# Ginning: a way of measuring its specific impact on fiber quality

Jean-Paul Gourlot*, Mamadou Togola**, Eric Gozé*, Bruno Bachelier*, Massa Coulibaly***, and Abdoul Karim Traoré****

CIRAD (France), ** CERFITEX (Mali), ***University of Bamako (Mali), ****IER (Mali)

*International Cotton Conference, Bremen, March 2018*

# Seed-cotton collection => bales

Productivity & Quality depend on

Production conditions (variety, sowing date, crop management, crop protection, pests, diseases, weeds, soil, climate…)





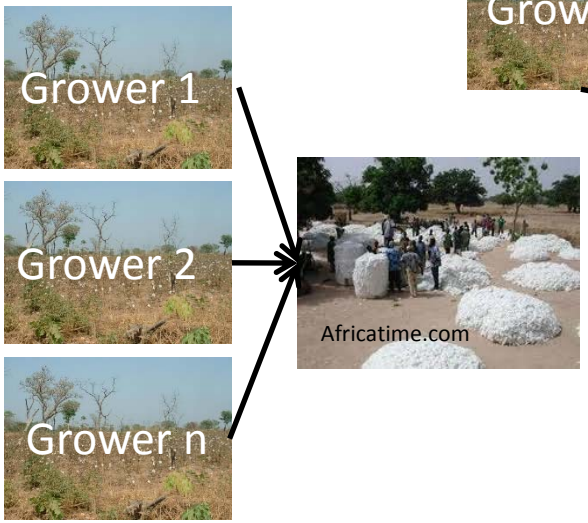



# Seed-cotton collection => bales

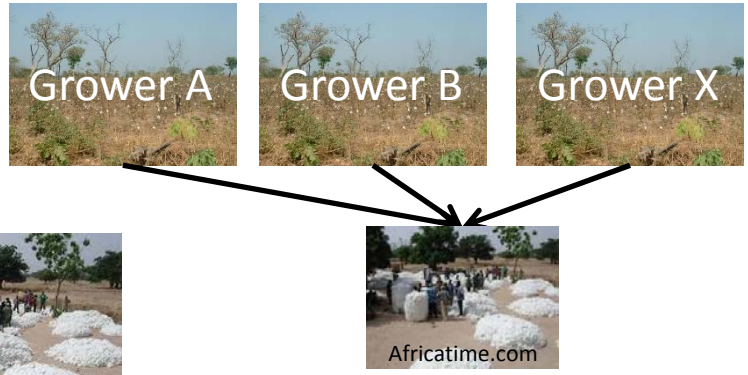
Productivity & Quality depend on

Production conditions + market organization…

Community seed cotton market




Community seed cotton market




Community seed cotton market

# Seed-cotton collection => bales

Productivity & Quality depend on

Production conditions + market organization + ginning conditions…

Community seed cotton market

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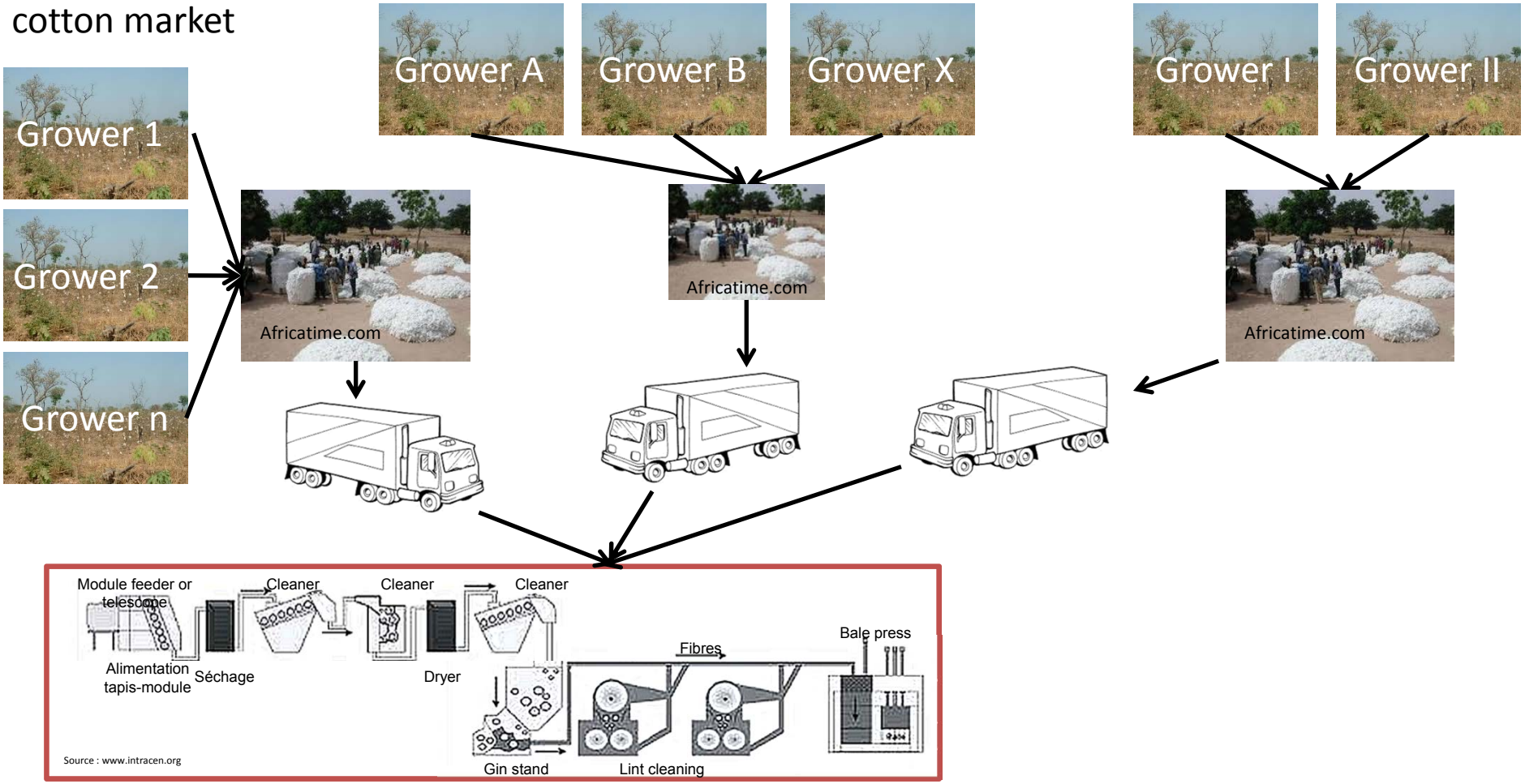

# Seed-cotton collection => bales

Productivity & Quality depend on

Production conditions + market organization + ginning conditions + characterization conditions

Community seed cotton market

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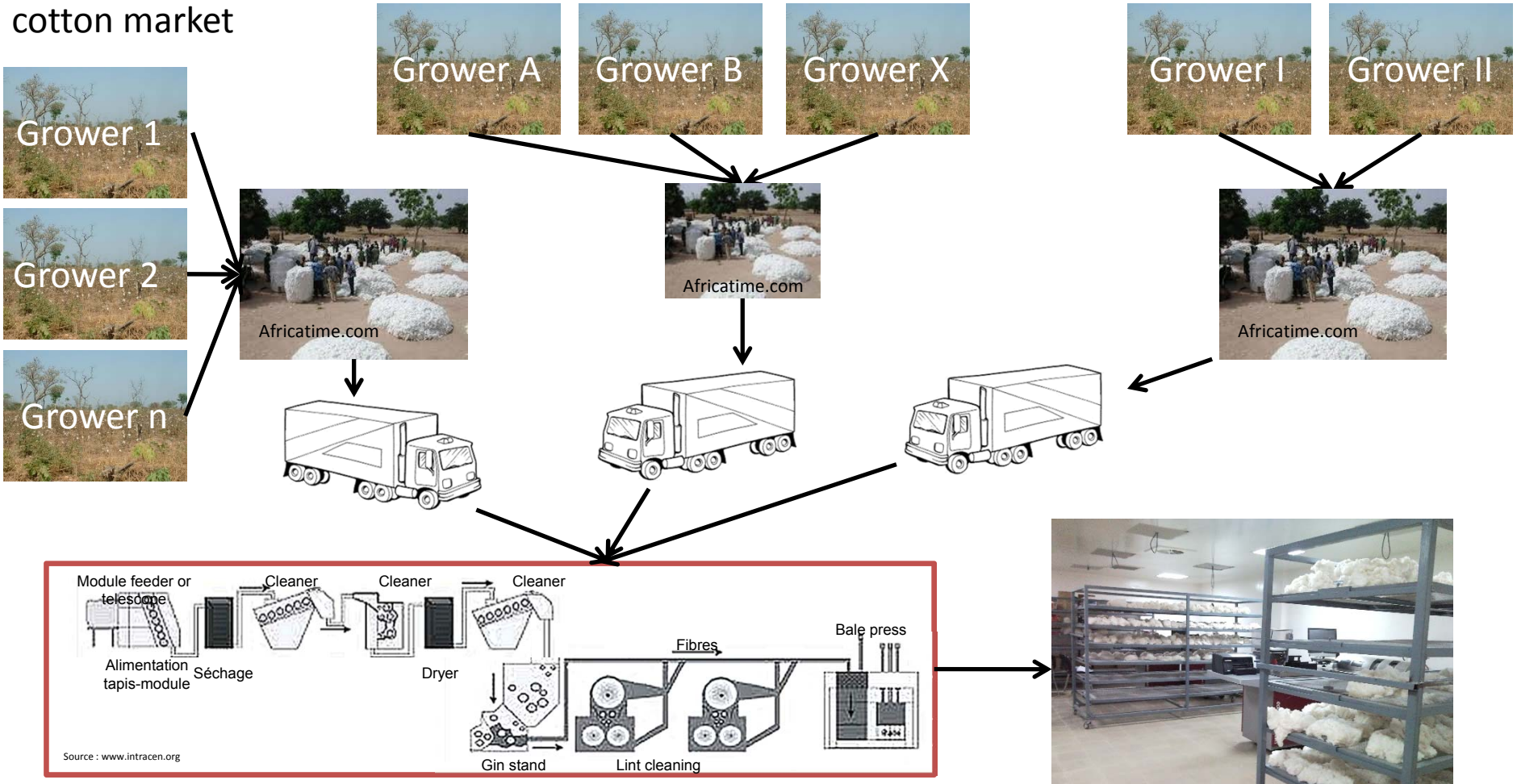
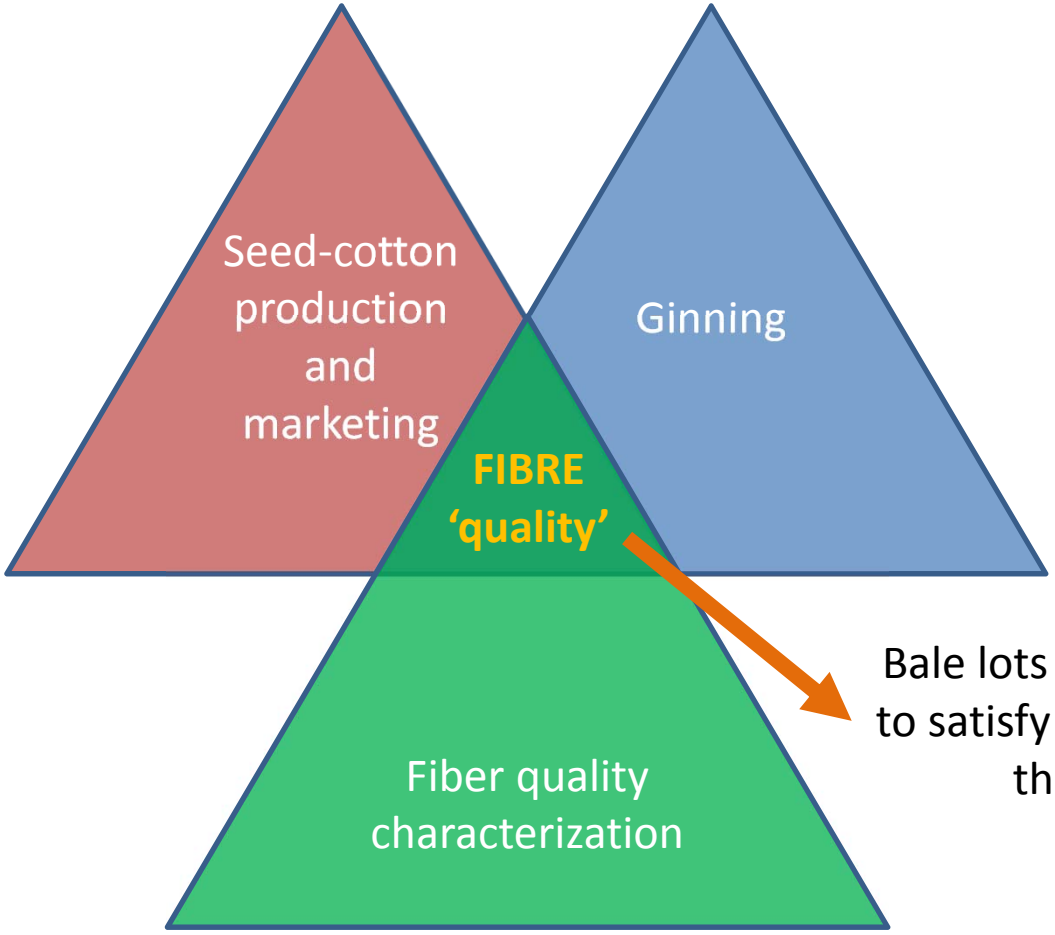


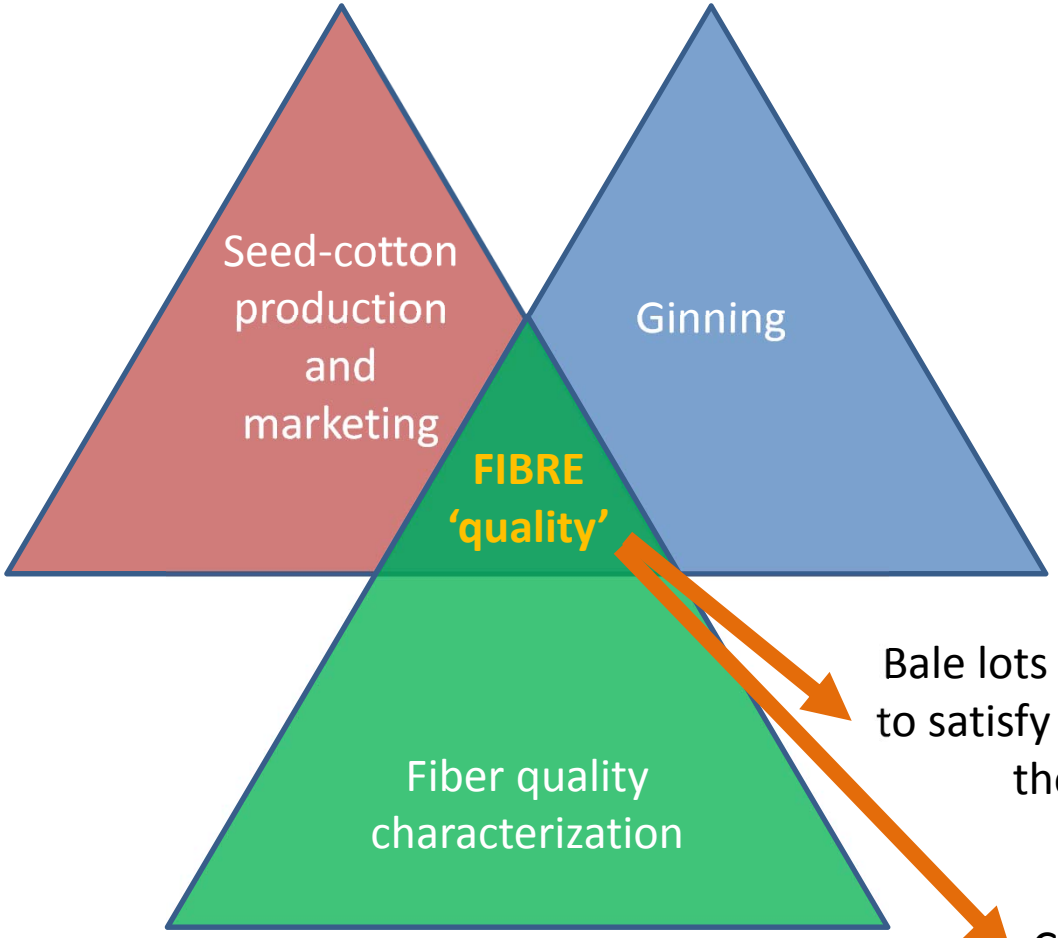
# Fiber quality: multi-scale interaction




Bale lots made up according to fiber quality to satisfy a specific requirement of buyers in the textile processing industry


Anthony, W. S. (1977). Cotton ginners handbook (1977th ed.). Agricultural Research Service.
Anthony, W. S. (1990). A good bale of cotton: interaction of variety, harvesting and ginning. The Cotton and Oil Mill Press
Columbus, E. P. *et al*. (1990). Maintaining cotton quality. Paper American Society of Agricultural Engineers, 1057–1065.
Curley, R. G. *et al*. (1973). Seed-cotton. California Agriculture.
Drieling, A. *et al*. (2012). Guideline for Standardized Instrument Testing of Cotton. www.csitc.org
Elsiddig, A. *et al*. (2003). Genotype-Environment Interaction. J. Agric. Sci., 12(1), 19–34.
Gérardeaux, E. *et al*. (2013). Positive effect of climate change on cotton in 2050 by CO2 enrichment and conservation agriculture in Cameroon. ASD, 33(3), 485–495.
Pettigrew, W. T. (2008). The Effect of Higher Temperatures on Cotton Lint Yield Production and Fiber Quality. Crop Science, 48(1), 278.

# Fiber quality: multi-scale interaction

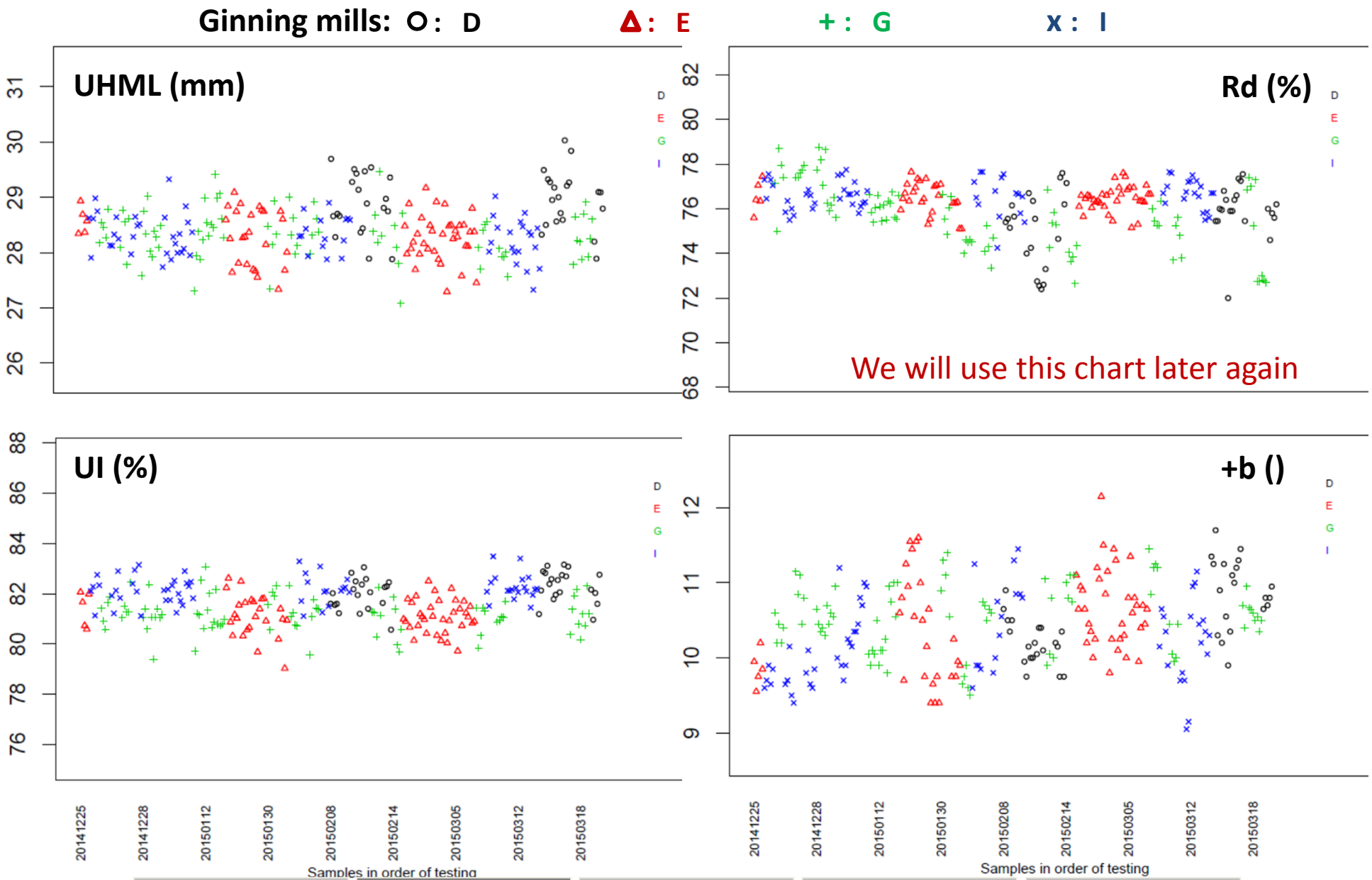



Bale lots made up according to fiber quality to satisfy a specific requirement of buyers in the textile processing industry

Characterization:
- Provides an overall view
- Results of an interaction

How to measure the specific impact of one source of variability on fiber quality?

# Classing characterization results

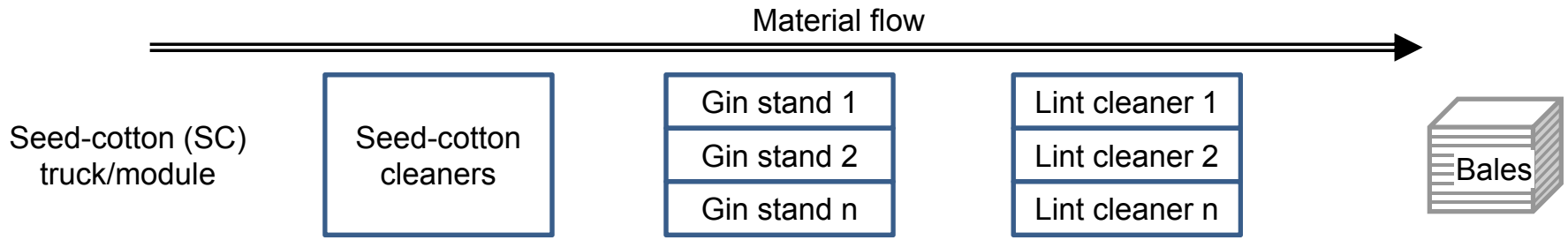


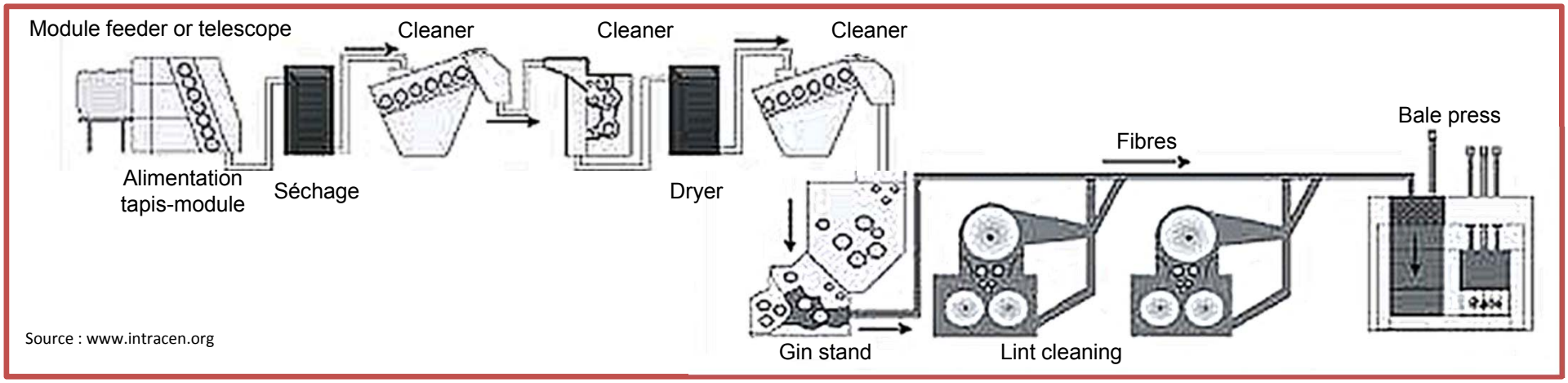
# Ginning process: how to measure its specific impact on fiber quality?

**Management and scientific issues:**

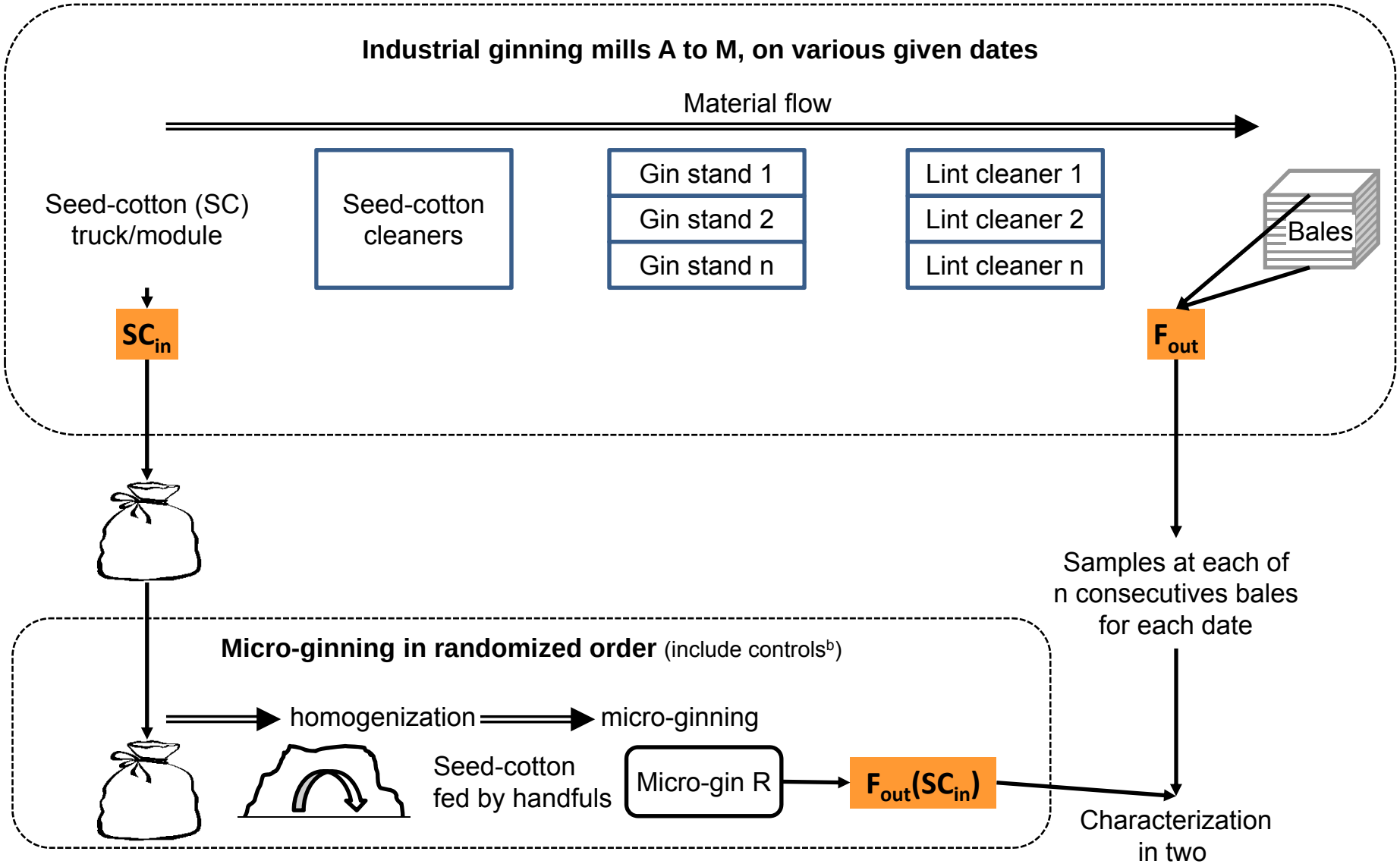
- How to trace the ginning process from fiber characterization results (collected on fiber samples)?
- How varies the ginning impact over time?
- What is the impact of each ginning step in the process?
- How to limit negative ginning impacts at acceptable levels?

# Material and methods: Ginning main sequences



# Material and methods: Experiment 1[a]




[a] Togola M. *et al*. (2017). Feasibility study: A new way to check the stability of industrial ginning along the season, TRJ
[b] Togola M. *et al*. (2016), Is it possible to check micro ginning fiber quality preservation performance using reference seed-cotton materials?, WCRC6

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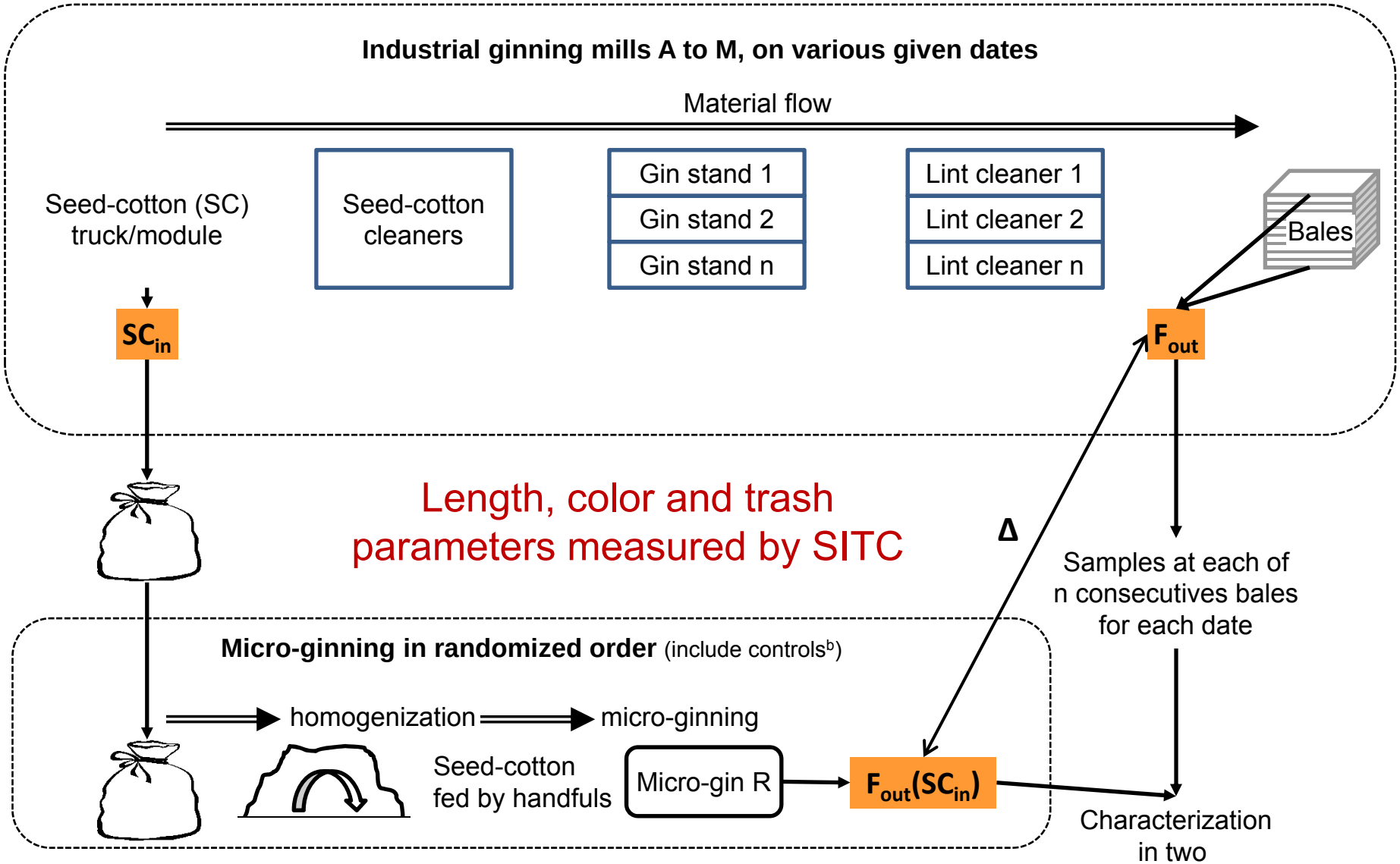


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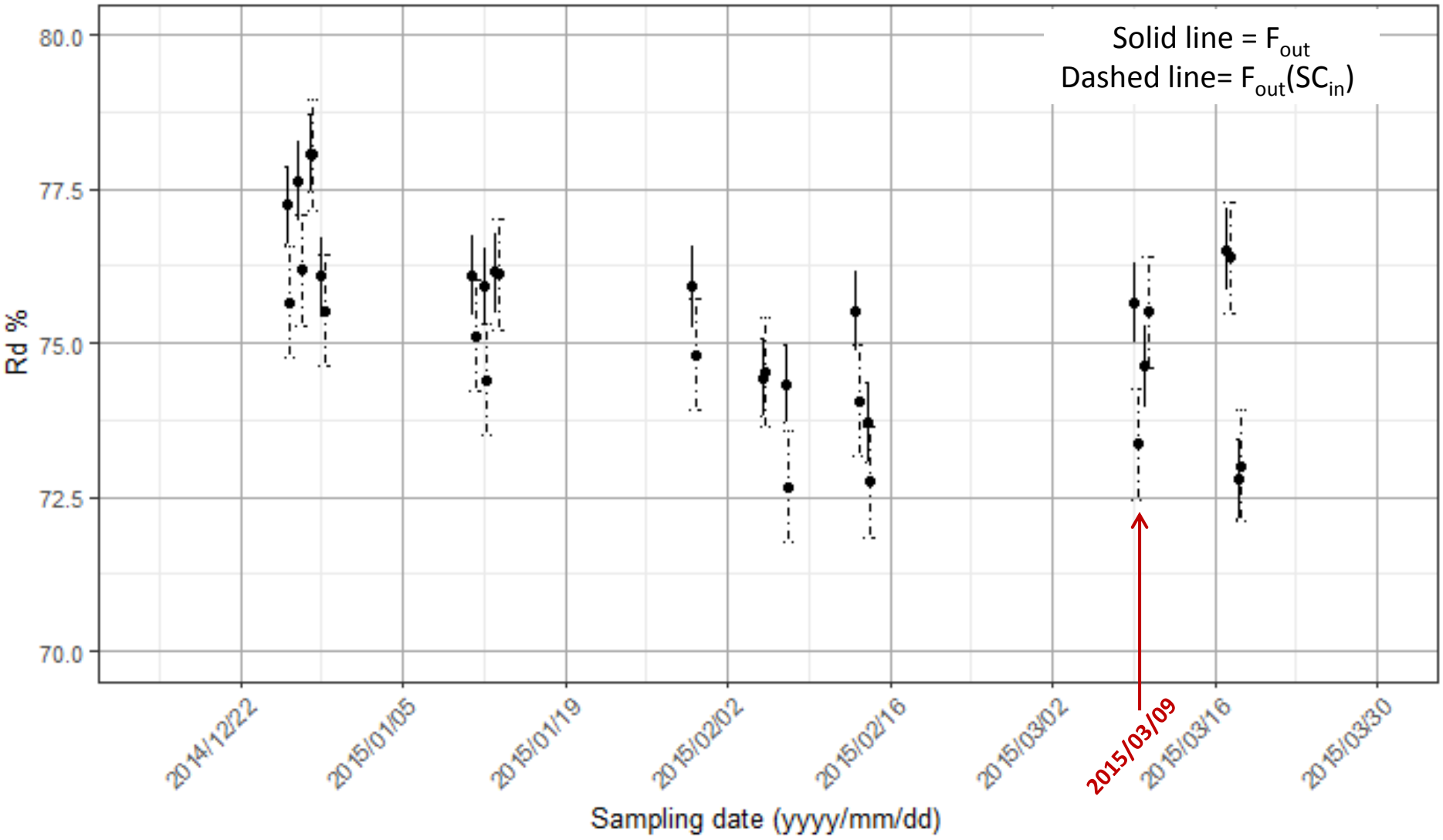
# Results: Experiment 1

**Industrial ginning mill G**

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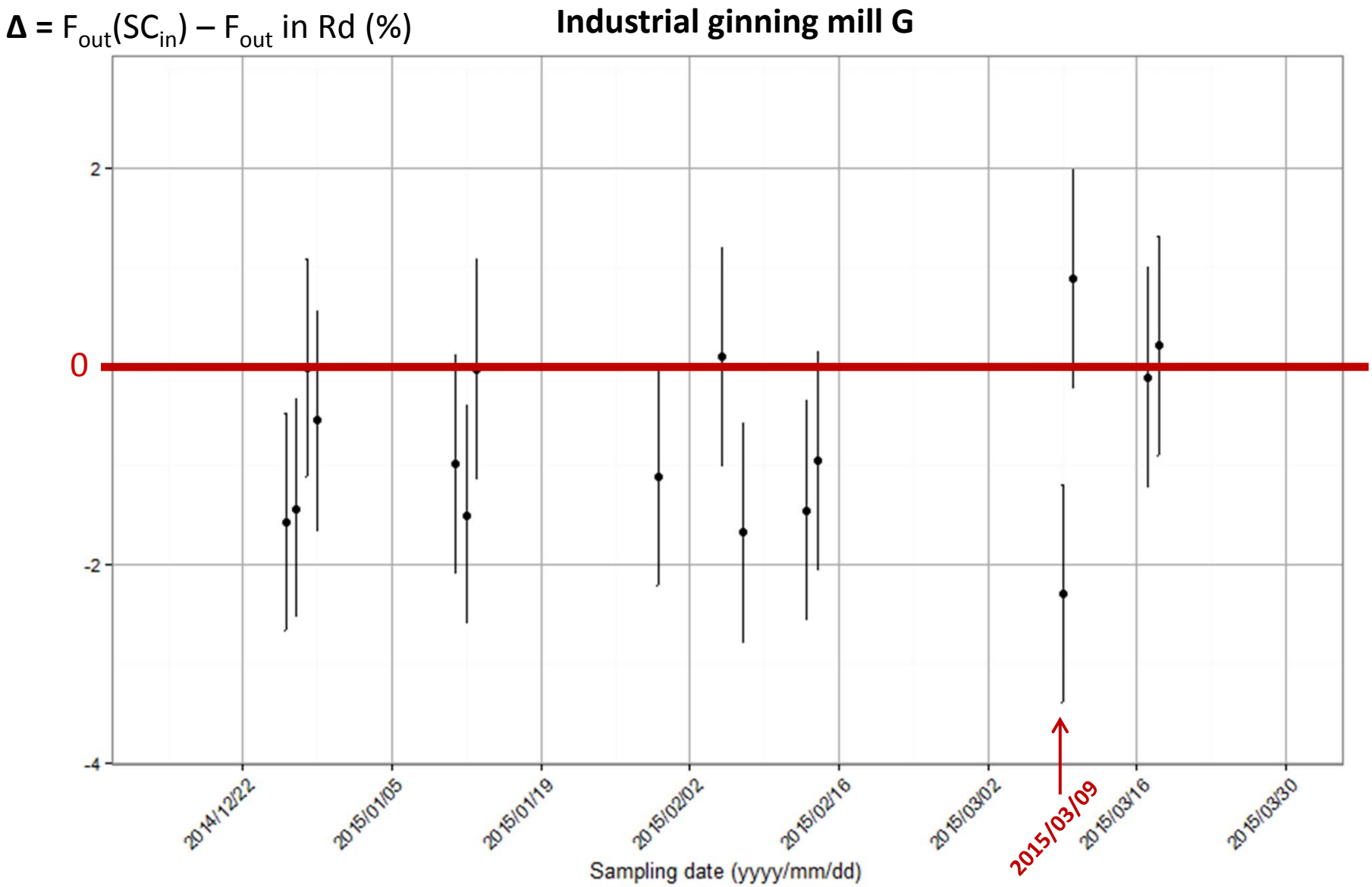


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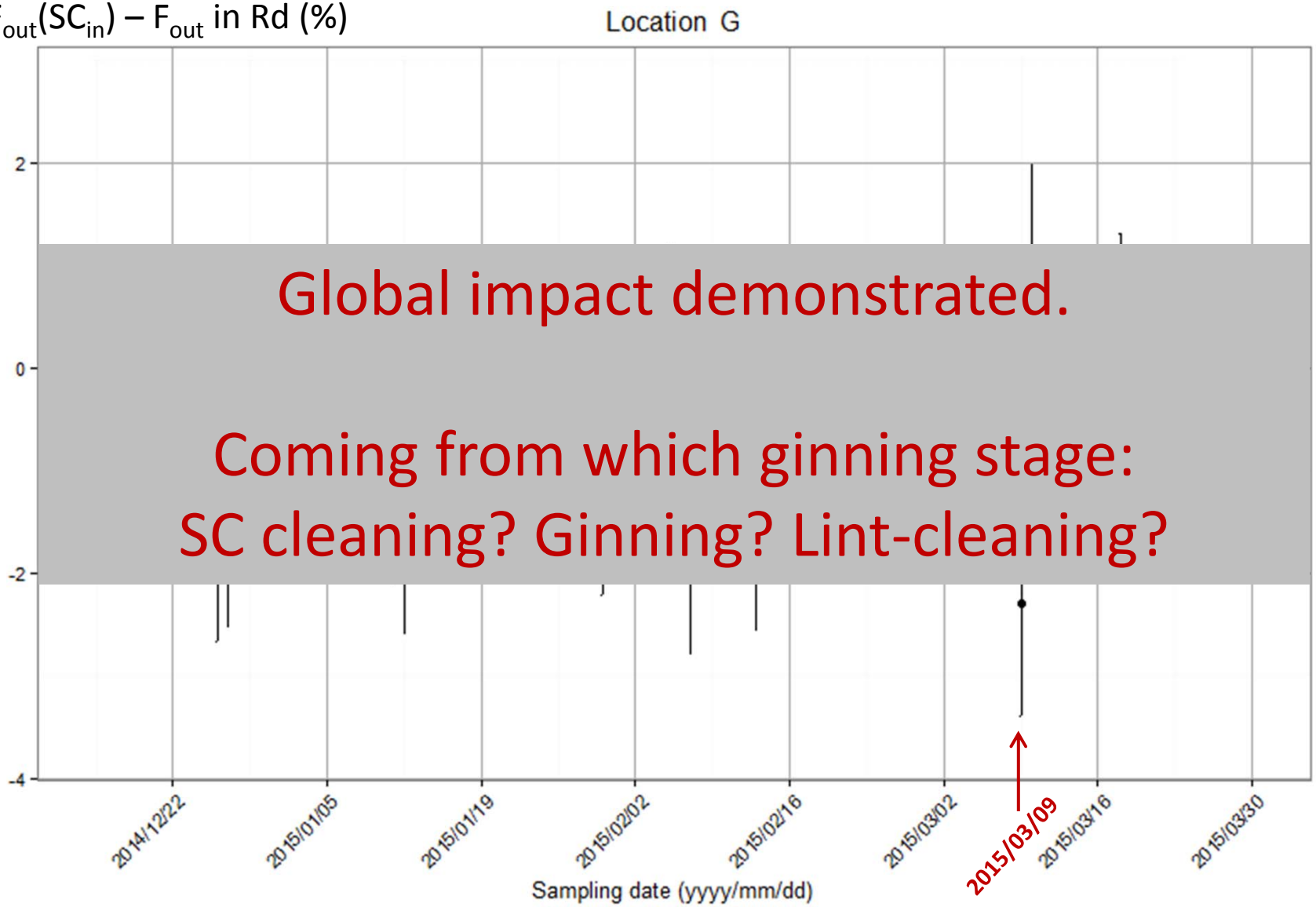
# Results: Experiment 1

**Δ** = $F_{out}(SC_{in}) - F_{out}$ in Rd (%)

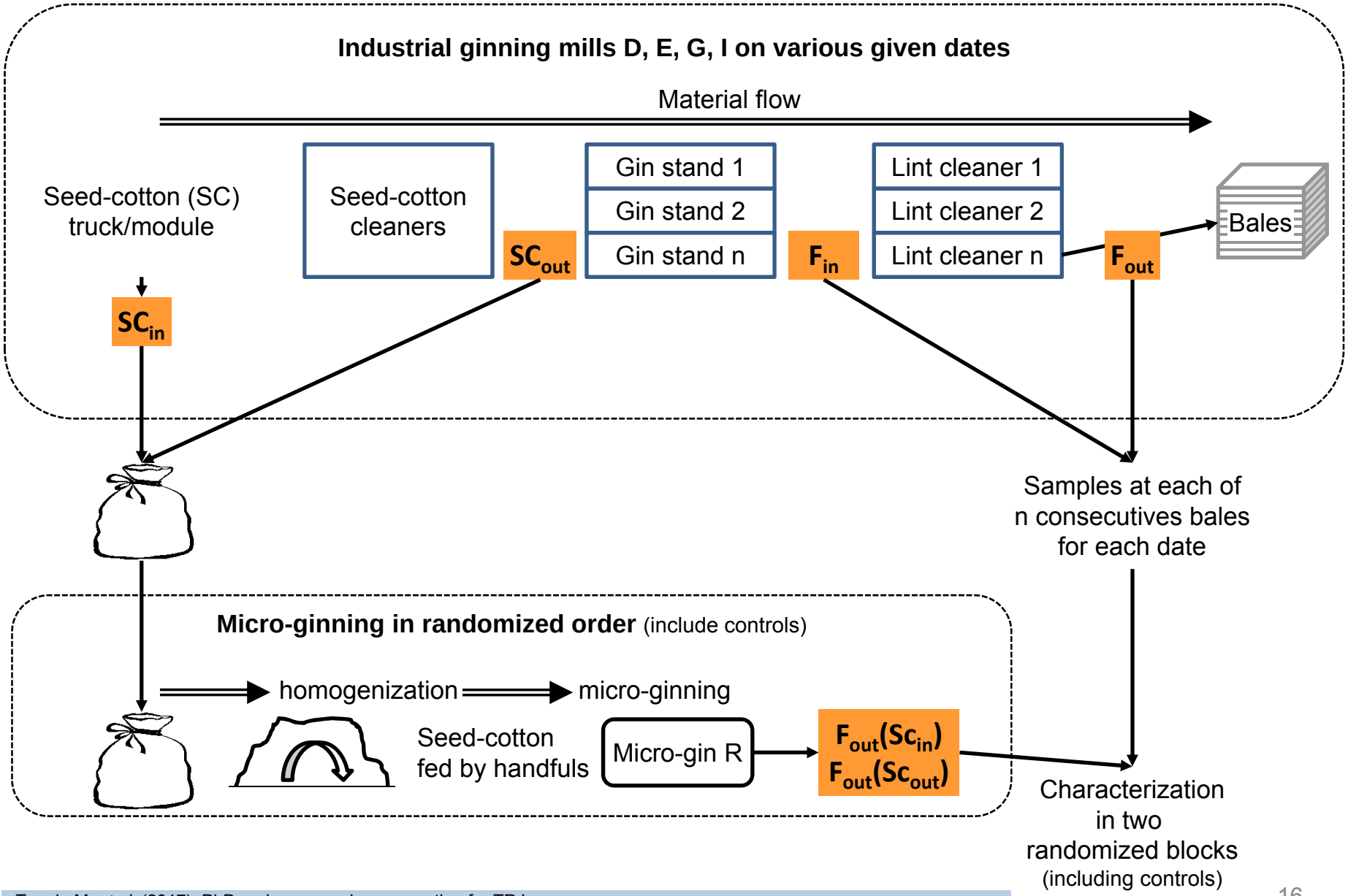



Global impact demonstrated.

Coming from which ginning stage:
SC cleaning? Ginning? Lint-cleaning?

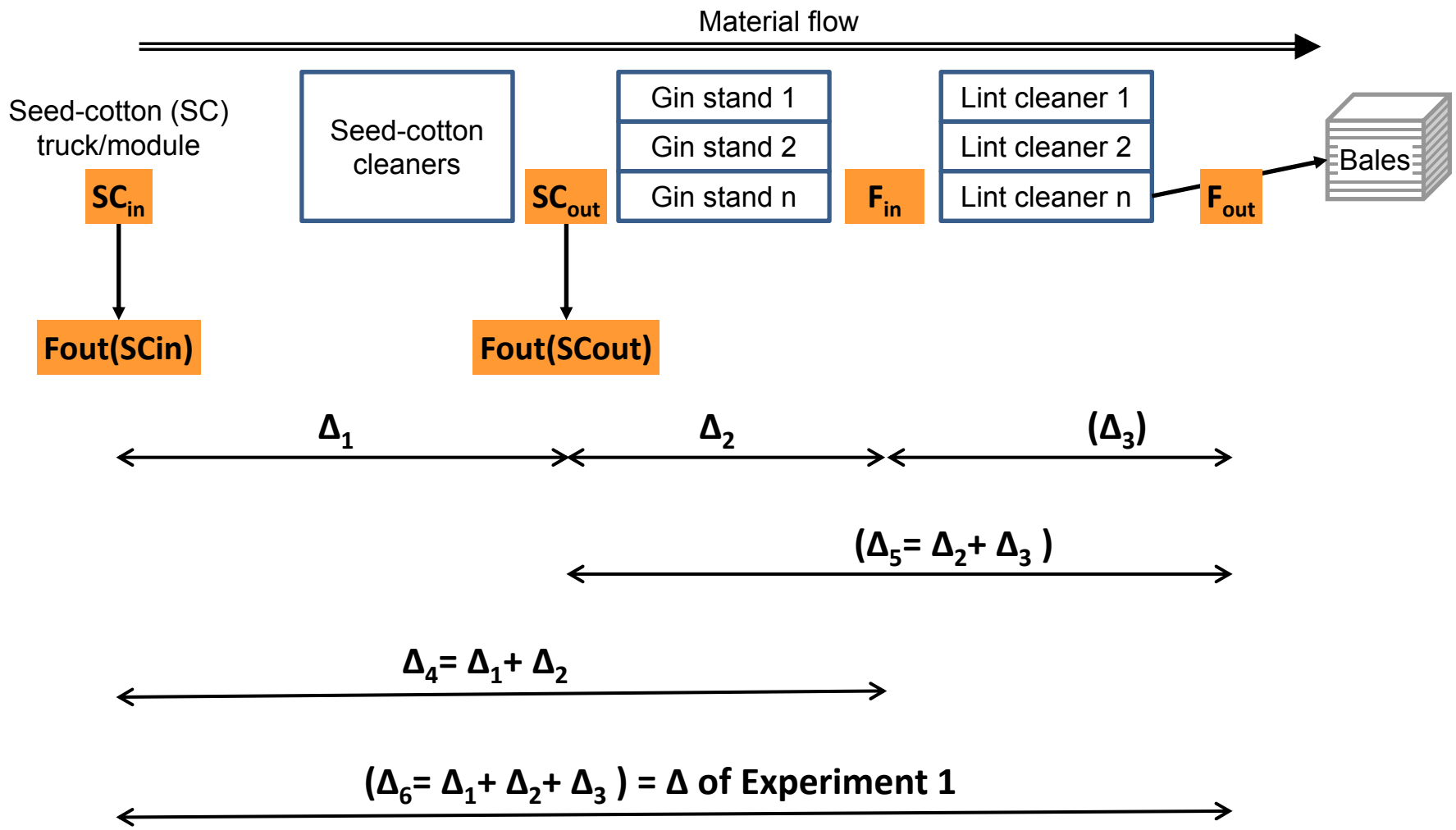
Togola M. *et al*. (2017). Feasibility study: A new way to check the stability of industrial ginning along the season, TRJ

# Material and methods: Experiment 2



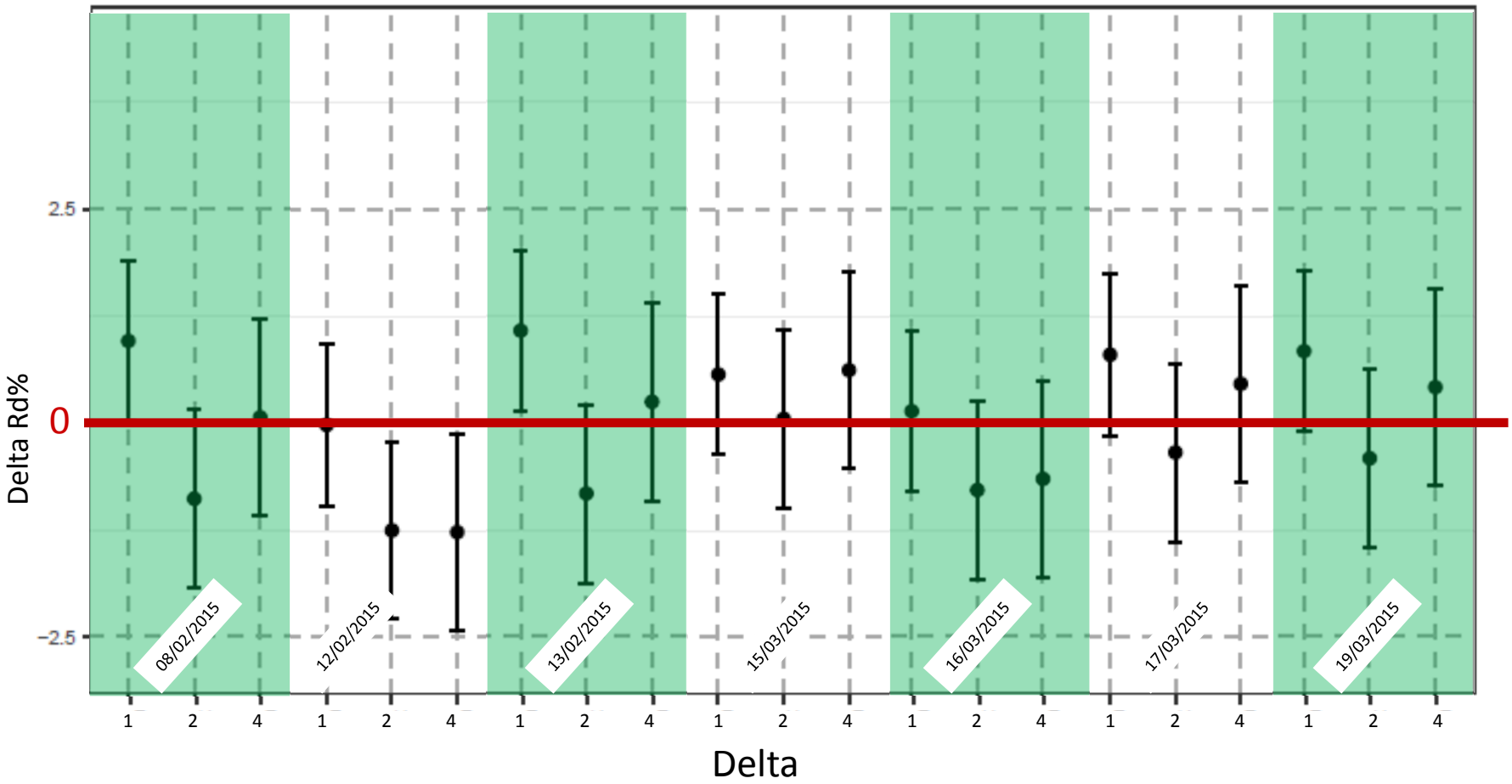

Togola M. *et al*. (2017). PhD and paper under preparation for TRJ

# Material and methods: calculations of quality Δs



# Results: Experiment 2

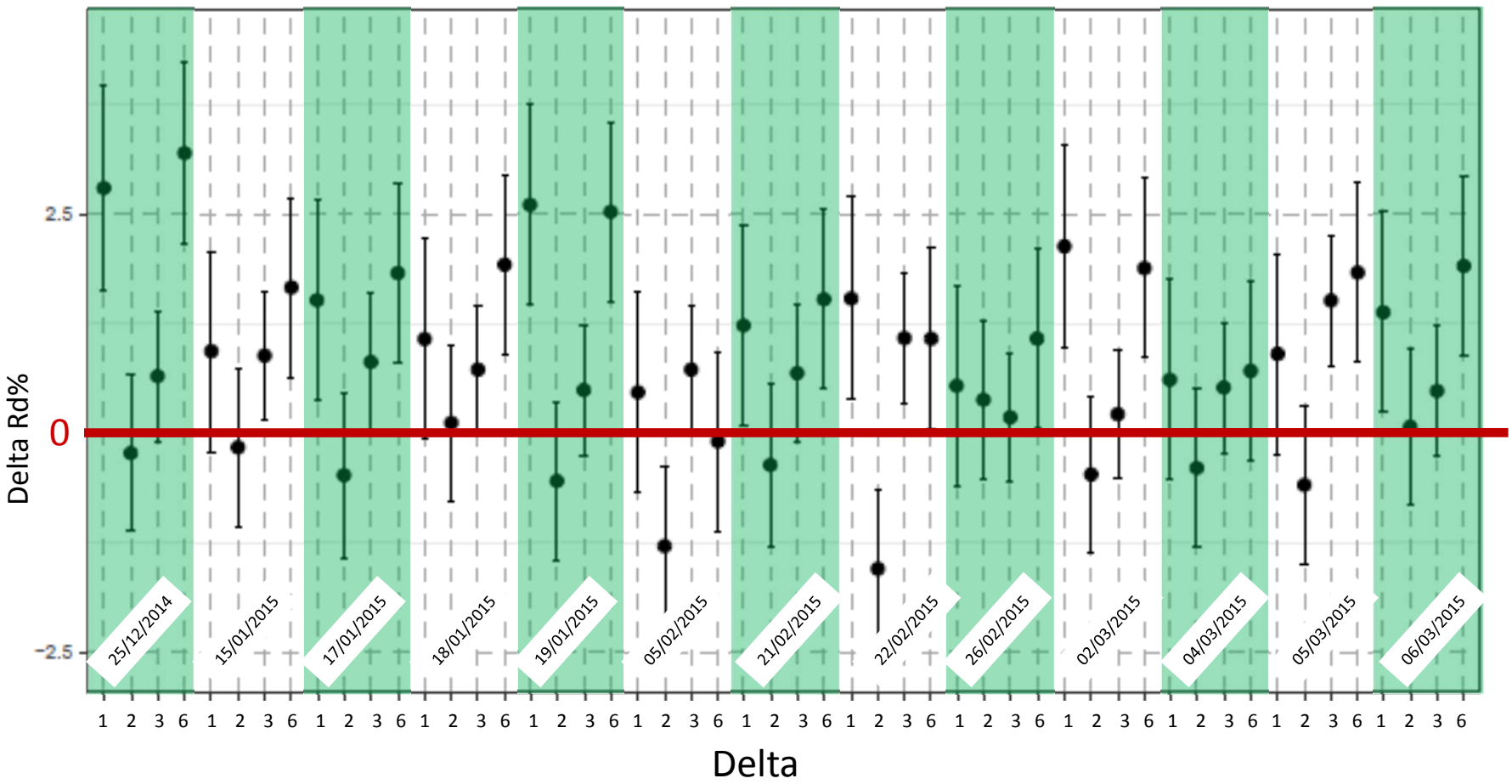
**Industrial ginning mill D**




Delta1: $SC_{out} – SC_{in}$ Delta2: $F_{in} – SC_{out}$ Delta4: $F_{in} – SC_{in}$

# Results: Experiment 2

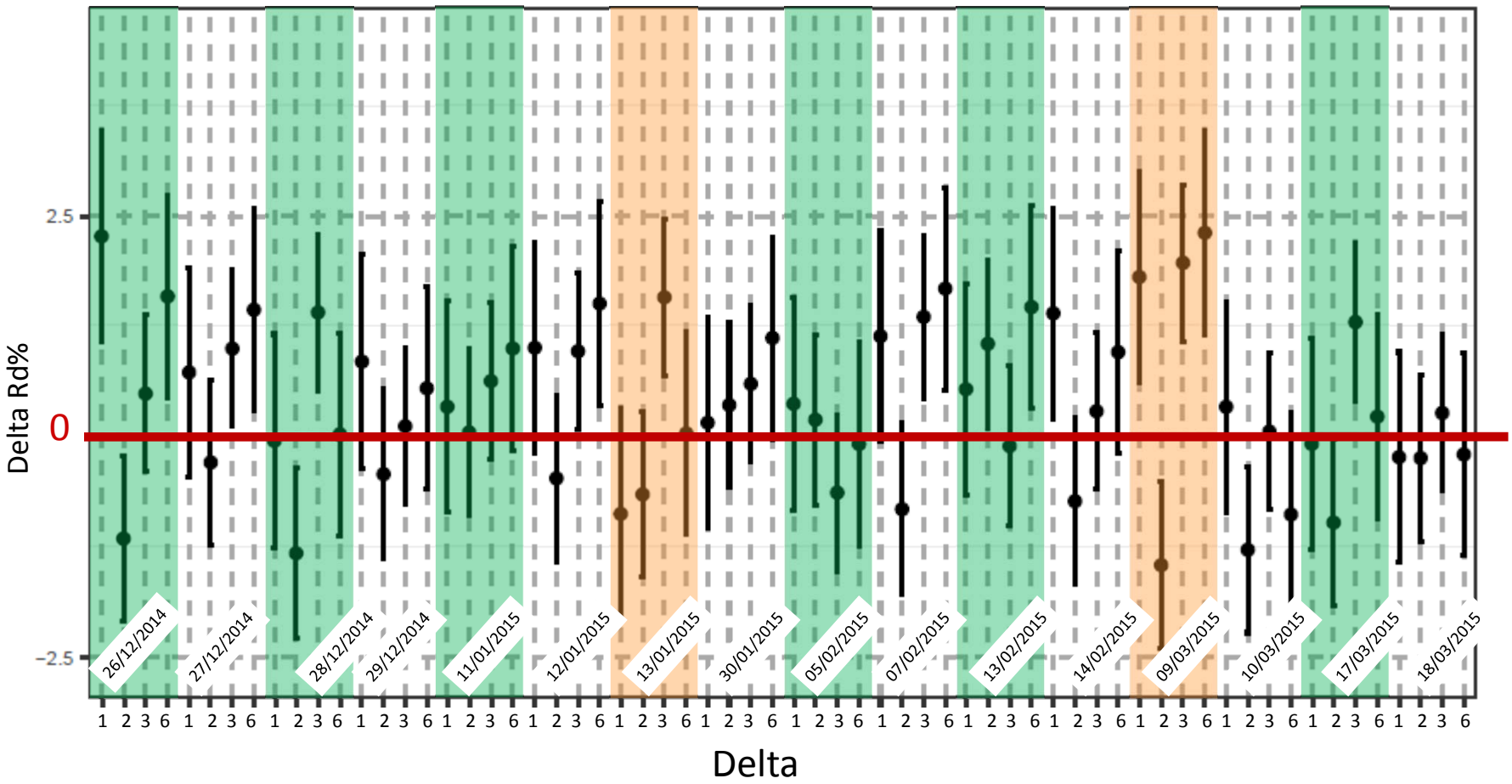
**Industrial ginning mill E**




Delta1: $SC_{out} – SC_{in}$ Delta2: $F_{in} – SC_{out}$ Delta3: $F_{out} – F_{in}$ Delta6: $F_{out}$ - $SC_{in}$

# Results: Experiment 2

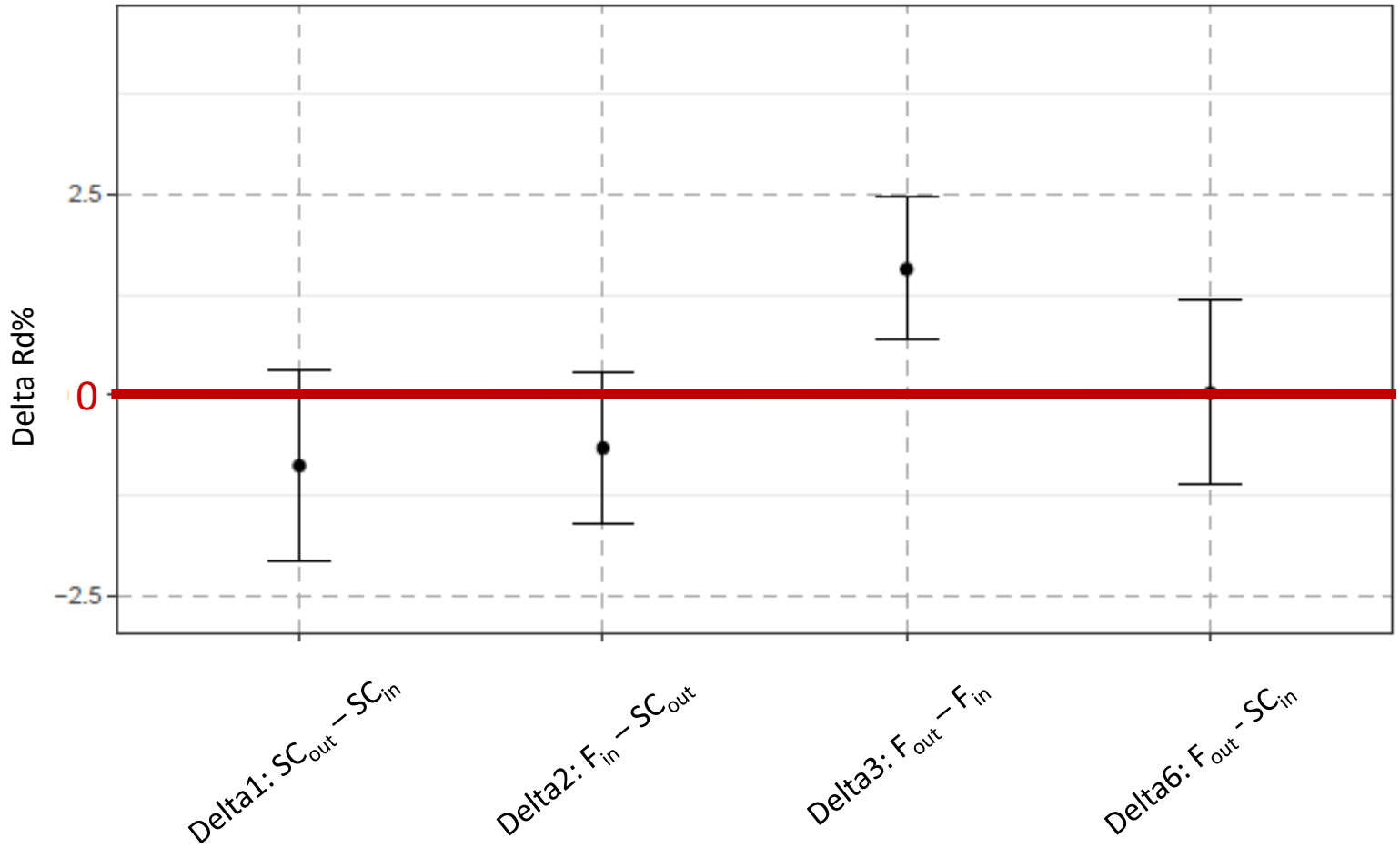
**Industrial ginning mill G**




Delta1: $SC_{out} – SC_{in}$ Delta2: $F_{in} – SC_{out}$ Delta3: $F_{out} – F_{in}$ Delta6: $F_{out}$ - $SC_{in}$

# Results: Experiment 2

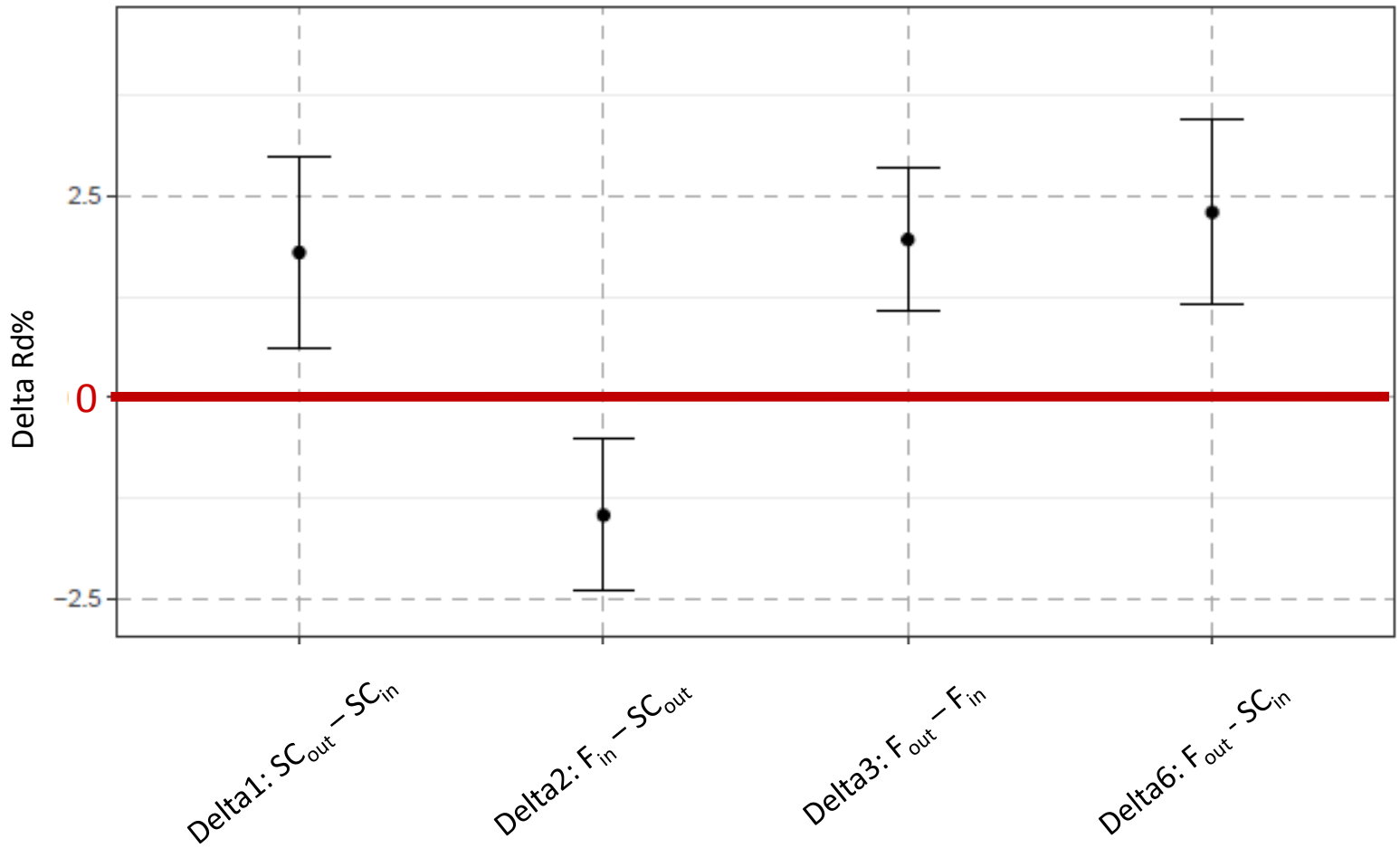
**Industrial ginning mill G, 13/01/2015**




| | $F_{out}(SC_{in})$ | | $F_{out}(SC_{out})$ | | $F_{in}$ | | $F_{out}$ |
|---|---|---|---|---|---|---|---|
| Rd%: | 76.1 | Seed-cotton cleaning | 75.2 | Ginning | 74.6 | Lint cleaning | 76.2 |
| +b: | 11.3 | | 11.2 | | 10.9 | | 10.8 |
| SqrTrArea: | 0.54 | | 0.45 | | 0.70 | | 0.45 |
| SqrTrCnt: | 4.66 | | 4.05 | | 6.14 | | 4.85 |

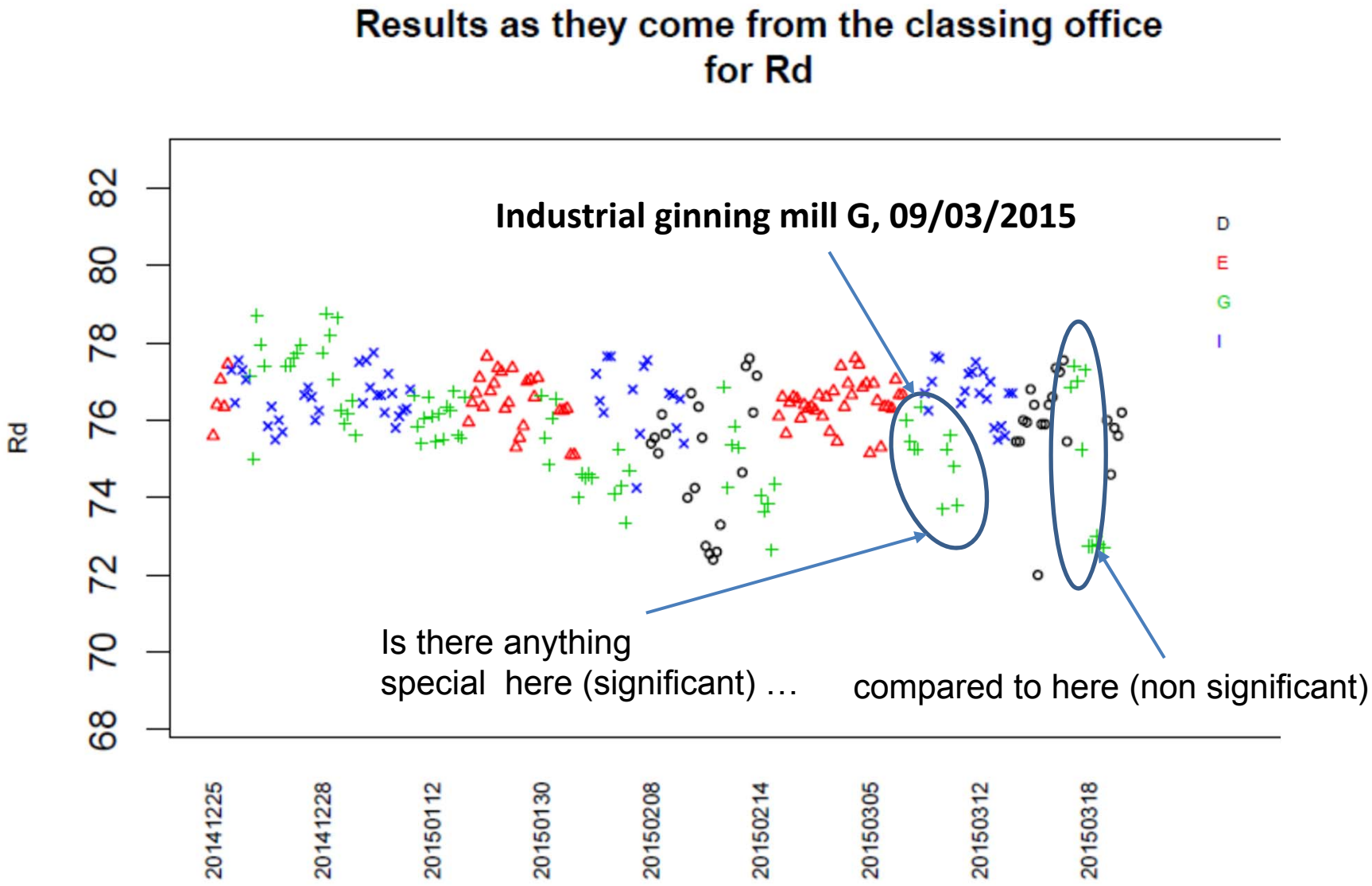
# Results: Experiment 2

**Industrial ginning mill G, 09/03/2015**




| | $F_{out}(SC_{in})$ | | $F_{out}(SC_{out})$ | | $F_{in}$ | | $F_{out}$ |
|---|---|---|---|---|---|---|---|
| Rd%: | 73.4 | Seed-cotton cleaning | 75.2 | Ginning | 73.7 | Lint cleaning | 75.6 |
| +b: | 11.0 | | 11.5 | | 11.2 | | 11.2 |
| SqrTrArea: | 0.64 | | 0.47 | | 0.68 | | 0.41 |
| SqrTrCnt: | 5.27 | | 4.40 | | 5.57 | | 4.43 |

# Results: Experiment 2



# Conclusion - Perspectives

Experiments conducted in industrial conditions:

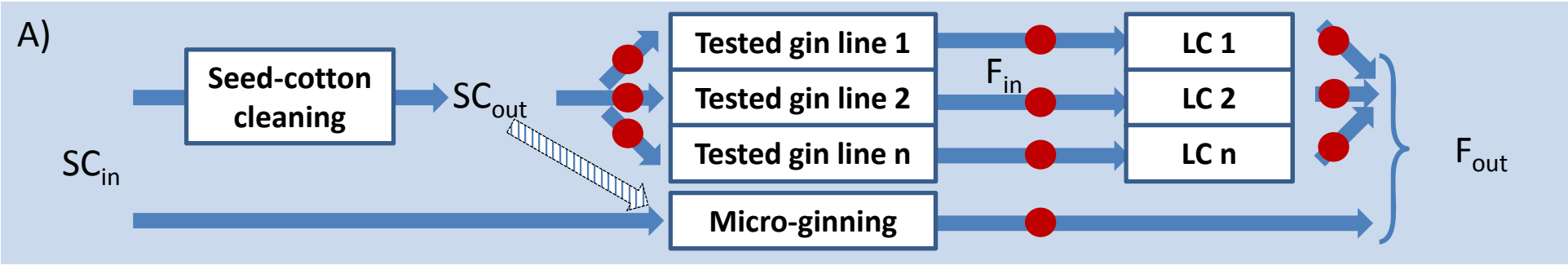
- Sampling done on-line
- Micro-ginning and testing were done off-line

⇒ **Delays not allowing fast maintenance actions**

**Would require automated sampling and testing stations**

- For lint, already exists (not all characteristics)
- For SC samples: including ginning tool in addition

# Application of sampling and testing stations




Sampling and testing station  Material flows  Optional material flows  * Chosen at purpose

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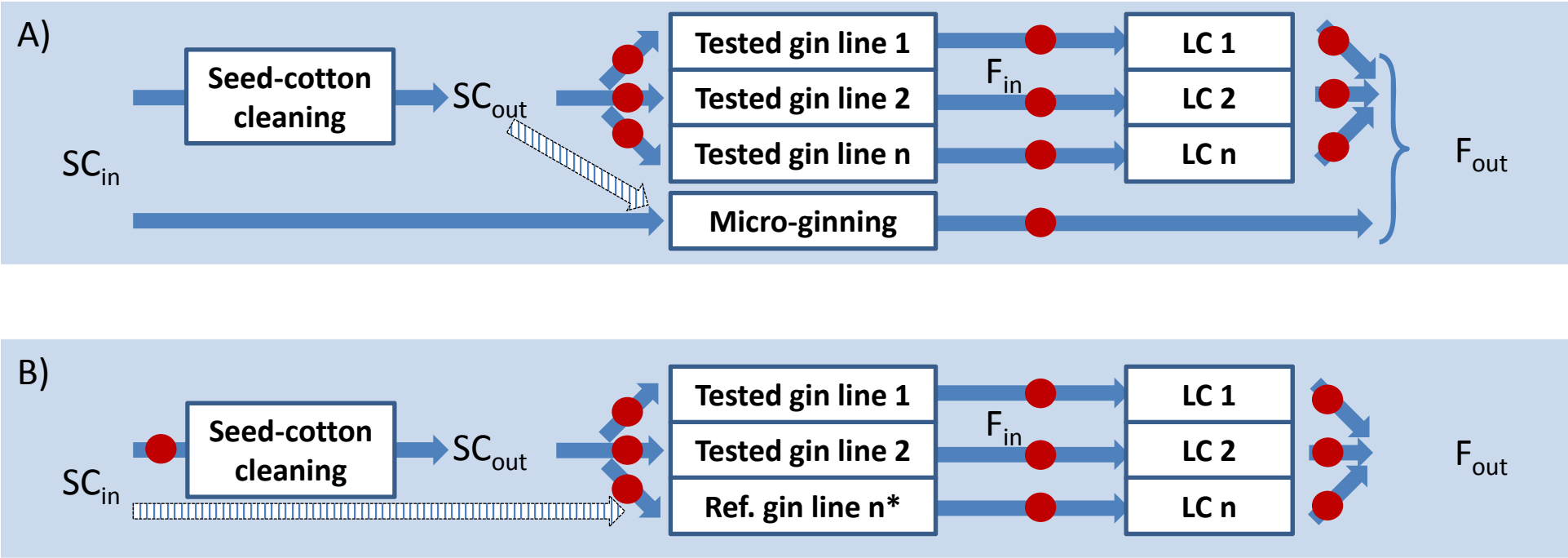


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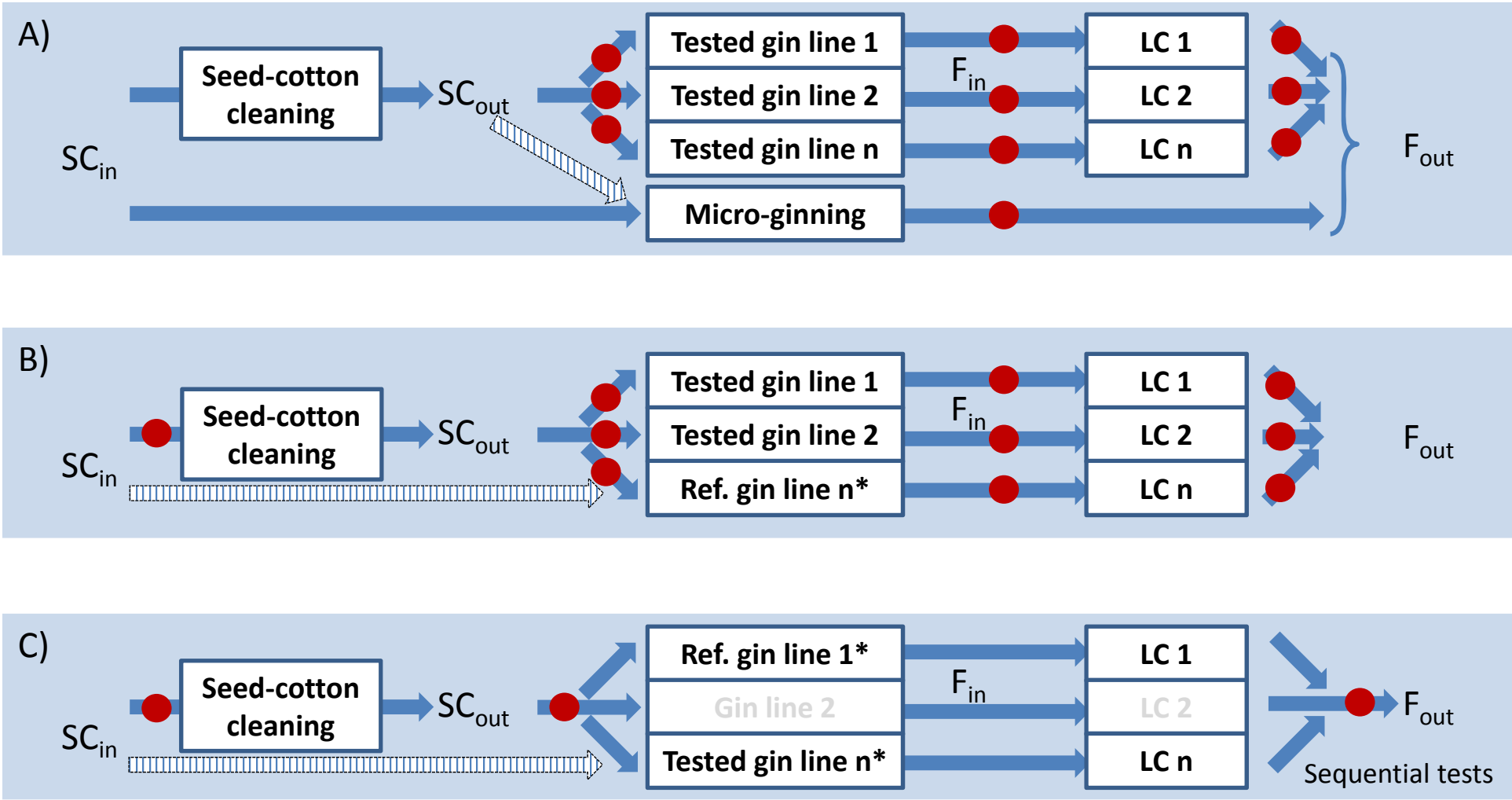
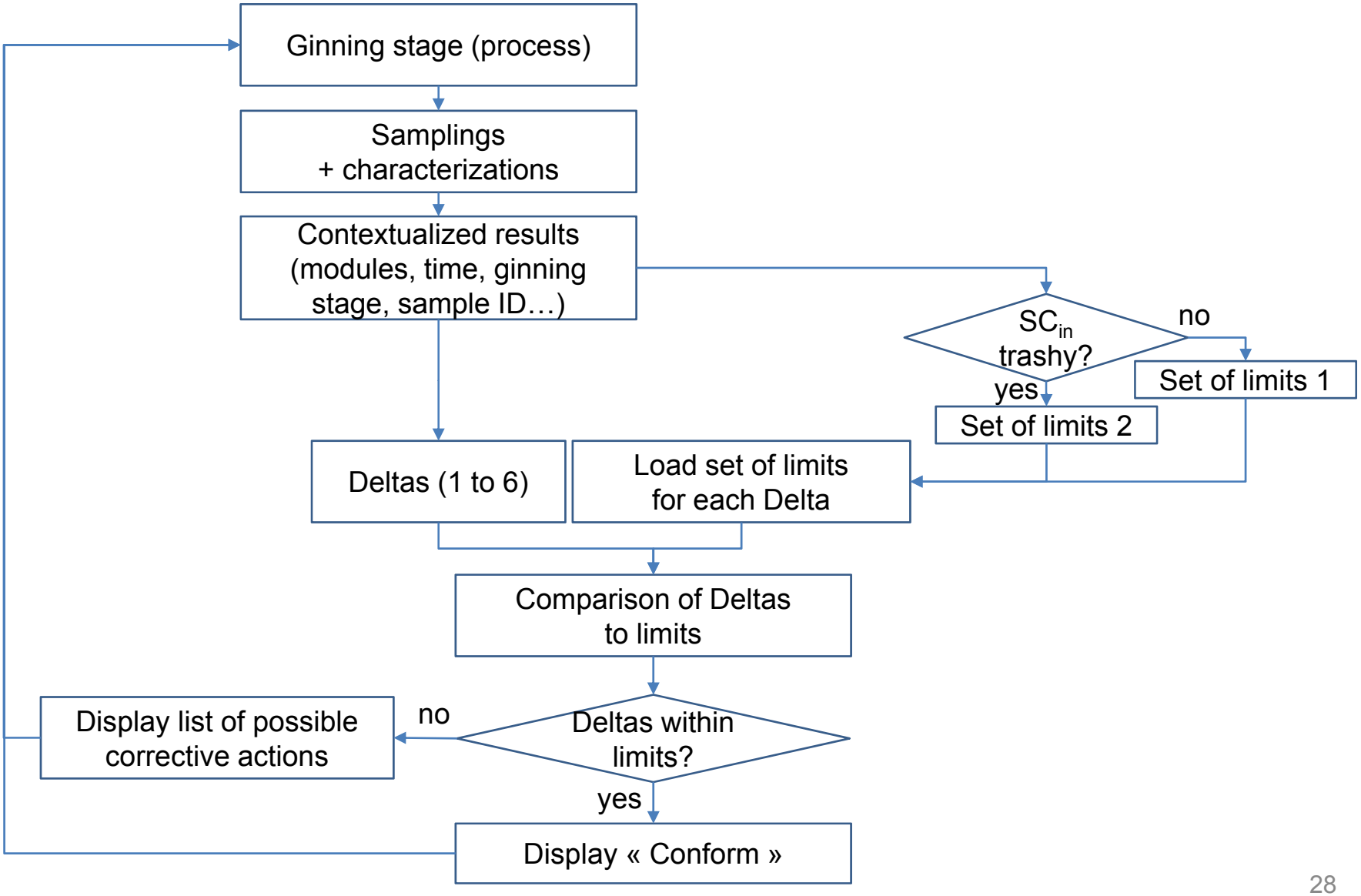



Sampling and testing station  Material flows  Optional material flows  * Chosen at purpose

# Use of sampling and testing stations

## Example of logic diagram to establish an on-line diagnosis



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## Thank you for your attention

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