Concepts needed for Irrigation Scheduling

Thursday, October 12, 2023 12:05 AM

1) Rainfall

Mapped using various methods

(Weather API)

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Calculate the direct runoff → used to design hydraulically efficient channel (manning's equation)

$V = \frac{(R)^{2/3}(S)^{1/2}}{n}$ derived from soil data mapping

$$\text{Volume} = \int_0^t Q(t)dt$$

$$V = \frac{(\text{mean rainfall on plot} - 0.3\times \text{water depth retention})^2}{(\text{mean rainfall on plot} + 0.7\times \text{water depth retention})} = \frac{(P-0.3S)^2}{(P+0.7S)}$$

$$S = \frac{25400}{\text{curve no.}} - 254$$

Curve Number → Derived from Digital Soil Map

↳ Calculated using AMC

2) Deep Percolation (part of infiltration)

↳ Depends on hydraulic conductivity, porosity and other Aquifer parameters (ASSUMPTION: Basin Irrigation)

3) ET_c (Based on crop type → seasonal cycle for different growth phase)

↳ Based on the balance between RAW, Root zone depletion and my ML model for ET_o we can map the ET_c and stress coefficient Ks we can get $ET_{c,adj}$ to get the perfect balance of Irrigation. Based on the amount of irrigation farmer does, the trajectory to a healthy plant can be mapped.

$$\text{NIR } d = \sum\left(\frac{M_{fci} - M_{bi}}{100}\right) \times A_i D_i$$

$$\text{GIR} = \frac{\text{NIR}}{\text{field efficiency}}$$ → Design of pumping based on method (Head value)

$$d_{gross} = \frac{d}{E_a}$$

M_{fci} = FC moisture of i^{th} layer

M_{bi} = Moisture content before irrigation in i^{th} layer

A_i = Bulk density

D_i = depth of layer

$$\text{Irrigation Frequency} = \frac{\text{Depth of water in one irrigation}}{\text{Peak } ET_c}$$

$d = (FC - PWP) \times \rho_{bulk}$

Concepts that I need to explore more: Water Stress coefficient vs. Actual yield

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can help in nutrient management....