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Research Paper

Assessment of AquaCrop model for simulating Baby corn (*Zea mays* L.) growth and productivity under different sowing windows and crop geometries

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ABSTRACT

The experiments were conducted at Agro Climate Research Centre, TNAU, Coimbatore. Calibration and validation of AquaCrop model was done using Winter and *Kharif*, 2022 data. Calibration showed that AquaCrop accurately simulated the canopy cover by low $RMSE \leq 13.1\%$, good $E \leq 0.76$, high $d \leq 0.94$ and high R^2 values ≥ 0.98 and biomass development by low $RMSE \leq 13.2\%$, high $E \leq 0.92$, good $d \leq 0.68$ and high R^2 values ≥ 0.95. During calibration, model well-simulated the CC under second sowing (D_2) and biomass under third sowing (D_3). Validation showed almost good fit of CC by low $RMSE \leq 22.0\%$, good $E \leq 0.68$, high $d \leq 0.84$ and high R^2 values ≥ 0.97 and biomass development with low $RMSE \leq 7.1\%$, good $E \leq 0.66$, good $d \leq 0.60$ and high R^2 values ≥ 0.98. During Validation, model well-simulated the CC and biomass under third sowing (D_3). Model showed good fit of yield during first sowing window (D_1) with a less deviation for both calibration and validation (15.6% and 5.8% respectively). From the result it could be concluded that sowing windows influence on baby corn production was accurately simulated using AquaCrop during calibration ($R^2=0.94$) and validation ($R^2=0.98$). Hence, AquaCrop proved to be a feasible tool for maximizing the Baby corn yield under different sowing windows.

Keywords: Baby corn, Calibration, Crop geometries, AquaCrop; Sowing windows, Validation.

Baby corn (*Zea mays* L.) also known as mini corn or candle corn is cultivated for unfertilized young ear, harvested after silks have turned pinkish colour just after emergence. The crop is newly evolved most importantly as dual purposes (vegetable and fodder) crops grown round the year in India (Kumar *et al.,* 2015) and popular among domestic and foreign market values both processing and export potential (Das *et al.,* 2008). According to Statista (2023), In India, 31.5 million metric tonnes of grain were produced in 2022–2023. When compared to the prior year production total roughly 32.5 million metric tonnes, this was a drop. In India, corn is often farmed during the *kharif* and winter seasons.

The genetics of the cultivar, the growing environment, and agronomic management all have an impact on baby corn growth and development. The relative growth of vegetative and reproductive portions, as well as their susceptibility to heat and moisture stressors, are all influenced by the sowing period. While the temperature is still high in the fall, early sown crops produce the essential biomass (Flores *et al.,* 2012). According to some cited data, increasing plant density boosts production, especially for late-planted crops like Faba bean (Zeleke, 2019). This is because early sown crops will have the necessary environmental conditions to develop adequate biomass whereas late-sown crops won't have enough time or resources to develop enough crop biomass unless this is compensated by increasing sowing density (Dar *et al.,* 2018).

A sound theoretical foundation is provided by the AquaCrop simulation model to study crop production response to environmental stress (Farahani *et al.,* 2009; Balvanshi and Tiwari, 2019). The four modules of AquaCrop are crop, soil, atmosphere, and management. Farmers and agronomists can adjust the management component (such as irrigation, fertiliser, sowing timing, and sowing rate) to increase yield and productivity. However, AquaCrop must first be calibrated and verified for a specific crop species to be used

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as a decision support tool and to evaluate genotype, environment, and management interactions. The productivity and yield of many crops, including millet (Bello and Walker, 2016), winter wheat (Trombetta *et al.,* 2016), leafy vegetables (Nyathi *et al.,* 2018), cotton (Garcia-Vila *et al.,* 2009), maize (Heng *et al.,* 2009), barley (Abrha *et al.,* 2012), and canola have been examined using AquaCrop (Zeleke *et al.,* 2011). As of right now, AquaCrop has not been calibrated or validated to simulate the growth and production of Baby corn under various agronomic managements. The objectives of this study are to: (1) Calibrate and validate AquaCrop for simulating green canopy cover (CC), above-ground biomass and yield. (2) assess the impacts of sowing windows, crop geometries, and mulching on Baby corn growth and productivity.

MATERIALS AND METHODS

Experimental location characteristics

Coimbatore district was chosen for conducting the experimental trails. Coimbatore is called Manchester of South India and it is situated on the banks of the river Noyyal. It is one of the western agro-climate zone districts, lies between 10º to 11º N latitude and 76º to 77º E longitude. The soil of experimental plot was clay loam in texture and type of soil is black with calcareous in nature, low in organic carbon (0.45%) and available nitrogen (213 kg ha^{-1}), high in available phosphorus (31.0 kg ha^{-1}) and potassium status (640 kg ha^{-1}).

Experimental details

The variety F_1 Sundar of Baby corn (*Zea mays* L.) was used as test crop to conduct the field experiments I and II during Winter (January – April) and *Kharif,* (June – September) 2022. Sowing windows taken as main plot and crop geometries (S_1-60x30 and S_2-60x20 cm) with mulching taken as a subplot, which was laid out in a split-plot design and replicated three times. All the package of practices were followed as per the Tamil Nadu Agricultural University crop production guide for Agriculture (TNAU CPG, 2020). The crop was harvested after the silk colour turned pinkish from milky white by leaving border sample rows. Details of the sowing windows for both seasons are given in Table 1.

Weather parameters

The daily weather data *viz.*, maximum and minimum temperature, wind speed, rainfall, bright sunshine hours and relative humidity during the crop season (Winter and *Kharif* 2022), were retrieved from Agro Climate Research Centre, Tamil Nadu Agricultural University, Coimbatore. The daily data were converted into standard meteorological weekly data during crop growing period (4th standard week - 21st January to 16th standard week – 22 April and 24th standard week – 15 June to 39th standard week – 30th standard week, respectively). From the meteorological data, the weather prevailed during Winter 2022 with a maximum temperature (29 ºC to 36.5 ºC), minimum temperature (25.5 ºC to 26 ºC), total rainfall (49.4 mm), relative humidity (44 % to 82%), wind speed (2.8 km/hr to 9.8 km/hr) and sunshine hours (upto 10.2 hours) and daylength (11.35 to 12.24 hours). Meanwhile, the weather prevailed during *Kharif* 2022 were maximum temperature (25.5 ºC to 34 ºC), minimum temperature (21 ºC to 24.5 ºC), total rainfall (273 mm), relative humidity (53 % to 82.5%), wind speed (3.4 km/hr to 19.4 km/hr) and sunshine hours (upto 11 hours) and daylength (12.01 to 12.46 hours).

Data collection and measurements

To assess crop development, leaf area index (LAI) and total aboveground biomass were monitored throughout the cropping season. During both the experiments, phenological growth and development data were collected at three dates of crop growing cycle (i.e., 25th, 45th and physiological harvest dates). Five plants in each experimental plots were selected randomly to evaluate biomass accumulation, the plants were clipped at the above ground surface, then subjected to an oven dried at 70°C until constant weight was attained and at harvest stage final grain yield and total oven-dry biomass were measured. Five plants in each experimental plots were selected and tagged to monitor biometric observations. The LAI was calculated through manually measured leaf area (maximal length x width) of each plant, multiplied by the shape factor (k = 0.75, Watson, 1947) for Baby corn and the plant density (Equation 1). LAI was converted to green canopy cover (CC) using Equation (2):

$$\text{LAI} = \frac{\text{L*W*K*Number of leaves plants}^{-1}}{\text{Land area occupied by the plant (cm}^2\text{)}}$$

(Wiersma and Bailey 1975) Equation (1)

$$\text{CC} = 1.005\,[1 - \exp(-0.6\ \text{LAI})]^{1.2}$$

Heng *et al.,* 2009 Equation (2)

Description of AquaCrop Simulation Model

Model background

AquaCrop model developed by the Land and Water Division of the FAO, Rome, Italy primarily has two fundamental principles. First one is that the AquaCrop model uses green Canopy Cover to express foliage development instead of Leaf Area Index. Second, the AquaCrop model simulates the yield into biomass and harvest index (HI) because HI is considered as a conservative parameter in AquaCrop.

Parameters and input data

The meteorological parameters were collected from Agro Climate Research Centre, Tamil Nadu Agricultural University. Basic soil characteristics were obtained in accordance with standard international procedures. Groundwater effects through capillary action were not simulated in the AquaCrop model since ground water table of the experimental site was below the effective root zone (typically >7 m). The input data of initial condition file in AquaCrop were measured at the start of each seasonal experiment (Table 2) and the necessary data were entered into the model as practiced in the field experiments. The crop parameters were included in the model *viz.*, plant density, emergence time, canopy senescence and maturity time, flowering period and yield formation duration, rooting depth, and reference HI.

Table 1: Details of the experiment combinations for the cropping seasons

Main Plot: Sowing Windows		Sub Plots: Crop Geometries and Mulching	
Experiment - I (Winter season):			
$\mathbf{D_1}$	- Mid-January (21.01.2022)	$\mathbf{S_1}$	- 60x30 cm^2
$\mathbf{D_2}$	- Early-February (05.02.2022)	$\mathbf{S_2}$	- 60x20 cm^2
$\mathbf{D_3}$	- Mid-February (20.02.2022)	$\mathbf{M_0}$	- without mulching
Experiment - II (*Kharif* season):		$\mathbf{M_1}$	- with mulching (paddy straw)
$\mathbf{D_1}$	- 1^{st} fortnight of June (15.06.2022)		
$\mathbf{D_2}$	- 2^{nd} fortnight of June (30.06.2022)		
$\mathbf{D_3}$	- 1^{st} fortnight of July (15.07.2022)		

Calibration and validation of AquaCrop model

The calibration of AquaCrop model was performed based on comparisons between simulated and observed canopy cover (CC), biomass and Baby corn yield at harvest under different sowing windows and crop geometries with mulching during experiment I (Winter 2022). For each simulation run, separate input files were created and simulations were performed.

Validation was performed using experiment II (*Kharif*, 2022) data also by considering the calibrated crop parameters observed in the field. For each of the simulation runs, input file *viz*., weather data, soil characteristics, irrigation applications, phenological days, and sowing density were entered as observed values.

Model evaluation

Four statistical variables were used to assess the goodness of fit between the findings of the AquaCrop simulated and observed values for Canopy Cover (CC), biomass and yield of Baby corn. The statistical variables *viz*., the coefficient of determination (R^2), the Root Mean Squared Error (RMSE, Equation (3)), the Nash-Sutcliffe model efficiency co-efficient (E, Equation (4) Nash and Sutcliffe 1970), and Willmott's Index of Agreement (d, Equation (5) Willmott, 1982) were used in this model study.

$$RMSE = \sqrt{\frac{\sum_{i=1}^{n}(M_i - S_i)^2}{n}} \quad \text{Equation (3)}$$

$$E = 1 - \frac{\sum_{i=1}^{n}(Mi - S_i)^2}{\sum_{i=1}^{n}(M_i - \bar{M})^2} \quad \text{Equation (4)}$$

$$d = 1 - \frac{\sum_{i=1}^{n}(n_i - s_i)^2}{\sum_{i=1}^{n}(|M_i - \bar{M}| + |S_i - \bar{M}|)^2} \quad \text{Equation (5)}$$

where, Mi and Si are the measured and simulated values, respectively.

n - the number of observations

M - the mean of n measured values

RESULTS AND DISCUSSION

Calibration

Calibration of the AquaCrop model was done by using the observed values from the field experiment I (Winter 2022) as model input. Table 2 lists the key variables used to calibrate the AquaCrop model for modelling maize growth and production for the study site, along with the default values found in the AquaCrop files.

Canopy cover

The goodness of fit indicators relative to CC curves obtained using calibrated parameters are given in Table 3. Among the sowing windows, under second sowing (D_2), there was a good agreement between simulated and observed CC for all crop geometries throughout the growing season as shown by low *RMSE* value ≤8.15%, good *E* value ≥0.81, high *d* value ≥0.95 and high R^2 value ≥0.99 than other sowing windows. Model simulated the better CC amount of 93.1%, 89.2% and 86.9% during the first (D_1), second (D_2) and third (D_3) sowing windows. Overall, the model predicted the canopy cover well over the growing season as indicated by low estimation errors (*RMSE*≤13.1%), good *E* values (*E*≤0.76), high *d* values (*d*≤0.94) and high R^2 values (R^2≥0.98), depicted in Table 4. There is no discernible difference between the two planting rates in either observed data or the AquaCrop simulation. Although sparser plants grow more aggressively and fill any gaps in plant rows, rather than close spacing.

Among the crop growing cycle, the most common trend of deviation between simulated and observed values was during early canopy closure days (25^{th} DAS) in the AquaCrop model (Table 4). Overall model slightly underestimated the CC during harvest days of Baby corn. The fact that corn phenology reacts variably depending on the environment is one of the causes of this dispute. According to Maddonni *et al.,* 2006, RUE decreases in maize crops grown in closer spacing and with huge canopy sizes (i.e., crops with high plant densities growing in conditions with little restrictions). Using the information from three experiments carried out under various environmental conditions, the canopy cover for maize demonstrated a good match between the simulated and measured values (Heng *et al.,* 2009).

Biomass and yield

The goodness of fit indicators was given in Table 3.

Table 2: AquaCrop default values and calibrated values used in Baby corn simulation.

Parameters	Default	Calibrated
Normalized crop water productivity ($g{\cdot}m^{-2}$)	33.7	17.0
Reference harvest index (%)	48	26.9
Base temperature (°C)	8	10
Cut-off temperature (°C)	30	30
Initial canopy cover (%)	0.49	0.35
Canopy cover (CC) per seedling (cm^2/plant)	6.5	6.95
Maximum canopy cover (%)	96	91
Maximum rooting depth (m)	2.3	1.0
Decline of crop coefficient (%/day)	0.30	0.30
Effect of CC on reducing evaporation (%)	50	50
Upper threshold for leaf expansion growth	0.14	0.14
Lower threshold for leaf expansion growth	0.72	0.72
Leaf growth stress coefficient curve shape	2.9	2.9
Upper threshold for canopy senescence	0.69	0.69
Senescence stress coefficient curve shape	2.7	2.7
Upper threshold for stomatal closure	0.69	0.69
Stomata stress coefficient curve shape	6.0	6.0
Aeration stress coefficient (% vol. saturation)	5.0	5.0

in-season biomass levels. Ahmadi *et al.,* (2015) and Salemi *et al.,* (2011) both showed similar RMSE values for biomass (RMSE 1.93 Mg ha^{-1}) and (RMSE 1.29 Mg ha^{-1}) respectively.

AquaCrop simulated the Baby corn yield with a good fitness to the field condition during first sowing window (D_1) with a less deviation (15.6%) whereas the deviation was increased towards the delay in sowings (18.3% and 31.4% of second and third sowing windows, respectively) with observed yield decreases of 23% and 39% respectively, while the simulated yield decrease was 22% and 31% respectively (Table 5). AquaCrop accurately predicted the impact of sowing date on Baby corn yield, resulting in a yield decline due to delayed sowing that was nearly identical to the measured values by overall *RMSE = 1.64, E=0.80 , d=0.81,* $R^2=0.95$ values. This result was supported by Zeleke, (2019), who found that the measured yield of faba bean decrease due to delayed sowing was 36%, while the simulated yield decrease was 42% in 2017 and measured yield decrease due to delayed sowing was 34%, while simulated yield decrease was 47% in 2018.

Table 3: Statistical indices of AquaCrop simulated results for the calibration dataset.

Statistic/ Treatment	Canopy cover (%) variables				Biomass variables			
	RMSE (%)	*E*	*d*	R^2	*RMSE* ($t.ha^{-1}$)	*E*	*d*	R^2
21st January (D_1)	8.38	0.72	0.95	0.99	13.88	0.85	0.70	0.98
05th February (D_2)	8.15	0.81	0.95	0.99	13.43	0.95	0.68	0.96
20th February (D_3)	9.30	0.75	0.92	0.98	12.38	0.95	0.66	0.92

Table 4: Observed and simulated canopy cover (%) and biomass ($t.ha^{-1}$) of Baby corn for different sowing windows during calibration.

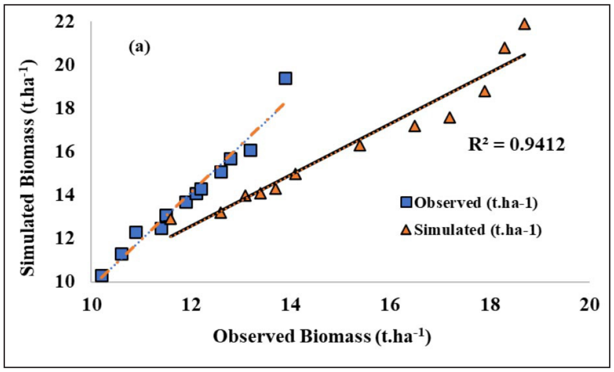
Treatments	25th DAS			45th DAS			Harvest		
	Observed	Simulated	Deviation	Observed	Simulated	Deviation	Observed	Simulated	Deviation
Canopy Cover (%)									
21st January (D_1)	56.5	50.8	-10.1	90.4	93.7	3.6	94.0	93.1	-1.0
05th February (D_2)	47.7	49.3	3.5	84.9	89.3	5.2	90.8	89.2	-1.7
20th February (D_3)	41.1	47.6	15.8	77.9	86.6	11.2	87.8	86.9	-1.1
Overall	*RMSE = 8.6%*	*E=0.76*	*d=0.94*	$R^2=0.98$					
Biomass ($t.ha^{-1}$)									
21st January (D_1)	0.73	0.81	10.1	6.46	7.39	14.4	13.10	16.59	26.6
05th February (D_2)	0.69	0.76	10.1	5.89	6.56	11.3	11.89	13.79	16.0
20th February (D_3)	0.60	0.68	13.9	5.00	6.24	24.8	10.76	11.59	7.7
Overall	*RMSE = 13.2%*	*E=0.92*	*d=0.68*	$R^2=0.95$					

Though model simulated higher amount of biomass during first sowing window (D_1), there is a good agreement between simulated and observed biomass under third sowing (D_3) for all crop geometries throughout the growing season as shown by low *RMSE* value ≤12.38%, high *E* value ≥0.95, good *d* value ≥0.66 and high R^2 value ≥0.92 with less deviation (7.7%) than other sowing windows. Generally, AquaCrop model simulated the Baby corn biomass very fit to the field condition, as mentioned by low estimation errors (*RMSE*≤13.2%), high *E* values (*E*≤0.92), good *d* values (*d*≤0.68) and high R^2 values (R^2≥0.95), depicted in Table 4. The performance of the AquaCrop model was assessed by Jin *et al.* (2014), who likewise discovered good agreement between actual and predicted

Table 5: Comparison of simulated and observed yield of Baby corn for calibrated cropping season (Winter 2022).

Treatment	Yield		
	Observed ($t.ha^{-1}$)	Simulated ($t.ha^{-1}$)	Deviation (%)
21st January (D_1)	9.9	11.5	15.6
05th February (D_2)	7.6	9.0	18.3
20th February (D_3)	6.1	8.0	31.4
Overall	*RMSE = 1.64, E=0.80 , d=0.81,* $R^2=0.95$		

Fig. 1a and 1b showed the deviation of above ground



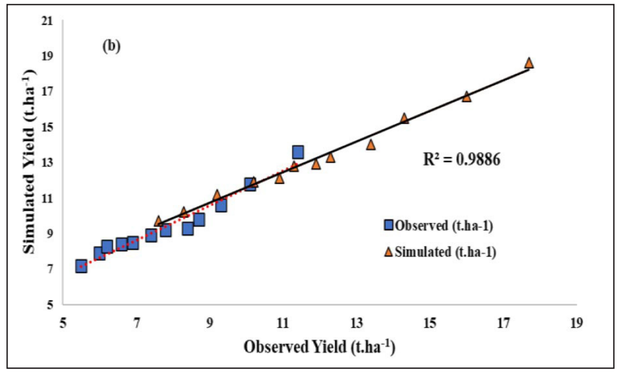


Fig. 1: Relation between observed and simulated values of Baby corn for (a) biomass and (b) grain yield for the calibration dataset (filled square) and validation dataset (filled triangle)

Table 6: Statistical measures of the Baby corn for the AquaCrop simulated results of validated dataset (*Kharif*, 2022).

Statistic/ Treatment	Canopy Cover (%) variables				Biomass variables			
	RMSE (%)	*E*	*d*	R^2	*RMSE ($t.ha^{-1}$)*	*E*	*d*	R^2
15th June (D_1)	27.15	0.71	0.77	0.97	8.58	0.70	0.58	0.99
30th June (D_2)	21.20	0.55	0.86	0.98	7.13	0.67	0.59	0.98
15th July (D_3)	17.68	0.79	0.89	0.98	5.68	0.62	0.62	0.99

Table 7: Observed and simulated canopy cover (%) and biomass ($t.ha^{-1}$) of Baby corn for different sowing windows during validation.

Treatments	25th DAS			45th DAS			Harvest		
	Observed	Simulated	Deviation	Observed	Simulated	Deviation	Observed	Simulated	Deviation
Canopy Cover (%)									
15th June (D_1)	57.0	12.7	-77.7	91.1	76.6	-15.9	96.4	92.6	-3.9
30th June (D_2)	49.1	12.7	-74.2	86.1	84.0	-2.4	92.9	88.7	-4.5
15th July (D_3)	40.0	12.3	-69.3	75.5	63.9	-15.4	86.4	81.7	-5.5
Overall	*RMSE = 22.0%*	*E=0.68*	*d=0.84*	R^2=0.97					
Biomass ($t.ha^{-1}$)									
15th June (D_1)	4.13	2.40	-41.9	11.05	13.43	21.6	18.03	19.77	9.7
30th June (D_2)	2.73	2.26	-17.2	9.33	13.92	49.3	14.93	15.66	4.9
15th July (D_3)	1.83	2.13	16.7	7.28	10.26	41.0	12.68	13.62	7.5
Overall	*RMSE = 7.1%*	*E=0.66*	*d=0.60*	R^2=0.98					

Table 8: Simulated and observed yield of Baby corn for validated cropping season (*Kharif*, 2022).

Treatment	Yield		
	Observed ($t.ha^{-1}$)	Simulated ($t.ha^{-1}$)	Deviation (%)
15th June (D_1)	15.4	16.2	5.8
30th June (D_2)	11.6	12.8	10.2
15th July (D_3)	8.8	10.8	21.9
Overall	RMSE = 1.41, E=0.77 , d=0.94, R^2=0.98		

biomass and yield from the 1:1 correlation line with R^2 value of 0.94 and 0.98 respectively, which confirmed the close agreement between observed and simulated final yield of Baby corn. The findings were supported by numerous studies, for example Nagafabad, Iran (Salmi *et al.,* 2011) had low *RMSE* (2.32) and high R^2 values, whereas Brusland, USA (Heng *et al.,* 2009) had high R^2 (0.76) values. Lee and Dang (2020) found a strong connection between the simulated and measured yields of cassava, with *d*=0.84-0.87*, RMSE*=0.25-0.33*, and* R^2=0.85-0.91 for the spring and summer crop seasons, respectively.

Validation

AquaCrop model was validated using the calibrated crop parameters. Validation simulation of seasonal development in canopy cover (CC), biomass accumulation and yield of Baby corn was done for Experiment II conducted during *Kharif,* 2022.

Canopy cover

The goodness of fit indicators for CC obtained using validated parameters were given in Table 6. Though the simulated

CC was more during first sowing window (D_1), there was a good fit between observed and simulated CC under third sowing window (D_3) as indicated by low *RMSE* value ≤17.68%, good *E* value ≥0.79, good *d* value ≥0.89 and high R^2 value ≥0.98 than other sowing windows. From the Table 7, it can be observed that overall, the model simulated the CC almost fit to the field condition as mentioned by low *RMSE* vales (*RMSE*≤22.0%), good *E* values (*E*≤0.68), high *d* values (*d*≤0.84) and high R^2 values (R^2≥0.97). Irrespective of the treatments, model was underestimated the CC during early canopy cover stage whereas simulated CC was good fit during harvest stage of the crop with deviation less than 10%. The model's performance in this investigation is comparable to earlier AquaCrop simulations for the growth of maize canopy cover (Abedinpoura *et al.,* 2012).

Biomass and yield

From the Table 6, it can be observed that there was a good fit during third sowing window (D_3) which was confirmed by low *RMSE* value ≤5.68%, good *E* value ≥0.62, good *d* value ≥0.62 and high R^2 value ≥0.99 than other sowing windows. The overall performance of the AquaCrop model for the biomass simulation in validation data set was good with low *RMSE* values (*RMSE*≤7.1%), good *E* values (*E*≤0.66), good *d* values (*d*≤0.60) and high R^2 values (R^2≥0.98), depicted in Table 7. Though the biomass production was more during first sowing (D_1), it was found that the deviation was also high (9.7%) during the same sowing window (Table 6). The result was supported by Ahmadi *et al.,* (2015), who found RMSE of 2.48 Mg.ha^{-1} of in-season maize biomass under full and deficit irrigation management, and Paredes *et al.,* (2014) similarly recorded RMSE of 3.83 Mg ha^{-1} of maize under full and controlled deficit irrigation techniques.

The measured and simulated yields during different sowing windows were depicted in Table 8. The measured yield decreases due to delayed sowing were 24% and 43% respectively, while the simulated yield decrease was 21% and 34% respectively. Lowest deviation was found i.e., 5.8% during first sowing (D_1), which was increasing towards the delay in the sowing windows (10.2% and 21.9% during second and third sowing, respectively). The overall $RMSE = 1.41, E=0.77 , d=0.94, R^2=0.98$ values were obtained for the validation dataset, which indicates a good prediction efficiency of AquaCrop model. Abedinpoura *et al.,* (2012) showed prediction error of 2.9% to 12.31% in grain yield of maize under various irrigation and nitrogen levels. These findings are consistent with those of our simulation. According to several experiments, AquaCrop accurately predicted maize biomass and final grain production (Heng *et al.,* 2009; Hsiao *et al.,* 2009).

CONCLUSION

The AquaCrop model was evaluated and found to be more reliable for simulating the harvest-stage parameters, including green canopy cover (CC), biomass build-up, and final grain yield of Baby corn (Winter and *Kharif*, 2022). AquaCrop was able to replicate the seasonal evaluation of CC and biomass with a high degree of accuracy for range of sowing dates, and sowing rates, according to statistical measures of root mean square error, model efficiency, and index of agreement, however the model underestimated the CC and biomass during the early stages of the crop. Irrespective of treatments, model simulated (86.1 to 94 % and 77.8 to 95%) the green canopy cover almost similar to the field condition (86.9 to 94.9 % and 82.5 to 97.2%) during calibration and validation respectively. The AquaCrop model is capable of accurately predicting final biomass and grain yield under various treatments, as evidenced by the high correlation of determination (R^2) obtained in a 1:1 analysis. Utilizing both the calibration and validation datasets, an overall R^2 value of 0.94 and 0.98 were achieved for biomass and yield, respectively. The findings of this study indicate that, under various planting dates, the AquaCrop model could be utilised to predict biomass and yield of Baby corn with acceptable accuracy. Consequently, the model can also be used as a tool to assist in making decisions for practical field management techniques.

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