Mettiamo in discussione le nostre conoscenze: può la ricerca rispondere alle esigenze degli agricoltori?

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7/6/2011 - Acqua e produzione alimentare

$$\text{Water poductivity} = \frac{\text{Actual yield}}{\text{Actual water use}}$$

$$WP = \frac{Ya}{P + CR + \Delta SW + Irrig}$$

$$WP = \frac{Ya}{ETa + LF + Perc + RO + ET_{non\text{-}crop}}$$

$$\max(WP) \longrightarrow = \frac{Ymax}{\text{opt } BWU + \min(NBWU)}$$

$$\text{Economic WP} = \frac{\text{Actual yield value}}{\text{Actual water use}}$$

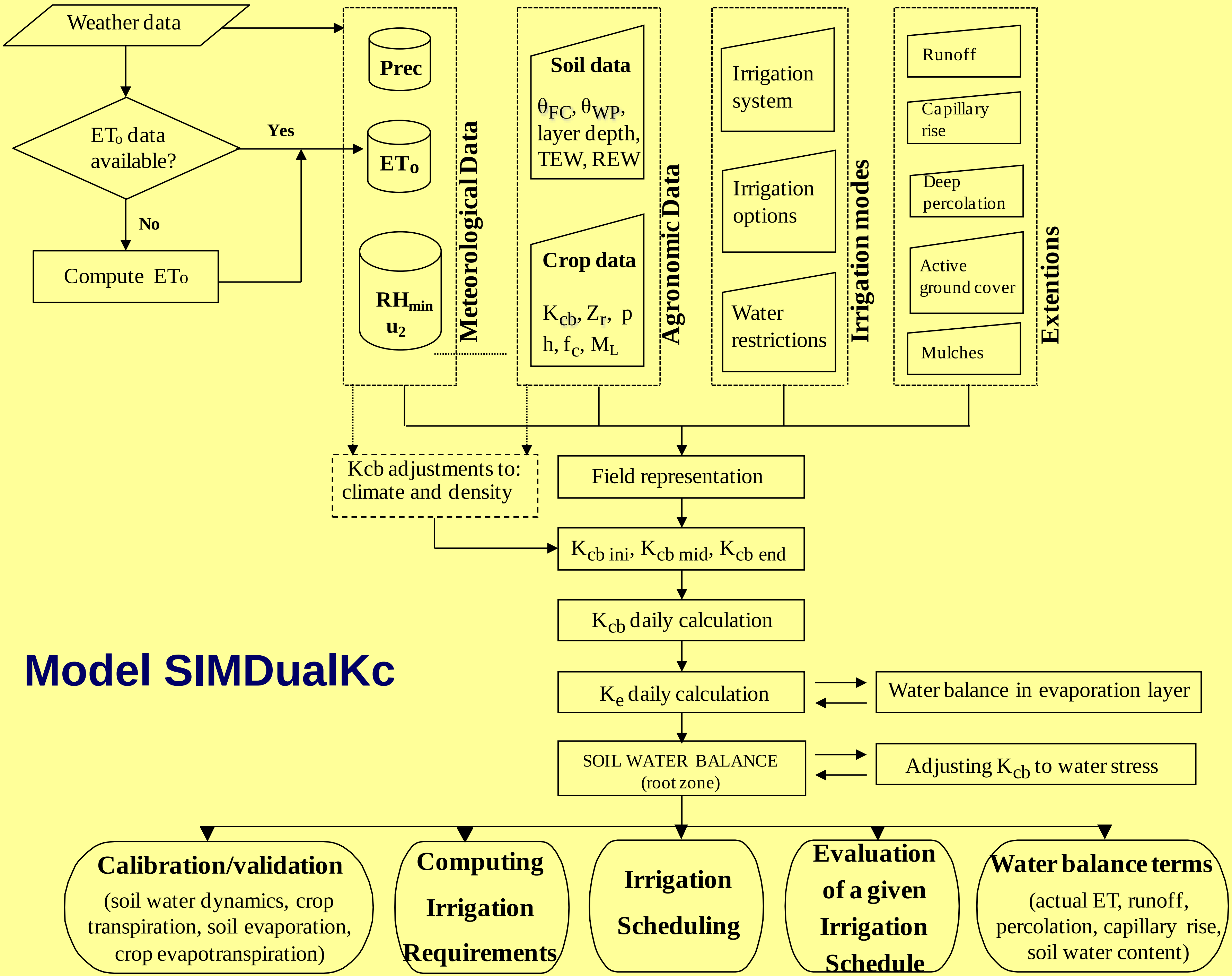
$$\text{EWP} = \frac{\text{Value (Ya)}}{P + \text{Irrig} + CR + \Delta SW}$$

$$\text{EWPR} = \frac{\text{Value (Ya)}}{\text{Costs (Irrig)} + \text{Costs (water conservation)}}$$

Economic Irrigation Production Ratio:

$$\max(\text{EIPR}) \longrightarrow = \max \frac{\text{(Yield value)}}{\text{(Production costs)}} = \max(\text{Revenue})$$

Model SIMDualKc



Model SIMDualKc

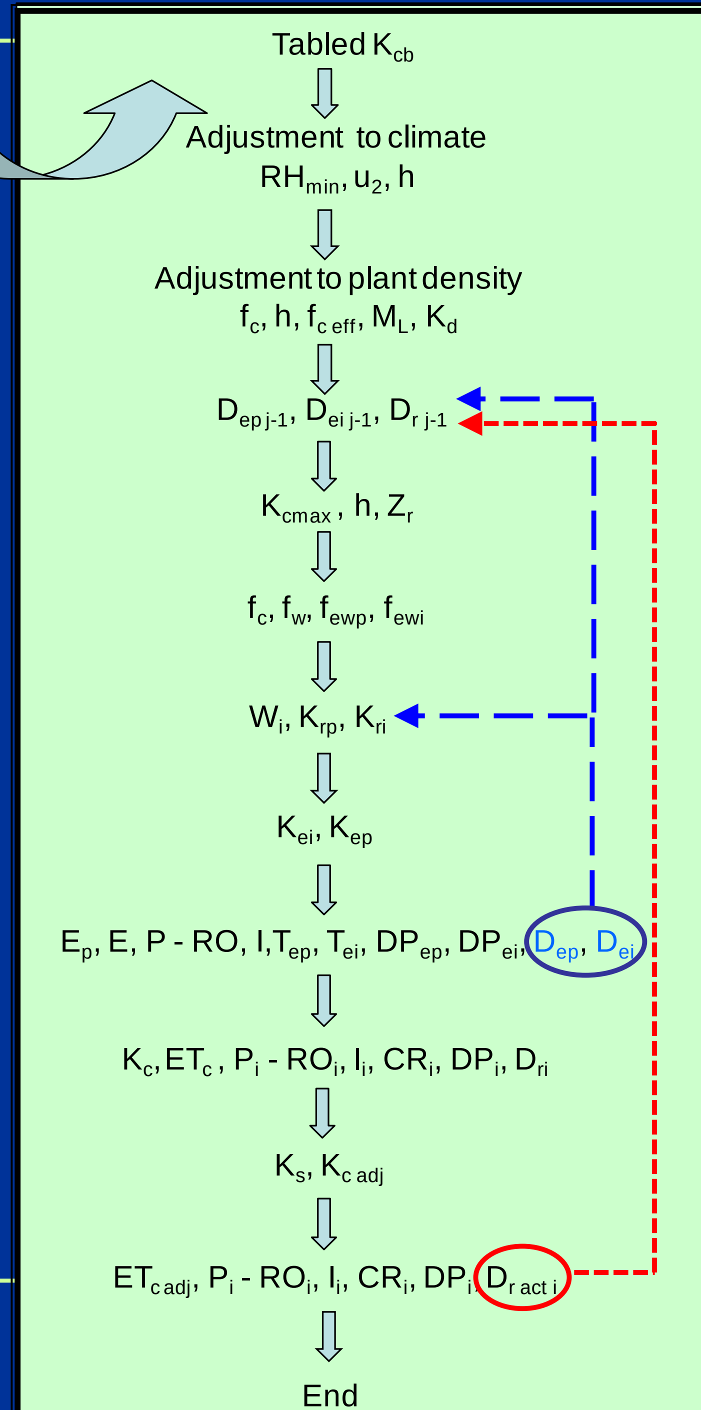
Input data

Mandatory

- Soil
- Climate
- Crop characteristics
- Irrigation

Non-mandatory

- Mulches
- Active ground cover
- Runoff
- Capillary rise
- Deep percolation



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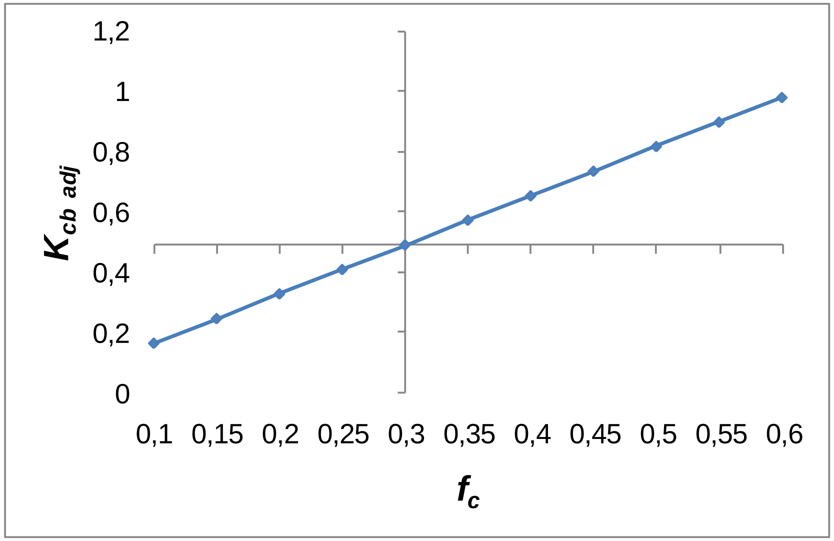
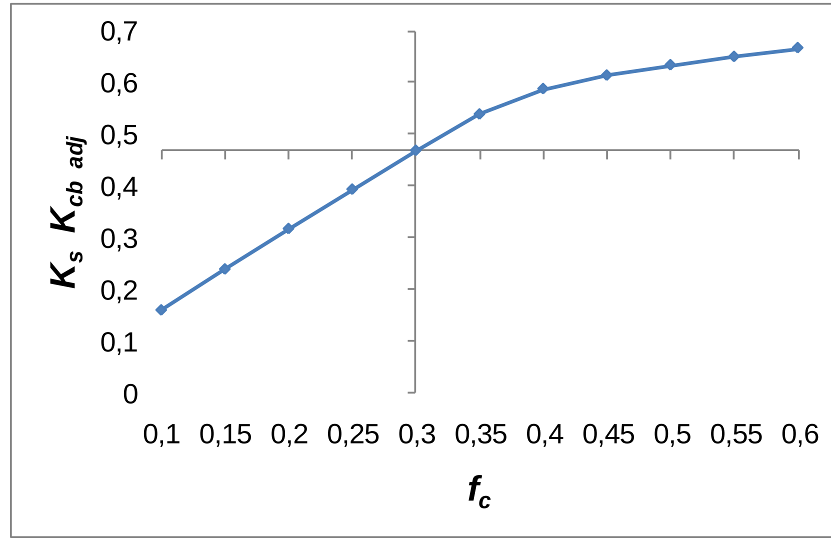
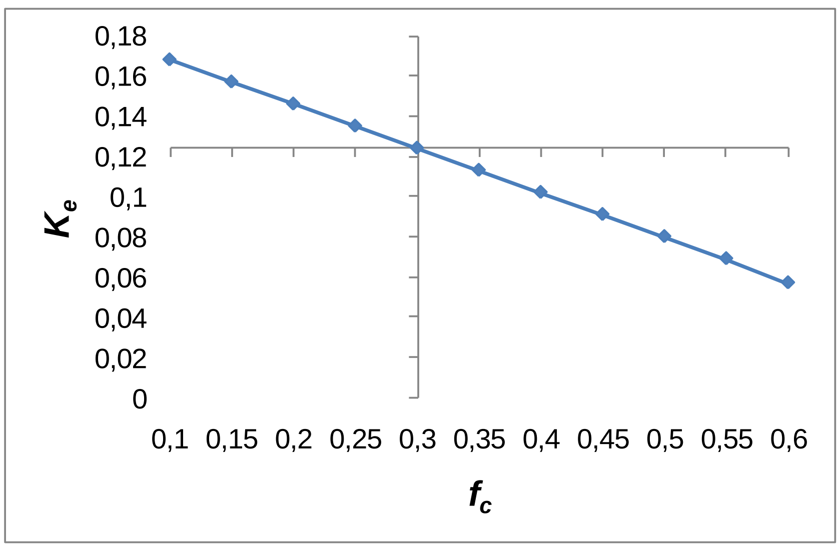
Sensitivity of the fraction of ground cover (fc) in a peach orchard



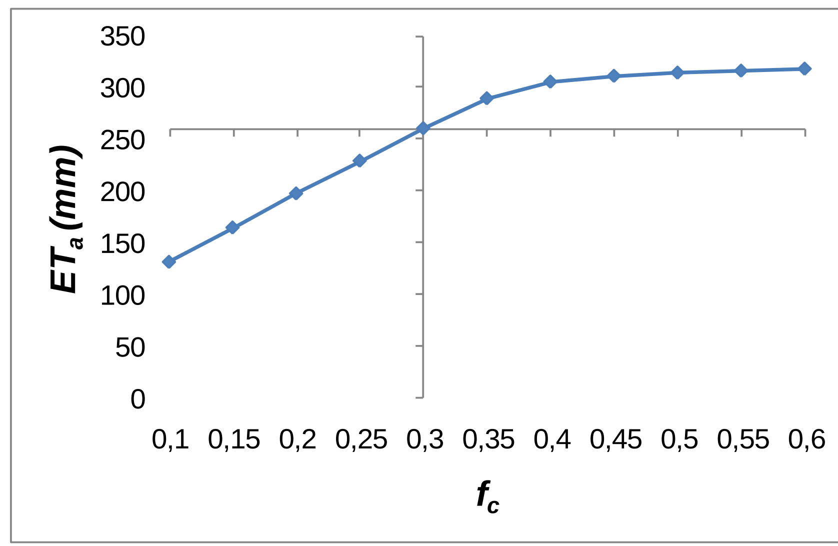
(a) ***Kcb values adjusted for crop density (Kcb adj)***



(b) ***Kcb values corrected for water stress (Ks Kcb adj)***

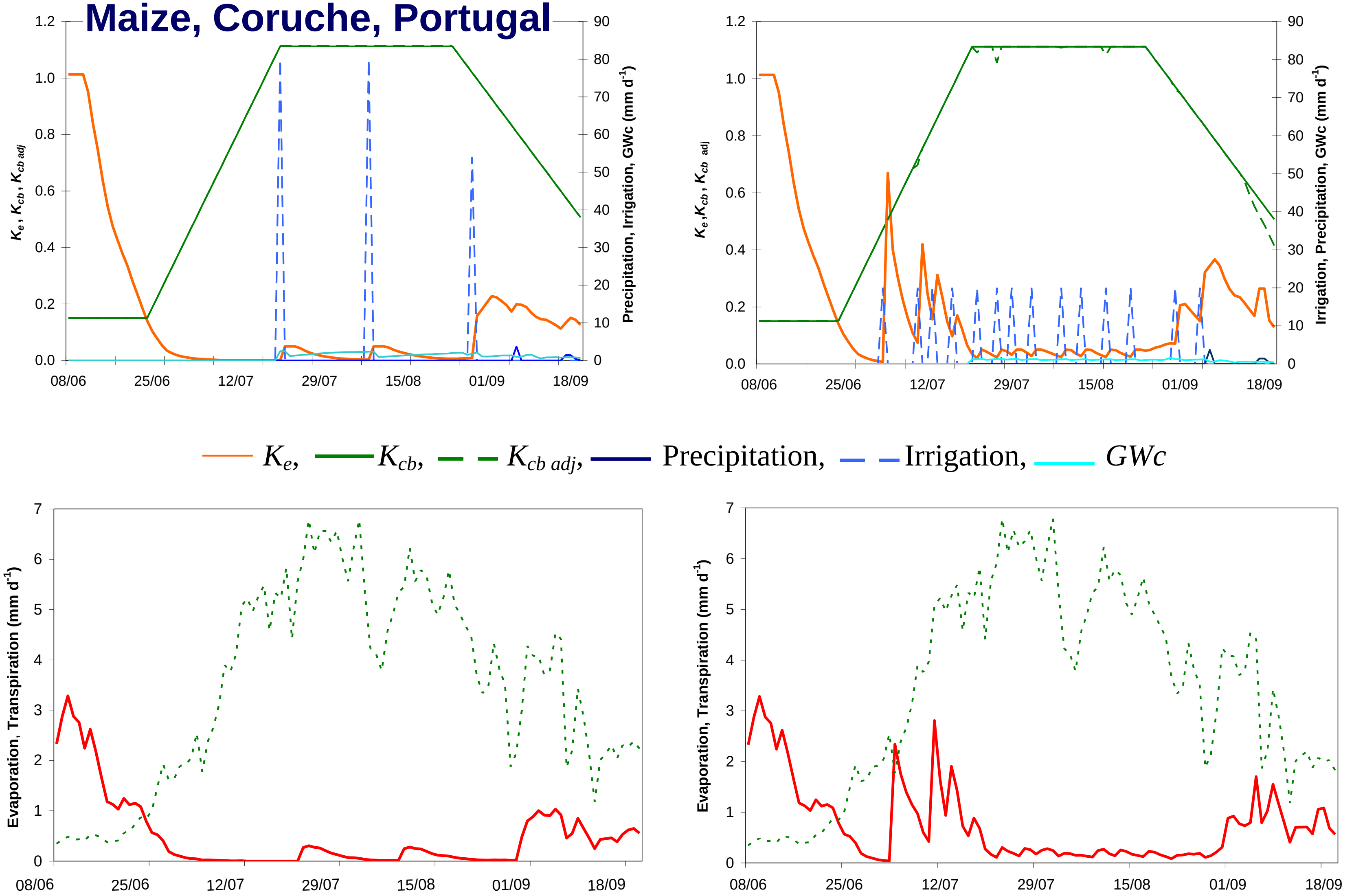


(c) ***Ke averaged over the midseason period***



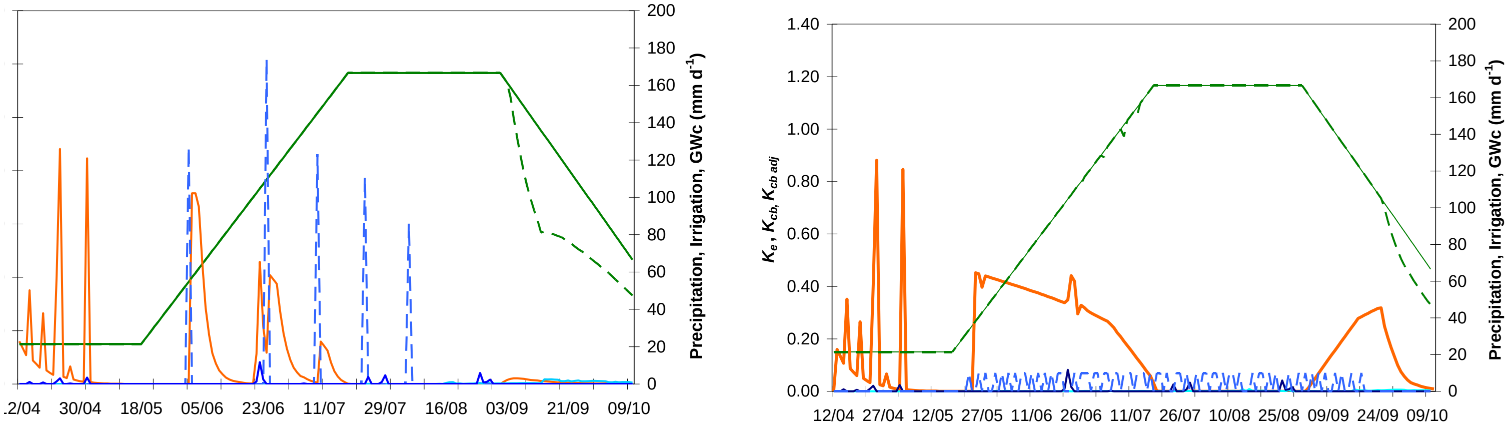
(d) ***Actual evapotranspiration (ETa) summed over the midseason***

Maize, Coruche, Portugal



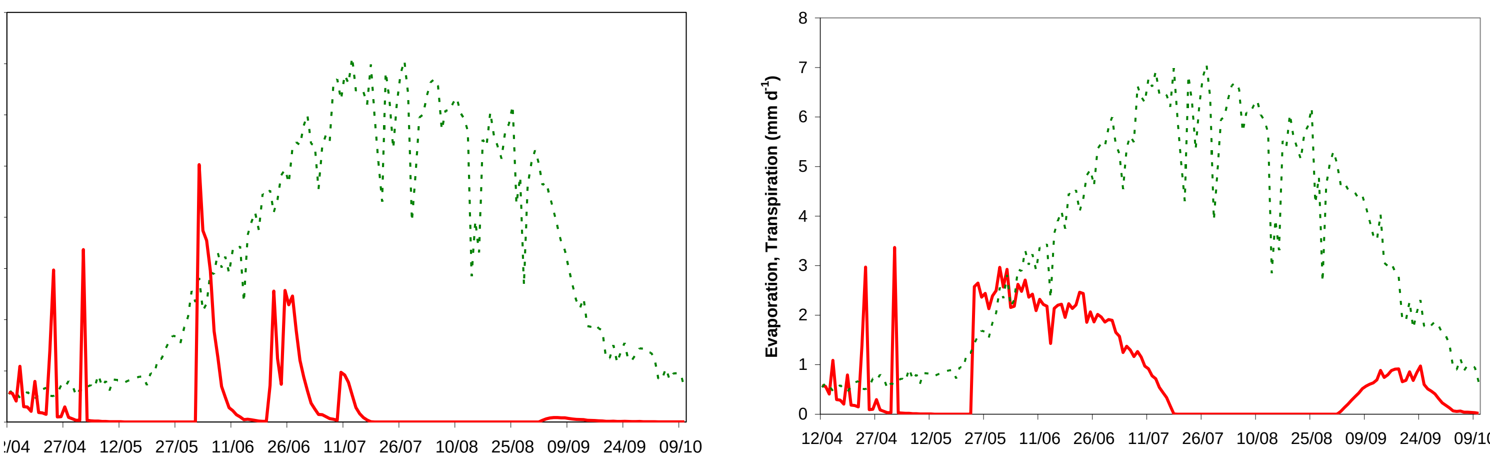
	Level-basin irrigation	Center-pivot irrigation
Irrigation + rainfall (mm)	221	287
GWc (mm)	93	63
Δ*SW* (mm)	-101	-91
E (mm)	52	80
T (mm)	363	361

Cotton, Fergana, Uzbekistan



a)

K_e, K_{cb}, $K_{cb\ adj}$, Precipitation, Irrigation, *GWc*



b)

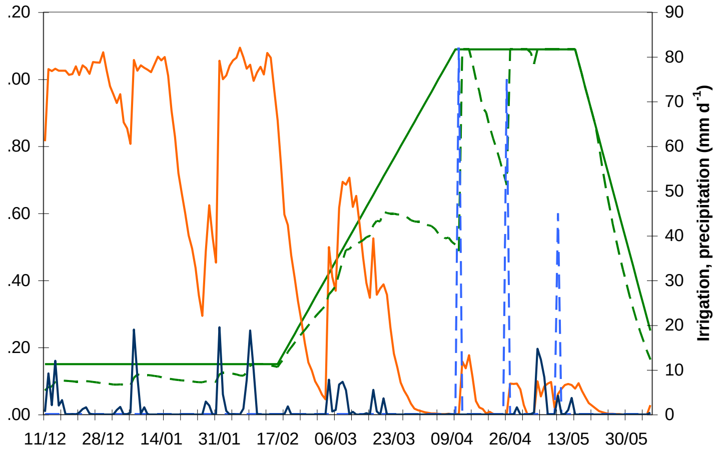
E T

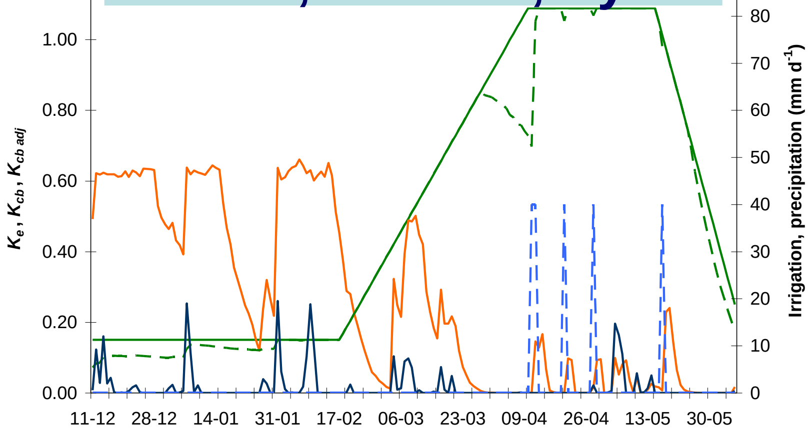
Furrow irrigation

Drip irrigation

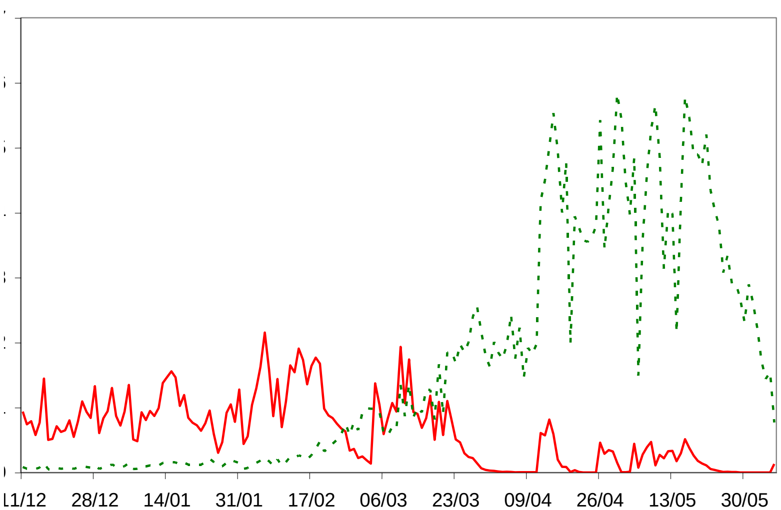
	Furrow irrigation	Drip irrigation
Irrigation + rainfall (mm)	666	665
GWc (mm)	54	35
Δ*SW* (mm)	-112	-47
Percolation (mm)	185	0
E (mm)	55	134
T (mm)	593	615

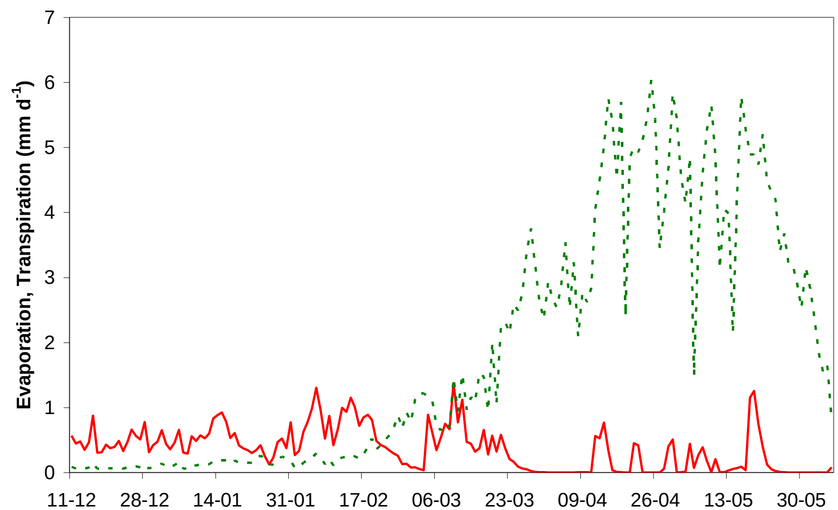
Wheat, ICARDA, Syria





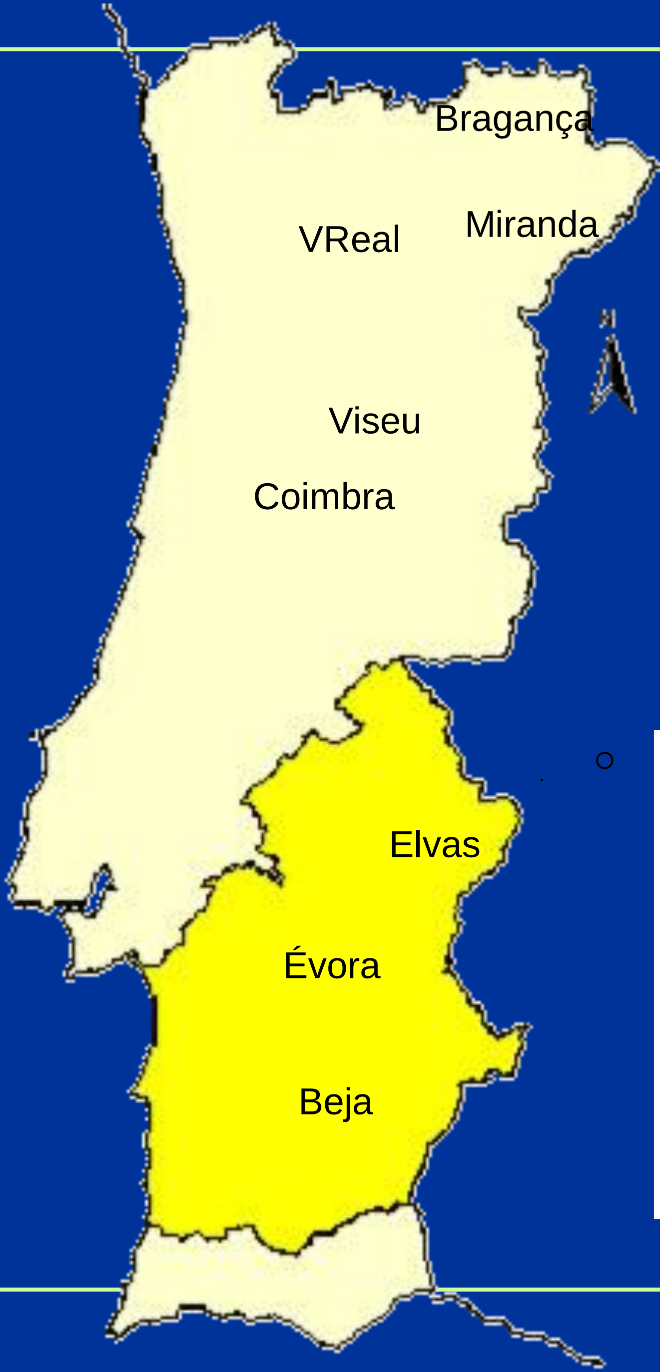
K_e, K_{cb}, $K_{cb\ adj}$, Precipitation, Irrigation





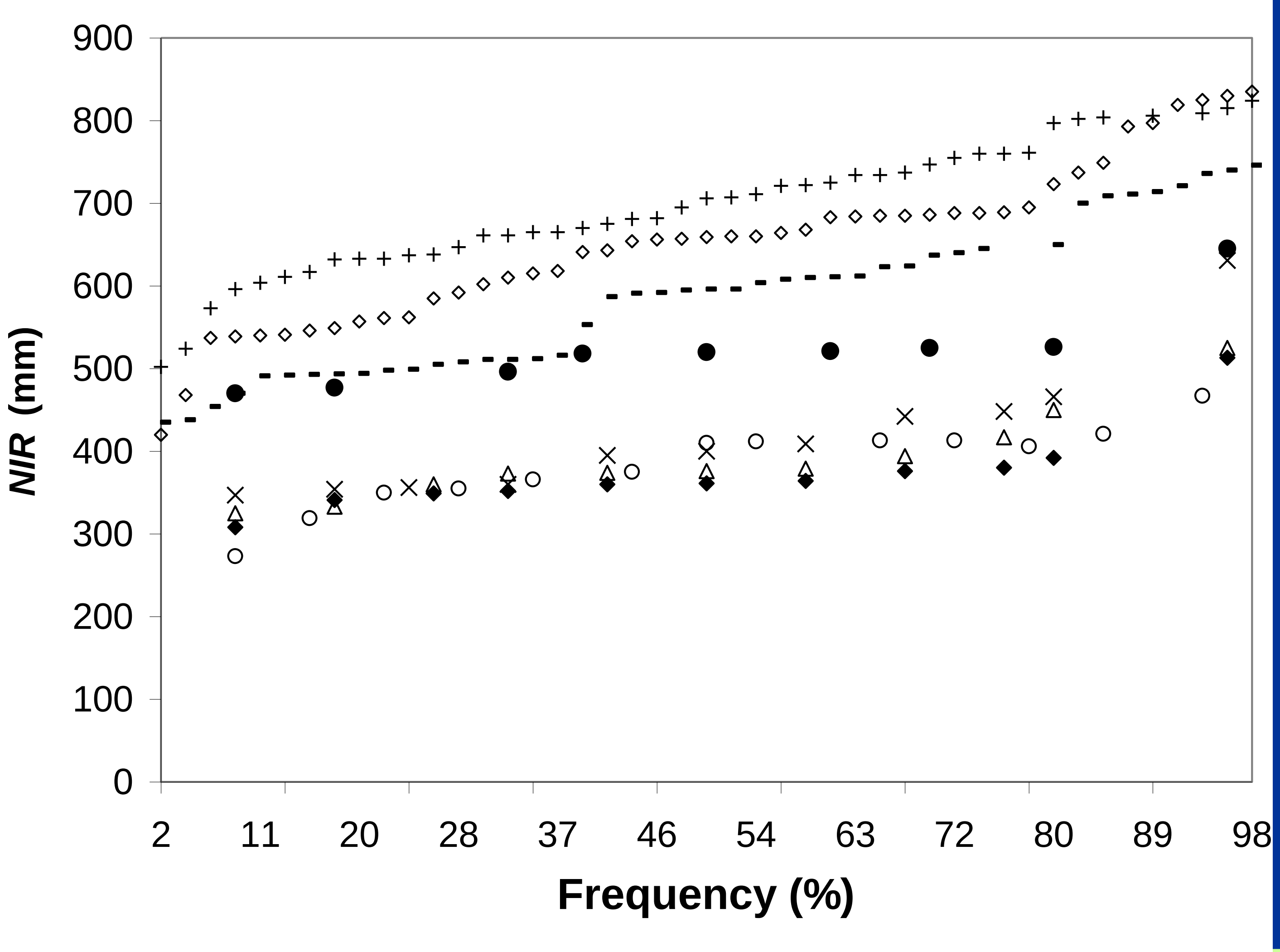
E T

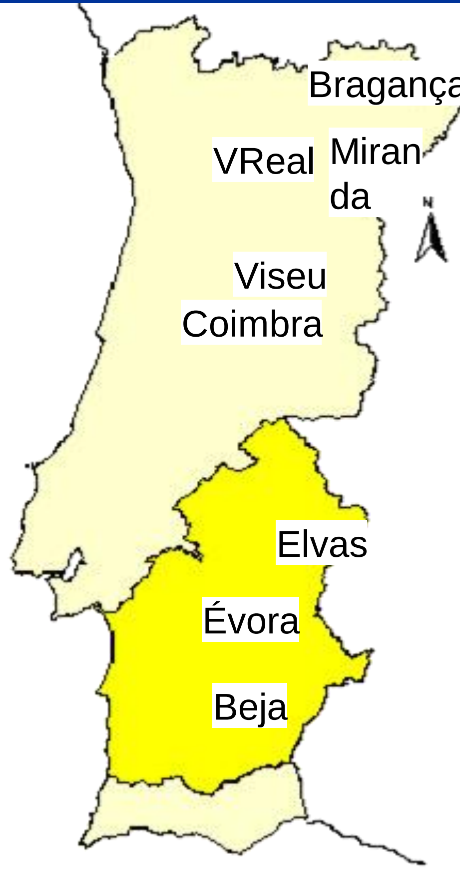
	Supplemental sprinkler irrigation	Supplemental sprinkler irrigation, mulch
Irrigation + rainfall (mm)	423	421
ΔSW (mm)	22	26
E (mm)	109	65
T (mm)	293	330



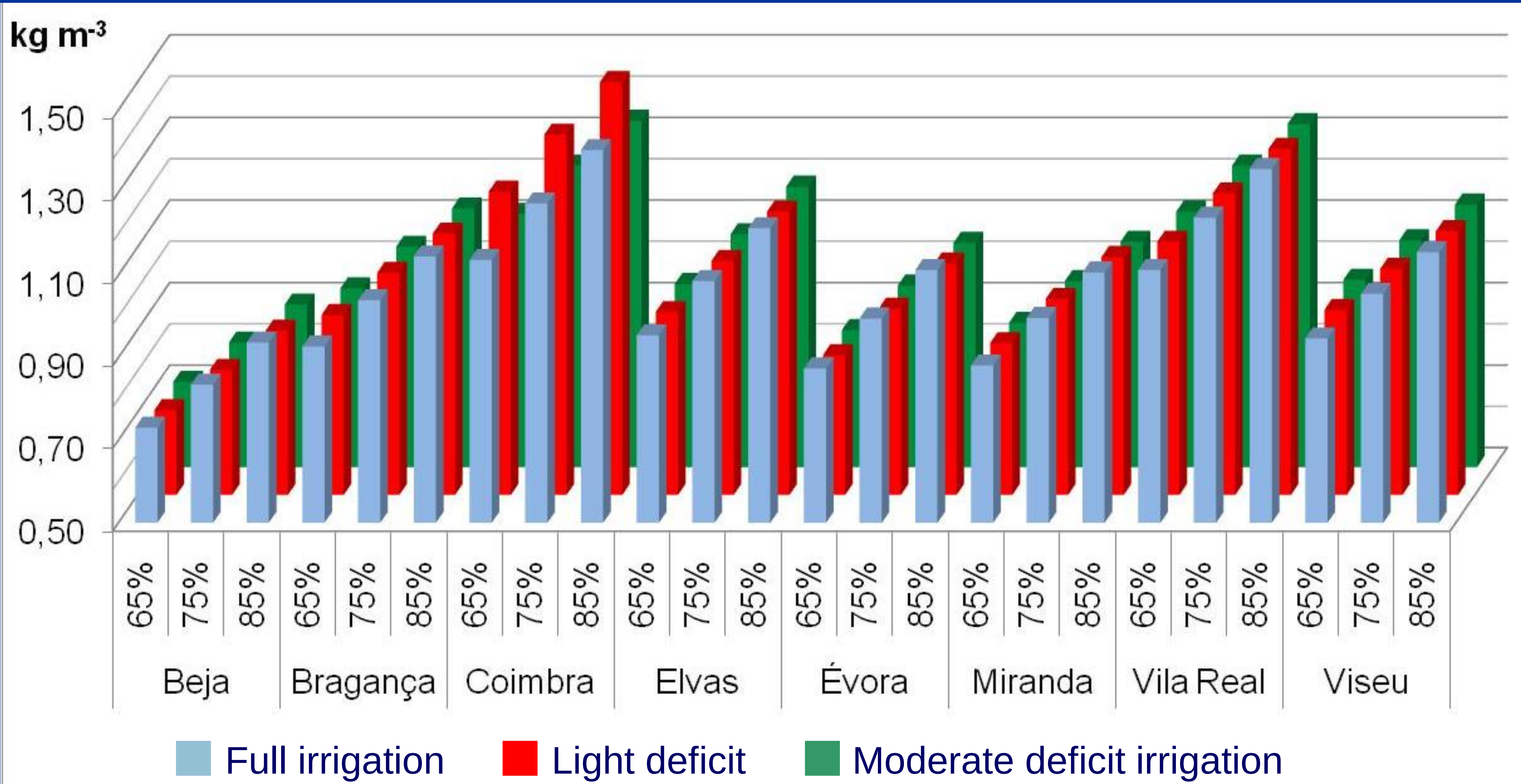
Layers (m)	θ_{FC} ($m^3\ m^{-3}$)	θ_{WP} ($m^3\ m^{-3}$)
0.00-0.20	0.36	0.10
0.20-0.40	0.35	0.09
0.40-0.60	0.36	0.10
0.60-0.80	0.35	0.10
0.80-1.00	0.34	0.10

Maize net irrigation requirements in various locations in Portugal



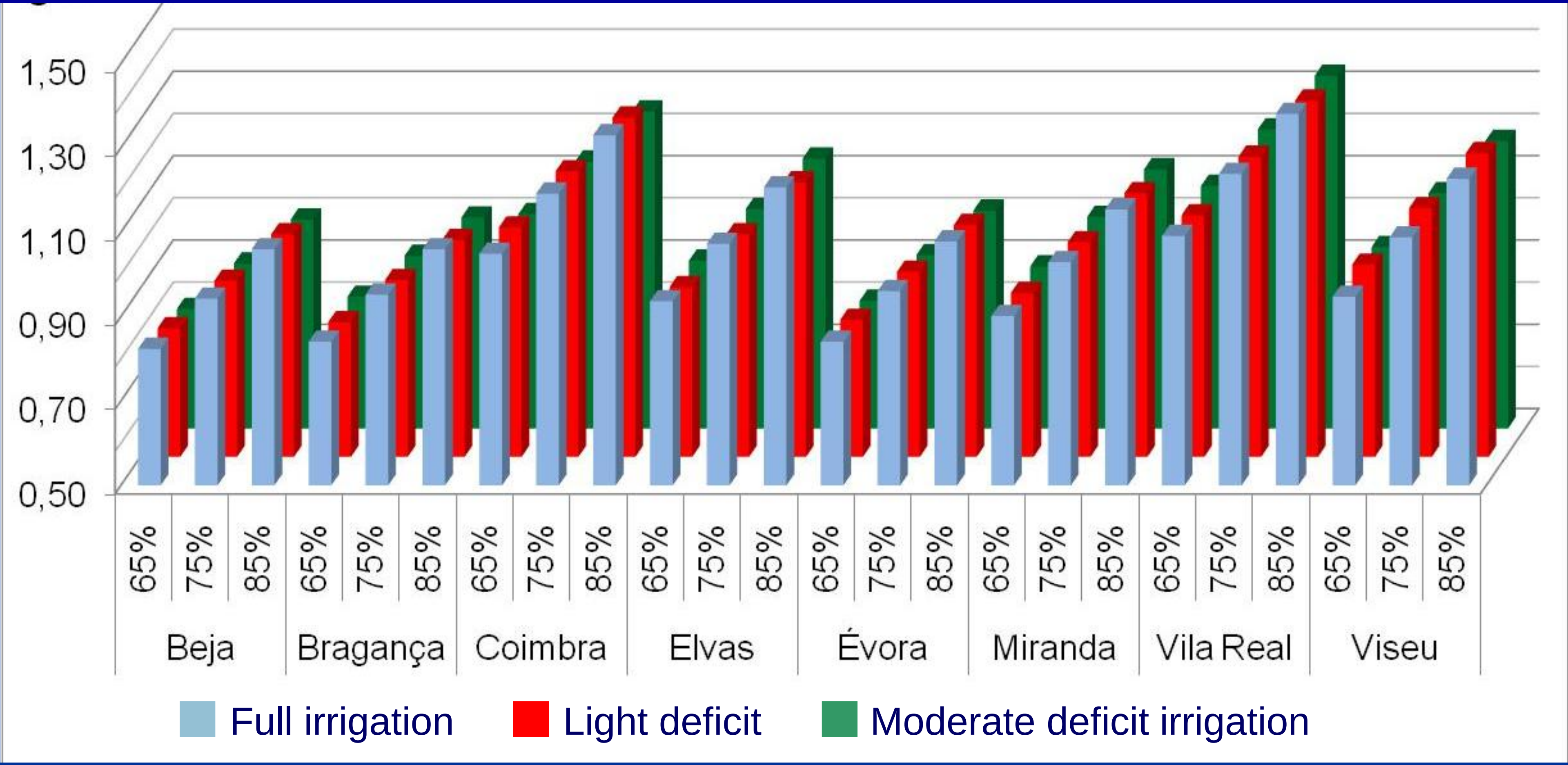


Maize water productivity at farm under sprinkler irrigation at various locations, high climate demand (severe drought) for full and deficit irrigation as influenced by the potential application efficiency



WP is higher for locations where demand is lower, and PELQ is higher.
WP is relatively insensitive to the deficit of irrigation

Maize water productivity at farm under sprinkler irrigation at various locations, very high climate demand (extremely severe drought) for full and deficit irrigation as influenced by the potential application efficiency



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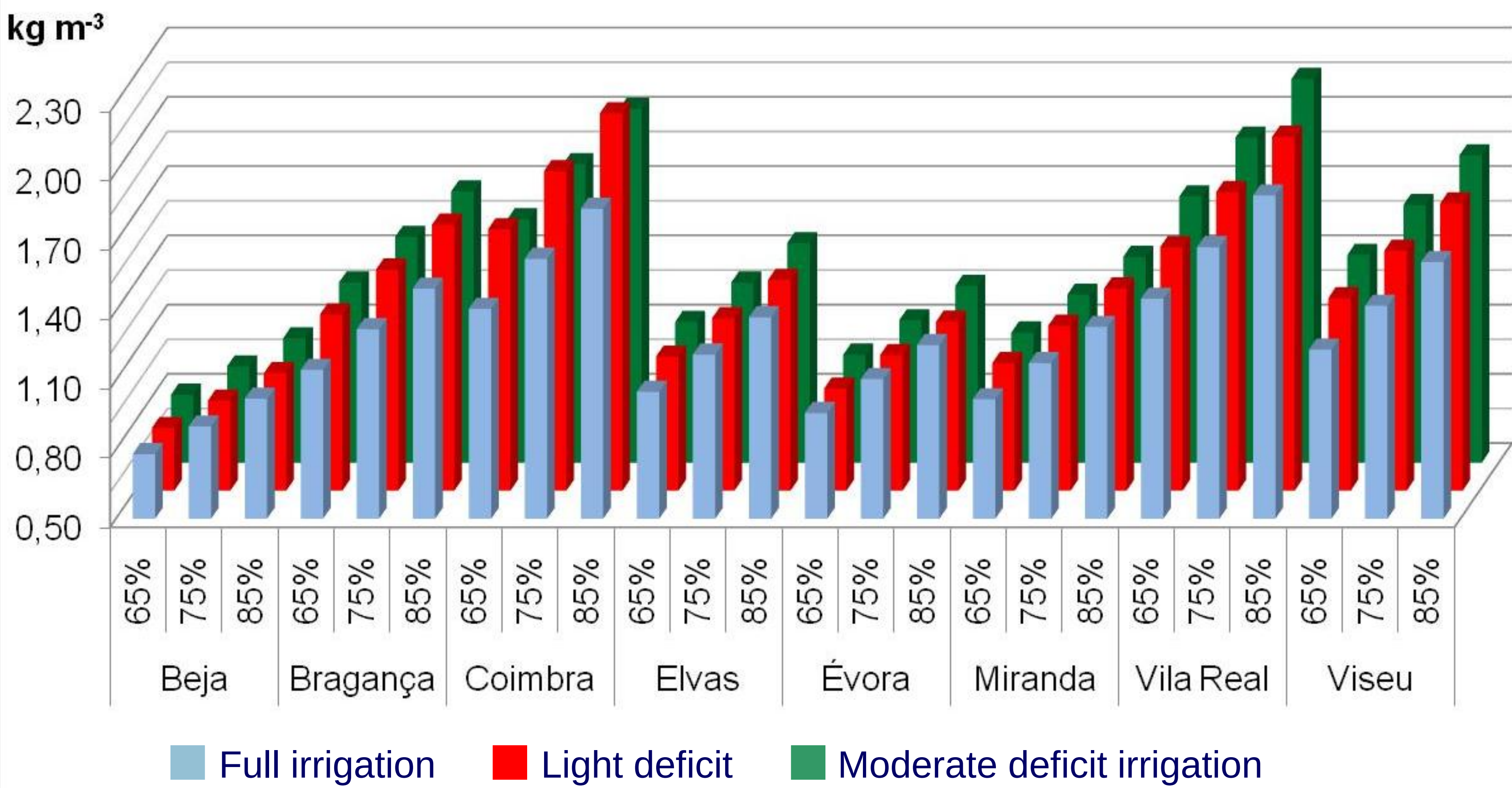
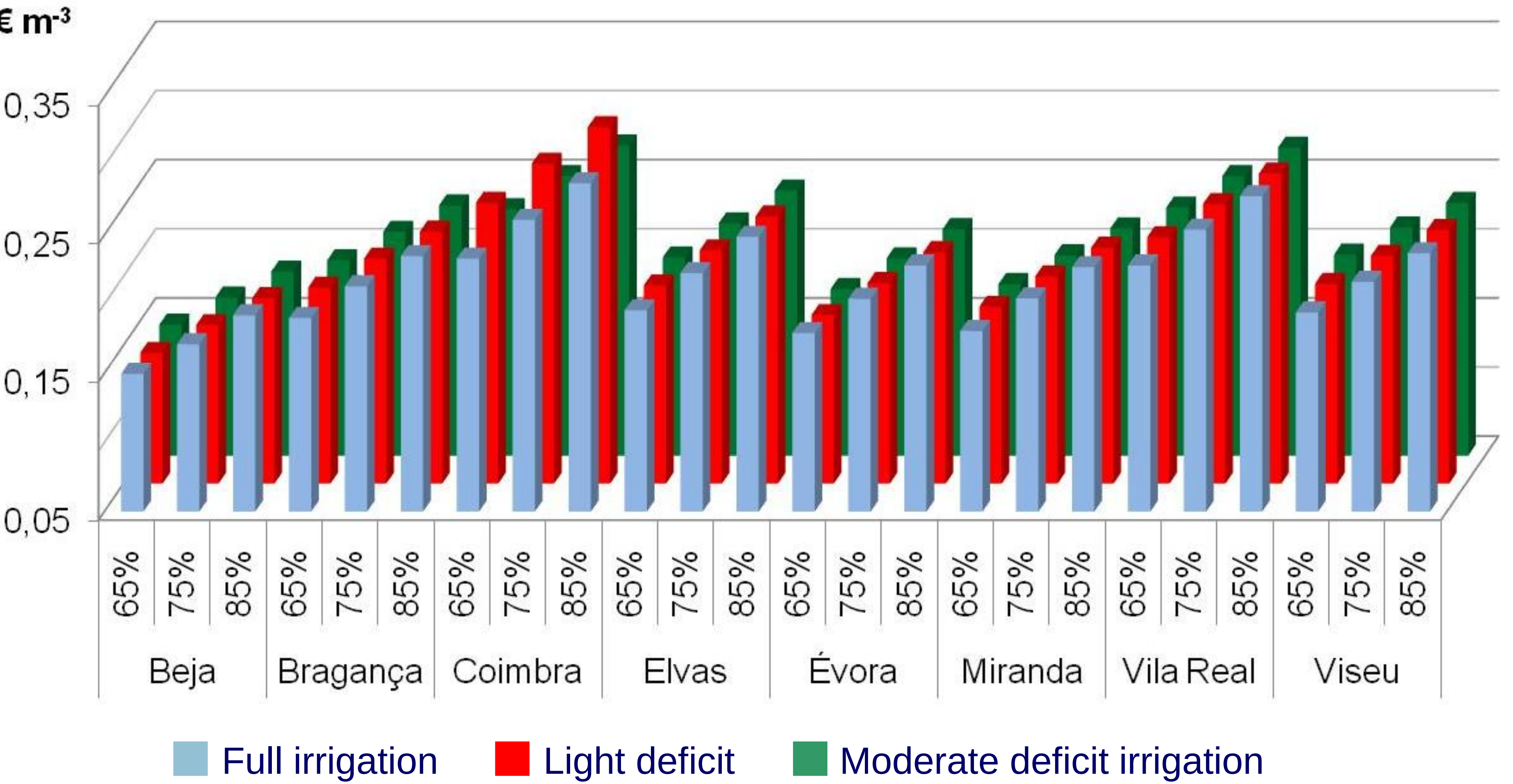


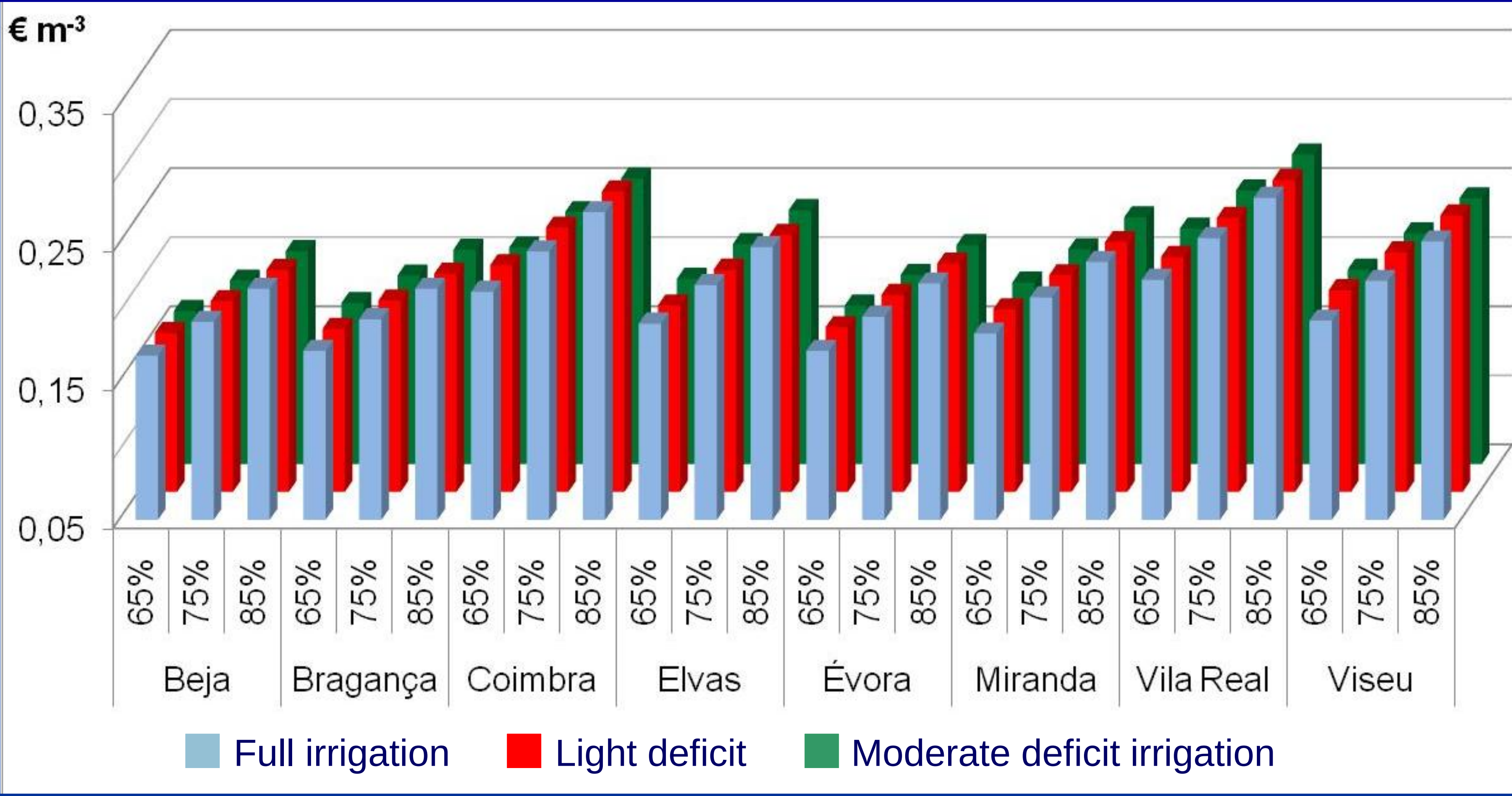
Irrigation WP is higher for locations where demand is lower, irrigation deficit is larger (less water use), and when PELQ is higher

Maize economic water productivity EWP at farm under sprinkler irrigation at various locations, high climate demand (severe drought) for full and deficit irrigation as influenced by PELQ



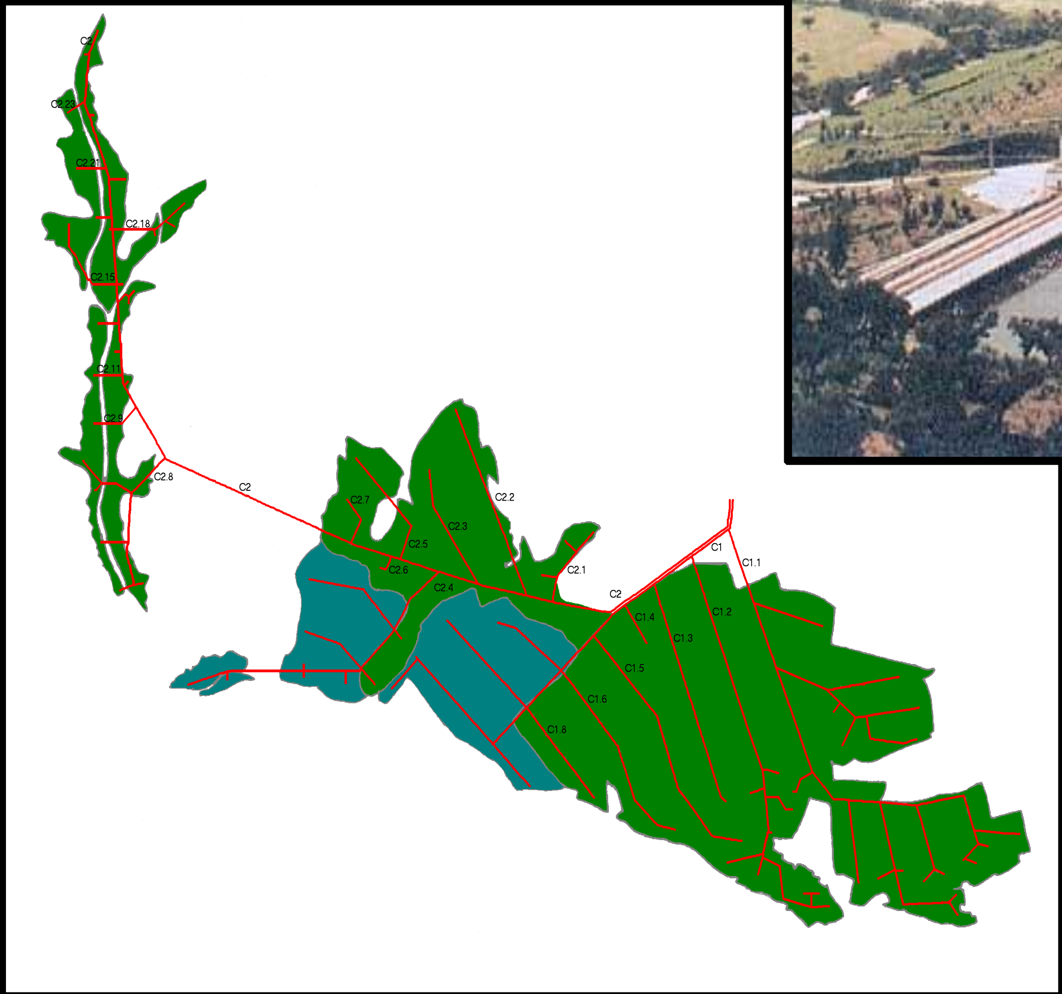
EWP follows WP trends (higher where demand is lower, relatively insensitive to the deficit of irrigation and highly influenced by PELQ

Maize economic water productivity EWP at farm under sprinkler irrigation at various locations, very high climate demand (extremely severe drought), full and deficit irrigation as influenced by PELQ



EWP follows WP trends (higher where demand is lower, relatively insensitive to the deficit of irrigation and highly influenced by PELQ

APROVEITAMENTO HIDROAGRÍCOLA DA VIGIA



Searching issues for deficit irrigation of maize, water productivity and economic results

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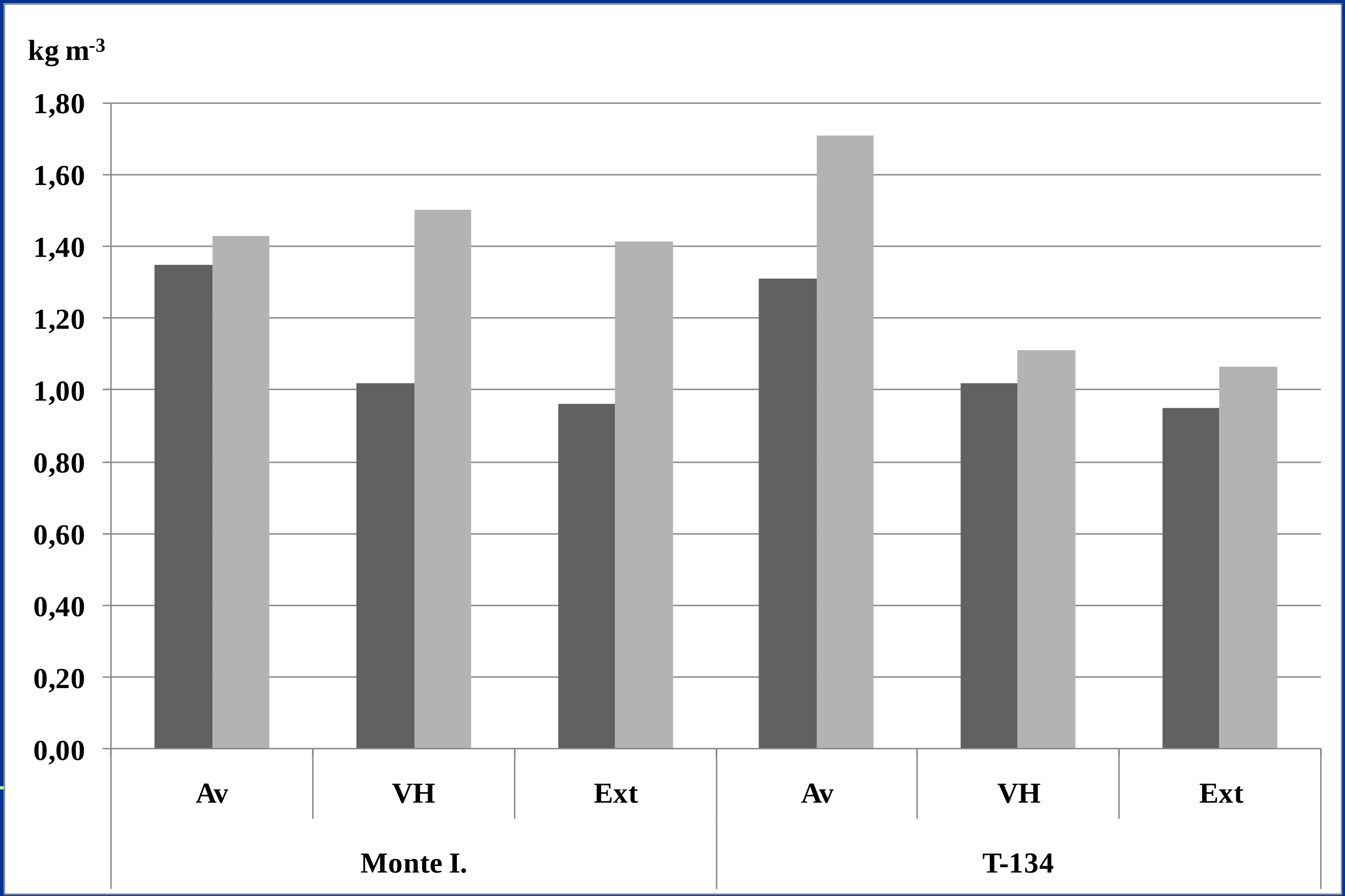
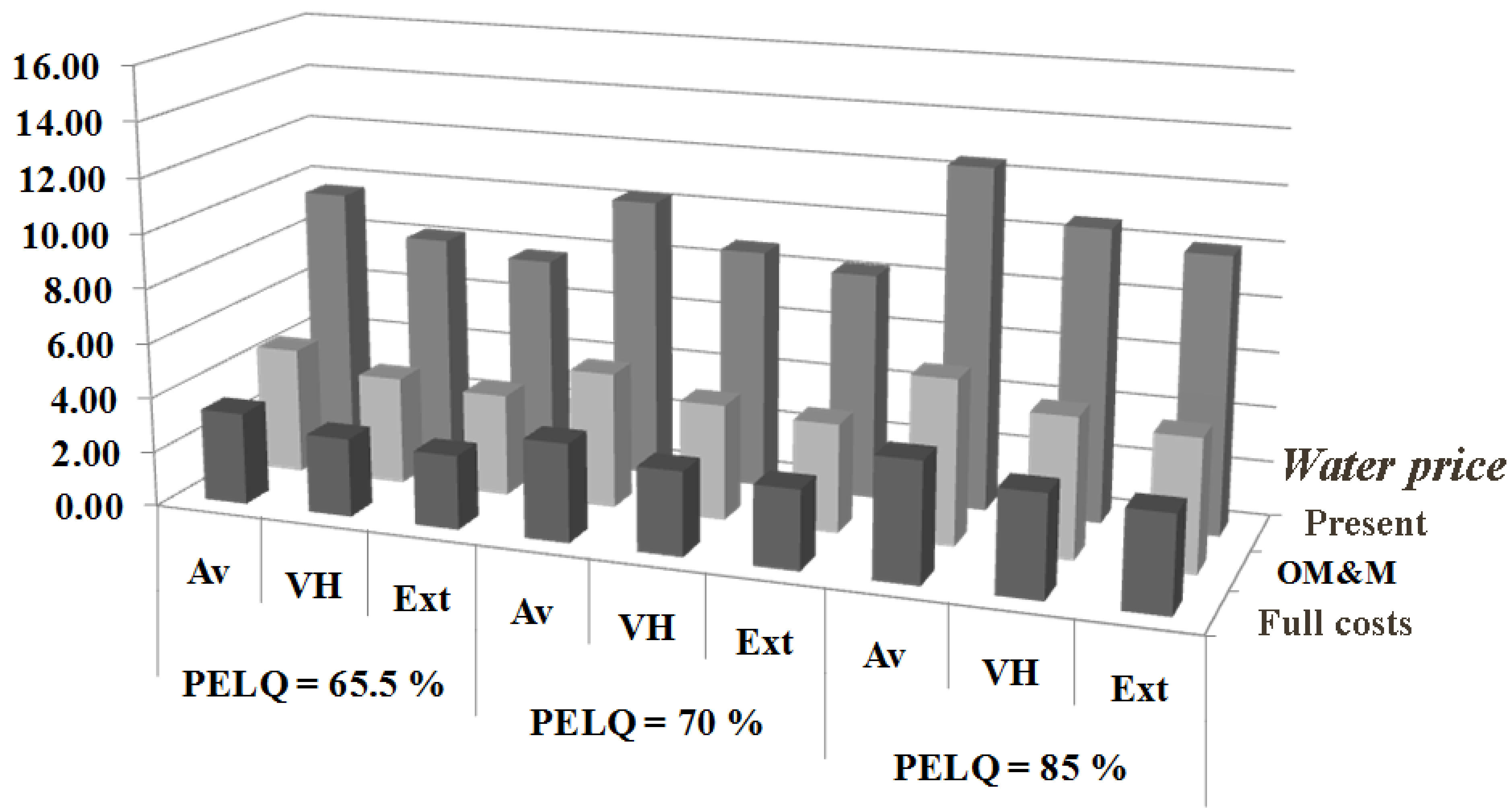
Water productivity of maize under full ■ and deficit irrigation ■ for average (Av), very high (VH) and extreme (Ext) demand; Application to 2 sprinkler irrigated farms in Southern Portugal



Economic Water Productivity Ratio (EWPR) for deficit irrigated maize (maize prices of 2010)

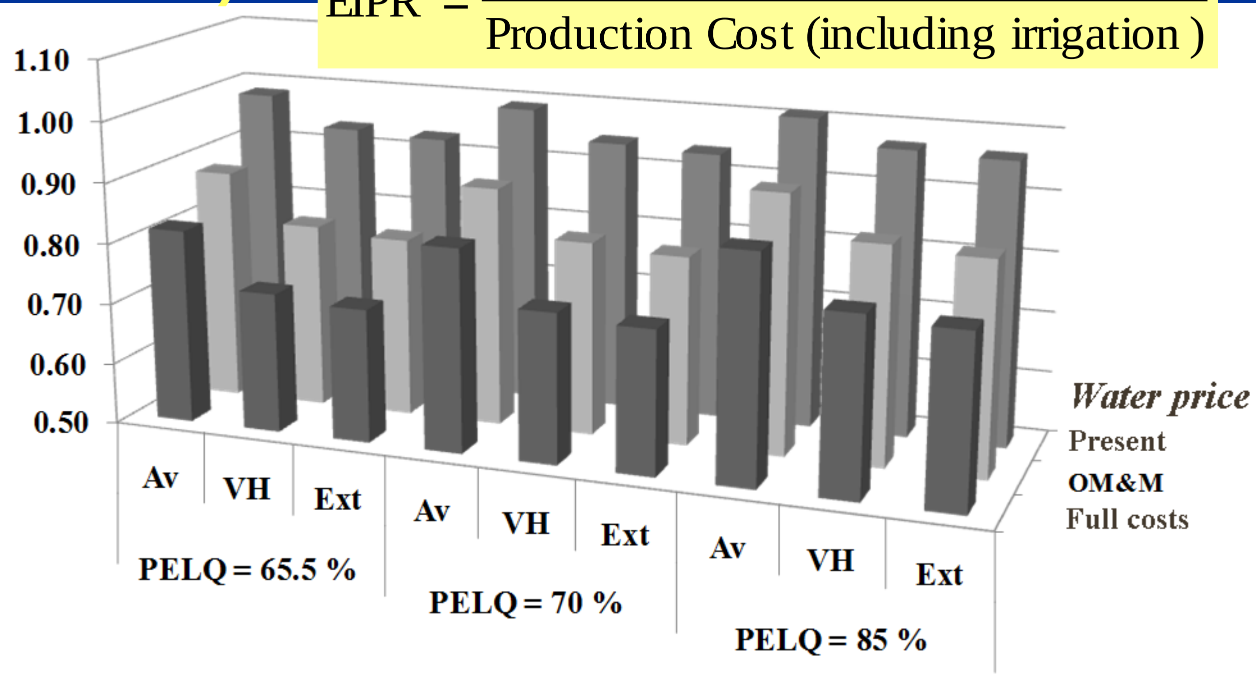
$$EWPR = \frac{Value(Ya)}{Cost(TWU)}$$



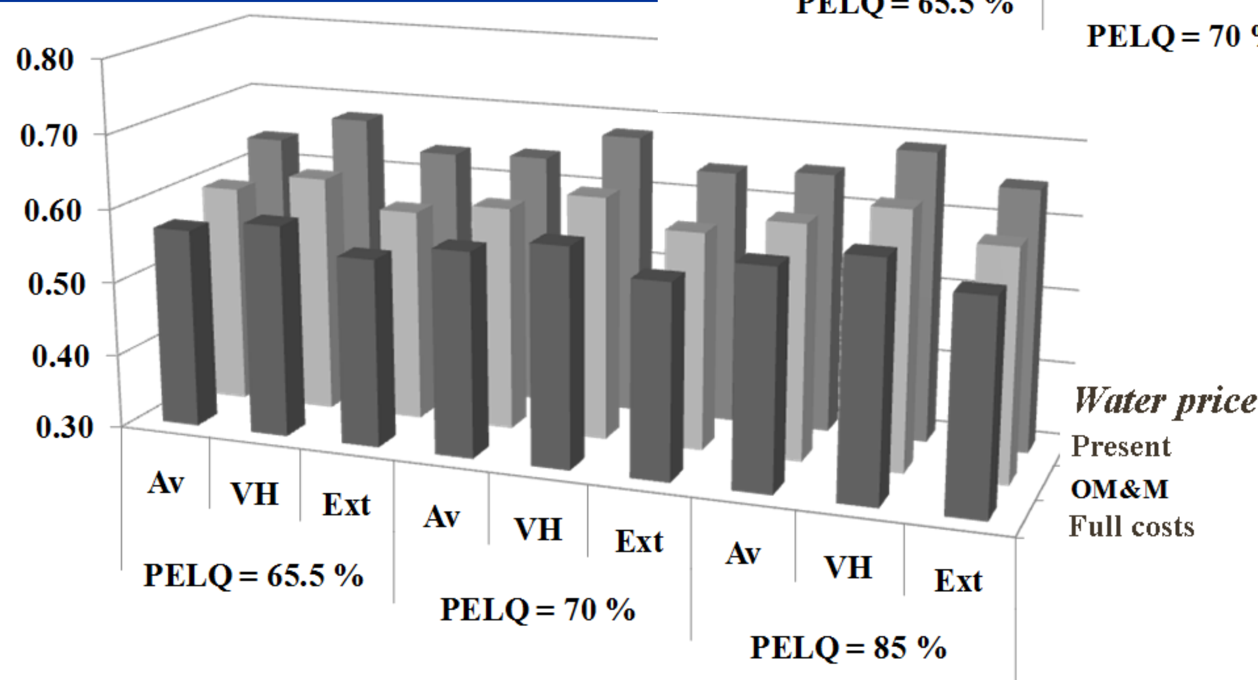
Economic irrigation production ratio EIPR, for 3 climatic demand conditions, 3 irrigation performance and 3 water prices (price of maize of 2010)

$$EIPR = \frac{\text{Value (Ya)}}{\text{Production Cost (including irrigation)}}$$

Full irrigation
(no water stress)



Deficit irrigation
(< 10% yield decrease)



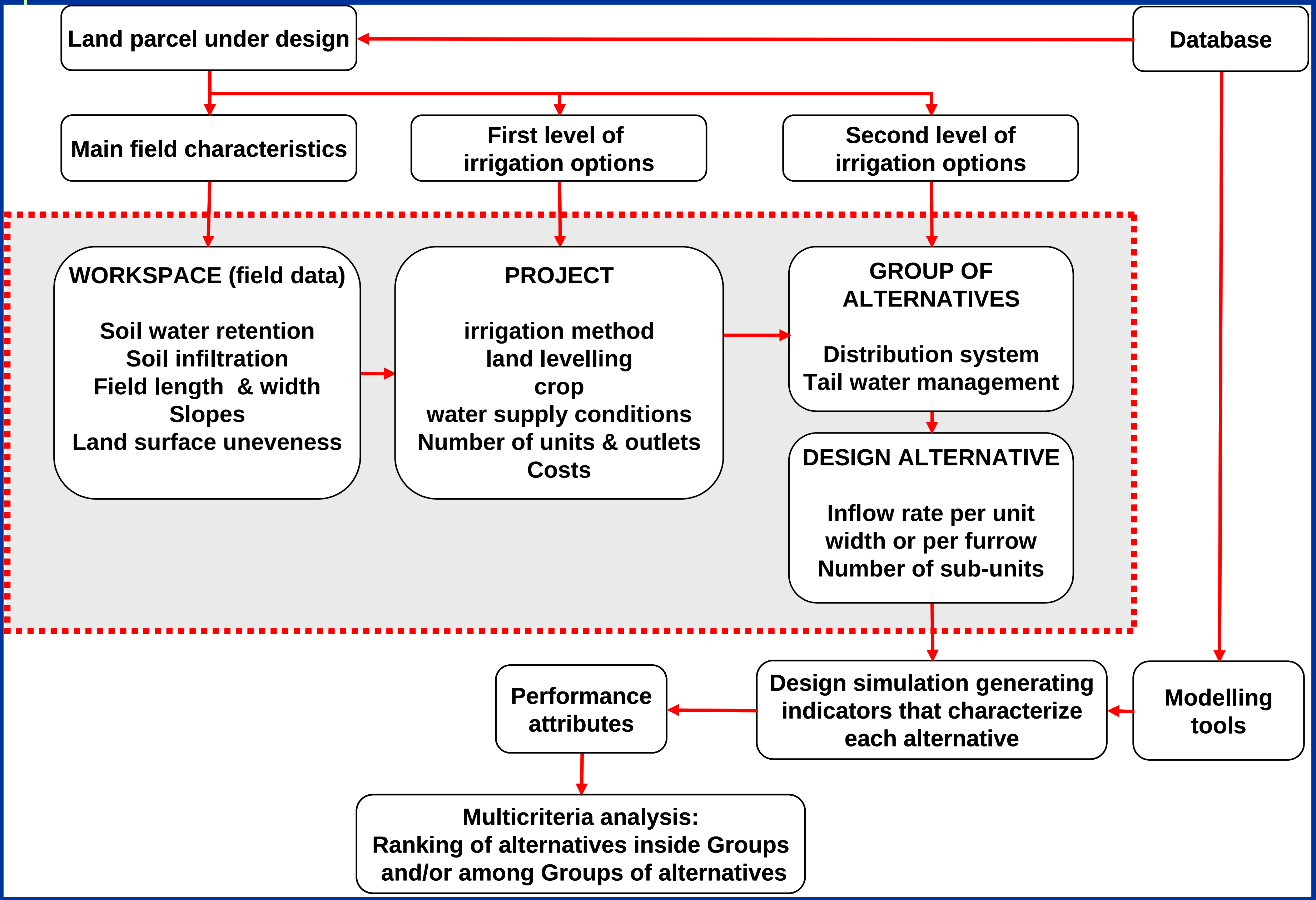
1. WP generally is higher when deficit irrigation is adopted

2. The economic results as analysed by the EWPR show to be highly dependent of the water prices (rlated to the EU Water Directive) and the performance of the irrigation system

3. Results of EIPR using full economic analysis data show that deficit irrigation may not feasible for maize and other crops having similar behaviour

4. Full irrigation of maize is feasible when yield prices are not low and irrigation systems have a good performance

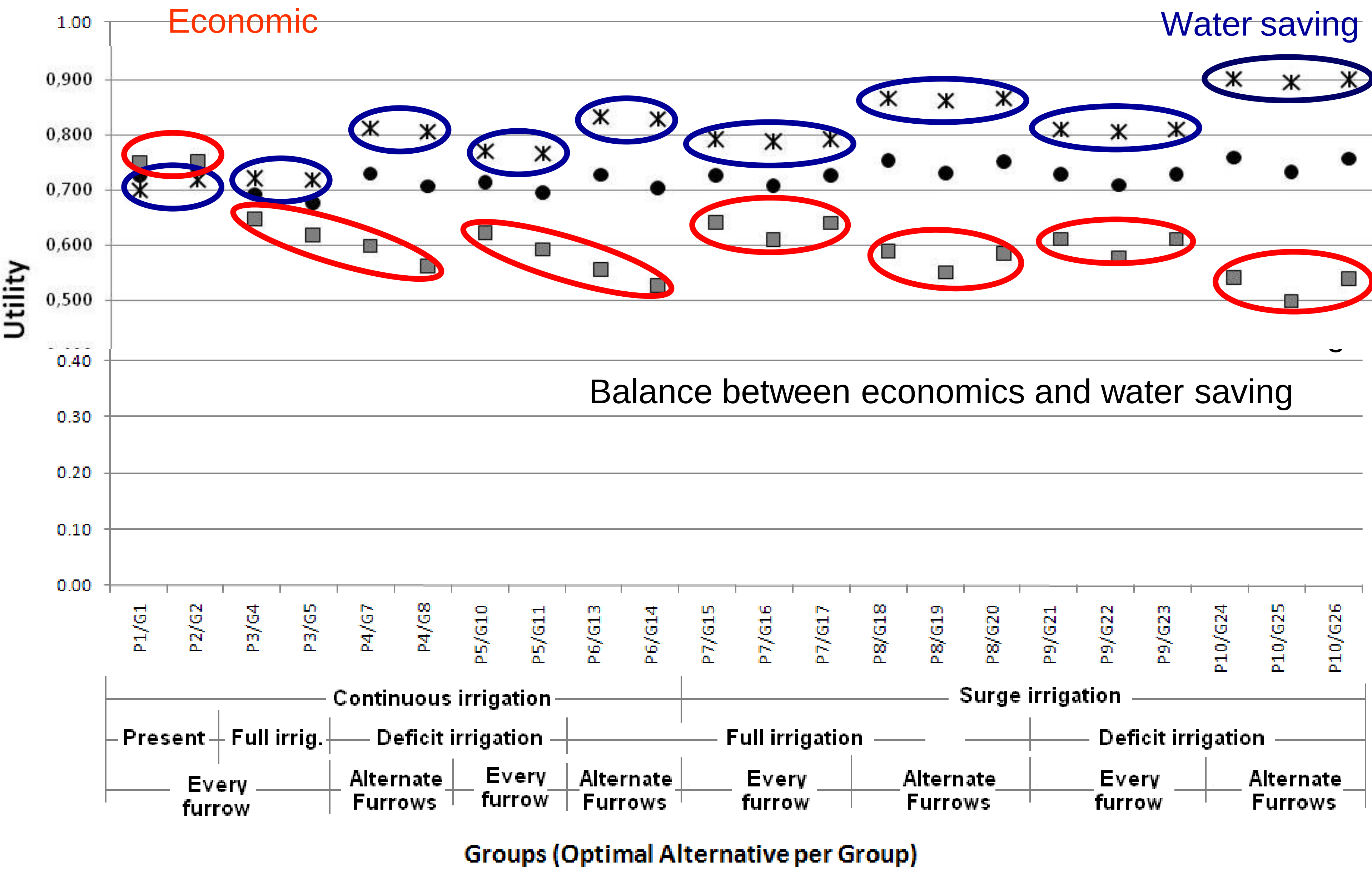
Decision Support System SADREG for surface irrigation design



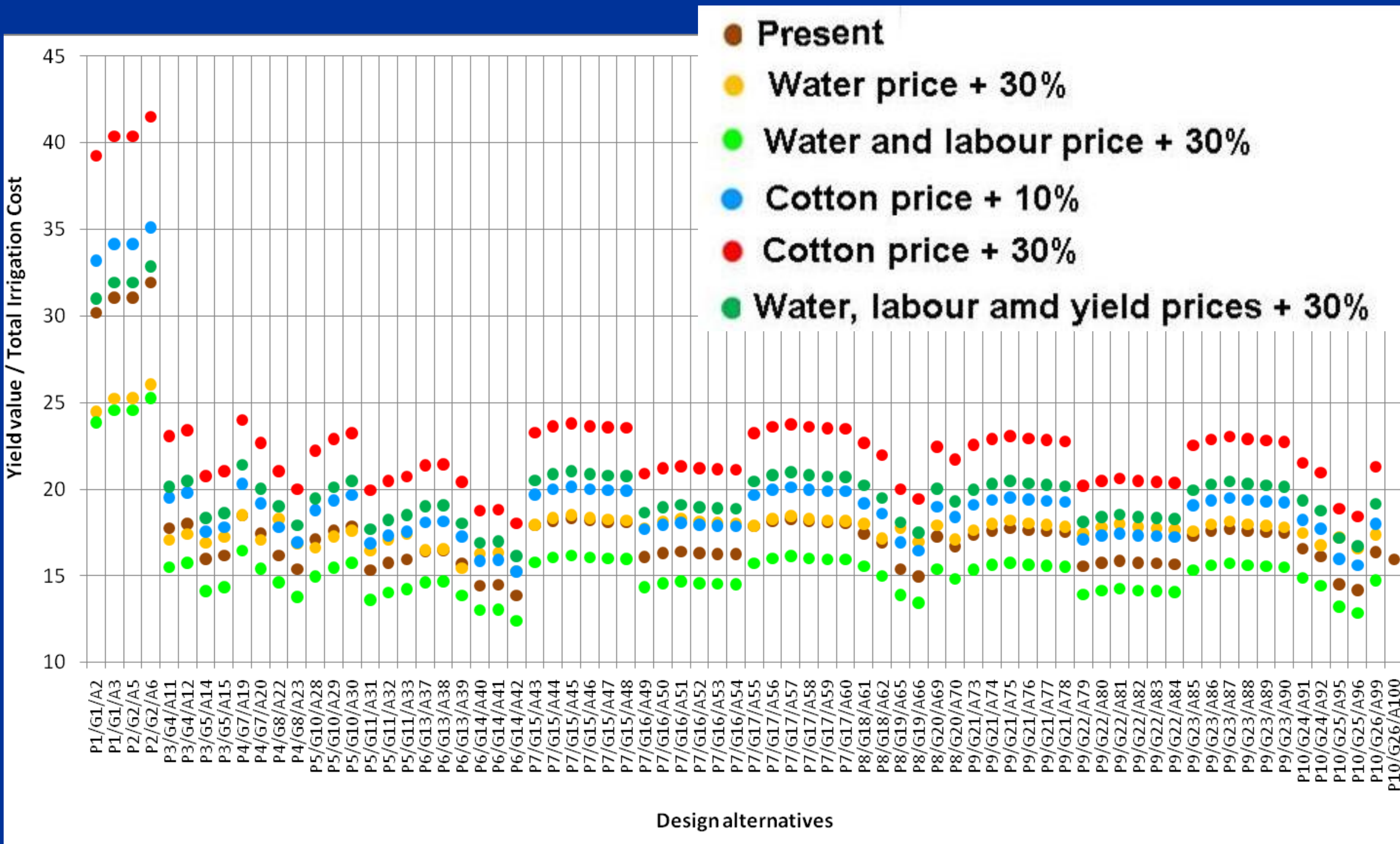
Criteria, Attributes, and Weights (%) relative to the Priorities to rank the alternatives

Criteria	Attributes	Weights (%) for several attributes in conditions of		
		Balance among economics, water saving, and environment	Priority to water saving and environment	Priority to economic results
Economic results	Economic land productivity	12	3	40
	Fixed costs	14	3	25
	Variable costs	14	4	25
	Total	40	10	90
Water saving and environment	Water use	20	30	2
	Irrigation water productivity	15	20	2
	Runoff	10	15	2
	Deep percolation	10	15	2
	Erosion index	5	10	2
	Total	60	90	10

Utilities of Groups' best design alternatives for different prioritization schemes adopting 2010 prices of cotton, of labour and of water



Ratio Yield value / Total Irrigation cost for all design alternatives as influenced by water, labour and yield prices



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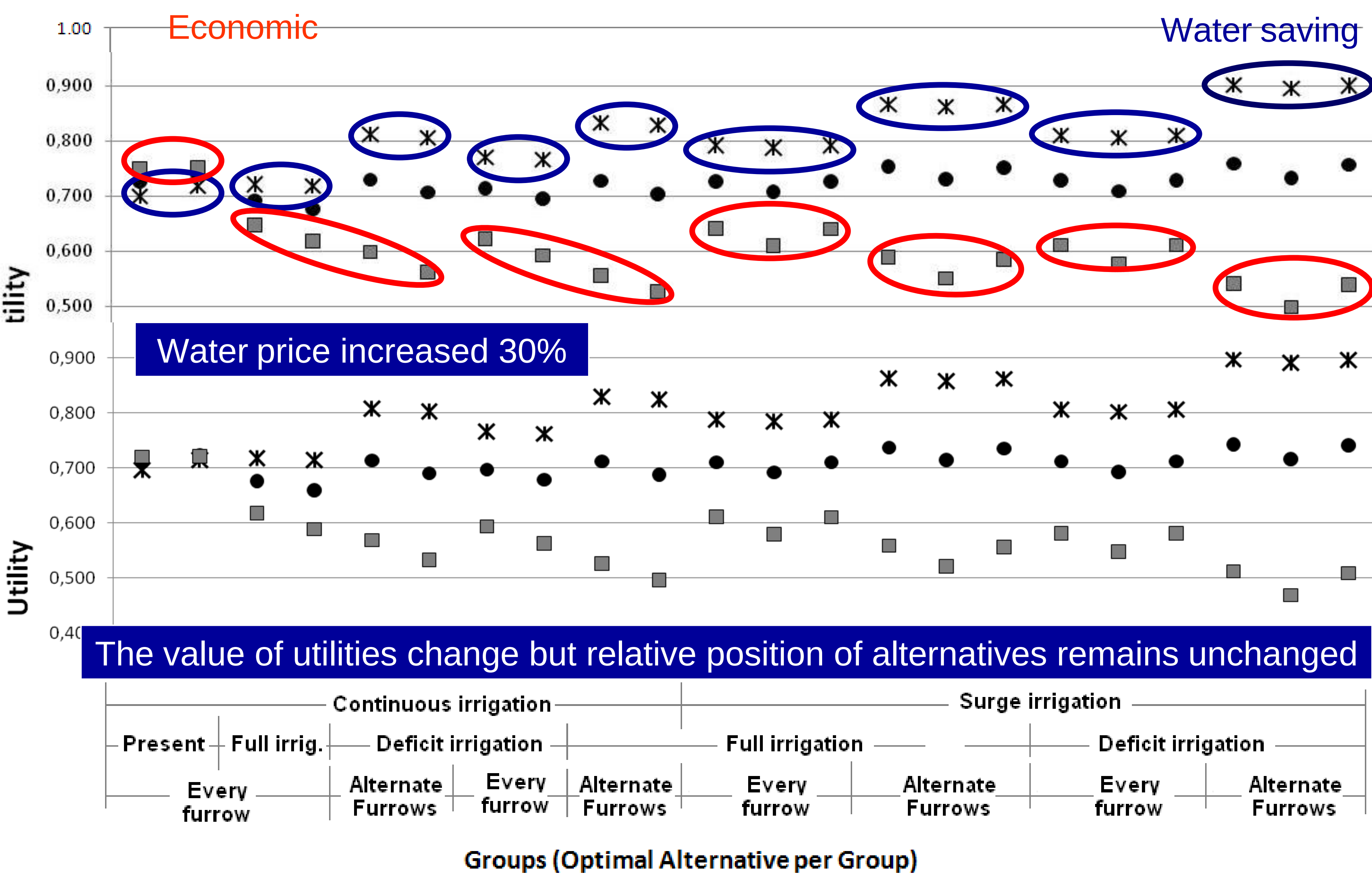
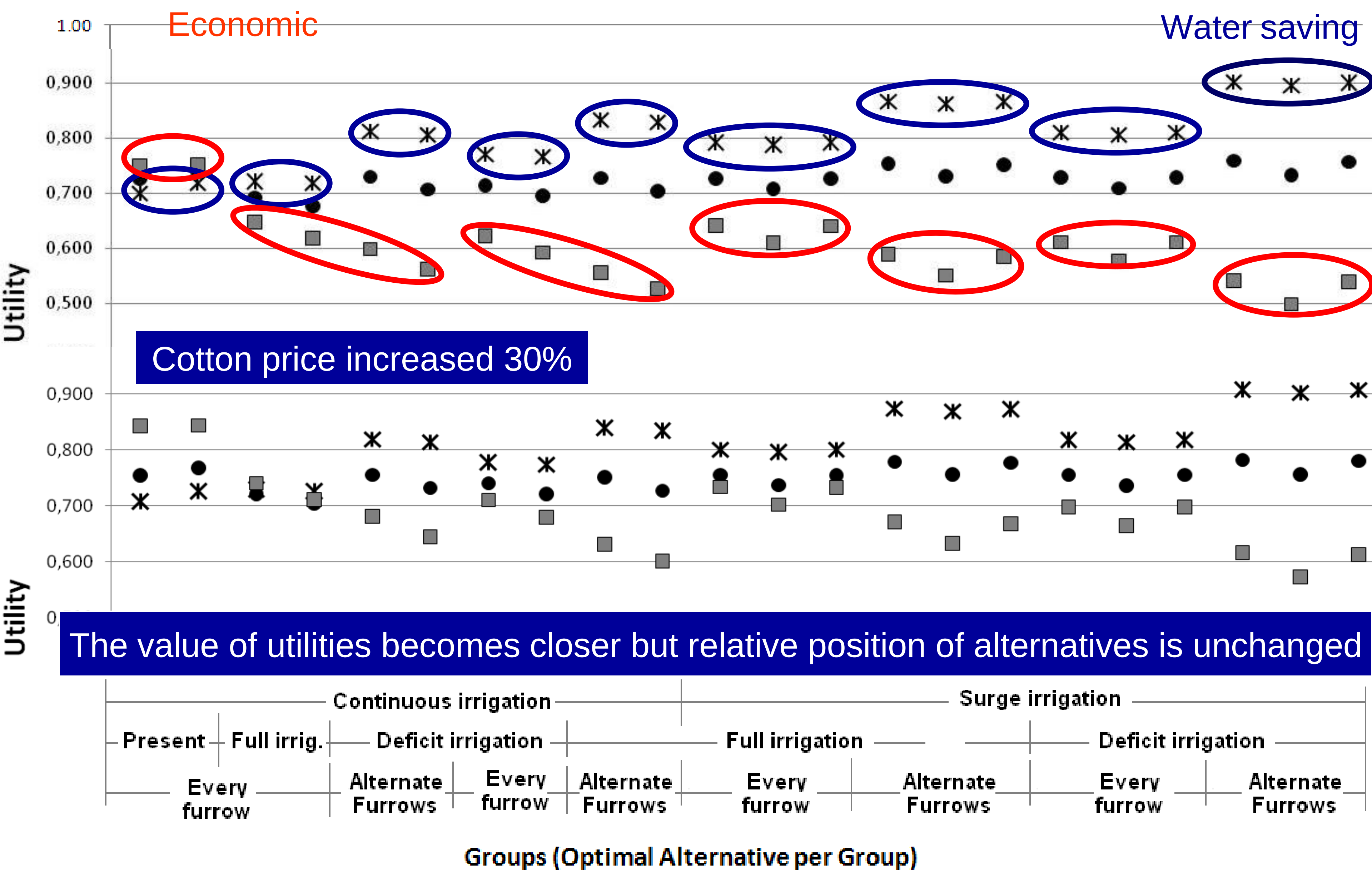
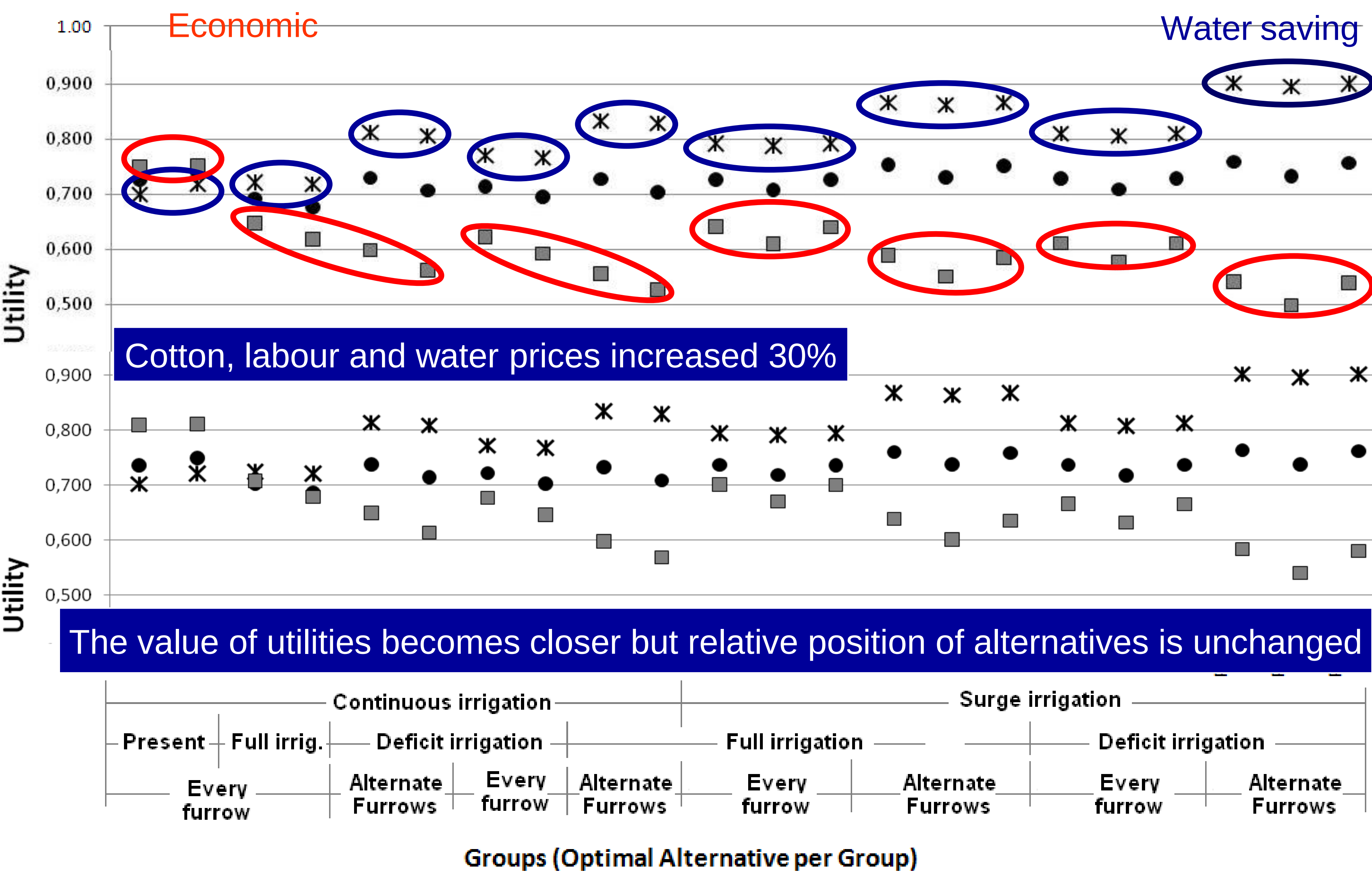


Utilities of Groups' best design alternatives for different prioritization schemes adopting 2010 prices of cotton, of labour and of water



Utilities of Groups' best design alternatives for different prioritization schemes adopting increased prices of cotton, labour and water



The value of utilities becomes closer but relative position of alternatives is unchanged

Ranking of alternatives depending on changes in water, labour & cotton prices

Priorities	Rank	Present	Water price + 30%	Water & Labour +30%	Cotton price + 30%	All + 30%
Water saving	1	91	91	91	91	91
	2	99	99	99	99	99
	3	95	95	95	95	95
	4	61	61	61	61	61
	5	69	69	69	69	69
	6	65	65	65	65	65
	7	37	37	37	37	37
	8	40	40	40	40	40
	9	92	92	92	92	92
	10	100	100	100	100	100
Economic	1	6	6	6	6	6
	2	5	5	5	5	5
	3	3	3	3	3	3
	4	2	2	2	2	2
	5	11	11	11	11	11
	6	12	12	12	12	12
	7	43	43	43	43	43
	8	55	55	55	55	55
	9	44	44	44	44	44
	10	56	56	56	56	56
Balance	1	91	91	91	91	91
	2	99	99	99	99	99
	3	61	61	61	61	61
	4	69	69	69	69	69
	5	6	6	6	6	6
	6	95	95	95	5	5
	7	65	65	19	95	19
	8	19	19	65	65	95
	9	5	5	74	19	65
	10	74	74	5	74	74

Adopting multicriteria analysis in irrigation modelling may be an issue to find coherent compromises between farmers economic criteria and managers water daving and environmental criteria

Our current knowledge is presently sufficient to build up such systems but it is difficult to accede to good quality economic data

When models take the form of a DSS farmers may participate not only in decision making but in building the alternatives with other irrigation professionals