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WeRise

Researchers' Manual

Towards strategic crop management in rainfed rice areas

Edited by Keiichi Hayashi, Lizzida Llorca, Iris Bugayong, Orden M.E.M., Agustiani N, Capistrano A.O.V.

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Japan International Research Center for Agricultural Sciences
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[1]JIRCAS,[2]IRRI,[3]CLSU,[4]ICRR,[5]PhilRice

March 2021

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TABLE OF CONTENTS

Acronyms and Abbreviations

AEWs	Agricultural Extension Workers
AIAT	Assessment Institute for Agricultural Technology
CCADS-RR	Climate Change Adaptation through Development of a Decision-Support tool to guide Rainfed Rice production
CJ	Central Java
CLSU	Central Luzon State University
FGD	Focus Group Discussion
GIS	Geographic information system
ICRR	Indonesian Center for Rice Research
ICT	Information and Communications Technology
IJCRP	IRRI-Japan Collaborative Research Project
ISSAAS	International Society for Southeast Asian Agricultural Sciences
JAMSTEC	Japan Agency for Marine-Earth Science and Technology
LCD	Liquid Crystal Display
NS	North Sumatra
RMSEn	Root mean square error
SD	Sowing date
WeRise	Weather-rice-nutrient Integrated Decision Support System
WNT	West Nusa Tenggara
WS	Wet season

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Chapter 1: Introduction

The Weather-rice-nutrient integrated decision support system (WeRise) is an ICT-based tool for rainfed rice farmers. WeRise can provide relevant information for rainfed rice cultivation such as optimum sowing timing and fertilizer application schedule. WeRise can also show yield predictions of different varieties that can help farmers to choose the most suitable variety according to the weather characteristics of the upcoming cropping season. The target users of WeRise are the AEWs because farmers consider them as trustworthy sources of information. WeRise can be among the measures to prevent the spread of COVID-19 as it can help farmers and AEWs to avoid the three C's while facilitating information exchange to prepare for incoming cropping season.

WeRise is an ICT-based tool hence internet access is a prerequisite. Those who have internet access either through a smartphone or tablet computer can access WeRise to get advisories. WeRise can still be accessed by those who have limited or no connectivity. Smartphone is becoming ubiquitous and those who have this tool can get in touch with WeRise through SNS like facebook. In the Philippines, all network subscribers can avail various services including calling, texting, and facebooking for free. Utilizing available networks among AEWs and farmers can facilitate the access to WeRise. Hence, farmers can get information to prepare for the upcoming season.

After the novel coronavirus disease (COVID-19) began in Wuhan, China and spread rapidly within China and other countries (Shereen et al. 2020), the role of ICT in agriculture became more important than before because of limitation and restrictions by local and national government in terms of field activities. Health Organization (WHO) declared a pandemic on March 11, 2020. To protect people from COVID-19, governments declared states of public health emergency and implemented lockdowns which entailed difficulties and challenges.

This has brought challenges to many sectors including agriculture particularly to farmers who are used to communicating with their fellow farmers to exchange information and update each other, and consulting with agricultural extension workers (AEWs) for crop production advice and new technologies. AEWs are among the major source of information of farmers who trust them for more complex information on the agricultural production (Bugayong et al. 2019). However, conventional communication methods (e.g., face-to-face meetings, trainings) which often entail the three C's, crowded places, closed spaces and close contact settings have become impractical if not limited or impossible due to the new normal. This is the new challenge in agricultural production, especially for farmers and AEWs.

WeRise was developed through the IRRI-Japan collaborative research project on climate change adaptation in rainfed rice areas (CCARA) and climate change adaptation through developing a decision support tool for rainfed rice areas (CCADS-RR) funded by the Ministry of Agriculture, Forestry and Fisheries of Japan. Indonesia, Philippines and Madagascar are the pilot countries for WeRise development. WeRise can provide relevant information to the farmers and AEWs re rice productions and it can support virtual communication between the farmers and AEWs during the period of COVID-19.

1. Objectives and target for this manual

This book documents the weather-rice-nutrient integrated decision support system (WeRise) for a user in research and agricultural extension. It consists of two sections: the first section contains the procedures for the development of crop, soil and weather databases for WeRise. Target users of this section are mainly researchers engaged in agronomy, varietal evaluation, and/or evaluation of ORYZA. The second section is a training program aimed at building the capacity of AEWs, farmer leaders/technicians, and other field agents to deliver extension advisories to rainfed rice farmers through the use of WeRise, ultimately facilitating its adoption.

2. Overview of WeRise development

WeRise functions through the interfacing of two models, ORYZA for crop growth and the cumulative distribution function downscaling method (CDFDM) for statistical downscaling of seasonal climate predictions from SINTEX-F. ORYZA was developed by IRRI for simulating the agronomic and phenological performances of a new variety or line in different agro-ecological conditions (Bouman et al. 2001). On the other hand, SINTEX-F was developed by JAMSTEC to predict ENSO, which is the main driver for Asian monsoon and has a high correlation with the onset of the rainy season in Asia (Luo et al. 2008). Interfacing these two models could bring a better solution to reduce constraints in rainfed rice production. However, the outputs of SINTEX-F should be downscaled prior to use in ORYZA simulation to reduce systematic errors (bias) (Iizumi et al. 2011, Hayashi et al. 2018). CDFDM was applied to utilize the outputs from SINTEX-F in ORYZA because it is a simple and less expensive model (Iizumi et al. 2011). The outputs from SINTEX-F is a paid product provided by the Forecast Ocean Plus, Inc. (Kudan Bldg. 7F 2-2-5, Kudanminami, Chiyoda-ku, Tokyo 102-0074, Japan).

Prior to running WeRise for predictions, weather and crop databases should be developed as shown in Fig 1.

SINTEX-F outputs (hindcast) and locally observed historical data are used for CDFDM to identify bias, which is used to correct SINTEX-F predictions. On the other hand, crop data should be evaluated and validated using two cropping seasons of on-station field experiment to develop crop database. Using these databases, predictions for certain varieties can be done in productivity as function of sowing periods, fertilizer application schedule and advisory for supplementary irrigation and these information will be stored in Amazon Web Services which a user can access directly to obtain the predictions.

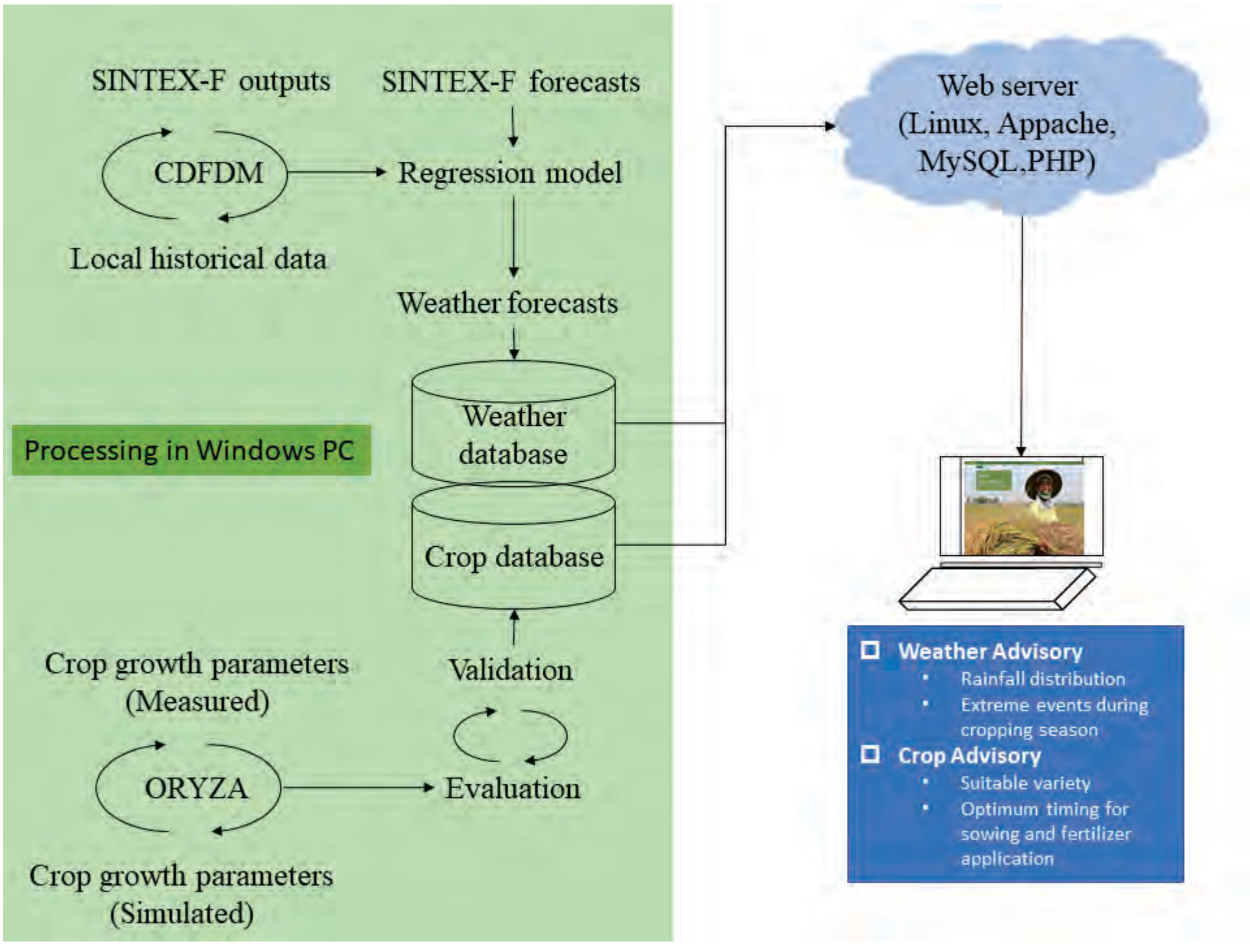

Fig 1. Conceptual flow of database development for WeRise (Any version of windows is accessible, and no macro is used for operation of WeRise)

3. File organization

In developing the required databases for WeRise, we need to deal with many files which are key for the preparation of the principal files (EXPERIMENTAL, SOIL, WEATHER files) which will be used to run each model. Hence, organizing files is crucial for efficient and accurate database development. Fig. 2 shows a sample structure of file organization.

1. Create a working folder, e.g. ***D:\Experiment,*** where all the simulation related files could be stored systematically. ①
2. In the working folder, create subfolders in following order: Country/Region or Province/ Station/ Year/ Season. ②
3. Each region/province has Soil folder. ③
4. Calibration folder should be under year.
5. Template folder contains the excel templates to format crop, weather, and soil data. ④

6. For example;
- Create a subfolder for different countries, e.g. ***INDO,PHL,MADA, Template***
- Create a subfolder for Regions, e.g. ***Region3, Rgeion6***
- Create subfolder year, e.g. ***2019***
- Create subfolder season, e.g. ***DS, WS, Calibration, Validation, Data***

7. Create another subfolder for the simulation outputs, e.g. ***D:\ Experiment\Outputs***.

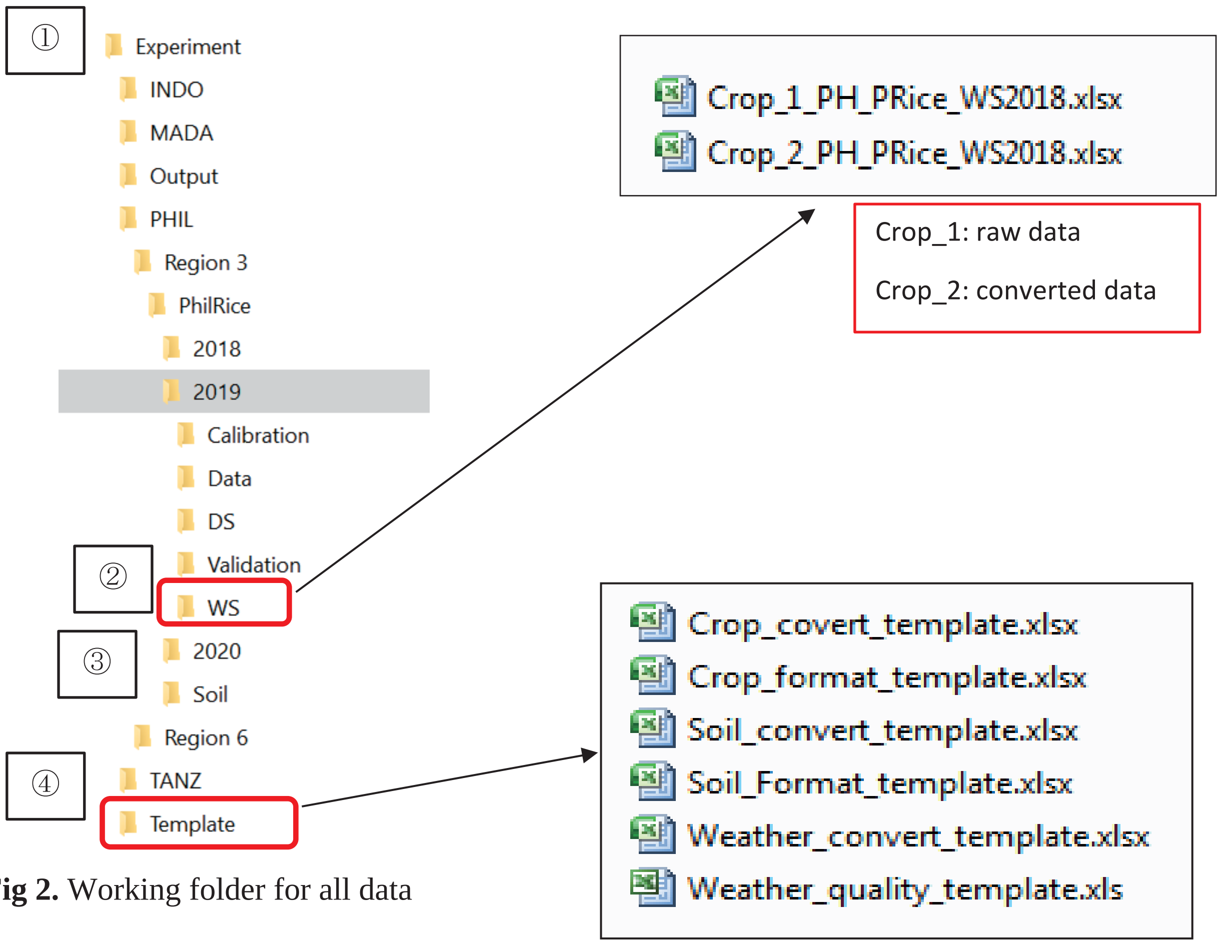

Fig 2. Working folder for all data

4. File naming

The general Excel file templates should be named as:

Raw data: Crop_format_template.xlsx
Converted/formatted file: Crop_convert_template.xlsx

Raw soil data: Soil_1_PH_Maligaya
(*filename description: 1 – raw data , PH –Philippines, Maligaya – Municipality)
Converted/formatted file : Soil_2_PH_Maligaya_2018.xlsx

Weather data: Weather_quality_template.xlsx
Formatted file: Weather_convert_template.xslm

1. After encoding all the raw crop data in ***Crop_format_template.xlsx,*** the file should be saved as ***Crop_1_PH_Price_DS2018.xlsx*** (“1” means raw data, Price means PhilRice)
2. Raw data need to be converted to a format acceptable to ORYZA. The template ***Crop_convert_template.xlsx,*** maybe used. Once converted, the file should be saved as ***Crop_2_PH_Price_DS2018.xlsx*** (“2” means converted data for ORYZA use)
3. File renaming will be done for all data files as in ***Soil_1_PH_Price_DS2018.xlsx, Soil_2_PH_Price_DS2018.xlsx , Weather_1_PH_Price_DS2018.xlsx and Weather_2_PH_Price_DS2018.xlsx***

** Note: Windows usually limits file names to 260 characters. But the file name must actually be shorter than that, since the complete path (such as C:\Program Files\filename.txt) is included in this character count.*

5. Data requirements for ORYZA v3

The following data sets are required to run ORYZA v3. These are the basic requirements for a successful model application and evaluation (Table 1). The completeness of data will determine the level of confidence in model outputs. Microsoft Excel 2010 was used to prepare all datasets describe in this manual.

- **Daily weather data**
  - Geo-coordinates and altitude
  - Precipitation or rainfall (mm)
  - Maximum and minimum temperature (^{o} Celsius)
  - Solar radiation (KJ/m2) or sunshine duration (hr)
  - Wind speed (m/s)
  - Vapor pressure (kPa)

❖ Daily weather data is a prerequisite for an area where experiments are conducted.
❖ Yields are largely affected by the weather conditions during the growing seasons.
❖ Measured data will be converted to its required unit format.
❖ Weather_convert_template will be used to format the weather file for ORYZA v 3.
❖ The weather data file is made up of three components: CNTR denotes the (acronym of the) country name (PHIL), ISTN denotes the weather station number (1), and IYEAR.

- **Soil characteristics**

Soil characteristics include the general soil profile. Soil data simulates the dynamics of soil water content and soil water tension to compute the effects of drought on crop growth and development.

- Soil texture (sand, silt, and clay)
- Soil organic carbon
- Soil organic N (=SOC/CN) *CN: C/N ratio

❖ To estimate soil hydraulic parameters, tool **SoilHydrau.exe,** a tool of ORYZA, will be used.

- **Crop measurements**

The following crop measurements are crucial in providing relevant information for crop growth.

- Date of sowing/planting
- Date of emergence
- Phenological stages
- Above-ground biomass (dry weight)
    a. Green Leaves and dead leaves
    b. Stem
    c. Panicle
- Fertilizer application date and dosage
- Grain yield and yield components

❖ Phenology dates should be inputted as Julian days.
❖ Fertilizer timing should be counted from days after sowing (DAS).
❖ The mean of the replicates of measured raw data will be used.

Table 1. Data requirement according to levels of accuracy (✓shows required data).
Protocol for experimental and data collection for modeling studies using ORYZA2000 (Li et al., 2012).

Data requirement for ORYZA v3 simulations

#	Data	Ideal data (High)	Adequate data (Acceptable)	Usable data (Uncertain)
1	Nursery density	√	√	√
2	Field density	√	√	√
3	Sowing date	√	√	√
4	Planting date	√	√	√
5	Daily radiation/sunshine	√ on-site	√	√
6	Maximum temperature	√ on-site	√ on-site	√
7	Minimum temperature	√ on-site	√ on-site	√
8	Rainfall	√ on-site	√ on-site	√
9	Wind speed	√ on-site	√	
10	Vapor pressure	√ on-site	√	
11	Phenology	PI, FL, PM	FL, PM	PM
12	Biomass accumulation	>3 measurements, component	1 measurement, component	Final, total
13	N uptake	>3 measurements, component		
14	Final grain yield	√	√	√
15	Harvest index	√	√	√
16	Grain weight	√	√	
17	Transpiration	√		
18	Soil texture	√	√	
19	Soil organic carbon	√	√	
20	Soil organic N	√		
21	Soil mineral N	√		
22	Irrigation	√	√	√
23	Soil water	√	√	
24	Fertilizer application	√	√	√
25	Pest & disease control	√	√	
26	Nutrient deficiency	√		

References

Bouman, B.A.M., Kropff,M.J., Tuong, T.P., Woperreis,M.C.S., ten Berge,H.F.M., van Laar,H.H., 2001. ORYZA2000: modeling lowland rice. Los Banos (Philippines): International Rice Research Institute, and Wageningen: Wageningen University and Research Centre. 235p.

Luo,J.J., Masson,S., Behera,S.K.,Yamagata,T. 2008. Extended ENSO predictions using a fully coupled ocean-atomosphere model. J. Clim. 21:84-93

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Iizumi, T., Nishimori, M., Dairaku, K., Adachi, S.A., Yokozawa, M., 2011. Evaluation and intercomparison of downscaled daily precipitation indices over Japan in present-day climate: strengths and weaknesses of dynamical and bias correction-type statistical downscaling methods. J. Geophys. Res. 116, D01111. http://dx.doi.org/10.1029/ 2010JD014513.

Hayashi, K., Llorca, L., Rustini, S., Prihasto, S., Zaini, Z. 2018. Reducing vulnerability of rainfed agriculture through seasonal climate predictions: A case study on the rainfed rice production in Southeast Asia. Agricultural Systems 162: 66-76.

Chapter 2: Step by step procedure for the preparation of WeRise predictions

This chapter navigates you for operating WeRise through stepwise procedure for the preparation of various data (Fig 3). Prior to proceed for WeRise operation, users are required to obtain ORYZA v3 through accessing http://sites.google.com/a/irri.org/oryza2000/downloads. (browsed on November 11, 2020).

1. Weather data file

1) Obtain weather data from the local station.
2) Check all units of parameters in raw data, Solar Radiation should be in KJ/m^2. If the data for solar radiation expressed in sunshine hours, then the appropriate values of the Ångström parameters should be given, so that the weather system of ORYZA could translate these into the correct data (Table 2).
3) Open Weather_quality_template and copy raw data in designated columns for each parameter (Fig 4).
4) Check the quality of obtained local weather data.

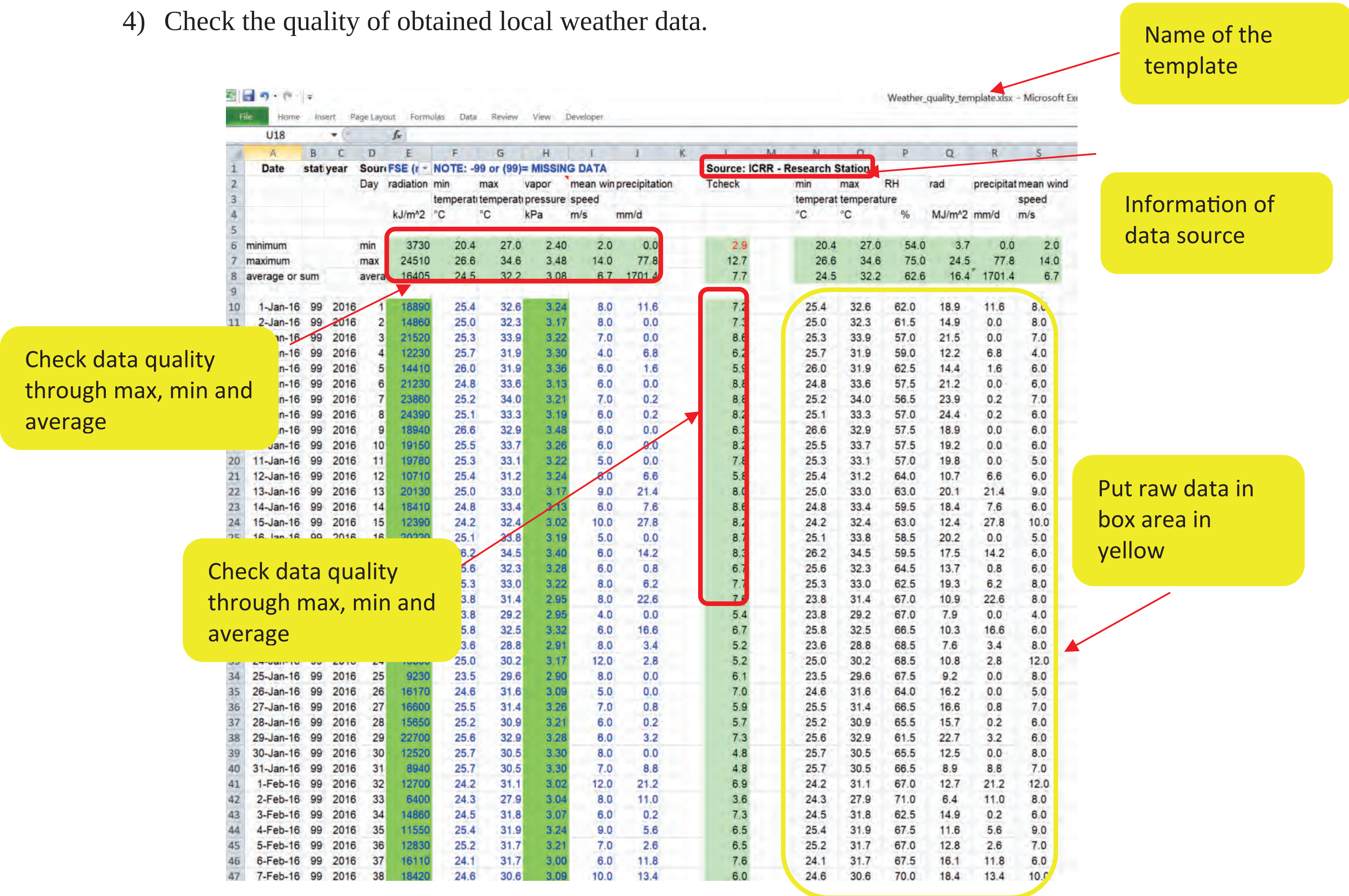


Fig 4. Weather_quality_template

Table 2. Indicative values for the empirical constants a and b in the Ångström formula, for broad ecological regions used by the Food and Agriculture Organization (FAO 1979).

Zones	**aA**	**bA**
Cold temperature	0.18	0.55
Dry tropical	0.25	0.45
Humid tropical	0.29	0.45

Source: Frère M, Popov GF. 1979. Agrometeorological crop monitoring and forecasting. Plant Production Protection Paper 17. Rome: Food and Agricultural Organization, 64 pp.

5) Save the file as Weather_1_country_station_year (for example, Weather_1_PH_Price_2019.xlsx).
6) Open prn_convert_template.xlsm.

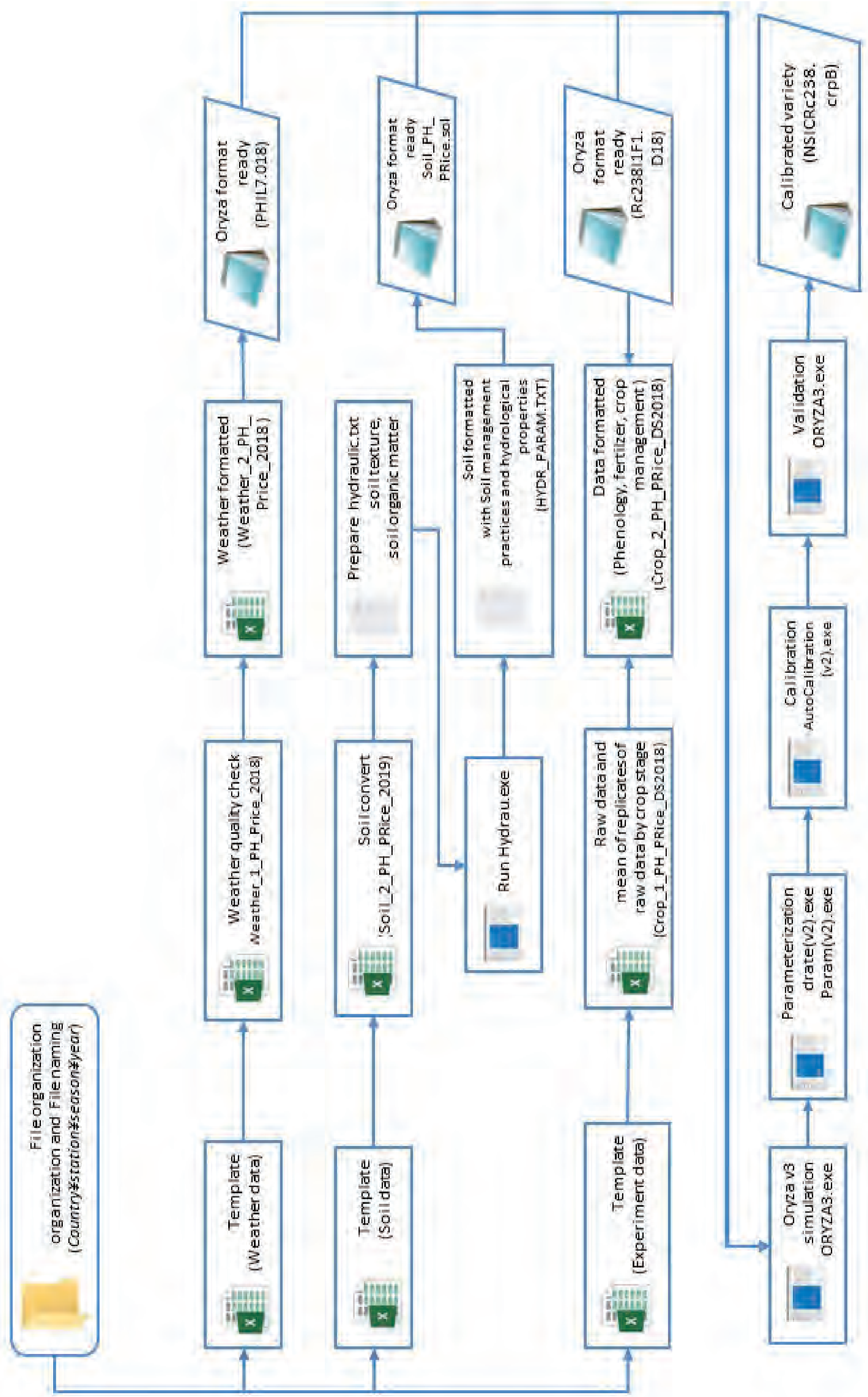


Fig 3. Flowchart of stepwise data preparation

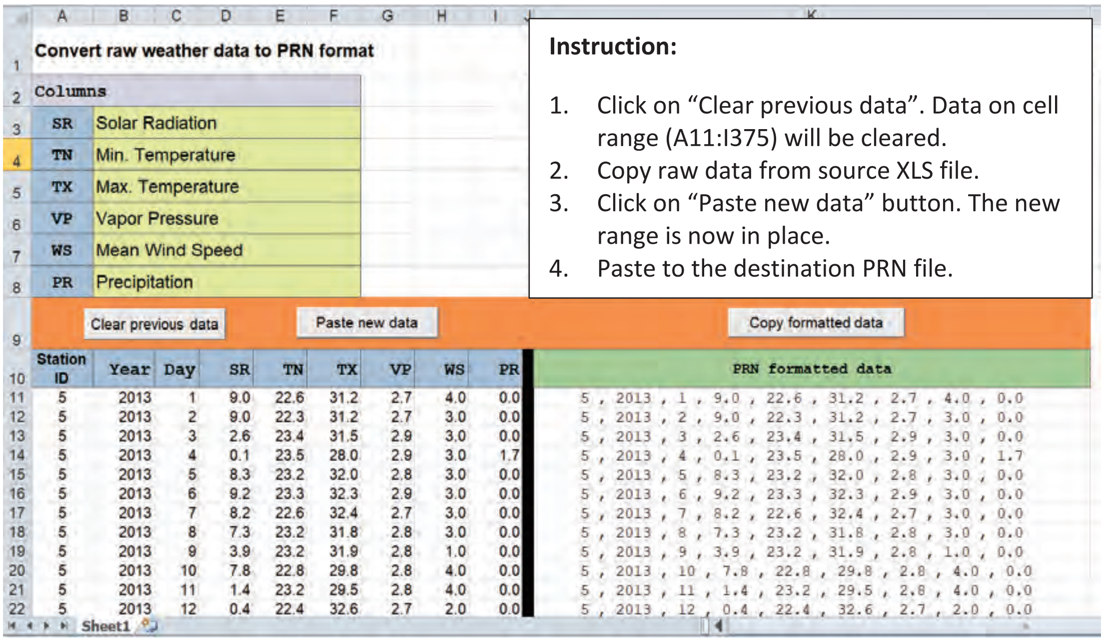


Fig 5. prn_convert_template.

7) Click on "Clear previous data". Data on cell range [A11:I375] will be cleared.

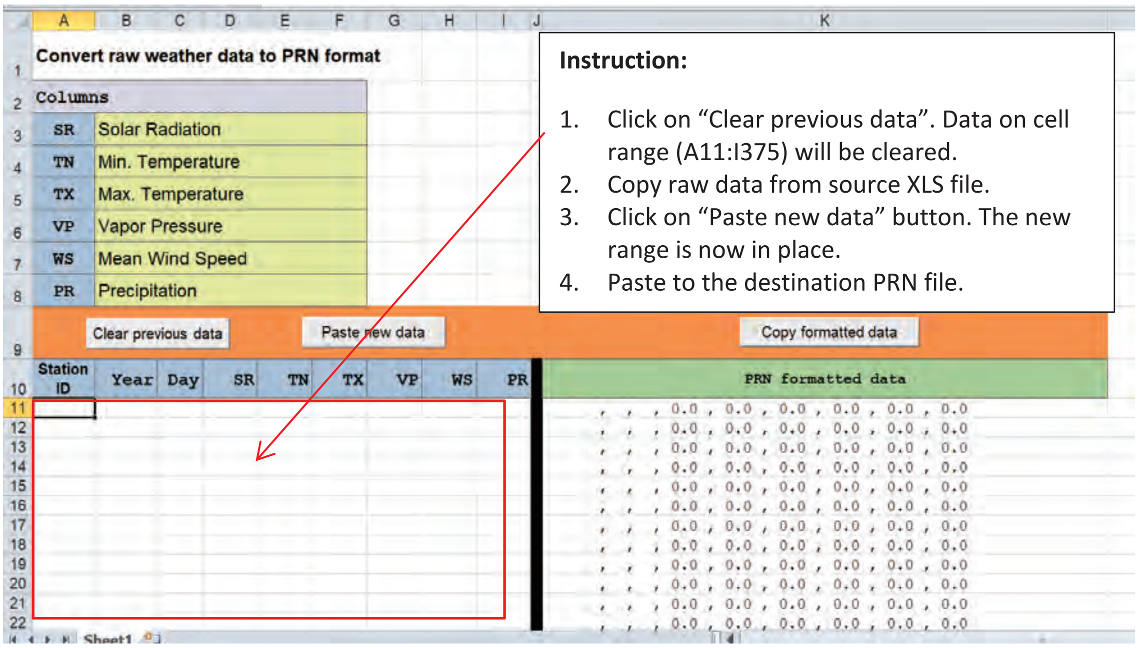
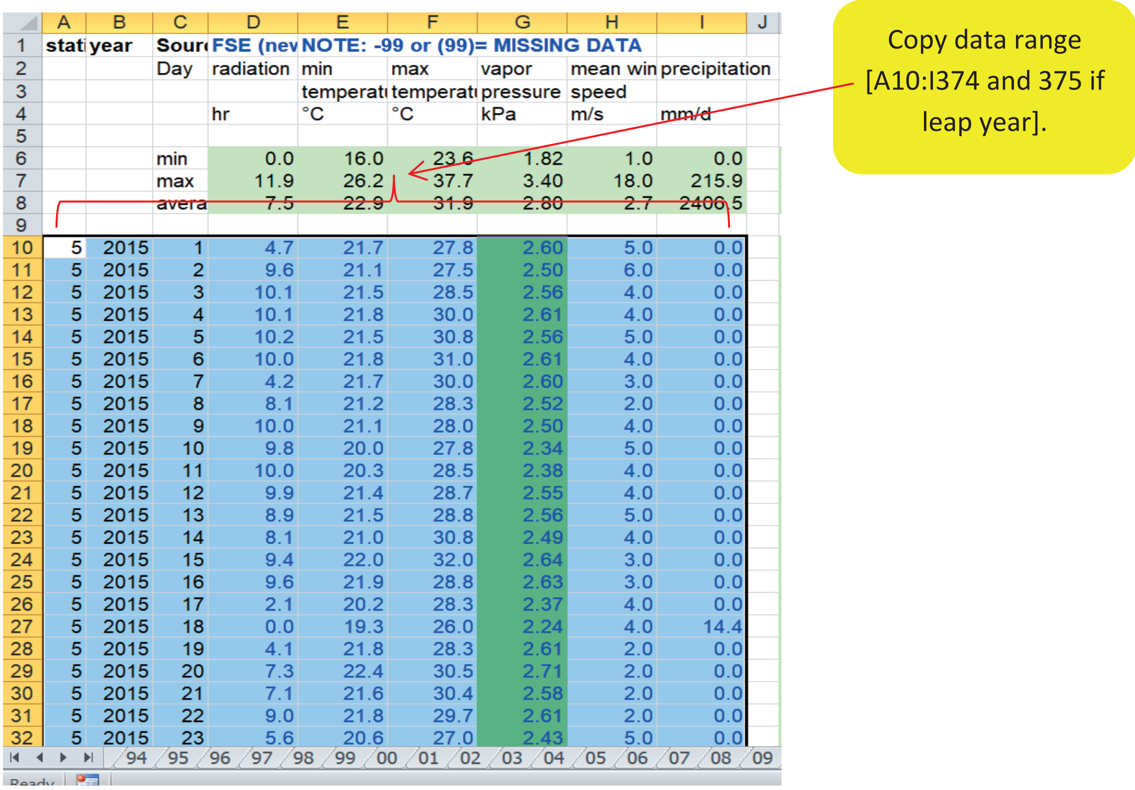


Fig 6. Weather_convert_template after clicking "Clear previous data".

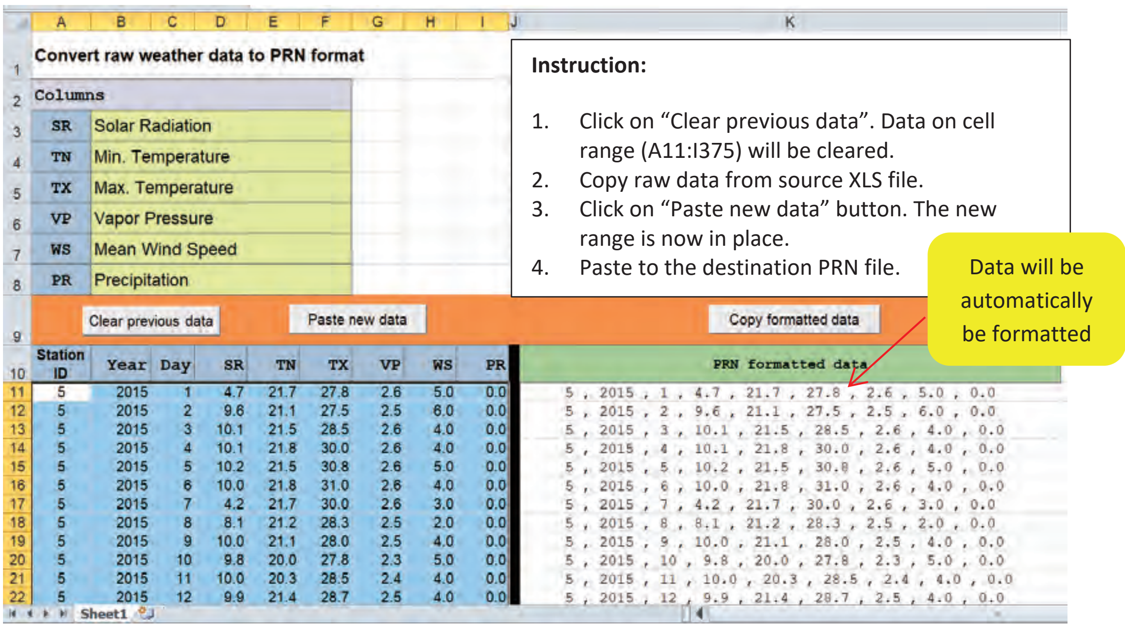
8) Copy raw data (cell range [A10:I375]) from Weather_1_PH_Price_2019.xlsx



	A	B	C	D	E	F	G	H	I
1	stati	year	Sour	FSE (nev	NOTE: -99 or (99)= MISSING DATA				
2			Day	radiation	min	max	vapor	mean win	precipitation
3					temperat	temperat	pressure	speed	
4				hr	°C	°C	kPa	m/s	mm/d
5									
6			min	0.0	16.0	23.6	1.82	1.0	0.0
7			max	11.9	26.2	37.7	3.40	18.0	215.9
8			avera	7.5	22.9	31.9	2.80	2.7	2406.5
9									
10	5	2015	1	4.7	21.7	27.8	2.60	5.0	0.0
11	5	2015	2	9.6	21.1	27.5	2.50	6.0	0.0
12	5	2015	3	10.1	21.5	28.5	2.56	4.0	0.0
13	5	2015	4	10.1	21.8	30.0	2.61	4.0	0.0
14	5	2015	5	10.2	21.5	30.8	2.56	5.0	0.0
15	5	2015	6	10.0	21.8	31.0	2.61	4.0	0.0
16	5	2015	7	4.2	21.7	30.0	2.60	3.0	0.0
17	5	2015	8	8.1	21.2	28.3	2.52	2.0	0.0
18	5	2015	9	10.0	21.1	28.0	2.50	4.0	0.0
19	5	2015	10	9.8	20.0	27.8	2.34	5.0	0.0
20	5	2015	11	10.0	20.3	28.5	2.38	4.0	0.0
21	5	2015	12	9.9	21.4	28.7	2.55	4.0	0.0
22	5	2015	13	8.9	21.5	28.8	2.56	5.0	0.0
23	5	2015	14	8.1	21.0	30.8	2.49	4.0	0.0
24	5	2015	15	9.4	22.0	32.0	2.64	3.0	0.0
25	5	2015	16	9.6	21.9	28.8	2.63	3.0	0.0
26	5	2015	17	2.1	20.2	28.3	2.37	4.0	0.0
27	5	2015	18	0.0	19.3	26.0	2.24	4.0	14.4
28	5	2015	19	4.1	21.8	28.3	2.61	2.0	0.0
29	5	2015	20	7.3	22.4	30.5	2.71	2.0	0.0
30	5	2015	21	7.1	21.6	30.4	2.58	2.0	0.0
31	5	2015	22	9.0	21.8	29.7	2.61	2.0	0.0
32	5	2015	23	5.6	20.6	27.0	2.43	5.0	0.0

Fig 7. Excel sheet in Weather_1_PH_2019.xlsx

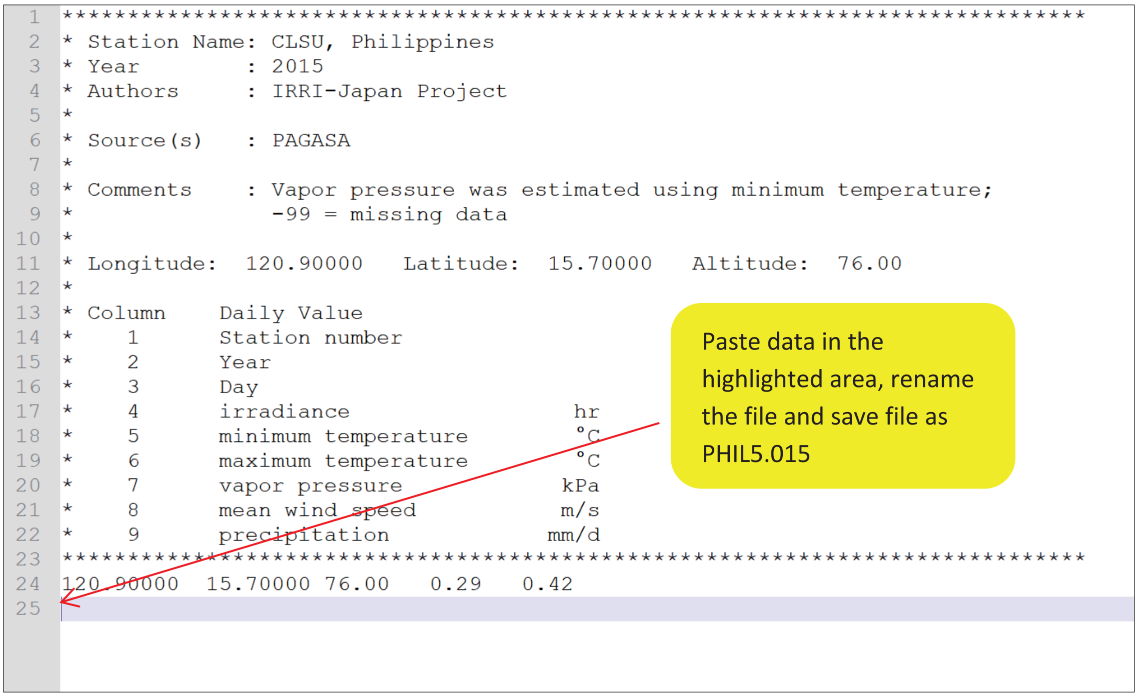
9) Click on "Paste new data" button.



	Station ID	Year	Day	SR	TN	TX	VP	WS	PR	PRN formatted data
11	5	2015	1	4.7	21.7	27.8	2.6	5.0	0.0	5 , 2015 , 1 , 4.7 , 21.7 , 27.8 , 2.6 , 5.0 , 0.0
12	5	2015	2	9.6	21.1	27.5	2.5	6.0	0.0	5 , 2015 , 2 , 9.6 , 21.1 , 27.5 , 2.5 , 6.0 , 0.0
13	5	2015	3	10.1	21.5	28.5	2.6	4.0	0.0	5 , 2015 , 3 , 10.1 , 21.5 , 28.5 , 2.6 , 4.0 , 0.0
14	5	2015	4	10.1	21.8	30.0	2.6	4.0	0.0	5 , 2015 , 4 , 10.1 , 21.8 , 30.0 , 2.6 , 4.0 , 0.0
15	5	2015	5	10.2	21.5	30.8	2.6	5.0	0.0	5 , 2015 , 5 , 10.2 , 21.5 , 30.8 , 2.6 , 5.0 , 0.0
16	5	2015	6	10.0	21.8	31.0	2.6	4.0	0.0	5 , 2015 , 6 , 10.0 , 21.8 , 31.0 , 2.6 , 4.0 , 0.0
17	5	2015	7	4.2	21.7	30.0	2.6	3.0	0.0	5 , 2015 , 7 , 4.2 , 21.7 , 30.0 , 2.6 , 3.0 , 0.0
18	5	2015	8	8.1	21.2	28.3	2.5	2.0	0.0	5 , 2015 , 8 , 8.1 , 21.2 , 28.3 , 2.5 , 2.0 , 0.0
19	5	2015	9	10.0	21.1	28.0	2.5	4.0	0.0	5 , 2015 , 9 , 10.0 , 21.1 , 28.0 , 2.5 , 4.0 , 0.0
20	5	2015	10	9.8	20.0	27.8	2.3	5.0	0.0	5 , 2015 , 10 , 9.8 , 20.0 , 27.8 , 2.3 , 5.0 , 0.0
21	5	2015	11	10.0	20.3	28.5	2.4	4.0	0.0	5 , 2015 , 11 , 10.0 , 20.3 , 28.5 , 2.4 , 4.0 , 0.0
22	5	2015	12	9.9	21.4	28.7	2.5	4.0	0.0	5 , 2015 , 12 , 9.9 , 21.4 , 28.7 , 2.5 , 4.0 , 0.0

Fig 8. prn_convert_template after "Paste new data".

10) Click on “Copy formatted data” button.
11) Open PRN template file from subfolder year.
12) Paste to the destination PRN file. Solar radiation is expressed as sunshine duration in this example.
13) Save as file with filename format as Country.station code.year (for example PHIL5.015)



```
*******************************************************************************
* Station Name: CLSU, Philippines
* Year         : 2015
* Authors      : IRRI-Japan Project
*
* Source(s)    : PAGASA
*
* Comments     : Vapor pressure was estimated using minimum temperature;
*                 -99 = missing data
*
* Longitude:  120.90000   Latitude:  15.70000   Altitude:  76.00
*
* Column     Daily Value
*     1      Station number
*     2      Year
*     3      Day
*     4      irradiance                      hr
*     5      minimum temperature             °C
*     6      maximum temperature             °C
*     7      vapor pressure                 kPa
*     8      mean wind speed                m/s
*     9      precipitation                 mm/d
*******************************************************************************
120.90000  15.70000 76.00   0.29   0.42
```


Fig 9. Sample of PRN template file.

2. Soil data file

1) Obtain soil data from the lab analysis.
2) Compile soil data in RAW DATA in soil_convert_template.xlsx.

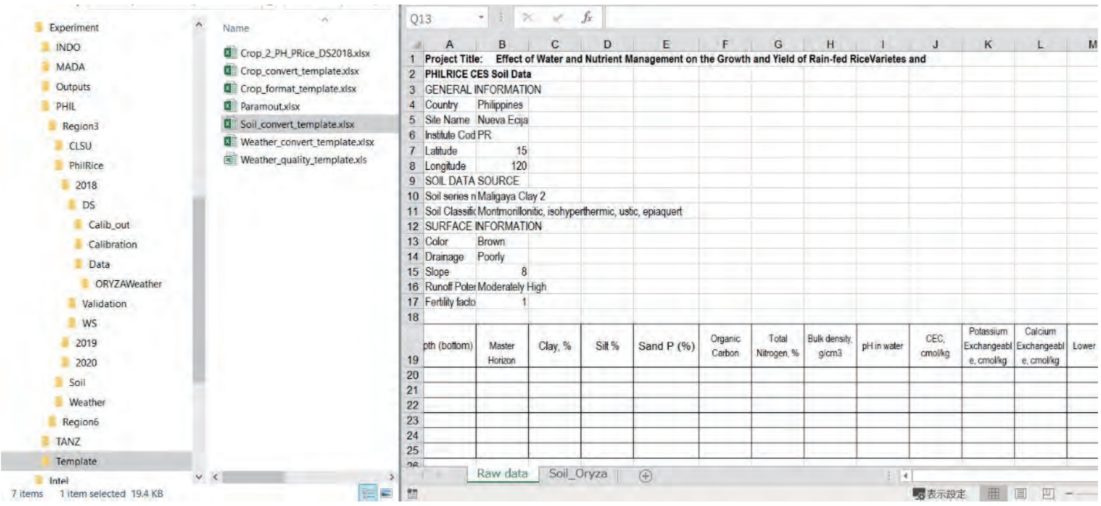


Fig 10. Soil_convert_template

3) Soil data in Soil_ORYZA will be automatically filled up as soon as raw data is inputted.
4) Soil information for ORYZA will be formatted in Soil_Oryza tab.

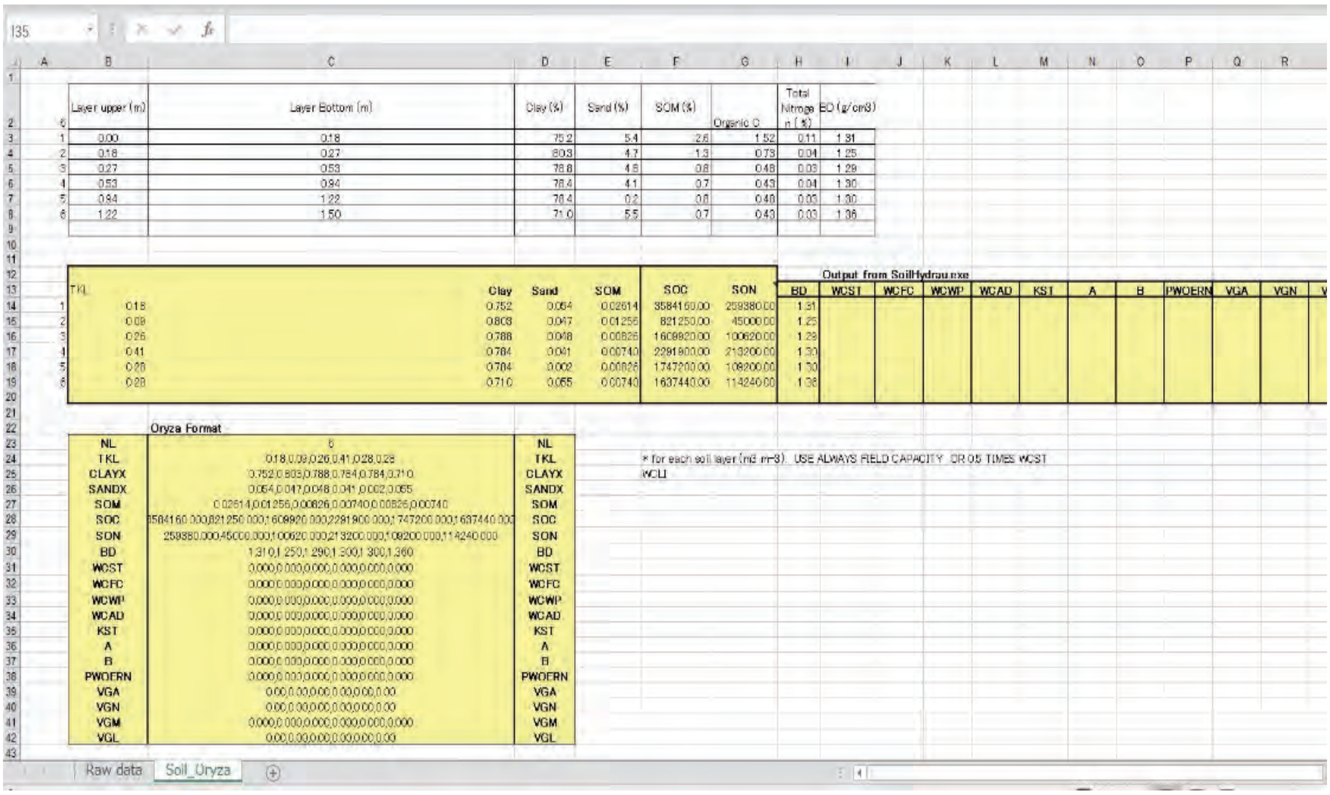


Fig 11. Soil data in Soil_ORYZA tab

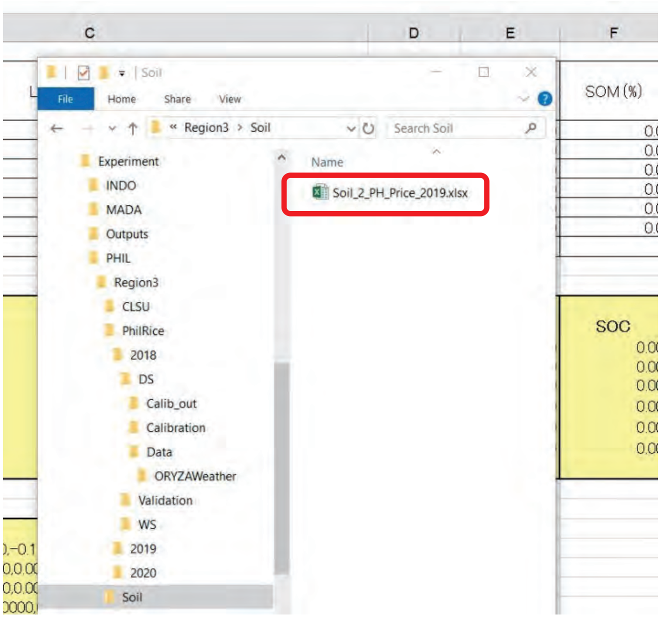


Fig 12. File in Soil folder

5) Save the file in **<u>Soil folder (Experiment\PHL\Region 3)</u>** as Soil_country_2_station_year (for ex, Soil_2_PH_Price_2019).
6) Open hydraulic.txt.
7) Go to previous file (for ex, Soil_2_PH_Price_2019) and copy NL, clay, sand content, SOM from ORYZA format table in Soil_Oryza tab (in Soil_2_PH_Price_2019).

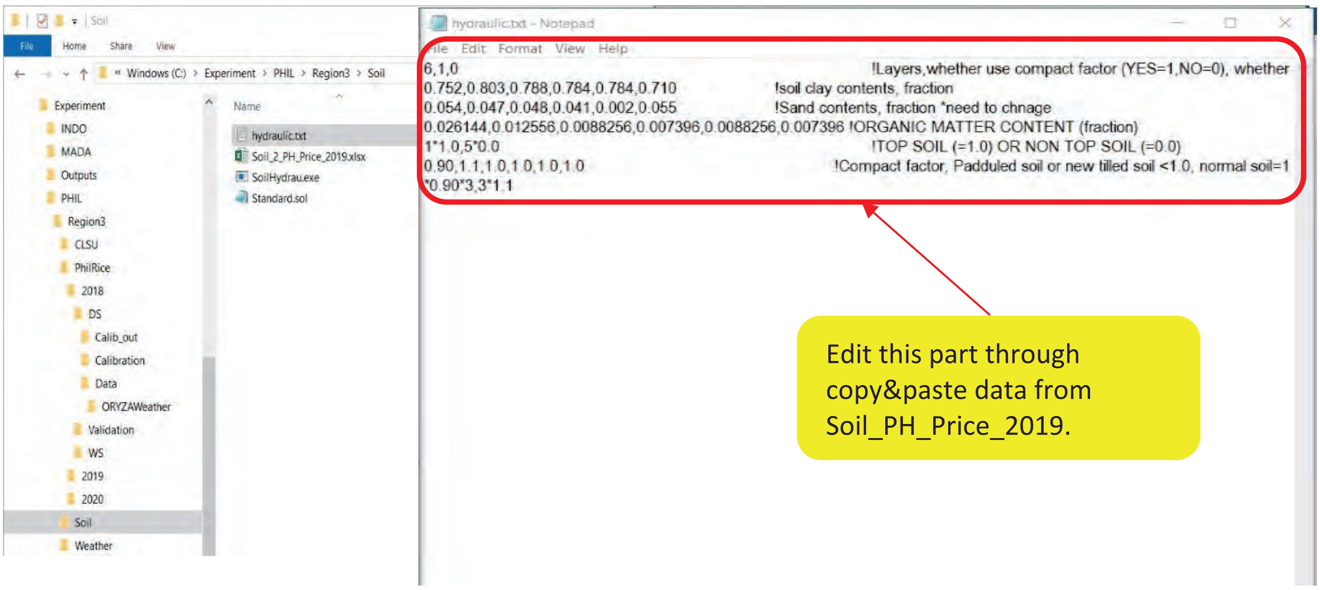


Fig 13. Location of hydralic.txt file and what to edit in hydralic.txt

8) Save the file as hydraulic_country_station.txt name (for example, hydraulic_PH_Price.txt) in Soil folder.

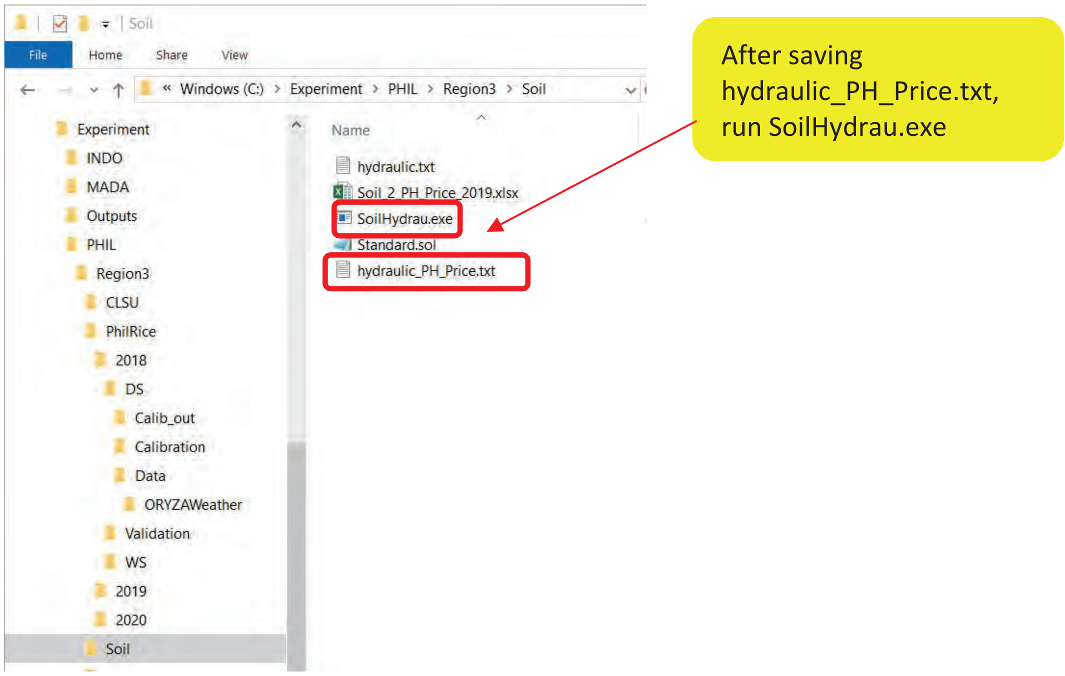


Fig 14. After editing hydraulic.txt, save the file in Soil folder.

9) Run SoilHydrau.exe (Please see Fig 3. in p12)

10) Choose the file we just created (for example, hydraulic_PH_Price.txt) and let SoilHydrau.exe simulates.

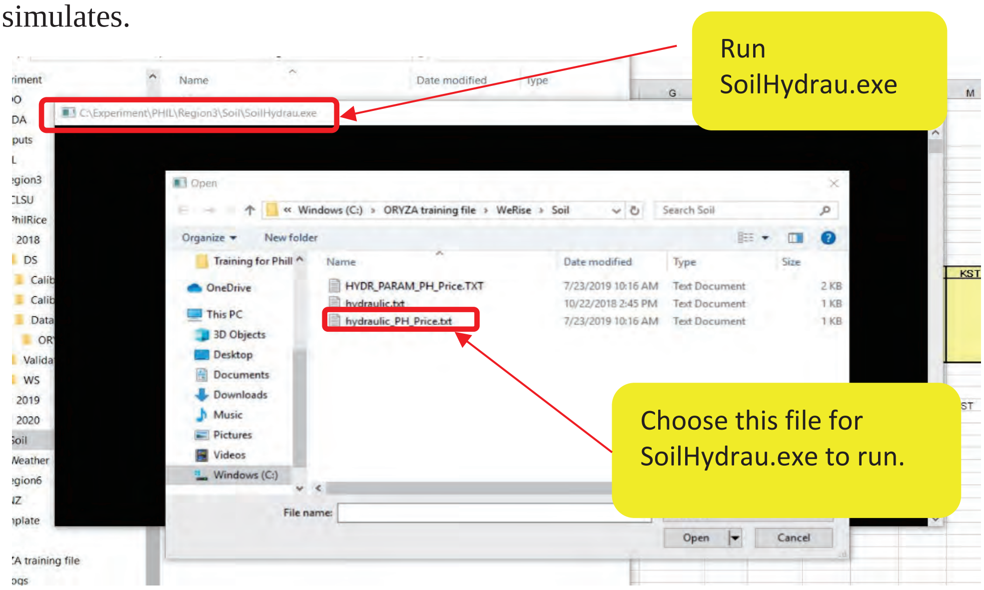


Fig 15. How to run SoilHydrau.exe

11) Go to the Soil folder, rename output as HYDR_PARAM_country_station_soil.txt (for example, HYDR_PARAM_PH_Price.txt).

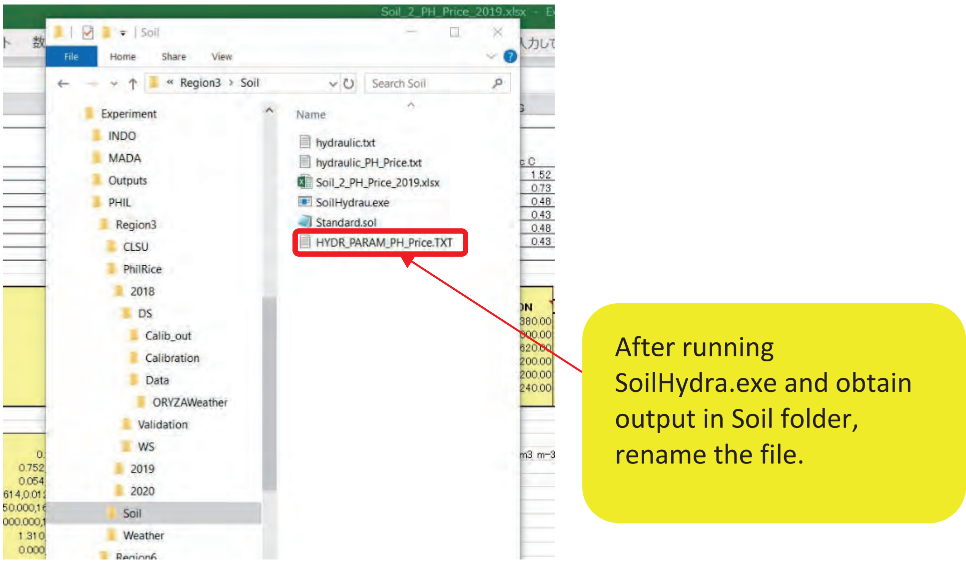


Fig 16. Output of SoilHydrau.exe in Soil folder

12) Open created output files (for example, HYDR_PARAM_PH_Price.txt and Soil_2_PH_Price_2019), copy all variables from HYDR_PARAM_PH_Price.txt to Output from SoilHydrau.exe table in Soil_2_PH_Price_2019.

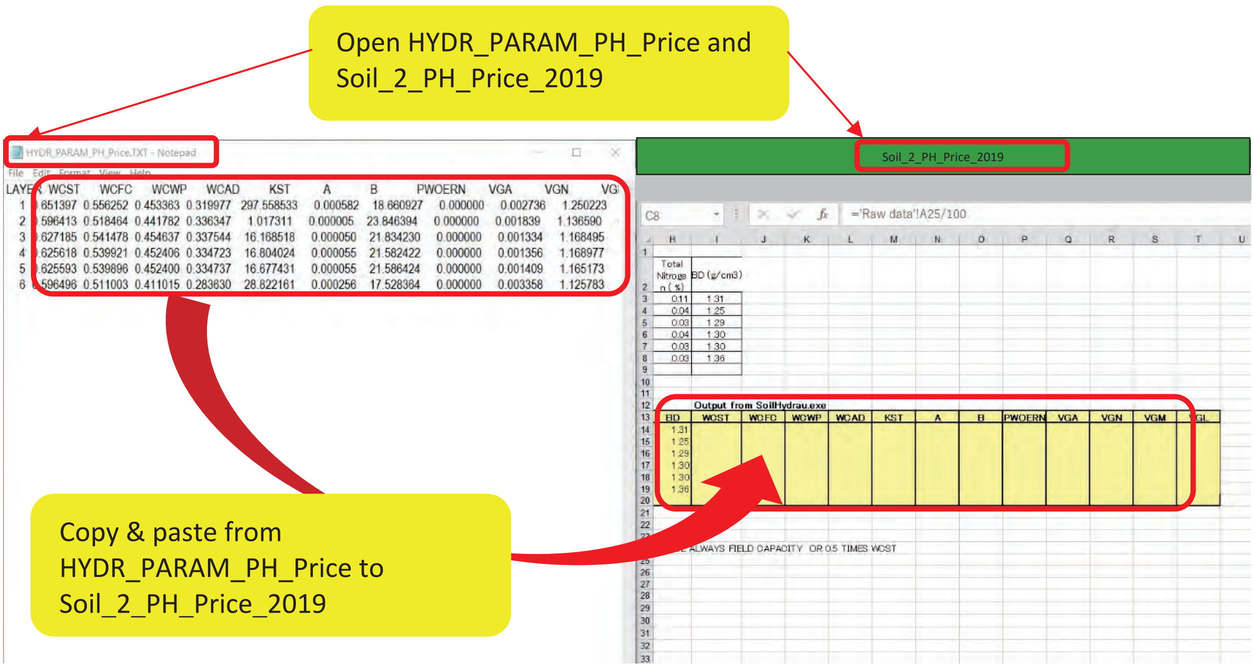


Fig 17. HYDR_PARAM_PH_Price.txt (left) and Soil_2_PH_Price_2019 (right)

TIPS: Data in HYDR_PARAM_PH_is text format and data for each parameter can't be copied directly in the designated column in excel. Use the convert **Text to Column** wizard to split the text into multiple columns. More details are as follow:

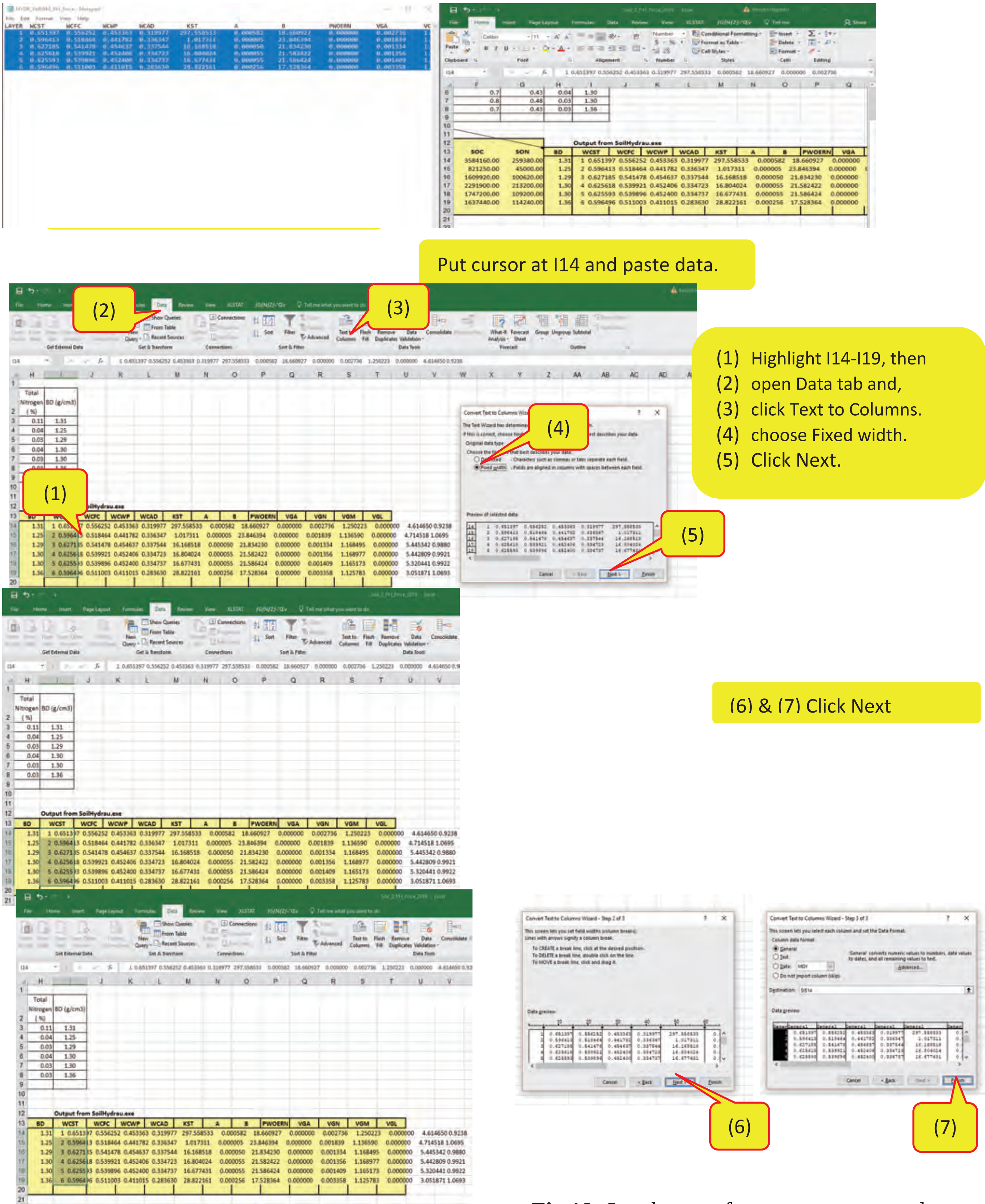


Fig 18. Step by step for convert text to column

13) After pasting data from HYDR_PARAM_PH_Price to Soil_2_PH_Price_2019, highlight I14-I19
14) Then open Data in Menu bar and then choose Text to Column icon.
15) In Convert Text to Columns Wizard-Step1 of 3, please choose Fixed width and then click Next>.
16) In Convert Text to Columns Wizard-Step 2 of 3, please click Next>.
17) In Convert Text to Columns Wizard-Step 3 of 3, please click Finish to complete the procedure.

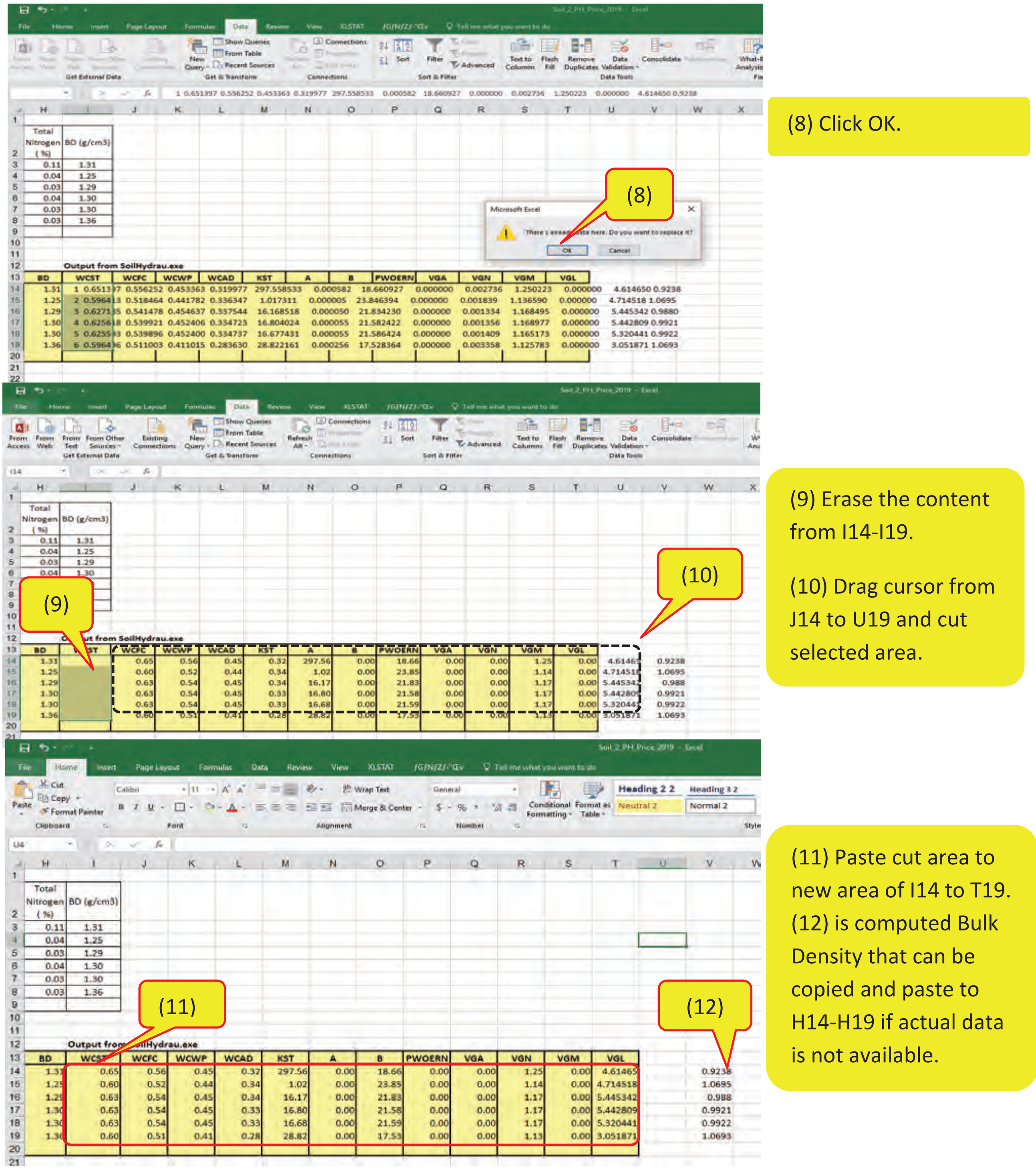
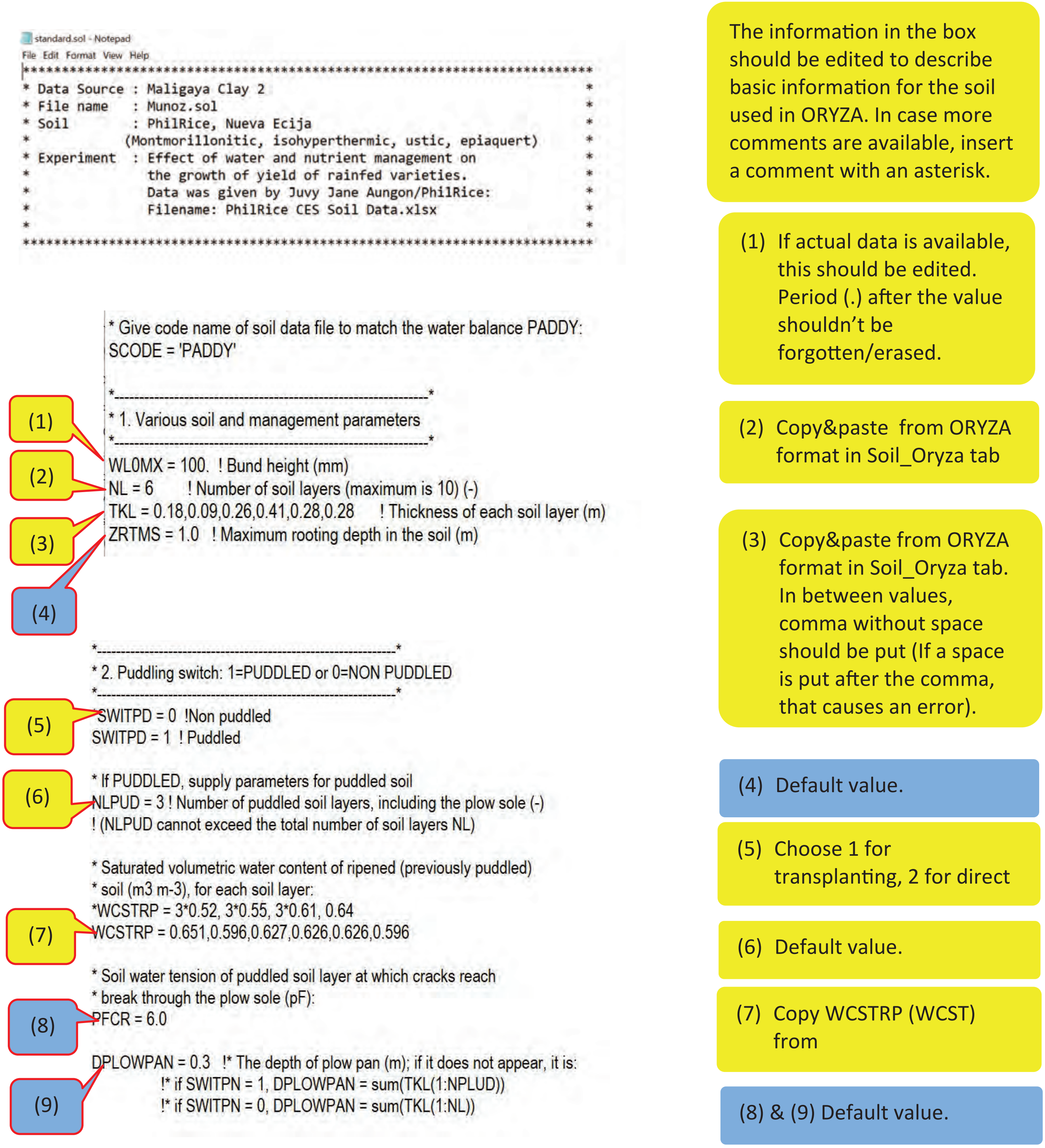


Fig 19. Step by step for convert text to column (Continued)

18) Check ORYZA format table in Soil_Oryza tab.
19) Save the file in Soil folder.
20) Open "Standard.sol".
21) Copy parameters in ORYZA format table to standard.sol by following steps:



```
standard.sol - Notepad
File Edit Format View Help
*****************************************************************************
* Data Source : Maligaya Clay 2                                             *
* File name   : Munoz.sol                                                   *
* Soil        : PhilRice, Nueva Ecija                                       *
*              (Montmorillonitic, isohyperthermic, ustic, epiaquert)        *
* Experiment  : Effect of water and nutrient management on                  *
*               the growth of yield of rainfed varieties.                   *
*               Data was given by Juvy Jane Aungon/PhilRice:                *
*               Filename: PhilRice CES Soil Data.xlsx                       *
*                                                                           *
*****************************************************************************

* Give code name of soil data file to match the water balance PADDY:
SCODE = 'PADDY'

*---------------------------------------------------------------*
* 1. Various soil and management parameters
*---------------------------------------------------------------*
WL0MX = 100.  ! Bund height (mm)
NL = 6        ! Number of soil layers (maximum is 10) (-)
TKL = 0.18,0.09,0.26,0.41,0.28,0.28     ! Thickness of each soil layer (m)
ZRTMS = 1.0   ! Maximum rooting depth in the soil (m)

*---------------------------------------------------------------*
* 2. Puddling switch: 1=PUDDLED or 0=NON PUDDLED
*---------------------------------------------------------------*
SWITPD = 0  !Non puddled
SWITPD = 1  ! Puddled

* If PUDDLED, supply parameters for puddled soil
NLPUD = 3 ! Number of puddled soil layers, including the plow sole (-)
! (NLPUD cannot exceed the total number of soil layers NL)

* Saturated volumetric water content of ripened (previously puddled)
* soil (m3 m-3), for each soil layer:
*WCSTRP = 3*0.52, 3*0.55, 3*0.61, 0.64
WCSTRP = 0.651,0.596,0.627,0.626,0.626,0.596

* Soil water tension of puddled soil layer at which cracks reach
* break through the plow sole (pF):
PFCR = 6.0

DPLOWPAN = 0.3   !* The depth of plow pan (m); if it does not appear, it is:
                 !* if SWITPN = 1, DPLOWPAN = sum(TKL(1:NPLUD))
                 !* if SWITPN = 0, DPLOWPAN = sum(TKL(1:NL))
```

```
*-----------------------------------------------------------------*
* 3. Groundwater switch: 0=DEEP (i.e., not in profile), 1=DATA
* (supplied), 2=CALCULATE
*-----------------------------------------------------------------*
SWITGW = 0 ! Deep groundwater
*SWITGW = 2 ! Calculate groundwater
*SWITGW = 1 ! Groundwater data

* If DATA, supply table of groundwater table depth (cm; Y-value)
* as function of calendar day (d; X value):
ZWTB =   1.,200.,
       366.,200.

* If CALCULATE, supply the following parameters:
ZWTBI = 200. ! Initial groundwater table depth (cm)
MINGW = 200. ! Minimum groundwater table depth (cm)
MAXGW = 200. ! Maximum groundwater table depth (cm)
ZWA   = 1.0  ! Receding rate of groundwater with no recharge (cm d-1)
ZWB   = 0.5  ! Sensitivity factor of groundwater recharge (-)
```

(10) If data is available, choose "1". If no data is available, choose "2". "0" is for Africa.

(11) This can be a default and actual information. In case of the latter, use sowing and harvest dates to edit ZWTB.

(12) No need to put asterisks.

```
*-----------------------------------------------------------------*
* 4. Percolation switch
* Value for SWITVP cannot be 1 (CALCULATE) for non-puddled soil
*-----------------------------------------------------------------*
SWITVP = -1 ! Fixed percolation rate
*SWITVP = 0 ! Percolation as function of the groundwater depth
*SWITVP = 1 ! Calculate percolation
*SWITVP = 2 ! Fixed percolation rate as function of time

* If SWITVP = -1, supply fixed percolation rate (mm d-1):
FIXPERC = 0.0

* If SWITVP = 0, supply table of percolation rate (mm d-1; Y-value)
* as function of water table depth (cm; X value):
*PERTB =   0., 3.,
*        200., 3.

* If SWITVP = 2, give percolation rate (mm/d) as function of calendar day
PTABLE =
  1., 1.0,   ! First number is calendar day, second is percolation rate)
 50., 1.0,
100., 20.0,
366., 20.0
```

(13) Default

```
*-----------------------------------------------------------------*
* 5. Conductivity switch: 0=NO DATA, 1=VAN GENUCHTEN or 2=POWER
  OR 3= SPAW  function used
*-----------------------------------------------------------------*
SWITKH = 0 ! No data
*SWITKH = 2 ! Power
*SWITKH  = 1 ! vanGenuchten
*SWITKH = 11 !Spaw function

*-----------------------------------------------------------------*
* 6. Water retention switch: 0=DATA; 1=VAN GENUCHTEN. When DATA, data
* have to be supplied for saturation, field capacity,
* wilting point and at air dryness
*-----------------------------------------------------------------*
*SWITPF = 0  ! Data
SWITPF  = 1 ! van Genuchten
*SWITPF = 11 ! SPAW FUNCTION
```

(14) Default

(15) Default

(16)

```
*-------------------------------------------------*
* 7.Soil physical properties, these parameters will be used when model
* runs under actual water or nitrogen condition, or even both. Otherwise
* these parameters will not be used.
*-------------------------------------------------*
CLAYX = 0.752,0.803,0.788,0.784,0.784,0.710     !soil clay content, fraction
SANDX = 0.054,0.047,0.048,0.041,0.002,0.055     !soil sand content, fraction
BD = 1.310,1.250,1.290,1.300,1.300,1.360     !soil bulk density (g/cm3)

*Soil organic carbon and nitrogen content in kg C or N/ha
SOC = 3584160.000,821250.000,1609920.000,2291900.000,1747200.000,1637440.000   ! Soil organic C (kg C/ha)
SON = 259380.000,45000.000,100620.000,213200.000,109200.000,114240.000     ! Soil organic N (kg N/ha)

*SNH4X = 2*4.97,3.77,3.13,1.62,0.50,0.05    !*soil NH4-N (kg N/ha)
*SNO3X = 2*2.45,0.62,1.52,0.27,0.083,0.0088  !*soil NO3-N (kg N/ha)

*FORGANC =200.0,1000.0, 5*0.0   !* Fresh organic carbon (kg C/ha)
*FORGANN = 10.0,100.0,5*0.0    !* Fresh organic nitrogen (kg N/ha)
*FCarboh = 0.54          !* Fraction of carbonhydrate in fresh organic matter (--)
*FCellulo = 0.38         !* Fraction of cellulos in fresh organic matter (--)
```

(16) Data from Oryza Format in Soil_Oryza should be copied and pasted.

```
*---------------------------------------------------------*
* 8. Soil hydrological properties. Required type of data input   *
* according to setting of conductivity and water retention switch *
*---------------------------------------------------------*
```

(17)

```
* Saturated hydraulic conductivity, for each soil layer
* (cm d-1) (always required!):
*KST = 2*255.850266, 297.858490, 114.549477, 0.789587, 1.244055, 2*74.991531
KST = 297.559,1.017,16.169,16.804,16.677,28.822    !
```

(18)

```
* Saturated volumetric water content, for each soil layer
* (m3 m-3)(always required!):
*WCST = 2*0.533142, 0.542527, 0.491697, 0.339206, 0.429186, 2*0.481078
WCST = 0.651,0.596,0.627,0.626,0.626,0.596     !):
```

(19)

(20)

```
* Van Genuchten parameters, for each soil layer
* (needed if SWITKH = 1 and/or SWITPF = 1):
VGA = 0.00,0.00,0.00,0.00,0.00,0.00     !* a parameter (cm-1)
VGL = 4.61,4.71,5.45,5.44,5.32,3.05 !* l parameter (-)
VGN = 1.25,1.14,1.17,1.17,1.17,1.13     !* n parameter (-)
VGR = 6*0.01                            !* residual water content (-)
```

(21)

```
* Power function parameters, for each soil layer (-)
* (needed if SWITKH = 2):
*PN = 3*-2.5, 3*-2.5, 2*-2.5, -2.5
```

(22)

```
*!* Volumetric water content at field capacity, for each soil layer
* (m3 m-3)(needed if SWITPF = 0):
WCFC = 0.556,0.518,0.541,0.540,0.540,0.511
```

(23)

```
*!* Volumetric water content at wilting point, for each soil layer
* (m3 m-3) (needed if SWITPF = 0):
WCWP = 0.453,0.442,0.455,0.452,0.452,0.411
```

(24)

```
*!* Volumetric water content at air dryness, for each soil layer
* (m3 m-3) (needed if SWITPF = 0):
WCAD = 0.320,0.336,0.338,0.335,0.335,0.284
```

(17)–(20), (22)-(24) Data from Oryza Format in Soil_Oryza should be copied and pasted.

(21)Default

(25) Data from Oryza Format in Soil_Oryza should be copied and pasted.

(26)- (29) Default

```
*---------------------------------------------------------------*
* 9. Initialization conditions, and re-initialization
*---------------------------------------------------------------*
WL0I = 0.   ! Initial ponded water depth at start of simulation (mm)

* Initial volumetric water content at the start of simulation,
* for each soil layer (m3 m-3):  USE ALWAYS FIELD CAPACITY, OR 0.5 TIMES WCST
WCLI = 0.651,0.596,0.627,0.626,0.626,0.596          (25)

! Initial ponded water depth at start of simulation (mm)

* Initial ponded water depth and water contents may be reset:
* Ponded water depth: at minimum of WL0I and WL0MX
* Water contents in all soil layers: at saturation value
* For direct-seeded rice, this happens at sowing, for transplanted
* rice, this happens at transplanting
* Re-initialize switch RIWCLI is YES or NO          (26)
*RIWCLI = 'NO'
RIWCLI = 'YES'                                      (27)

*---------------------------------------------------------------*
* 10. Initialization of soil thermal conditions     (28)
*---------------------------------------------------------------*
SATAV = 18.0     ! Soil annual average temperature of the first layers
SOILT = 22.0, 17.0, 16.0, 15.0, 14.0, 2*15.0
! Initial soil temperature in each layer
! Have to provide above either one or two of above parameter, otherwise,
! model start the calculation of soil temperature at 0 degree

*---------------------------------------------------------------*
* 11. Observations/measurements                     (29)
*   Switches to force observed water content in water balance
*---------------------------------------------------------------*
*!* WCL1_OBS, WCL2_OBS,...WCL10_OBS: Observed soil water contents
* in layer 1, 2, ..., 10. Format: year, day number, water content
* Not obligatory to give data

*WCL1_OBS =
* TO BE FILLED-IN (OPTIONAL)

*!* Parameter to set forcing of observed water content yes (2) or no (0)
* during simulation (instead of using simulated values)
*WCL1_FRC = 0 ! No forcing
*WCL1_FRC = 2 ! Forcing

* Table for interpolation of water content between soil layers for
* those layers for which no observations were made: first number is
* the soil layer for which interpolation needs to be done, the second
* is the number of the underlying soil layer, the third is the number
* of the overlying soil layer. No interpolation is performed when all
* three numbers are the same:
WCLINT = 1,1,1,
    2,2,2,
    3,3,3,                                          (30)
    4,4,4,
    5,5,5,
    6,6,6

*!* MSKPA1_OBS, MSKPA2_OBS,...MSKPA10_OBS: Observed soil water contents
* in layer 1, 2, ..., 10. Format: year, day number, water content
* Not obligatory to give data
```

(30) This corresponds to the numbers of soil layers (in case of 6, WCLINT should be up to 6, for example)

22) After completing all steps, save the file in "Calibration" folder (for example, Soil_PH_Price.sol).

.

3. Experimental file

1) Obtain crop data from field experiment
2) Create experimental file by encoding data in excel template file with (Crop_format_template.xlsx).

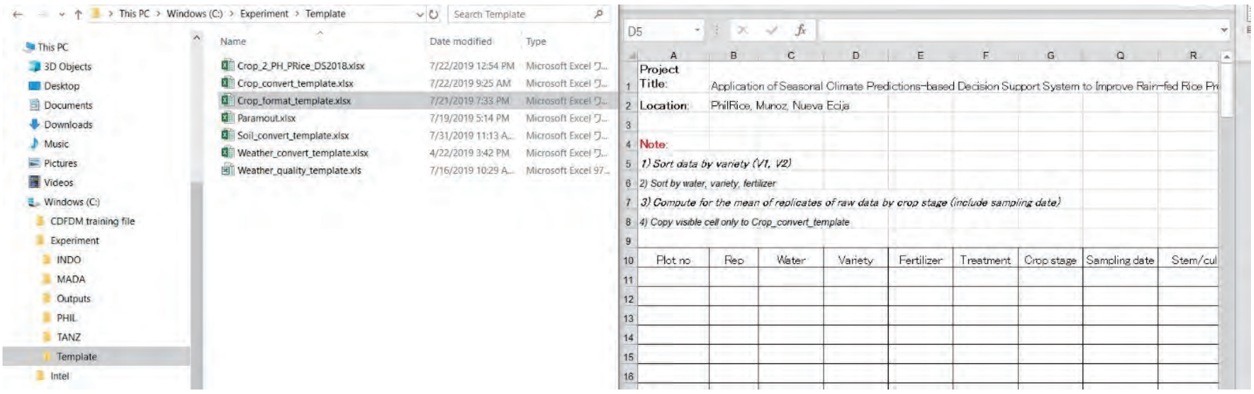


Fig 20. Crop_format_template

3) Data file should be named as Crop_1_country_station_seasonyear (ex, Crop_1_PH_Price_ DS2018) and save in Data folder. "1" means raw data.

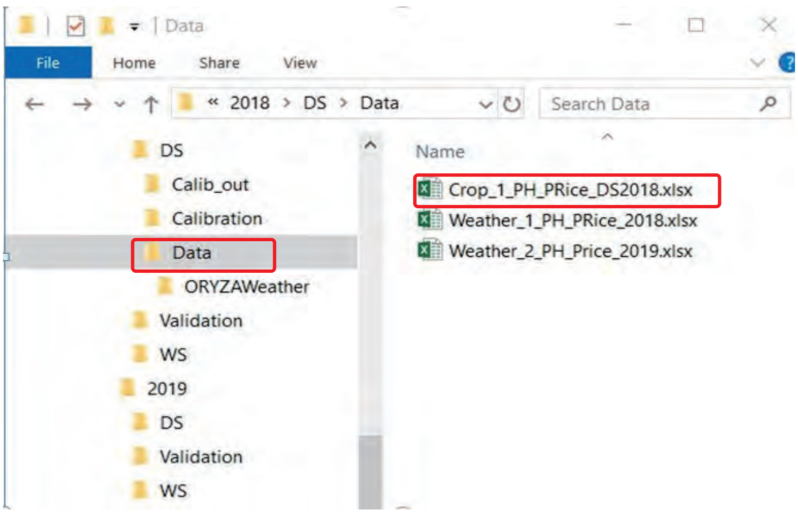


Fig 21. Crop_1_PH_Price_DS2018 saved in Data folder

4) After saving the file, open the "SeqBiomass_Ave" tab, highlight Colum G, H, I, J, K, L, M which corresponds to Crop stage, Sampling date, Stem/culm, Gleaves, Dleaves, Panicles, Leaf Area Index.
5) Press ctrl+G to open "Go to" window, click "Special" then choose "visible cells only" and click "ok". To copy the highlighted area in Crop_1_PH_Price_DS2018 to V1 or V2 in Crop_convert_template, press ctrl+C and paste (ctrl+V) in V1 or V2 of Crop_2_PH_Price_DS2018.

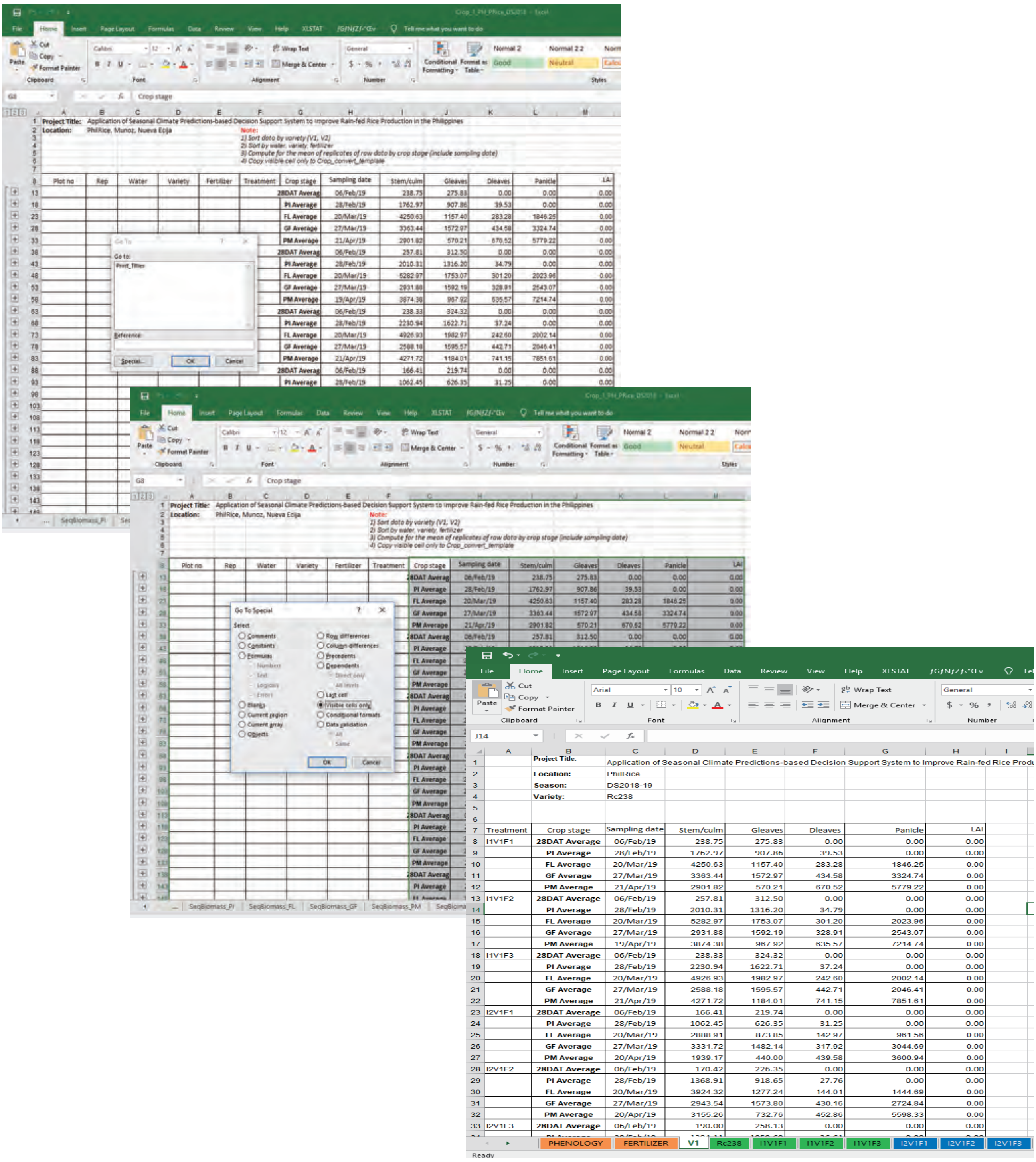


Fig 22. "SeqBiomass_Ave" tab in Crop_1_PH_Price_DS2018 and V1 tab.

6) Data in the Variety tab (Rc238, for example) will be automatically completed.

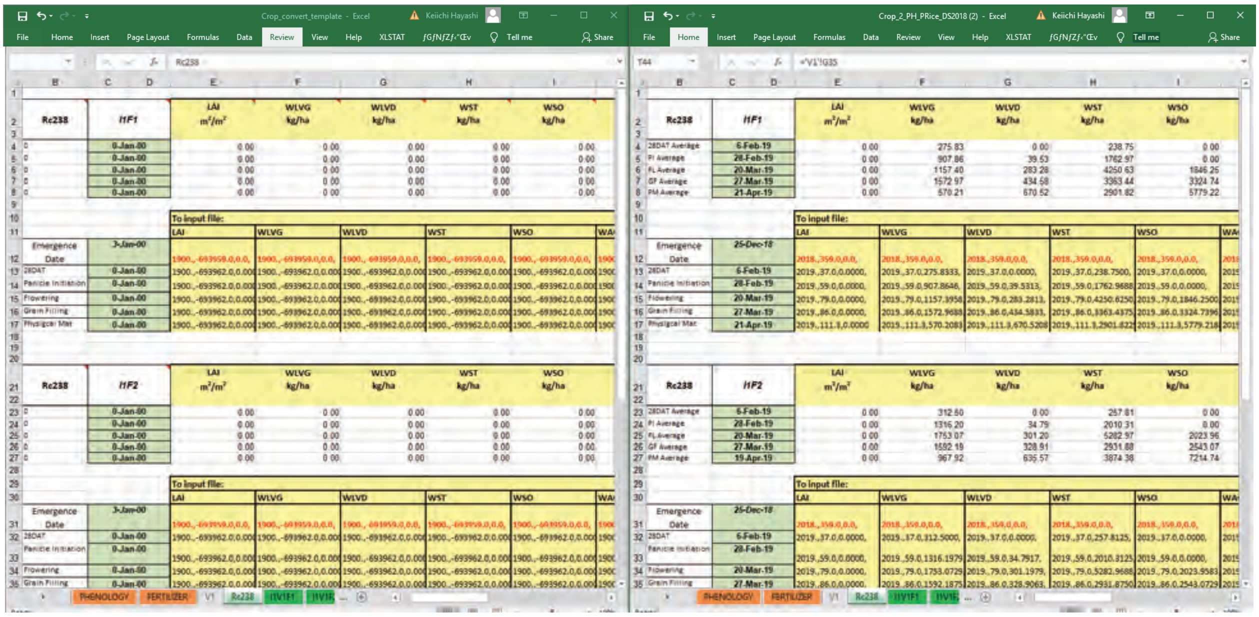


Fig 23. Completed variety tab (Rc238)

7) Go to the Tab "PHENOLOGY", and complete the phenology data and other information.

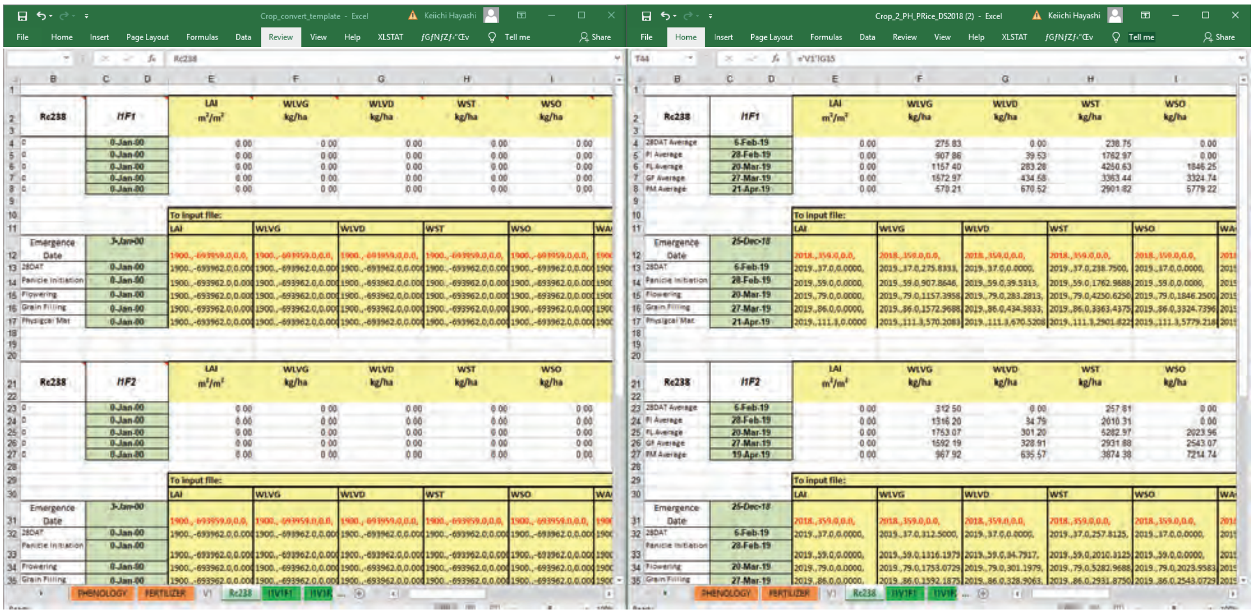


Fig 24. Completed variety tab (Rc238) (continued)

8) Go to the Tab “FERTILIZER” and complete the required information.

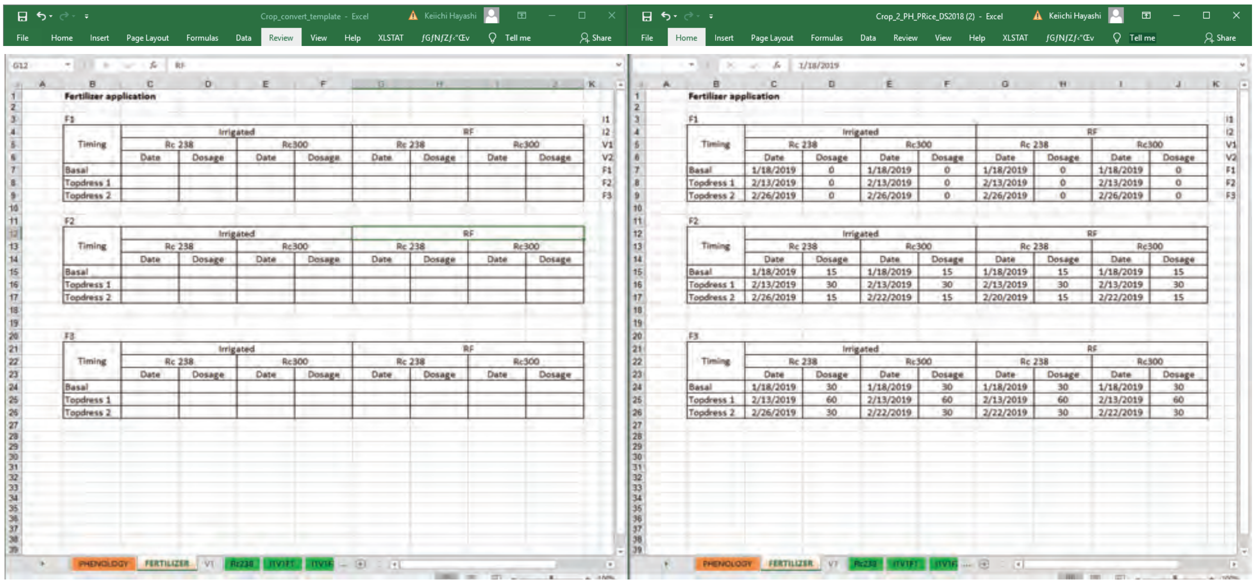


Fig 25. Completed Fertilizer tab

9) Go to Tab for treatment (I1V1F1, for example).
10) In the Crop management table, some cells (for Cultivar, Sowing data, Seedbed duration, Panicle initiation, Day of flowering, Day of maturity) will be automatically filled out but some other cells (Treatment, Production environment, Method of establishment) should be filled manually.
11) ORYZA input (Yellow highlighted table) will be automatically completed.
12) The fertilizer management table will be automatically completed.
13) Overwrite on Crp_2_PH_Price_DS2018 to save the file.

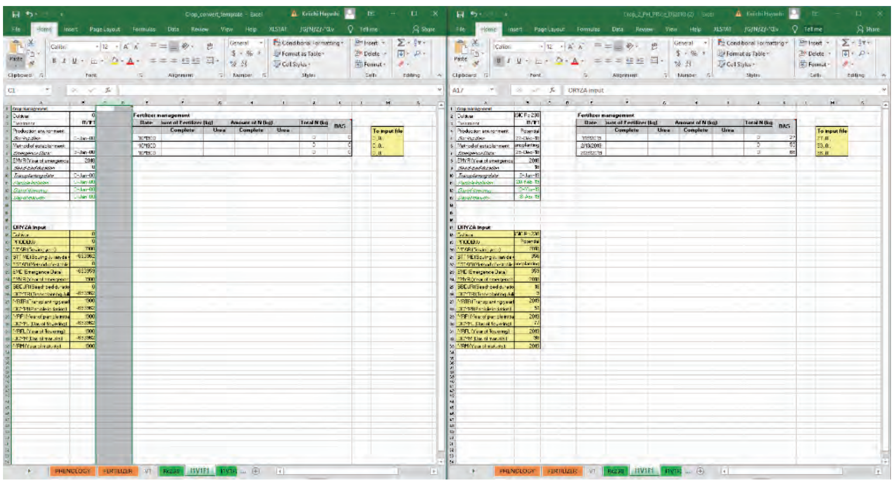


Fig 26. ORYZA format in Treatment tab of Crop_2_PH_Price_DS2018

14) Open the Experimental file in the Calibration folder and start editing for a selected variety and treatment.
15) Rename the file to this format (VarietynameTreatment.Season(first letter only)Year) for example Rc238I1F1.D18.

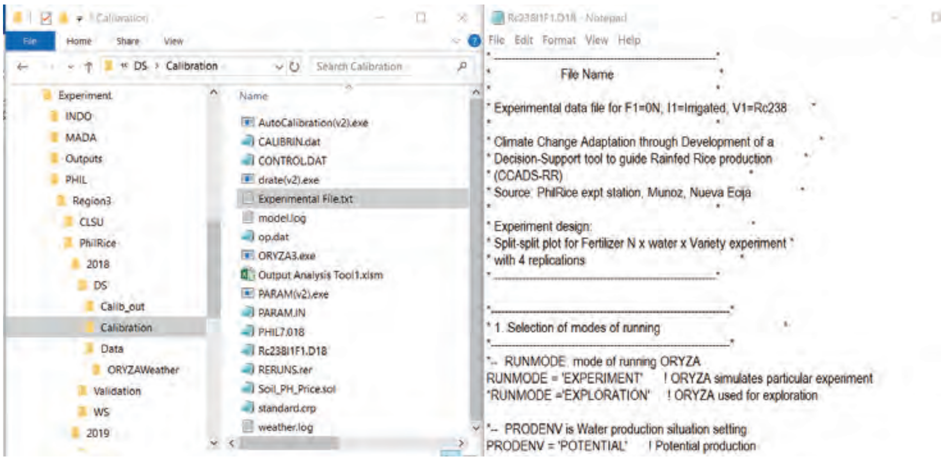


Fig 27. Experimental File

16) Modify the header part in the Experimental file which contains the description and location of the experiment.

Note: TAB shouldn't be used to edit Experimental File. Each line with an asterisk (*) is considered as a comment hence it will not be read by the program.

```
*--------------------------------------------------------------*
* 1. Selection of modes of running                              *
*--------------------------------------------------------------*
*-- RUNMODE: mode of running ORYZA
RUNMODE = 'EXPERIMENT'     ! ORYZA simulates particular experiment
*RUNMODE ='EXPLORATION'     ! ORYZA used for exploration

*-- PRODENV is Water production situation setting
PRODENV = 'POTENTIAL'      ! Potential production
*PRODENV = 'WATER BALANCE'   ! Production may be water-limited

*-- WATBAL is choice of water balance
*   needs only be given when PRODENV = 'WATER BALANCE'
WATBAL = 'PADDY'  ! PADDY water balance (for lowland soils)
*WATBAL = 'SAHEL'  ! SAHEL water balance (for freely draining upland soils)
*WATBAL = 'SAWAH'  ! SAWAH water balance (for lowland or upland soils)
*WATBAL = 'LOWBAL' ! LOWBAL water balance (for lowland soils)
*WATBAL = 'SOILPF' ! SOILPF water balance (Soil water tension read from file)

*-- NITROENV is Nitrogen production situation setting
*NITROENV = 'POTENTIAL'         ! Potential production
NITROENV = 'NITROGEN BALANCE' ! Production may be nitrogen-limited

*-- ETMOD is method for evapotranspiration calculation:
ETMOD = 'PENMAN'          ! Penman-based (Van Kraalingen& Stol,1996)
*ETMOD = 'PRIESTLY TAYLOR'  ! Priestly-Taylor (")
*ETMOD = 'MAKKINK'          ! Makkink (Van Kraalingen&Stol, 1996)

*--------------------------------------------------------------*
* 2. Timer data for simulation                                  *
*--------------------------------------------------------------*
IYEAR  = 2018          ! Start year of simulation (year)*sowing
STTIME = 356.          ! Start time  (day number)
FINTIM = 1000.         ! Finish time (days after start)
DELT   = 1.            ! Time step   (day)
```

(5) Choose 'EXPERIMENT'

(6) Choose 'POTENTIAL' for irrigated rice; 'WATER BALANCE' for rainfed rice.

(7) 'PADDY' for Southeast Asia; 'SAHEL' for Africa.

(8) Choose 'NITROGEN BALANCE'.

(9) Choose 'PENMAN' if you have complete weather data set.

(10) Put year (please DON'T put a period).

(11) Put sowing date in Julian date (Please PUT a period).

(12) Keep 1000 as default (Please PUT a period).

(13) Keep 1 as default (Please PUT a period).

```
*--------------------------------------------------------------------*
* 3. Weather station and climatic data for simulation               *
*--------------------------------------------------------------------*
WTRDIR = ' ' ! Directory of weather data
CNTR   = 'PHIL'          ! Country code
ISTN   = 7               ! Station code
*MULTIY  = 'YES'             !  Whether multiple year weather file is used,
                          ! default is 鮮O･ or if the variable do not appear.
ANGA = 0.29              ! Angstrom A parameter
ANGB = 0.45              ! Angstrom B parameter

*TMCTB =  0., 0.,          ! Table for temperature increase
*      366., 0.           ! Climatic Change studies

TMINCTB = 0.,0.   ! Table for temperature increase for minimum temperature
       366.,0.   ! It has been used with TMAXCTB

TMAXCTB = 0., 0., ! Table of temperature increase for maximum temperature
       366., 0.  ! use TMINCTB & TMAXCTB, must disable TMCTB

*CO2A = 0.,375.,  ! Table for daily CO2 concentration AFTER EMERGENCY
*       1.,400.,  ! if this table appear, its value will overwrite the value
*       5.,400.,  ! of CO2 in crop file.
*       6.,720.,  ! Please pay attention on the CO2 concentration in crop
*      50.,720.,  ! and experiment files to make them compatible except for
*      51.,375.,  ! CO2 testing period during crop growth
*     150.,375.   ! Note: column one is the DAYS AFTER EMERGENCY

FAOF   = 1.       ! Multiplying factor for potential evapotranspiration (FAO)
                 ! Value Murty & Tuong

TMPSB = 0.         ! Temperature increase in seed-bed due to cover:
                 ! Zero when no cover over seed-bed; 9.5 with seed-bed
```

(14) Put the path of the folder for weather data (for example, PHIL7.018, C:\Experiment\PHIL\Region3\PhilRice\2018\DS\Calibration)

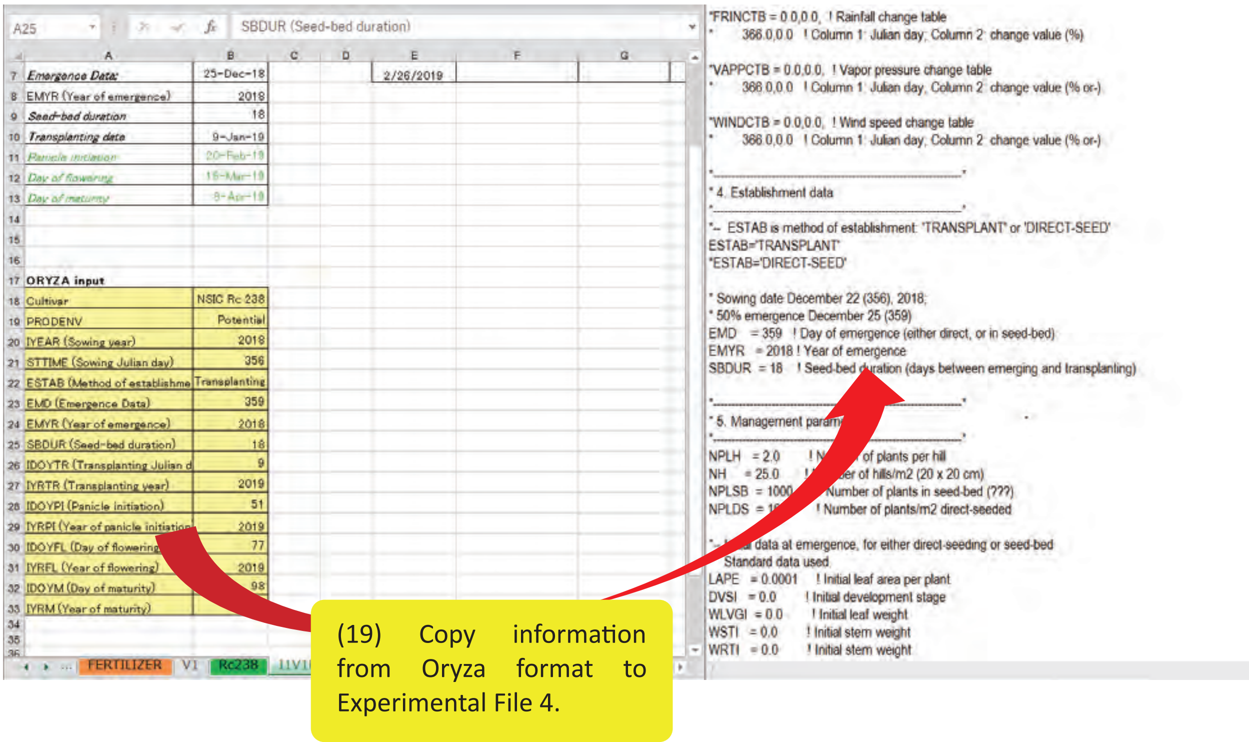
(15), (16) Put the code for the country and station (for example, PHIL for the Philippines, 7 for Nueva Ecija).

(17) Keep it as default.

(18)

```
*TMCTB = 0.0, 0.0,    ! Daily average temperature increment table (oC)
*       366.0, 0.0    ! Column 1: Julian day, Column 2: change value

*TMAXCTB = 0.0, 0.0, ! Daily maximum temperature change,
*        366.0, 0.0  ! either TMCTB or TMAXCTB
                     ! Column 1: Julian; Column 2: Increment value (oC)

*TMINCTB = 0.0,0.0,  ! Daily minimum temperature change, use with TMAXCTB
*        366.0, 0.0  ! Column 1: Julian day; Column 2: Increment (oC)

*RADCTB = 0.0, 0.0,  ! Total daily radiation change
*       190.0, 0.0,  ! Column 1: Julian day; Column 2: change percentage (%)
*       191.0, -5.0,
*       366.0, -5.0

*XFRDIF = 0.0        ! How you count diffusive radiation change?
*                    ! 0: no change
*                    ! 1: change in percentage based theoretical fraction
*                    ! 2: Change with given diffusive radiation fraction

*FRDIFCTB = 0.0,0.0, ! Diffusive radiation change table if XFRDIF > 0
*        366.0,0.0   ! Column 1: Julian day; Column 2: change value (% or-)

*CCYEAR = 2008       ! The start year for climate change computation

*FRINCTB = 0.0,0.0,  ! Rainfall change table
*        366.0,0.0   ! Column 1: Julian day; Column 2: change value (%)

*VAPPCTB = 0.0,0.0,  ! Vapor pressure change table
*        366.0,0.0   ! Column 1: Julian day; Column 2: change value (% or-)

*WINDCTB = 0.0,0.0,  ! Wind speed change table
*        366.0,0.0   ! Column 1: Julian day; Column 2: change value (% or-)
```

(18) Keep it as default.




```
*-----------------------------------------------------------------*
* 4. Establishment data
*-----------------------------------------------------------------*
*-- ESTAB is method of establishment: 'TRANSPLANT' or 'DIRECT-SEED'
ESTAB='TRANSPLANT'
*ESTAB='DIRECT-SEED'

* Sowing date December 22 (356), 2018;
* 50% emergence December 25 (359)
EMD    = 359   ! Day of emergence (either direct, or in seed-bed)
EMYR   = 2018 ! Year of emergence
SBDUR  = 18    ! Seed-bed duration (days between emerging and transplanting)
```

(20) Change this according to the crop establishment for the experiment.

(21) Edit these informations according to actual information.

(22) Put actual information from the experiment.

(23) Day of emergency is obtained from sowing date + 3 days.

Fig 28. Preparation of Establishment data

(24)

```
*-----------------------------------------------------------------*
* 5. Management parameters                              *
*-----------------------------------------------------------------*
NPLH   = 2.0        ! Number of plants per hill
NH     = 25.0       ! Number of hills/m2 (20 x 20 cm)
NPLSB  = 1000.      ! Number of plants in seed-bed (???)
NPLDS  = 165.       ! Number of plants/m2 direct-seeded

*-- Initial data at emergence, for either direct-seeding or seed-bed
*   Standard data used.
LAPE   = 0.0001     ! Initial leaf area per plant
DVSI   = 0.0        ! Initial development stage
WLVGI  = 0.0        ! Initial leaf weight
WSTI   = 0.0        ! Initial stem weight
WRTI   = 0.0        ! Initial stem weight
WSOI   = 0.0        ! Initial weight storage organs
ZRTI   = 0.0001     ! Initial root depth (m)

*-- Re-initialization at transplanting (standard data used)
ZRTTR  = 0.05       ! Root depth at transplanting (m)
```

(24) Keep it as default.

```
*-----------------------------------------------------------------*
* 6. Irrigation parameters
* Need only to be filled-in when PRODENV = 'WATER BALANCE'
*-----------------------------------------------------------------*
* NEW, SEPT 2006:
DVSIMAX = 2.0 ! Development stage after which no more irrigation is applied

* NEW SETTING, 21 MAY 2010
* The determination for switch critical
ICOMBA = 1 ! 1: Use Julian day;
           ! 2: Use DVS;
           ! 3: Use mixture of DVS and Julian day,
           !    but the Julian day is not allowed to be smaller than 2;
           ! 4: use DAE;

* Combining irrigation management methods table IRMTAB, it must have at least
* two lines, X (Julian day or DVS or DVS+Julian, present the switching day),
*          Y (methods in real number)
IRMTAB = 9.,2.0,
       107.,2.0
       108.,0.0
       116.,0.0
```

(25)

```
IRMTAB = 9., 2.0,
       107.,2.0,
       116.,2.0
```

(25) Replace IRMTAB if running potential production or IRRIGATED. 2nd column should 2.0, put 0.0 if Rainfed or no irrigation

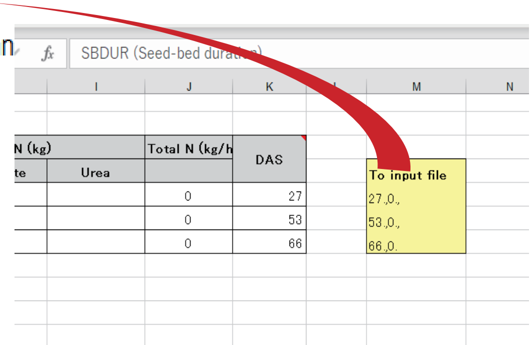
```
AUTODEPT = -10.0  ! The surface water depth (mm) for determining irrigation
                  ! amount automatically
                  ! Function is disabled when it did not appear or with
                  ! negative number
```

(26) Choose a suitable SWITIR.

(26)

```
** FSelect from the following options are available for setting IRMTAB:
SWITIR = 0 ! No irrigation; rainfed
*SWITIR = 1 ! Irrigation supplied as input data
*SWITIR = 2 ! Irrigation at minimum standing soil water depth
*SWITIR = 3 ! Irrigation at minimum soil water potential
*SWITIR = 4 ! Irrigation at minimum soil water content
*SWITIR = 5 ! Irrigation at x days after disappearance of standing water
*SWITIR = 6 ! Irrigation at minimum soil water potential in defined periods
           ! only
```

```
*------------------------------------------------------------------*
* 7. Nitrogen parameters                                           *
*------------------------------------------------------------------*
*TWO SOIL C AND N DYNAMICS
NUTRIENT = 'GENERAL SOM'  ! USE GENERAL SOIL ORGANIC C AND N MODULE T(
                         ! THE NUTRIENT CHANGES
*NUTRIENT = 'FIXED SUPPLY' ! Use fixed mineralization rate with fertilizer
                          ! recovery rate

* Table of recovery fraction of Nitrogen in the soil (-) second column
* versus development stage (DVS) (first column) STANDARD VALUE
RECNIT =
0.0, 0.30,
0.2, 0.35,
0.4, 0.50,
0.8, 0.75,
1.0, 0.75,
2.5, 0.75

* NO DATA ON SOILSP: THIS 0.8 IS FOR IRRI CONDITIONS IN THE DS......
SOILSP = 0.8  ! Soil N mineralization rate (kg N/ha/d)
*SOILSP = 0.1  ! Soil N mineralization rate (kg N/ha/d)

* Table of fertilizer rate (kg N/ha) (second column
* in the seed-bed (!) (first column)
FERTIL =
0., 0.,
27.,0.,
53.,0.,
66.,0.

*Fresh organic residue input at land surface if it is applicable
*SORGANC = 1000.0   ! Surface residue carbon input at kg C/ha
*SORGANN = 20.0     ! Surface residue nitrogen input at kg N/ha
```



(27) Keep it as default.

(28) Keep it as default if an actual data is not available.

(29) Go to Crop_2_PH_Price_DS2018 and copy highlighted area. This is expressed in DAS, not Julian date.

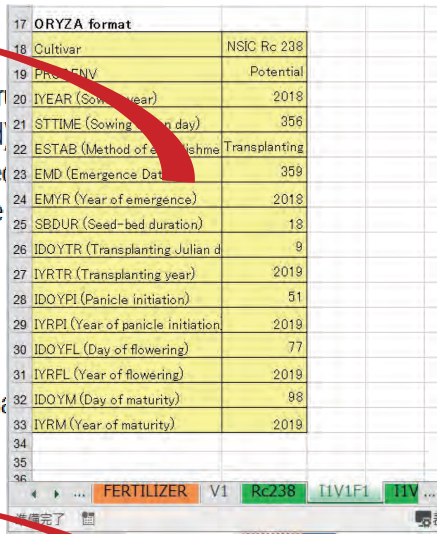
(30) Put actual data if it is available to improve the accuracy.

```
*--------------------------------------------------------------------------*
* 8. Measured data for model calibration and comparison                    *
*    And option to force measured LAI during simulation                    *
*    (instead of using simulated values)                                   *
*--------------------------------------------------------------------------*
* Observed phenology: only required if program DRATES is r
IDOYTR = 9      ! Day of transplanting (give 0 if direct-seeded)
IYRTR  = 2019   ! Year of transplanting (give 0 if direct-seede
IDOYPI = 51     ! Day of panicle initiation (estimated as same
                ! jointing)
IYRPI  = 2019   ! Year of panicle initiation
IDOYFL = 77     ! Day of flowering
IYRFL  = 2019   ! Year of flowering
IDOYM  = 98     ! Day of maturity (estimated as 7 d before ha
IYRM   = 2019   ! Year of maturity

*! Leaf Area Index (m2 leaf / m2 ground):
*LAI_OBS =
*2018.,359.0,0.0,
*2019.,37.0,0.0000,
*2019.,59.0,0.0000,
*2019.,94.0,0.0000,
*2019.,105.0,0.0000,
*2019.,112.0,0.0000

*-- Parameter to set forcing of observed LAI during simulation
LAI_FRC = 0      ! No forcing
*LAI_FRC = 2     ! Forcing

* Green leaf dry wt (kg/ha)
WLVG_OBS =
2018.,359.0,0.0,
2019.,37.0,275.8333,
2019.,59.0,907.8646,
2019.,79.0,1157.3958
2019.,86.0,1572.9688
2019.,111.3,570.2083
```

(31)

(32)

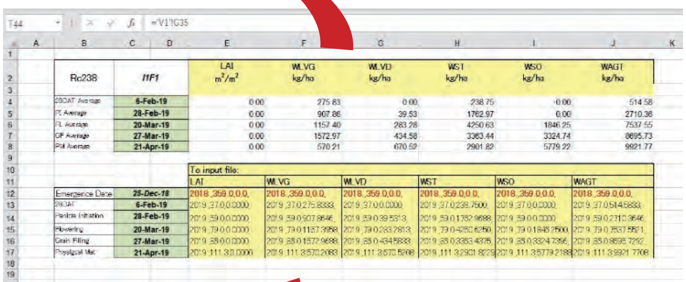
(33)



17	ORYZA format	
18	Cultivar	NSIC Rc 238
19	PRODENV	Potential
20	IYEAR (Sowing year)	2018
21	STTIME (Sowing Julian day)	356
22	ESTAB (Method of establishment)	Transplanting
23	EMD (Emergence Date)	359
24	EMYR (Year of emergence)	2018
25	SBDUR (Seed-bed duration)	18
26	IDOYTR (Transplanting Julian d	9
27	IYRTR (Transplanting year)	2019
28	IDOYPI (Panicle initiation)	51
29	IYRPI (Year of panicle initiation	2019
30	IDOYFL (Day of flowering)	77
31	IYRFL (Year of flowering)	2019
32	IDOYM (Day of maturity)	98
33	IYRM (Year of maturity)	2019
34		
35		

FERTILIZER V1 Rc238 I1V1F1 I1V ...

準備完了



T44 =V1'!G35

Rc238	I1F1	LAI m²/m²	WLVG kg/ha	WLVD kg/ha	WST kg/ha	WSO kg/ha	WAGT kg/ha
28DAT Average	6-Feb-19	0.00	275.83	0.00	238.75	0.00	514.58
PI Average	28-Feb-19	0.00	907.86	39.53	1762.97	0.00	2710.36
FL Average	20-Mar-19	0.00	1157.40	283.28	4250.63	1846.25	7537.55
GF Average	27-Mar-19	0.00	1572.97	434.58	3363.44	3324.74	8695.73
PM Average	21-Apr-19	0.00	570.21	670.52	2901.82	5779.22	9921.77

To input file:

		LAI	WLVG	WLVD	WST	WSO	WAGT
Emergence Date	25-Dec-18	2018.,359.0,0.0,	2018.,359.0,0.0,	2018.,359.0,0.0,	2018.,359.0,0.0,	2018.,359.0,0.0,	2018.,359.0,0.0,
28DAT	6-Feb-19	2019.,37.0,0.0000,	2019.,37.0,275.8333,	2019.,37.0,0.0000,	2019.,37.0,238.7500,	2019.,37.0,0.0000,	2019.,37.0,514.5833,
Panicle Initiation	28-Feb-19	2019.,59.0,0.0000,	2019.,59.0,907.8646,	2019.,59.0,39.5313,	2019.,59.0,1762.9688,	2019.,59.0,0.0000,	2019.,59.0,2710.3646,
Flowering	20-Mar-19	2019.,79.0,0.0000,	2019.,79.0,1157.3958,	2019.,79.0,283.2813,	2019.,79.0,4250.6250,	2019.,79.0,1846.2500,	2019.,79.0,7537.5521,
Grain Filling	27-Mar-19	2019.,86.0,0.0000,	2019.,86.0,1572.9688,	2019.,86.0,434.5833,	2019.,86.0,3363.4375,	2019.,86.0,3324.7396,	2019.,86.0,8695.7292,
Physiological Mat	21-Apr-19	2019.,111.3,0.0000	2019.,111.3,570.2083	2019.,111.3,670.5208	2019.,111.3,2901.8229	2019.,111.3,5779.2188	2019.,111.3,9921.7708

(31) Go to Crop_2_PH_Price_DS2018 and copy variables in Oryza format.

(32) Go to variety tab (Rc238) in Crop_2_PH_Price_DS2018 and copy&paste LAI.

(33) Copy data from Crop_2_PH_Price_DS2018

* Dead leaf dry wt (kg/ha)
WLVD_OBS =
2018.,359.0,0.0,
2019.,37.0,0.0000,
2019.,59.0,39.5313,
2019.,79.0,283.2813,
2019.,86.0,434.5833,
2019.,111.3,670.5208

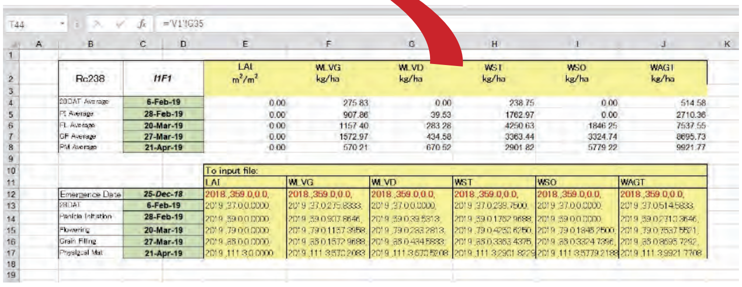
* Stem dry wt (kg/ha)
WST_OBS =
2018.,359.0,0.0,
2019.,37.0,238.7500,
2019.,59.0,1762.9688,
2019.,79.0,4250.6250,
2019.,86.0,3363.4375,
2019.,111.3,2901.8229

* Panicle dry wt (kg/ha)
WSO_OBS =
2018.,359.0,0.0,
2019.,37.0,0.0000,
2019.,59.0,0.0000,
2019.,79.0,1846.2500,
2019.,86.0,3324.7396,
2019.,111.3,5779.2188

* Total dry wt (kg/ha)
WAGT_OBS =
2018.,359.0,0.0,
2019.,37.0,514.5833,
2019.,59.0,2710.3646,
2019.,79.0,7537.5521,
2019.,86.0,8695.7292,
2019.,111.3,9921.7708

(34)

(34) Copy data from Crop_2_PH_Price_DS2018



Rc238	I1F1	LAI m²/m²	WLVG kg/ha	WLVD kg/ha	WST kg/ha	WSO kg/ha	WAGT kg/ha
28DAT Average	6-Feb-19	0.00	275.83	0.00	238.75	0.00	514.58
PI Average	28-Feb-19	0.00	907.86	39.53	1762.97	0.00	2710.36
FL Average	20-Mar-19	0.00	1157.40	283.28	4250.63	1846.25	7537.55
GF Average	27-Mar-19	0.00	1572.97	434.58	3363.44	3324.74	8695.73
PM Average	21-Apr-19	0.00	570.21	670.52	2901.82	5779.22	9921.77

		To input file:					
		LAI	WLVG	WLVD	WST	WSO	WAGT
Emergence Date	25-Dec-18	2018.,359.0,0.0,	2018.,359.0,0.0,	2018.,359.0,0.0,	2018.,359.0,0.0,	2018.,359.0,0.0,	2018.,359.0,0.0,
28DAT	6-Feb-19	2019.,37.0,0.0000,	2019.,37.0,275.8333,	2019.,37.0,0.0000,	2019.,37.0,238.7500,	2019.,37.0,0.0000,	2019.,37.0,514.5833,
Panicle Initiation	28-Feb-19	2019.,59.0,0.0000,	2019.,59.0,907.8646,	2019.,59.0,39.5313,	2019.,59.0,1762.9688,	2019.,59.0,0.0000,	2019.,59.0,2710.3646,
Flowering	20-Mar-19	2019.,79.0,0.0000,	2019.,79.0,1157.3958,	2019.,79.0,283.2813,	2019.,79.0,4250.6250,	2019.,79.0,1846.2500,	2019.,79.0,7537.5521,
Grain Filling	27-Mar-19	2019.,86.0,0.0000,	2019.,86.0,1572.9688,	2019.,86.0,434.5833,	2019.,86.0,3363.4375,	2019.,86.0,3324.7396,	2019.,86.0,8695.7292,
Physiological Mat	21-Apr-19	2019.,111.3,0.0000	2019.,111.3,570.2083	2019.,111.3,670.5208	2019.,111.3,2901.8229	2019.,111.3,5779.2188	2019.,111.3,9921.7708

(35)

```
*! Leaf N (g N/g leaf):
*FNLV_OBS =

*! Leaf N (g N/m2 leaf):
*NFLV_OBS =

*-- Parameter to set forcing of observed NFLV values during simulation
*NFLV_FRC = 0      ! No forcing
*NFLV_FRC = 2      ! Forcing
```

(35) Keep it as default.

(36)

```
*! Root biomass observation in a layers
*ROOTM1_OBS =
*2008.00,   209.00,   0.00,
*2008.00,   263.00,   663.2

*! Root biomass observed in a year
*TOORM3_OBS =
*2008.00,   209.00,   0.00,
*2008.00,   263.00,   663.2
```

(36) Put actual data if it is available to improve the accuracy. If not, keep it as default.

(37)

```
*-----------------------------------------------------------------------
* Additional input for night temperature control experiment, if you have     * temperature control
*-----------------------------------------------------------------------
*ISTEMC = 0   ! WHETHER USE TEMPERATURE CONTROL 0 = NO,
*             ! 1= NIGHT CONTROL, 2=DAY CONTROL, 3=Both Control

*SHOUR  = 19.   ! Start time for temperature control
*EHOUR  = 5.    ! Ending time for temperature control
*The SHOUR and EHOUR define the night time period, it should be SHOUR>EHOUR

*SDAY   = 202.  ! Julian day temperature control starting
*TSYEAR = 1989.
*EDAY   = 303.  ! Julian day temperature control ending
*TEYEAR = 1989.
*TTEMPD = 28.   ! Target, -999 means net change is used
*TTEMPN = 21.   ! Target temperature for nighttime,
*               ! -999 means net change is used
*TCHANG = -999. ! Net change of temperature,
*               ! -999 means target temperature is used
*CONTRM = 2     ! 1 = control the temperature exceed the defined range,
*               ! 2 = constant temperature
```

(37) Keep it as default.

17) File should be saved in “Calibration folder”.

4. ORYZA parameterization and calibration

The purpose of parameterization is to generate ‘starting values’ for calibration of a certain variety. The final output of parameterization and calibration is the new crop file (calibrated variety).

1. The experimental file from 1st on-station field experiment is used for this section.
2. Check all the files in the Calibration folder. The following should be found in the folder: Experimental file, soil file, weather file, ORYZA3.exe, CONTROL.DAT, RERUNS.rer, standard.crp, drate(v2).exe, AutoCalibration(v2).exe, PARAM(v2).exe, PARAM.IN, Output Analysis Tool1.xlsm, CALIBRIN.dat

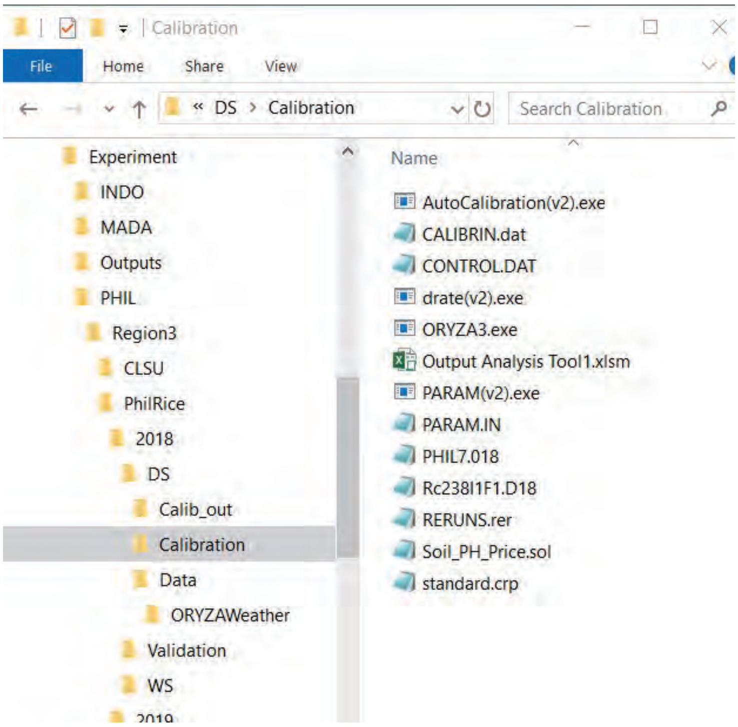


Fig 29. Files in the Calibration folder

3. Open CONTROL.DAT
4. Edit FILEIT, this command corresponds to the experimental data file, in this example Rc238I1F1.D18 is the experimental file.
5. FILEIT should be the RERUNS.rer, FILEI2 should be soil file (PH_Price_Maligaya.sol).
6. Save as it is in the Calibration folder.

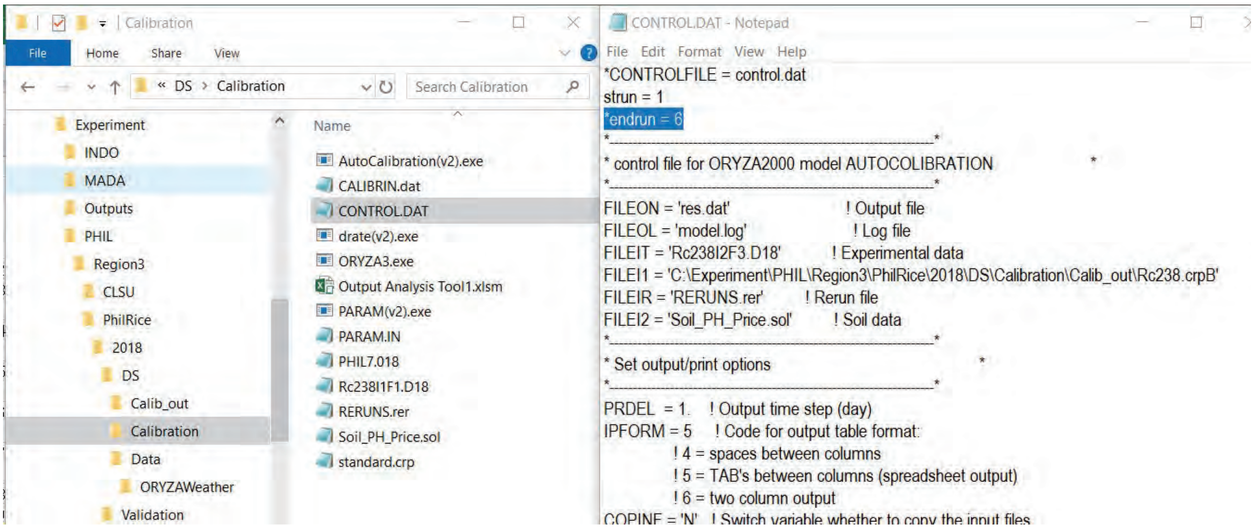


Fig 30. CONTROL.DAT in Calibration folder

7. Open RERUNS.rer and enter all the experimental files as shown in the figure below.

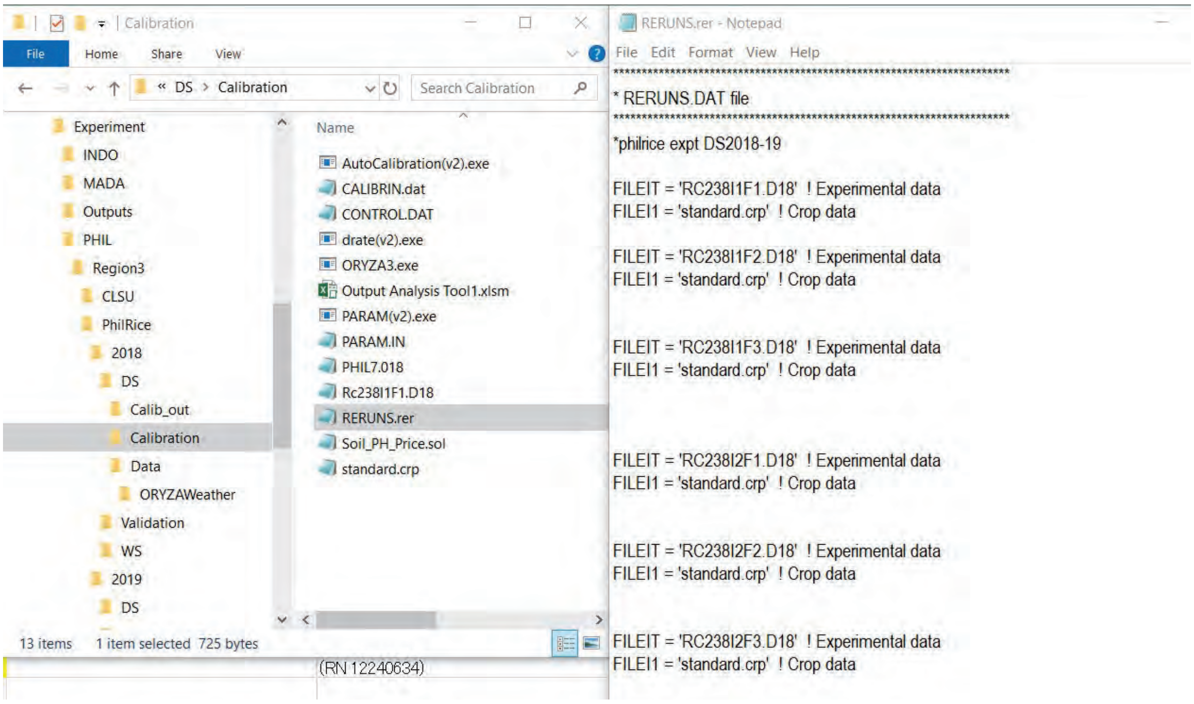


Fig 31. RERUNS.rer in Calibration folder

*RERUNS.RER provides the parameters which are specific for the different treatment and variety being simulated.

8. Save the file in the Calibration folder.
9. Run ORYZA.exe to check if all files are ready for calibration (pre-calibration).
10. If no error occurred, proceed for parameterization by following these steps.
11. Open PARAM.IN and edit as follows;
    FILEOOP, FILEOR, FILEOL, FILEIR are default
    FILEIT=’standard .crop’
    FILET1=’put treatment file name’ (for example, RC238I1F1.D18)
    PRDEL, IPFORM, COPINF, DELTMP, IFLAG use default (no need to change the value)
12. Save the file as it is (PARAM.IN)

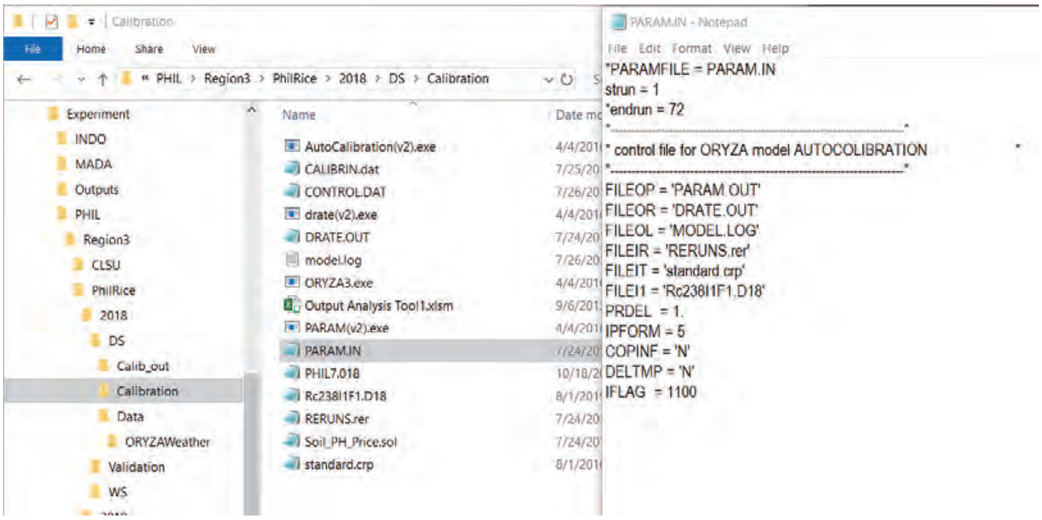


Fig 32. PARAM.IN in Calibration folder

13. Run drate(v2).exe to produce DRATE.OUT (*drate(v2).exe determines the phenology development rate of a given variety).
14. Open DRATE.OUT and RERUNS.rer.
15. Copy DVRJ, DVRI, DVRP, DVRR for each RerunSet to RERUNS.rer (as shown below).
    There are 6 RerunSet in these examples.

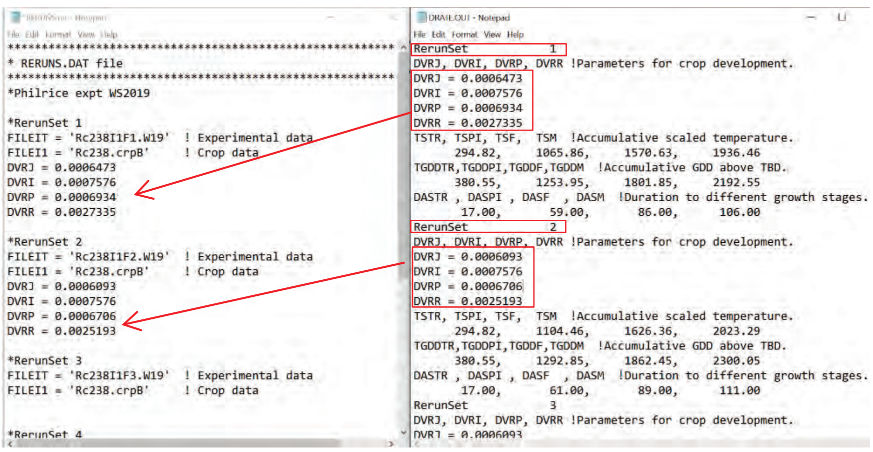


Fig 33. Examples of Rerun file

16. After copying all 6 RerunSet, save the file as RERUNS2.rer.
17. Open PARAM.IN, and edit FILEIR = 'RERUNS2.rer'.
18. Save the file (*PARAM.IN is the control file of parameterization).
19. Run PARAM(v2).exe (*PARAM(v2).exe estimates crop parameters for specific variety based on the observed data from the experiment.)
20. Look for PARAM.OUT and open the file.
21. Open PARAM.OUT.xlsx template. Arrange window as shown below.
22. Look for 'calculated partitioning factors' in PARAM.OUT file.
23. Copy calculated partitioning factors to Original Partitioning Factors table in ParamOUT tab.
24. 'Modified Partitioning Factors' table will be automatically be filled. Follow the instructions in the excel file template in calculating the partitioning factors.

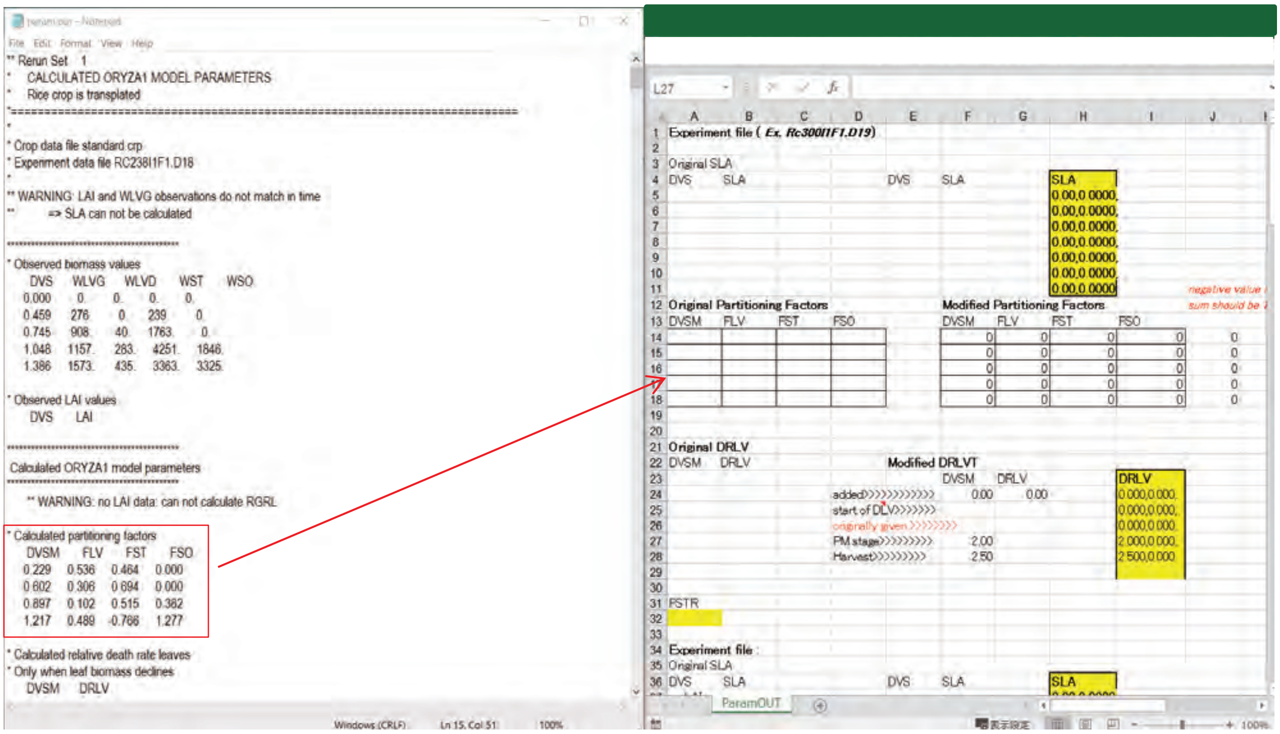


Fig 34. Copy calculated partitioning factors to Original Partitioning Factors table in ParamOUT tab

25. Calculated relative death rate leaves (DVSM, DRLV) and calculated fraction stem reserves should be copied to Original DRLV table in the excel template (If no value is shown in param.out, leave DVSM and DRLV blank.
26. Check Modified DRLV table.
27. The first row (row 23 in the figure below) in Modified DRLV table should be 0 for DVSM and DRLV.
28. 2nd row (row 24 in the figure below), copy DVS in **observed biomass values** in PARAM.OUT, look for column WLVD (dead leaves) if the value is not 0, get the corresponding value in DVS column (it means plants have started to have dead leaves). Copy DVS value to Modified DRLV in Paramout.xlsx. DRLV should be 0.

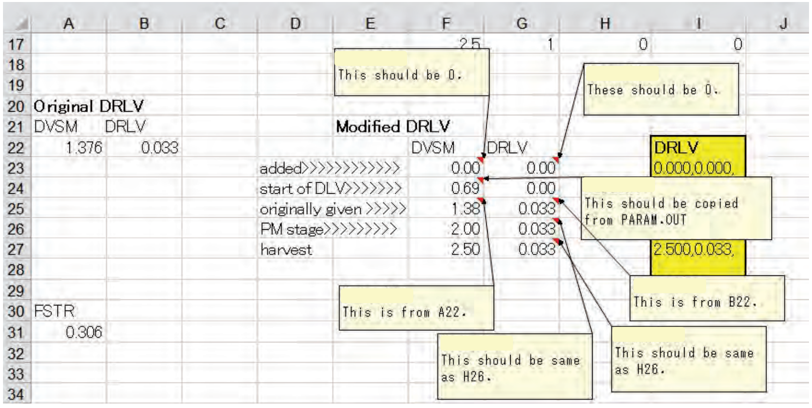
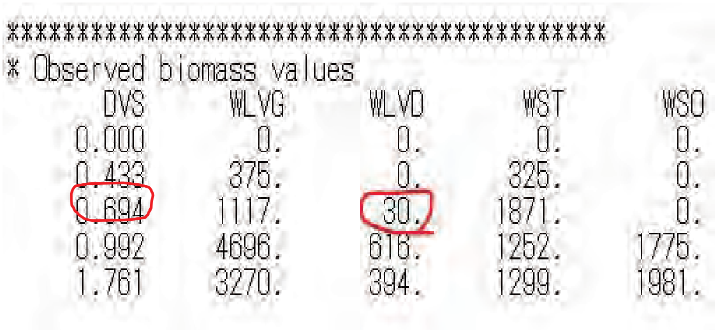


Fig 35. Explanation for the excel file template



****
* Observed biomass values

DVS	WLVG	WLVD	WST	WSO
0.000	0.	0.	0.	0.
0.433	375.	0.	325.	0.
0.694	1117.	30.	1871.	0.
0.992	4696.	616.	1252.	1775.
1.761	3270.	394.	1299.	1981.

Fig 36. Observed biomass values in PARAM.OUT

29. Continue editing the Paramout.xlsx . Copy FSTR from PARAM.OUT to the excel template.
30. Continue the same steps from 21) to 29) for other treatments.

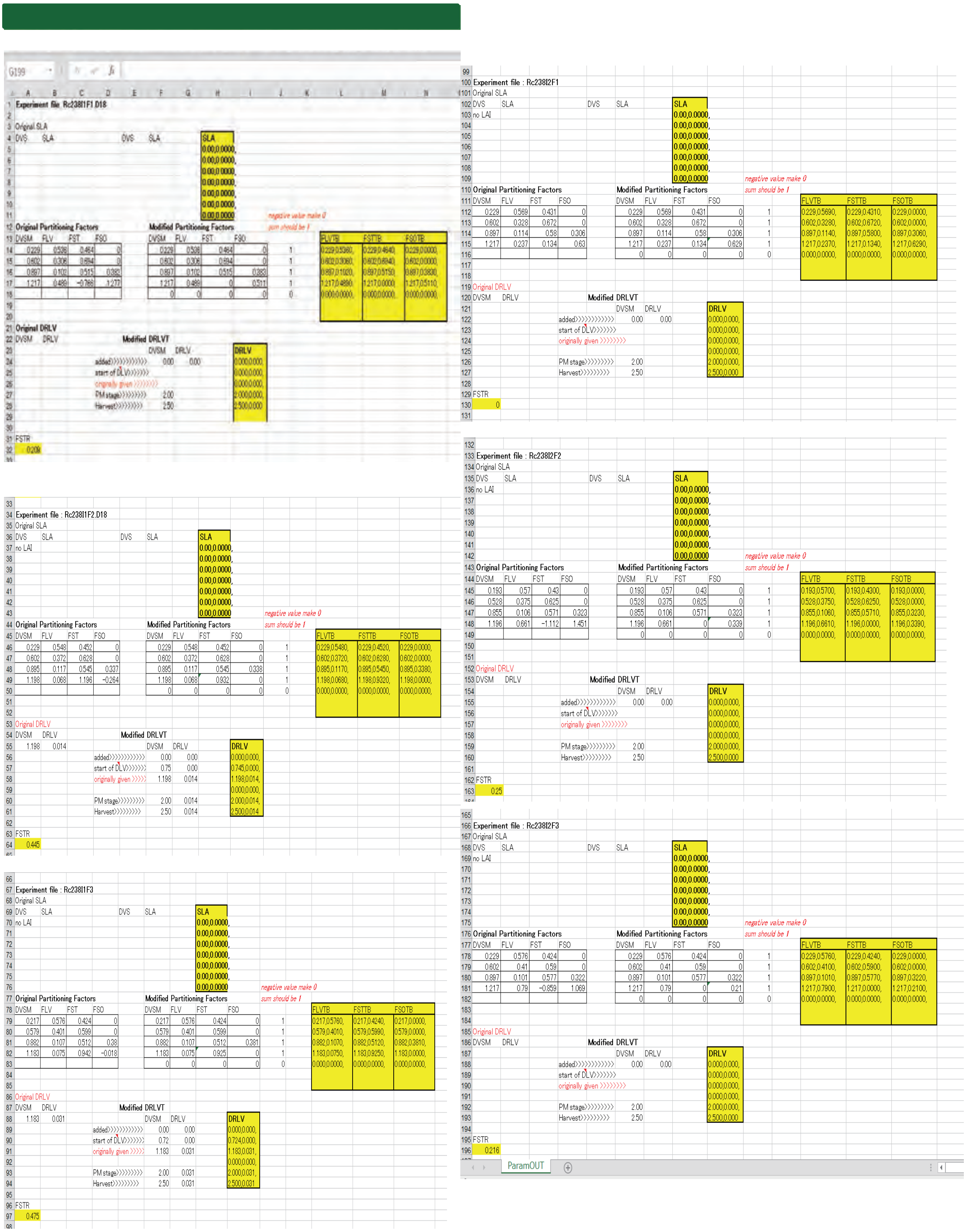


Fig 37. Copy calculated partitioning factors to Original Partitioning Factors table in ParamOUT tab for other treatments

31. Save the file as Paramout_variety.xlsx (for example, Paramout_Rc238.xlsx) in the Calibration folder after filling out all the tables.

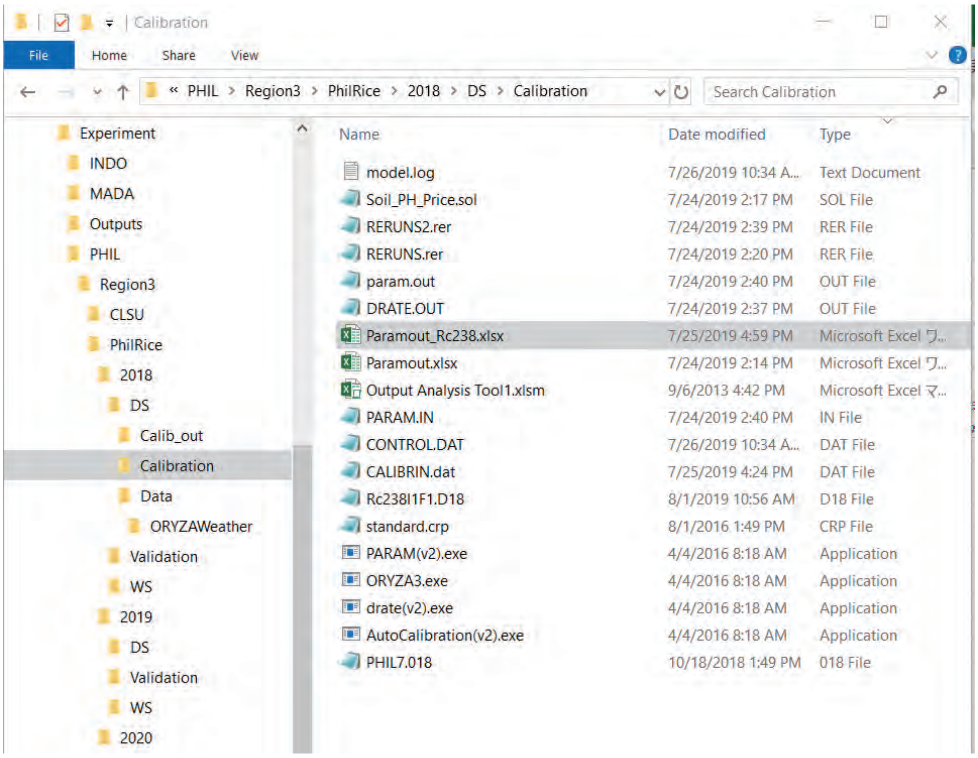


Fig 38. Saved file of Paramout for designated variety (Rc238) in calibration folder

32. Open RERUNS2.rer, open standard.crp, then go to “6. Growth parameters”. Find FSTR, FLVTB, FSTTB, FSOTB, DRLVT from standard.crp and insert them in designated space in RERUNS2.rer as follows.

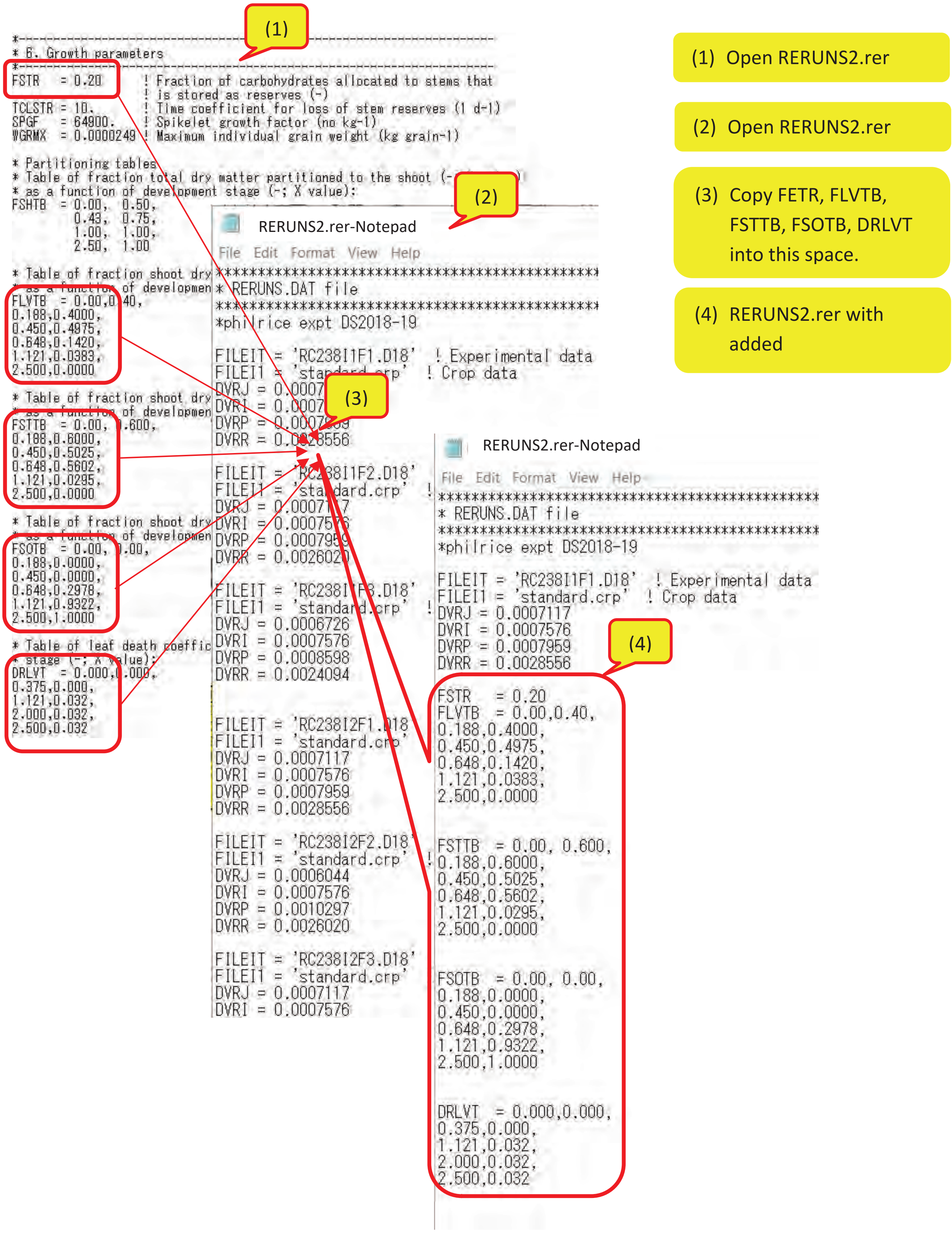


Fig 39. Editing RERUNS2.rer through standard.crop

33. After copying all variables, open Paramout_Rc238.xlsx and copy the value of FSTR to RERUNS2.rer.
34. Continue the same steps for other treatments to complete RERUNS2.rer.

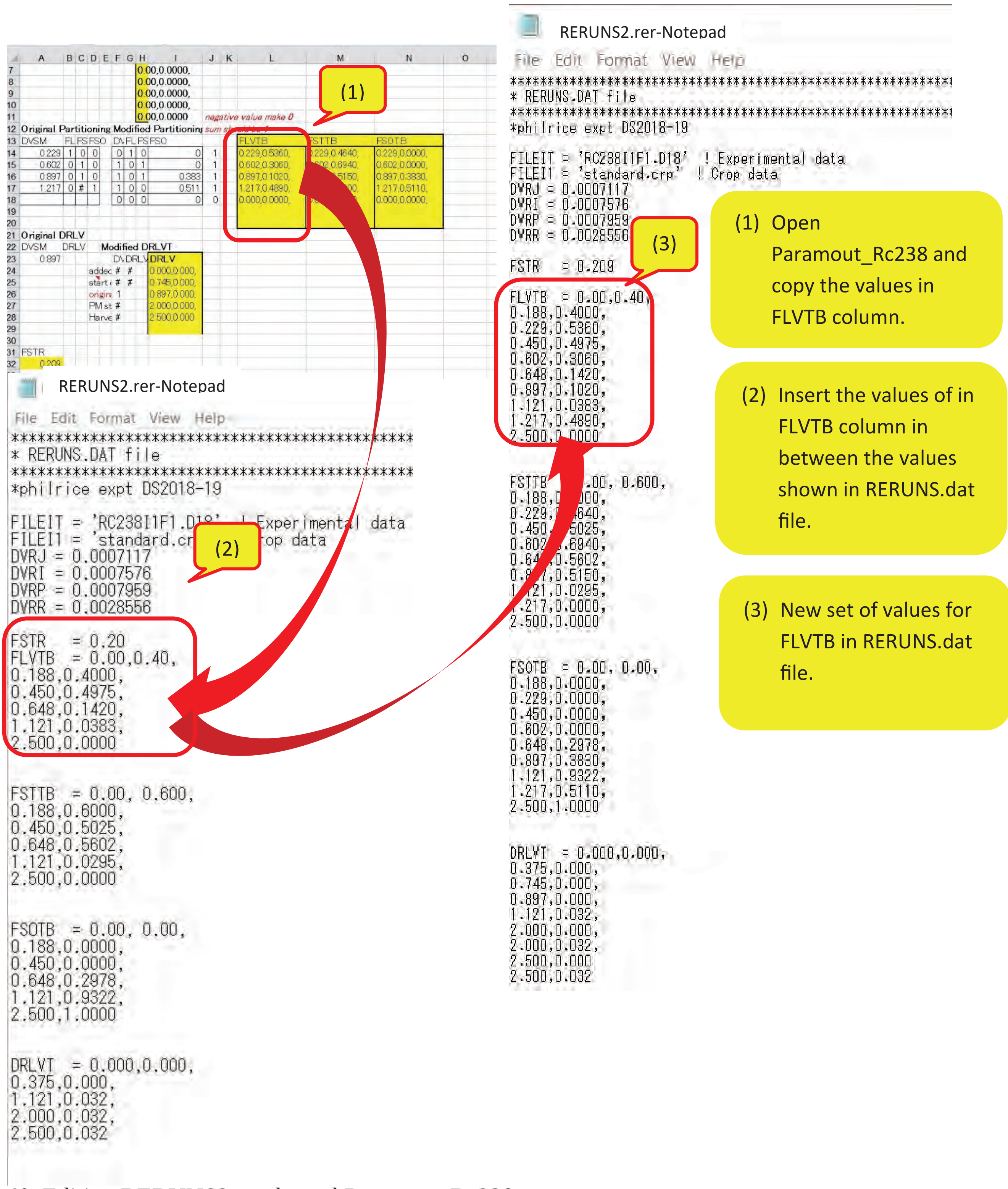


Fig 40. Editing RERUNS2.rer throughParamout_Rc238.

35. After inputting all growth parameters, save the file as RERUNScalib.rer in the Calibration folder.

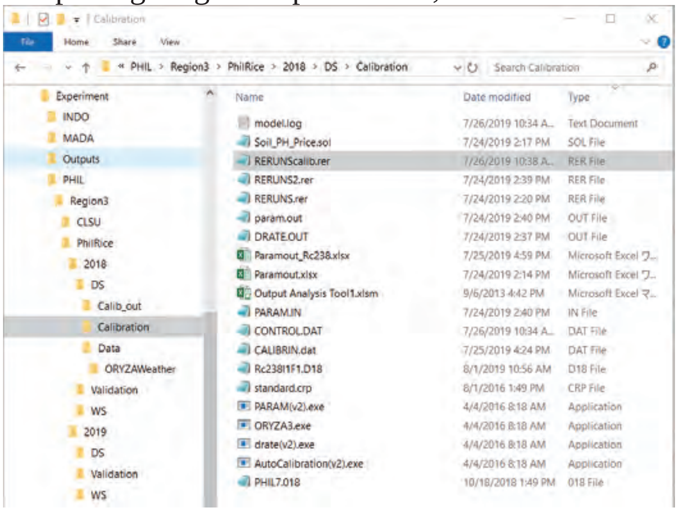


Fig 41. Saved RERUNScalib.rer in the Calibration folder

36. Create new folder named as Calib_out.

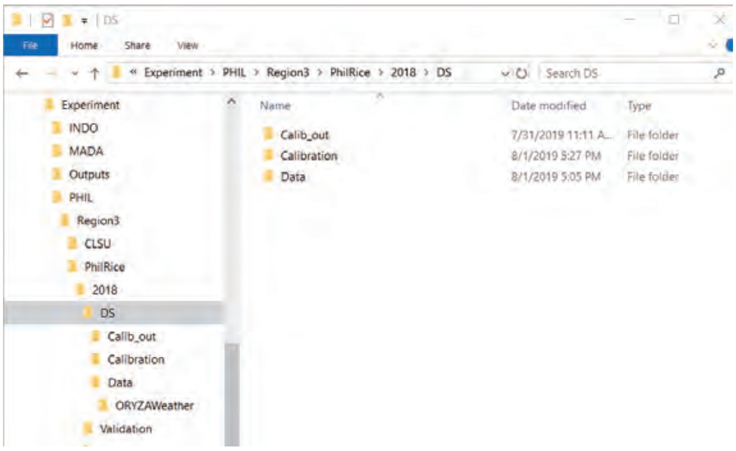


Fig 42. Calib_out folder

37. Open CALIBRIN.dat (*CALIBRIN.dat serves as the control file for the calibration).
38. Edit the information of 1. Input files and 2. Calibration parameter controls

- ✓ FILEON='directory\Calib_out\'
- ✓ FILEOL=' directory \Calib_out\'
- ✓ FILEIR=' directory \rerunscalib.rer'
- ✓ FILEIT=' directory \Rc238I1F1.D18'
- ✓ FILEI1=' directory \standard.crp'
- ✓ FILEI2=' directory\Soil_PH_Price.sol'

* write the path name for each files and the output folder for the **Calib_out**
**do not use spaces in creating a folder name, use underscore instead if needed.
Like for example, Calib_out not Calib out for space will cause an error.

39. Edit the information in 2. Calibration Parameter Controls (change the path of OUTFOLDER into Calib_out, Rc238.crp for OUTCROP, no need to change for OUTSOIL, ORYZA3.exe for ORYZA)
    - ✓ RERUNS=7000, INRERUNS=6, USEREFER='YES'
    - ✓ Put asterisk to USEREFER (*USEREFER)
    - ✓ OUTFOLDER='directly\Calib_out\'
    - ✓ OUTCROP='Experimental file (for example, 'Rc238.crp')
    - ✓ OUTSOIL is 'c_soil.sol' (default)
    - ✓ ORYZA='directly\ORYZA3.exe'

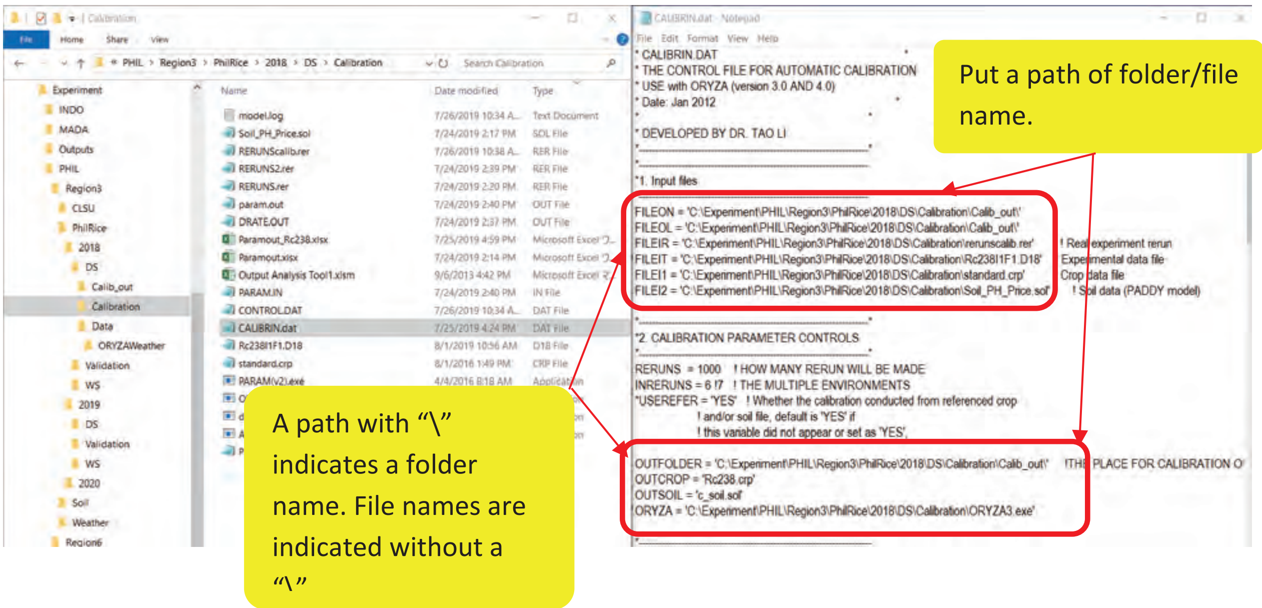


Fig 43. Editing the information in 2. Calibration Parameter Controls

40. No need to change any content from 3 to 8.
41. Save as it is (CALIBRIN.dat).
42. Rename the file CONTROL.DAT (for example, xCONTROL.DAT).

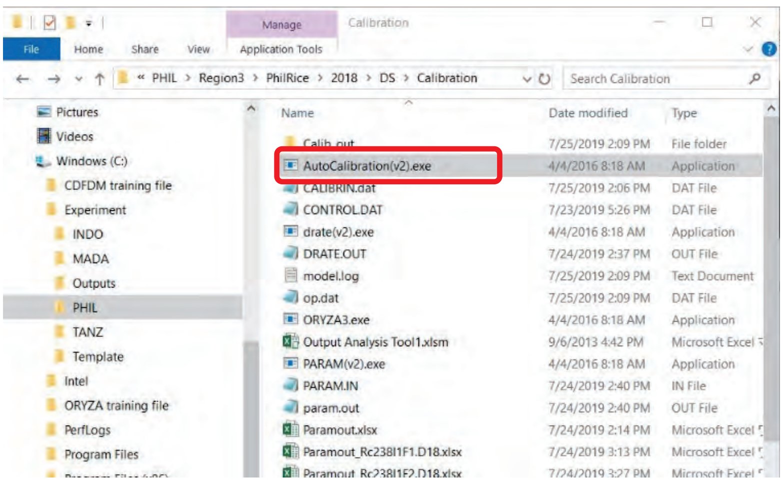


Fig 44. AutoCalibration(V2).exe to proceed for calibration

43. Click AutoCalibration(v2).exe.
44. New window will pop up. Choose CALIBRIN.dat and click open.

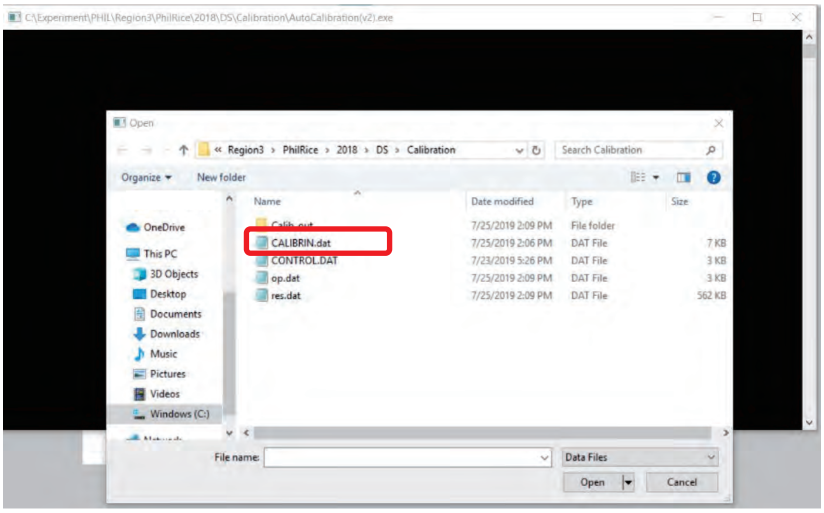


Fig 45. AutoCalibration(V2).exe to proceed for auto-calibration (continued)

45. Open Calib_out folder and look for CLIBRATION_OUT.DAT. Check if the file shows some values other than 0 or if there's an error message.
46. Calibration is successful if the calibrated variety is produced (for example, Rc238.crpB, B means "calibrated") as shown below.

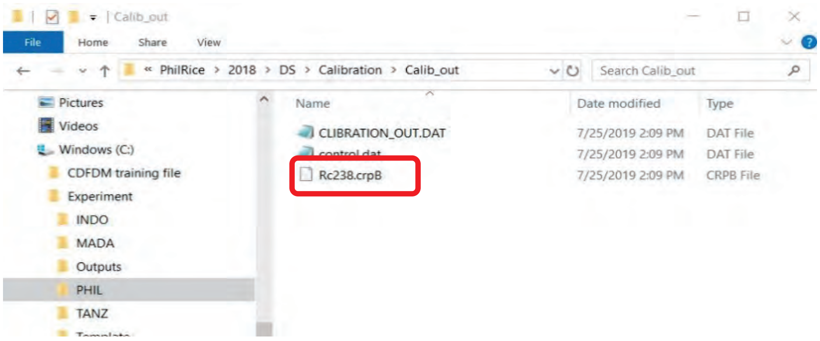


Fig 46. AutoCalibration(V2).exe to proceed for auto-calibration (continued)

47. In our example, **RC238.crpB** is the new crop file (composed of the **variety name** and with an extension of **crpB).** CROP1.CRP will be produced if calibration is not successful.
48. To evaluate the calibrated variety, rename xCOTROL.DAT to CONTROL.DAT in Calibration folder. Replace standard.crp with Rc238.crpB (calibrated variety). For example, FILEI1 = Experiment\PHL\Region 3\2019\DS\Calibration\Calib_out\Rc238.crpB
49. Save the CONTROL.DAT file.

5. Evaluation of calibrated variety

1) Run ORYZA.exe.
2) After running ORYZA.exe, look for op.dat and res.dat files in the Calibration folder.
3) op.dat and res.dat are the results of the calibration using calibrated variety (for example, Rc238.crpB).
4) To analyze the calibrated variety. Open Output Analysis Tool1.xlsm.
5) Click the Main tab, enable Macro function.
6) Change the path for op.dat and res.dat (for example, Experiment\PHL\Region 3\2019\DS\Calibration).
7) Click "Analysis" and wait for the results.
8) Click the Table tab to check the statistical analysis.
9) Check the RSMEn for all runs. The acceptable value is less than 30% and if the value is higher, check each run and identify the treatment which might cause the poor RMSEn result.

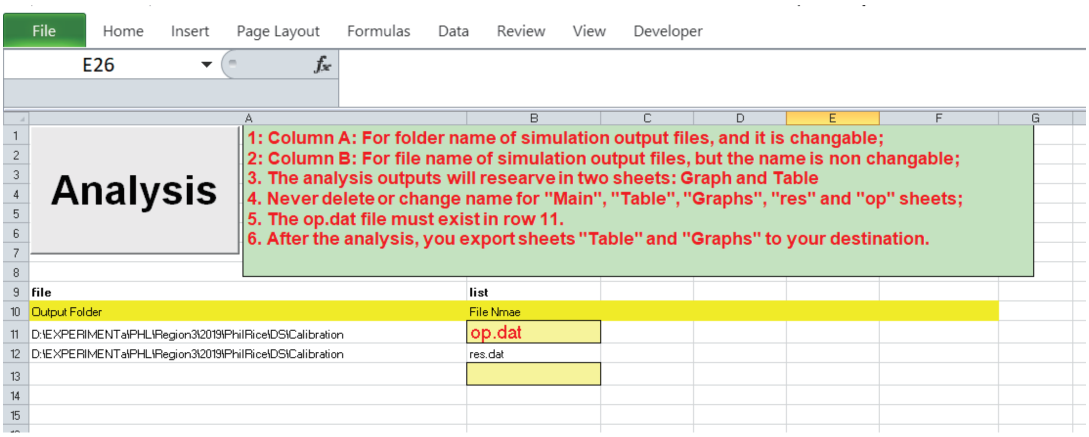
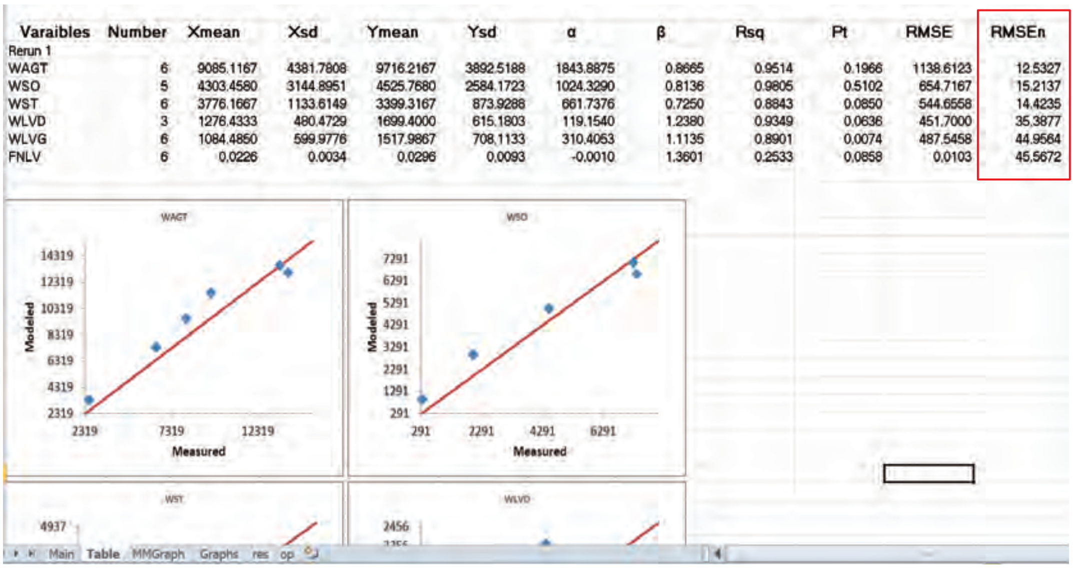


Fig 47. Open Output Analysis Tool1.xlsm to analyze the calibrated variety



Varaibles	Number	Xmean	Xsd	Ymean	Ysd	α	β	Rsq	Pt	RMSE	RMSEn
Rerun 1											
WAGT	6	9085.1167	4381.7808	9716.2167	3892.5188	1843.8875	0.8665	0.9514	0.1966	1138.6123	12.5327
WSO	5	4303.4580	3144.8951	4525.7680	2584.1723	1024.3290	0.8136	0.9805	0.5102	654.7167	15.2137
WST	6	3776.1667	1133.6149	3399.3167	873.9288	661.7376	0.7250	0.8843	0.0850	544.6558	14.4235
WLVD	3	1276.4333	480.4729	1699.4000	615.1803	119.1540	1.2380	0.9349	0.0636	451.7000	35.3877
WLVG	6	1084.4850	599.9776	1517.9867	708.1133	310.4063	1.1135	0.8901	0.0074	487.5458	44.9564
FNLV	6	0.0226	0.0034	0.0296	0.0093	-0.0010	1.3601	0.2533	0.0858	0.0103	45.5672

Fig 48. Results of analysis shown through table and graphs

6. Validation of calibrated variety

1) Go back to the first step for the Experimental file and prepare the Experimental file based on the new data sets from the new field experiment (results from the 2nd on-station field experiment).
2) Save the new experimental file in the Validation folder.
3) Go back to the first step for Weather file and prepare the Weather file for a new experiment.
4) Save the file in the Validation folder (working folder).
5) Check all the needed files in your working folder. The following files should be placed under the Validation folder: Experimental file, soil file, weather file, ①PARAM.IN, ②drate(v2).exe, ③ DRATE.OUT, ④ RERUNS.rer, ⑤ CONTROL.DAT, ⑥ ORYZA3.exe, ⑦ Output Analysis Tool1.xlsm).
6) Open ①PARAM.IN.
7) Edit FILEIT and FILEI1
   FILEIT = 'Rc238.crpB'
   FILEI1 = 'Rc346I1F1.W18' (newly created Experimental file, data from WS field experiment.)
8) Save the file as it is.
9) Run ②drate(v2).exe.
10) Open ③DRATE.OUT and copy DVRJ、DVRI, DVRT, DVRP, DVRR for each treatment (RerunSet 1, 2 ,3, 4, 5, 6 for example) and paste in ④RERUNS.rer. Save the file as RERUNS2.rer.
11) Open ⑤CONTROL.DAT.
12) Edit FILEIT, FILEI1, and FILEIR.
    FILEIT = 'Rc238.crpB'
    FILEI1 = 'Rc346I1F1.W18' (newly created Experimental file, data from WS field experiment.)
    FILEIR = 'RERUNS2.rer'
13) Save CONTROL.DAT file.
14) Run ⑥ORYZA3.exe
15) After running ORYZA3.exe, look for op.dat and res.dat files in the Validation folder
16) op.dat and res.dat are the results of simulation using the newly calibrated variety.
17) Open ⑦Output Analysis Tool1.xlsm.
18) Click the Main tab, enable Editing and Macro function
19) Change the path for op.dat and res.dat (for example, Experiment\PHL\Region 3\2019\DS\Validation).
20) Click "Analysis" and wait for the results.
21) Click the Table tab to view the statistical analysis and check the RMSEn results of all reruns.

7. WeRise installation

1) Install XAMPP (go to https://www.apachefriends.org/index.html) to download the application.
2) Look for C:\xampp\php\php.ini after installation and replace the following values:

Keyword	Old value	New value
Memory_limit	128M	528M
Post_max_size	8M	20M
Upload_max_filesize	2M	20M

3) Save the file as it is.
4) Copy folder (werise-dss) to C:\ xampp\htdocs
5) Import the database (see below).
6) Open command line.
7) Type cd C:\xampp\mysql\bin as shown below.

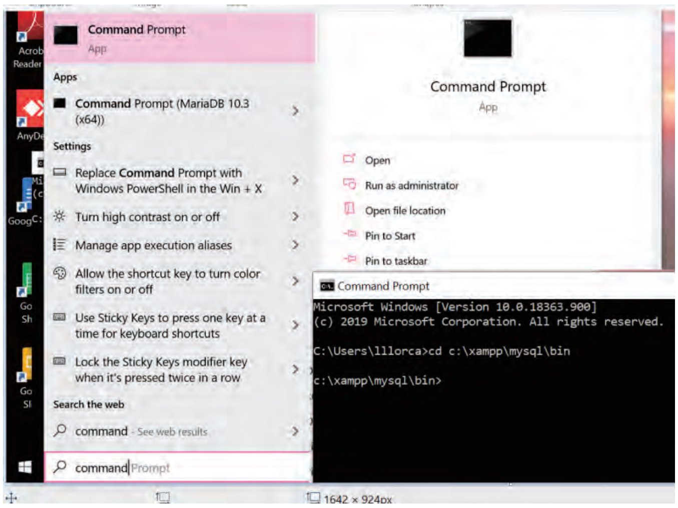


Fig 49. Open command prompt

8) Type mysql –uroot –p
9) Press enter.
10) Type source **{usb-folder}**/werise_dss.sql (for example , D:\Database\werise_dss.sql)
11) Type source **{usb-folder}**/werise_dss_data.sql
12) Open a browser and type http://localhost/werise-dss/docs

8. Uploading database in WeRise

WeRise system is managed through the administration section of the website. Here, the administrator has the responsibility to generate and curate the data that are displayed in the public website.

A. Local/Historical weather database

1. Copy the local weather data prepared from \Experiment\PHL\Reg3\Data to \werise-dss\weather-data\weather_ver3\realtime\PHL\Reg3
2. Open WeRise and go to Admin<Option
3. Select Weather Data. Choose the location to be updated.
4. Click Show files to display the available data

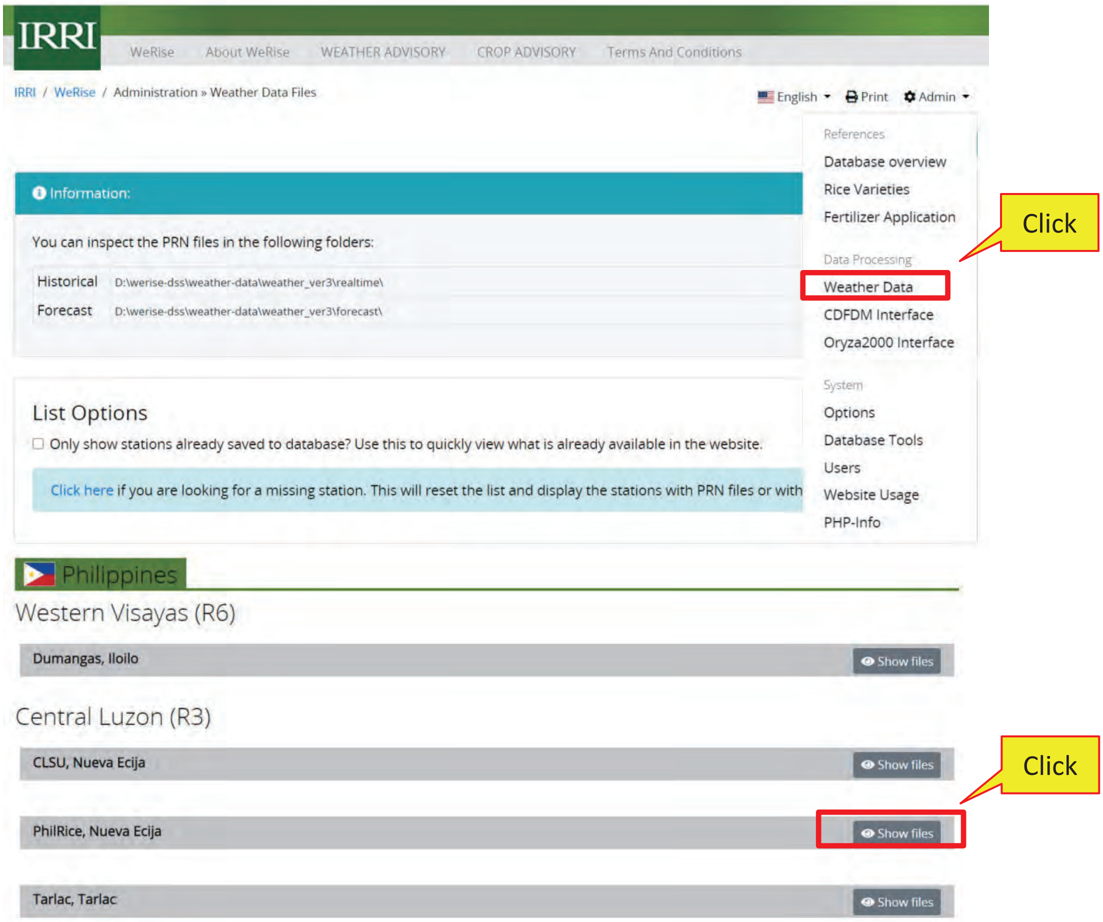


Fig 50. How to upload local weather data in WeRise

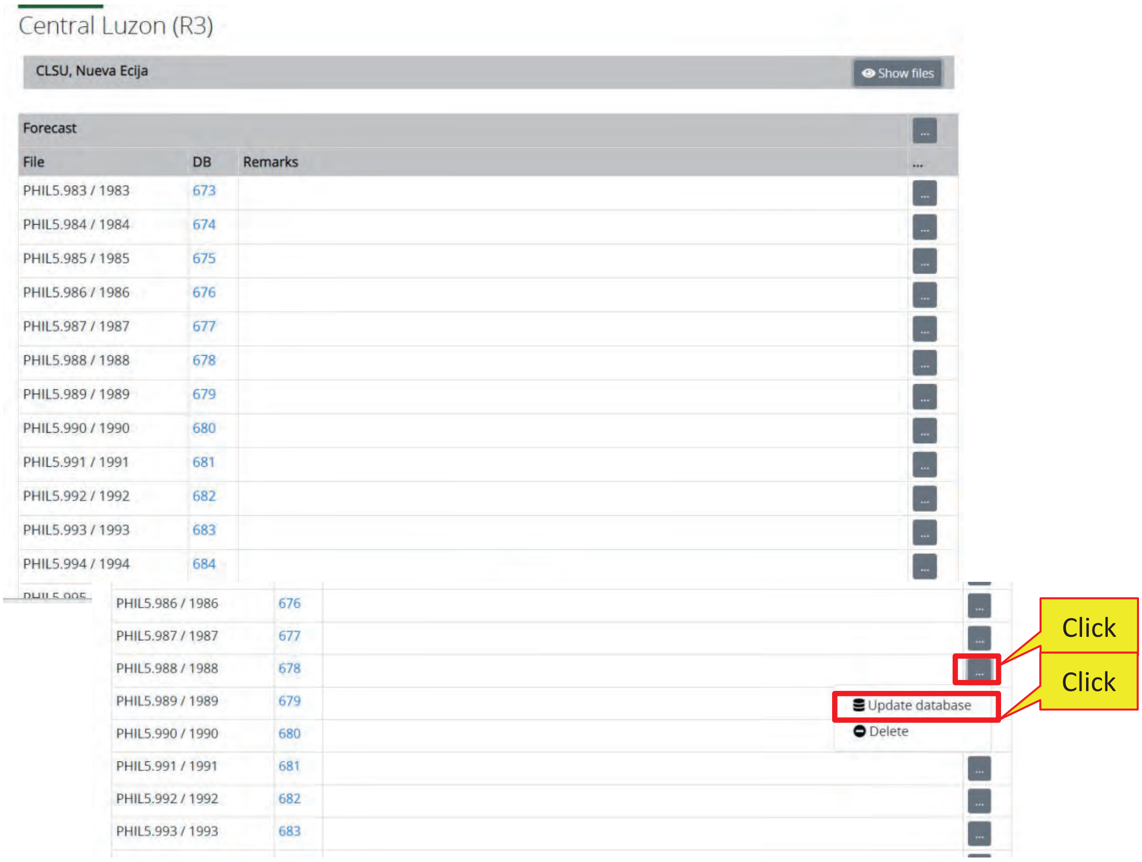


Fig 51. How to upload local weather data in WeRise (continuation)

5. Click the black box and select Update database.
6. New dialog box will show if the data was saved successfully. Click Back to list.

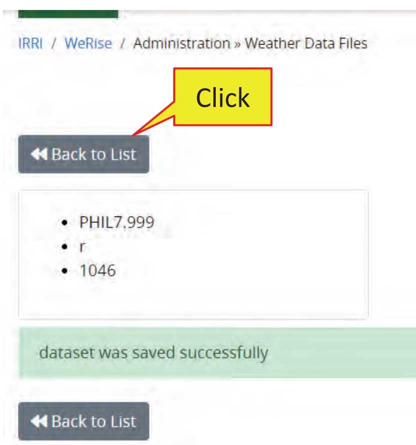


Fig 52. Dialog box after successful upload.

B. Forecast weather database

Sintex-F data will be processed using the bias reduction or C*umulative Distribution Function-based Downscaling Method* (CDFDM). It is a Fortran program that generates forecast data.

1) Check if the Sintex-F data is located in the sintex-f folder.

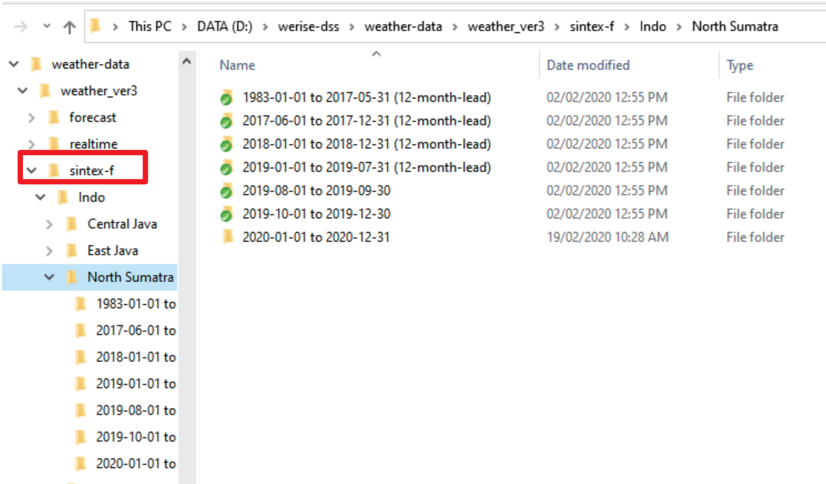


Fig 53. Location of Sintex-F folder in the directory.

2) Open WeRise and go to Admin<Option.
3) Select CDFDM Interface.

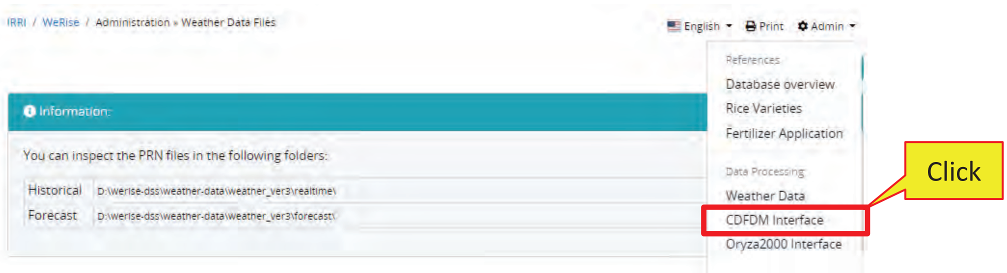


Fig 54. How to upload weather/SINTEX-F data

4) List of available SINTEX- F data will be displayed.
5) Select the **Region/location** to be processed.

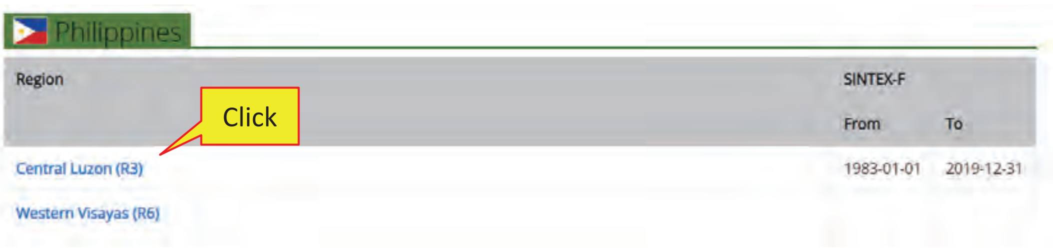
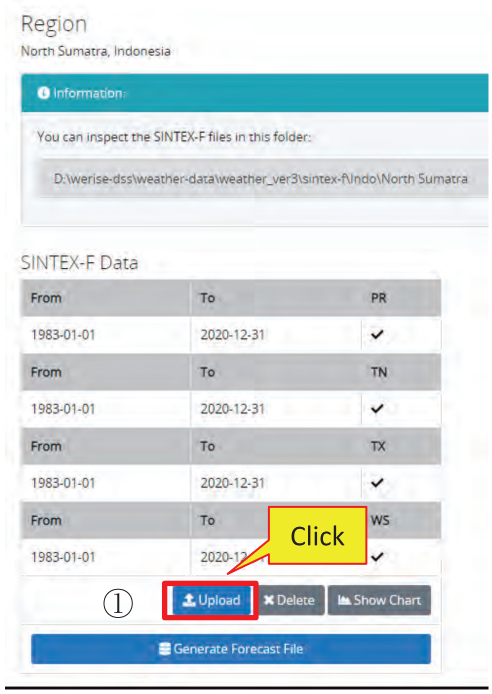


Fig 55. How to upload weather/SINTEX-F data (continued)

6) Available year and weather parameters of Sintex-F data will be listed. To generate Forecast file, click Upload. ①



A verification window will appear to make sure that the SINTEX-F files are in the correct folder. Click Upload to continue. ②

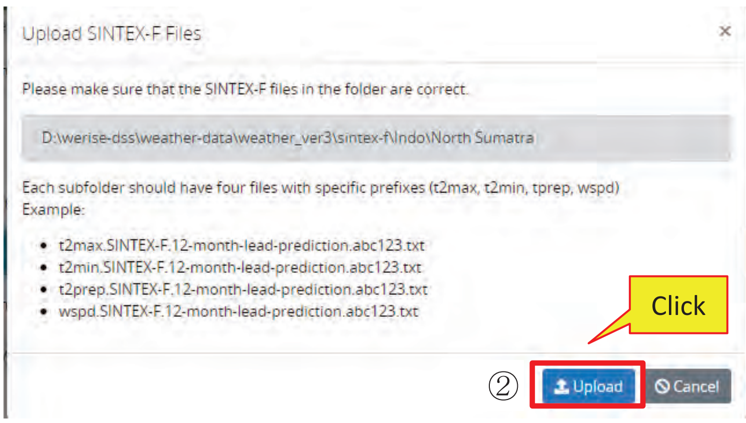


Fig 56. How to upload weather/SINTEX-F data (continued)

7) Click Generate File forecast if files was saved successfully.
8) Choose Location and click Generate files to run CDFDM program**.**

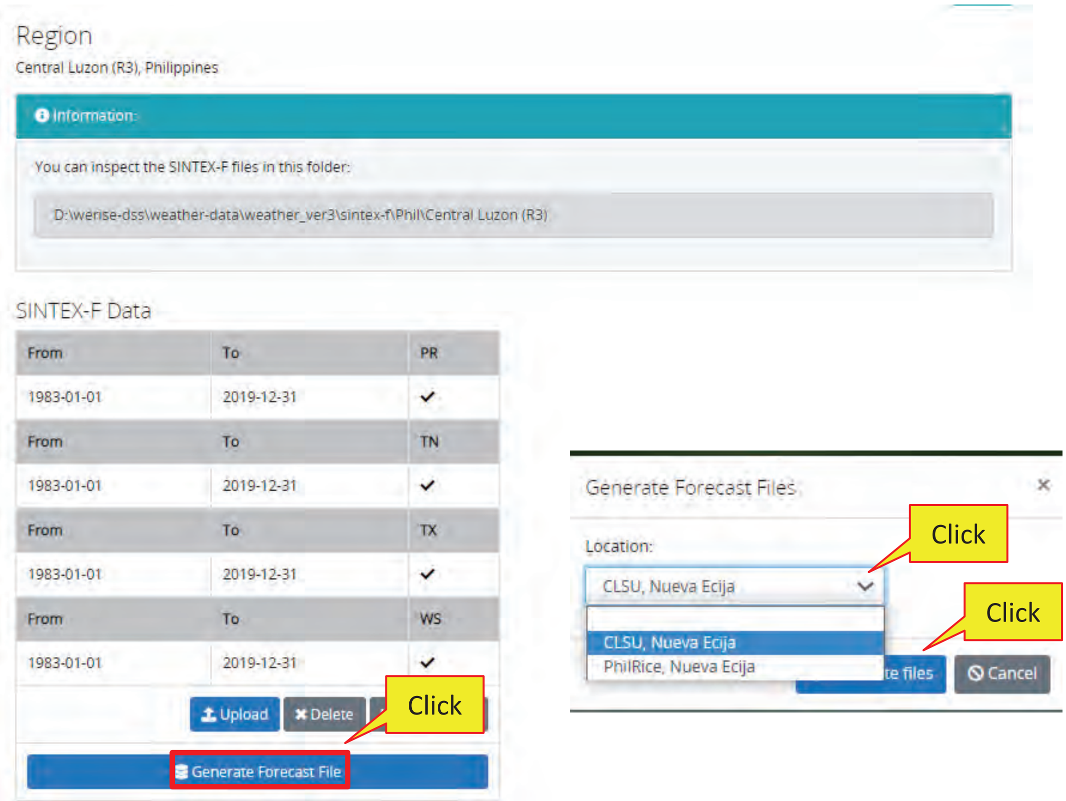


Fig 57. Generating forecast file.

9) The system will display run progress while processing the SINTEX-F data.

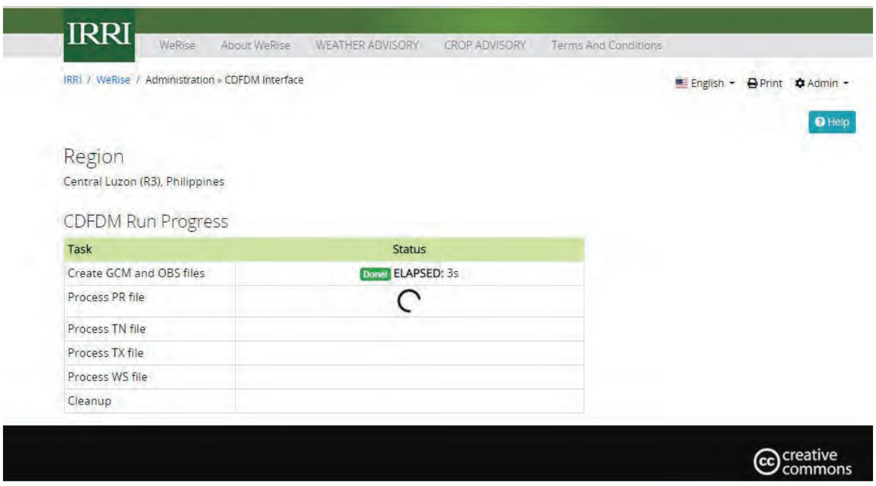


Fig 58. Generating forecast file (continued)

10) Enter the Year of data to be processed for example 2019. Click Export if CDFDM data was successfully processed.
11) CDFDM output details will be shown. To check the result, click Display data.

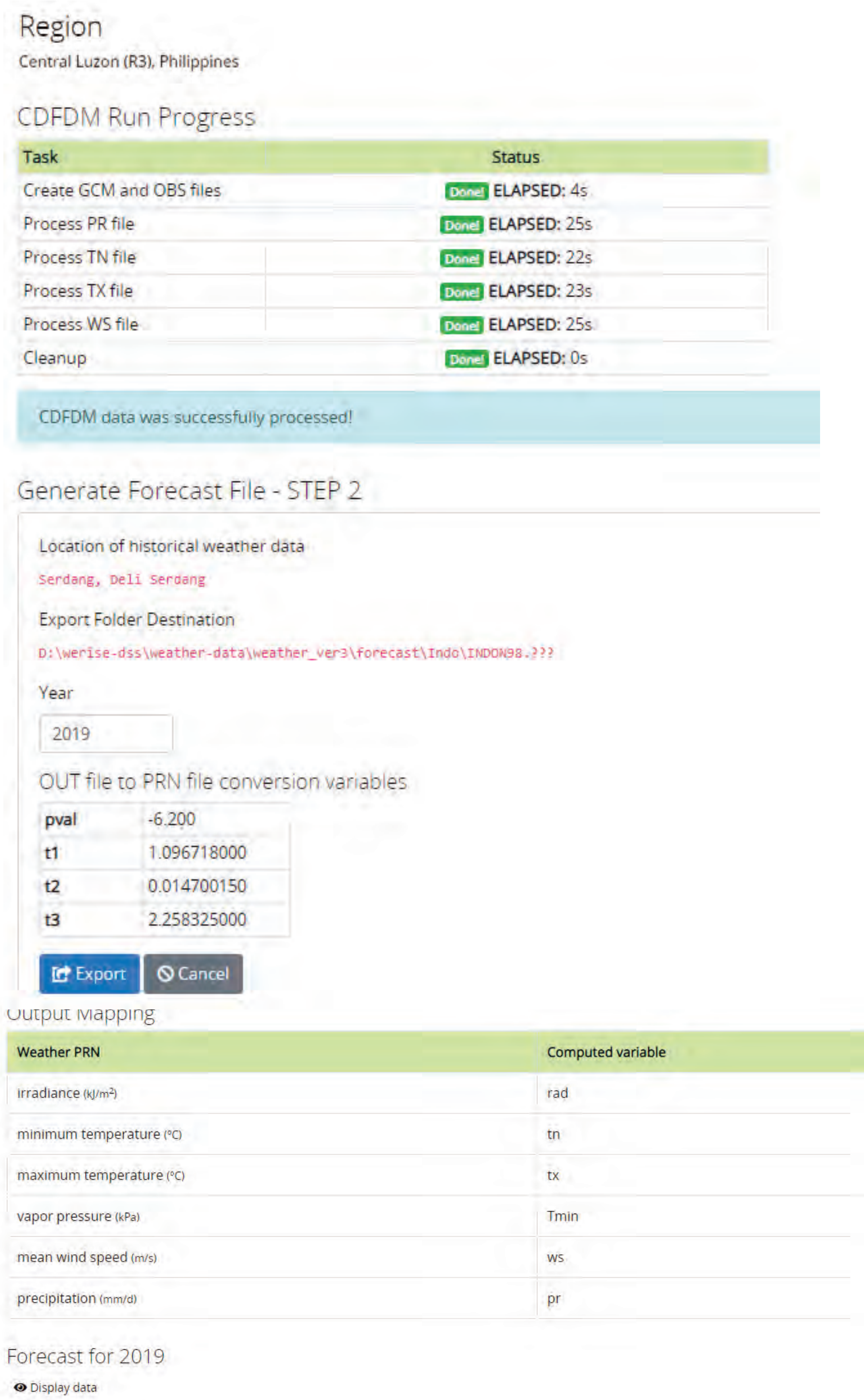


Fig 59. Generating forecast file (continued)

*Weather data are stored as files to be used by CDFDM and ORYZA. Forecast data is generated by CDFDM. Once both are available, ORYZA can generate grain yield simulations.

C. Crop database

1. All calibrated varieties should be placed in WeRise-dss\oryza3\rice-variety folder.
2. Add the new calibrated variety, for example NSICRc238.crpB in rice-variety folder.
3. To upload new variety in crop database, open WeRise and go to Admin<Options. Type the name of newly calibrated variety (for example NSICRc238.crpB in the List of variety to use. Press Enter and click Ok.

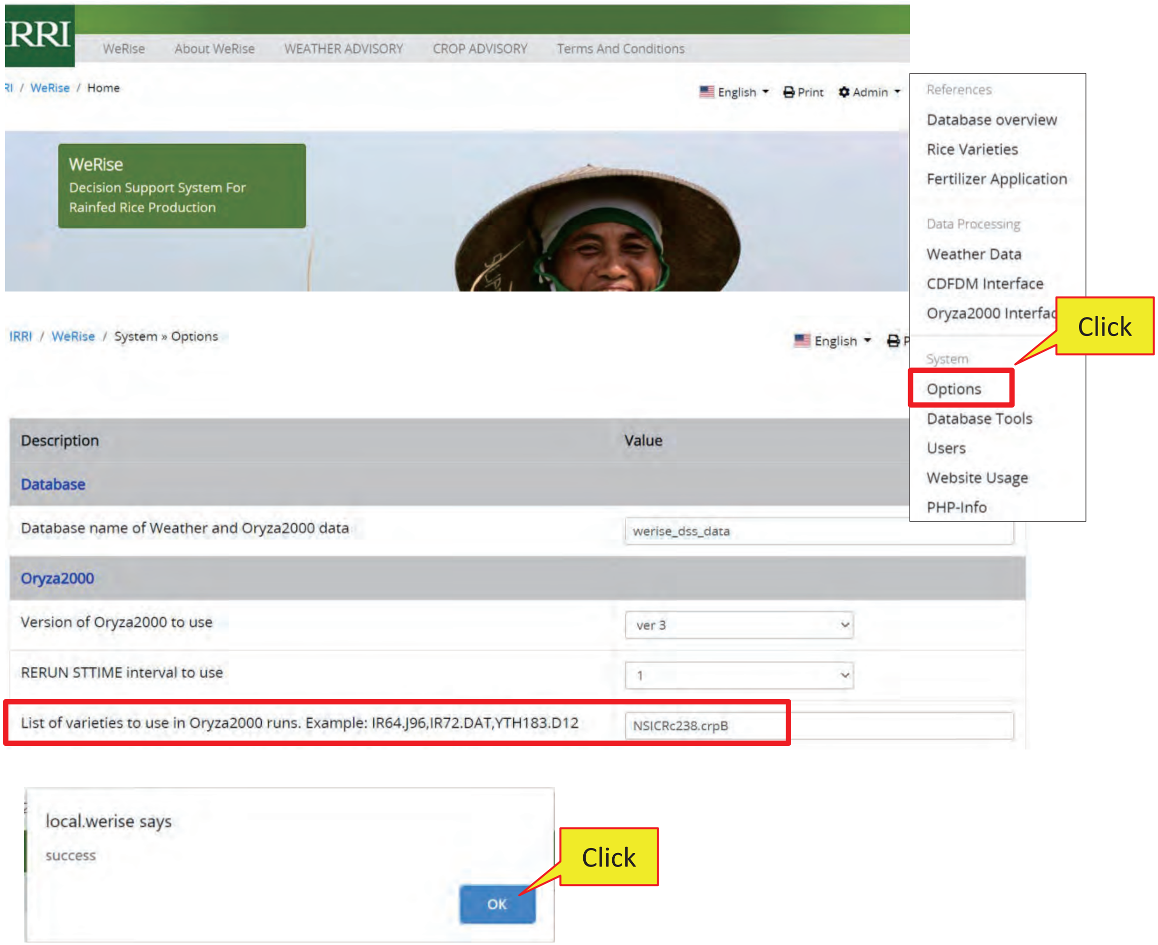


Fig 60. How to upload new crop file (calibrated variety)

4. To run Oryza simulation go to Admin<Options<Oryza2000 Interface.
   Choose country and province/district (for example, Central Luzon, Nueva Ecija).
   Click Show files.

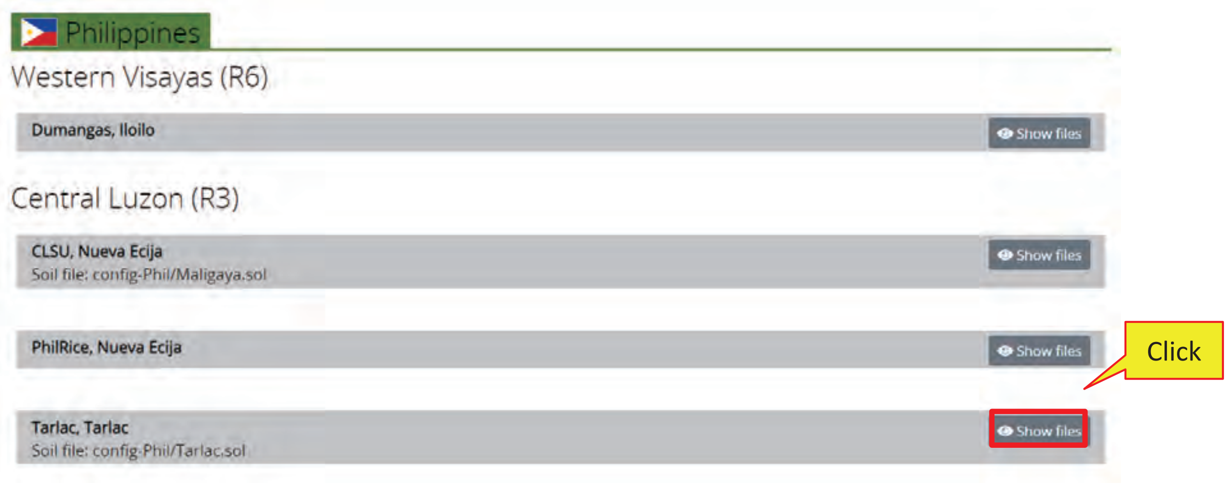


Fig 61. How to upload new crop file (continued)

5. Look for the year to be forecasted. Click Save to database.

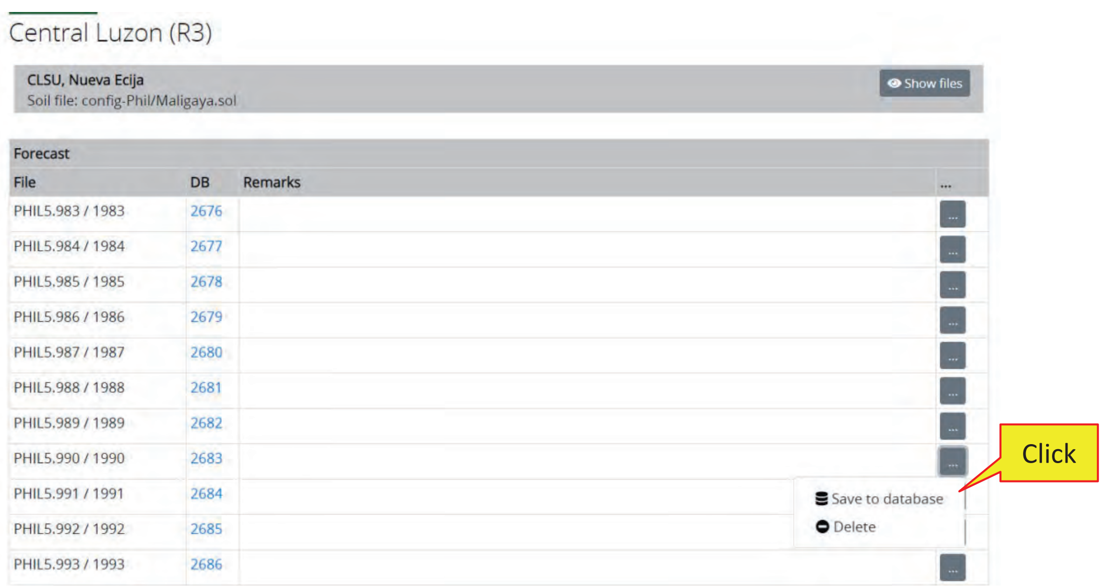


Fig 62. How to upload new crop file (continued)

6. Soil file can be edited manually. Enter soil file, click Change Soil File and click Ok. If all the information are correct, Click Start Process to begin the simulation.

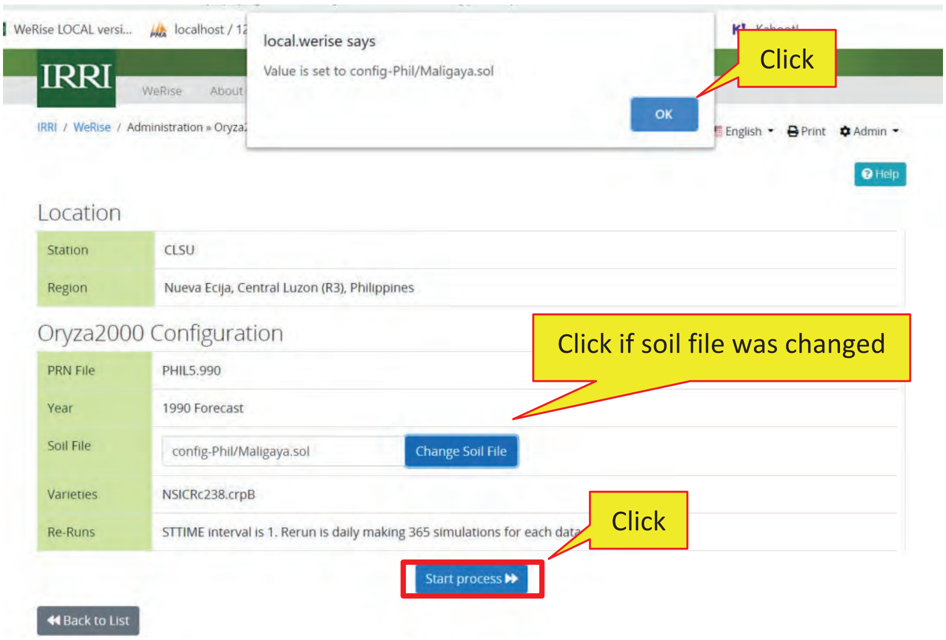


Fig 63. How to upload new crop file (continued)

7. Pro gress bar will be shown when processing the crop data. Wait for the result. The system displays the status when processed successfully. Click here to show the results.

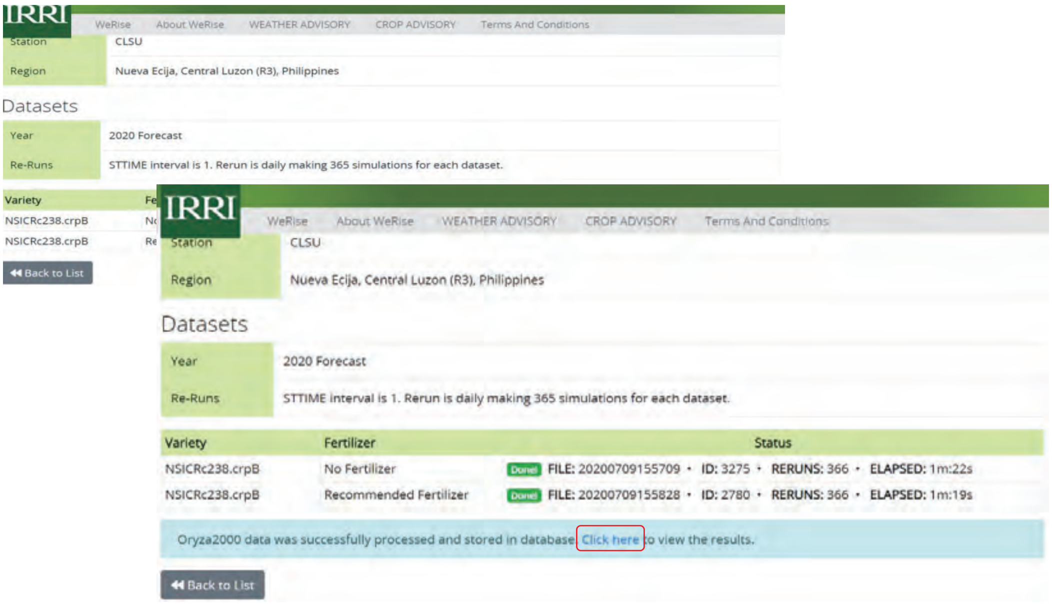


Fig 64. New crop was successfully simulated and stored in the database.

9. Generating WeRise advisories

A. Weather Advisory

To generate Weather prediction, open WeRise, go to WEATHER ADVISORY tab. Select Location, Forecast Year and Weather data parameters to be displayed. (Rainfall, Temperature, Solar Radiation, Vapor pressure, Wind speed). Click Show Advisory to display the prediction.

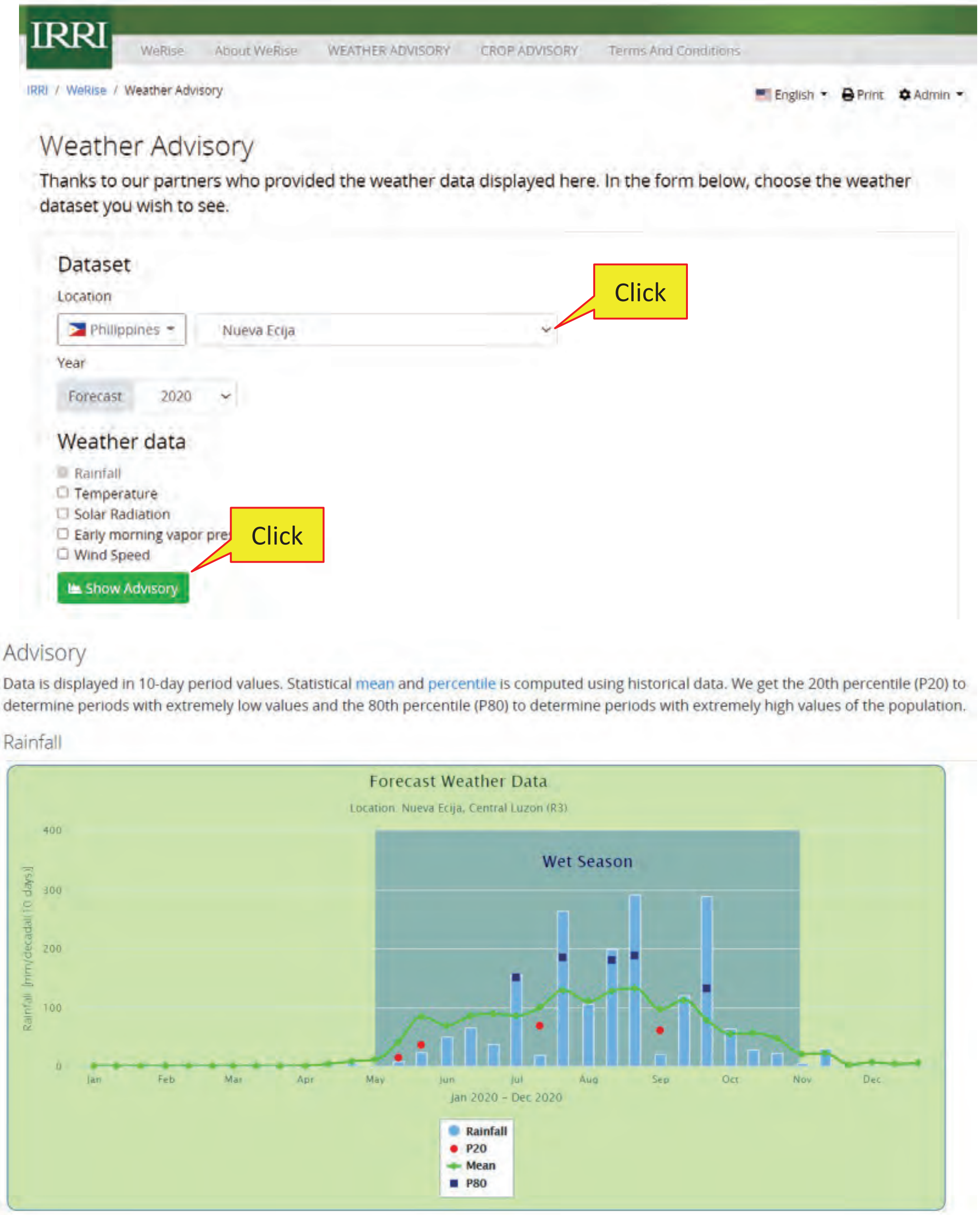


Fig 65. How to generate weather advisory

B. Crop Advisory

Select CROP ADVISORY tab. Choose the Location, Year and Variety combination for first crop and second crop. Click Show Advisory to display the crop prediction.

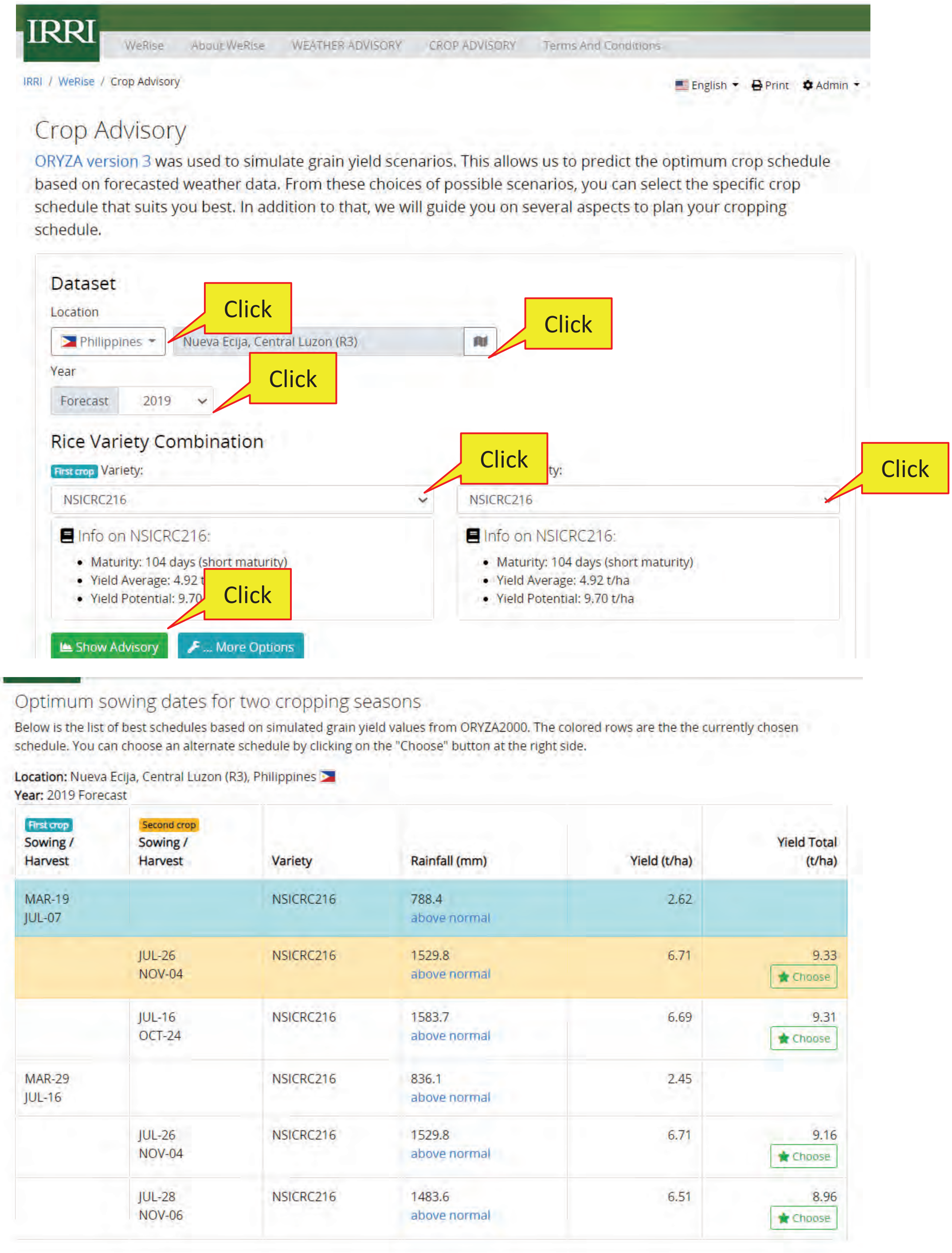


Fig 66. How to generate crop advisory

Chapter 3: WeRise Frequently Asked Questions (FAQs)

This FAQ was produced by the IRRI-Japan Collaborative Research Project (IJCRP) on Climate Change Adaptation through Development of a Decision-Support tool to guide Rainfed Rice production (CCADS-RR), funded by the Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan. WeRise is accessible through http://werise.irri.org/.

1. GENERAL

- **What is WeRise?**
  WeRise is short for "Weather-rice-nutrient integrated decision support system." It was developed to improve productivity in rainfed rice areas in Indonesia, Philippines and Madagascar. WeRise is a computerbased decision support tool that provides advisories on the best time to plant and apply fertilizer, and the suitable variety for planting for the upcoming cropping season. The advisories are based on the weather characteristics of the upcoming cropping season, crop growth development, soil characteristics, and farm management practices.

- **How can WeRise help rainfed rice farmers manage their crop production more strategically?**
  WeRise advisories could be generated from the website at least three months before the upcoming cropping season, providing sufficient time for farmers to identify and allocate their resources (i.e., capital for purchase of seeds, fertilizer and other inputs, and labor requirements).

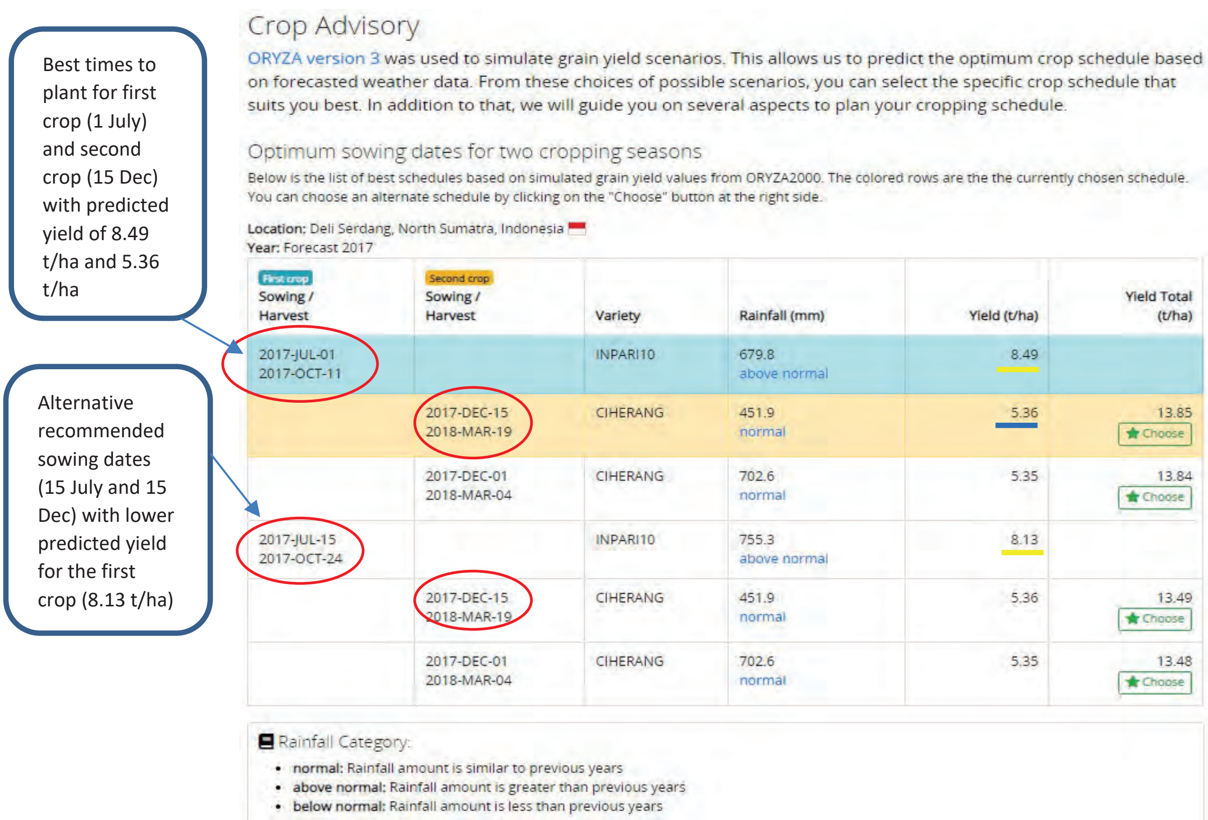


Fig 67. WeRise recommends the optimum fertilizer application schedule.

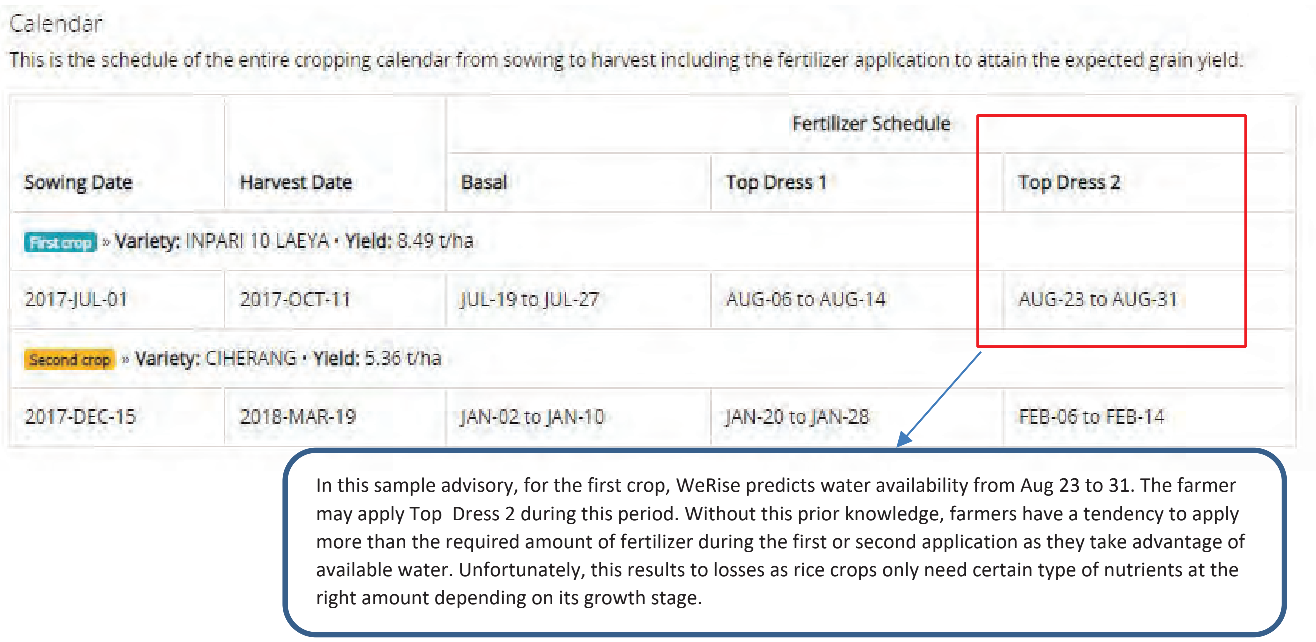


Fig 68. WeRise provides advisories on the suitable variety/varietal combinations for planting.

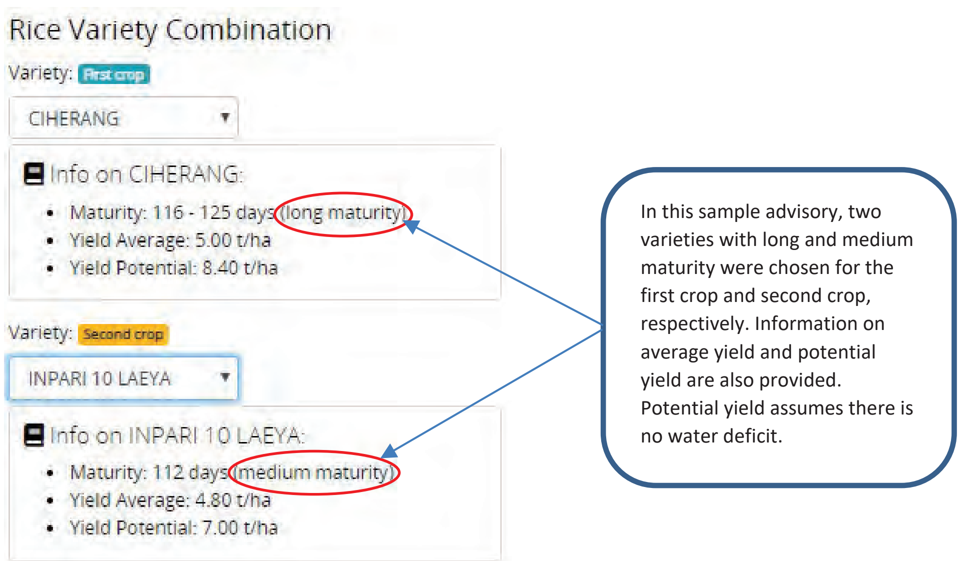


Fig 69. Farmers may be able to plant more than one rice crop by choosing a combination of varieties with different maturity duration (e.g., long-short, medium-long, etc.).

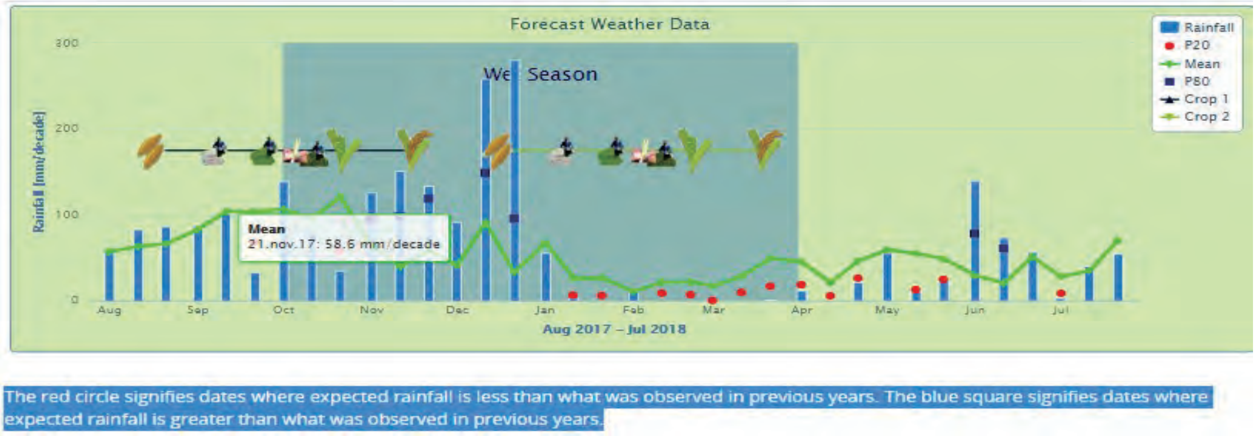


Fig 70. WeRise provides forecast weather data including possibility of extreme weather events. WeRise is able to identify extremely high and low weather data implying possibility of drought and flooding occurrences. Prior knowledge of these possibilities helps farmers manage risks, anticipate them, and plan accordingly.

- **Weather extremes and variabilities seem to have become the new normal. How accurate are WeRise predictions amidst climate change?**
  WeRise enables data-driven decision support through its science-based weather and crop advisories. It was developed using data (historical and observed), models, and an understanding of crop management practices. It integrates localized seasonal climate prediction and real-time weather data with a crop growth model. The seasonal weather predictions are based on the statistical downscaling of SINTEX-F oceanatmosphere coupled general circulation model (GCM) developed by Japan's Agency for Marine-Earth Science and Technology (JAMSTEC). Yield predictions are based on recommended sowing and fertilizer application timings using the ORYZA crop growth model, which simulates the growth and development of rice as well as water under different conditions. Statistical downscaling, calibration, and validation are done to improve the accuracy of the predictions. For more information on these models, please visit these links: ORYZA (www.irri.org/oryza, browsed on November 11, 2020) and SINTEX-F (www.jamstec.go.org/applinfo/sintexf/e/seasonal/outlook.html, , browsed on November 11, 2020).

- **Who can use WeRise?**
  Anyone can use WeRise. But, the extension workers are the primary target users. Through WeRise, extension workers can deliver timely science-based weather and crop advisories to rainfed rice farmers. Researchers, development managers, and policy makers can also use WeRise in developing evidence-based R&D plans and policies. Farmers can also use WeRise directly. Please contact werisehelpline@irri.org for any specific questions on the use of WeRise that are not included in this document.

- **Do I need to pay for WeRise advisories?**
  No. WeRise advisories can be generated for FREE. WeRise is an international public good which was developed under the CGIAR Research Program on RICE through the IRRI-Japan Collaborative Research Project with funding from the Ministry of Agriculture, Forestry and Fisheries of Japan and the Japan International Research Center for Agricultural Sciences.

- **Can I use the WeRise advisories for publications like scientific paper, technical reports, and similar materials?**
  The terms and conditions on the use of WeRise may be found in this link. In case a user would like to use the WeRise advisories in publications, a letter of request must first be sent to werisehelpline@irri.org indicating location, period covered, and type of advisories. Users must acknowledge the IRRI-Japan Collaborative Research Project as the source of data.

2. ACCESS

- **Do I need internet to access WeRise?**
  Yes.

- **How do I log in to WeRise?**
  To log in, open a web browser and enter werise.irri.org. Click "**weather advisory**" or "**crop advisory**" from the menu or their corresponding icons that can be found in the landing page.

Fig 71. WeRise landing page where a user can log in

You will be directed to a log in screen that asks for your username and password. If you do not have an account yet, register a FREE account.

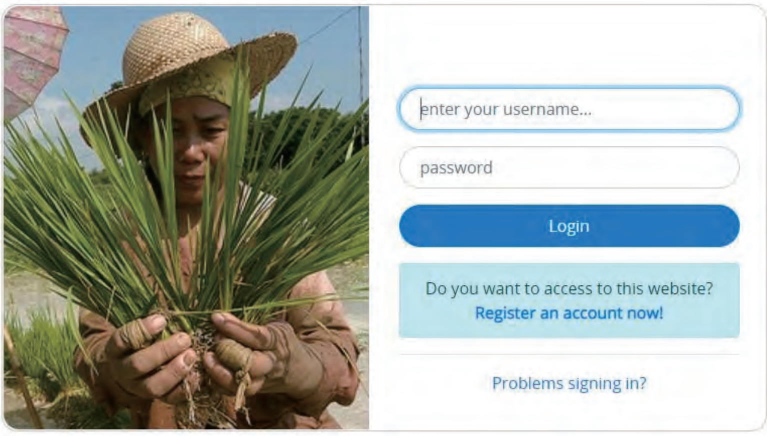


Fig 72. Log in page

Register an account by filling out the form below.

If registration is successful (you have entered all the required information), you will see the message below:

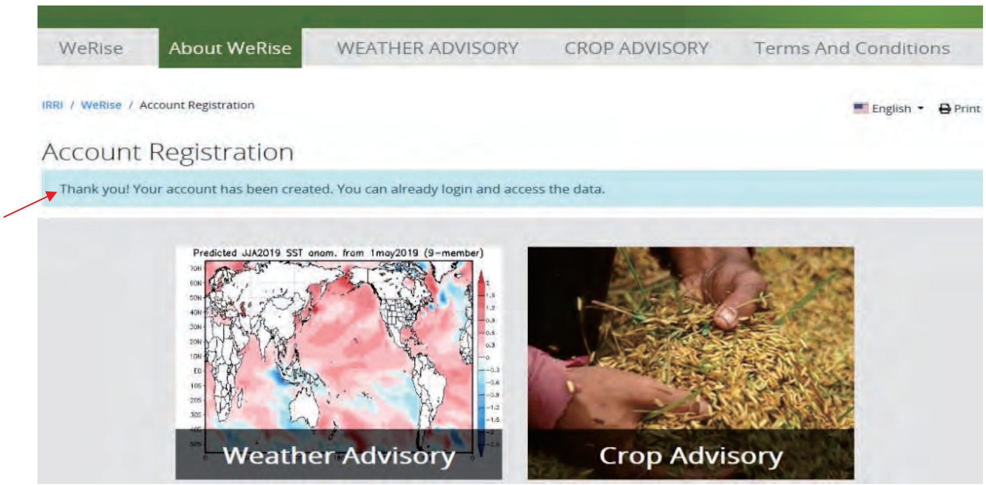


Fig 73. Form to fill out to register to use WeRise

When you click the Weather Advisory and Crop Advisory from the menu or their corresponding icon, you will be able to access the Weather and Crop advisory pages. Your username will also appear in the upper right portion of the page.

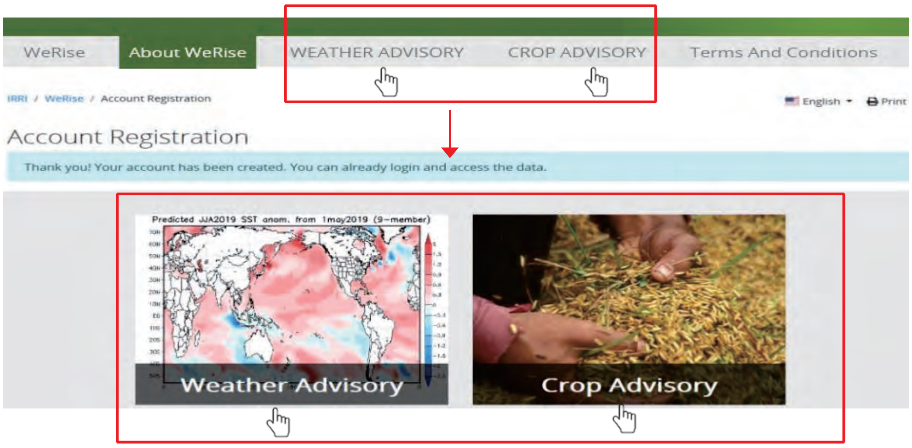


Fig 74. Weather Advisory and Crop Advisory in WeRise

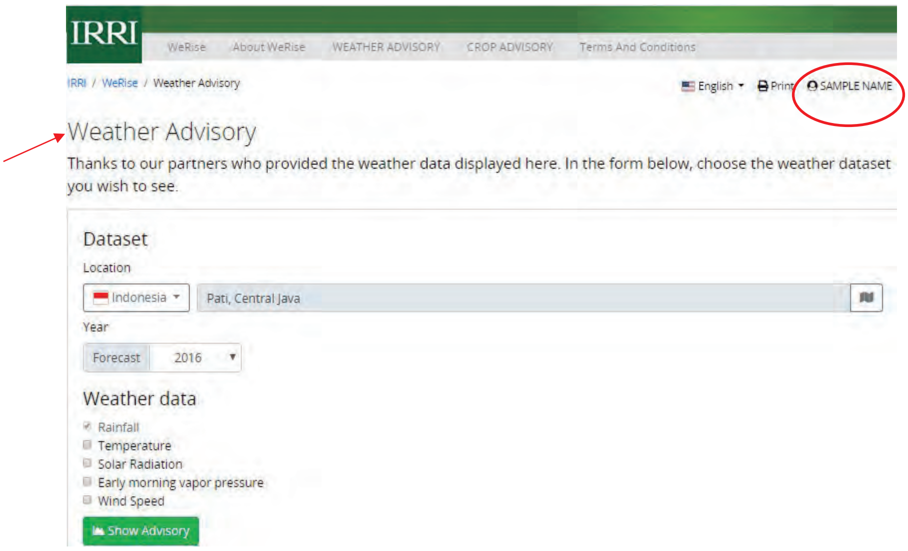


Fig 75. An example of page in Weather Advisory

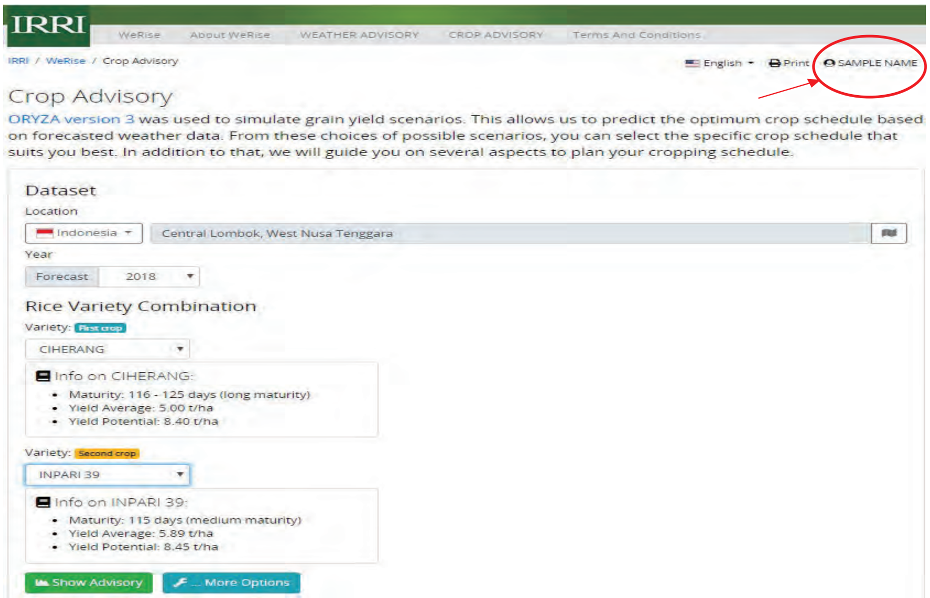


Fig 76. An example of page in Crop Advisory

- ## **Do I need to pay to register a WeRise account?**

No. Registration is FREE.

- ## **I cannot log in to my account, what is wrong?**

If you are unable to log in, you will see an error message: "**invalid credentials** "which means you have entered the wrong username and/or wrong/expired password. In this case, proceed for password recovery.

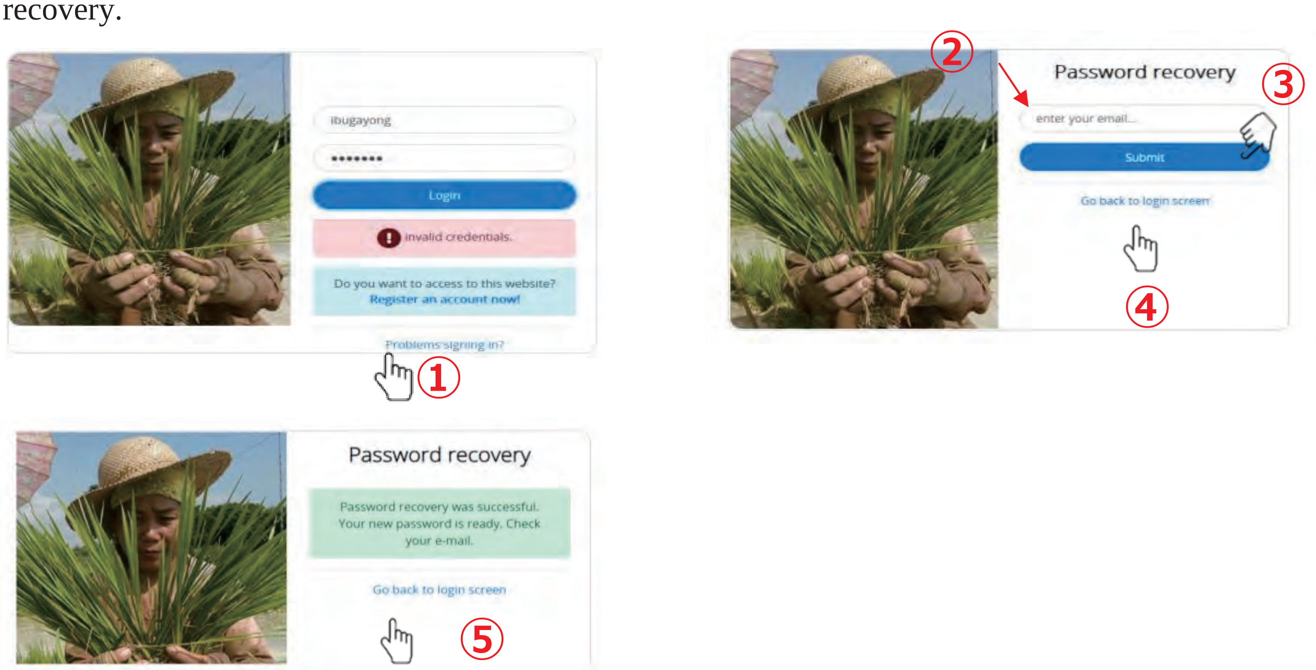


Fig 77 . Trouble shooting for correct log in

- **Can WeRise be downloaded as an app from Google play store?**

  The current version of WeRise is accessible via web.

- **I do not have a computer or mobile phone to access WeRise. I also do not have internet access. How can I get WeRise advisories/predictions?**

  Please contact your extension workers or agriculture and extension office or email i.bugayong@irri.org for assistance and additional information.

- **How do I log out of WeRise?**

  You do not need to log out. Just close the page.

3. ADVISORIES

- **How do I generate weather advisories?**

  Click the Weather Advisory tab from the menu or click its icon on the landing page > ①②Select the location and ③forecast year under "Data Set." > ④Choose the weather data you want to generate under "Weather Data." > Click "Show Advisory." See link to sample outputs.

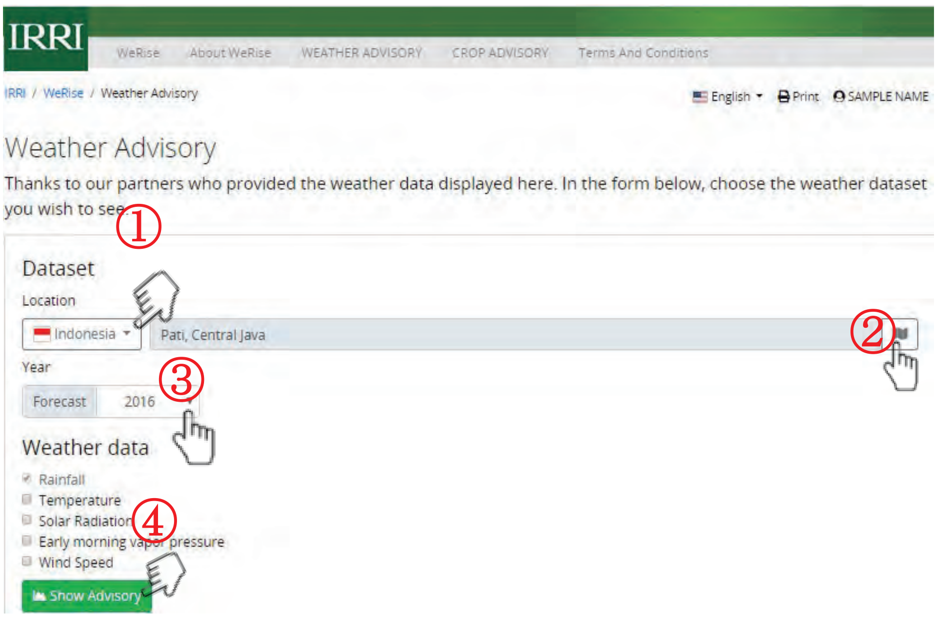


Fig 78. How to generate weather advisories

The default parameter is rainfall. You may also generate advisories for temperature, solar radiation, early morning vapor pressure, and wind speed.

- **How do I print the weather advisories?**

  Click the print icon beside your username and print.

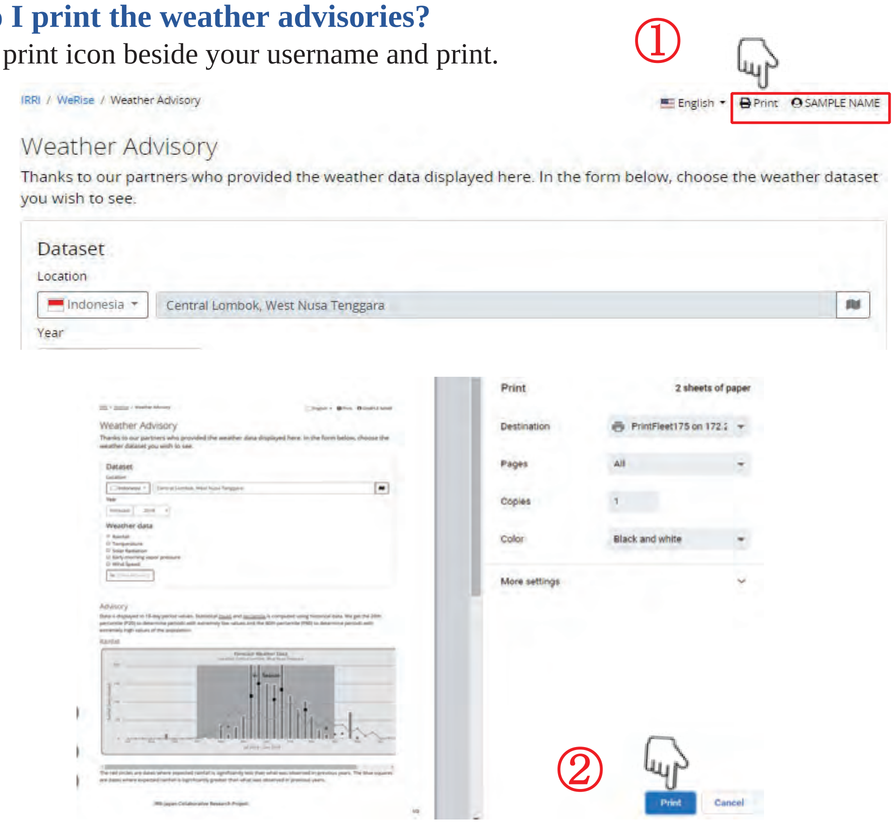


Fig 79. How to print the weather advisories

You may also save the file for printing later.

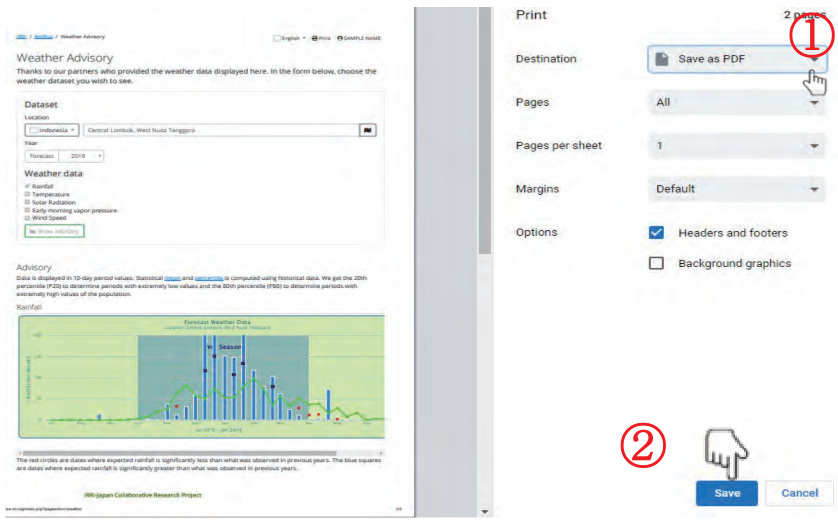


Fig 80. Change the destination and save the file in PDF format to print later

- **How do I generate crop advisories?**
  Click the Crop Advisory tab from the menu or click its icon on the landing page > ①②Select the location and ③forecast year under "Data Set." > Select your preferred variety for the first crop and second crop. > ④⑤Click "Show Advisory."

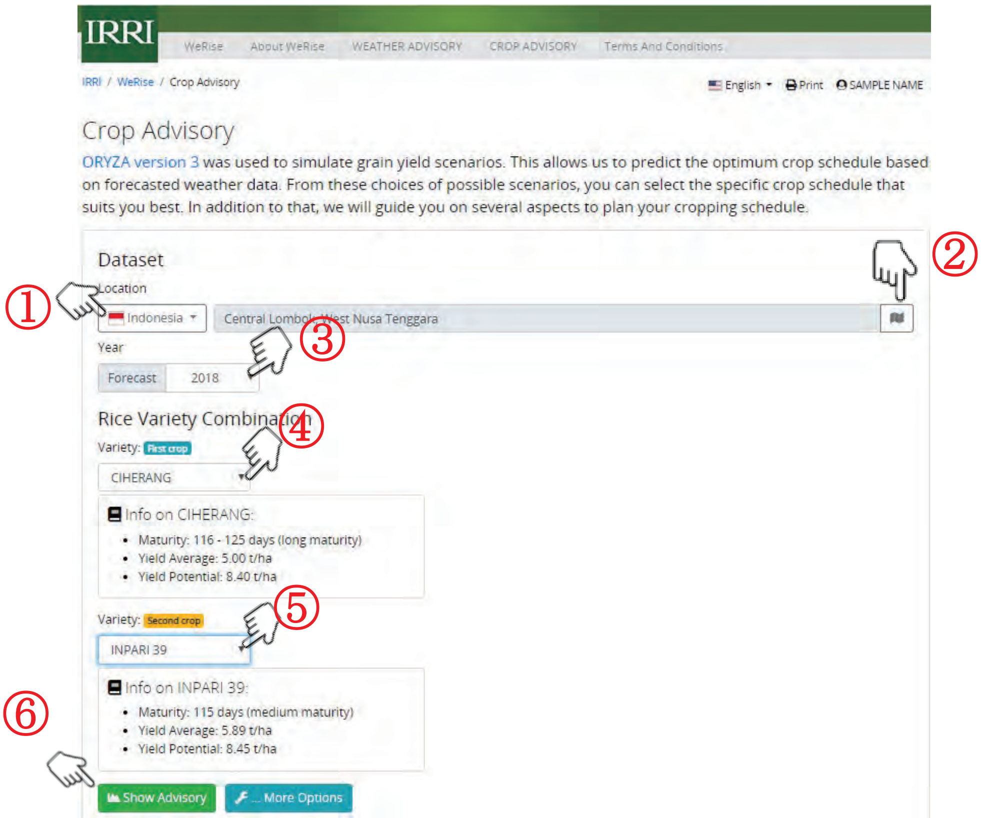
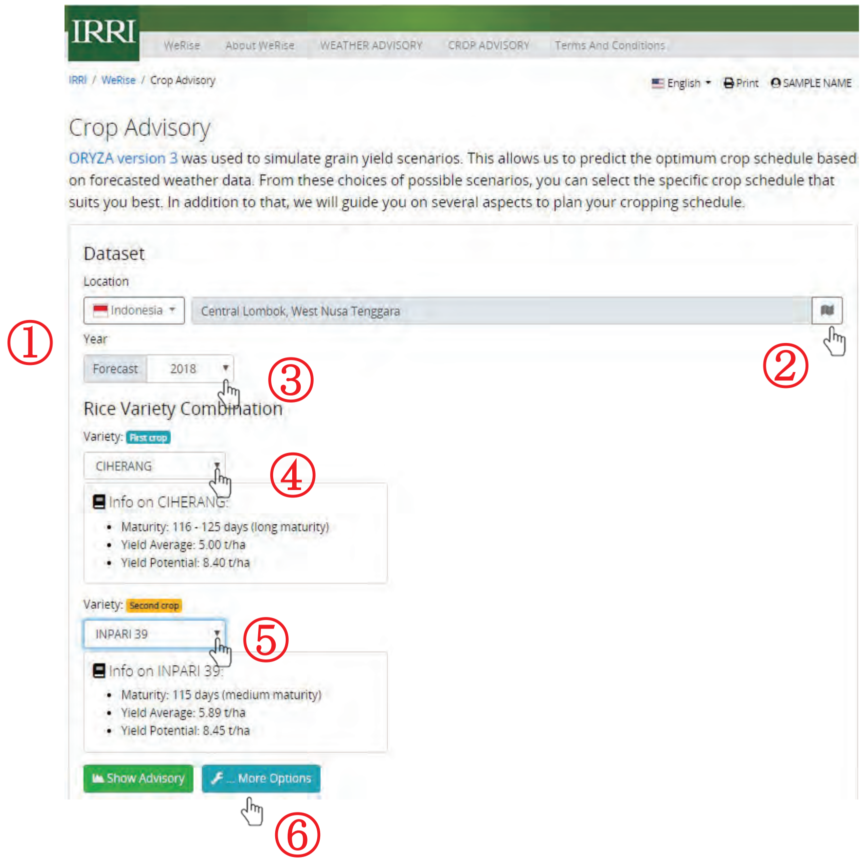


Fig 81. How to generate crop advisories

- **How do I print and save the crop advisories?**
  Follow the instructions for printing and saving the weather advisories.

- **I have a sowing date in mind. Can I still generate crop advisories?**
  Yes, click the Crop Advisory tab from the menu or click its icon on the landing page > Select the location and forecast year under "Data Set." > Select the location and forecast year under "Data Set." > Select your preferred variety for the first crop and second crop. > Click "More Options." > Set your sowing dates. > Click "Show Advisory."



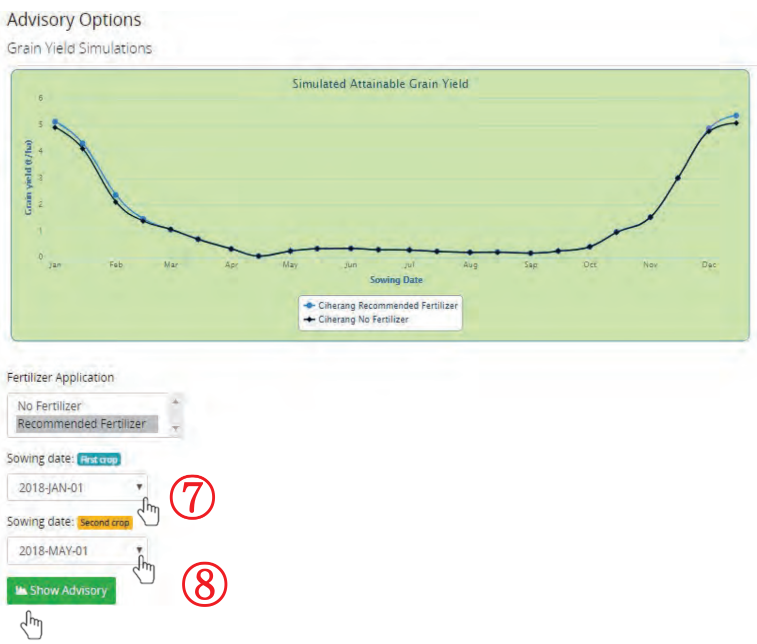
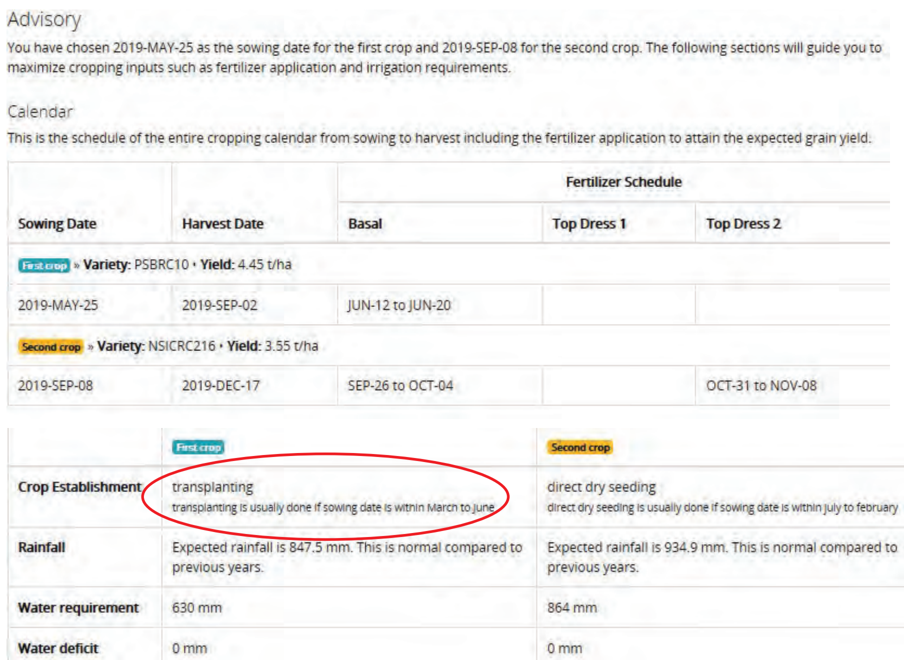


Fig 82. "More options" to accommodate customizing sowing dates

- **I generated crop advisories which indicate transplanting as the crop establishment for the first crop. Can I still follow the advisories if I practice direct seeding?**
  Yes, you can still follow the advisories. For transplanted rice, sowing timing means sowing in the seedbed. WeRise recommends sowing dates based on water availability.



Advisory

You have chosen 2019-MAY-25 as the sowing date for the first crop and 2019-SEP-08 for the second crop. The following sections will guide you to maximize cropping inputs such as fertilizer application and irrigation requirements.

Calendar

This is the schedule of the entire cropping calendar from sowing to harvest including the fertilizer application to attain the expected grain yield.

		Fertilizer Schedule		
Sowing Date	Harvest Date	Basal	Top Dress 1	Top Dress 2
First crop » Variety: PSBRC10 • Yield: 4.45 t/ha				
2019-MAY-25	2019-SEP-02	JUN-12 to JUN-20		
Second crop » Variety: NSICRC216 • Yield: 3.55 t/ha				
2019-SEP-08	2019-DEC-17	SEP-26 to OCT-04		OCT-31 to NOV-08

	First crop	Second crop
Crop Establishment	transplanting transplanting is usually done if sowing date is within March to June	direct dry seeding direct dry seeding is usually done if sowing date is within July to February
Rainfall	Expected rainfall is 847.5 mm. This is normal compared to previous years.	Expected rainfall is 934.9 mm. This is normal compared to previous years.
Water requirement	630 mm	864 mm
Water deficit	0 mm	0 mm

Fig 83. How to understand the meaning of advisories

- **I generated the advisories 3 months before the cropping season. Can I generate it again one month before the cropping season or during the cropping season? How often do the predictions or crop advisories change in a given year?**
  WeRise is updated twice a year, the advisories you generated three months, one month before and during the cropping season will be the same.

- **Can I change the language?**
  Yes, you can change the language by clicking the language icon beside the print icon.

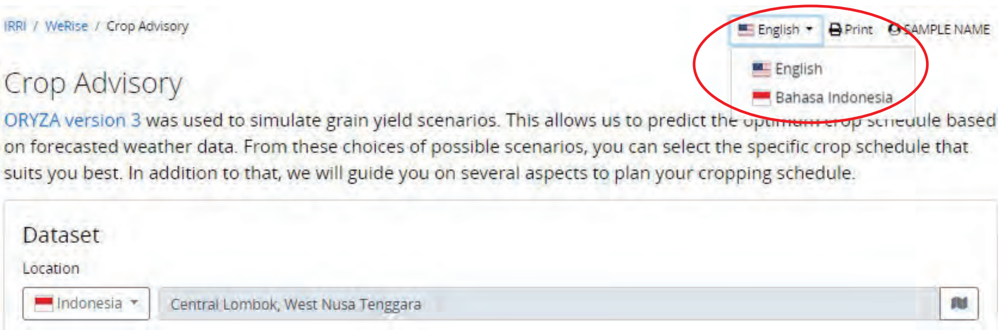


Fig 84. How to switch the language from one to another

- **I cannot find our district (location) in the WeRise database, can I use the advisories for the available district?**
  No. WeRise predictions are localized.

- **I cannot find the varieties I prefer to plant in WeRise. Can I use a substitute variety (i.e., maturity days near the variety I prefer)?**
  You cannot use a substitute variety by considering only the maturity days. Varieties have other traits that affect their yield and crop growth which were considered in WeRise development. Please contact i.bugayong@irri.org to suggest additional varieties.

- **Can WeRise be used in irrigated areas?**
  Yes, to some extent. Farmers in irrigated areas can choose from the different varieties and follow the recommended sowing time, thus save on irrigation water. Please also check this tool specific for irrigated areas: RCM (www.irri.org/crop-manager, browsed on November 11, 2020)

- **Can WeRise provide predictions for pest and disease occurrence or advisories?**
  No. There are other tools for pest and disease management and crop management to complement WeRise. Please check these links: Rice Knowledge Bank (www.knowledgebank.irri.org/, browsed on November 11, 2020) and Rice Doctor (www.knowledgebank.irri.org/decision-tools/rice-doctor, browsed on November 11, 2020).

- **Does WeRise recommend the amount and type of fertilizer I should apply in my field?**
  No. WeRise only suggests the schedule of fertilizer application based on water availability and crop growth.

- **For the advisory I generated, the recommended WeRise fertilizer schedule is only once for the entire cropping season. Why is this so?**

  WeRise fertilizer schedule advisories are based on water availability. In the sample advisory below, the amount of rainfall for the first crop is predicted to be below normal with water deficit of 612 mm and periods of possible drought. The predicted yield is also low (0.02 t/ha). In this case, the farmer may decide not to plant rice or plant an alternative crop or allocate his resources (financial) to other income-generating activities. For those with supplementary irrigation, guidelines are also provided.

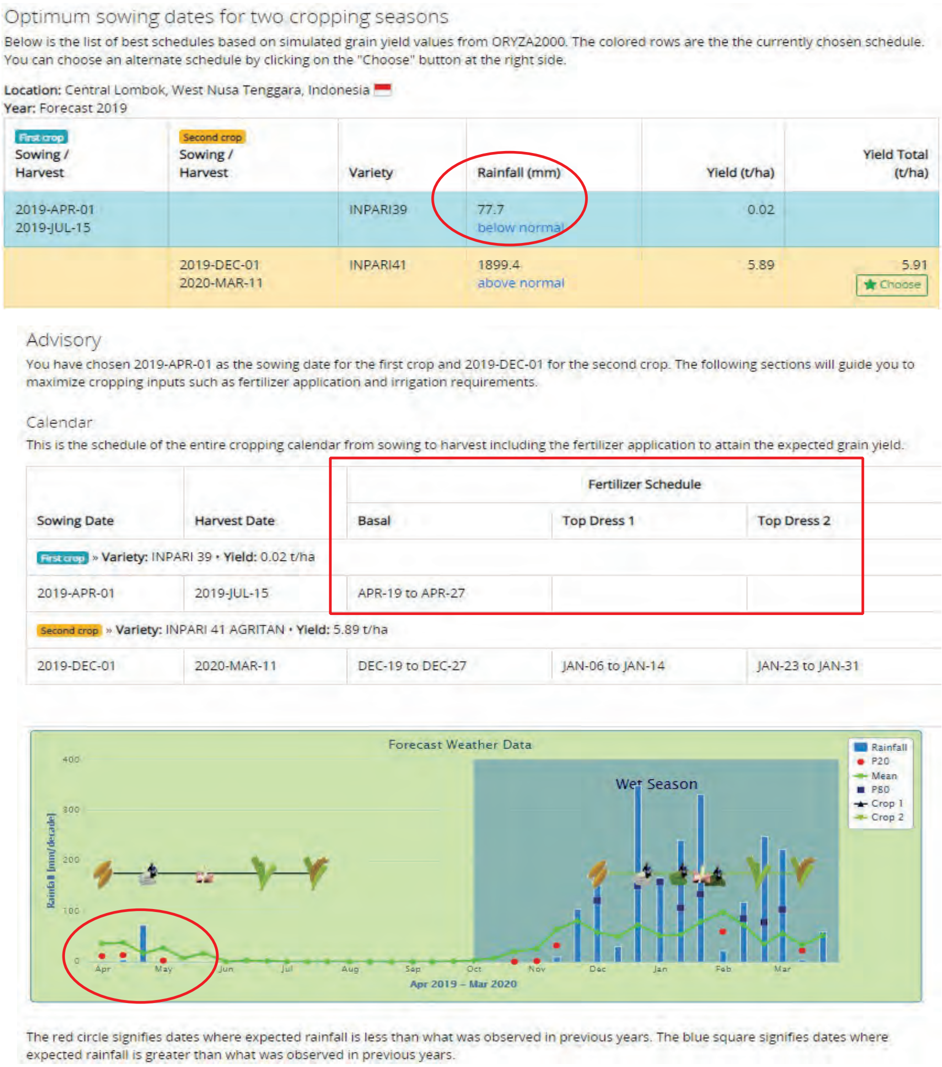


Fig 85. How to understand Fertilizer schedule in Crop Advisory

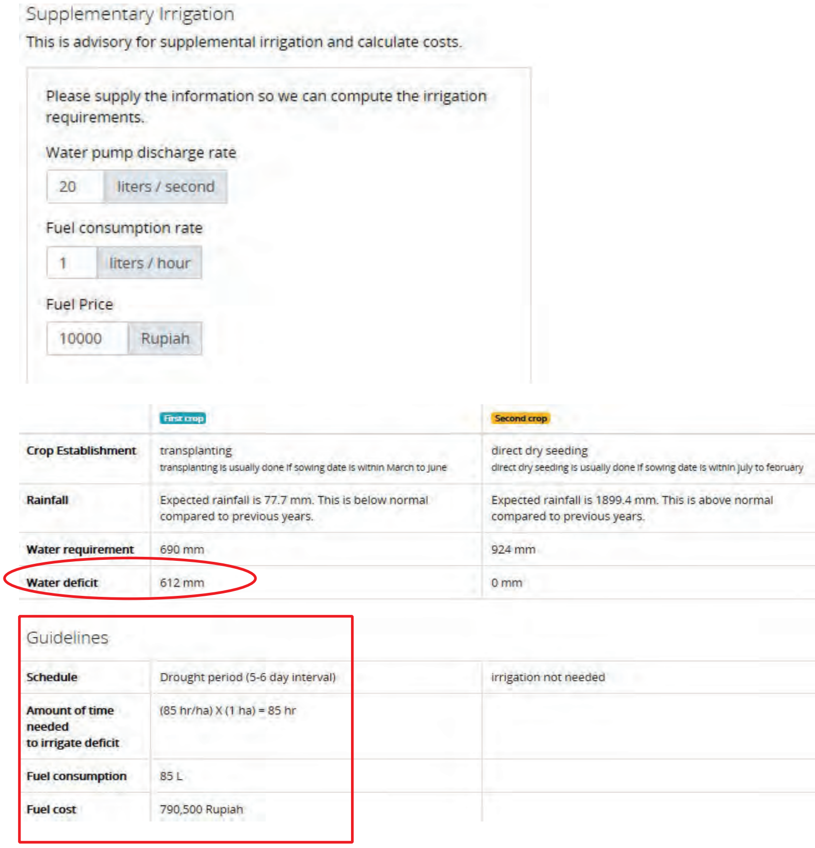


Fig 86. An additional advisory in supplementary irrigation when water deficit is predicted during cropping period

- **Can WeRise be used for other commodities besides rice?**

  No. WeRise was developed using ORYZA, a crop growth model only for rice.

- **Is a second rice crop possible?**

  WeRise enables efficient water- and nutrient-use by determining optimum sowing timing and fertilizer application schedule. It can also help you to decide and plan ahead if it would be better to plant another crop.

- **Can WeRise predict rice yield?**

  Yes. WeRise can predict the yield based on variety, time of sowing, amount of fertilizer applied and rainfall. This prediction can serve as your basis in deciding what variety to plant, when to sow and when to apply fertilizer.

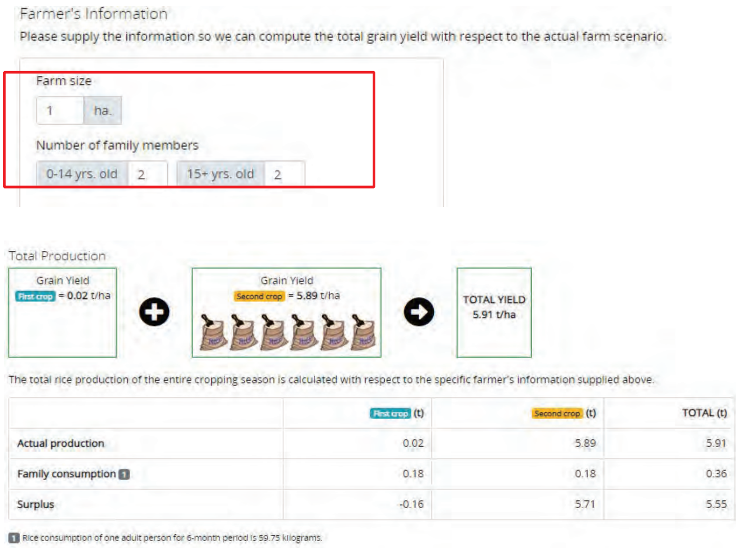


Fig 87. An additional advisory in computing a surplus according to grain yield predations

- **There is information on water deficit and irrigation guidelines. Does WeRise provide predicted yield if farmers will irrigate accordingly?**

  No. But you could find the potential and average yield as among the information for the variety you will choose. Potential yield assumes there is no water deficit.

- **How can WeRise compute for the surplus?**

  WeRise can compute for any surplus when you supply information on farm size and number of family members.

4. TECHNICAL SUPPORT

- **Who can I contact for additional assistance or feedback?** Please contact i.bugayong@irri.org

- **Do you conduct training for WeRise?**

  There have been trainings for Agricultural Extension Workers on communicating WeRise advisories and for researchers on operation and maintenance.

5. OTHERS

- **Our organization would like to partner with the developers. How can we do this?**
  Please contact us at c.florey@irri.org or i.bugayong@irri.org

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Towards strategic crop management in rainfed rice areas

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