

Phenotyping of sorghum photoperiod responses using heuristics

Michael Dingkuhn, Mamatou Kouressy, Michel Vaksman, Benoît Clerget,
Jacques Chantereau

CIRAD

TA59 Ave. Agropolis, 34398 Montpellier CEDEX 5, France

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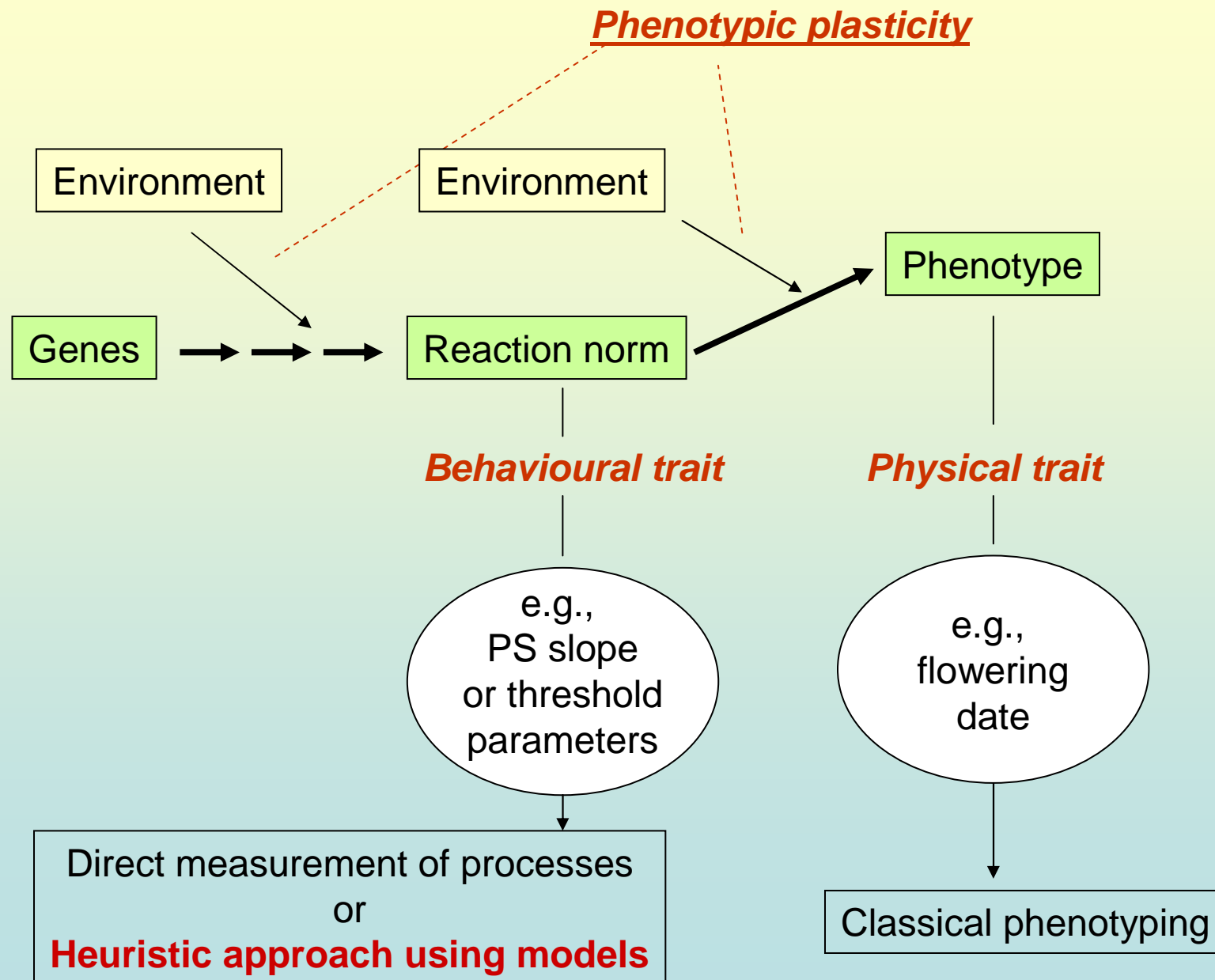
Laboratoire Sol Eau Plante de Sotuba, P.O. Box 262 Bamako, Mali

ICRISAT

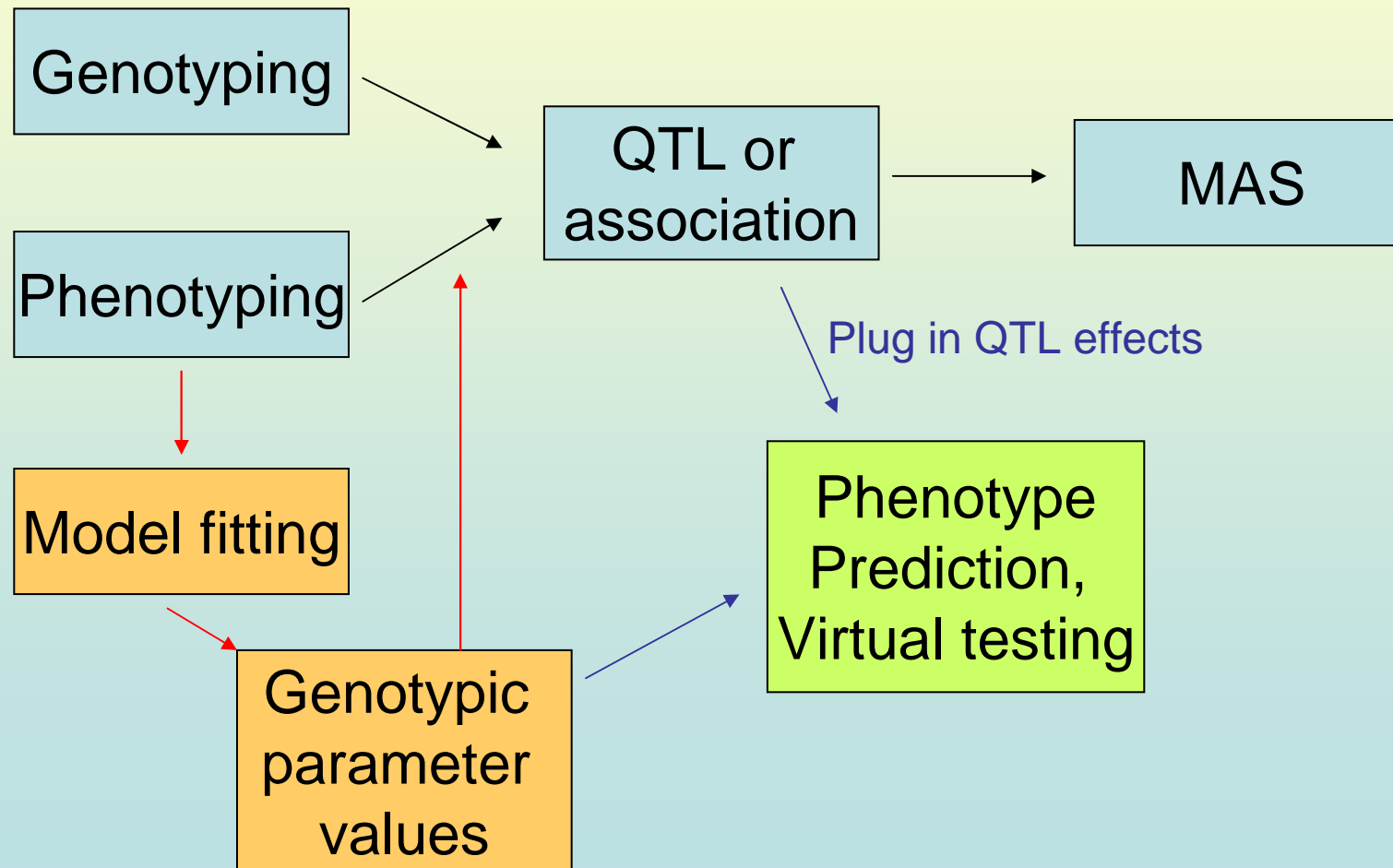
Samanko Research Station, BP 320, Bamako, Mali



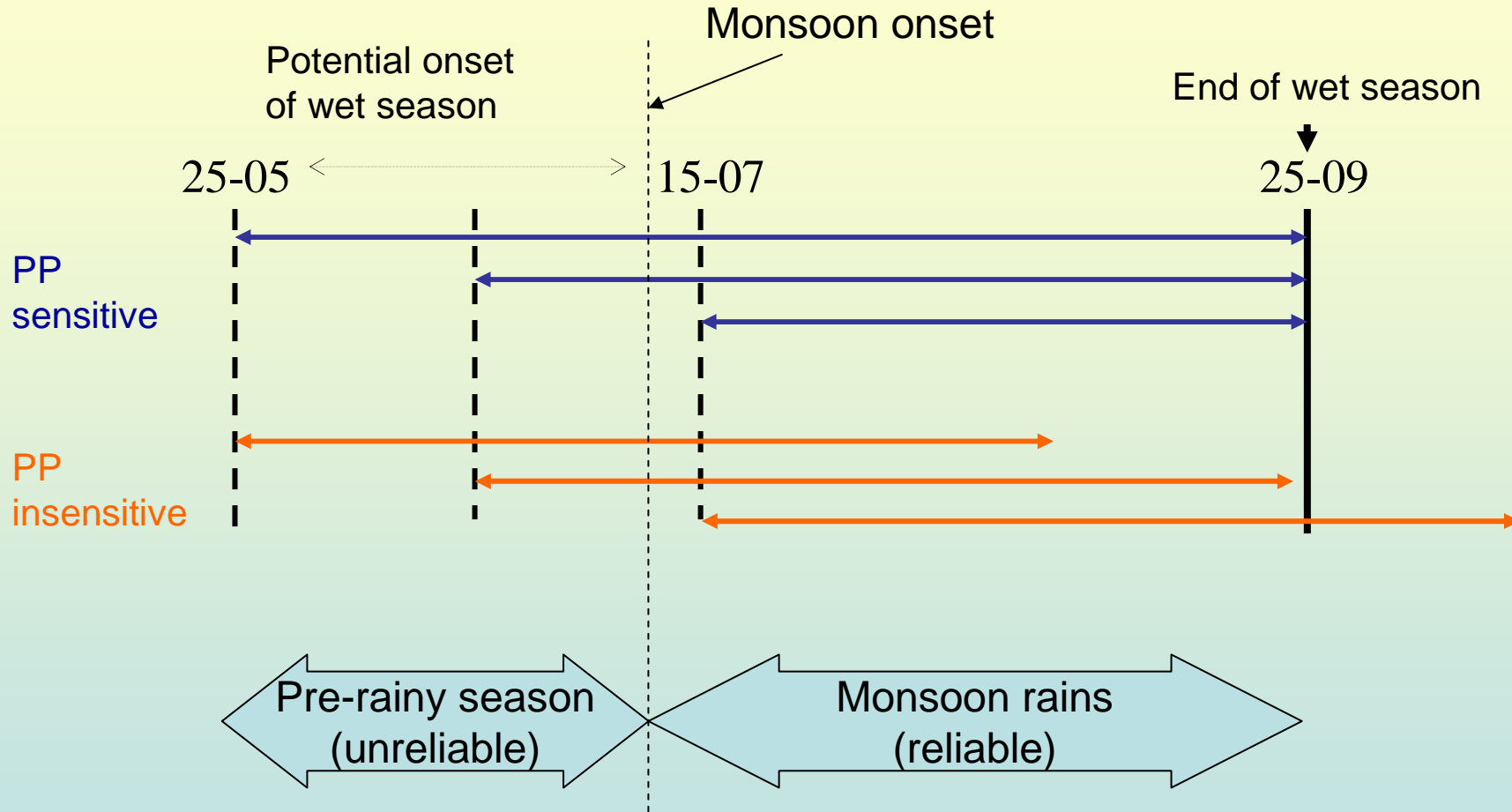
How to phenotype plasticity traits



Model assisted phenotyping for complex traits

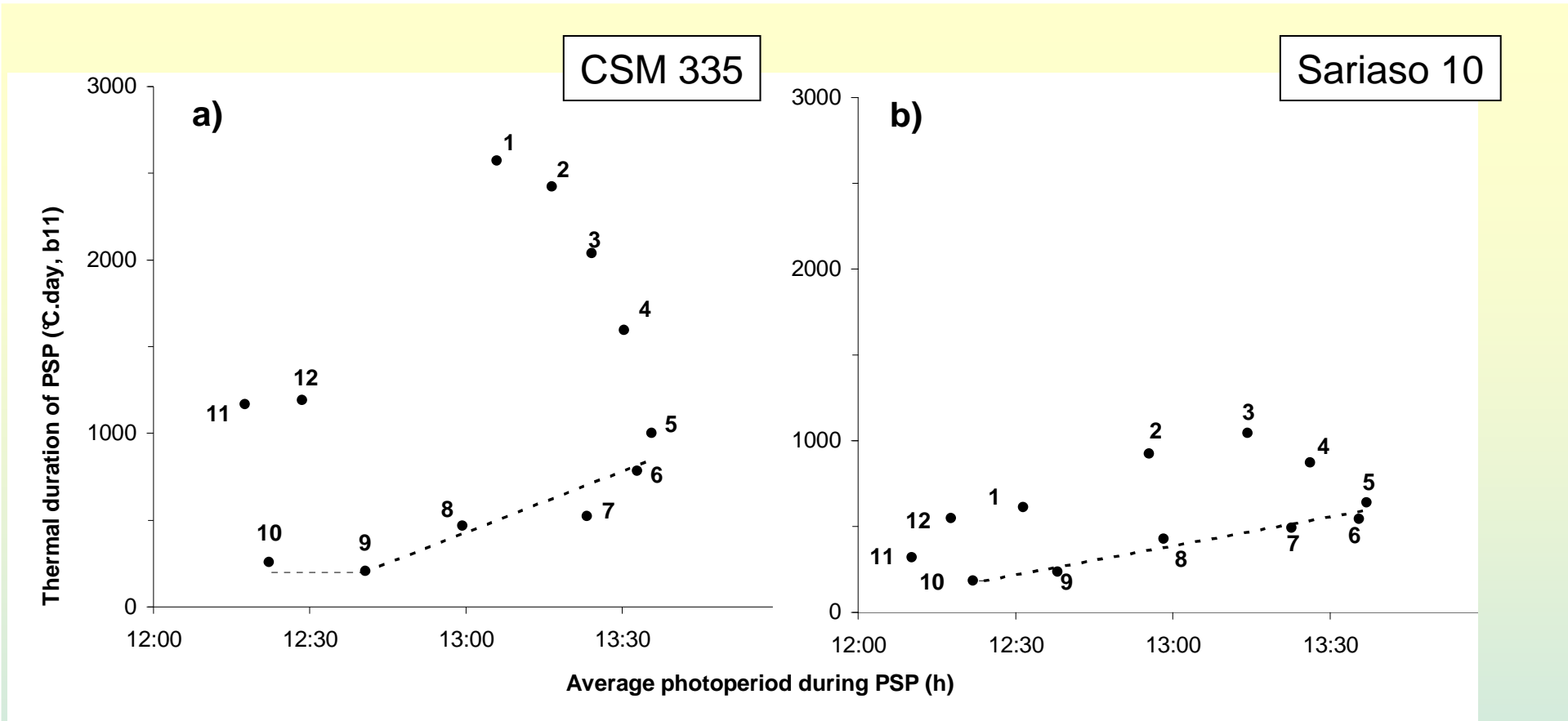


Adaptive Value of Sorghum Photoperiodism



Need to flower at end of wet season:

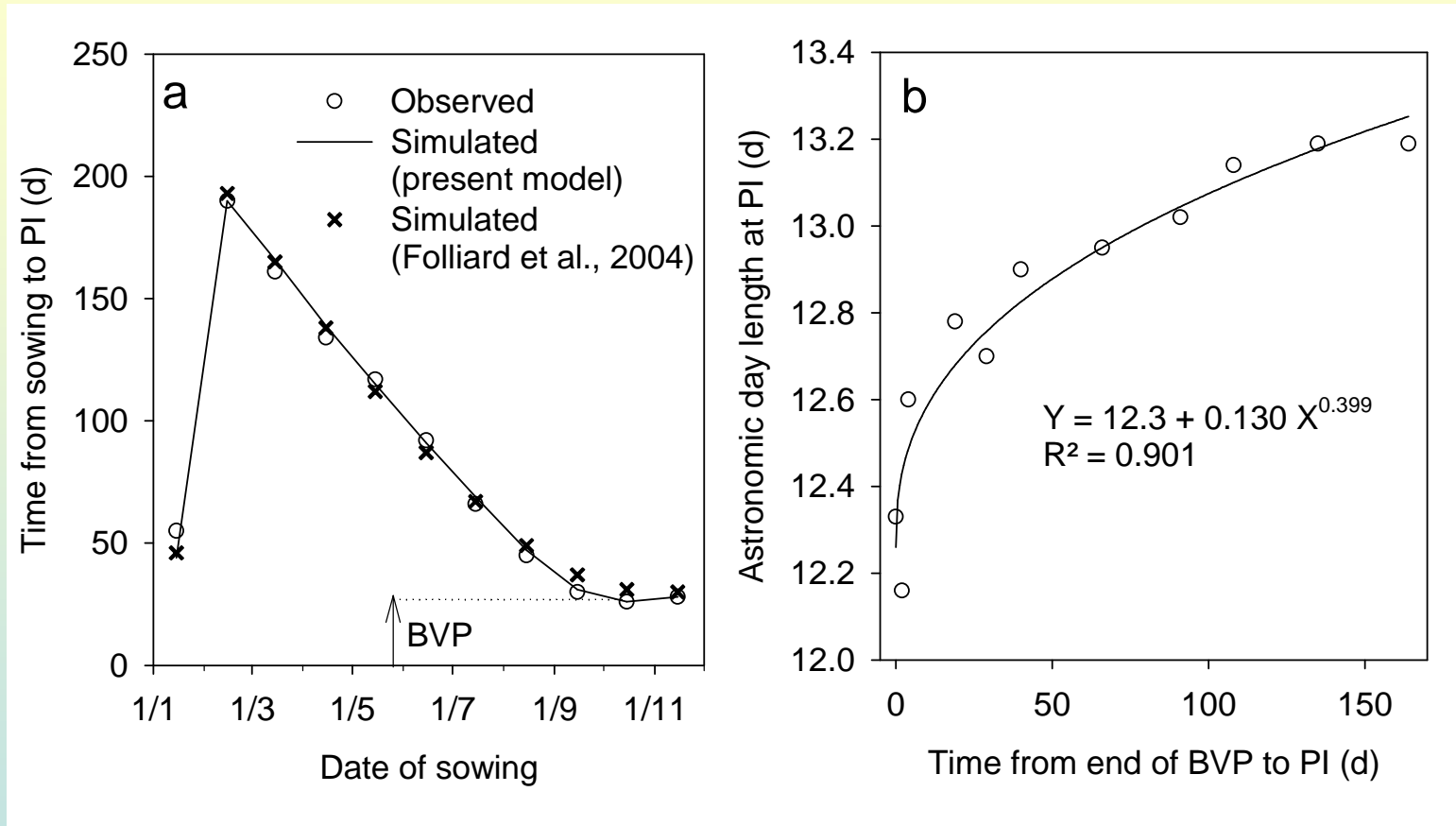
- If late: Terminal drought
- If early: Stem & panicle rot, birds



Thermal duration of PSP vs mean PP during PSP for two sorghum cvs. for 12 sowing dates (months) at Bamako, Mali.

---- = wet season

The « Impatience » hypothesis



Threshold lowering during extended wait states:
PI happens at less short days

The « Impatience » Concept

Idea borrowed from animal/human ethology:

« During extended wait states for an external stimulus (appetence), the organism lowers its threshold »

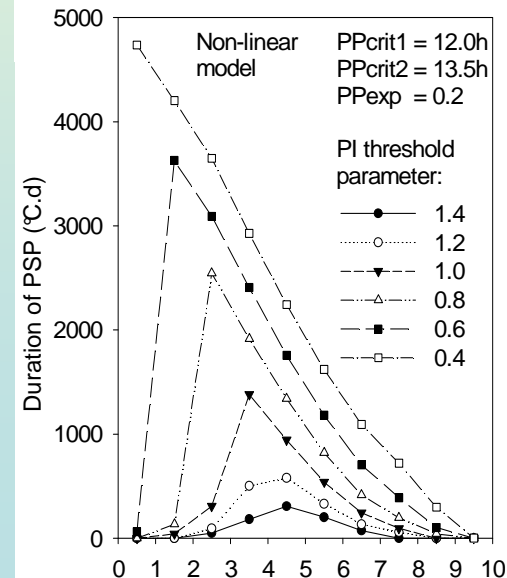
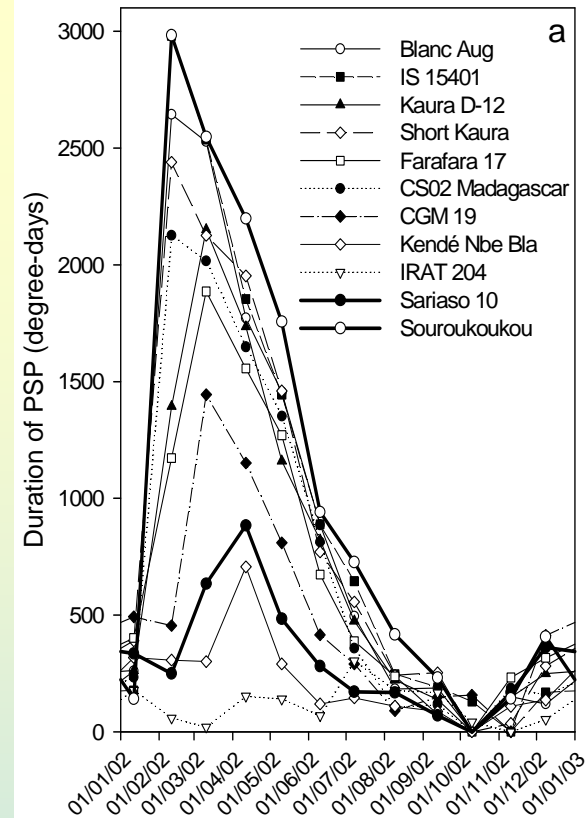
Principle:

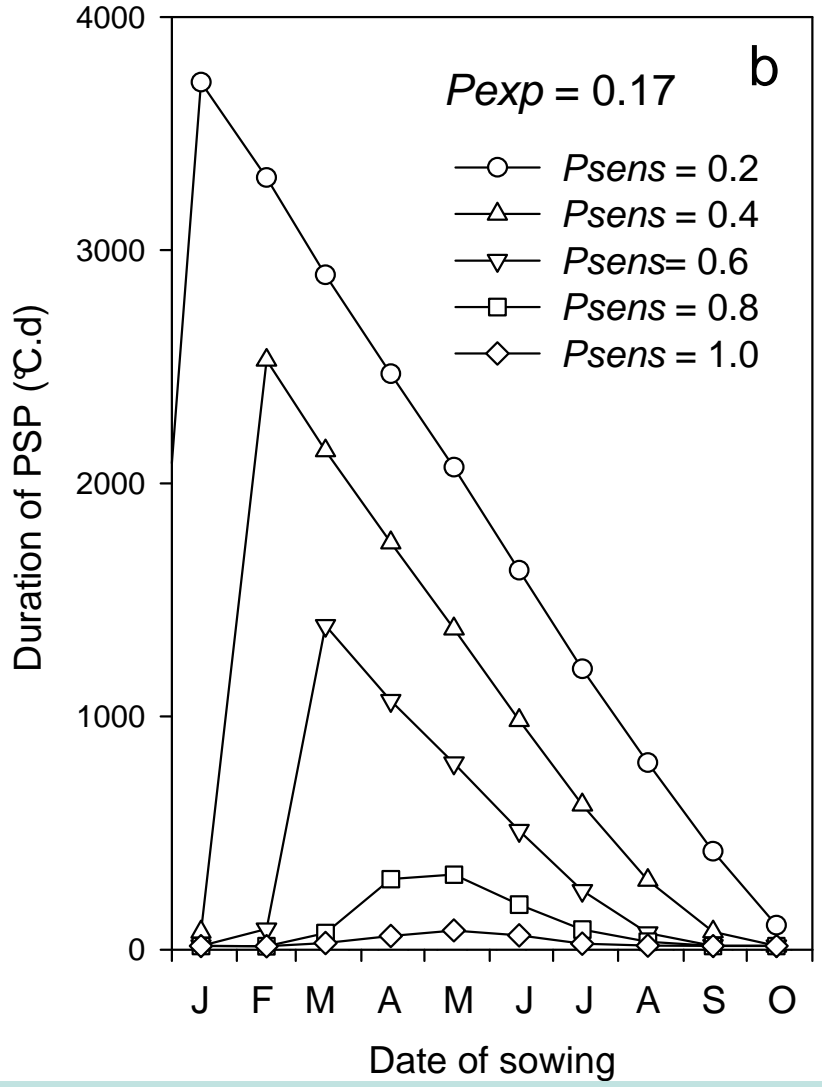
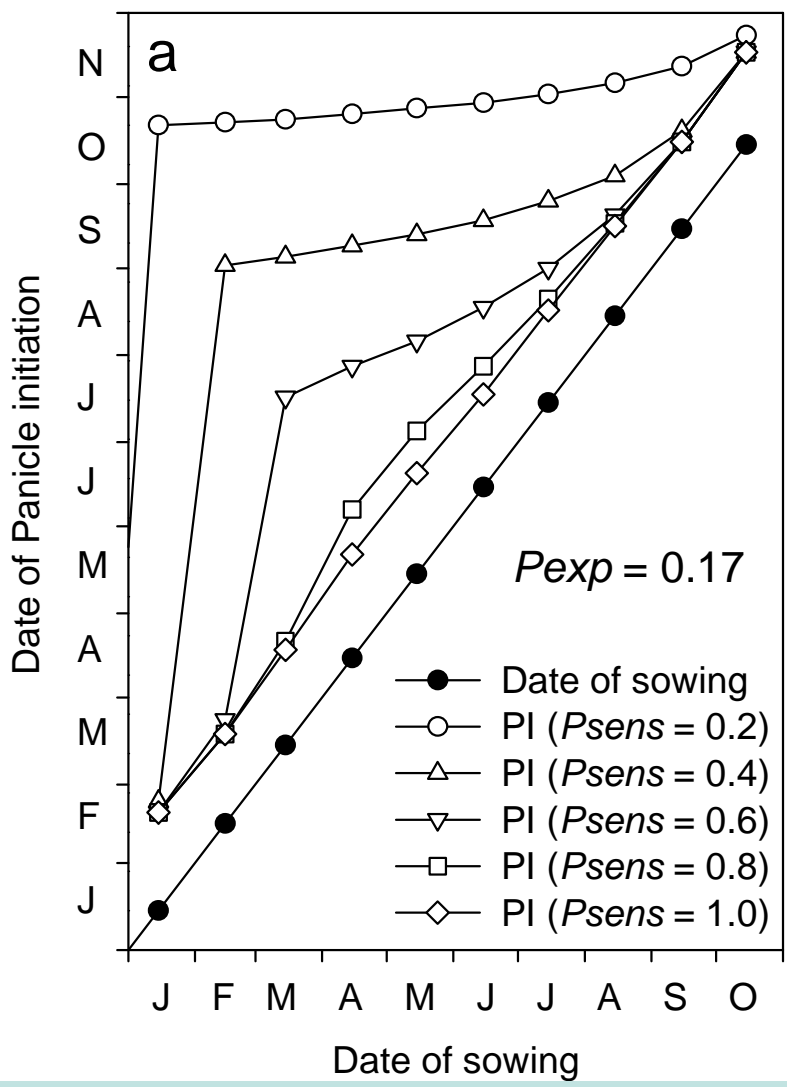
Wait state = thermal duration of PSP
 External signal = sufficiently short day length
 Threshold lowering = floral induction happens under longer days

Algorithm:

$$\text{TEST} = (1/\text{PSP})^{\text{Pexp}} * (\text{Pact} - \text{Psat}) / (\text{Pbase} - \text{Psat})$$

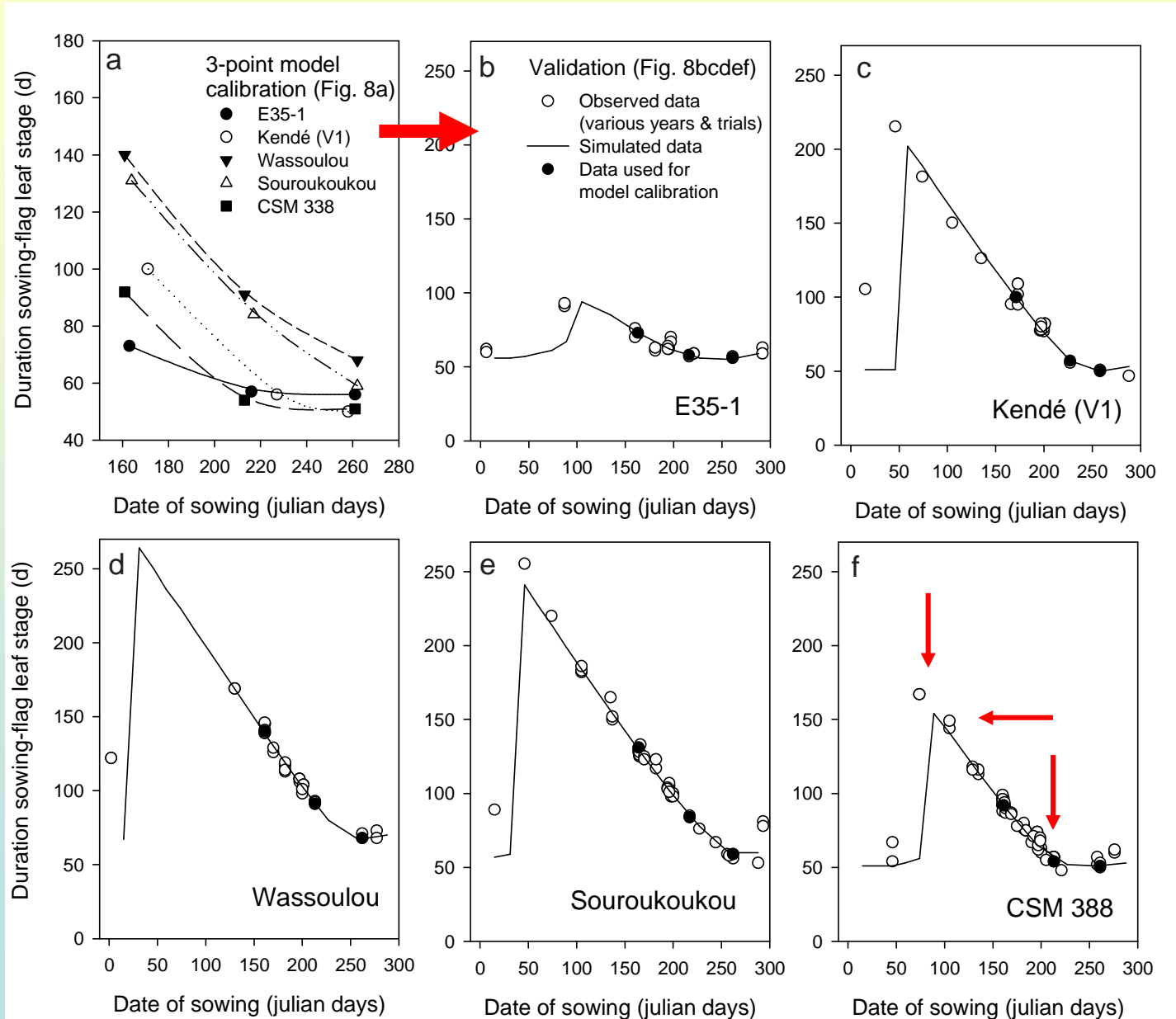
If TEST < Psens then IP





Applications: genotype specific *parameterization*, model assisted *phenotyping*

→
**3-point fitting,
 2 parameters
 (5 cvs.)**



Measurements required

- Flowering dates for 3 key sowing dates
- Daily Tmin & Tmax

Conclusion

- Complex behaviour of PSP explained
- Most genotypic patterns explained with 1 parameter (*P_{sens}*)
- « Quantitative » and « qualitative » response patterns explained with a single model
- Holds for bicolor, caudatum, guinea & durra types (but not all kafir)
- The model explains why tropical, PP-sensitive sorghums do flower at Montpellier
- We don't claim the model is physiologically «true»: recent findings on *A. thaliana* provide new clues
- Next step: association analysis for sorghum core collection