Harsh, the following are the things you need to add more in the GUI features:

Keep the options for adding **n** number of nodes, the crop type option(say, rice, wheat and others), the graphs, the date options (to and from, showing a particular period of time as one wishes) to view the data/graphical representations in the graphs window(box) and the following decision taking or triggering action formulae.

Make it functional to show a demo version to Sir, by applying the data you have got with you or you can use the data for the month of August I am sending alongwith this document(table 1).

**Formulae applied for decision considering only 1 node at a time:**

**Soil moisture depletion, SMD approach**

Total available water, TAW = (M.Cfc - M.Cpwp )/100 \* drz……………….Equation 1

Allowable depletion, AD = TAW \* MAD……………………Equation 2

Where MAD = management allowable depletion

In our case, M.Cfc = 34%; M.Cpwp =16%; drz = 45cm and MAD = 50%

Thus, TAW = (0.34 – 0.16) \* 45 = 8.1cm (from Equation 1)

Allowable depletion, AD = 8.1cm \* 0.5 = 4.05cm or 40.5mm (from Equation 2)

Soil moisture depletion, SMD = AWC \* drz ………..Equation 3

AWC = Available water content in percent

SMDfor the whole profile = SMD1 + SMD2 , in our case as we have considered only two depths.

SMD1,2 represents soil moisture depletion from layers 1 and 2 respectively.

The table below shows only 1st day data for the node

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Day | Layers | depths(cm) | M.C.fc | M.C.present |
| 1 | 1 | 0- 22.5 | 0.34 | 0.29 |
| 2 | 22.5-45.0 | 0.34 | 0.33 |

Similarly, the successive day’s data can be obtained in such a tabular form.

SMD for day 1: SMD1 = AWC1 \* drz1 (from Equation 3)

SMD1 = (0.34-0.29) \* 22.5cm = 1.098cm or 10.98mm (calculated in 4th column of **table1**)

SMD2 = AWC2 \* drz2 (from Equation 3)

SMD2 = (0.34-0.33) \* 22.5cm = 0.2cm or 2.0mm (calculated in 5th column of **table1**)

Thus, SMDtotal = SMD1 + SMD2 = 1.298cm or 12.98mm (as shown in the last column of **table1**)

Thus, we can say that the irrigation needs to be applied when the soil moisture depleted by 4.05cm (applying equation 2) in the root zone depth which we have considered, say 45cm(in our case as only two sensors are installed at two different depths). The same 4.05cm depth of water needs to be applied in the root zone depth to bring the soil profile to field capacity. An example is shown in **table 1**. In the example provided, we have considered the root zone in two layers of 22.5cm each, the two layers soil water content is shown by volumetric moisture content in percentage for P1 and P2 respectively. As can be observed from the table 1, that the soil moisture depletion is more from the top layer than the second profile, and the total soil moisture depletion from the two layers for a particular day is calculated in the last column. It can be seen that the soil moisture depletion increases with the increase in day unless there occurs some precipitation during the growing season. The date for next irrigation did not reach in our case as the moisture depletion was below our allowable depletion level for the subsequent 30 days we have considered.

Another approach

**Not applicable**

**Moisture deficiency, MD:**

MDi % = M.Cfc - M.Ci, %; for ith day

Depth of water to be added due to moisture deficiency = MD% \* ρ \* drz (in cm);

ρ is the bulk density of the soil profiles in g/cc.

ρ1,2 is the bulk density of the 1st and 2nd layer of the soil respectively.

Here, the bulk density is considered to be same for both the profiles.

The calculations of moisture deficiency in percent and the depth of water to be added due to moisture deficiency is done in table 2 for 1st and 2nd layers represented by P1 and P2 respectively. As from the **table 2**, the days marked by red colour denote that the allowable depletion level is reached and that the same amount of water should be applied to bring the moisture content of the plot/field represented by the node to field capacity.

In both the examples it is assumed that a node represents a particular plot or field, and if **n** number of nodes are deployed to a particular plot/field then the data obtained from each node’s sensors for certain depths will not vary much from the other nodes data, and so, the soil moisture depletion in each nodes will remain more or less the same and hence the irrigation date will also remain the same.

**Table 1:** Calculations of a month for a single node

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Days | P1 | P2 | SMD,mm for P1 | SMD,mm for P2 | Total SMD, mm |
| 1 | 29.12 | 33.11 | 10.98 | 2.00 | 12.98 |
| 2 | 24.08 | 32.28 | 22.32 | 3.87 | 26.19 |
| 3 | 23.43 | 32.05 | 23.78 | 4.39 | 28.17 |
| 4 | 23.1 | 31.97 | 24.53 | 4.57 | 29.09 |
| 5 | 22.48 | 31.89 | 25.92 | 4.75 | 30.67 |
| 6 | 26.17 | 32.55 | 17.62 | 3.26 | 20.88 |
| 7 | 25.14 | 32.43 | 19.94 | 3.53 | 23.47 |
| 8 | 24.29 | 32.27 | 21.86 | 3.89 | 25.75 |
| 9 | 23.84 | 32.20 | 22.87 | 4.04 | 26.91 |
| 10 | 23.37 | 32.18 | 23.92 | 4.09 | 28.01 |
| 11 | 22.99 | 32.10 | 24.78 | 4.28 | 29.06 |
| 12 | 23.01 | 32.01 | 24.73 | 4.48 | 29.21 |
| 13 | 23.04 | 32.02 | 24.65 | 4.44 | 29.09 |
| 14 | 22.76 | 31.93 | 25.29 | 4.66 | 29.95 |
| 15 | 22.62 | 31.89 | 25.59 | 4.74 | 30.34 |
| 16 | 23.7 | 32.33 | 23.18 | 3.77 | 26.94 |
| 17 | 23.49 | 32.49 | 23.65 | 3.40 | 27.06 |
| 18 | 23.34 | 32.35 | 23.98 | 3.72 | 27.69 |
| 19 | 25.01 | 32.76 | 20.23 | 2.79 | 23.01 |
| 20 | 28.38 | 33.45 | 12.65 | 1.24 | 13.89 |
| 21 | 28.18 | 33.28 | 13.11 | 1.62 | 14.73 |
| 22 | 28.72 | 33.61 | 11.89 | 0.87 | 12.76 |
| 23 | 27.35 | 33.44 | 14.96 | 1.25 | 16.21 |
| 24 | 24.09 | 32.89 | 22.29 | 2.50 | 24.79 |
| 25 | 23.7 | 32.59 | 23.18 | 3.17 | 26.35 |
| 26 | 22.79 | 32.21 | 25.22 | 4.03 | 29.25 |
| 27 | 24.52 | 32.28 | 21.33 | 3.87 | 25.20 |
| 28 | 25.55 | 32.63 | 19.01 | 3.08 | 22.09 |
| 29 | 24.64 | 32.64 | 21.05 | 3.07 | 24.12 |
| 30 | 23.03 | 32.11 | 24.69 | 4.25 | 28.93 |

Table 2: Not correct to be used as in our case…

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Days | P1 | P2 | Moisture deficiency,% for P1 | Moisture deficiency,% for P2 | Depth of water to be added, cm | | |
|  |  |  |  |  | In 1st profile | In 2nd profile | For both profile |
| 1 | 29.12 | 33.11 | 4.88 | 0.89 | 1.65 | 0.30 | 1.95 |
| 2 | 24.08 | 32.28 | 9.92 | 1.72 | 3.35 | 0.58 | 3.93 |
| 3 | 23.43 | 32.05 | 10.57 | 1.95 | 3.57 | 0.66 | 4.23 |
| 4 | 23.1 | 31.97 | 10.90 | 2.03 | 3.68 | 0.69 | 4.36 |
| 5 | 22.48 | 31.89 | 11.52 | 2.11 | 3.89 | 0.71 | 4.60 |
| 6 | 26.17 | 32.55 | 7.83 | 1.45 | 2.64 | 0.49 | 3.13 |
| 7 | 25.14 | 32.43 | 8.86 | 1.57 | 2.99 | 0.53 | 3.52 |
| 8 | 24.29 | 32.27 | 9.71 | 1.73 | 3.28 | 0.58 | 3.86 |
| 9 | 23.84 | 32.20 | 10.16 | 1.80 | 3.43 | 0.61 | 4.04 |
| 10 | 23.37 | 32.18 | 10.63 | 1.82 | 3.59 | 0.61 | 4.20 |
| 11 | 22.99 | 32.10 | 11.01 | 1.90 | 3.72 | 0.64 | 4.36 |
| 12 | 23.01 | 32.01 | 10.99 | 1.99 | 3.71 | 0.67 | 4.38 |
| 13 | 23.04 | 32.02 | 10.96 | 1.98 | 3.70 | 0.67 | 4.36 |
| 14 | 22.76 | 31.93 | 11.24 | 2.07 | 3.79 | 0.70 | 4.49 |
| 15 | 22.62 | 31.89 | 11.38 | 2.11 | 3.84 | 0.71 | 4.55 |
| 16 | 23.7 | 32.33 | 10.30 | 1.67 | 3.48 | 0.57 | 4.04 |
| 17 | 23.49 | 32.49 | 10.51 | 1.51 | 3.55 | 0.51 | 4.06 |
| 18 | 23.34 | 32.35 | 10.66 | 1.65 | 3.60 | 0.56 | 4.15 |
| 19 | 25.01 | 32.76 | 8.99 | 1.24 | 3.03 | 0.42 | 3.45 |
| 20 | 28.38 | 33.45 | 5.62 | 0.55 | 1.90 | 0.19 | 2.08 |
| 21 | 28.18 | 33.28 | 5.83 | 0.72 | 1.97 | 0.24 | 2.21 |
| 22 | 28.72 | 33.61 | 5.28 | 0.39 | 1.78 | 0.13 | 1.91 |
| 23 | 27.35 | 33.44 | 6.65 | 0.56 | 2.24 | 0.19 | 2.43 |
| 24 | 24.09 | 32.89 | 9.91 | 1.11 | 3.34 | 0.38 | 3.72 |
| 25 | 23.7 | 32.59 | 10.30 | 1.41 | 3.48 | 0.48 | 3.95 |
| 26 | 22.79 | 32.21 | 11.21 | 1.79 | 3.78 | 0.60 | 4.39 |
| 27 | 24.52 | 32.28 | 9.48 | 1.72 | 3.20 | 0.58 | 3.78 |
| 28 | 25.55 | 32.63 | 8.45 | 1.37 | 2.85 | 0.46 | 3.31 |
| 29 | 24.64 | 32.64 | 9.36 | 1.36 | 3.16 | 0.46 | 3.62 |
| 30 | 23.03 | 32.11 | 10.97 | 1.89 | 3.70 | 0.64 | 4.34 |