Yield stable in this M Range

M → 0.15 - 0.85 Range

Marginal costs = $\frac{\text{change in Total Costs}}{\text{Change in Units}}$

Marginal revenue = $\frac{\text{Change in Revenue}}{\text{change in Units}}$

Y max = 100

Y decay Rate 1 = 0.03

Initial Moisture 1 = 0.5

Water Delay = 7

R(t) from given file

~~M(t)~~ M decay Rate 1 = 0.095

M(t+1) = M(t) - 0.095 + R(t)

0.665 loss every week

+0.3 W1

ask for this

Sample M for F1

M(1) = 0.5 +0.3 0.8

M(2) = 0.405

M(3) = 0.311

M(4) = 0.216

M(5) = 0.117

M(6) = 0.023

M(7) = -0.07 +0 0.135 0.293

M(8) = -0.163 +0.507 0.8

M(9) =

M(10) =

M(11) =

M(12) =

M(13) =

M(14) = 0.135

M(15) =

M(16) =

Table assumes max yield calculations

These calculations are done with constants to illustrate the math. For the 4 farmers, we will use the given data to calculate and formulate decision strategies

For max yield calculations (with price/water → 0.2)

total_water 1 = 0.3 + 0.665(16)

F1 Profit = Ymax − total_water1 * price of water

Sample F1 profit = 100 − 10.94(0.2) = 97.812

Impact of water bought vs Impact of Yield

Decay Yield per day is 0.03. So per week → 0.21

Decay after 120 days = 3.6

At 50% Yield,

Sample F1 profit = 50 − x(0.2)

Even if x = 0 F1 profit << 97.812

So we need a yield of atleast 97.812 to maximize our profits in this case.

Unit price of water * Required water scales much faster than Decay in Yield

∴ We can afford a decay of ≈ 2 units

$\frac{2}{0.21/wk} = 9.5$ so optimally, we can work w/o water on alternating weeks

However, not getting any water for a week was "unfair" earlier. We can offset this by purchasing half the req amount to 0.8 i.e Rs

$$\frac{0.8 + 0.15}{2} = 0.475$$

This keeps our Yield solid for 3 days To max yield and maintain atleast 50% of the max yield. → Stable yield for 5 days

$0.475 + 0.095 = 0.57$ units of water.

At 0.57 units, Flprofit = 97.147

This calculation maximizes the profit of the farmer regardless of what the unit price of water would be!
We achieved this by calculating Marginal Revenue & Marginal Cost. Setting them equal to each other gets us Maximized Profit MC = MR

Note that Rain Forecast amounts will be summed up for the coming week & adjusted in the 0.57 units purchased to further enhance profits