Arbitrer entre différentes valorisations du grain : apports de l'ingénierie des connaissances

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Session « Valorisation non alimentaire / alimentaire (animale et humaine) »

Food or feed ?

Food or fuel ?

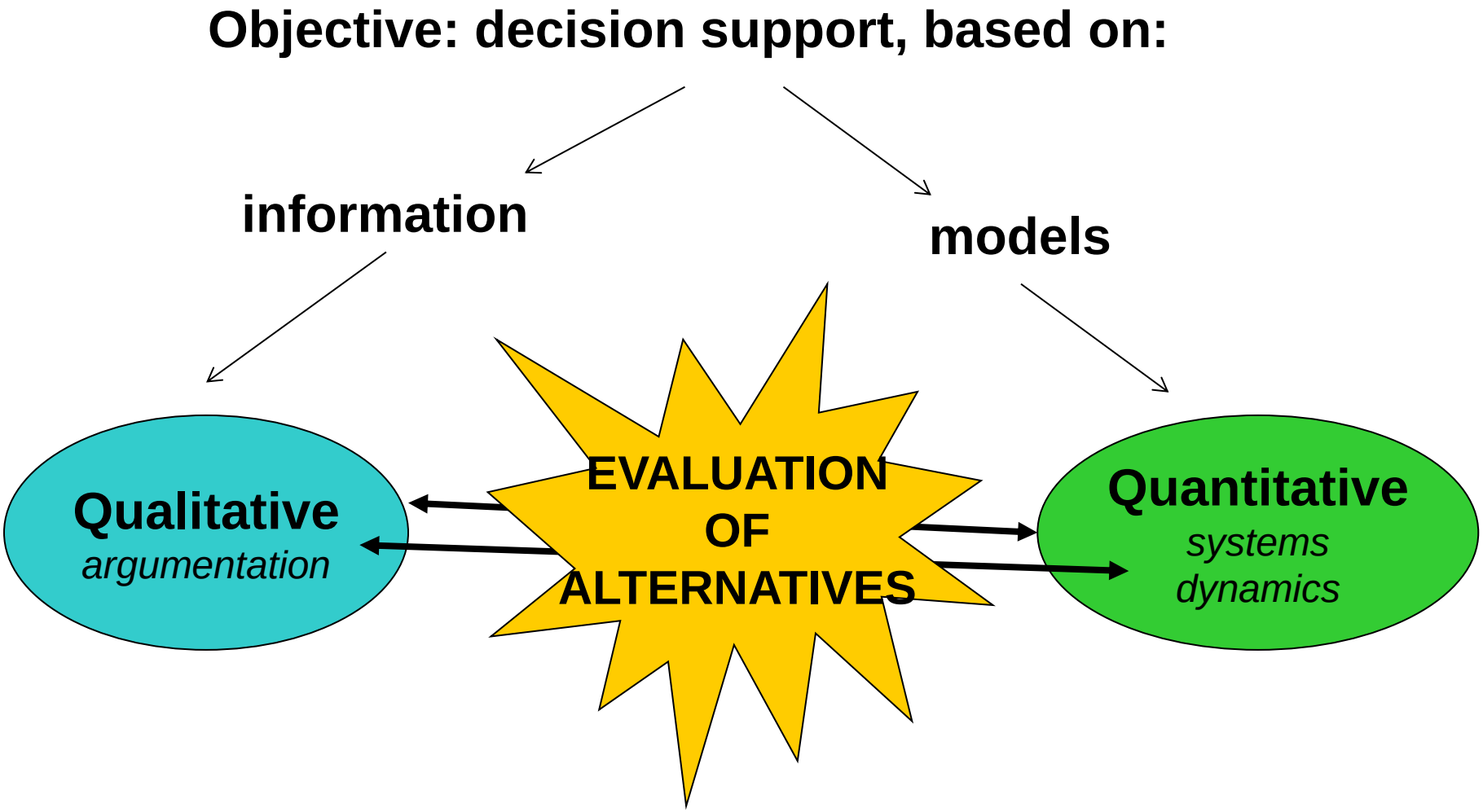
...

agropolis fondation

INRA SCIENCE & IMPACT

UNIVERSITÉ LAVAL

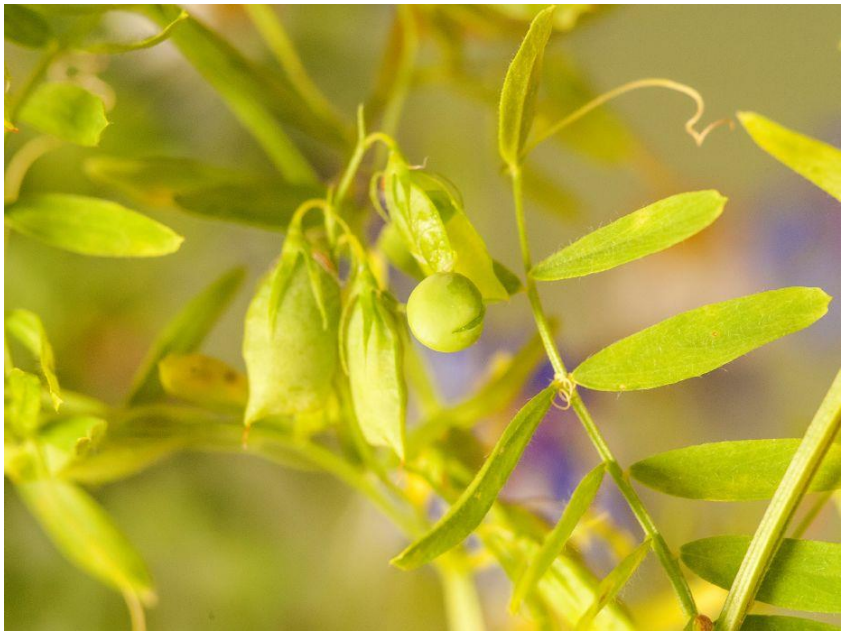
Research context



Cultural alternatives

1) Cereals in monoculture

2) Associated with legumes



Objective and steps

In the context of decision support (choice of cultural alternatives), we aim at comparing the alternatives by:

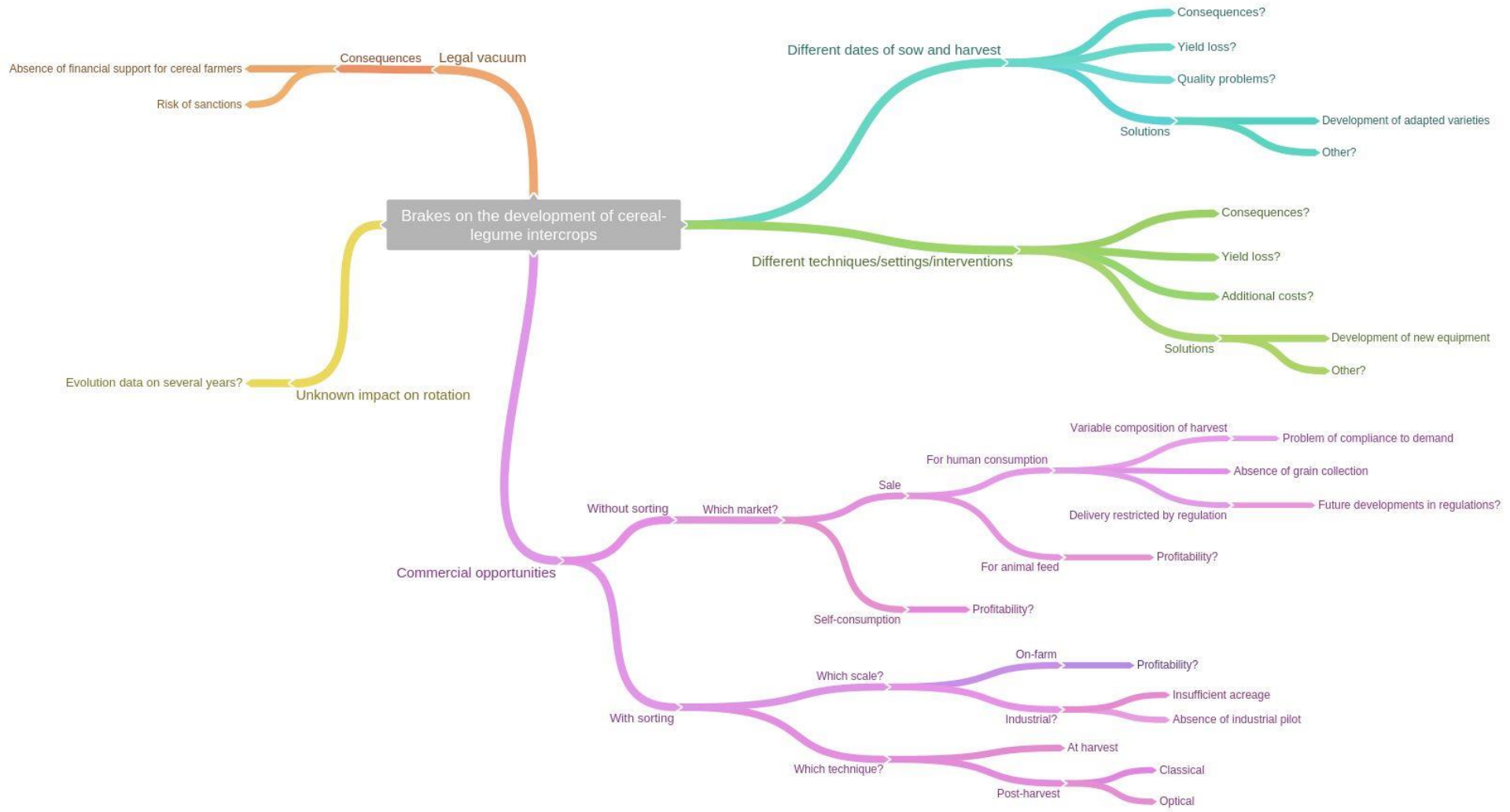
- collecting arguments expressed in support of the different alternatives
- considering hypotheses on parameters, based on selected arguments
- performing numerical simulations to assess the alternatives in different scenarios
- discussing the relevance of the alternatives

Arguments (1)

+ improved soil fertility
+ reduction of organic nitrogen fertilizers, expensive and inefficient
+ higher protein content of harvested grain, which is a quality criterion for durum wheat
+ better control of weeds
+ better resistance against plant aggressors
+ more stable yields despite climate variability.

– non-synchronized optimal dates for sowing and harvest of the two species
– variable composition of harvest
– specific sorting operation required for human consumption
– lack of distribution and valorization networks
– restricted marketing possibilities due to the absence of a regulatory state for cereal-legume intercrops
– discouraging European aid policies.

Arguments (2)


Brakes on the development of cereal-legume intercrops
Legal vacuum
Consequences
Absence of financial support for cereal farmers
Risk of sanctions
Unknown impact on rotation
Evolution data on several years?
Different dates of sow and harvest
Consequences?
Yield loss?
Quality problems?
Solutions
Development of adapted varieties
Other?
Different techniques/settings/interventions
Consequences?
Yield loss?
Additional costs?
Solutions
Development of new equipment
Other?
Commercial opportunities
Without sorting
Which market?
Sale
For human consumption
Variable composition of harvest
Problem of compliance to demand
Absence of grain collection
Delivery restricted by regulation
Future developments in regulations?
For animal feed
Profitability?
Self-consumption
Profitability?
With sorting
Which scale?
On-farm
Profitability?
Industrial?
Insufficient acreage
Absence of industrial pilot
Which technique?
At harvest
Post-harvest
Classical
Optical

Arguments (3) – No sorting

Id	Arg. type	Explanation	Option	Criterion	Intended use
1	-	Mixed grains are not economically viable, by lack of market opportunities	No sorting	Economic (added value)	Commercialization of the mix
2	+	Commercializing mixed grains is competitive, since the sorting step, which is very costly, is avoided	No sorting	Economic	Commercialization of the mix
3	+	Mixed grains can be consumed on the farm	No sorting	Technical (Ease of use)	Own consumption
4	-	Own consumption is limited to small quantities and non-profit use, since no added value is created	No sorting	Economic	Own consumption
5	+	Little sorting, or not at all, is required for animal feed	No sorting	Technical (Ease of use)	Commercialization of the mix for animal feed
6	-	Market prices to commercialize mixed grains for animal feed are lower than for human consumption, and possibly below cost	No sorting	Economic	Commercialization of the mix for animal feed
7	-	Product innovation is required to use mixed grains (e.g. durum wheat/pea couscous; durum wheat/legume pasta)	No sorting	Technical (feasibility)	Commercialization of the mix for human consumption
8	+	There are growing market opportunities for mixed grain products	No sorting	Economic	Commercialization of the mix for human consumption

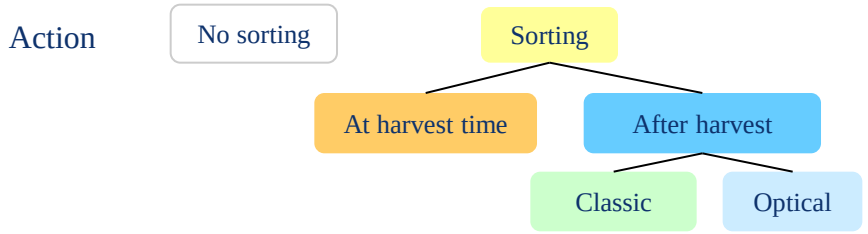
Arguments (3) - Sorting at harvest time

Id	Arg. type	Explanation	Option	Criterion	Intended use
9	-	Dual combine harvesters are not available on the market currently	Sorting at harvest time	Technical	Commercialization of separate grains
10	+	Dual combine harvesters could be manufactured	Sorting at harvest time	Technical	Commercialization of separate grains
11	+	The harvest can be achieved in two phases: a first run with a legume-setting of the harvester, then a second run with a cereal-setting	Sorting at harvest time	Technical	Commercialization of separate grains
12	-	The two-phase option is costly and thus unlikely	Sorting at harvest time	Economic	Commercialization of separate grains

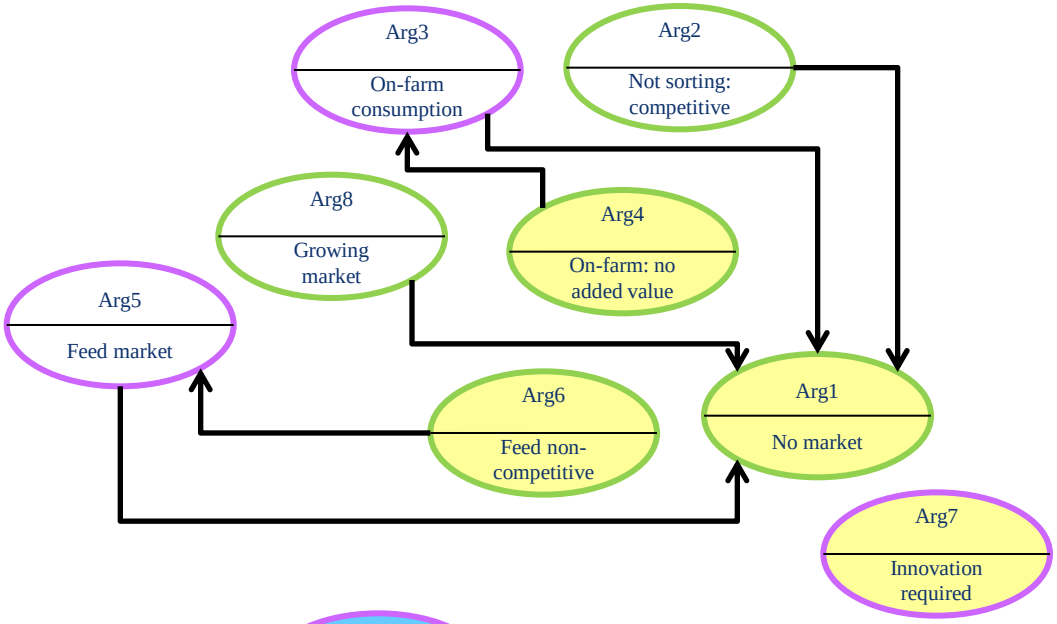
Arguments (3) – After-harvest sorting

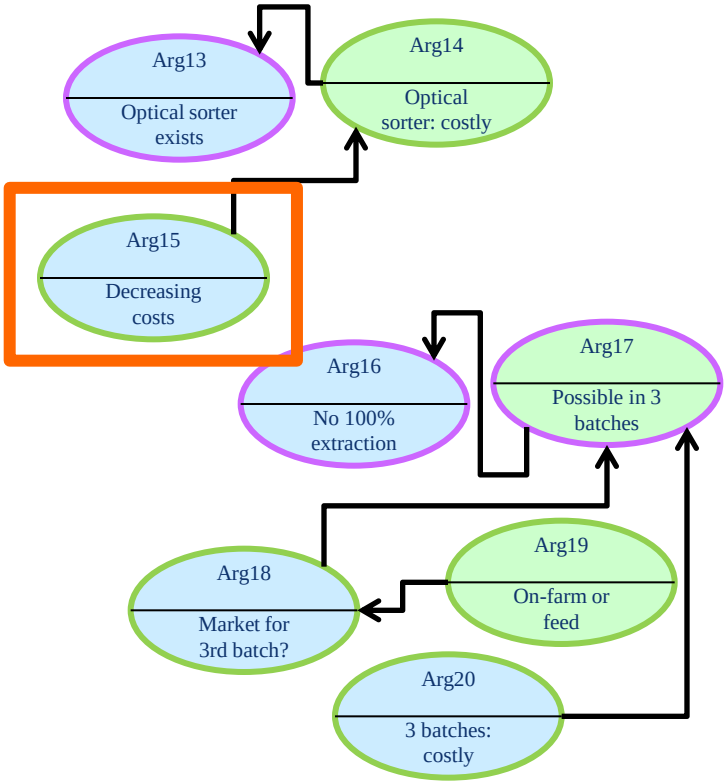
Id	Arg. type	Explanation	Option	Criterion	Intended use
13	+	Optical sorting type effective technology exists	After-harvest optical sorting	Technical	Commercialization of separate grains
14	-	Optical sorting type technology is costly	After-harvest optical sorting	Economic	Commercialization of separate grains
15	+	Prices for optical sorters are trending downwards	After-harvest optical sorting	Economic	Commercialization of separate grains
16	-	100% extraction of wheat and legume during classic sorting is impossible, since some of the broken legume grains have the same size as some of the wheat grains	After-harvest classic sorting	Technical	Commercialization of separate grains
17	+	A 3-batch sorting is possible: easily separable wheat, easily separable pea, non-separable wheat and pea mix	After-harvest classic sorting	Technical	Commercialization of separate grains
18	-	In case of 3 batches, the question of the use of the non-separable wheat and pea mix still remains	After-harvest classic sorting	Economic	Commercialization of separate grains
19	+	The non-separable batch may be used for own consumption or for commercialization in animal feed	After-harvest classic sorting	Economic	Commercialization of separate grains
20	-	The 3-batch solution is still costly, since it requires handling, several repetitions, and leads to a lower financial benefit of the non-separable batch	After-harvest classic sorting	Economic	Commercialization of separate grains

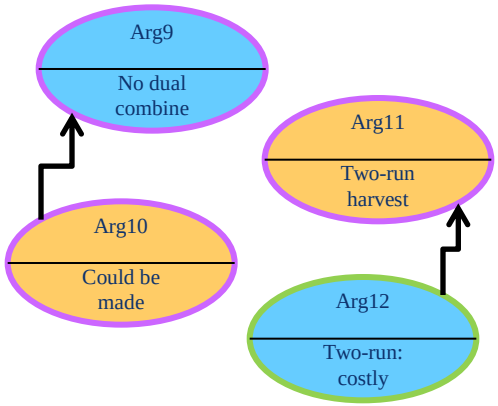

Criterion
Economic
Technical


Action
No sorting
Sorting
At harvest time
After harvest
Classic
Optical

Arguments (4)


Arg3
On-farm consumption
Arg2
Not sorting: competitive
Arg8
Growing market
Arg4
On-farm: no added value
Arg5
Feed market
Arg6
Feed non-competitive
Arg1
No market
Arg7
Innovation required


Arg13
Optical sorter exists
Arg14
Optical sorter: costly
Arg15
Decreasing costs
Arg16
No 100% extraction
Arg17
Possible in 3 batches
Arg18
Market for 3rd batch?
Arg19
On-farm or feed
Arg20
3 batches: costly


Arg9
No dual combine
Arg11
Two-run harvest
Arg10
Could be made
Arg12
Two-run: costly

Critère

économique (rentabilité)

technologique (faisabilité)

Action

pas de tri

tri

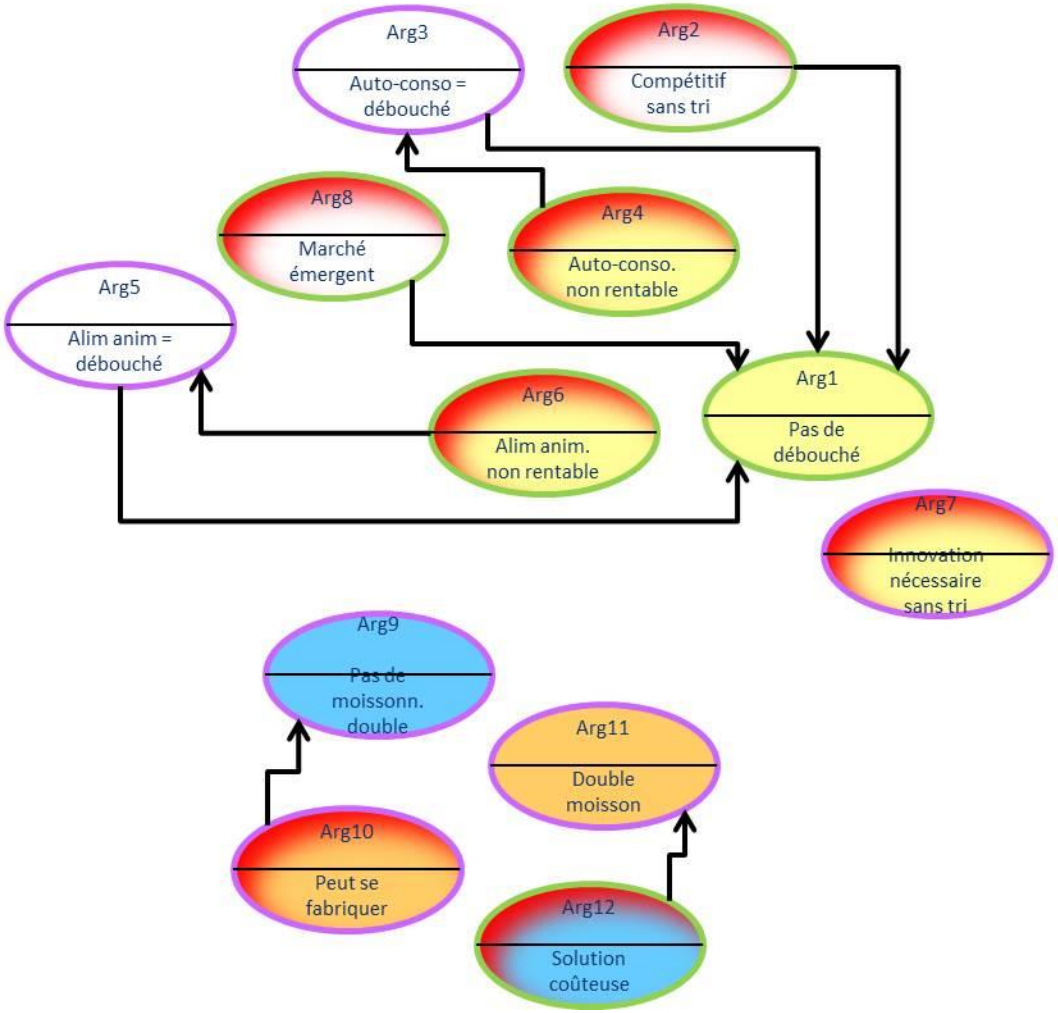
à la récolte

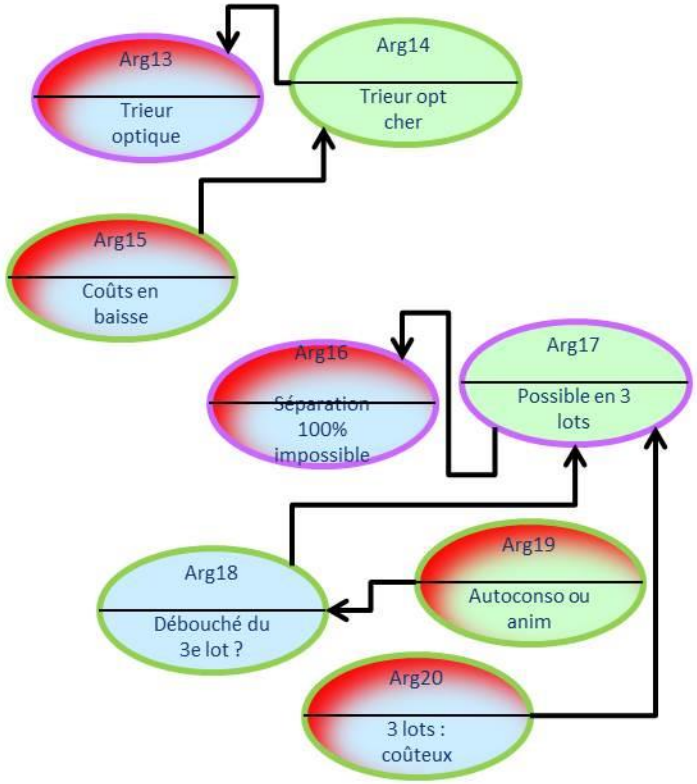
post-récolte

classique

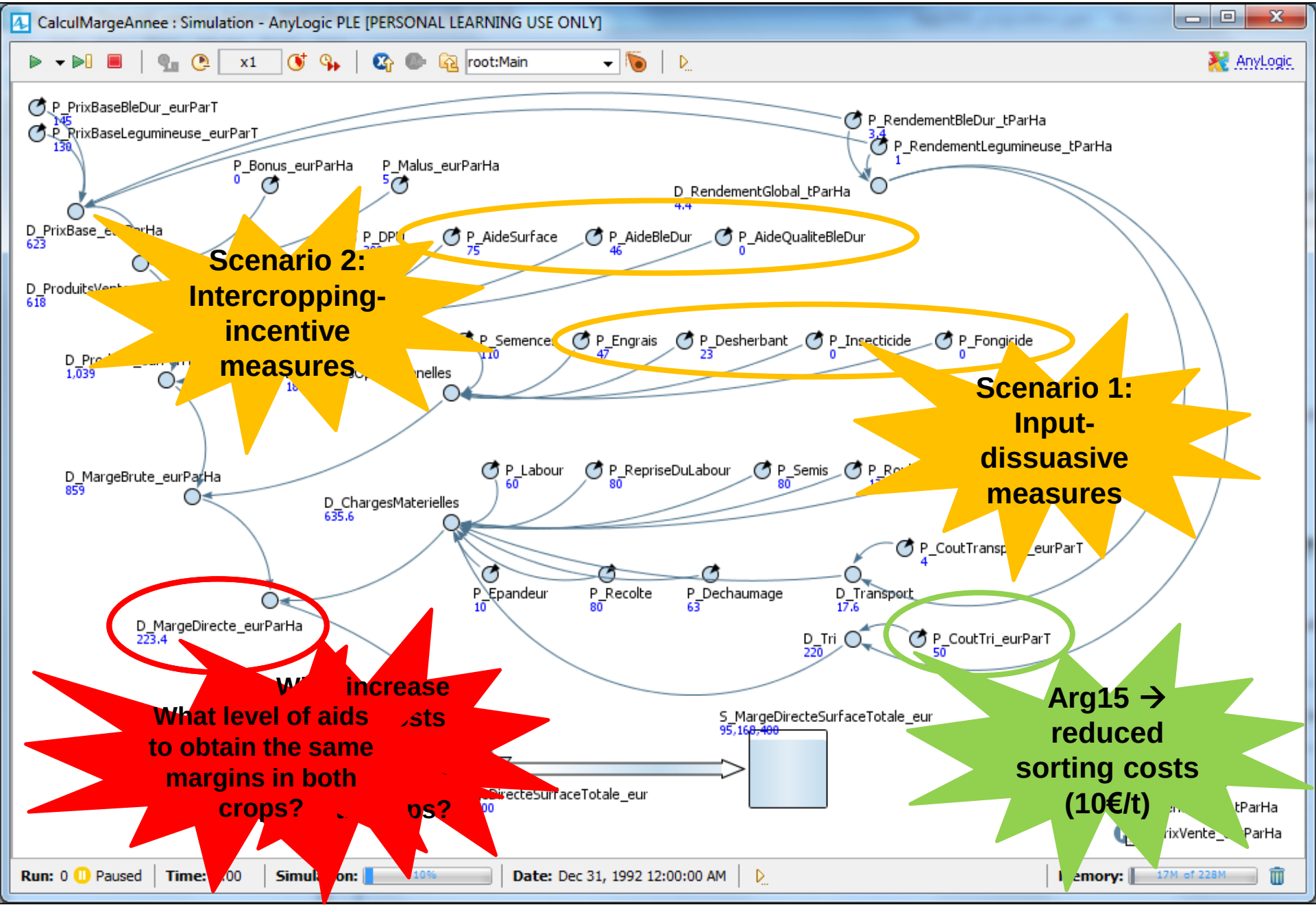
optique

Preferred extension

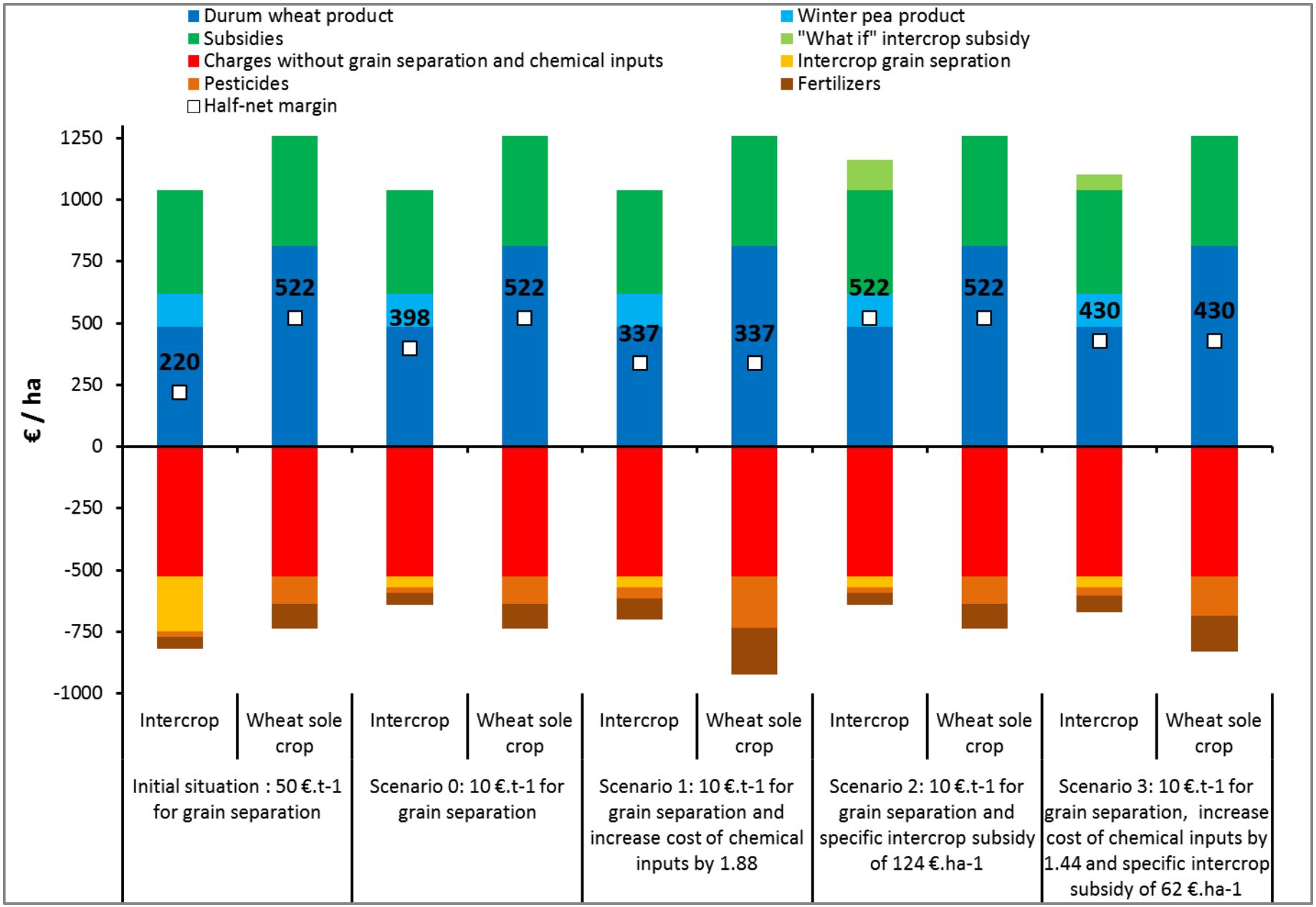


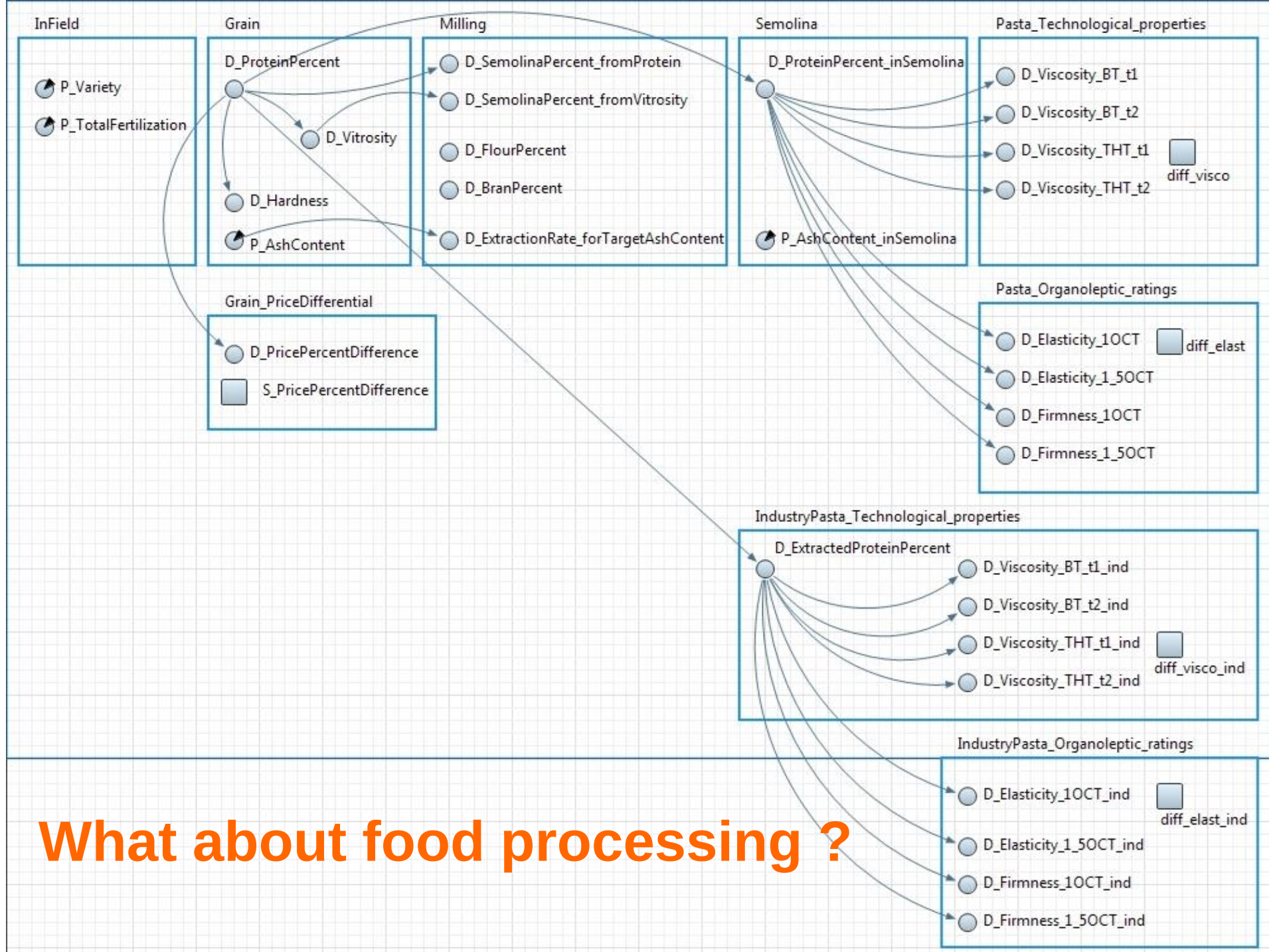


What-if scenarios



Comparison of scenario results





What about food processing ?

Conclusion

1) Strength of the combined argumentation/simulation approach:

- For the objectives of the project
- For the session topic
  - highlights the diversity of concerns
  - reveals the most consensual arguments
  - provides an integrated view of the different parameters
  - tests the influence of hypotheses on the system (e.g. public aids)

2) Perspectives:

- Environmental impacts
- Rotation scale
  - preceding crop
  - successive years
- Complementary types of scenarios coupled with agronomic models