/1999	1.05	0.95	0.60
07/05/1999	1.05	0.95	0.60
08/05/1999	1.05	0.95	0.60
09/05/1999	1.05	0.95	0.60
10/05/1999	1.05	0.95	0.60
11/05/1999	1.05	0.95	0.60
12/05/1999	1.05	0.95	0.60
13/05/1999	1.05	0.95	0.60
14/05/1999	1.04	0.94	0.60
15/05/1999	1.04	0.94	0.59
16/05/1999	1.03	0.93	0.59
17/05/1999	1.03	0.93	0.59
18/05/1999	1.02	0.92	0.58
19/05/1999	1.02	0.92	0.58
20/05/1999	1.01	0.91	0.58
21/05/1999	1.01	0.91	0.57
22/05/1999	1.00	0.90	0.57
23/05/1999	0.99	0.89	0.57
24/05/1999	0.99	0.89	0.57
25/05/1999	0.98	0.88	0.56
26/05/1999	0.98	0.88	0.56
27/05/1999	0.97	0.87	0.56
28/05/1999	0.97	0.87	0.55
29/05/1999	0.96	0.86	0.55
30/05/1999	0.96	0.86	0.55
31/05/1999	0.95	0.85	0.54
01/06/1999	0.94	0.84	0.54
02/06/1999	0	0	0
03/06/1999	0	0	0
04/06/1999	0	0	0

option to use the maximum yield obtainable in the region under optimum condition because the model calculates the yield at harvest day from the accumulation of daily biomass and the harvest index. It is clear from Fig. 1 that the crop growth, biomass production and yield does not need the maximum yield of the region as input as claimed by the authors because it is calculated by the model. The simulated daily dry matter and yield are generated and saved in an excel file in the Results folder. (Example is given hereunder in Table 1).

For "what if "Scenarios modelling. SALTMED model offers this option for relative yield calculation (relative to a reference maximum yield observed in the region):

The relative crop yield, RY is calculated as:

$$RY = \frac{\sum S(x,z,t)}{\sum S\max(x,z,t)}$$

The relative crop yield RY is estimated as the sum of the actual water uptake "S" over the season divided by the sum of the potential water uptake (under no water and salinity stress conditions, $S_{max.}$ This option assumes that salinity and water are the only 'stressors' and all other factors are at optimum level. It is used for quick answers when one needs to run several "what if" hypothetical scenarios. Should the user need to know how the relative yield translates into ton/ha, the user needs to input the maximum obtainable yield under optimum condition in the region (Ymax), then SALTMED model will convert the relative yield to actual yield in ton/ha. This is not a crop growth model. Just quick estimate of expected relative changes in the yield under hypothetical scenarios. This is not an outcome of crop growth process.

Discussion: Page 13. The authors wrote "Therefore, using Eqs. (31) and (32) (of their paper) in the SALTMED model structure can result in a more accurate simulation." The authors suggest, as a way to improve the yield prediction of SALTMED model, to adopt another water uptake function as those of Eqs. 31&32.

Comments

I. This is a surprise, as the authors quoted in page 8: "According to the results it can be said that the accuracy of the SALTMED in simulating the amount of grain yield is excellent with $R^2 = 0.95$ validation Page 8 ". This indicates that the water uptake function used in SALTMED is giving good results.

II. This water uptake function of SALTMED Model did produce a good R^2 in this study and in many other studies around the world. Due to the extensive and successful use of the SALTMED model, Wiley, Ltd USA dedicated its first virtual issue to the SALTMED model. "A special issue about SALTMED MODEL application "SALTMED Publications in Irrigation and Drainage. Virtual Issues First published: 20 May 2020 Last updated: 20 May 2020. Wiley online Library". https://onlinelibrary.wiley.com/doi/toc/https://doi.org/10.1002/(ISSN)1531-0361.saltmed-publications

III. There is no good reason to believe that multiplicative stresses functions would give better results than the additive stresses function. The authors did not run a field experiment specifically to measure the water uptake and compare it with water uptake calculated by Eq. 31 or 32 or against the values obtained by SALTMED. Therefore, there is no basis to suggest they are better than the water uptake function used in SALTMED. There are a number of ways to measure water uptake, among them the weighing lysimeters. The authors did none. For that reason, there is no ground to think the water uptake function of SALTMED could be improved further by using the suggested equation without any concrete evidence that they are more accurate than the one of SALTMED, while SALTMED water uptake function produced a yield with R^2 above 0.95 which contradicts their criticism.

Discussion: Page 13. The authors wrote "the root growth changes during the growing season are similar to crop coefficient variations and it is reduced at the end growth stage. Meanwhile, other researchers reported the process of root growth in the whole growing season in an S-shape. In other words, according to these researchers, the root depth at the end growth stage of a plant is equal to the maximum root depth and remains constant."

Comment

It is physiologically known that crops in their final stage before harvest reduce gradually their water uptake while progressing towards senescence/dryness before harvest. "This reduction in water uptake is represented by a slight gentle gradual decrease in the water uptake using a gradually decreasing root zone area as a proxy to reduce the water uptake. This can be presented by the same trend of Kc over time. It is logic for the root activity to follow the Kc curve which represents the crop growth that gradually decreases during the final growth stage towards harvest, after reaching the maximum growth period (mid-season stage). Keeping root depth constant until harvest means crops will continue water uptake until harvest with the same rate as in the development stage which is not natural. Table 1 is produced by the model during the run. It shows the gentle gradual decrease of the root depth to mimic the reduction in water uptake close to harvest.

Conclusions: Page 15

I. The authors wrote "Like the grain yield, the values of statistical indices demonstrated that the model's accuracy experienced a slight decrease as the stress levels increased".

Comment

This is an incorrect statement. When discussing Fig. 4 "Relationship between the measured and simulated grain yield for calibration (a) and validation (b) in their article, the authors stated that "the accuracy of the SALTMED in simulating the amount of grain yield is excellent." Fig. 4 did not show any noticeable differences at higher salinity levels. The figure shows perfect agreement at all salinity levels, with R^2 for calibration 0.89 and for validation 0.95. Their Table 5 shows that the validation process produced a value of R^2 equal to 1.00 for the highest salinity level 10 dS/m (exact match), 0.96 for 7 dS/m, 0.99 for 4 dS/m, and 1.0 for 0.6 dS/m.

II. The authors wrote "Using more realistic and conceptual root water uptake patterns and root growth function can improve simulations of yield and growth of crops by SALTMED."

Comment

This is a baseless statement as it is not supported by any evidence that the Water Uptake function of SALTMED is less accurate than other functions.

The authors did not run a field experiment and compared the measured water uptake (for example using weighing Lysimeters) with calculated water uptake obtained by different water uptake function. In addition, the authors used parameters from literature e.g. the water stress factor h50 and the salinity stress factor π50 that are essential to obtain accurate water uptake, Given the authors did not measure these parameters and assumed arbitrary values, they cannot judge the accuracy of SALTMED results based on data and parameters assumed or based on literature.

Additional remarks

I. SALTMED model is not designed to be a plant physiological model to study the root growth process and elongation under water stress conditions. It is a field management model. The authors' comment regarding the inability of SALTMED to simulate the response of the roots to water stress is irrelevant to the model and to the paper as this issue was not part of their study/experiment did not include root growth and elongation observations.

II. SALTMED model is not designed to be a soil chemistry model. It is a field management model. The comment that the model is not dealing with ion content/composition is irrelevant to the model and to the paper too as their study and measurements did not include soil chemistry aspects.

III. The authors wrongly reported that "management and soil texture are factors that can affect salinity tolerance". This is incorrect. The truth is that the salinity tolerance of a plant is largely genetically determined and not related to management or soil texture.

Declarations

Conflict of interest The author did not receive financial support from any organization for the submitted work. Also, the author has non-financial interests. The author has no relevant financial or non-financial interests to disclose. The author has no conflicts of interest to declare that are relevant to the content of this article.

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