

REAL DECISION MAKERS AND REAL ALTERNATIVES ARE IMPORTANT INGREDIENTS FOR EXPERIMENTAL DECISION RESEARCH

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1. Background: Wheat Variety Selection is a Bad-Structured Inference Problem

Selecting wheat varieties is a decision task farmers are familiar with.

Due to...

- **complexity:** diverse interactions between plant, soil and production system,
 - **uncertainty:** huge influence by poorly predictable annual weathering,
 - **multitude of available information:** 160 varieties x 20 attributes = 3.200
- ...variety selection is a bad structured inference problem.

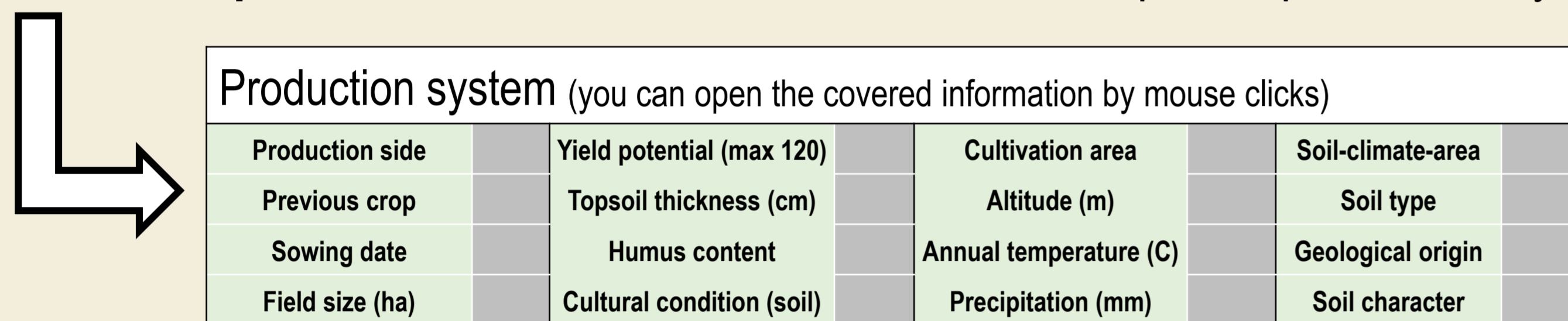
Heuristic strategies to solve this inference task

- (1) **Model-based:** evaluation of alternatives based on (some) variety characteristics applying different heuristic principles
- (2) **Memory-based:** variety names can be used to recall memories about varieties' performance in the past
- (3) Combinations of **both strategies mentioned before**

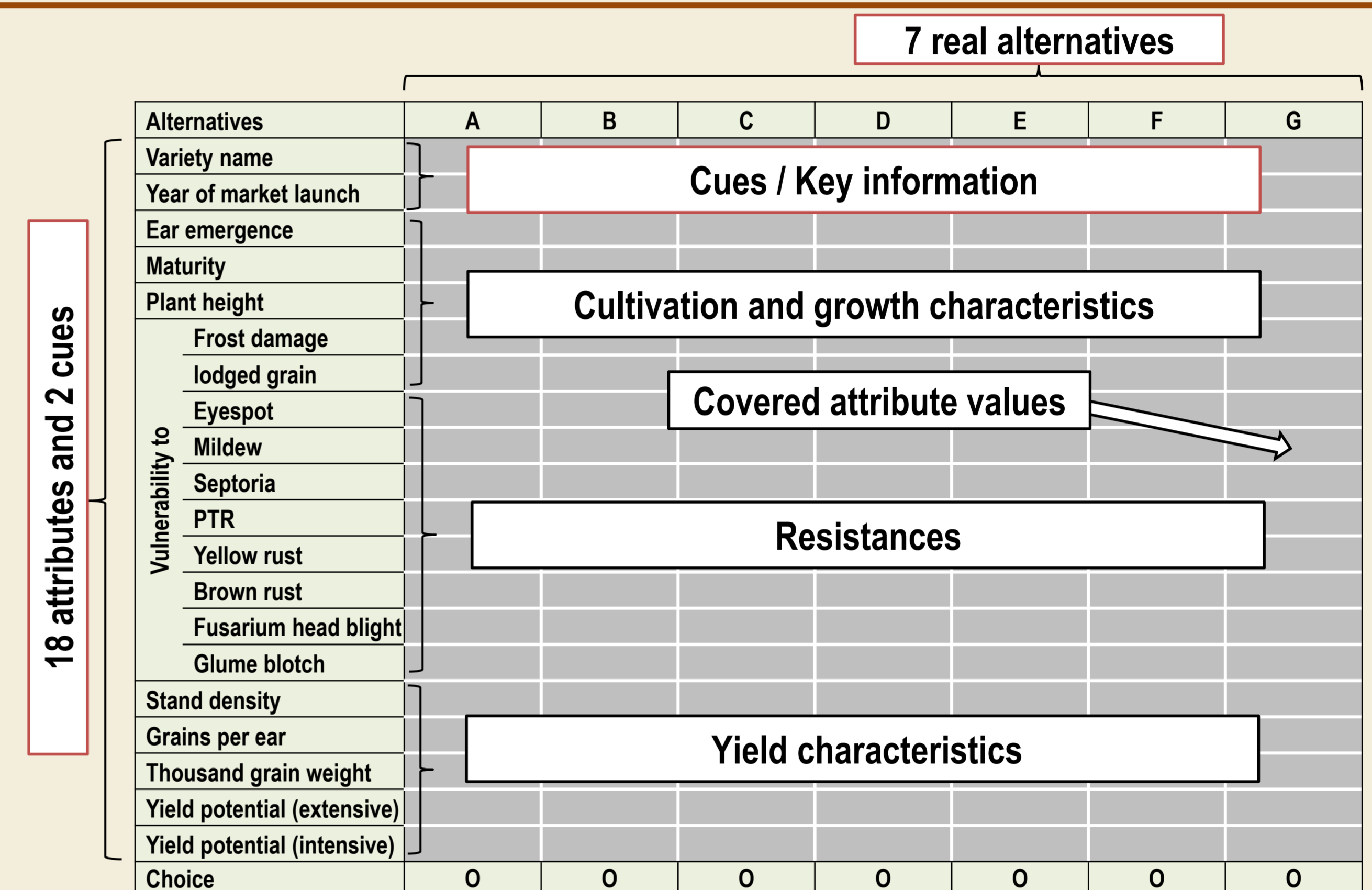
Objectives: Identification of heuristic strategies in (familiar) decision situations.
Examination of **key factors** for the application of different strategies.

2. Method: Incentivized Lab Experiment

- **Real decision makers:** 145 operative managers (farmers) and reference group (43 agricultural students)
- **Real-world problem:** selection of wheat varieties for 7 specific production systems



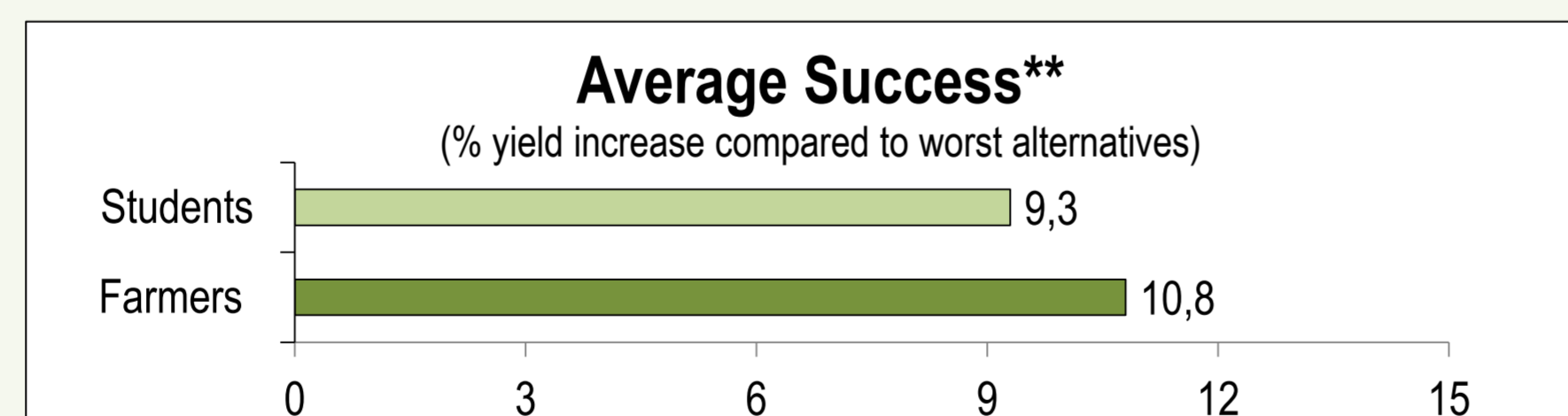
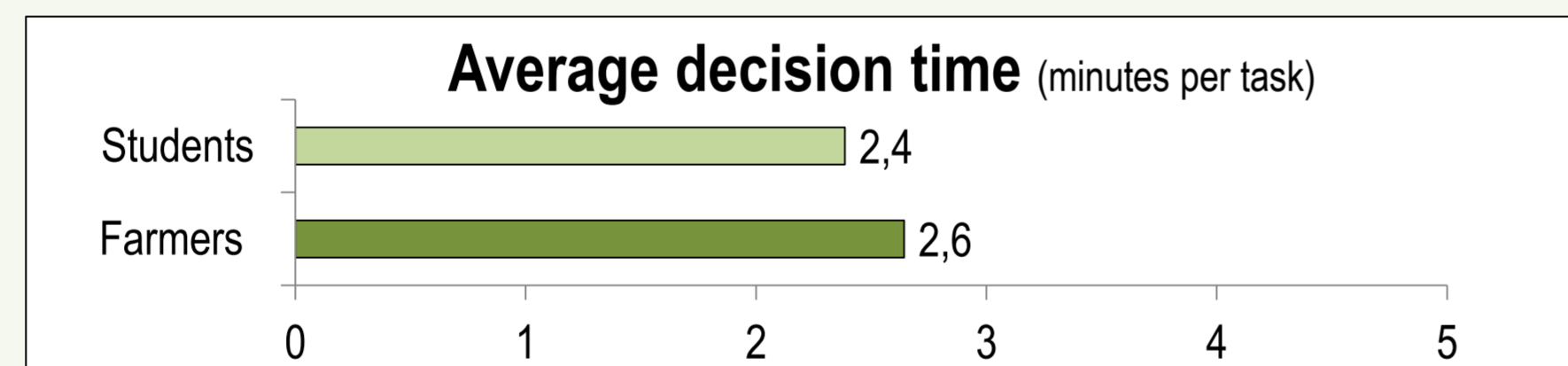
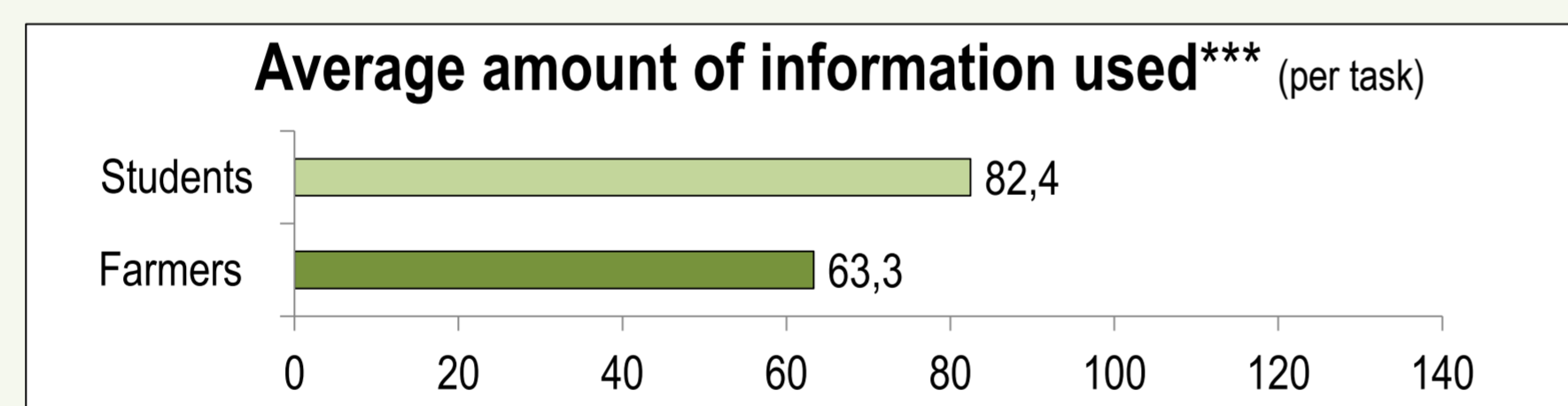
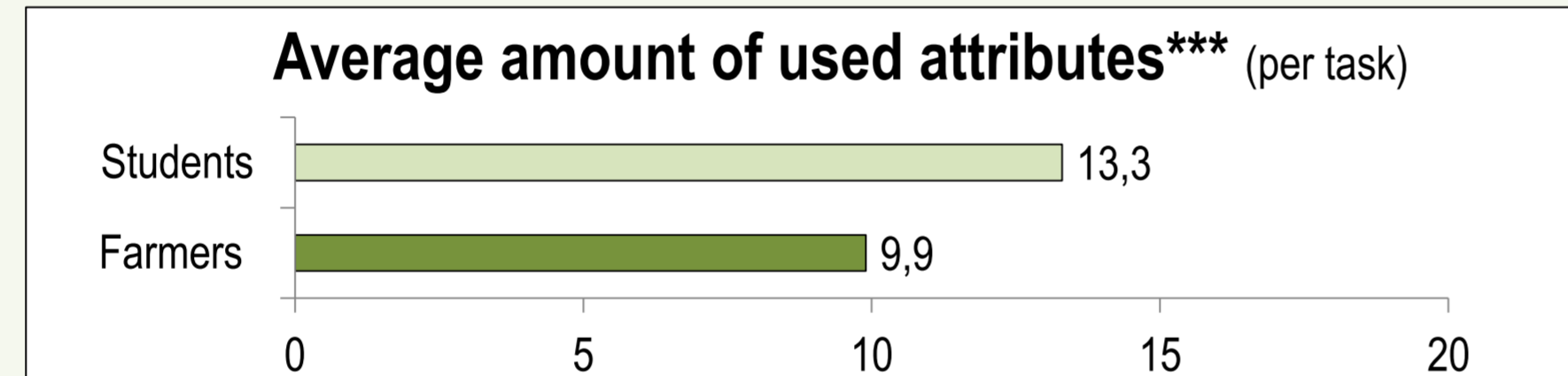
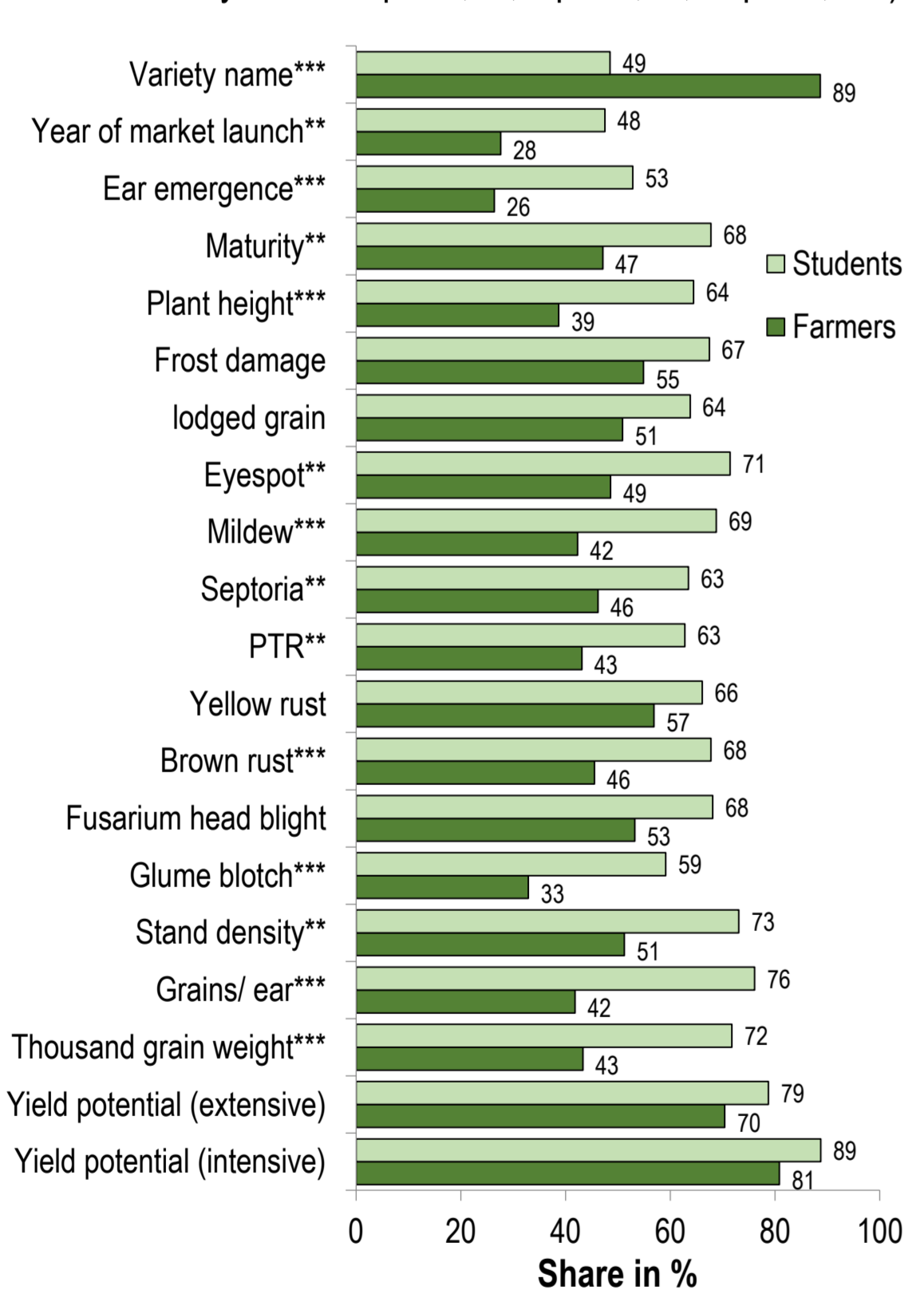
- **Real alternatives:** wheat varieties available on the market
- **Information search tracing** via information-display-matrix
- **Incentive:** monetary pay-off based on varieties' performance in reality
- **Participants' characterization** through accompanying survey



3. Results

(I) Convenience samples lead to biases in experimental decision research

Share of participants using attributes (farmers: n = 7*145= 1015; students n=7*43 = 301; two side Mann-Whitney-U-Test: *p < 0,05; **p < 0,01; ***p < 0,001)



In comparison to the reference group, farmers ...

- use cues (variety names) to apply memory-based and combined decision strategies.
- assess significantly less and different attributes.
- take the same decision time.
- are significantly more successful.

(III) Memories are a key factor for the application of heuristics

Share in % (farmers: n=145)

Task (production system)	HR1	HW1	HW5	KR5	GR5	MW1	MM1
Experience with at least one alternative in reality	60,7	61,4	51,0	28,3	12,4	58,6	63,4
Variety name used	90,3	87,6	89,7	89,7	89,0	88,3	85,5
Take the best heuristic ¹ with "variety name"	8,3	6,9	4,8	9,0	2,1	5,5	7,6
Non-compensatory evaluation of "variety name"	11,0	6,9	5,5	7,6	7,6	13,1	9,0
Total	19,3	13,8	10,3	16,6	9,7	18,6	16,6

The more participants are experienced with alternatives the more participants evaluate "variety names" non-compensatory

➔ Availability of internal information determines application of heuristics

(IV) Mental models² are a key factor for the application of heuristic strategies

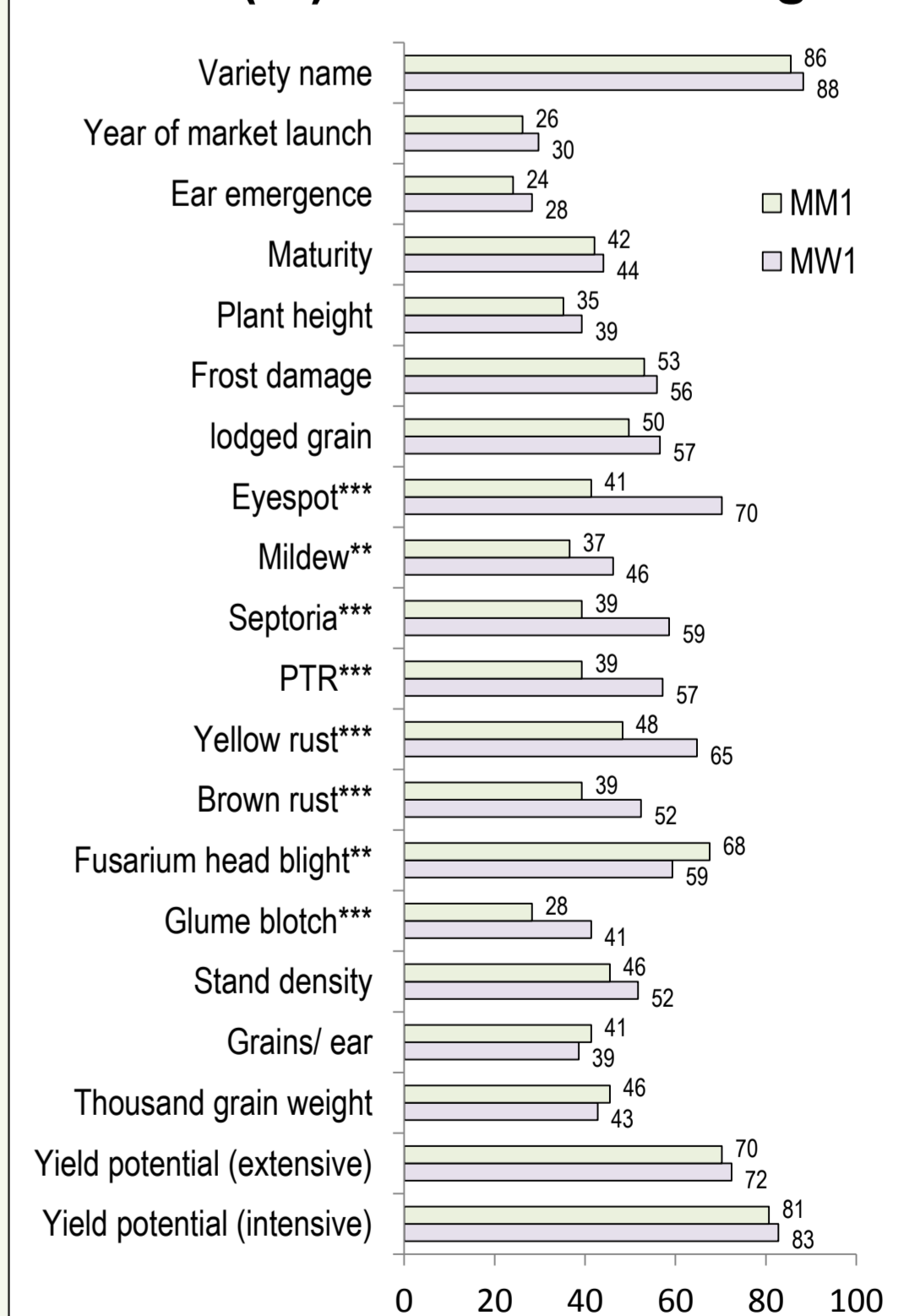
Task variation and decision effort (farmers, n=145; (Wilcoxon signed-rank test: *p < 0,05; **p < 0,01; ***p < 0,001)

Task (production system)	MM1	MW1	p value
Previous crop	Corn	Wheat	
Yield potential rating (max. = 120)	75	75	
Altitude (m)	190	190	
Temperature (°C)	8,4	8,4	
Precipitation (mm)	605	605	
Field size (ha) (pay-off multiplying factor)	1	1	
Average number of used information	47,0	56,9	0,000***
Average decision time (seconds)	143,8	171,2	0,000***

Significant differences in decision effort and used attributes between tasks with different production systems.

➔ Mental models explain decision effort and application of heuristic principles

Share (%) of farmers using...



(II) Decision scope is not a key factor for heuristic application

Decision scope and decision effort (farmers, n=145; (Wilcoxon signed-rank test: *p < 0,05; **p < 0,01; ***p < 0,001)

Task (production system)	HW1	HW5	p value
Yield potential rating (max. = 120)	57	52	
Altitude (m)	206	206	
Temperature (°C)	8,1	8,1	
Precipitation (mm)	670	670	
Field size (ha) (pay-off multiplying factor)	1	5	
Average number of used information	52,3	56,8	0,068
Average decision time (seconds)	154,4	183,4	0,059

No significant difference in decision effort between tasks with different decision scope.

➔ Accuracy effort considerations can not explain decision effort.

4. Conclusion

Farmers' significant heavy use of memory-based decision making shows the importance of using real decision problems, real alternatives and samples of real decision makers in experimental decision research.

➔ Otherwise it is just observing someone's behavior in some situation.