Transformation Elasticity for regional version of SIMPLE derived by mrwater

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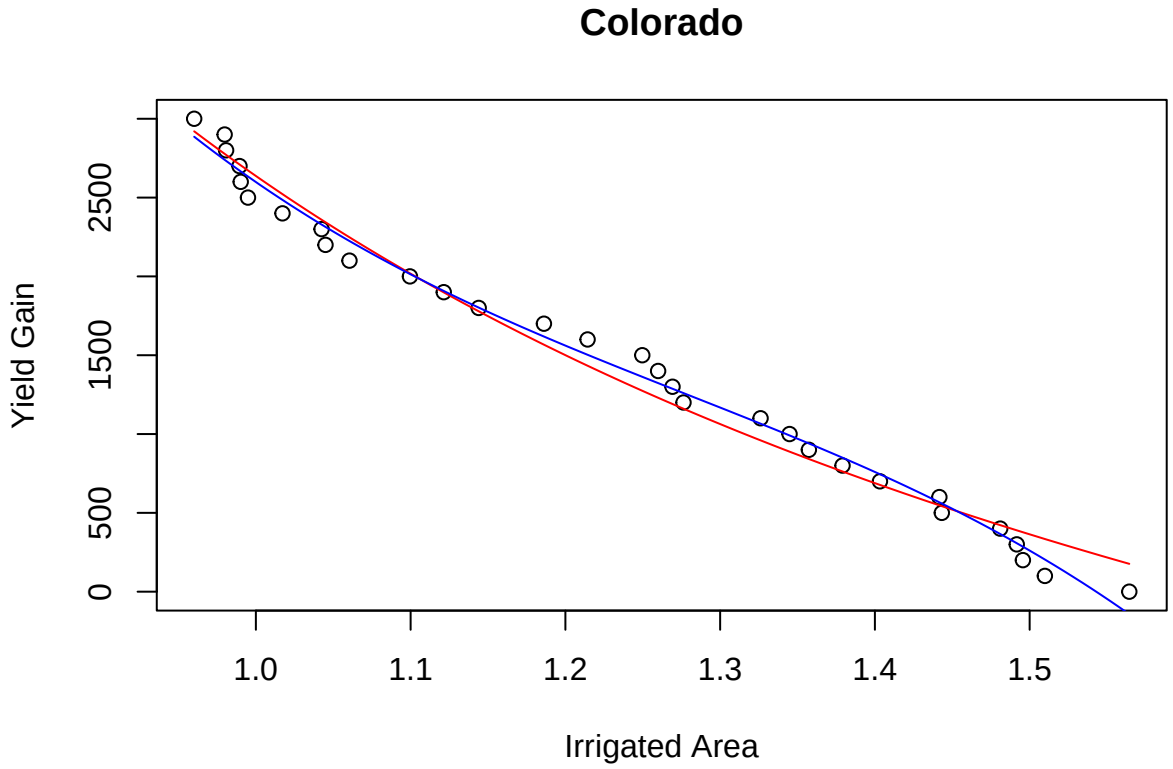
2023-09-08

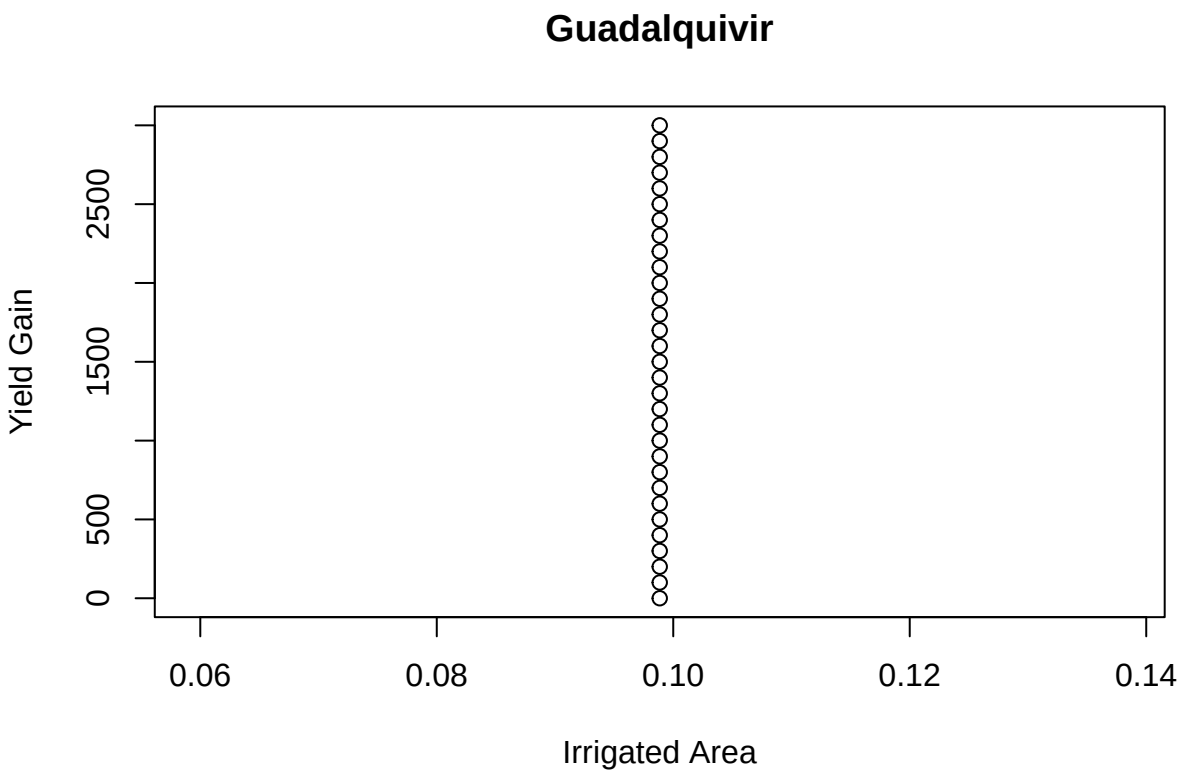
Introduction

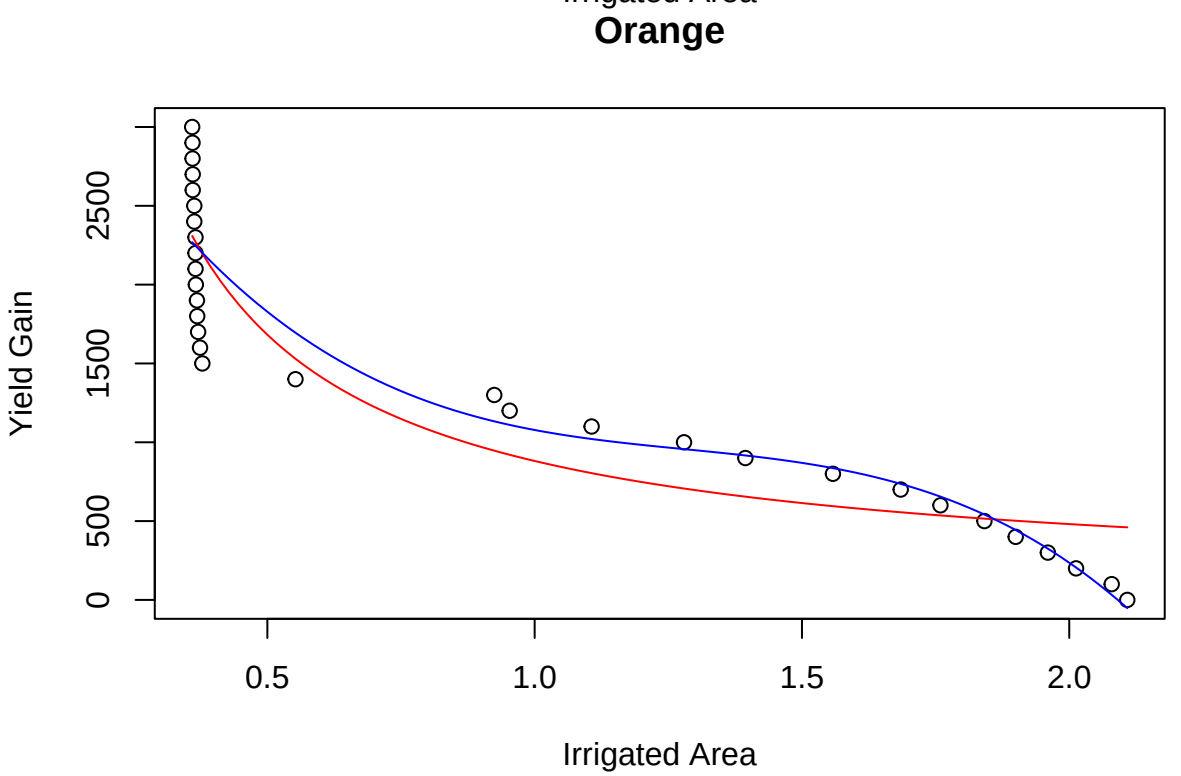
Here, we assess use data from mrwater to derive the transformation elasticity between rainfed and irrigated land at an aggregated scale.

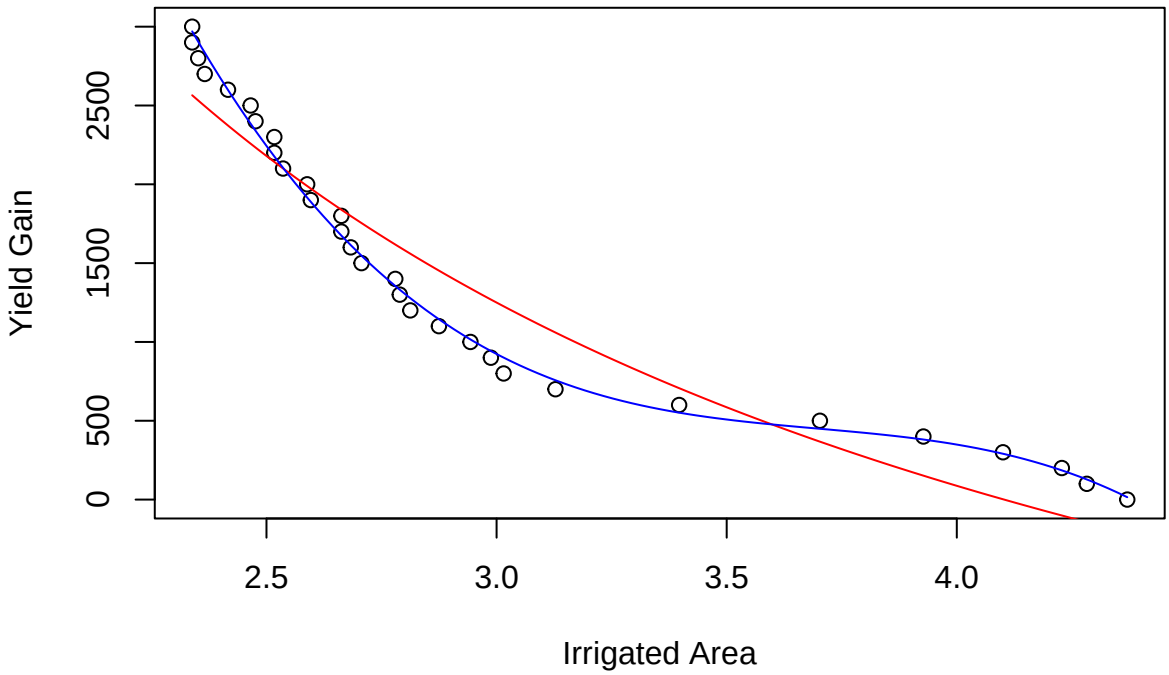
Basin Elasticity

I tried to fit the simulated data (little circles in the graph) to some functional form using a regression. I tried 1/x (red) and a polynomial function (blue).

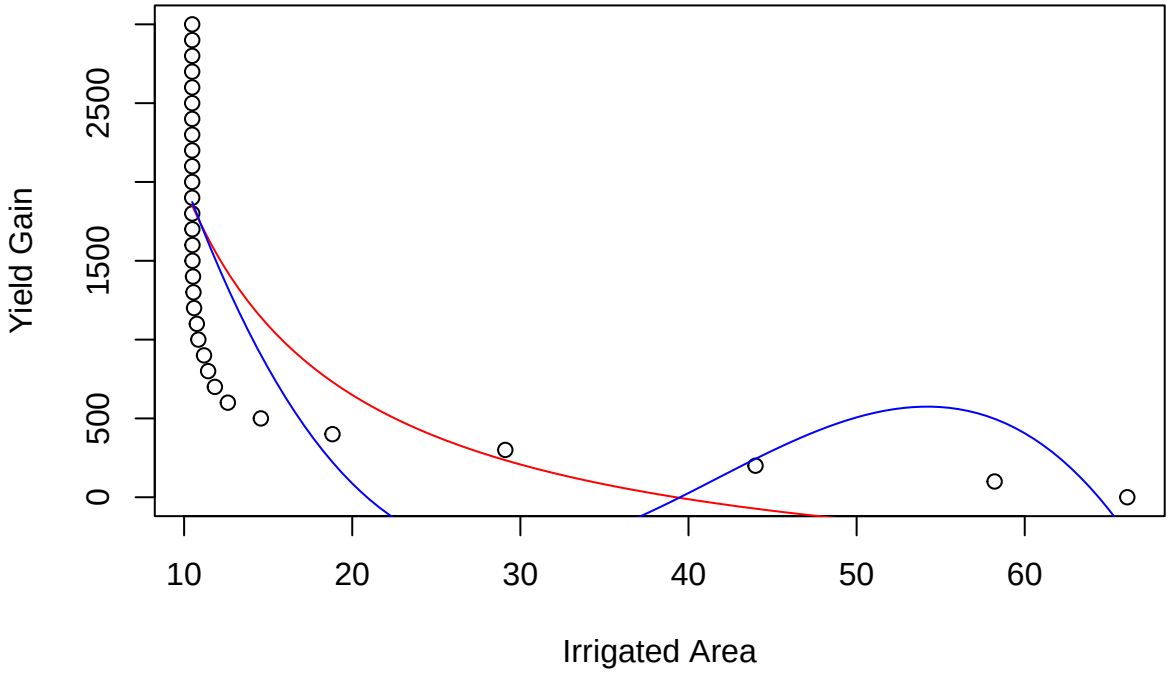


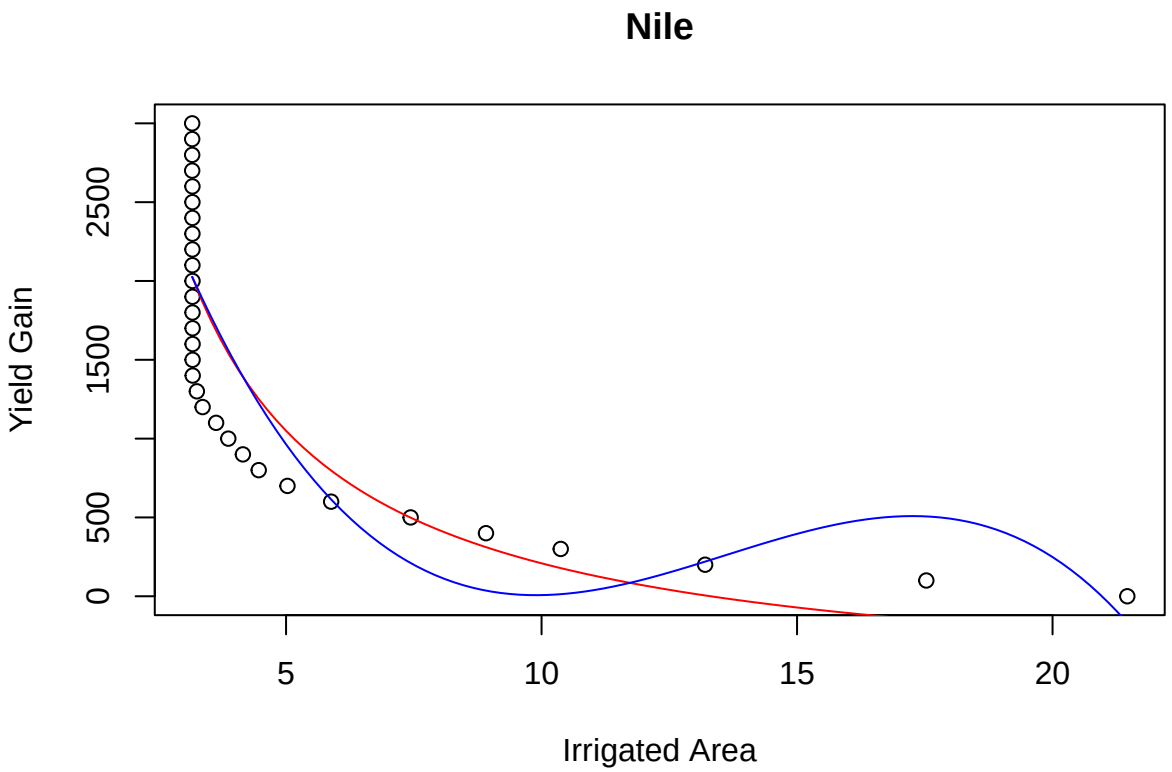

Guadalquivir
Yield Gain
0
500
1500
2500
0.06
0.08
0.10
0.12
0.14
Irrigated Area

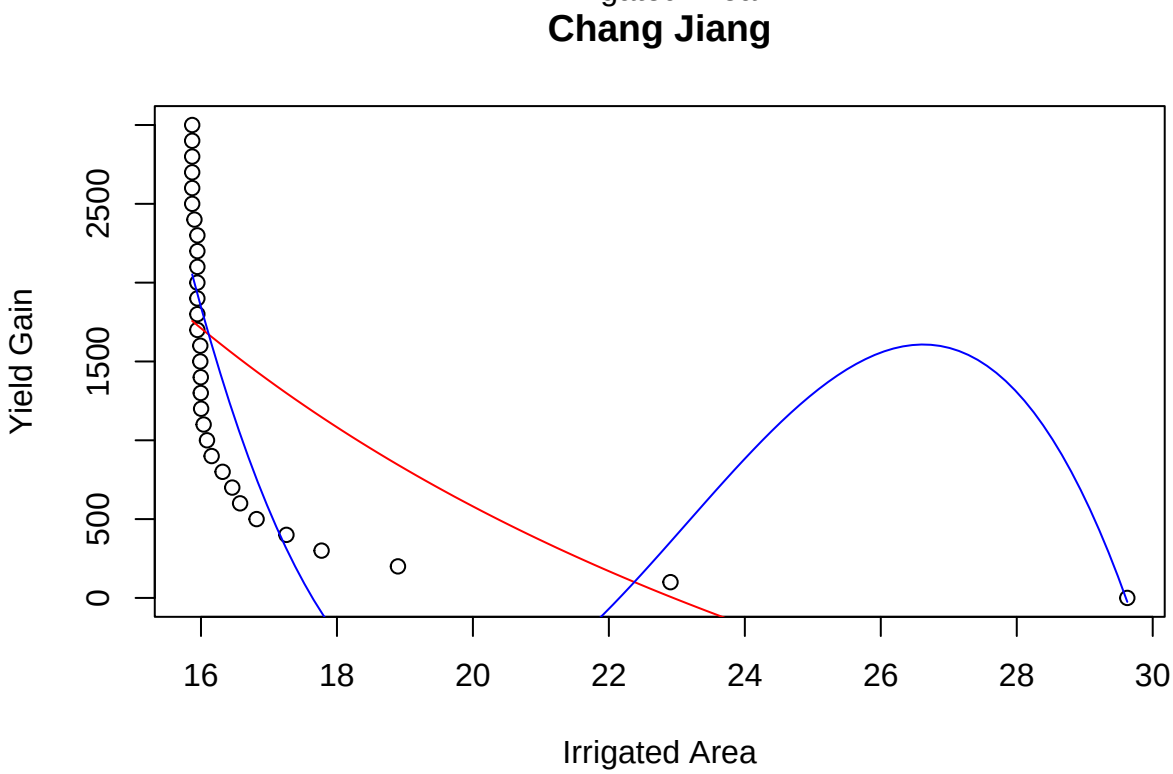

Orange
Yield Gain
0
500
1500
2500
0.5
1.0
1.5
2.0
Irrigated Area

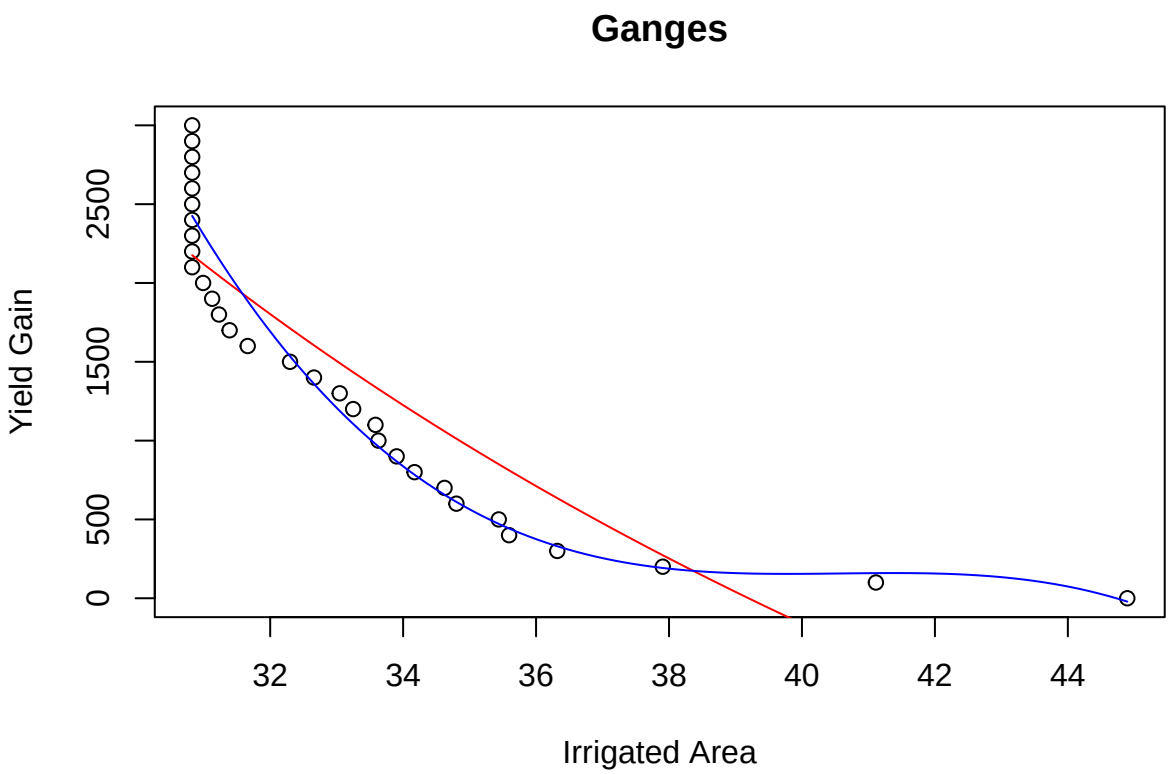


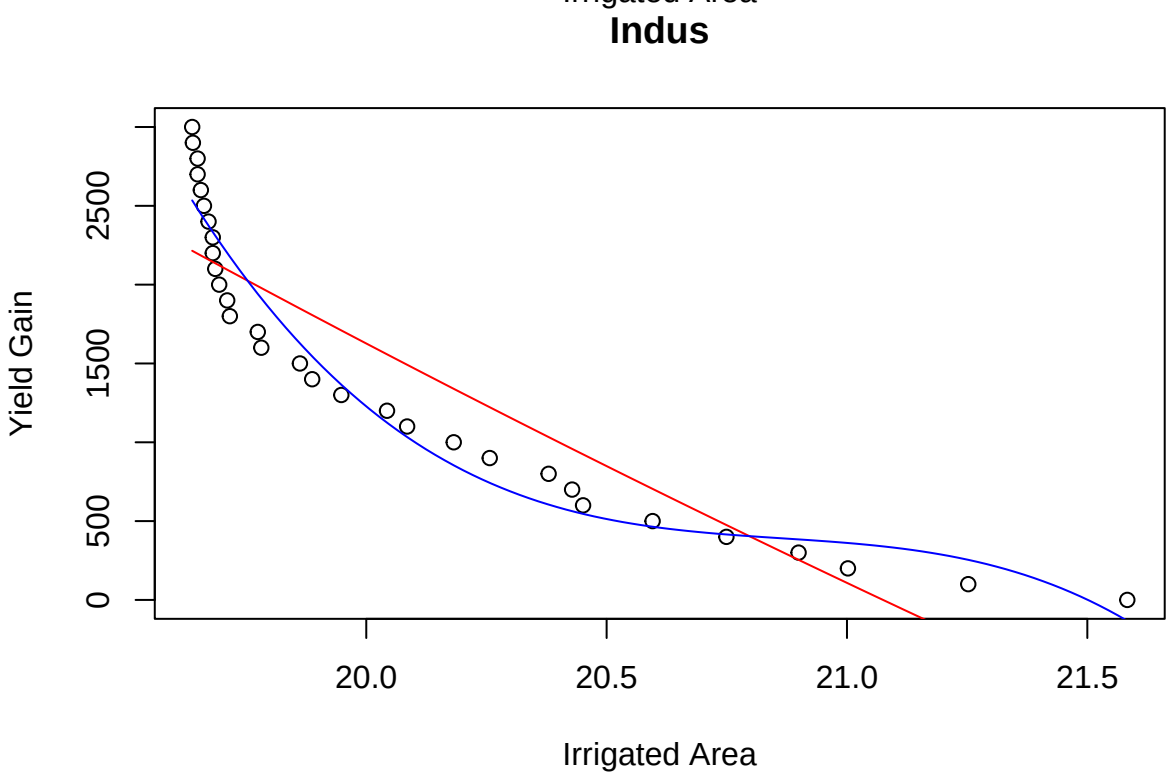
Mississippi

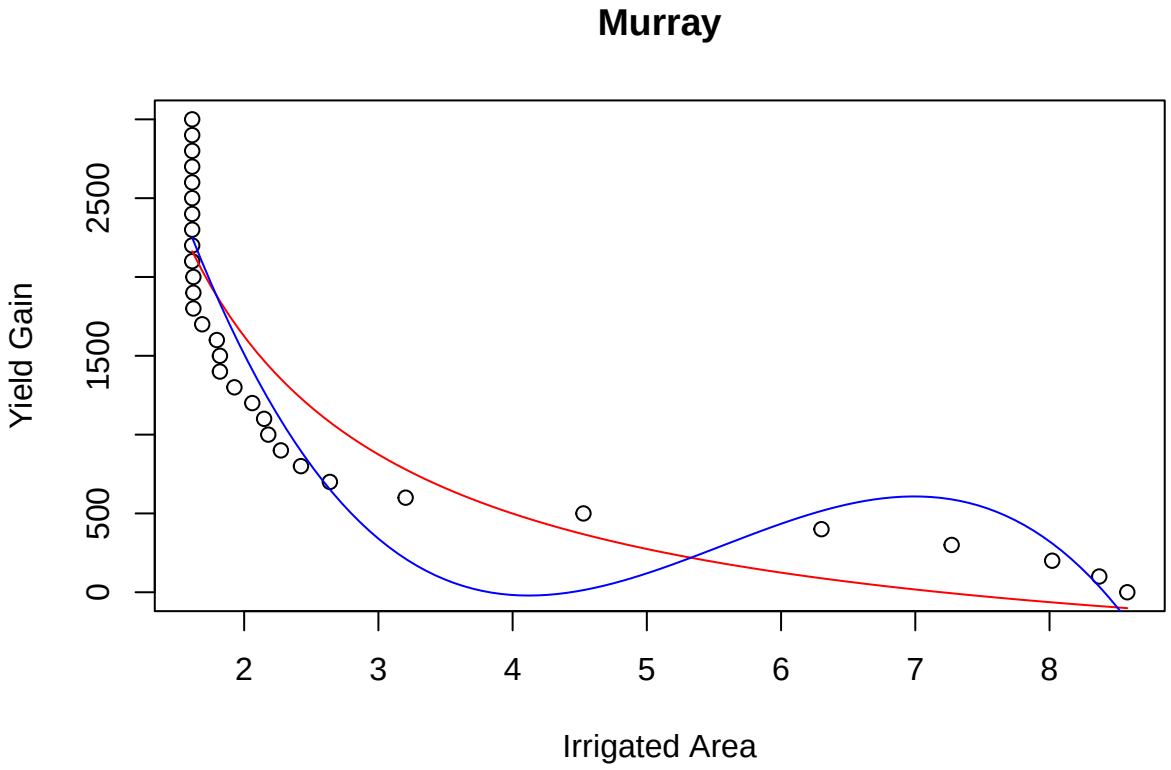


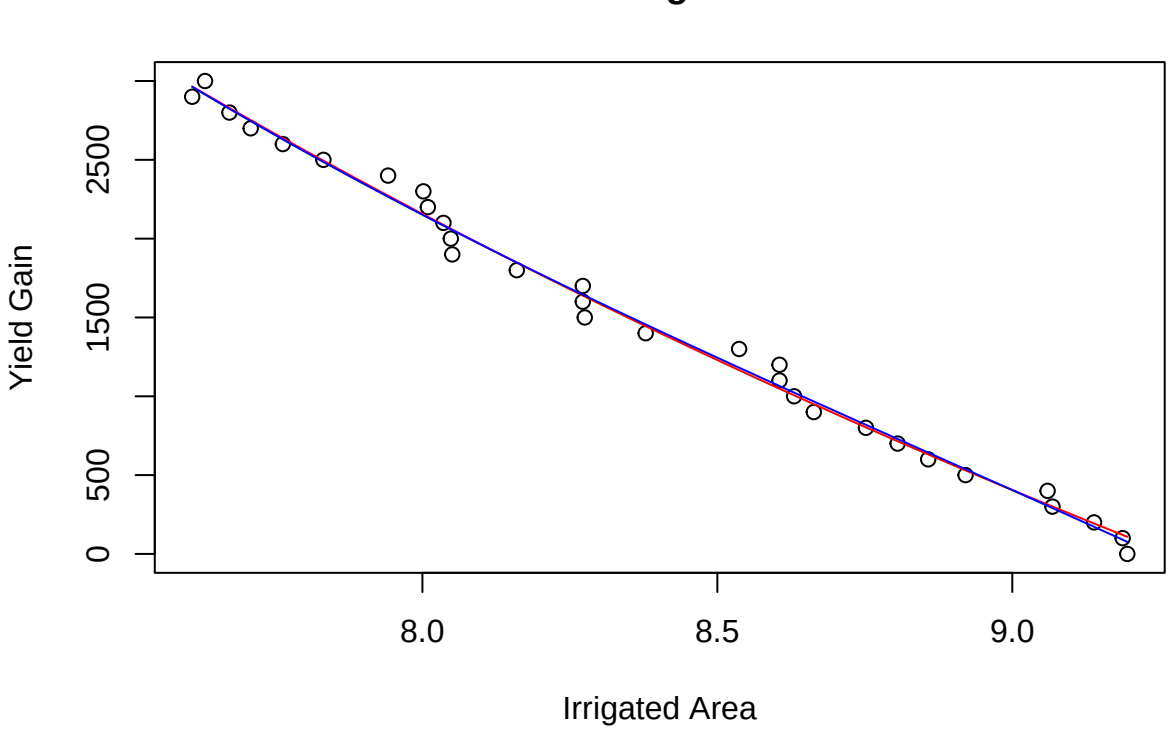

Nile
Yield Gain
0
500
1500
2500
5
10
15
20
Irrigated Area

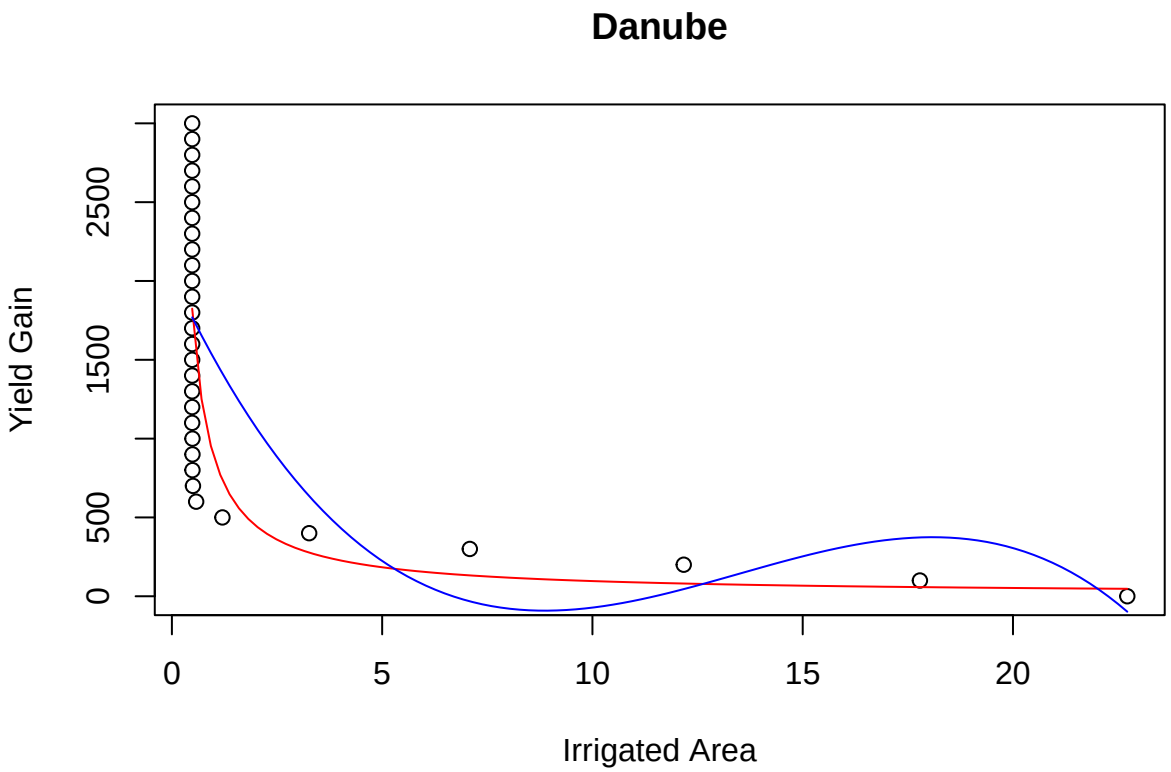

Chang Jiang
Yield Gain
0
500
1500
2500
16
18
20
22
24
26
28
30
Irrigated Area

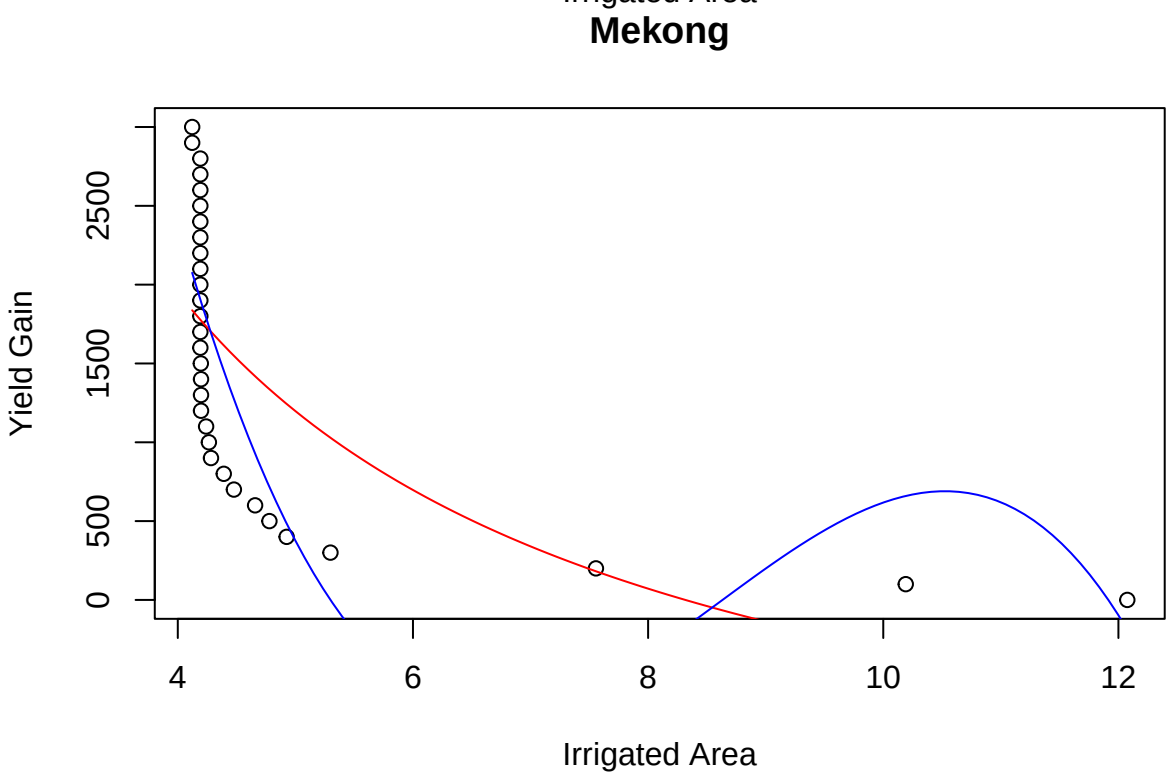

Ganges
Yield Gain
0
500
1500
2500
32
34
36
38
40
42
44
Irrigated Area

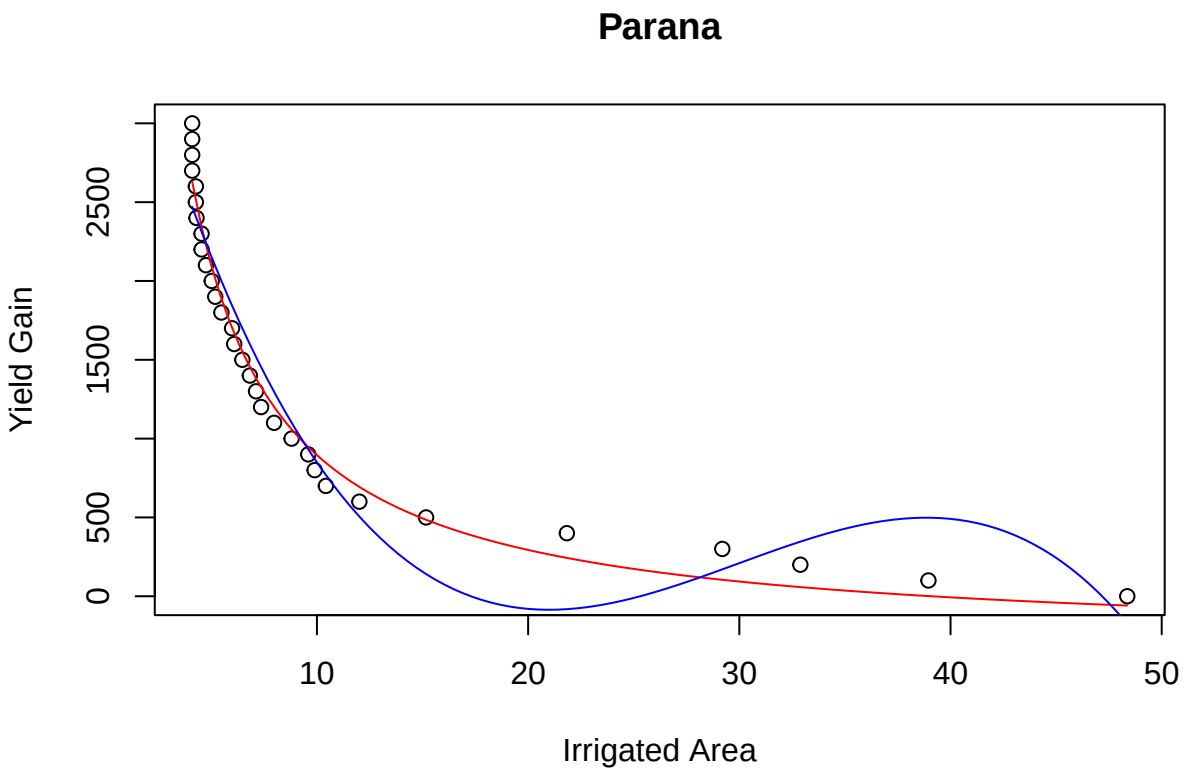

Indus
Yield Gain
0
500
1500
2500
20.0
20.5
21.0
21.5
Irrigated Area

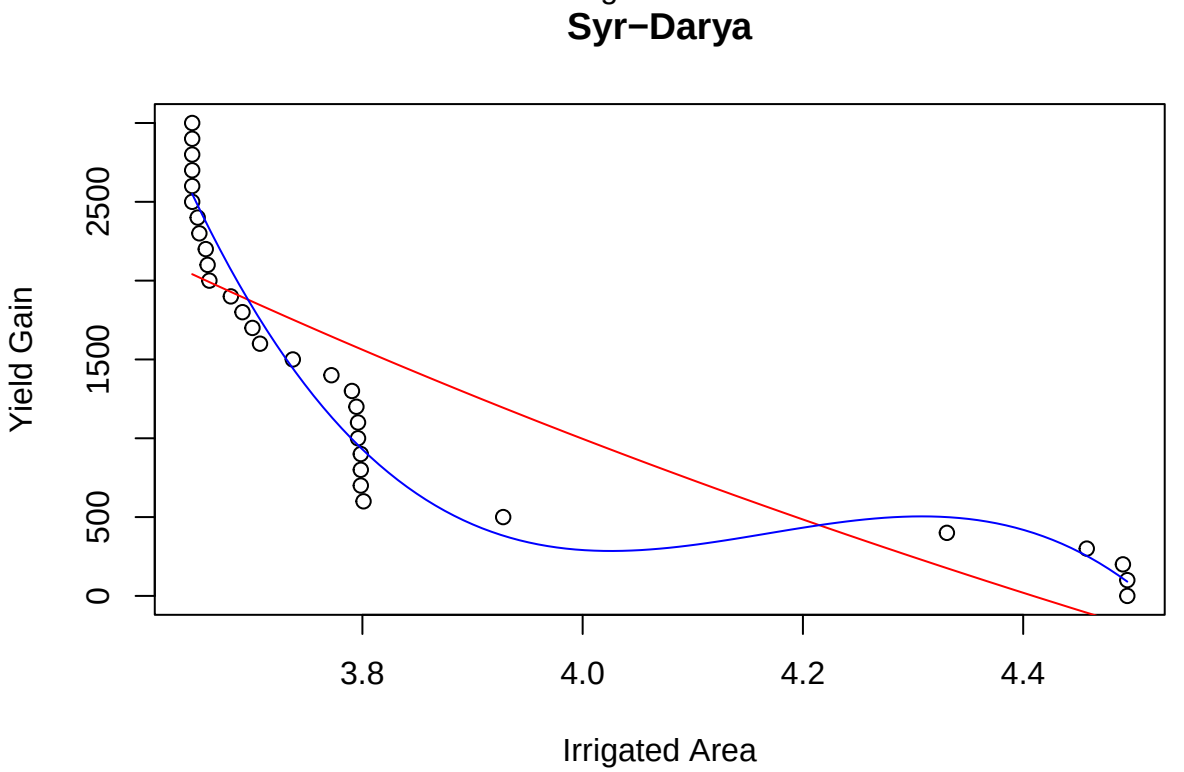

Murray
Yield Gain
0
500
1500
2500
2
3
4
5
6
7
8
Irrigated Area

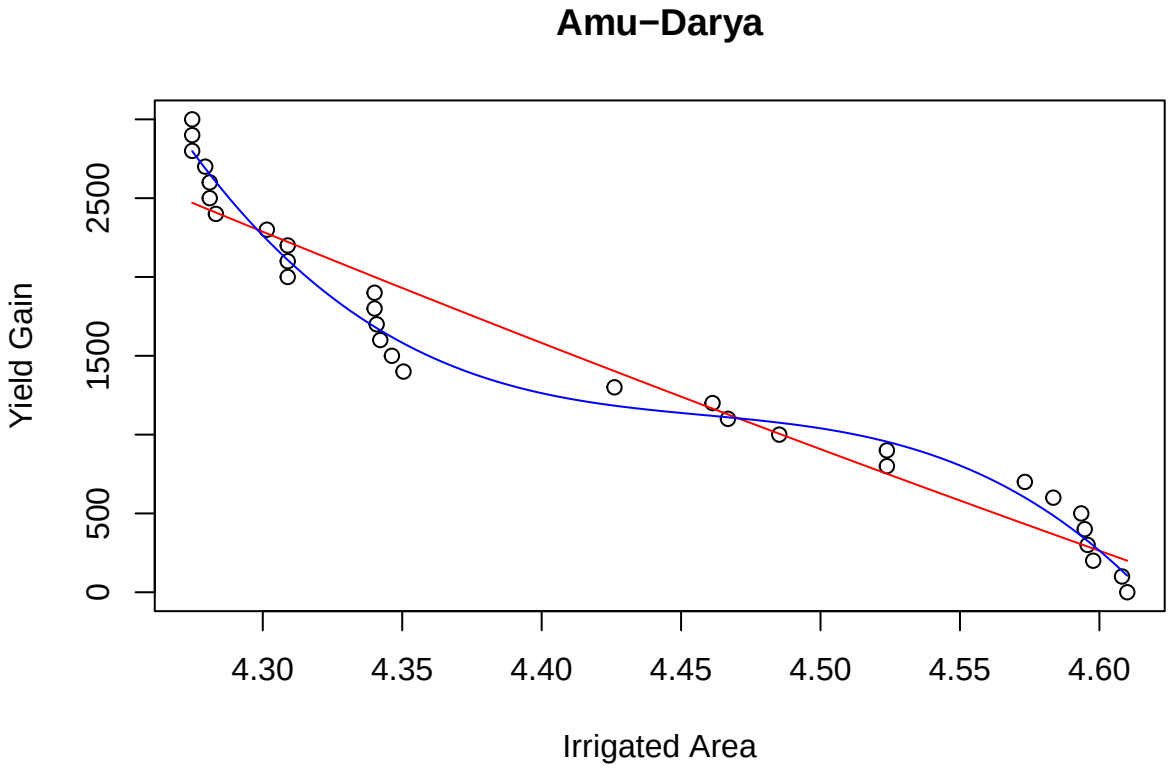

Huang He
Yield Gain
0
500
1500
2500
8.0
8.5
9.0
Irrigated Area


Danube
Yield Gain
0
500
1500
2500
0
5
10
15
20
Irrigated Area


Mekong
Yield Gain
0
500
1500
2500
4
6
8
10
12
Irrigated Area


Parana
Yield Gain
0
500
1500
2500
10
20
30
40
50
Irrigated Area


Syr−Darya
Yield Gain
0
500
1500
2500
3.8
4.0
4.2
4.4
Irrigated Area



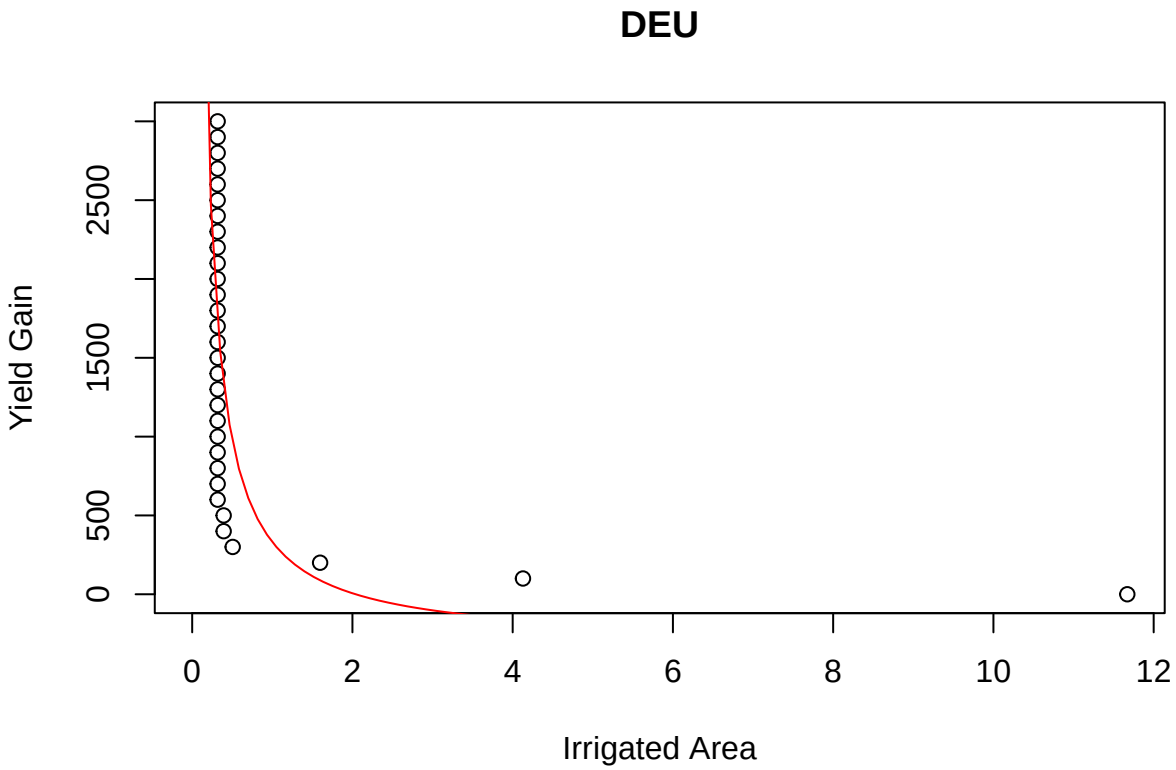
Note: I also tried log(x), sqrt(x), x + x^2. They all look worse.

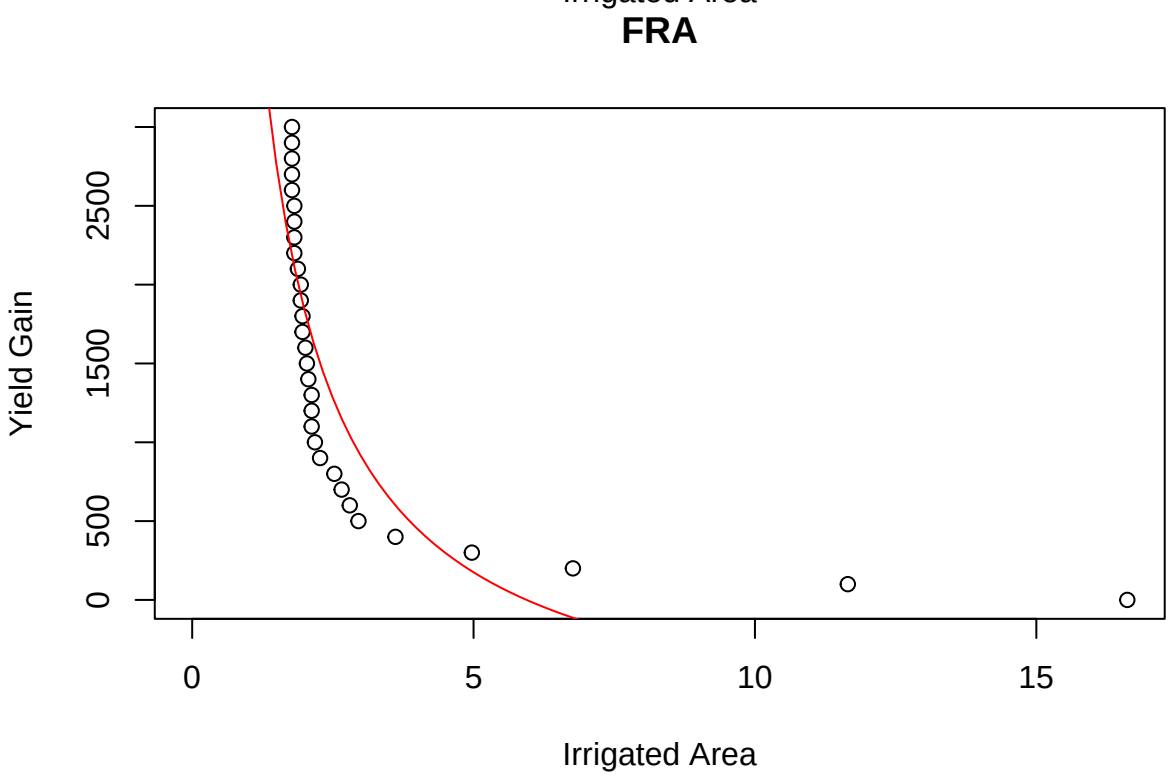
The functional form seems to vary by basin, wich I believe is a bit problematic. There are also completely inelastic basins (like Guadalquivir in Spain). For these, the function could not be fitted, but I think these are special cases for which we just assume completely inelastic demand (elasticity is 0).

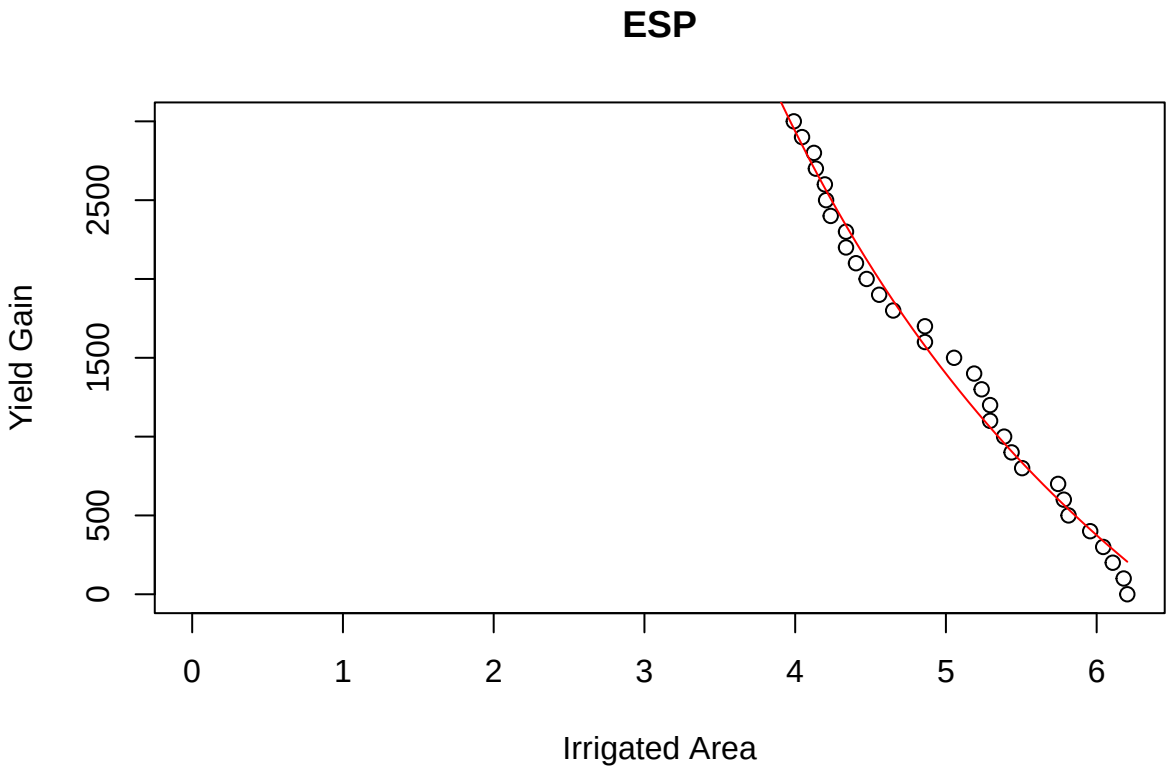
Questions: How to choose a good data range? (probably country-specific) How to choose a good functional form? (seems to be different by country... we need a flexible functional form)

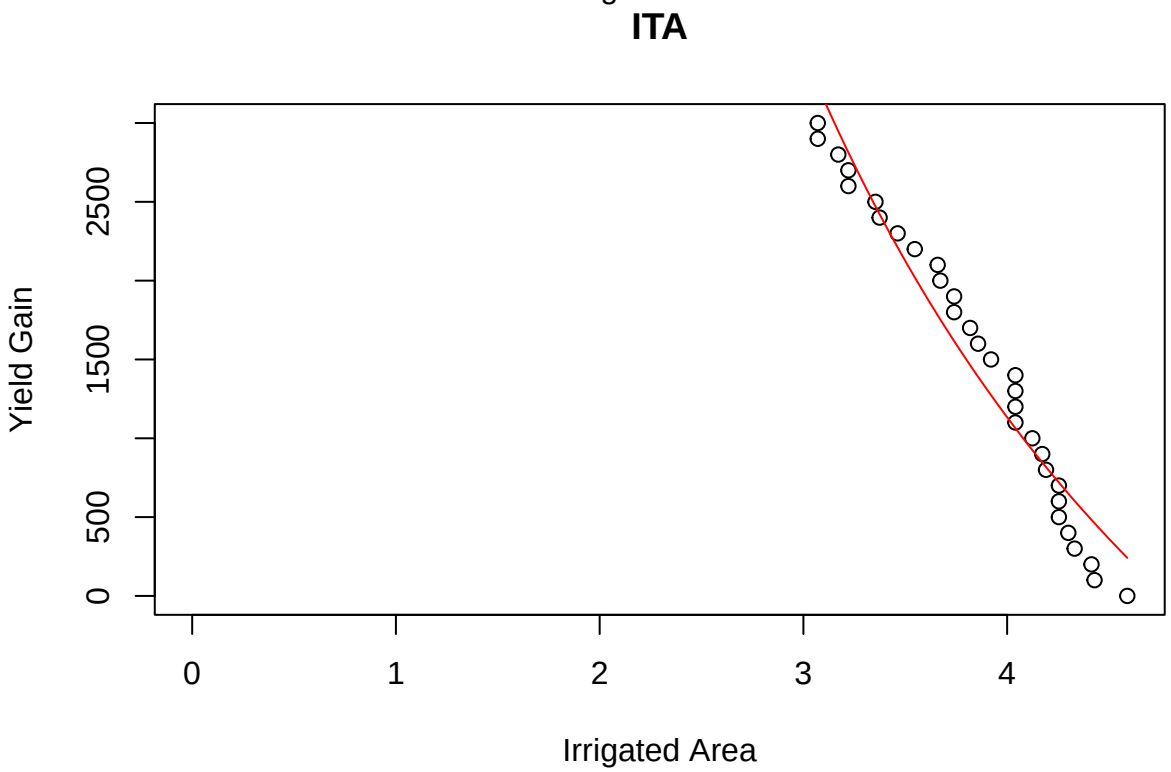
Country elasticity

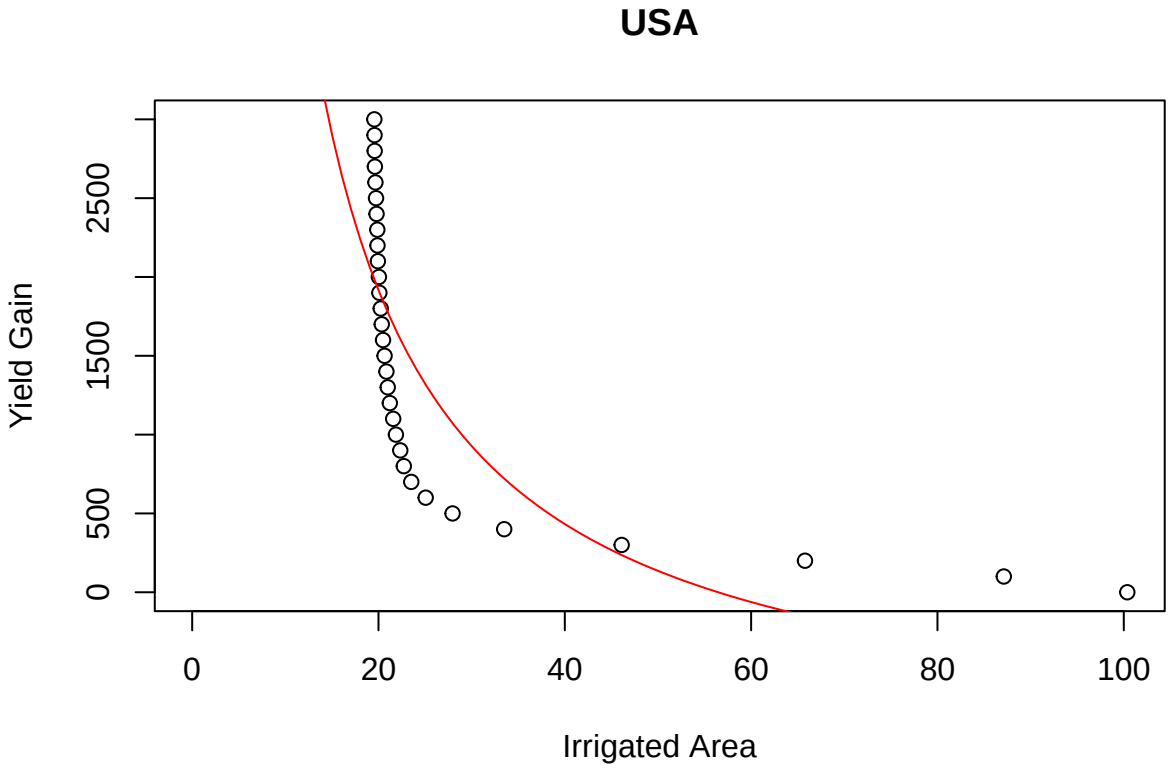
I repeated this exercise for some countries. In that case the functional form 1/x seemed to fit better. I still wonder whether this is good enough (see IND, CHN, USA).

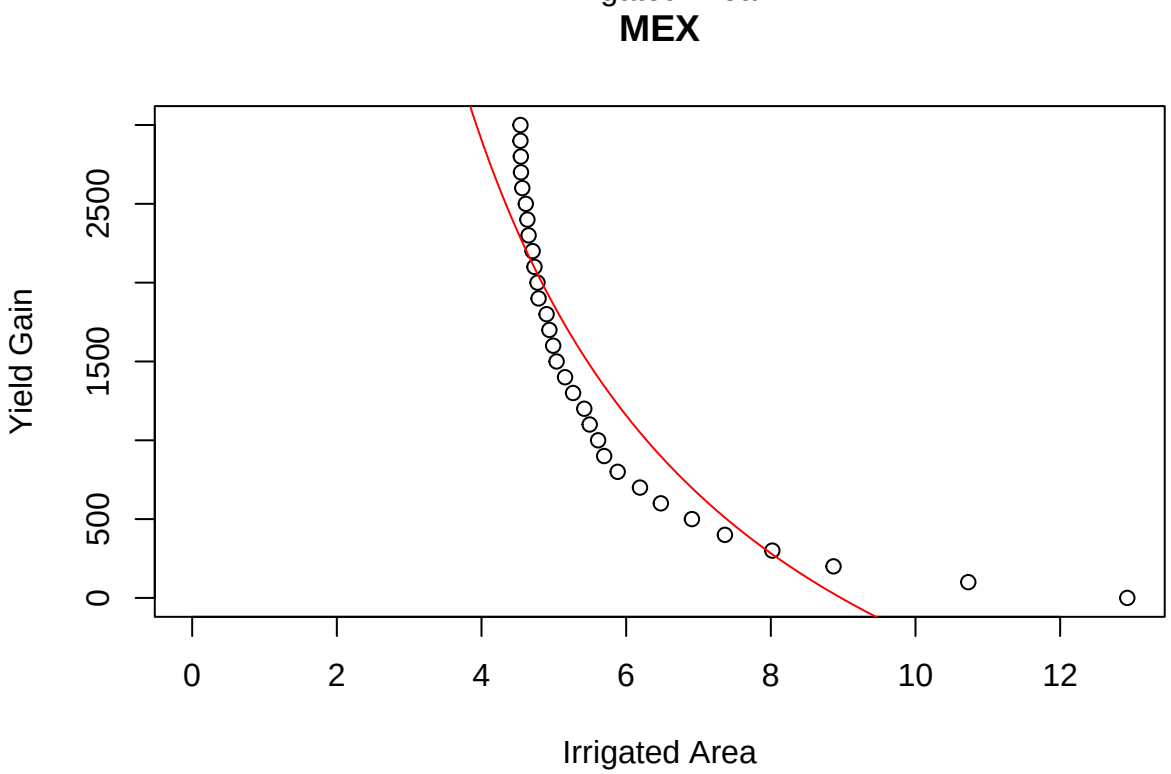

DEU
Yield Gain
0
500
1500
2500
0
2
4
6
8
10
12
Irrigated Area

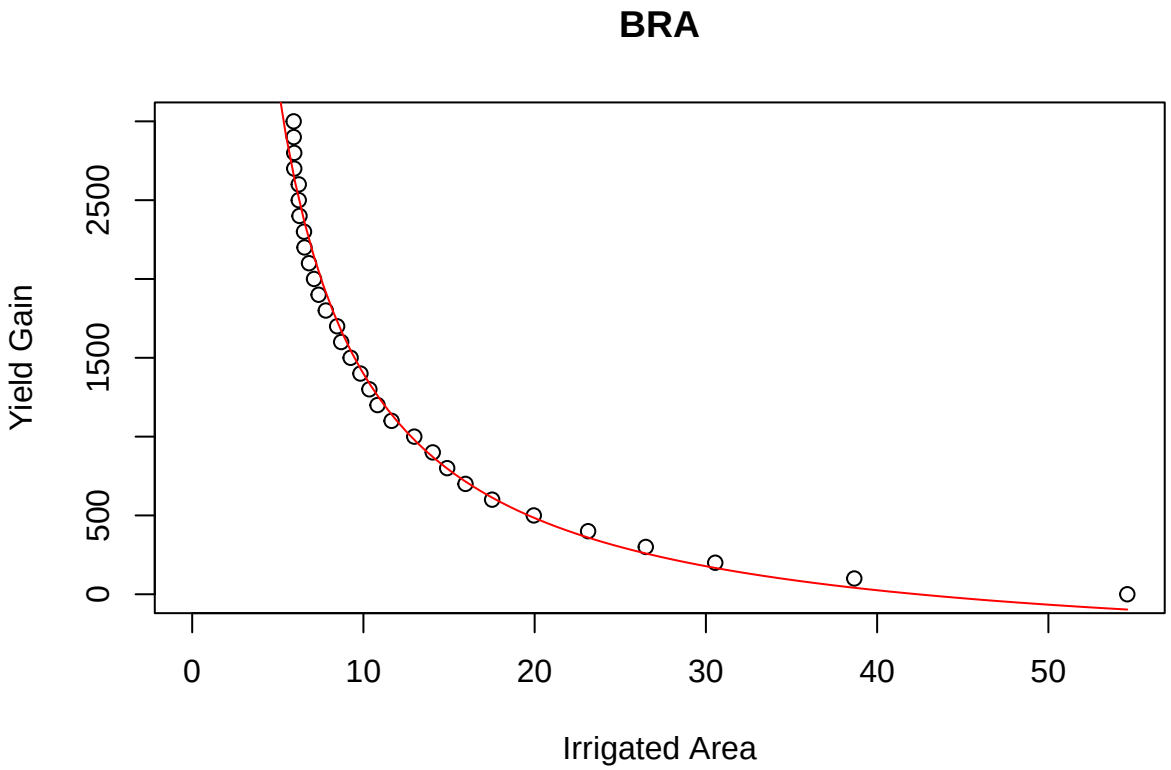

FRA
Yield Gain
0
500
1500
2500
0
5
10
15
Irrigated Area

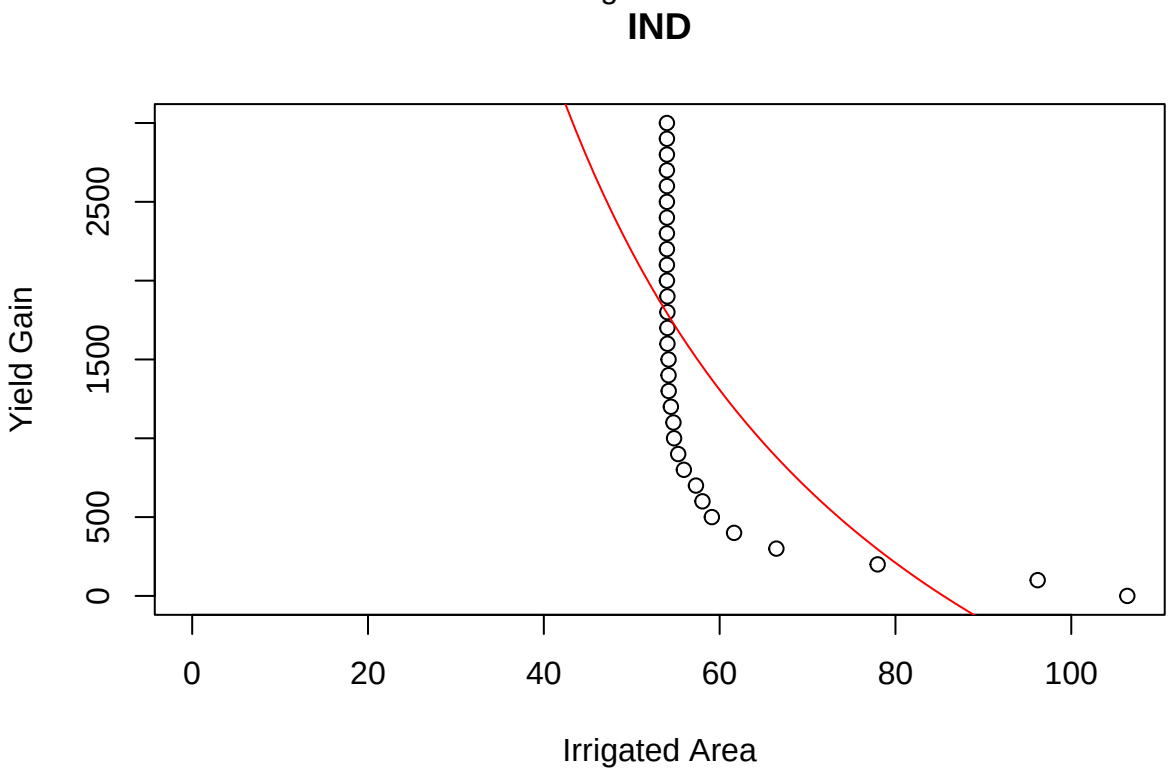

ESP
Yield Gain
0
500
1500
2500
0
1
2
3
4
5
6
Irrigated Area

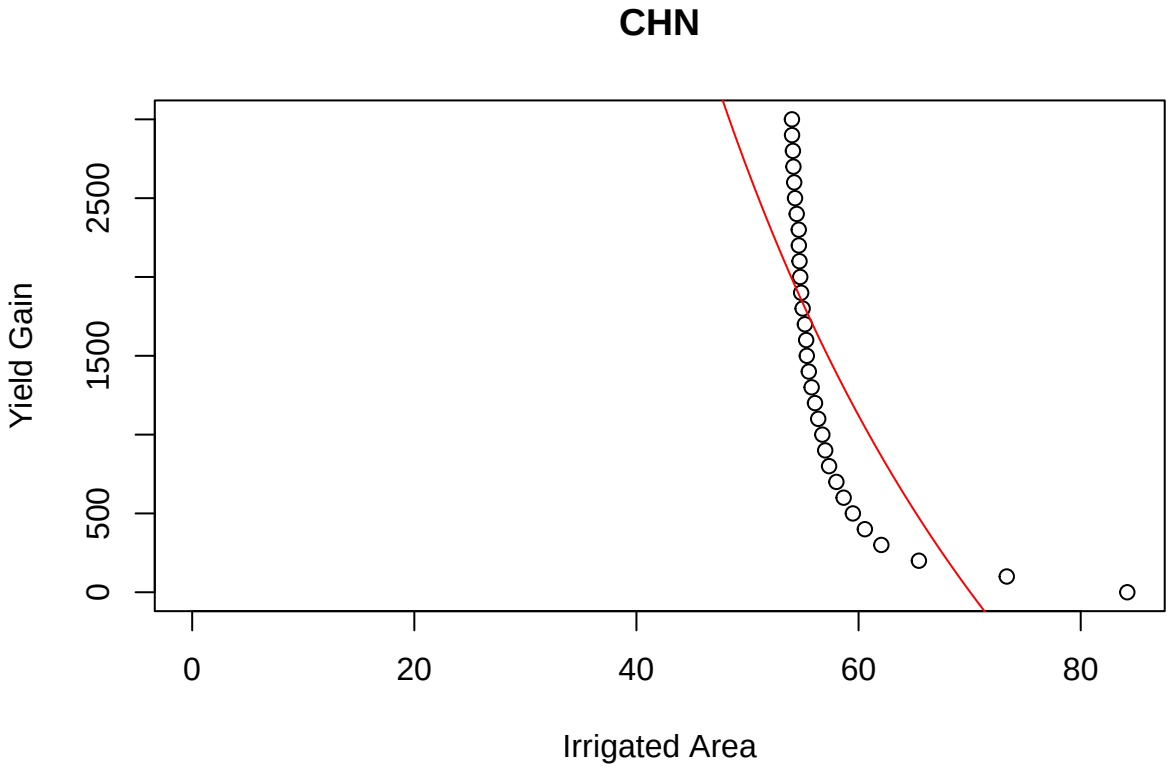

ITA
Yield Gain
0
500
1500
2500
0
1
2
3
4
Irrigated Area

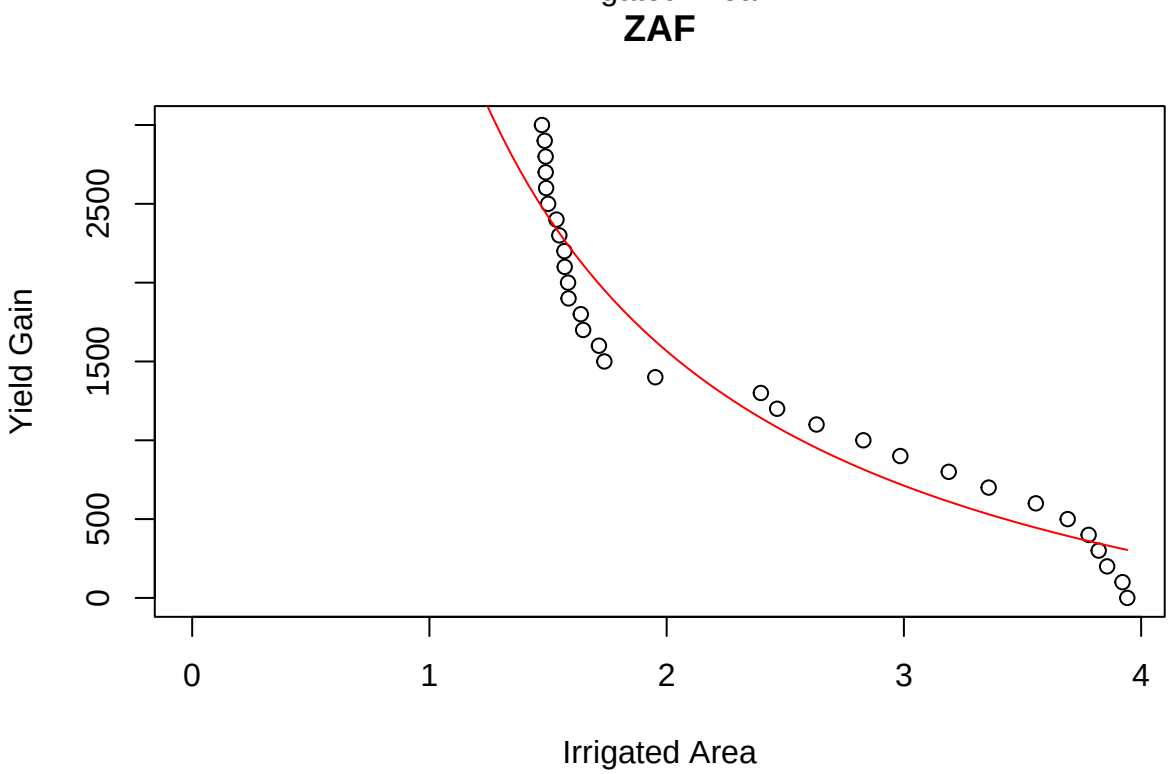

USA
Yield Gain
0
500
1500
2500
0
20
40
60
80
100
Irrigated Area


MEX
Yield Gain
0
500
1500
2500
0
2
4
6
8
10
12
Irrigated Area


BRA
Yield Gain
0
500
1500
2500
0
10
20
30
40
50
Irrigated Area


IND
Yield Gain
0
500
1500
2500
0
20
40
60
80
100
Irrigated Area





Do you have better ideas how to approach this exercise? Does the fit y = yield gain, x = irrigated area make sense or should it be the other way around?