CSIRO Publishing
The South Pacific Journal of Natural and Applied Sciences, **34**(1), 1-11, 2016
www.publish.csiro.au/journals/spjnas
10.1071/SP16001

Evaluation of Decision Support System for Agrotechnology Transfer SUBSTOR Potato Model (v4.5) Under Tropical Conditions

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Abstract

Decision Support System for Agrotechnology Transfer (DSSAT) SUBSTOR Potato model (v4.5) was calibrated using Desiree variety. DSSAT SUBSTOR Potato model simulates on a daily basis the development and growth of potatoes using inputs such as climate, soil and crop management. The experiment was conducted in Banisogosogo, Fiji Islands, during the potato growing season of 2012. Fresh and dry weights of belowground plant component (tubers) were taken during progressive harvests. The DSSAT SUBSTOR Potato model was calibrated using experimental field data, soil and weather data of the growing season. The manual calibration steps involved recalculation of soil water content and the adjustments of genetic co-efficient to suit the temperature and daylength regime similar to the experimental conditions. Tuber dry weight was used as the main parameter to evaluate the model. The R^2 values of the observed and simulated model outputs before calibration for replicate plot 1, replicate plot 2 and replicate plot 3 were 0.52, 0.49 and 0.61 respectively. After calibration, the R^2 values for tuber dry yield for replicate plot 1, replicate plot 2 and replicate plot 3 were 0.88, 0.66 and 0.92 respectively indicating a strong positive relationship between the simulated and the observed yield.
Keywords: *DSSAT SUBSTOR Potato model, Calibration, Tuber weight, Simulation*

1. Introduction

Crop simulation models are a representation of a simplified crop production system made up of non-linear mathematical equations to provide a systematic analysis of a crop production system. Crop simulation models have become accurate enough and widely accepted (Easterling *et al.,* 1996). Reliable crop models have been developed to predict the development, growth and yield of different crops in semi and arid tropic regions taking into consideration the selection of suitable genotypes and management options for agricultural sustainability (Wolday and Hruy, 2015). Crop simulation models can be used to determine the potential and attainable yield, optimise crop management options, evaluate the impact of climate change and climate variability on yield and increase the efficiency of multi-environment testing (Singh, 1999). It can be used as decision support system for education and training, research and policy development (Rivington and Koo, 2010), interdisciplinary collaboration (Chakrabarti, 2005) and statistical links between weather and yield which is useful for economic modelling (Roberts *et al.,* 2013). One of the most widely used crop model is the Decision Support System for Agrotechnology Transfer (DSSAT) which was developed by The International Benchmark Sites Network for Agrotechnology Transfer (IBSNAT) (Hoogenboom, 2003). The DSSAT SUBSTOR Potato model is one of the sixteen crop model software developed by the IBSNAT project (Fleisher *et al.,* 2000). This model includes water and nitrogen balance similar to CERES models with growth and development simulated on a daily basis taking into consideration the effects of soil water and nitrogen balance (IBSNAT, 1989).

When working with models, it is important to test the performances in wide range of circumstances so that the scope of validity and limitations are identified. One reason for doing this is that simulation models are site- and crop-specific in nature and cannot be used widely unless validated (Ahmed and Fayyaz-ul-Hassan, 2011) or recalibrated under local conditions (Singh *et al.*, 1998). Moreover, model evaluation can be time consuming and challenging because it requires the collection of large data sets such as weather, soil, crop and field management information over long periods (Stastna *et al.*, 2002).

There has always been ongoing research and interest to grow potatoes in Fiji, primarily as a substitute for imports to save foreign exchange. Fiji imports its potatoes from New Zealand and Australia. The current imports are about 23 million tonnes worth $22 million annually (The Government of Fiji, 2014). Production in Fiji has varied over the years both in terms of hectare planted and yield obtained. The variable yield obtained in Fiji range from 5 t/ha to 25 t/ha. Production of potatoes is confined to months of May to September due to the optimum temperature. Potatoes can be grown at almost sea-level and up to 1000 m (Iqbal, 1982). There is a strong government policy on export that encourages local research on the performance of specific potato varieties in Fiji. This creates the need to look at specific tools, such as crop simulation models to assist the optimization of crop management to increase and sustain production.

This study was conducted to investigate the performance of DSSAT SUBSTOR Potato model (v4.5) under tropical conditions using Desiree variety.

2. Materials and Method

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2.1. Experimental Site

The experimental replicate plots set on a clay soil were replicated three times and arranged in a randomized complete block design (Hoogenboom *et al.*, 1999) in Banisogosogo, Rakiraki, Fiji Islands (longitude 17˚ 31' 25.4" South and latitude 178˚ 15' 08.4" East) (Google Map, 2016). Each replicate plot was 7.5 m in length and 4.8 m in width, a total area of 36 m^2. A total of 187 potato seeds were planted in 11 rows and 17 columns with a row spacing of 75 cm between rows and 30 cm within the rows. The potatoes were planted at a depth of 1.5 cm (Table 1). The experiment was carried out from July to September, 2012.

Table 1. Planting information for Desiree.

Variable	Information
Cultivar	Desiree
Planting Date	July 2nd 2012
Harvest Date	September 20th 2012
Planting Method	Dry seed
Planting Distribution	Rows
Row Spacing	75 cm
Plant Population (m^2)	5
Planting Depth	1.5 cm
Irrigation	14 mm in 4 application
N-fertilizer	80 kg/ha in 2 application (5 g/plant, banded beneath the surface at 5cm depth)

2.2. Data Collection, Treatments and Importations

2.2.1. Weather Data

The DSSAT SUBSTOR Potato model required daily solar radiation (SRAD MJ/m^2/d), maximum temperature (T_{max}) and minimum temperature (T_{min}) (°C) and precipitation (mm) to prepare and run the simulation (Holden *et al.*, 2003). Therefore, the weather data of 2012 (January-September) were collected from the Sugar Research Institute of Fiji (SRIF) and Fiji Meteorological Services (FMS). Since solar radiation data was not available from either of these two institutions in Fiji, these data were downloaded from the National Aeronautics and Space Administration (NASA) website (Prasad *et al.*, 2015). The missing rainfall and/or temperature data were replaced with NASA data creating a "hybrid" weather data. The weather data was formatted in Microsoft Excel 2007® and then imported into WeatherMan tool in DSSAT.

2.2.2. Soil Data

Soil samples were taken from each experimental replicate plot at 0-40, 40-100 and 100-110 cm and analyzed by Koronivia Research Station. The soil was analyzed for pH, electrical conductivity (EC), percentage of total carbon and nitrogen, cation exchange capacity (CEC), exchangeable potassium (K) and moisture levels (Prasad *et al.*, 2015). Physical soil structures were also noted for each depth. The soil data were entered into SBuild tool of DSSAT SUBSTOR Potato model. Other soil variables, such as saturated soil water content, drained upper limit of extractable plant water (field capacity), lower limit of plant extractable soil water (permanent wilting point), initial soil water content at the start of soil water balance simulation and relative root weighing factor were automatically calculated based on the physiochemical properties of the soil by the SBuild tool of DSSAT SUBSTOR Potato model (Hoogenboom *et al.*, 2012).

2.2.3. Crop Management Data and Harvesting

Crop management data included information on previous crop, planting date, emergence date and harvest dates. The amount of nitrogen fertilizer and irrigation applied to the plant were also recorded (Snapp and Fortuna, 2003). Each replicate had 3 rows and 2 plants per row were harvested with a total of 18 plants for all replicates in each sampling time of T1, T2 and T3. T4 sampling allowed harvesting of 4 plants per row, which is 12 plants per replicate plot with a total harvest of 36 plants. The first harvest (T1) was in the period of tuber initiation where 50% plants had at least one tuber greater or equal to 1cm in diameter. The second harvest (T2) took place 20 days after T1 and the third harvest (T3) took place 20 days after T2. The final harvest (T4) was carried out when the green-leaf canopy had been reduced to 20% of the maximum canopy cover (Hoogenboom *et al.,* 1999).

2.2.4. Biomass Collection

The belowground biomass (tubers) from the harvest was cleaned, blotted dry with tissue paper and the fresh weight of the tuber was taken and recorded using a digital scale (CAS Model KD-BN Balance Scale). The tubers were then oven dried using Ontherm Thermotec 2000 at 70^{o}C over varying durations and weighed until a stable weight was reached (Mourice *et al.,* 2014; Prasad *et al.,* 2015). This was recorded as the dry biomass. Harvest period with pest and disease infestation was also noted.

2.3. Average File (AFile) and Time Series File (TFile)

AFile contained information on T4 harvest and was used to generate the observed data for simulation comparison. The TFile was created by taking into consideration the average of the replicates of each time series (T1, T2, T3 and T4). These data were entered into Excel Worksheet and imported into DSSAT SUBSTOR Potato model under Experimental Data. During simulation, the SUBSTOR Potato model read the content of the selected weather file (WeatherMan), crop management (XBuild), soil file (SBuild) and observed data (AFile and TFile). The pre-calibration simulation read the default genetic co-efficient values for Desiree variety.

2.4. Model Calibration

2.4.1. Soil Water Recalculation

The soil water content of the site was recalculated due to the high clay content. Default Medium Silty Clay (with similar water holding capacity) from DSSAT soil database was used to calculate these model inputs. A conversion factor was calculated by dividing the Default Medium Silty Clay soil by the bulk density of replicate plot 1 experimental site soil. The replicate plot 1 bulk density was then multiplied by the conversion factor to obtain the recalculated bulk density. The same procedure was repeated for lower limit, drained upper limit and saturation. This method was repeated for replicate plot 2 and 3 soils.

2.4.2. Genetic Co-Efficient Adjustment

During calibration, the genetic co-efficient (leaf expansion rate ($cm^2/m^2/d$) (G2), tuber growth rate ($g/m^2/d$) (G3), determinancy (PD), photoperiod sensitivity (dimensionless) (P2) and critical temperature (°C) (TC) were adjusted manually in the Genetic file by comparing the simulation results for phenology (tuber initiation, maturity) and growth (tuber numbers, yield) with observed results until the cultivar parameter modification gave the best output where the simulated values were closest to the observed values (Godwin *et al.*, 1989). A similar approach has been adopted by researchers for several other crops (Andarzian *et al.*, 2015; Dzotsi *et al.*, 2003; Rezzoug *et al.*, 2008; Saythong *et al.*, 2012).

Table 2. Recalibration of genetics co-efficient (leaf expansion rate ($cm^2/m^2/d$) (G2), tuber growth rate ($g/m^2/d$) (G3), determinancy (PD), photoperiod sensitivity (dimensionless) (P2) and critical temperature (°C) (TC).

Variety	G2	G3	G4	PD	P2	TC
Default Desiree	2000	25.0	0.2	0.9	0.6	17.0
Desiree tropics	4000	25.0	0.2	0.9	0.4	18.0

Recalibration of genetic co-efficient included adjustments in leaf expansion rate (G2), photo sensitivity (P2) and critical temperature (TC).

2.4.3. Statistical Analysis

The observed yield means were computed using Excel Worksheet and the statistical component of DSSAT software. Further, graphic representations were automatically drawn using the DSSAT SUBSTOR Potato model's PlantGro component. The correlation (R^2) to compare the simulated and the observed yields were also computed using Excel Worksheet. Mean tuber dry weight (kg/ha) and percentage difference in yield change of each replicate before and after calibration were also found Medany (2006).

3. Results and Discussion

3.1. Soil Physiochemical Properties

Replicate plot 1 had the lowest pH (6.5-7.0) followed by replicate plot 2 (6.7-7.1) and replicate plot 3 (6.8-7.2) (Table 3). It was also noticed that the pH increased with increased depth. Highest organic carbon and nitrogen were present in replicate plot 2. Potatoes grow best under acidic soil with optimum pH of 5.5-6.0 and high organic matter (Singh *et al.,* 1998). The analysis also indicated that the overall texture of the soil was clay with very low percentage of silt.

3.2. Weather Information

The weather information of the planting season (July-September) generally had low values of solar radiation, T_{max}, T_{min} and rainfall as compared to off season months

(January-April and October-December) (Table 4). Since the lowest average monthly temperature was recorded in July (27.8 °C day/20.6 °C night), this indicated that July was a good time for potato cultivation. The average annual rainfall of the field site is about 2095 mm (Gawander *et al.*, 2012) with average T_{max} and T_{min} (1960-2012) as 29.21 °C and 22.53 °C respectively.

3.3. Experimental File

AFile showed that the highest tuber dry weight (UWAH) was 2452 kg/ha obtained from treatment 3 (replicate plot 3) while the highest tuber fresh weight (UYAH) was 19.97 t/ha obtained from treatments 2 and 3 (replicate plots 2 and 3) (Table 5). This is due to high carbon and nitrogen content in the soil.

TFile showed that tuber dry weight continued to increase from T2 and T3 and declined for T4 (Table 6). T2 represents biomass partitioning in tubers. In the DSSAT SUBSTOR Potato model, tubers are given the first priority to accessible assimilate from photosynthesis and reserved carbohydrate pool (Griffin *et al.*, 1993). As plants mature, majority of assimilates are transferred to the organ sinks (Singh *et al.*, 1998). Additionally, a decline in tuber dry weight during T4 was noted due to the presence of pests.

Table 3. Chemical properties of the soil for each replicate plot.

Replicate Plot	Depth (cm)	pH	Electric conductivity (mS/cm)	Total carbon (%)	Total nitrogen (%)	Cation exchange capacity (cmol(+)/kg)	Exchangeable potassium (me/100g)	Moisture
1	0-40	6.5	0.1	2.32	0.19	40.85	0.75	8.2
	40-100	6.9	0.07	1.92	0.16	43.43	0.24	7.6
	100-110	7.0	0.06	1.74	0.14	38.96	0.2	8.3
2	0-40	6.7	0.1	3.51	0.29	41.27	0.84	9.0
	40-100	7.0	0.06	2.27	0.19	37.43	0.24	6.1
	100-110	7.1	0.05	1.74	0.14	43.71	0.21	8.1
3	0-40	6.8	0.09	2.14	0.18	36.49	0.56	8.8
	40-100	7.0	0.06	2.32	0.19	43.49	0.21	8.2
	100-110	7.2	0.06	1.74	0.14	43.94	0.2	8.1

Table 4. Monthly average of solar radiation (SRAD), maximum temperature (T_{max}) and minimum temperature (T_{min}) from January to September, 2012.

Month	SRAD ($MJ/m^2/d$)	T_{max} (^oC)	T_{min} (^oC)	Rain (mm)
January	19.4	30.6	23.6	990.4
February	18.7	30.2	23.0	460.5
March	19.4	31	23.8	761.3
April	14.9	30	23.0	575.6
May	15.0	28.9	22.3	41.3
June	13.1	28.0	21.6	164.9
July	14.2	27.8	20.6	18.6
August	16.2	28.7	21.6	75.3
September	17.7	28.9	22.0	215.1

Table 5. Values for each treatment for tuber dry weight (UWAH), tuber fresh weight (UYAH), tuber initiation date (TDAT) and harvest date (HDAT) for AFile (Average File).

	UWAH (kg/ha)	UYAH (t/ha)	TDAT	HDAT
1	2196	17.55	219	263
2	2080	19.97	219	263
3	2452	19.97	219	263

Table 6. Time series (TFile) values for tuber dry weight (UWAD) and tuber fresh weight (UYAD).

Replicate	Sample	UYAD (t/ha)	UWAD (kg/ha)
1	T1	0.49	19.4
	T2	16.4	1987
	T3	24.9	2588
	T4	17.5	2196
2	T1	1.09	95
	T2	19.2	2109
	T3	16.9	4270
	T4	19.9	2081
3	T1	1.17	101
	T2	16.9	2200
	T3	11.3	2967
	T4	19.4	2452

3.4. Calibrations

The results before calibration indicated that the correlations between simulated and observed tuber yield values were low (Table 7 and Figure 1) with R^2 as 0.5227, 0.4964 and 0.6092 for replicate 1, 2 and 3 respectively (Figure 2). This was mainly because the genetic co-efficient and the soil parameters were not properly defined by the model (Godwin *et al.*, 1989). Additionally, DSSAT SUBSTOR Potato model has been developed in USA. Hence, the use of this model outside its domain of development becomes challenging as large set of data, which are not readily available, are required for calibration and validation (Mourice *et al.*, 2014).

The simulated tuber initiation day was 50 days after planting (dap) while the observed value was 35 dap. It was also noticed that the final harvest of observed tuber dry weight and the mean harvest were higher than simulated tuber dry weight. The simulated tuber dry weight for replicate 1 was 1769 kg/ha while the observed tuber dry weight was 2196 kg/ha. For replicate 2, the simulated tuber dry weight was 1918 kg/ha while the observed tuber dry weight was 2080 kg/ha. Replicate 3 indicated that the simulated tuber dry weight was 1833 kg/ha while the observed tuber dry weight was 2452 kg/ha. The differences in percentage yield ranged from 8.45% to 33.77%.

Table 7. DSSAT SUBSTOR Potato model (v4.5) simulation results for replicate plot 1, 2 and 3 for cultivar Desiree before calibration.

	Replicate plot 1		Replicate plot 2		Replicate plot 3	
Variable	Simulated	Observed	Simulated	Observed	Simulated	Observed
Tuber initiation day (dap)	50	35	50	35	50	35
Tuber fresh weight (t\ha) harvest	8.55	17.55	9.59	19.97	9.17	19.97
Tuber dry weight (kg\ha) harvest	1769	2196	1918	2080	1833	2452
Mean tuber dry weight (kg/ha)	900.75	1660.35	940.25	2130	949.25	1948.75
% yield change between simulated and observed (tuber dry weight)	24.13		8.45		33.77	

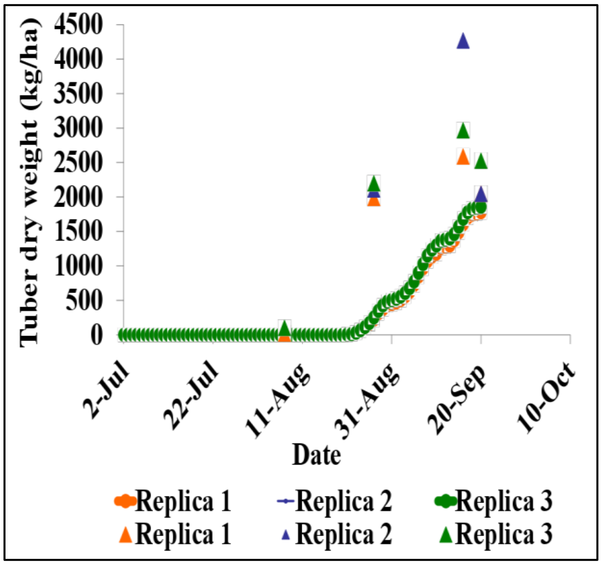

Figure 1. Simulated and observed (Δ) values for Desiree tuber dry weight (kg/ha) before calibration.

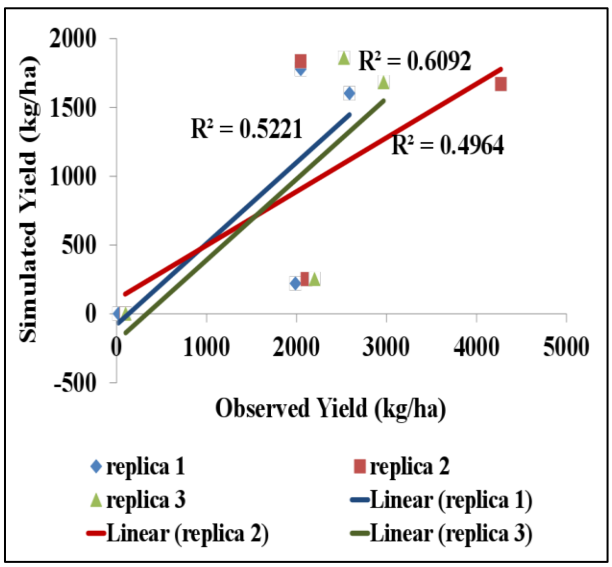

Figure 2. Evaluation of potato yield (dry matter in kg/ha) for replica 1, 2 and 3 before calibration. The straight line represents the linear regression function relating the observed and simulated tuber dry yield.

The DSSAT SUBSTOR Potato model was calibrated for tuber dry weight using replicate plot 2 soil since it had high carbon and nitrogen content. The calibration process included the recalculation of soil water content and recalibration of the genetic-co-efficient of Desiree variety. The initial inaccurate water content were due to high clay content in the soil (Agricultural Model Intercomparison and Improvement Project, 2013; Dalgliesh and Foale, 1998), that is the algorithm used in SBuild was unable to differentiate tropical soils with high clay content and aggregation due to iron oxides as in Banisogosogo from the soil with similar clay content without aggregation. The clay soils exhibit shrink-swell behaviour and as the soil dries there is a change in volume of soil aggregates that is more or less equal to the volume of water lost. The air filled porosity remains constant whereas the bulk density increases (Dalgliesh and Foale, 1998). Hence, the bulk density, lower limit, drained upper limit and saturation were recalculated using a conversion factor from Default Medium Silty Clay with similar water holding capacity.

Furthermore, the five cultivar genetic co-efficient (P2, PD, G2, G3 and TC) affect the development rate of potato (Fleisher *et al.*, 2003; Raymundo *et al.*, 2014). The accumulation and partitioning of biomass and development in potato are influenced by three main environmental variables- temperature, photoperiod and intercepted radiation (Griffin *et al.,* 1993). The genetic co-efficient of Desiree was manually recalibrated (Table 2) in Genetic file to improve the correlation between the simulated and observed values of tuber initiation day, tuber dry yield and tuber fresh yield. Larger leaf expansion rates (G2) results in higher leaf area index (LAI) which leads to higher light interception and therefore larger amounts of assimilates. The decreased P2 value indicates lesser photoperiod sensitivity; hence, tuber induction can take place earlier, even under long day conditions. Increased TC reflects higher temperature tolerance (Raymundo *et al.,* 2014). In DSSAT SUBSTOR Potato model, tuber initiation is a function of cultivar response to both temperature and photoperiod as well as plant nitrogen and soil water status (Griffin *et al.,* 1993). The adjustment of genetic co-efficient brought marked improvement in the performance of the model, particularly in the tuber initiation day for which both simulated and observed values were 35 days after planting. These adjustments are justified given the Desiree variety has not been calibrated under temperature and daylength regime similar to the experimental conditions (tropical conditions).

After calibration, the correlation between simulated and observed tuber initiation day and tuber yield values improved (Table 8 and Figure 3). The simulated and the observed tuber initiation day was 35 dap for the three replicate plot. Replica 1 shows that the simulated tuber dry weight was 2947 kg/ha while the observed tuber dry weight was 2196 kg/ha. For replica 2 the simulated tuber dry weight was 4478 kg/ha while the observed tuber dry weight was 2080 kg/ha. Replica 3 indicated that the simulated tuber dry weight was 3375 kg/ha while the observed tuber dry weight was 2452 kg/ha. The mean simulated dry tuber weight increased after calibration. The difference in percentage yield ranged from -25.48% to -53.55%. The R^2 of replicate 1, 2 and 3 were 0.88, 0.66 and 0.92 respectively (Figure 4). The DSSAT SUBSTOR Potato model has been effectively utilized for simulating tuber yield (Bowen, 2003; Griffin *et al.,* 1993) and gives a very close agreement between the simulated and observed yields (Knox *et al.,* 2010).

Over-estimation of yield has been previously noticed in DSSAT SUBSTOR Potato model (Snapp and Fortuna, 2003). The observed values of T1, T2 and T3 are in good agreement with the simulated values whereas the model was over predicting T4 (Figure 3). The high simulation of yield in replicate plot 2 can be due to high organic carbon and nitrogen content of the soil (Van Delden, 2001). Other reasons why the simulated yields were not obtained can be due to constraints such as pests (Dzotsi *et al.,* 2003; Stastna and Dufkova, 2008). The DSSAT SUBSTOR Potato model does not take into consideration the loss of tuber due to disease or insect infestation (Griffin *et al.,* 1993; Snapp and Fortuna, 2003). During harvest of T3 and T4, the experimental replicate plot was heavily infected with pest, such as snail (*Quantula striata*), beetle larvae and beetle (*Papuana spp.*) which led to low observed tuber yield (Hare, 1980).

Table 8. DSSAT SUBSTOR Potato model (v4.5) simulation results for replicate plot 1, 2 and 3 for cultivar Desiree after calibration.

	Replicate plot 1		Replicate plot 2		Replicate plot 3	
Variable	Simulated	Observed	Simulated	Observed	Simulated	Observed
Tuber initiation day (dap)	35	35	35	35	35	35
Tuber fresh weight (t\ha) harvest	14.73	17.55	22.39	19.97	16.88	19.97
Tuber dry weight (kg\ha) harvest	2947	2196	4478	2080	3375	2452
Mean tuber dry weight (ka/ha)	1873.5	1660.35	2775.25	2130	2122.5	1948.75
% yield difference between simulated and observed (tuber dry weight)	-25.48		-53.55		-27.35	

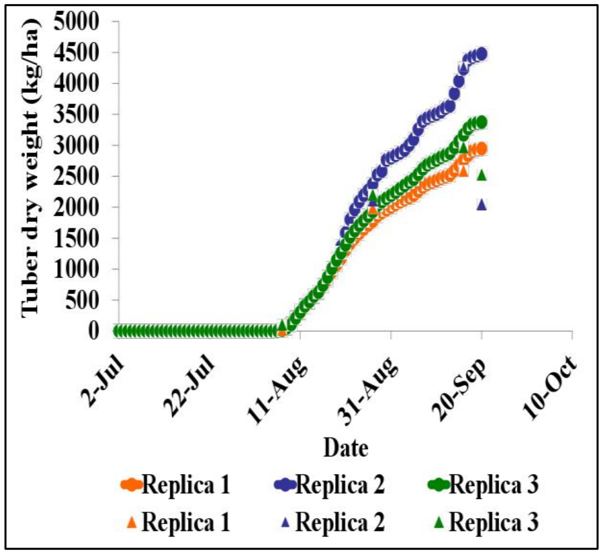

Figure 3. Simulated and observed (Δ) values for Desiree tuber dry weight (kg/ha) after calibration.

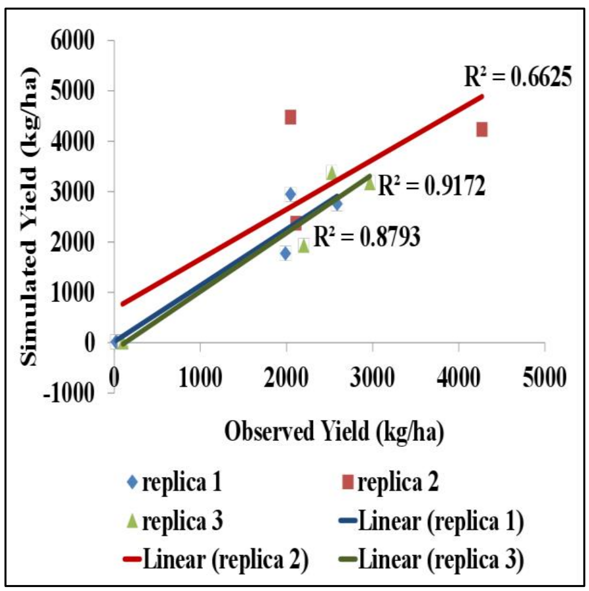

Figure 4. Evaluation of potato yield (dry matter in kg/ha) for replica 1, 2 and 3 after calibration for year 2012. The straight line in the figure represents the linear regression function relating the observed and simulated tuber.

4. Research Limitations

The following are the limitations of the experiment. Firstly, the soil water content had to be manually recalculated using a conversion factor. The SBuild program should be modified based on the soil data from the tropics. This can be done by conducting actual field experiments on tropical soil parameters, such as the actual measurement of the lower limit of plant extractable soil water, bulk density and drained upper limit (Dalgliesh and Foale, 1998). This will help improve the performance of soil water balance module and improve the calculation of soil water flux and root water absorption. There is also a major resign needed in models with major focus on soil (Keating *et al.*, 1992). Moreover, the pedotransfer functions (PTFs) developed for soils in temperate regions are inappropriate for soils in the tropics; hence PTFs should be developed for specific geographic locations with sufficient data (Mdemu and Mulengera, 2003). It is also very crucial to establish soil database for the tropic region and use of proper PTFs (Suprayogo *et al.*, 2003; Tomasella and Hodnett, 2004).

The DSSAT SUBSTOR Potato model does not take into consideration the impact of pest and disease on the tuber yield (Griffin *et al.*, 1993). As indicated by the results, T3 and T4 were severely affected by pests. More attention to pest and disease control is needed for experimental trials, particularly those used for model validation since most models do not simulate pest and disease effect.

Likewise, the weather data imported into WeatherMan was also a combination of Fiji Meteorological Services and NASA data. Investment in automated weather stations that determine daily solar radiation, temperature, rainfall, humidity and wind would provide ground validation of NASA data.

Finally, further work is needed to test the DSSAT SUBSTOR Potato model performance in the Tropics with vigorous multi-location trials using suitable "tropical" varieties. The simulation of potato growth across the diverse environment and different cultivars must also take into consideration (Stastna and Dufkova, 2008) with the effect of temperature, photoperiod and intercepted radiation.

5. Conclusion

The DSSAT SUBSTOR Potato model was calibrated for tuber dry weight. Before calibration, the correlation between the observed and the simulated values were weak. The manual calibration steps involved recalculation of soil water content and the adjustments of genetic co-efficient to suit the temperature and daylength regime similar to the experimental conditions. After calibration the correlations between the observed and the simulated values were improved. This study showed that the SUBSTOR Potato model has good potential to simulate potato in Fiji and can assist farmers to optimize conditions to increase and sustain yield.

Acknowledgement

This study was part of Future Climate Leaders, AusAid scholarship. The authors sincerely thank Dr Riley Ralph, Mr. Karuna Reddy and Mr. Prashneel Kumar.

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