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SUMO: SUgarbeet MOdel for predicting yield and quality

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Yield and quality forecast

- present yield forecast 2003
- history of yield forecast
- *SUMO*: estimations
- *SUMO*: factors determining yield and quality
- *SUMO*: results
- conclusions

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Average yield forecast The Netherlands 2003

Based on *SUMO*

present forecast

date	root yield (t/ha)	sugar yield (t/ha)
28-07	68	11.0
11-08	69	11.2
25-08	66	10.7
08-09	66	10.7
final yield 2002	60	9.6
final yield 1993-2002	58	9.3

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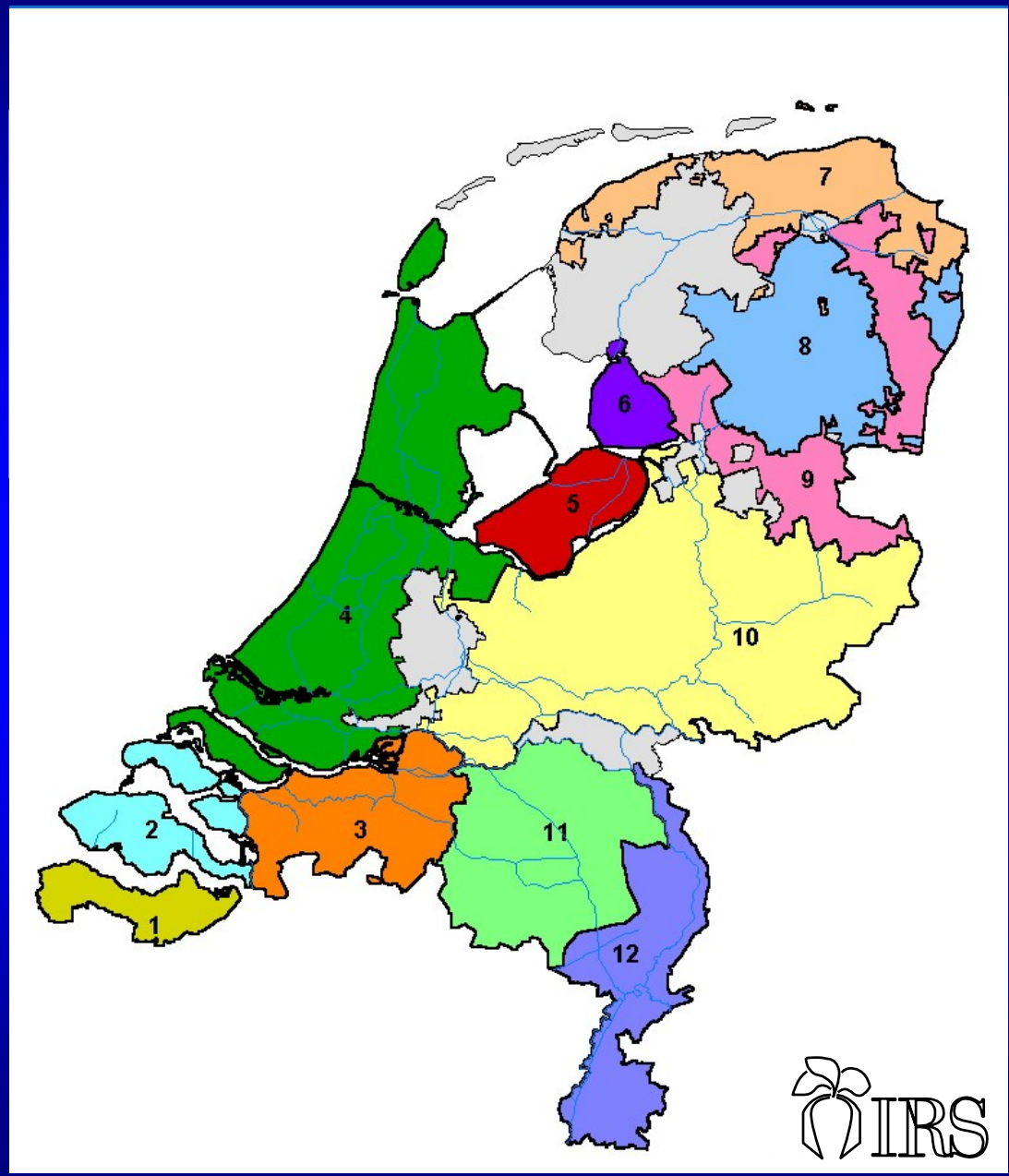
1 = Zeeuwsch-Vlaanderen
2 = Zeeuwse Eilanden
3 = West-Brabant
4 = Noord- en Zuid-Holland
5 = Oost- en Zuid-Flevoland
6 = Noordoostpolder
7 = Noordelijk klei
8 = Noordelijk zand
9 = Noordelijk dal
10 = Gelderland e.o.
11 = Oost-Brabant
12 = Limburg



present forecast

Yield forecast individual regions 2003

Based on *SUMO*

Region No.	Name	Root yield (t/ha)	Sugar yield (t/ha)
1 =	Zeeuwsch-Vlaanderen	65	10.8
2 =	Zeeuwse Eilanden	67	11.0
3 =	West-Brabant	66	10.8
4 =	Noord- en Zuid-Holland	72	11.6
5 =	Oost- en Zuid-Flevoland	84	13.3
6 =	Noordoostpolder	81	13.3
7 =	Noordelijk klei	72	11.6
8 =	Noordelijk zand	53	8.8
9 =	Noordelijk dal	57	9.4
10 =	Gelderland e.o.	59	9.3
11 =	Oost-Brabant	58	9.2
12 =	Limburg	65	10.1
	Netherlands	66	10.7

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- untill 1995: periodic harvests
  - 1 sampling site per 100 – 400 ha
  - 4 - 10 samplings/year
- growth models
  - WUR: scientific model
  - Suikerunie: applied model
- *SUMO*
  - synthesis between applied and scientific
  - calibration: yield and weather data 1981-1986
  - Oracle database; start in 1996
  - national forecast without additional sampling

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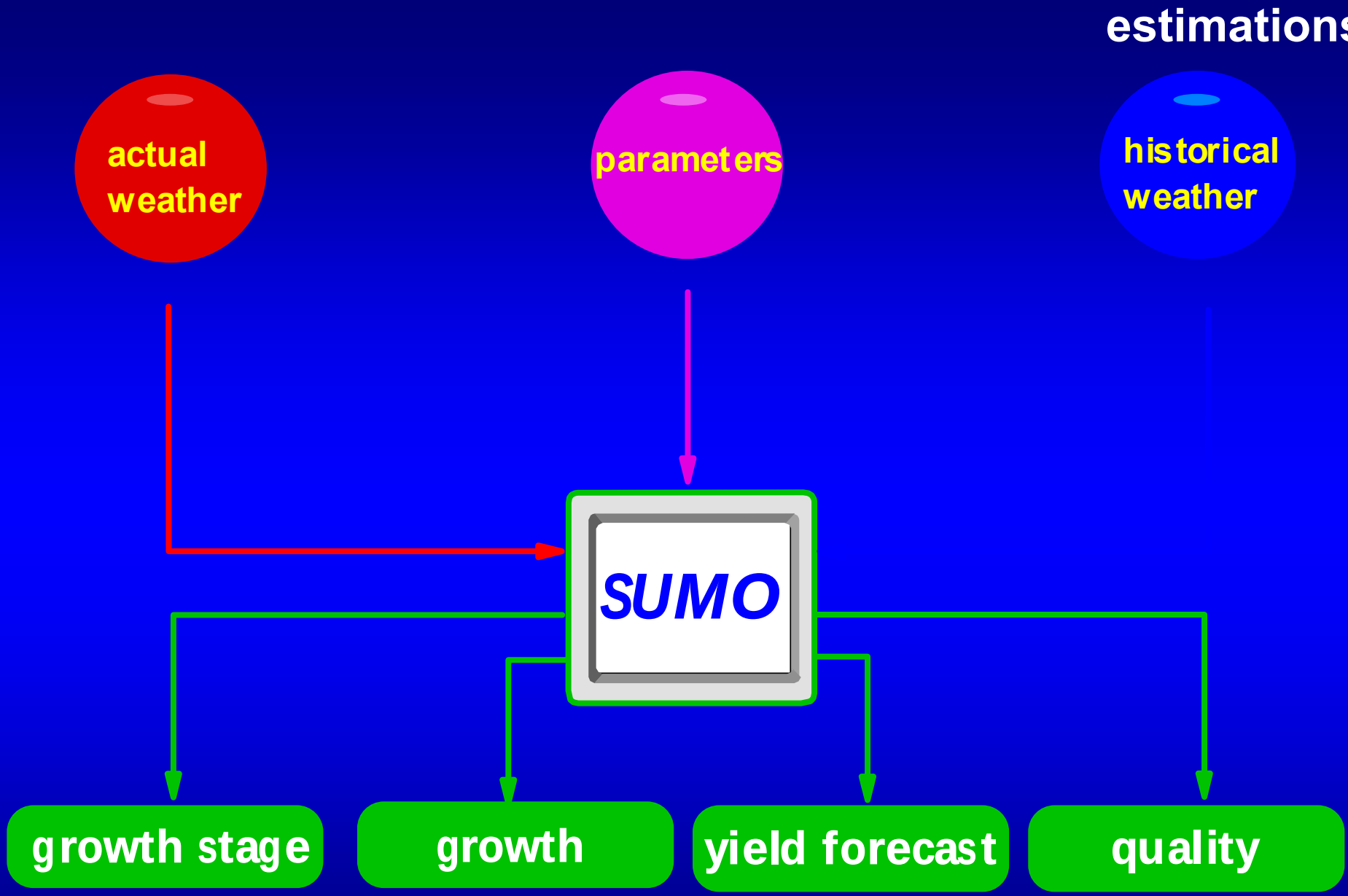
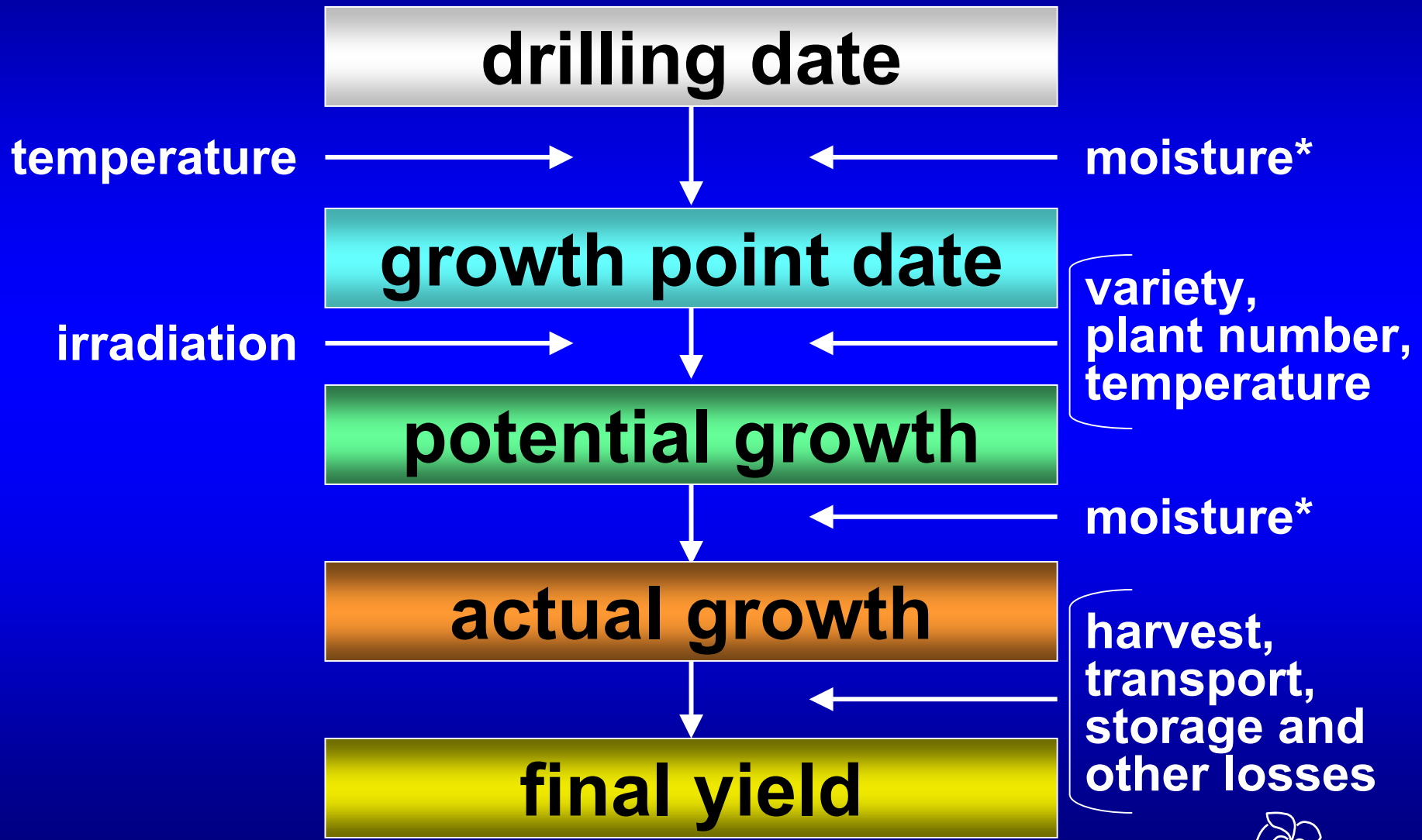

estimations
actual weather
parameters
historical weather
SUMO
growth stage
growth
yield forecast
quality

driving factors:

adjusting factors:



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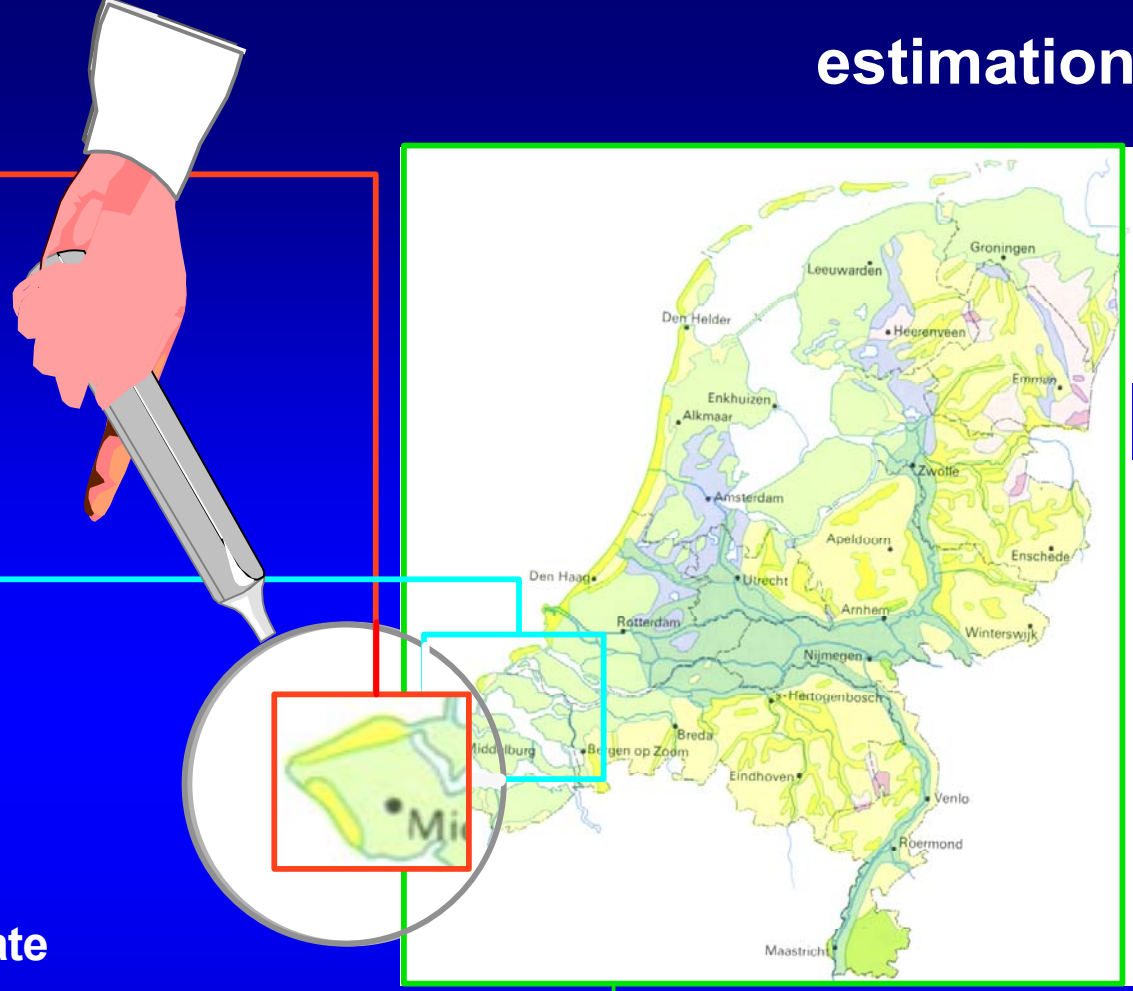
estimations

Level 3

- acreage
- soil conditions
- moisture balance
- % drought susceptible
- % irrigation



Level 2

- sowing date
- temperature sum required
- growth coefficient
- reduction factors variety, plant number
- regression coefficient yield

Level 1

- quality

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Quality forecast

- extractability sugar and molasses
- average of the Netherlands

$$K+Na = a \times DCC + b \times Precipitation^{1} + c \times Variety\ factor + d$$

$$\alpha\text{-amino N} = e \times Precipitation^{2} + f \times Temperature + g \times Variety\ factor + h$$

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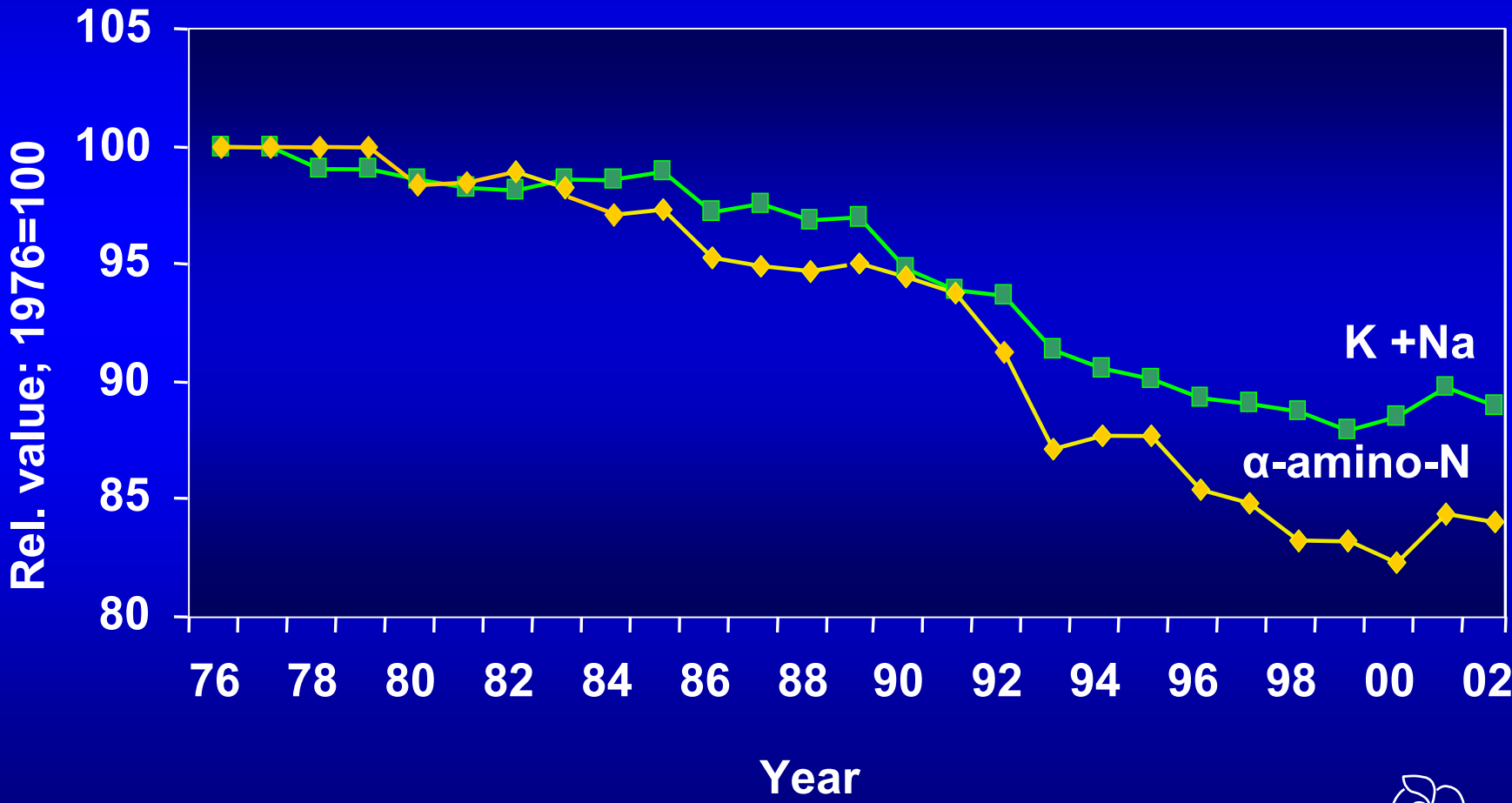
Quality and variety

estimations

Quality improvement of sugar beet varieties, 1976 – 2002 (values adjusted for year effects)



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Sowing date

sowing date	root yield (t/ha)	sugar yield (t/ha)
March 1	61,1	9,6
March 15	60,5	9,6
March 31	58,3	9,2
April 15	55,4	8,8
April 30	51,4	8,3
May 15	45,4	7,4

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Temperature I

Temperature sum to date of closed canopy:

Polders	590° . days
Holland	611° . days
Northern sand	641° . days

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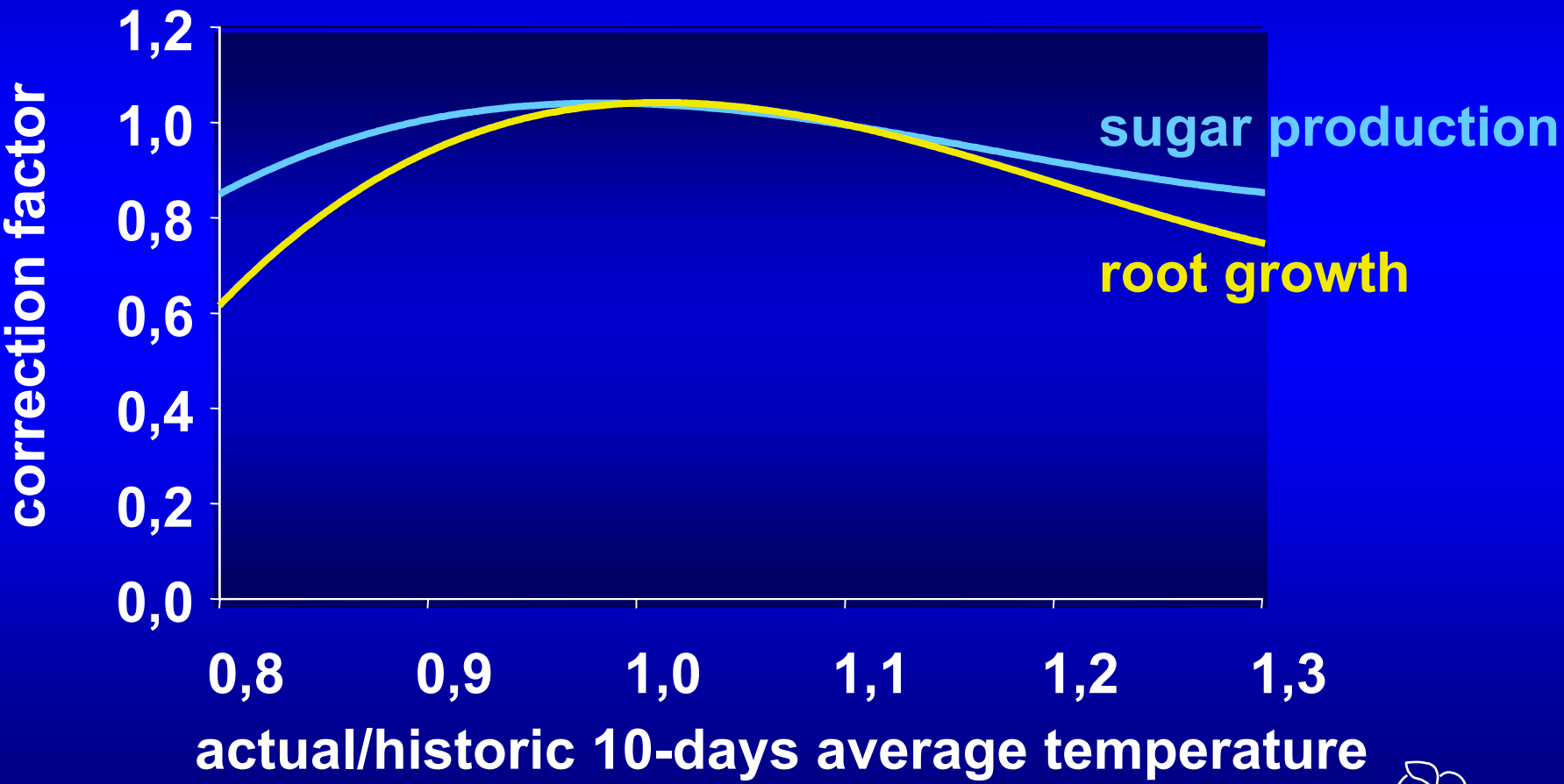
Temperature II

Effect of average daily temperature during summer



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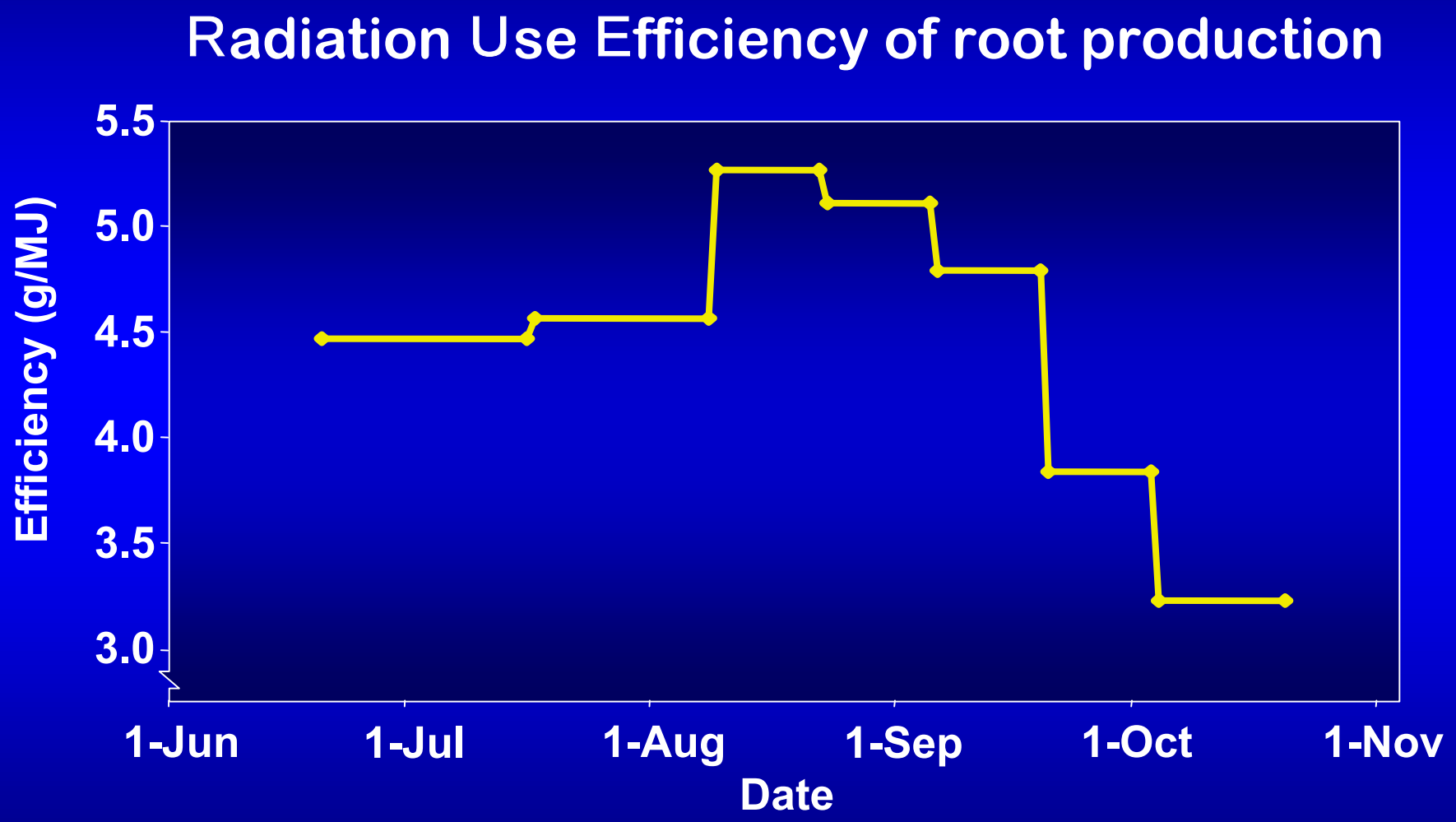
Radiation I



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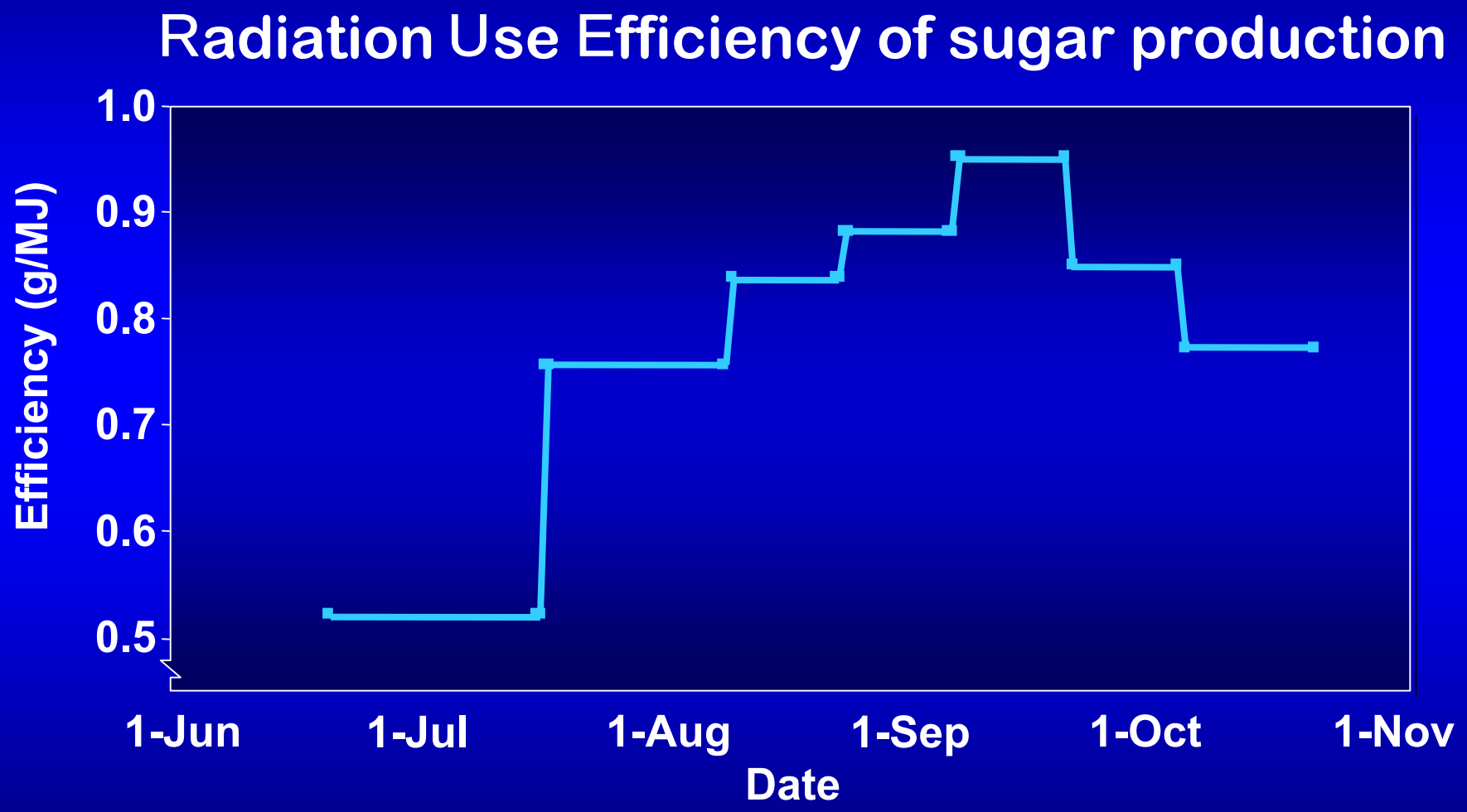
Radiation II



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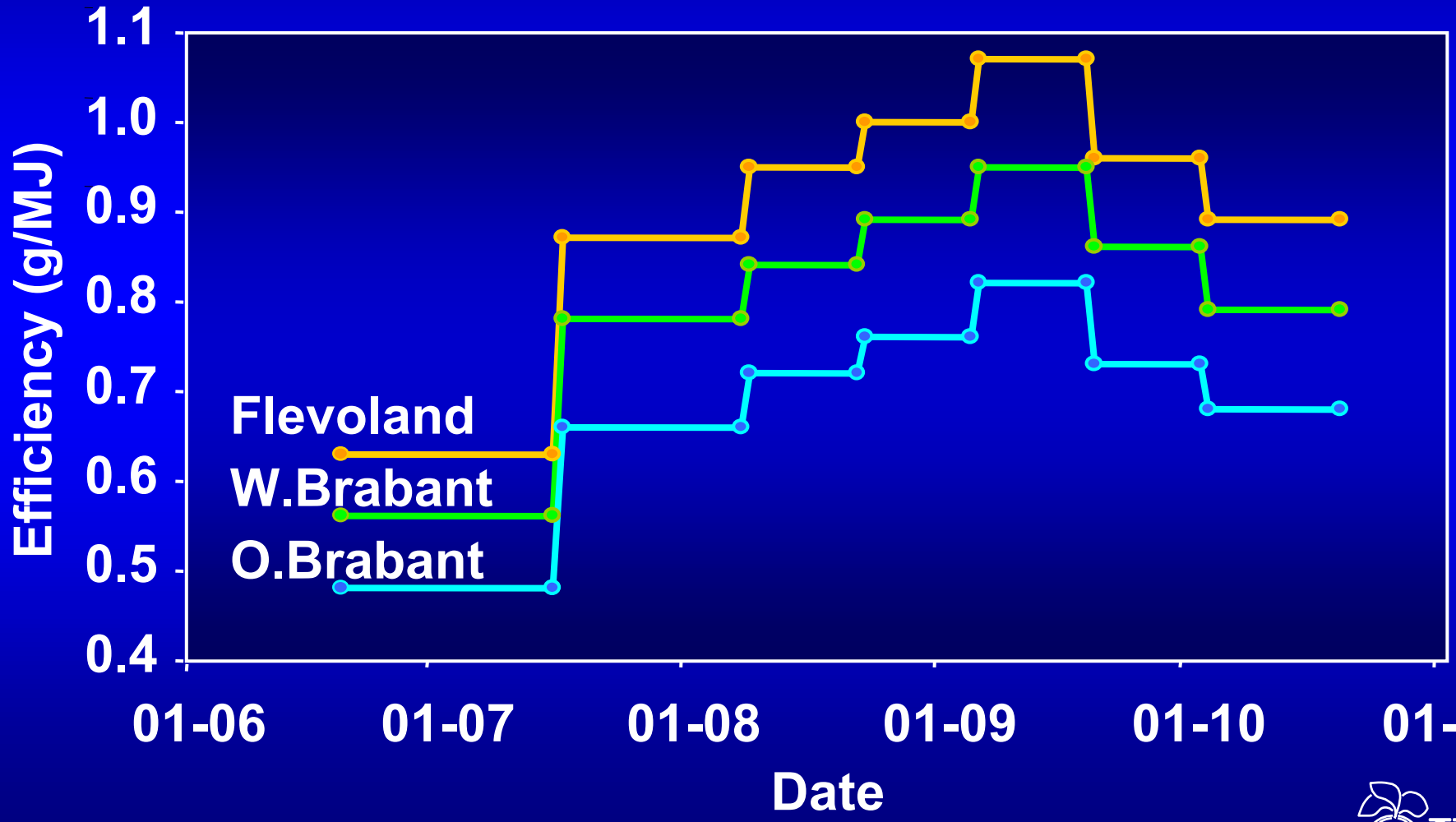
Radiation III

Radiation Use Efficiency of sugar production, difference between areas



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Variety

- use of varieties with high sugar content
- use of resistant varieties with lower yield potential

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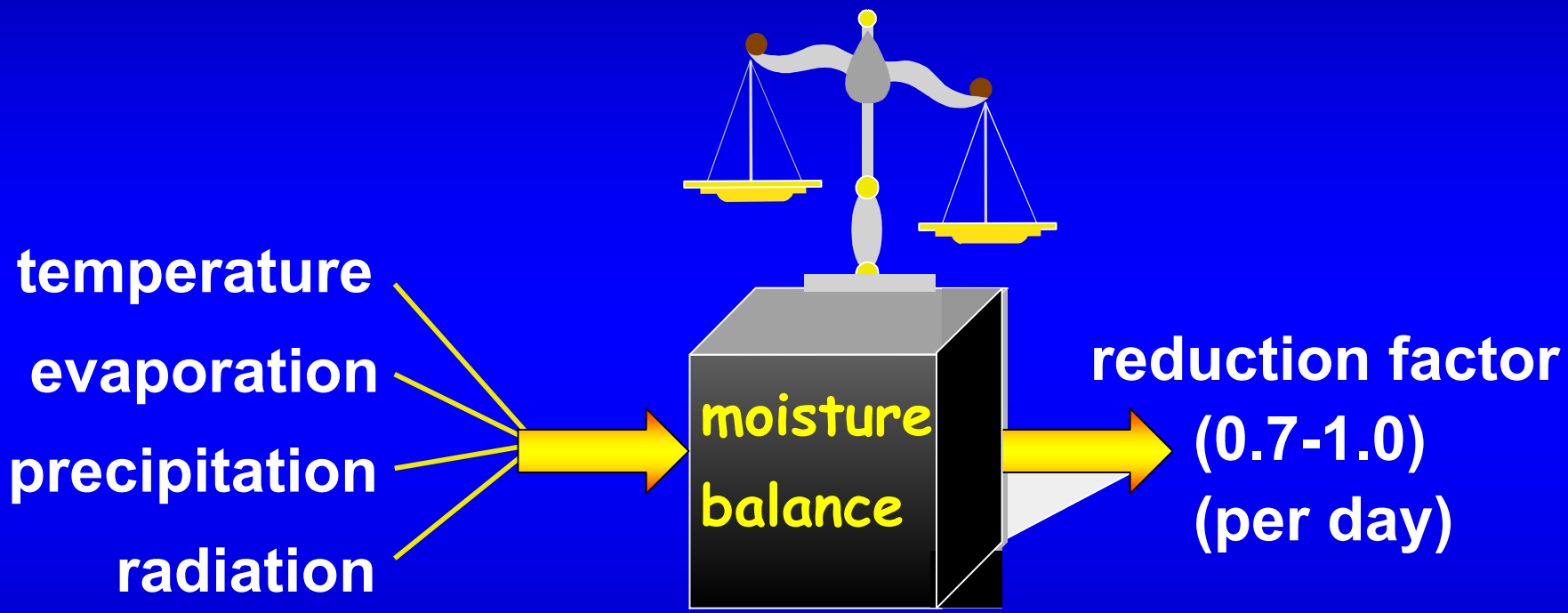
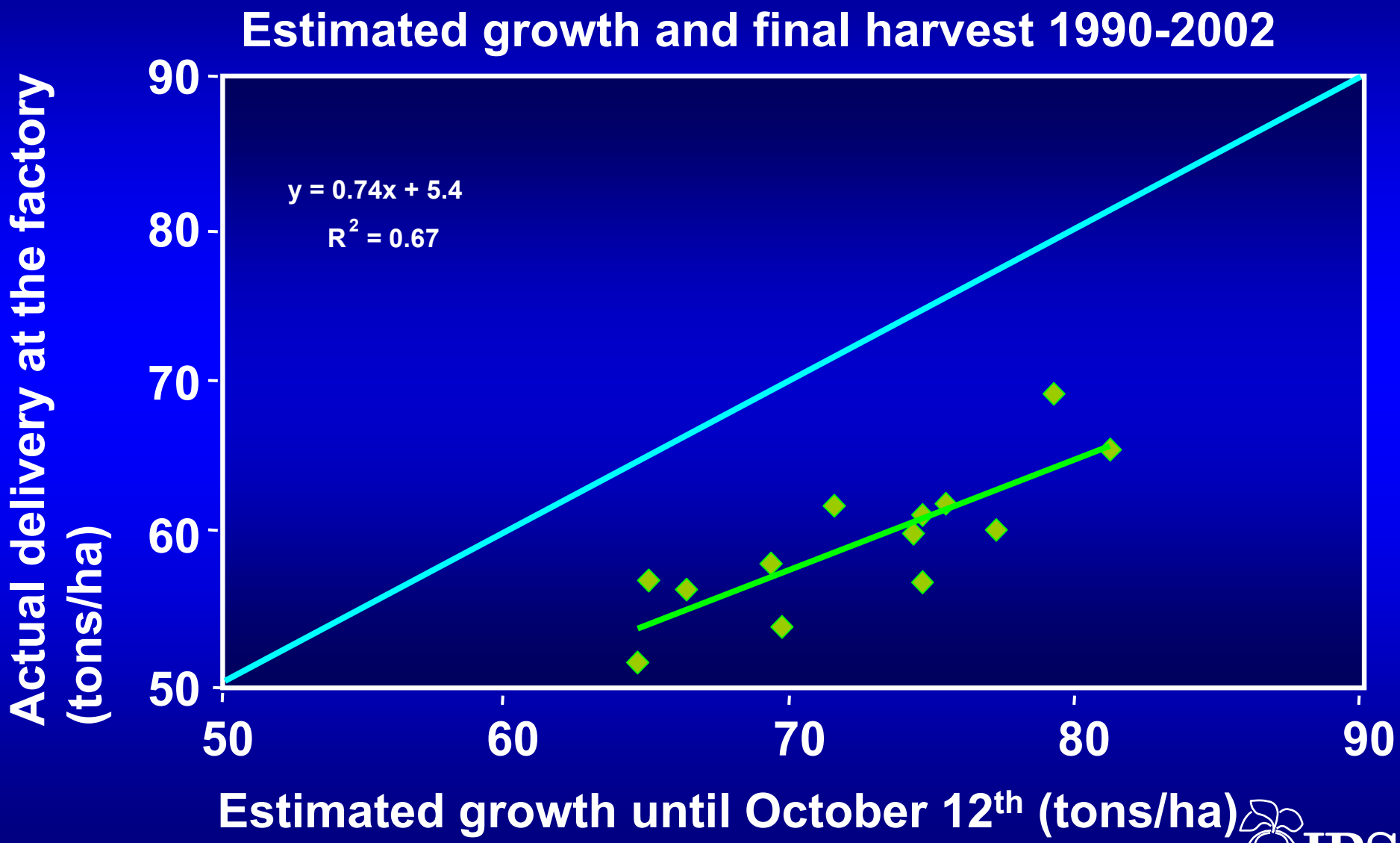
Moisture


temperature
evaporation
precipitation
radiation
moisture
balance
reduction factor
(0.7-1.0)
(per day)

Harvest losses



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Not included in *SUMO*

- pests and diseases
- soil structure
- fertilization
- resistant varieties
- extreme weather conditions

These are partly covered by overall regressions over the years.

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Mid-August sugar yield predicitons (tons/ha)

Year	prediction		realized	difference prediction - realised	
	SUMO	sampling	yield	*SUMO*	sampling
average 1989-1995	9.6	9.8	9.6	0.4	0.4
1996	9.1		9.3	0.2	
1997	9.6		9.5	0.1	
1998	9.1		8.0	1.1	
1999	9.4		9.8	0.4	
2000	10.0		9.8	0.2	
2001	9.0		9.1	0.1	
2002	10.1		9.6	0.5	
average 1996-2002	9.5		9.3	0.4	

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- ☑ forecast *SUMO* or sampling
  → same precision
- ☑ *SUMO*: input required is minimal
- ☑ extreme conditions or diseases are not included

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