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Forschungsanstalt Agroscope Changins-Wädenswil ACW

Soybean breeding for cool climates

Danube Soya / European soya breeders research workshop

Agroscope ACW
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3-4 june 2013, IPZ Freising

Agroscope

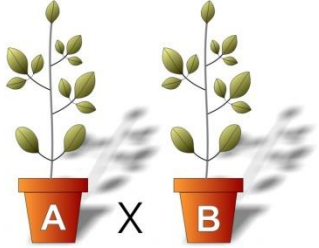
Introduction

- Soybean breeding initially supported by Nestlé (1981-1987).
- 50-100 hybridizations per year.
- Two breeding nurseries (Switzerland and south of France).

- Swiss climate is not well suited to the plants physiology

=> **Main objective : genetic adaptation to cool climates** (other breeding goals are not presented here)

breeding scheme



Breeding sites

- Early maturity groups at Changins.
- Later groups in south of France.

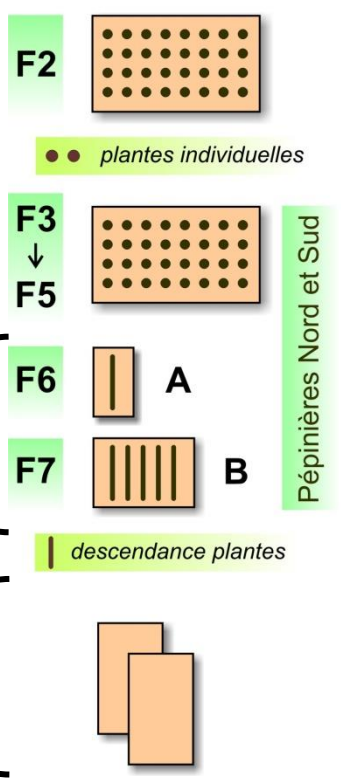
Mass selection (F2-F5)

(earlyness and cold resistance)

Plant-to-row (F6-F7)

Multi sites trials (F8-F10)

Registration + DUS



Cold tolerance

Symptoms of tolerance vs. sensitivity

Schori *et al.* Revue suisse Agric. 24 (6): 341-344, 1992.

Tolerant Sensitive

- Sensitivity : Yield losses (barren nodes).
- And/or delayed maturity (due to apical compensation).
- And poor harvest quality or shattering (uneven ripening).

Main mechanisms of agronomic tolerance

- True tolerance (reduced abscission of the flowers on central raceme).
- Ability for compensation on the same node (on lateral racemes).

Mechanism 1 : True Tolerance (1)

Basic

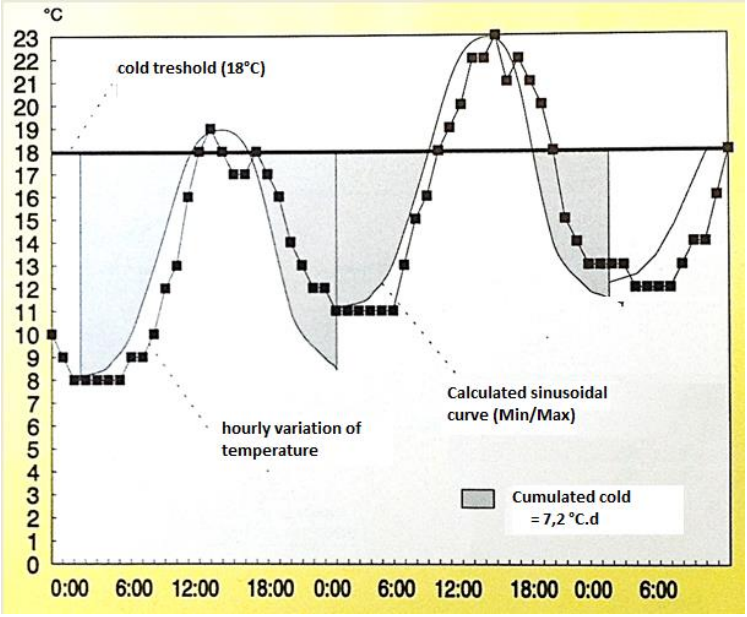
Abscission of flowers depends on genotypes and on :

- Intensity AND duration of the cold spell.
- Phenological stage of the plant :

  highest susceptibility 10 days before and 15 days after stage R1

Method

→ Use of cold accumulation during this period.



Graph : Illustration of cold accumulation for a period of 48h.

Gass *et al.* Revue suisse Agric. 26 (3): 171-178, 1994.

Observed phenotypical differences

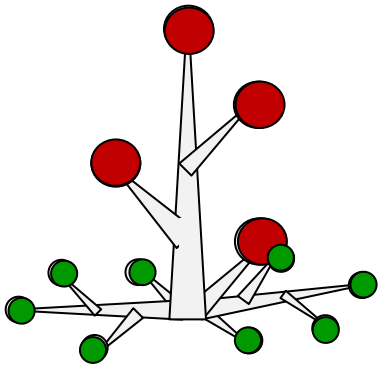
Cumulated cold (18°C) °C.Day	Important abscission		Ability to compensate	
	Tolerant genotypes	Susceptible genotypes	Tolerant genotypes	Susceptible genotypes
55	no	yes	yes	yes
70	yes	yes	yes	yes
85	yes	yes	yes	no
100	yes	yes	no	no

Graph : Cumulated cold (18°C) during the sensitive phase above which visible damages occur

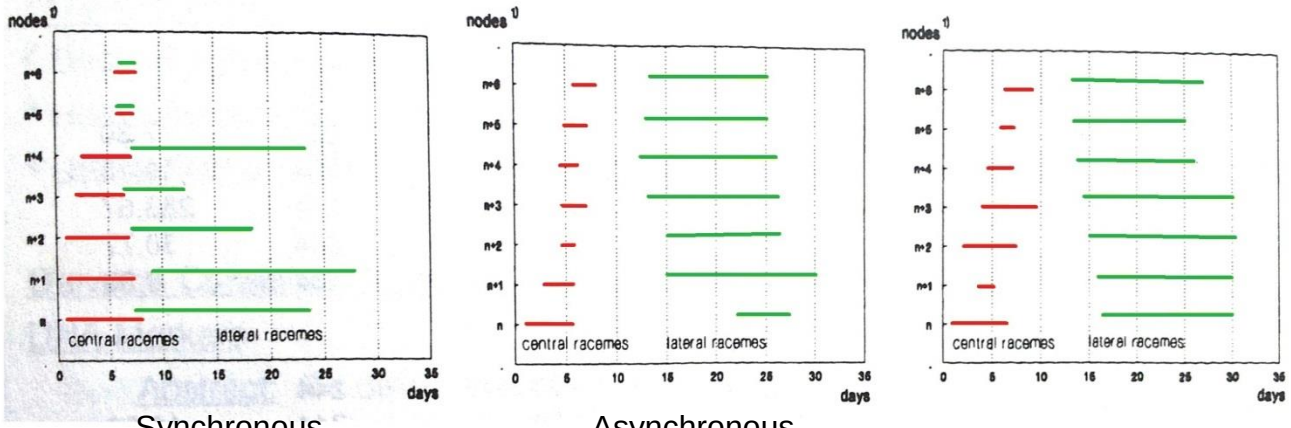
Gass *et al.* Revue suisse Agric. 26 (3): 171-178, 1994.

- 85 °C.d used for our screening
- Up to 3°C difference in the threshold for tolerant/sensitiv (15°C vs 18°C) .

Mechanism 2 : Ability to compensate losses



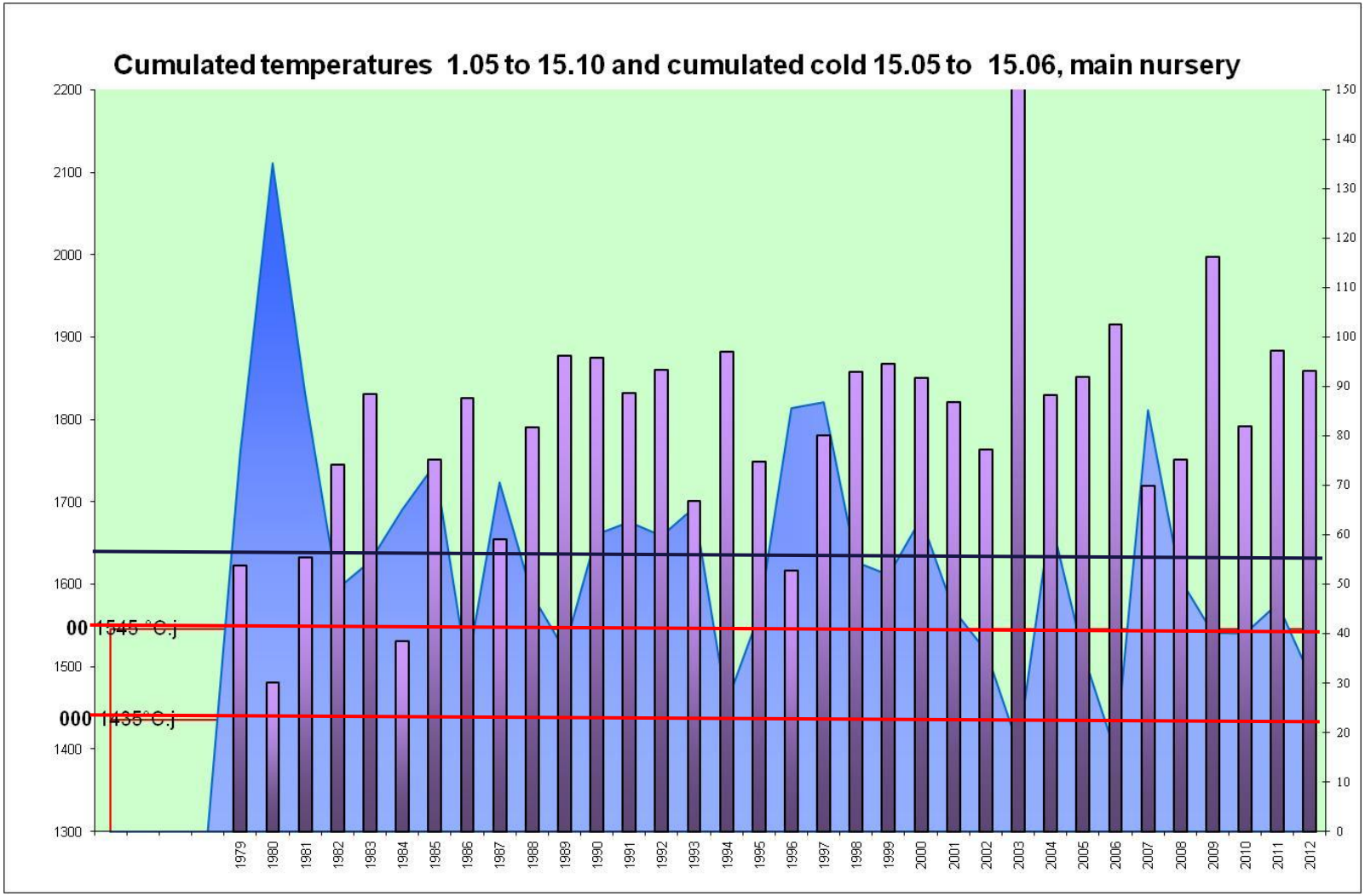
Chronology of anthesis on a single node.
Red =main, central raceme, green lateral racemes



Graph : *Duration of blooming on central and lateral racemes on the reproductive nodes of a synchronous and an asychronous type, and of its F1.*

- Asynchronous (Ceresia type) better adapted.
- Asyn. in close linkage with the tawny allele (group 1).

Schori and Gass, Soybean genetics Newsletter. 21: 156-160, 1994.


Cumulated temperatures 1.05 to 15.10 and cumulated cold 15.05 to 15.06, main nursery
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1545 °C.j
1435 °C.j
1979
1980
1981
1982
1983
1984
1985
1986
1987
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2002
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2004
2005
2006
2007
2008
2009
2010
2011
2012

For the next years…

- Cheaper and quicker screening for cold tolerance. QTL, growth chamber…
- Rhizobium /plant interactions. Selection of performing stains in cool soils.
- Keep on reducing the leaf area (and lodging), test it or bred it in organic conditions as well, Improve sclerotinia resistance.
- Quality : Better know what consumers want (organoleptic, rheology)
- Favor multiple site nurseries and trials
- Create broader breeding populations, better use the available genetic diversity.