AMICAF/MOSAICC seminar

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Trends, detrending, retrending and trend projection

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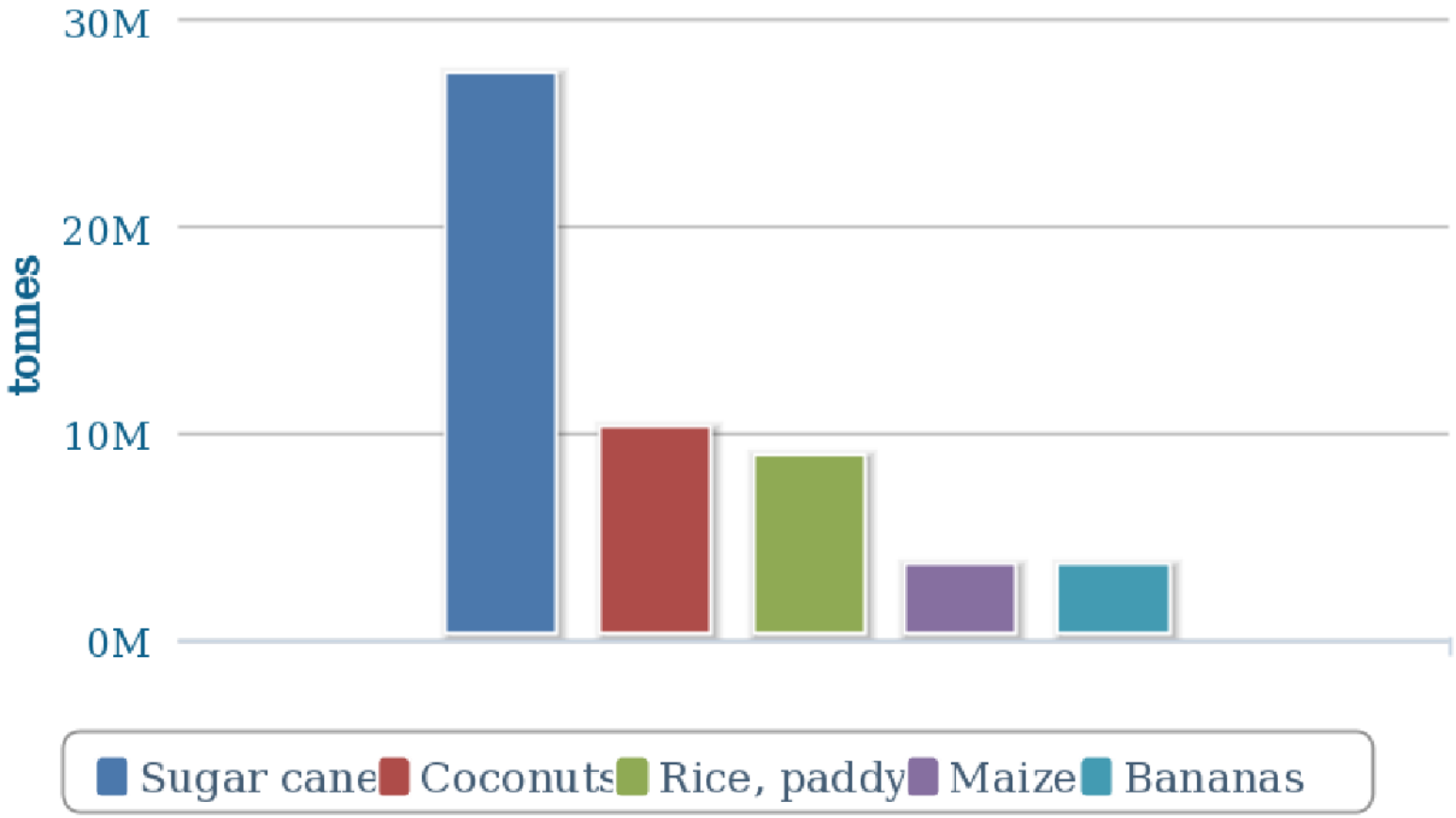
Overview

We have two reasons to be interested in trends: to meaningfully calibrate models, and to understand the role of “technology” in the future. We cover...

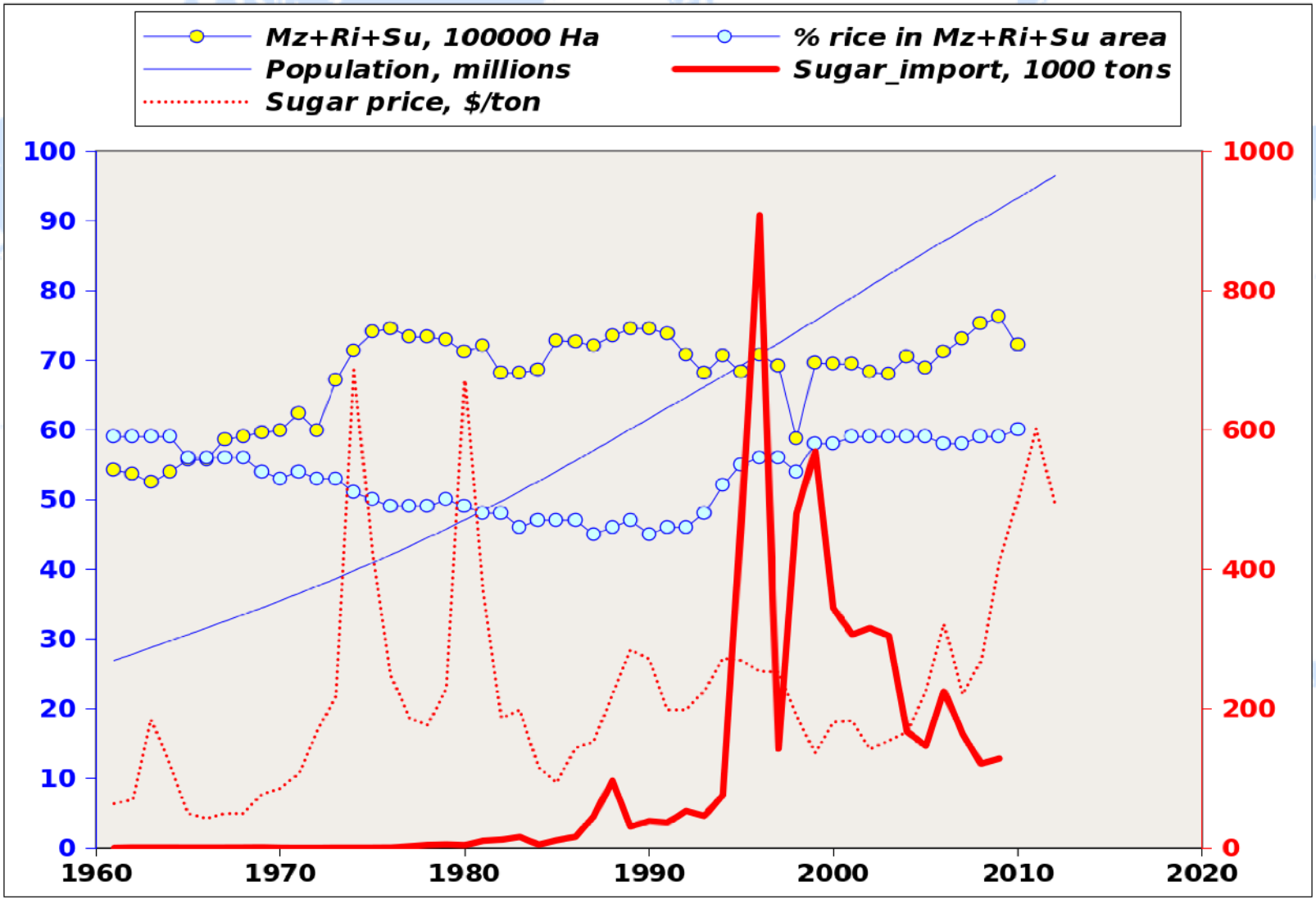
- National trends
- Local trends (Nueva Ecija, annual)
- Local trends by quarter
- Future trends

Most produced crops in the Philippines (Source: FAOstat)

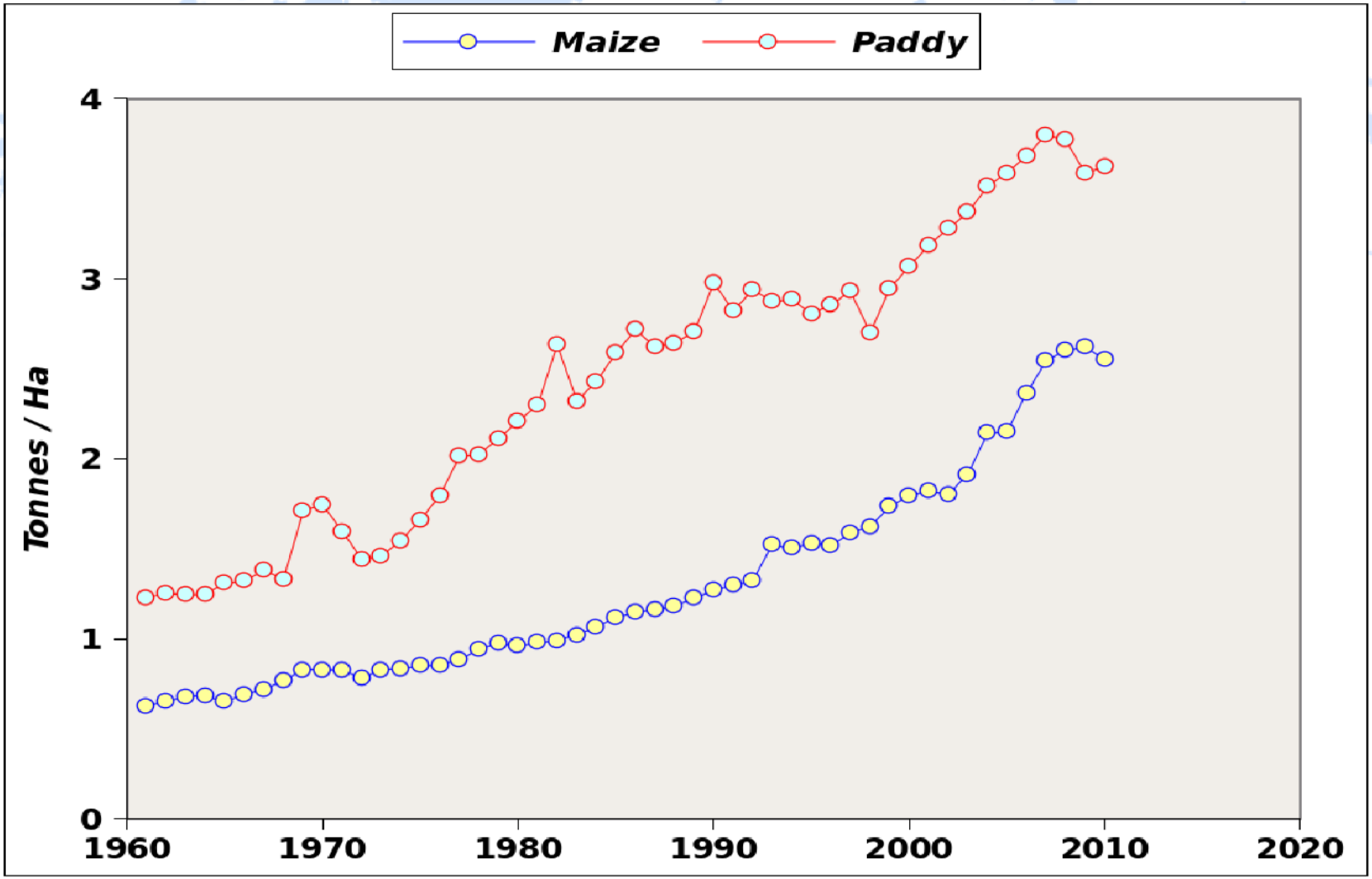


Philippines: more trends

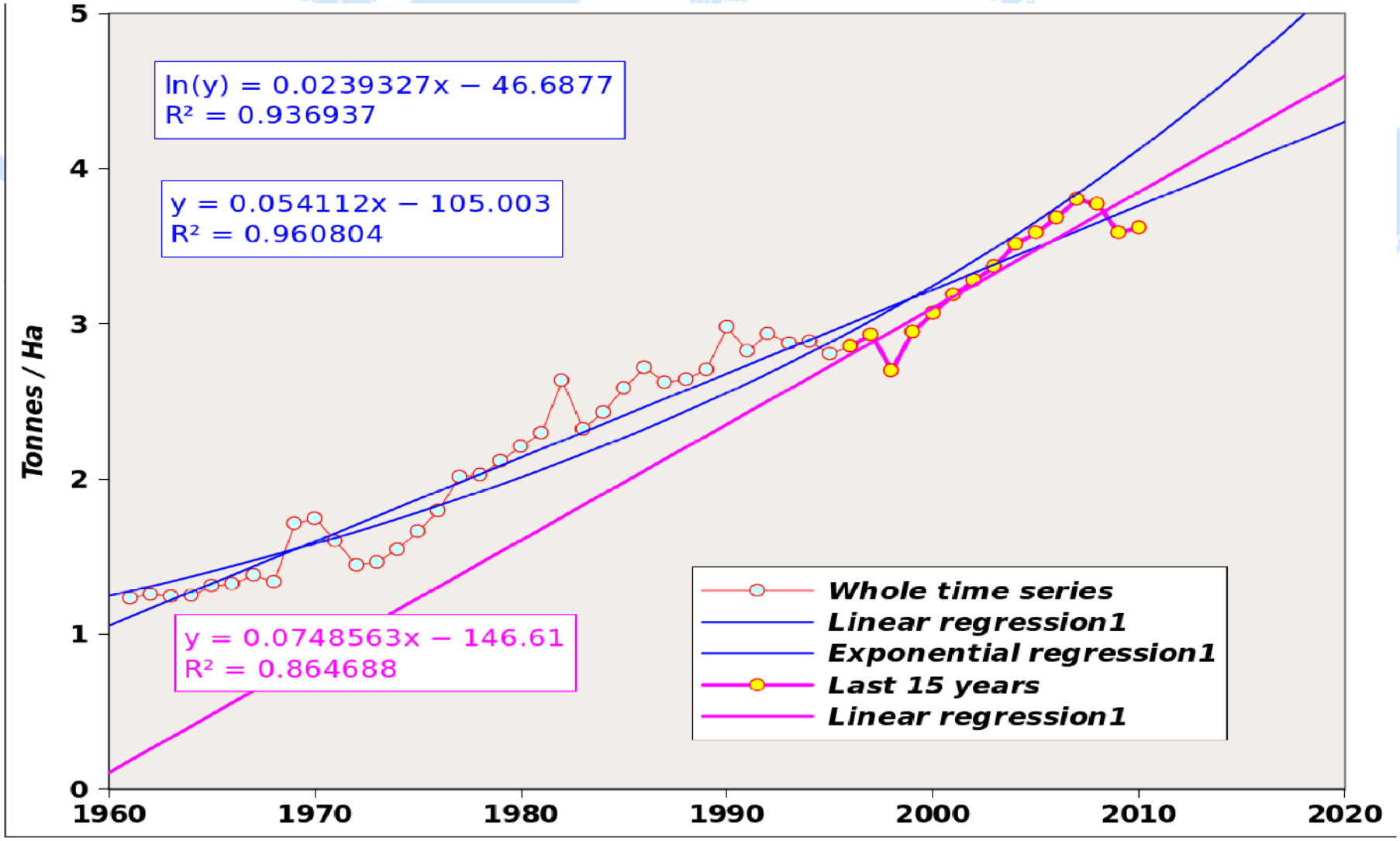
(based on FAOstat data)



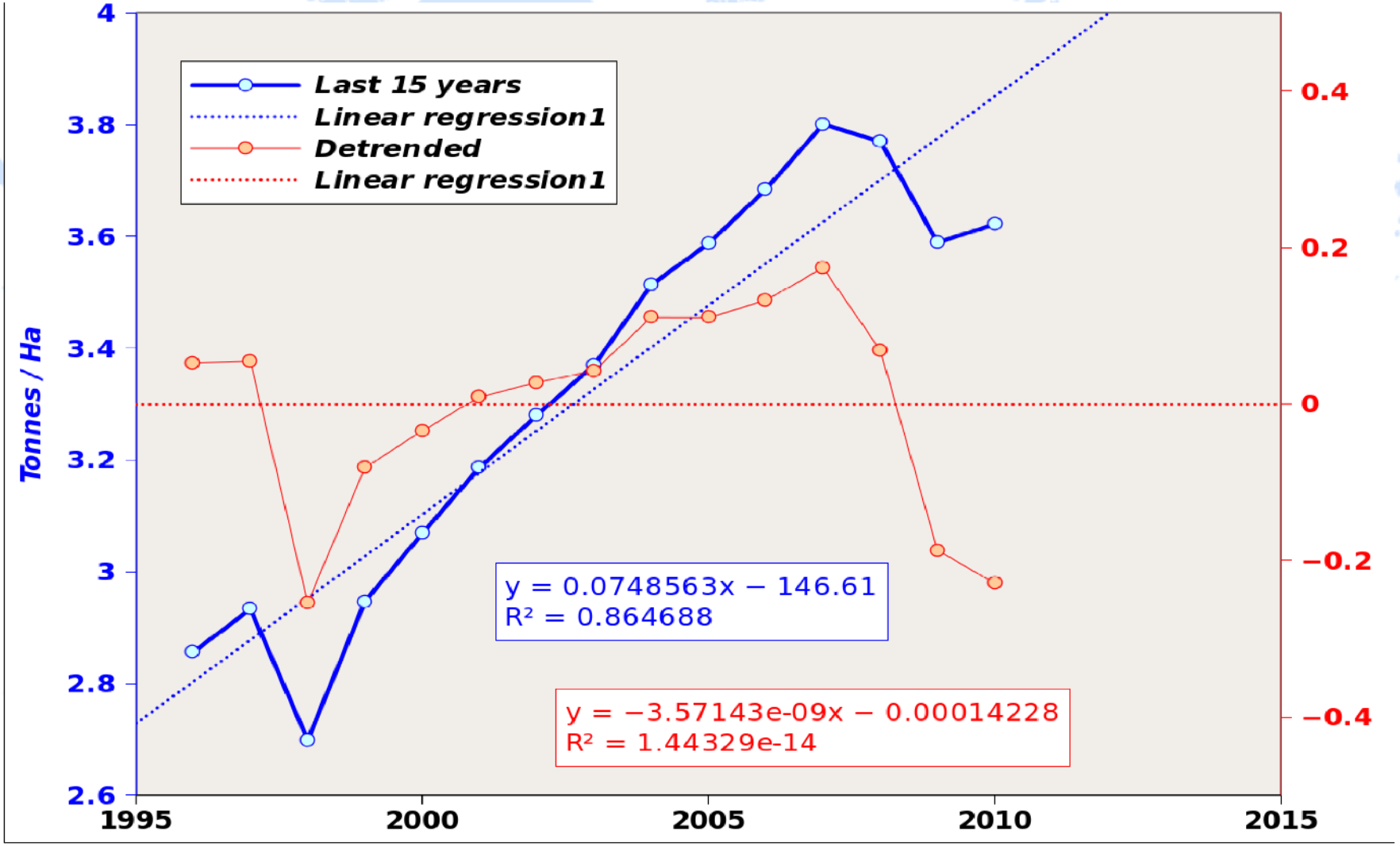
Philippines: Paddy and maize trends (based on FAOstat data)



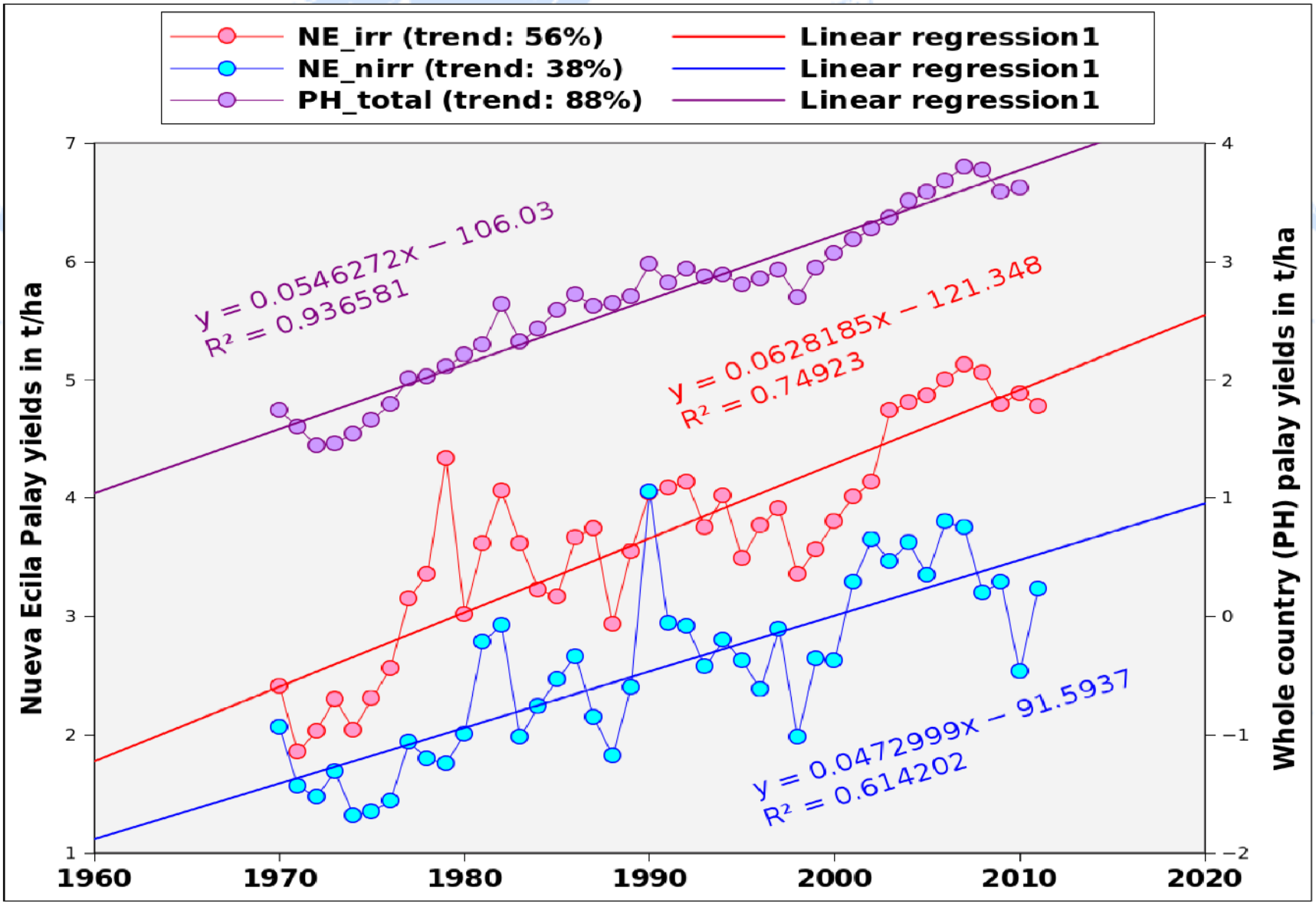
Philippines national paddy yield trends (FAOstat data)



Philippines national paddy yield detrended (FAOstat data)



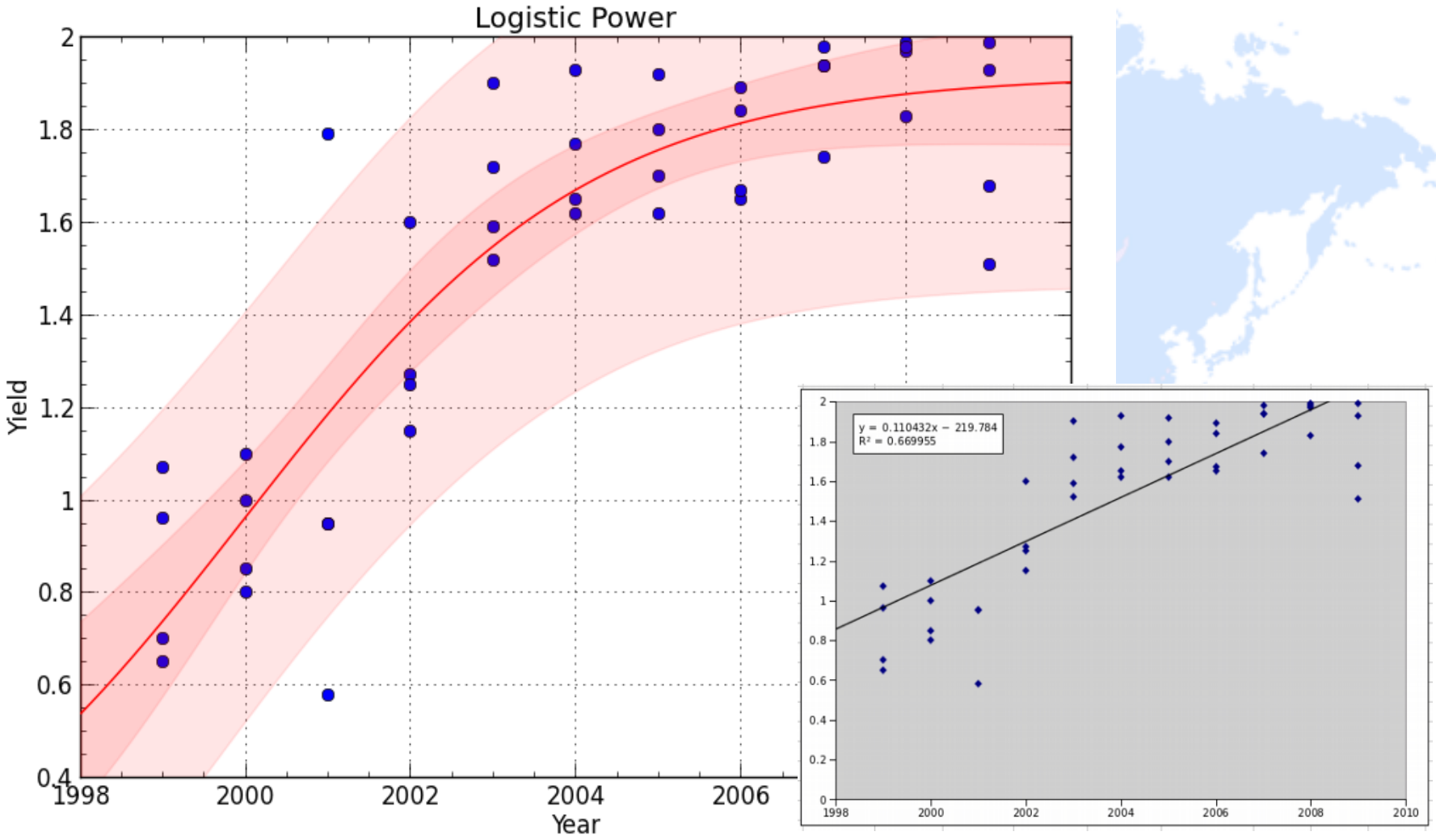
Nueva Ecija total Palay



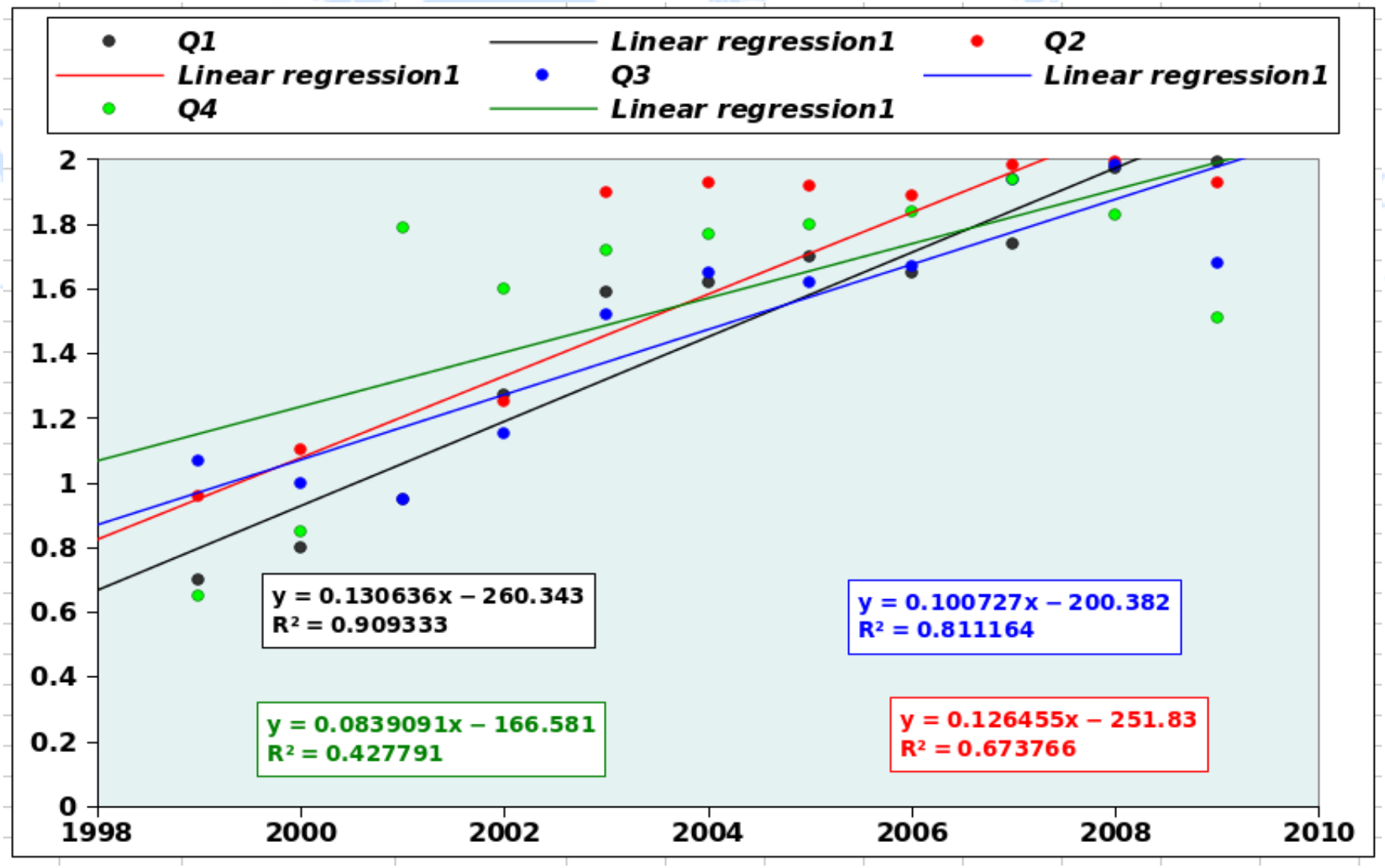
Nueva Ecija 1999-2009 white corn yields, by quarter

	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
slope	0.1306	0.1265	0.1007	0.0839				
Intercept	−260.34	−251.83	−200.38	−166.58				
R^2	0.909	0.674	0.811	0.428				
	Yield				Detrended yield			
1999	0.7	0.96	1.07	0.65	−0.10	0.01	0.10	−0.50
2000	0.8	1.10	1.00	0.85	−0.13	0.02	−0.07	−0.39
2001	0.95	0.58	0.95	1.79	−0.11	−0.63	−0.22	0.47
2002	1.27	1.25	1.15	1.60	0.08	−0.08	−0.12	0.19
2003	1.59	1.90	1.52	1.72	0.27	0.44	0.15	0.23
2004	1.62	1.93	1.65	1.77	0.17	0.34	0.18	0.20
2005	1.7	1.92	1.62	1.80	0.12	0.21	0.04	0.14
2006	1.65	1.89	1.67	1.84	−0.06	0.05	−0.01	0.10
2007	1.74	1.98	1.94	1.94	−0.10	0.01	0.16	0.12
2008	1.97	1.99	1.98	1.83	0.00	−0.10	0.10	−0.08
2009	1.99	1.93	1.68	1.51	−0.11	−0.29	−0.30	−0.48
Average	1.45	1.58	1.48	1.57	0.00	0.00	0.00	0.00
St.dev	0.45	0.51	0.37	0.43	0.14	0.29	0.16	0.32

Nueva Ecija 1999-2009 white corn yields, by quarter



Nueva Ecija 1999-2009 white corn yields, by quarter



Nueva Ecija 1999-2009 white corn yields, by quarter

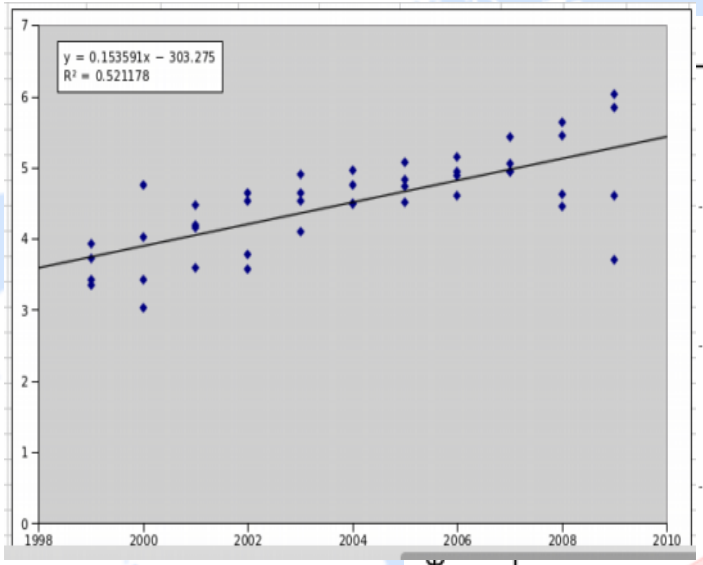
Departure from logistic trend		
	Average	St.dev
Q1	−0.068	0.109
Q2	0.064	0.257
Q3	−0.045	0.176
Q4	0.052	0.245

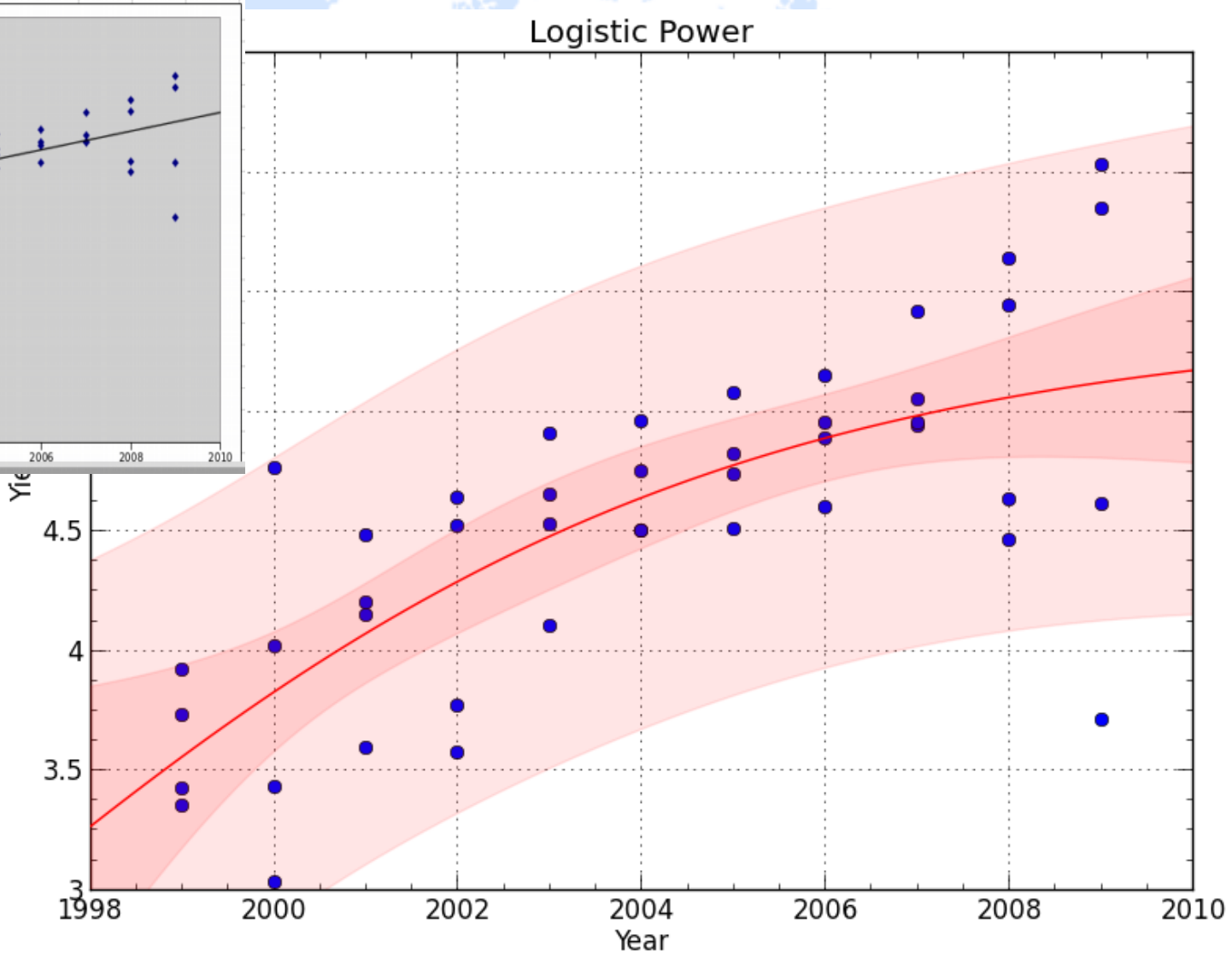
We use logistic trend (r^2=0.772) - which is better than the linear trend (r^2=0.669) - and we apply no quarter correction

Nueva Ecija 1999-2009 palay yields, by quarter

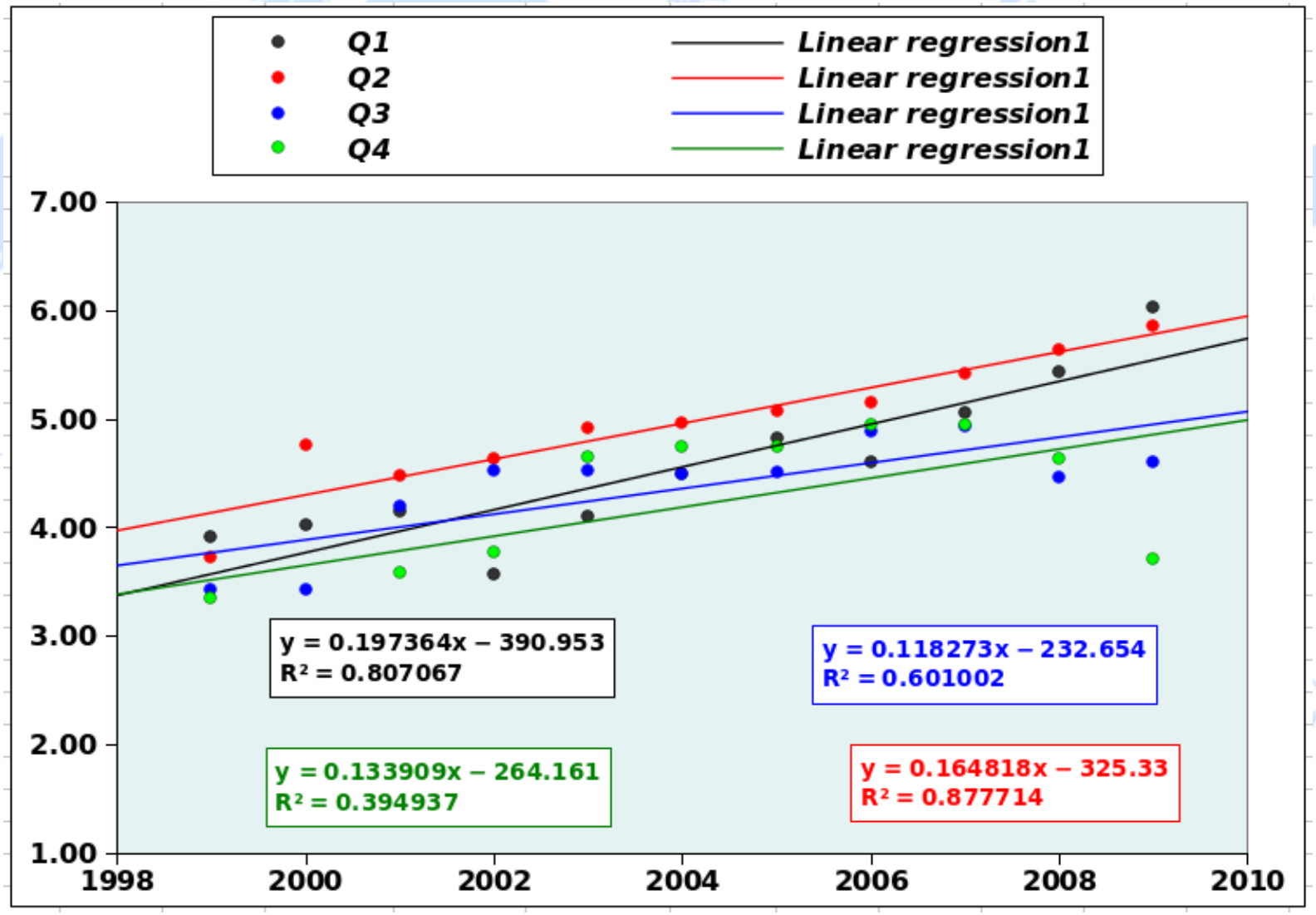
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
slope	0.1974	0.1648	0.1183	0.1339				
Intercept	−390.95	−325.33	−232.65	−264.16				
R^2	0.807	0.878	0.601	0.394				
	Yield				Detrended yield			
1999	3.92	3.73	3.42	3.35	0.34	−0.41	−0.35	−0.17
2000	4.02	4.76	3.43	3.03	0.24	0.45	−0.46	−0.63
2001	4.15	4.48	4.20	3.59	0.18	0.01	0.19	−0.20
2002	3.57	4.64	4.52	3.77	−0.60	0.00	0.39	−0.15
2003	4.10	4.91	4.53	4.65	−0.27	0.11	0.28	0.59
2004	4.50	4.96	4.50	4.75	−0.06	−0.01	0.13	0.56
2005	4.82	5.08	4.51	4.74	0.06	−0.05	0.03	0.41
2006	4.60	5.15	4.89	4.95	−0.36	−0.14	0.29	0.49
2007	5.05	5.42	4.94	4.95	−0.11	−0.04	0.22	0.36
2008	5.44	5.64	4.46	4.63	0.09	0.02	−0.38	−0.10
2009	6.03	5.85	4.61	3.71	0.48	0.06	−0.35	−1.15
Average	4.56	4.97	4.36	4.19	0.00	0.00	0.00	0.00
St.dev	0.73	0.58	0.51	0.71	0.32	0.20	0.32	0.55

Nueva Ecija 1999-2009 palay yields, by quarter





Nueva Ecija 1999-2009 palay yields, by quarter



Nueva Ecija 1999-2009 palay yields, by quarter

	Departure from trend			
	Logistic		Linear	
	Average	St.dev	Average	St.dev
Q1	0.043	0.433	0.043	0.351
Q2	0.445	0.221	0.445	0.206
Q3	−0.156	0.266	−0.156	0.342
Q4	−0.328	0.475	−0.328	0.554

Since there is so little difference between logistic trend (r^2=0.549) and linear trend (r^2=0.521) we use linear trend PLUS the average quarter yield as variables

Nueva Ecija 1999-2009 yellow corn yields, by quarter

Departure from logistic trend		
	Averag	St.dev
Q1	0.065	0.315
Q2	0.128	0.354
Q3	−0.156	0.772
Q4	−0.474	0.441

Logistic trend is much better than linear trend (R^2= 0.890 Vs. R^2=0.681)

We use that plus average quarter yield

Future yields in n years from now...

Future yield = Y(n) * F_{CO2}(n) + (n – t) * annual yield increase$^{(i)}$

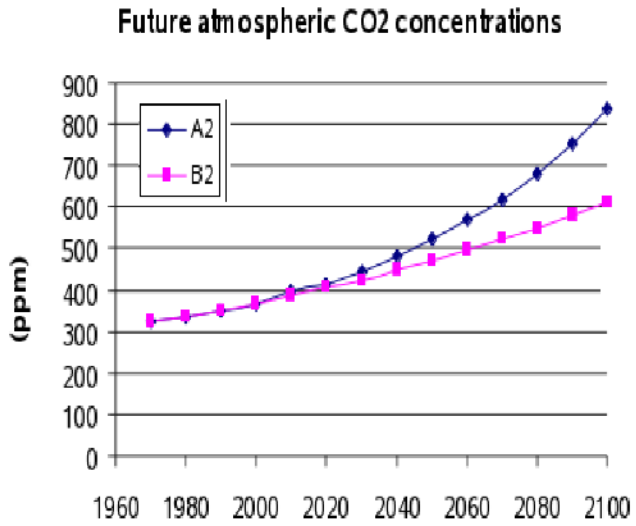
Y(i): yield function calibrated against current data (ending year t), computed with data for year i

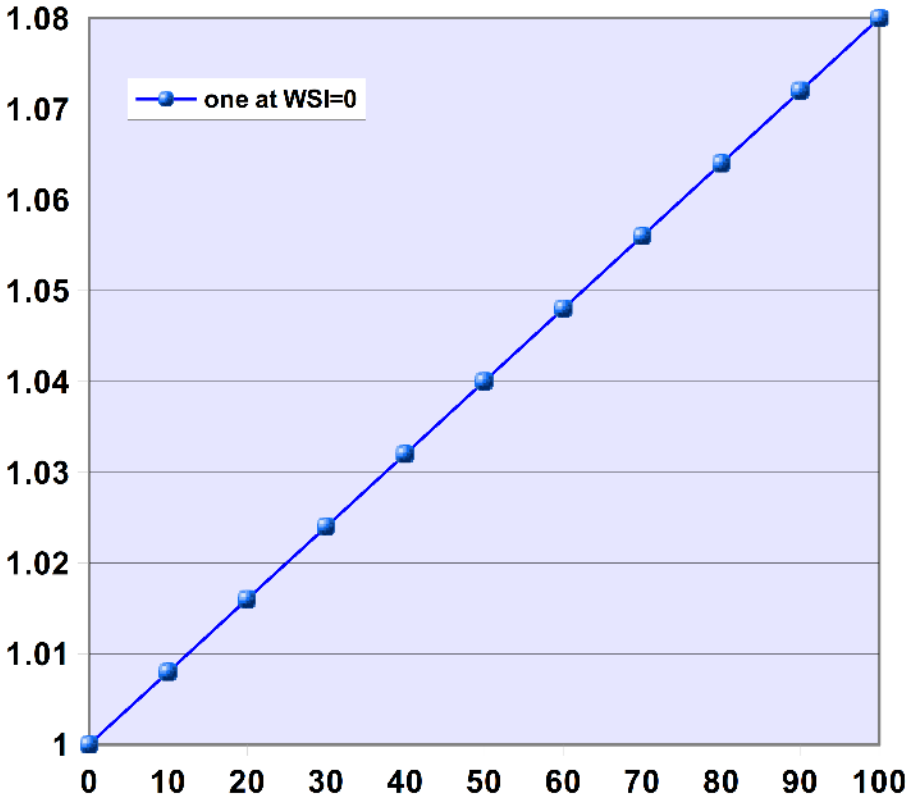
(i): if trend is linear

F_{CO2}: CO_2 correction factor

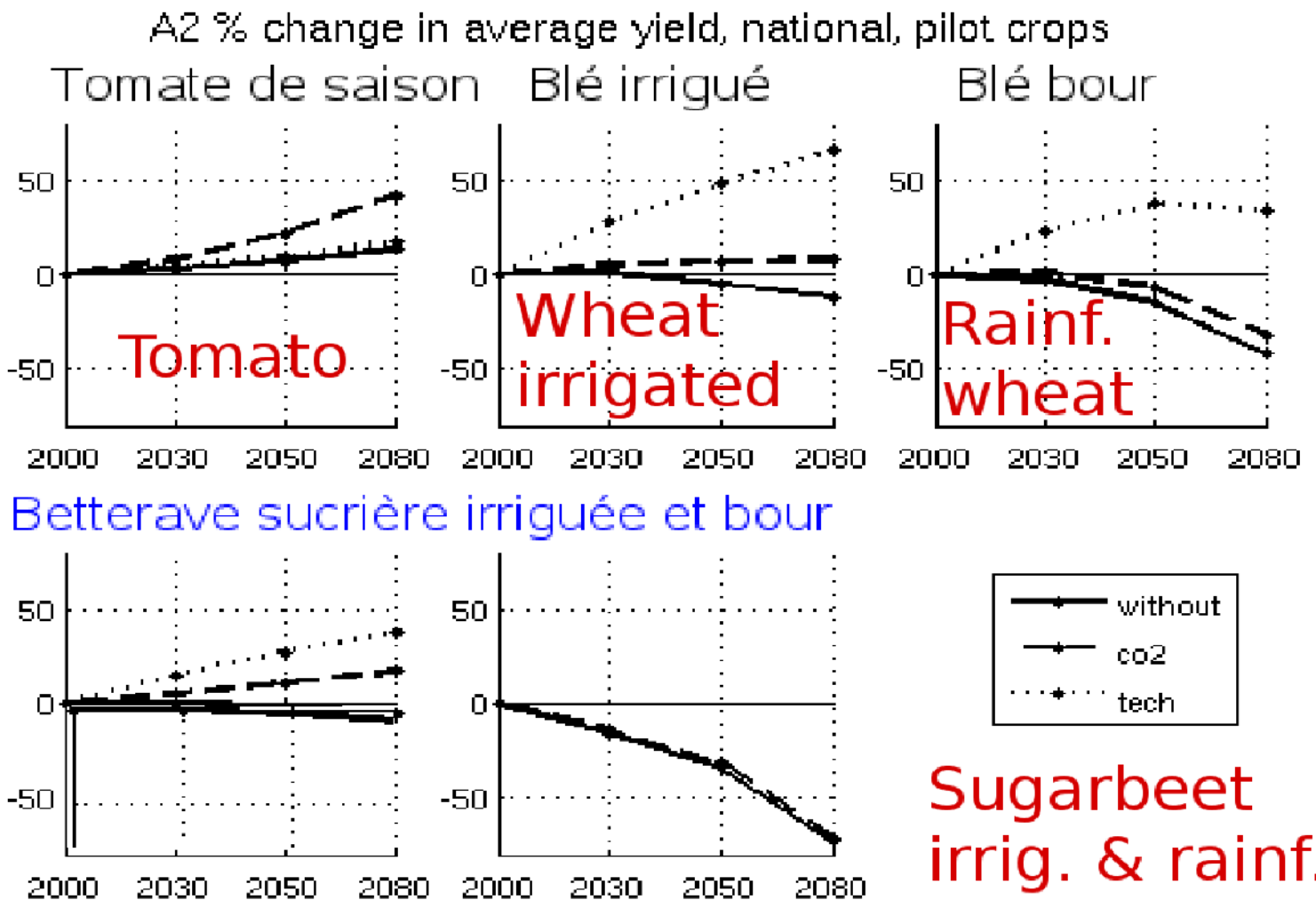
F(CO_2) Correction CO_2

ppm CO_2	C3	C4
330	1.00	1.00
440	1.11	1.05
550	1.19	1.08
660	1.25	1.10
770	1.30	1.12
880	1.33	1.13
990	1.36	1.14





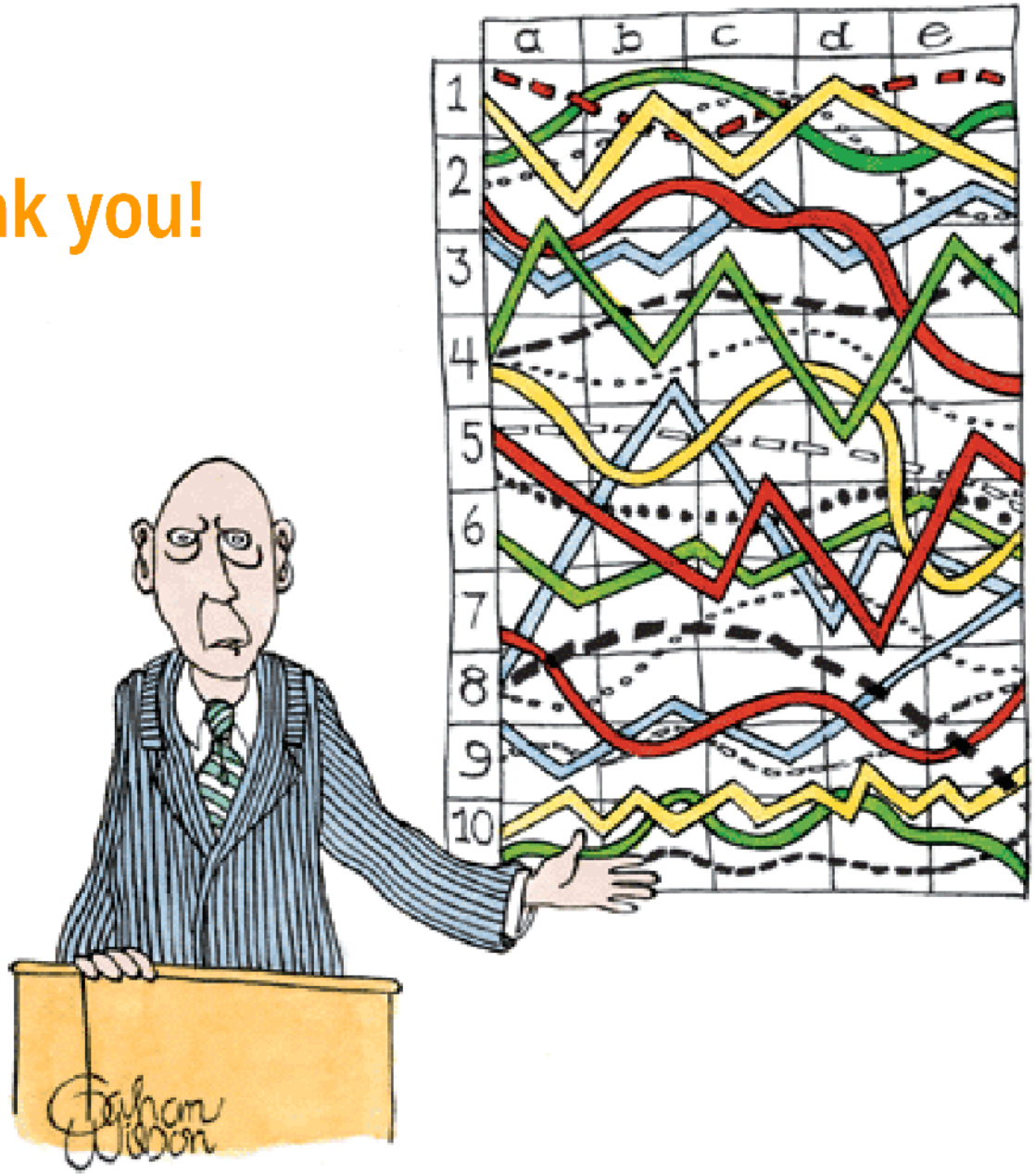
Morocco: trend Vs effects of CO_2



Conclusions

- Trends are difficult statistical creatures, but they nevertheless do exist
- Their removal must normally precede modelling; there is no simple and objective way to do so: statistical Vs. agronomic significance
- There is no objective way of projecting trends into the future either

Thank you!



"I'll pause for a moment so you can let this information sink in."