Arbitrer entre différentes valorisations du grain : apports de l'ingénierie des connaissances
Session « Valorisation non alimentaire / alimentaire (animale et humaine) »

Food or feed?

Food or fuel?
Objective: decision support, based on:

- Qualitative argumentation
- Information
- Models
- Quantitative systems dynamics

EVALUATION OF ALTERNATIVES
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)
## Arguments (3) – No sorting

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

<table>
<thead>
<tr>
<th>Id</th>
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<th>Option</th>
<th>Criterion</th>
<th>Intended use</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>-</td>
<td>Dual combine harvesters are not available on the market currently</td>
<td>Sorting at harvest time</td>
<td>Technical</td>
<td>Commercialization of separate grains</td>
</tr>
<tr>
<td>10</td>
<td>+</td>
<td>Dual combine harvesters could be manufactured</td>
<td>Sorting at harvest time</td>
<td>Technical</td>
<td>Commercialization of separate grains</td>
</tr>
<tr>
<td>11</td>
<td>+</td>
<td>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</td>
<td>Sorting at harvest time</td>
<td>Technical</td>
<td>Commercialization of separate grains</td>
</tr>
<tr>
<td>12</td>
<td>-</td>
<td>The two-phase option is costly and thus unlikely</td>
<td>Sorting at harvest time</td>
<td>Economic</td>
<td>Commercialization of separate grains</td>
</tr>
<tr>
<td>Id</td>
<td>Arg. type</td>
<td>Explanation</td>
<td>Option</td>
<td>Criterion</td>
<td>Intended use</td>
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<td>-----------------------------------------------</td>
</tr>
<tr>
<td>13</td>
<td>+</td>
<td>Optical sorting type effective technology exists</td>
<td>After-harvest optical sorting</td>
<td>Technical</td>
<td>Commercialization of separate grains</td>
</tr>
<tr>
<td>14</td>
<td>–</td>
<td>Optical sorting type technology is costly</td>
<td>After-harvest optical sorting</td>
<td>Economic</td>
<td>Commercialization of separate grains</td>
</tr>
<tr>
<td>15</td>
<td>+</td>
<td>Prices for optical sorters are trending downwards</td>
<td>After-harvest optical sorting</td>
<td>Economic</td>
<td>Commercialization of separate grains</td>
</tr>
<tr>
<td>16</td>
<td>–</td>
<td>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</td>
<td>After-harvest classic sorting</td>
<td>Technical</td>
<td>Commercialization of separate grains</td>
</tr>
<tr>
<td>17</td>
<td>+</td>
<td>A 3-batch sorting is possible: easily separable wheat, easily separable pea, non-separable wheat and pea mix</td>
<td>After-harvest classic sorting</td>
<td>Technical</td>
<td>Commercialization of separate grains</td>
</tr>
<tr>
<td>18</td>
<td>–</td>
<td>In case of 3 batches, the question of the use of the non-separable wheat and pea mix still remains</td>
<td>After-harvest classic sorting</td>
<td>Economic</td>
<td>Commercialization of separate grains</td>
</tr>
<tr>
<td>19</td>
<td>+</td>
<td>The non-separable batch may be used for own consumption or for commercialization in animal feed</td>
<td>After-harvest classic sorting</td>
<td>Economic</td>
<td>Commercialization of separate grains</td>
</tr>
<tr>
<td>20</td>
<td>–</td>
<td>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</td>
<td>After-harvest classic sorting</td>
<td>Economic</td>
<td>Commercialization of separate grains</td>
</tr>
</tbody>
</table>
Arguments (4)

- **Criterion**
  - Economic
  - Technical

- **Action**
  - No sorting
  - Sorting
    - At harvest time
      - Classic
      - Optical
    - After harvest

- **Arguments**
  - Arg1: No market
  - Arg2: Not sorting: competitive
  - Arg3: On-farm consumption
  - Arg4: On-farm: no added value
  - Arg5: Growing market
  - Arg6: Feed non-competitive
  - Arg7: Innovation required
  - Arg8: Feed market
  - Arg9: No dual combine
  - Arg10: Could be made
  - Arg11: Two-run harvest
  - Arg12: Two-run: costly
  - 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
Preferred extension
What-if scenarios

Scenario 1: Input-dissuasive measures

Scenario 2: Intercropping-incentive measures

What increase in input costs to obtain the same margins in both crops?

What level of aids to obtain the same margins in both crops?

Arg15 → reduced sorting costs (10€/t)
Comparison of scenario results

- **Durum wheat product**
- **Subsidies**
- **Charges without grain separation and chemical inputs**
- **Pesticides**
- **Half-net margin**

### Initial situation: 50 €.t-1 for grain separation
- Intercrop
- Wheat sole crop

### Scenario 0: 10 €.t-1 for grain separation
- Intercrop
- Wheat sole crop

### Scenario 1: 10 €.t-1 for grain separation and increase cost of chemical inputs by 1.88
- Intercrop
- Wheat sole crop

### Scenario 2: 10 €.t-1 for grain separation and specific intercrop subsidy of 124 €.ha-1
- Intercrop
- Wheat sole crop

### Scenario 3: 10 €.t-1 for grain separation, increase cost of chemical inputs by 1.44 and specific intercrop subsidy of 62 €.ha-1
- Intercrop
- Wheat sole crop

€/ha Values:
- Intercrop (Scenario 0): 522
- Wheat sole crop (Scenario 0): 398
- Intercrop (Scenario 1): 337
- Wheat sole crop (Scenario 1): 337
- Intercrop (Scenario 2): 522
- Wheat sole crop (Scenario 2): 430
- Intercrop (Scenario 3): 430
- Wheat sole crop (Scenario 3): 430
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