A Web based Photothermic Indexing Calculator for Rice Genotypes

Plants require a certain amount of heat to develop from one point in their life cycles to another. This measure of accumulated heat is known as physiological time. Physiological time is often expressed and approximated in units called degree days (D). The development rate over time is expressed in daily heat units/degree days(°C d).All plants tend to respond to the seasonal and daily variation in the duration of night and day time periods. Plant responses to this variation were attributed to the variation in the day time duration(Photoperiod) rather than to its complementary part of dark time duration (Nyctoperiod). Rice has been classified as a quantitative short day plant. In other words, it is a long night requiring plant. Hence nyctoperiods are also considered.

Heat Units/Degree Days(^{0}C d) : The growth and development of both plants and insects is strongly dependent on temperature. Below the base temperature (Td) and above the maximum temperature (Tm) the rate of development is zero. Three cardinal temperatures base temperature, optimum temperature(To) and maximum temperatures are identified to compute the heat units. The development rate over time is expressed in daily heat units/degree days(^{0}C d) . Daily heat units were calculated using the following formula

$$HU = \sum_{h=1}^{24} (HUH)$$

where h is time of the day. Hourly increments in Heat Units (HUH) are calculated if Td<=Tb and Td>=Th then HUH=0

if Tb<Td and Td<=To then HUH=(Td-Tb)/24

if To<Td and Td<Th then

$$HUH = [T_{opt} - (T_d - T_{opt}) \times (T_{opt} - T_{base})/(T_{high} - T_{opt})]/24$$

Daylengh (Photoperiod in hours): These calculations involve some empirical relationships that calculate the day length and integral of the sine of the solar angle from the day number and latitude. Nyctoperiod is calculated by subtracting the photoperiod from 24.(total no. of hours /day).

Manual process of computing day wise values is tedious and time consuming. Hence, Photothermic Indexing (PTI) software has been developed to compute day wise heat units, photoperiod and nyctoperiod and genotype wise cumulative photoperiod and nyctoperiod at different stages of Rice crop.

PTI software has 3 tabs for Home, Compute PTI and Contact details. Home page has login form with brief introduction about computation of PTI. User registration is mandatory for using the computation facility of PTI. Compute PTI tab has 3 menu items such as Heat Units/Degree Days, Day Length/Photoperiod and Nyctoperiod, Experimental data- Photoperiod and Nyctoperiod.

Heat Units/Degree days

This menu prompts for location, start date and end date and minimum and maximum temperatures for computing degree days. In addition to this, there is “Copy from Excel check box” to copy temperatures from excel to the interface and by clicking the “Click here to copy data to the grid” the data will be copied to the grid. By using ‘Calculate Result’ Heat degrees will be computed and displayed in the grid. This data can be copied easily to Excel or Word.

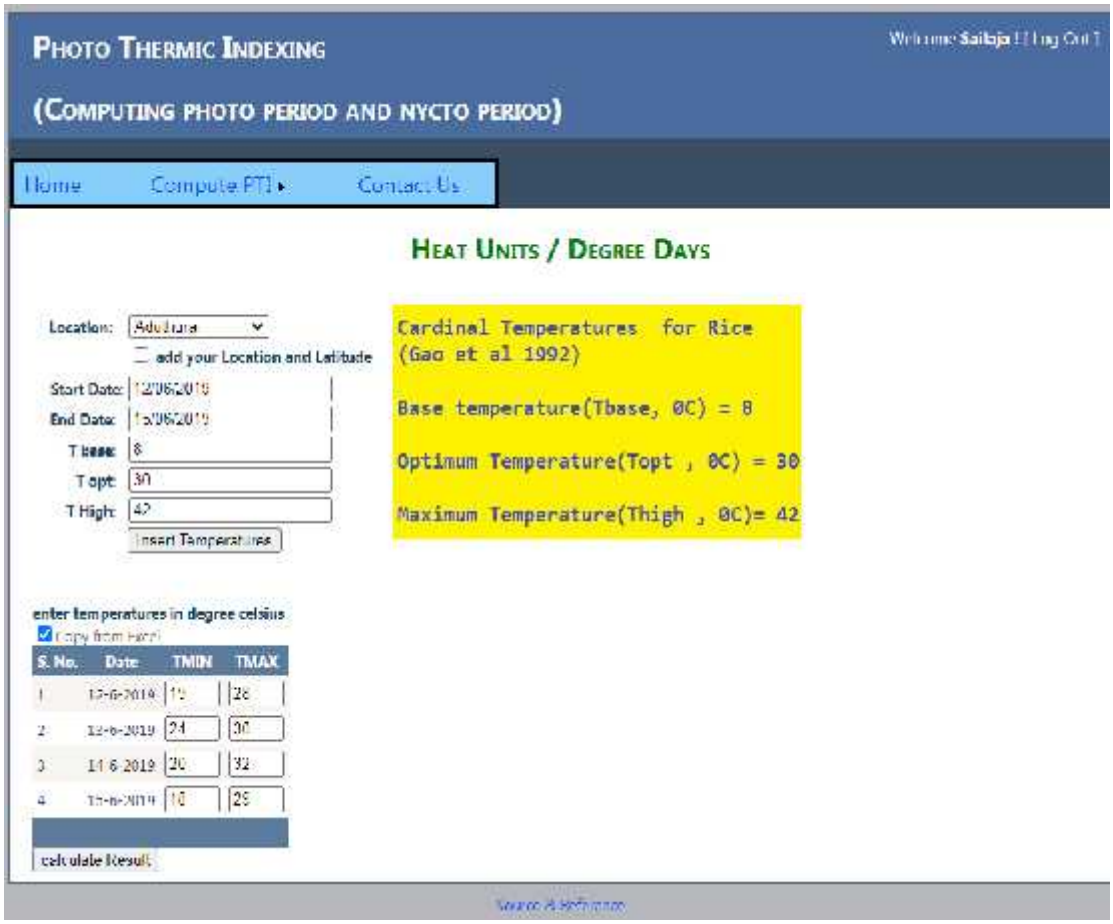
PHOTO THERMIC INDEXING
Welcome Sailaja ! [Log Out]
(COMPUTING PHOTO PERIOD AND NYCTO PERIOD)
Home
Compute PTI
Contact Us
HEAT UNITS / DEGREE DAYS
Location:
Adutura
add your Location and Latitude
Start Date:
End Date:
T base:
T opt:
T High:
Insert Temperatures
Cardinal Temperatures for Rice
(Gao et al 1992)
Base temperature(Tbase, 0C) = 8
Optimum Temperature(Topt , 0C) = 30
Maximum Temperature(Thigh , 0C)= 42
enter temperatures in degree celsius
S. No.
Date
TMIN
TMAX
1
12-6-2019
2
13-6-2019
24
30
3
14 6 2019
20
32
4
15-6-2019
18
28
calculate Result
Source & Reference


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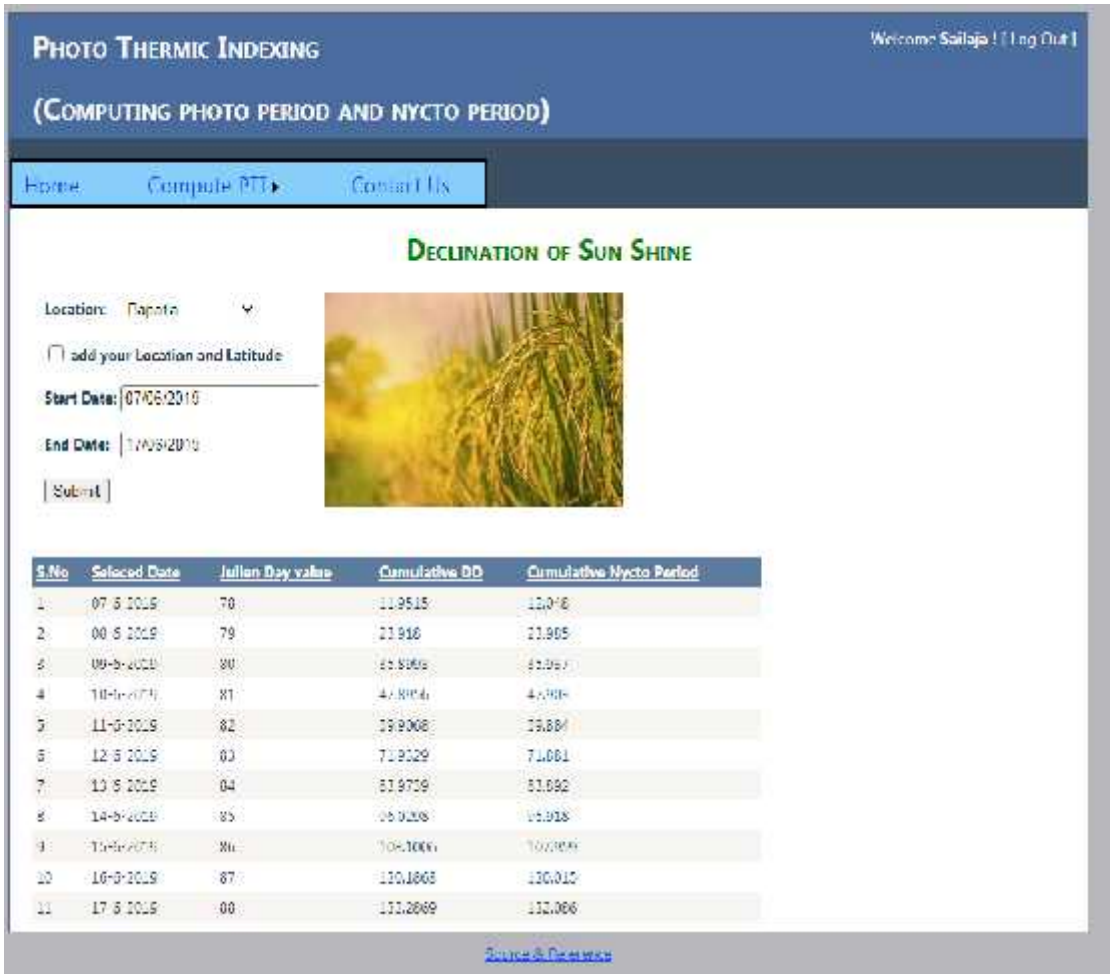
14 6 2019
20
32
4
15-6-2019
18
28
Source & Reference

Daylengh (Photoperiod in hours)

This menu prompts for location, start date and end date and computes photoperiod and nyctoperiod for the input dates. By using the submit button Julian date, photoperiod and nyctoperod will be calculated and displayed in the grid. This data can be copied easily to Excel or Word.



Experimental data- Photoperiod and Nyctoperiod

Experimental data interface has two forms; One form prompts for sowing date, sowings, number of replications and varieties. There are two check boxes for opting the crop growing stages like Panicle Initiation and Flowering. Second form generates grid for the above sowings, replications and varieties. The data can be copied from excel using 'Copy from Excel' check box and by clicking the "Click here to copy data to the grid" the data will be copied to the grid. The by using "Add PTI details", the data will added to the PTI database and computes grid wise photoperiod and nyctoperiod at different stages of rice crop. The values will be displayed in the grid. The data generated by this software can be easily copied to excel and use for further nalysis with other data sets.

PTI Using Experimental Data

Location: IRR

add your Location and Latitude

Sowing stage Level: 1 - Early

Sowing Date for Level1: 10/06/2020

Number of Replications: 2

Number of Varieties: 2

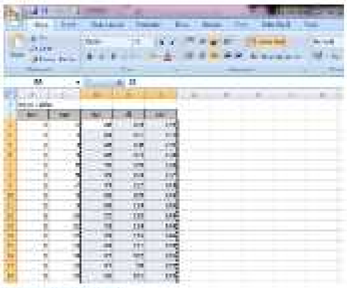
Stage: days pi - panicle initiation days fl - flowering

Add

Copy from excel

```
30	78	120
35	80	125
25	77	128
23	65	123
```

click here to copy data to the Grid below



Location	PTI Year	Sowing Level	Replication	Variety	Days_PI	Days_FL	Days_MAT
IRR	2020	1	1	1	31	78	120
IRR	2020	1	1	2	35	80	125
IRR	2020	1	2	1	25	77	128
IRR	2020	1	2	2	23	65	123

Add PTI Details

Photo Thermic Indexing

(Computing photo period and nycto period)

Welcome Sailaja ! [Log Out]

Home Compute PTI ▸ Contact Us

PTI - Experimental Data

S.No	Level	Replication	Varieties	DD PI	Nycto Period PI	DD FL	Nycto Period FL	DD MAT	Nycto Period MAT
1	1	1	1	356.9	251.1	676.24	801.76	1526.13	1353.87
2	1	2	1	420.42	400.58	1006.07	1023.96	1590.5	1409.5
3	1	1	2	304.76	265.24	1102.16	825.84	1628.01	1442.99
4	1	2	2	230.01	271.99	811.59	748.41	1564.78	1387.22

Source & Reference

This software was evaluated with five years data of photothermic indexing experiment conducted under All India Coordinated Rice Improvement Programme (AICRIP). This software is easily understandable and user friendly. As this program uses solar declination and latitude to compute photoperiod and nyctoperiod, the software can be used for other crops also. This can be easily customized any other experimental designs.