Barriers to the Adoption of Accelerated Rice Breeding Technologies in ASEAN

Dr. Bailey Peterson-Wilhelm
Dr. Pedro Naso
Dr. Nicholas Tyack

Accelerated Crop Breeding for Climate Resilience in Rice: Challenges and Opportunities

April 16, 2026

Overview

- Survey Results (40 minutes + 5 for questions)
  - Motivation
  - Current State of Accelerated Breeding
  - Barriers to Adoption
- Panel Discussion (40 minutes)

Survey Results

Motivation

What is the role of economics?

Economics is the study of making decisions with finite resources, among unlimited wants and needs.

Useful to consider:

→ Trade-offs with time and resources

→ Demand at all stages of the supply chain from breeders to farmers

Objectives?

1. Understand the ASEAN rice breeding sector right now
   - Need to know the baseline to know how to improve
2. Identify barriers to adoption that can be addressed collectively

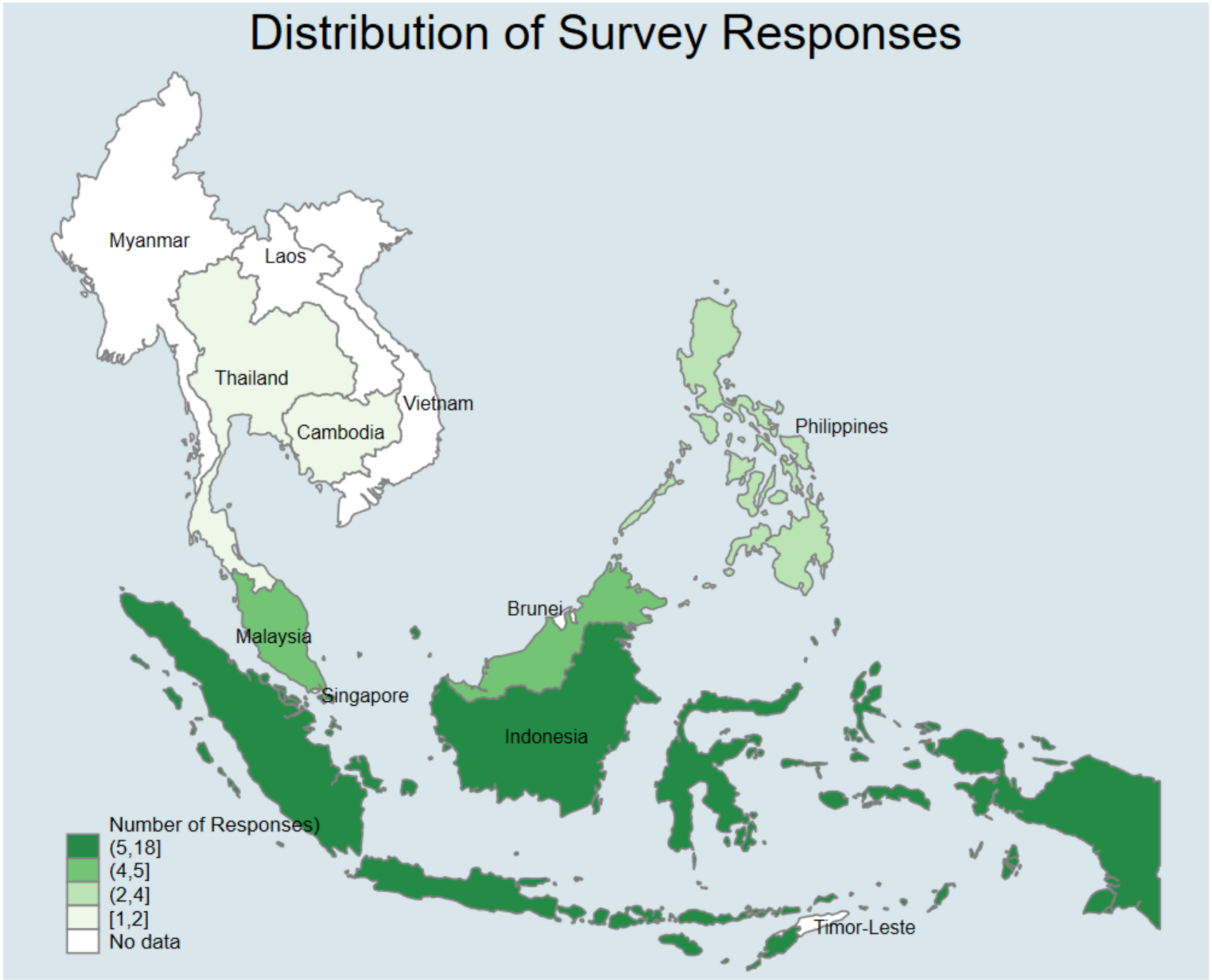
Survey Methods

Survey

- Surveys are a great way to understand a population of interest, especially when no other information is available
- Snowball collection method $\rightarrow$ start with a targeted population and watch it grow (we hope!)
- The more responses, the greater the representativeness

Who has completed the survey so far?

Distribution of Survey Responses



A similar study was published in 2018 [1].

Lenaerts *et al. Agric & Food Secur (2018) 7:40*
https://doi.org/10.1186/s40066-018-0191-3

Agriculture & Food Security

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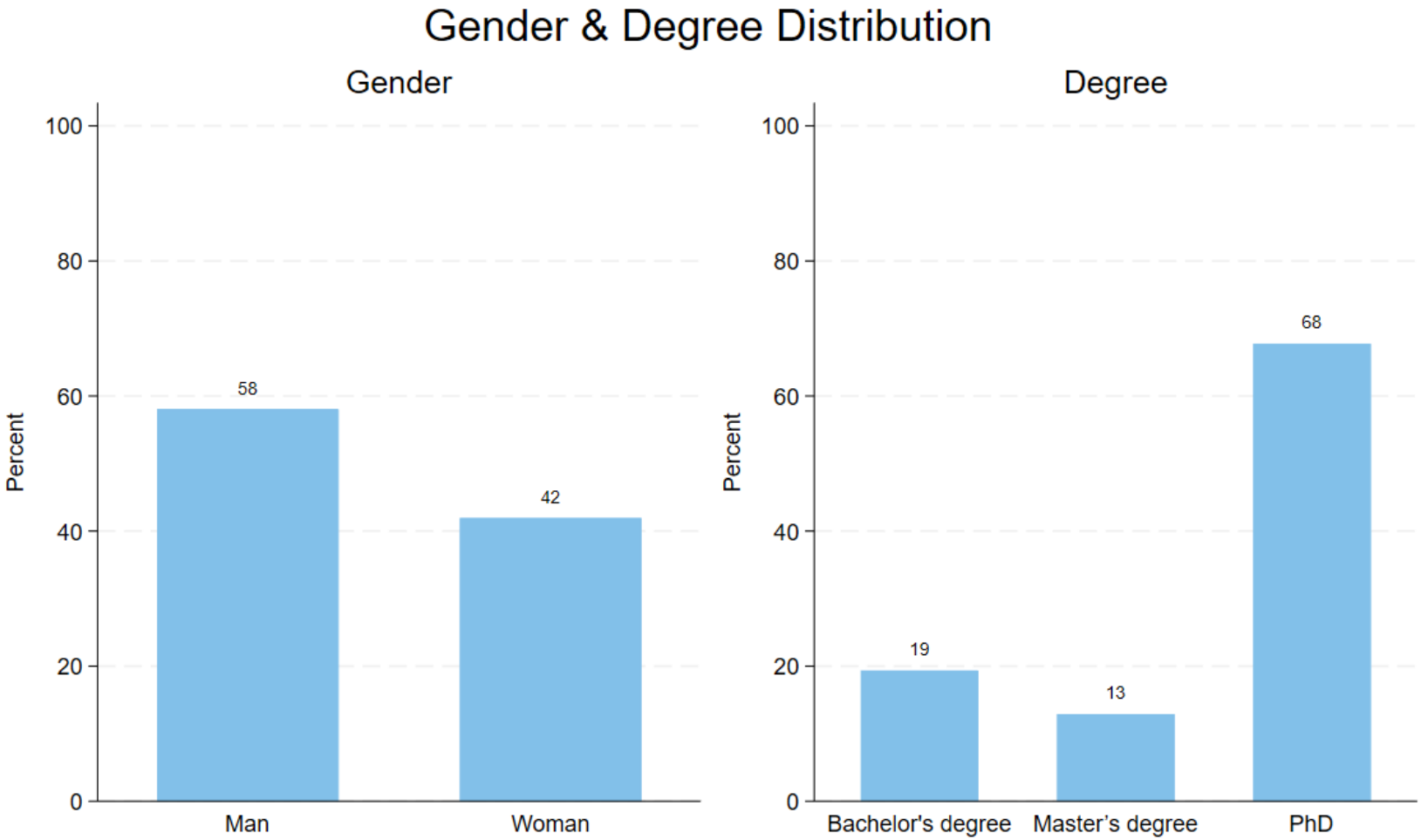
Global survey of rice breeders to investigate characteristics and willingness to adopt alternative breeding methods

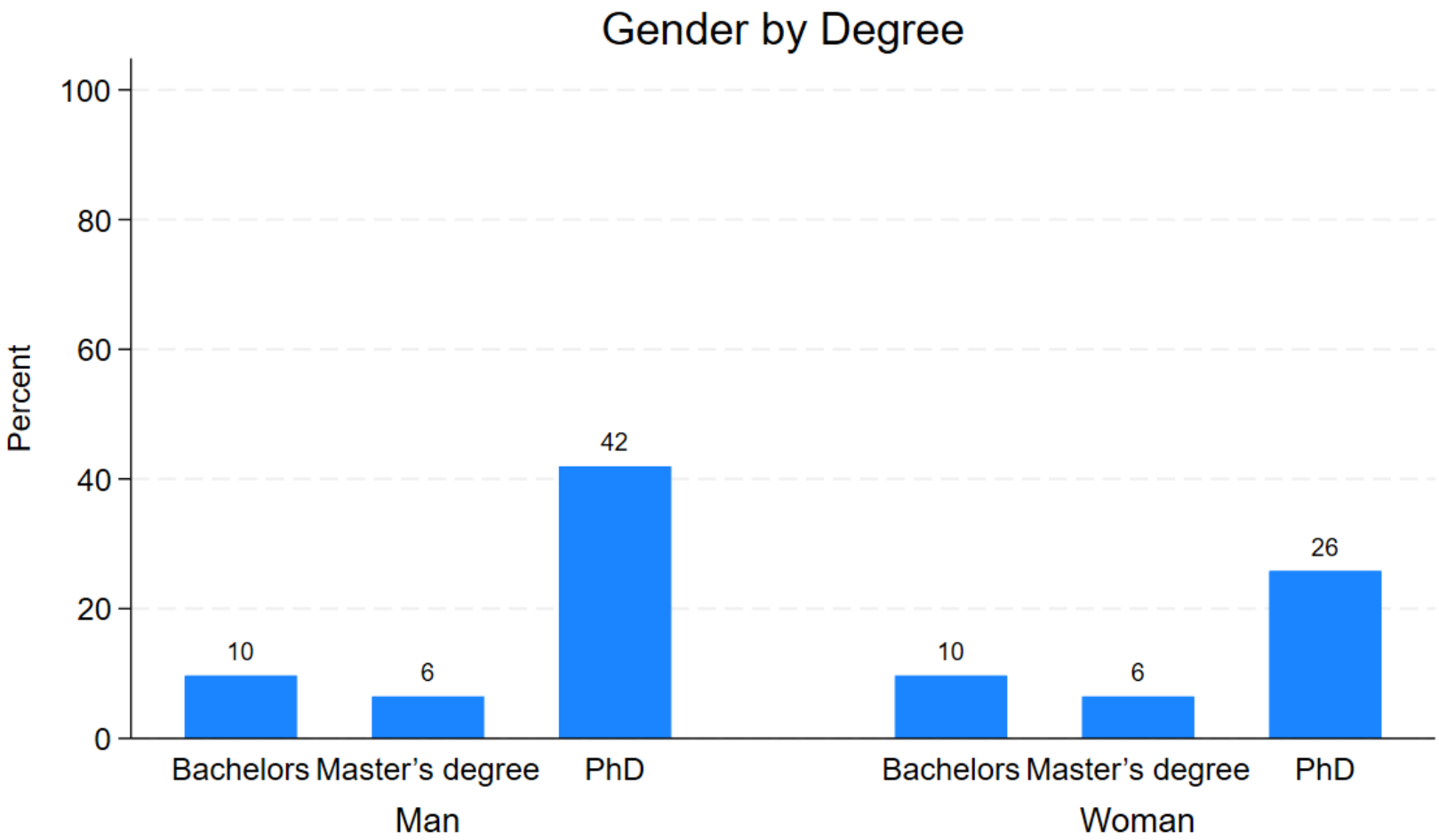
Bert Lenaerts[1,2,3], Bertrand C. Y. Collard[4] and Matty Demont[2*]

Throughout the presentation, we will compare findings over time.

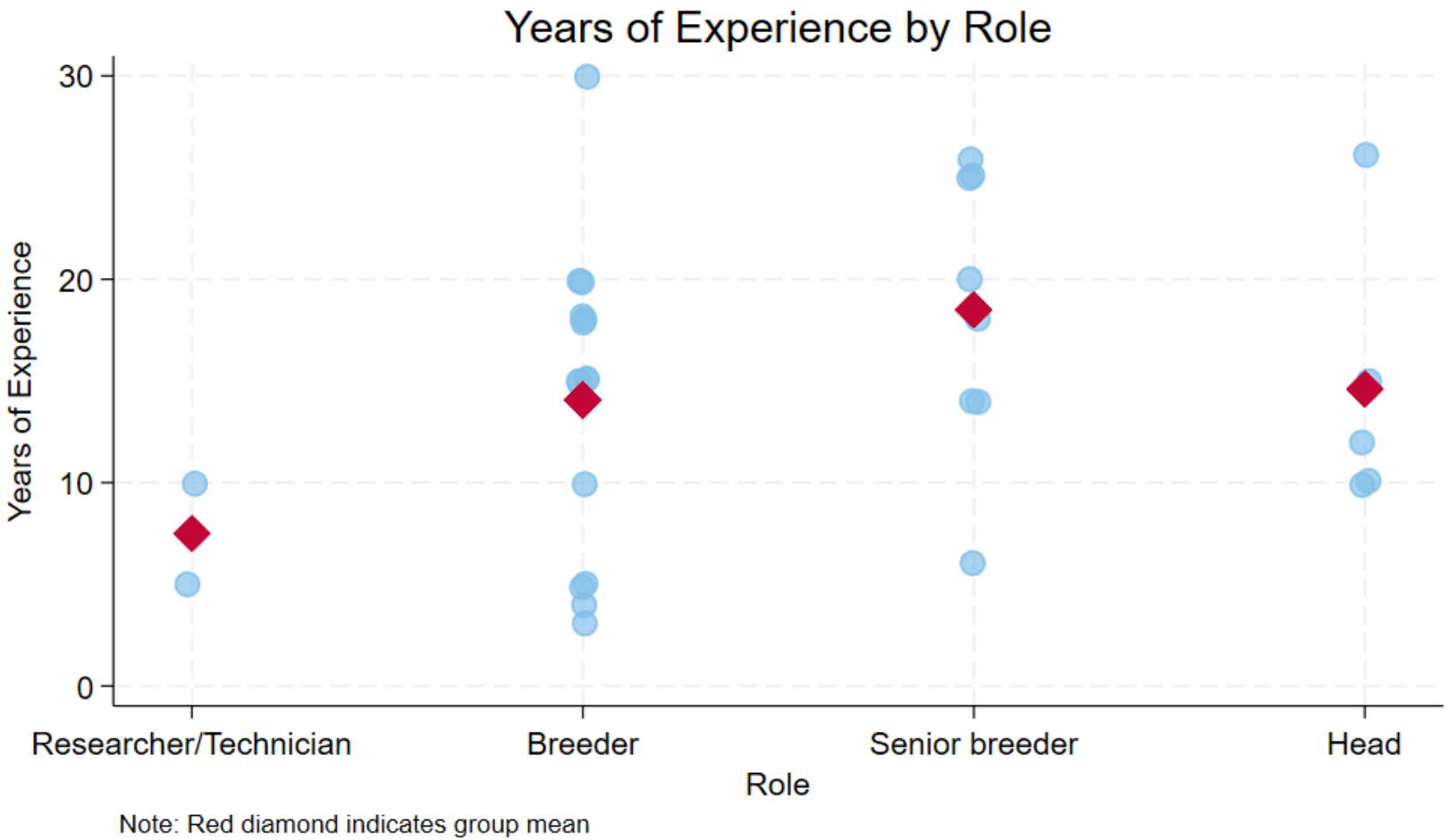
Characteristics of Breeders



There are more woman breeders (22% → 42%) and more Ph.D. breeders (60% → 68%) now than in 2017!

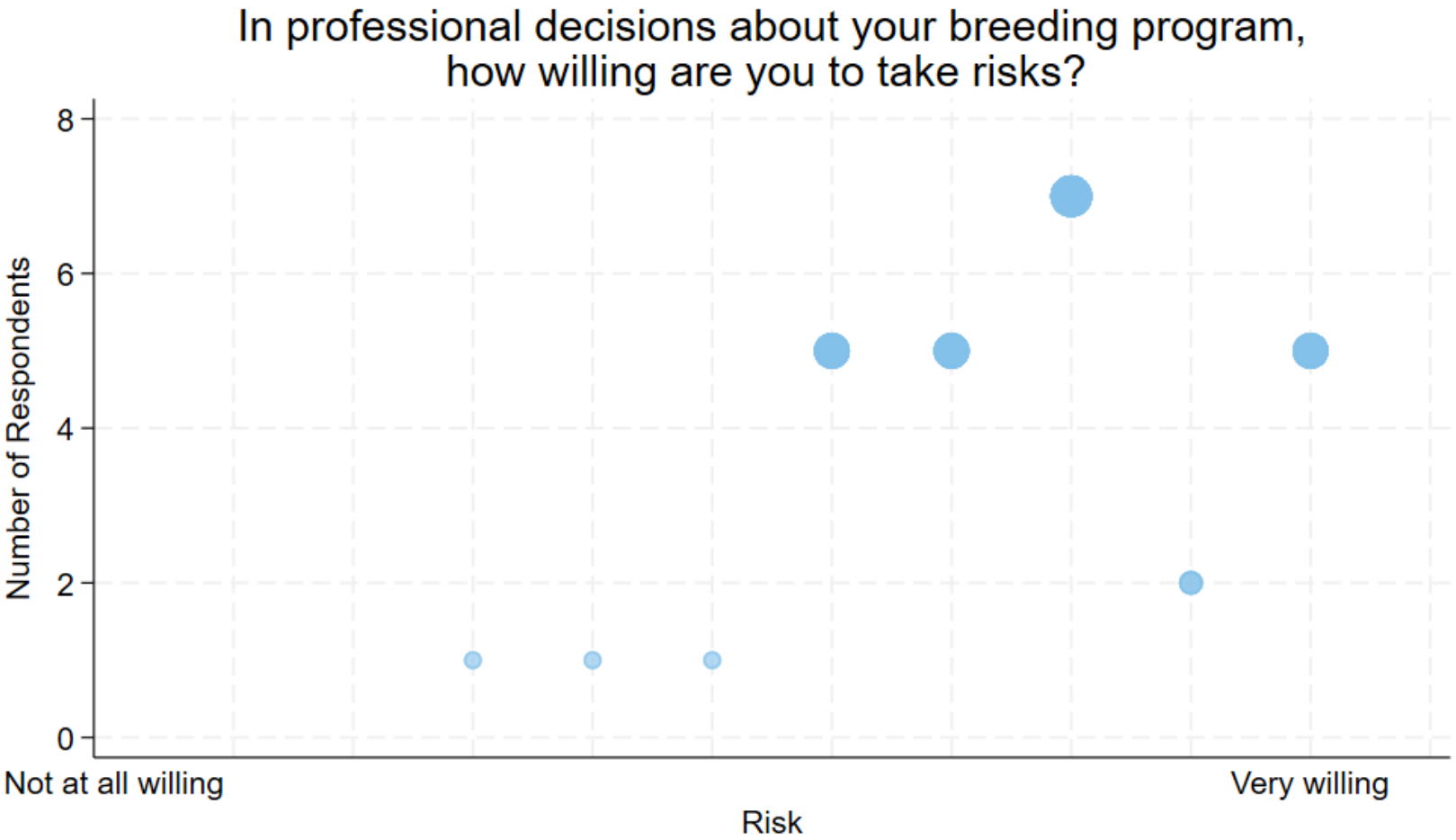


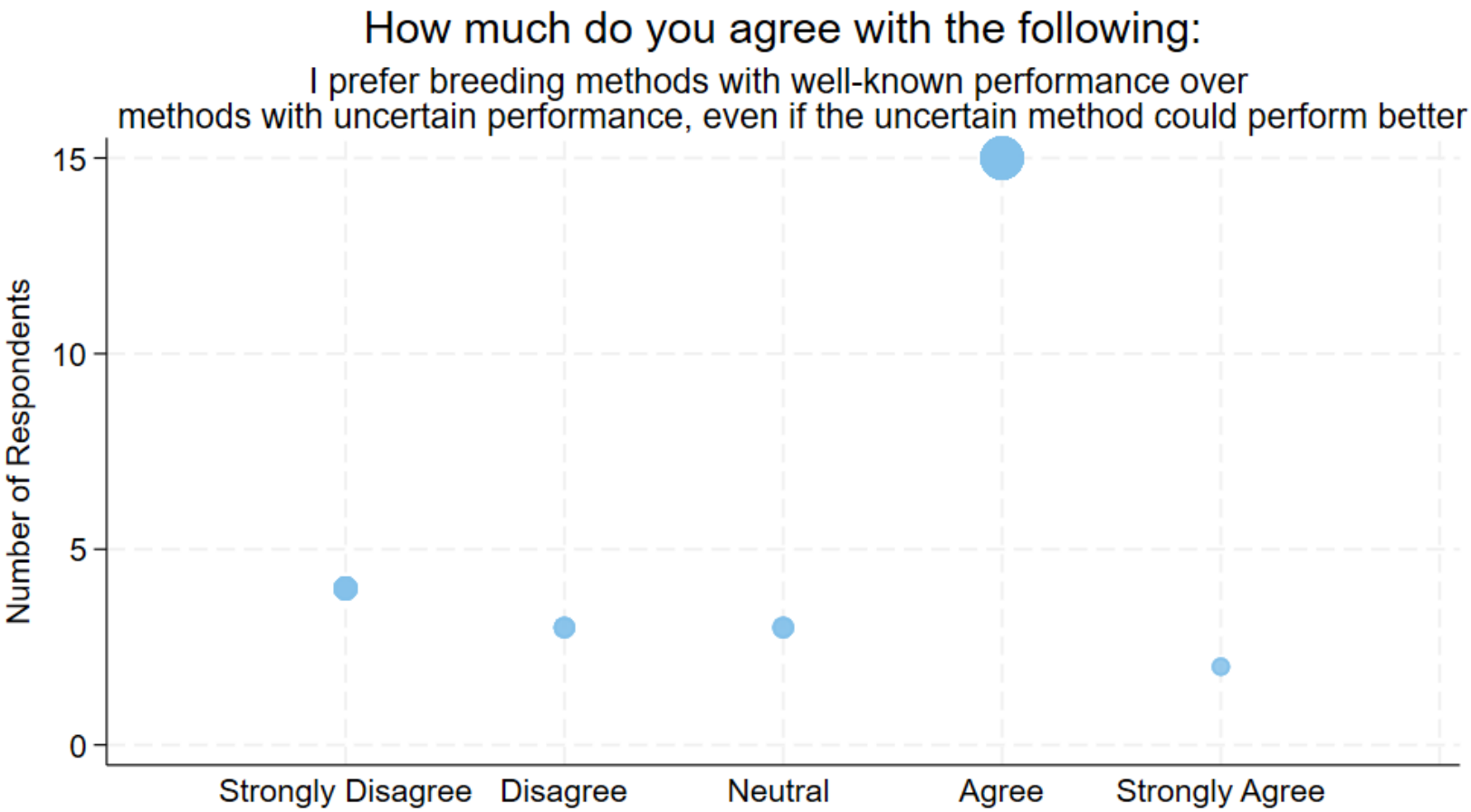
Ph.D.'s are now much more evenly distributed among women (35% → 62% of women's degrees are PhD's)



Average years of experience decreased slightly (16.9 → 14.5).

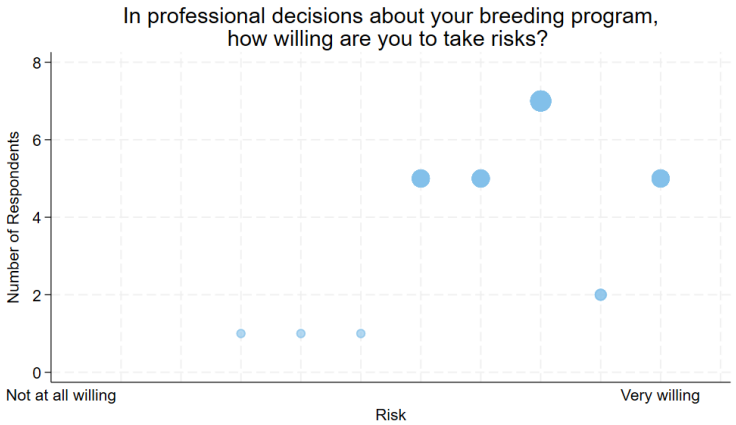
Likely because of the number of women entering the field.

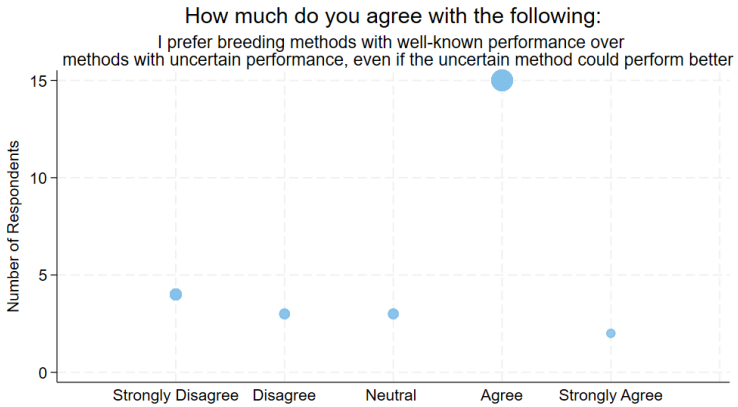

In professional decisions about your breeding program, how willing are you to take risks?
Number of Respondents
0
2
4
6
8
Not at all willing
Very willing
Risk



Willingness to take risks has increased slightly (5 → 6)

What do these things mean together?





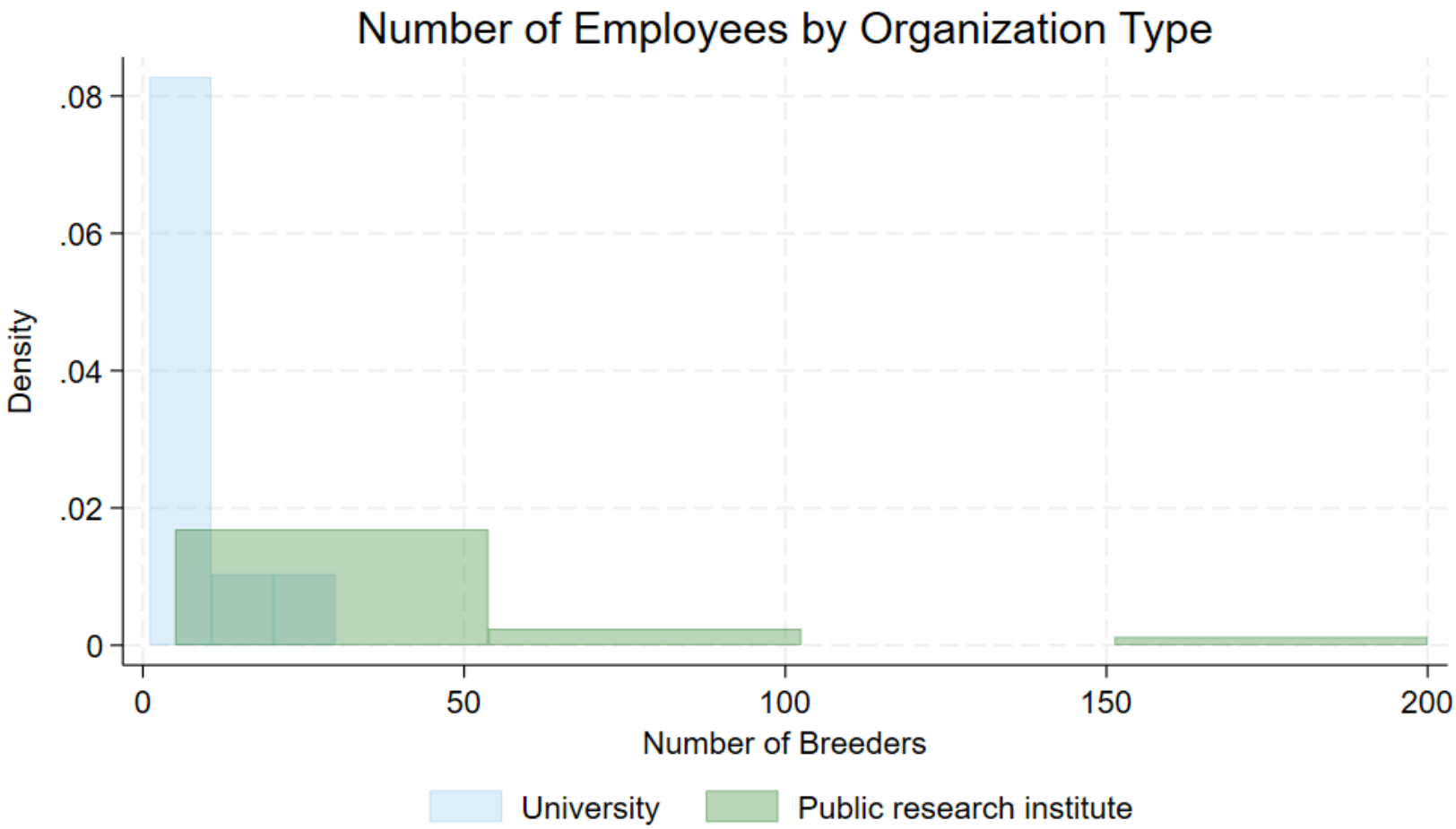
Good context-specific evidence ⇒ More experimentation

Where do you learn about accelerated breeding methods?

Source	Count
Papers	16
University	10
Online	9
Colleagues at other institutions	7
Colleagues at own institution	6
National Training	3

Seems like there are untapped opportunities to learn from each other.

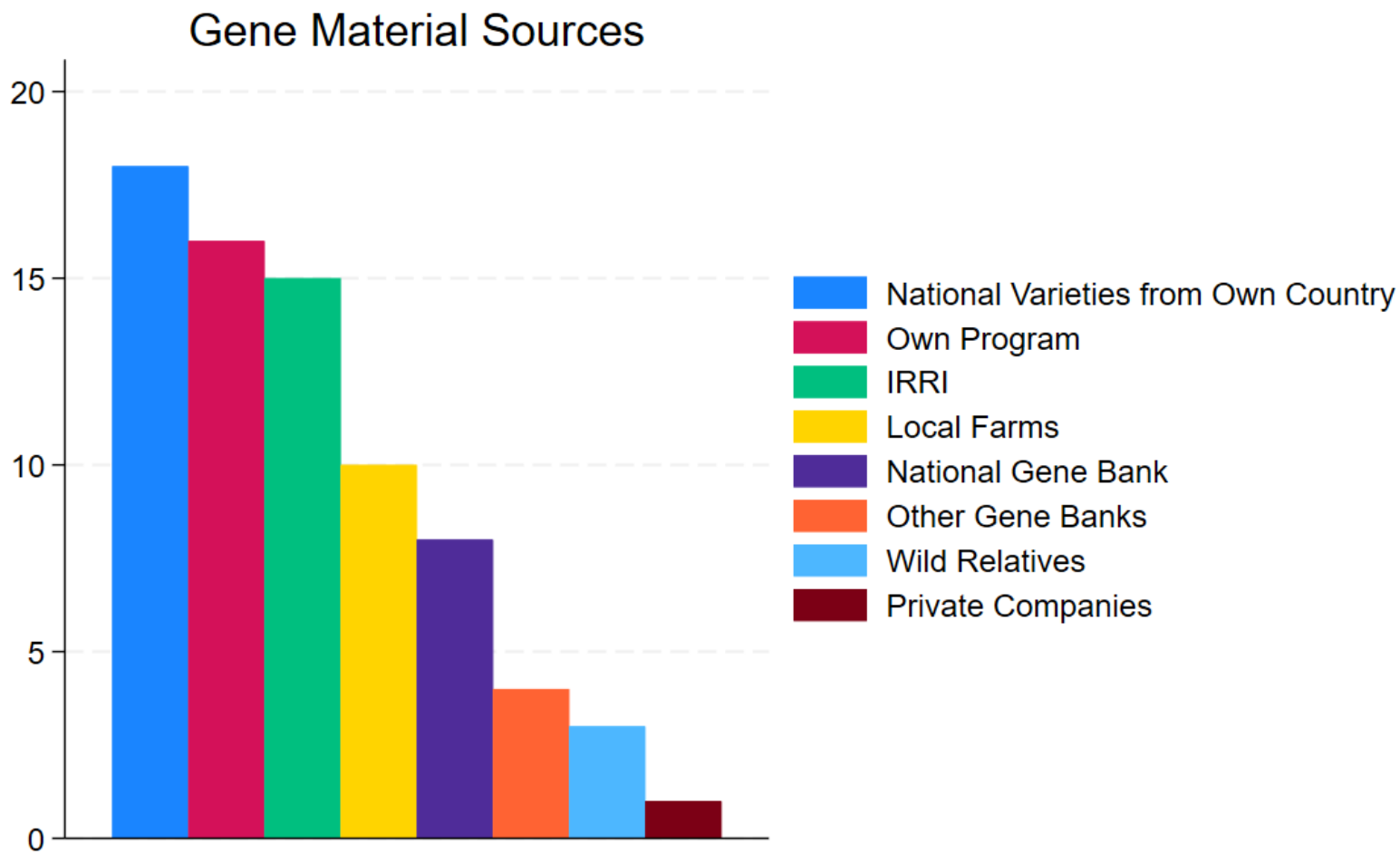
Characteristics of Breeding Programs



Breeding programs have gained employees (17 → 19)

Average Annual Budget

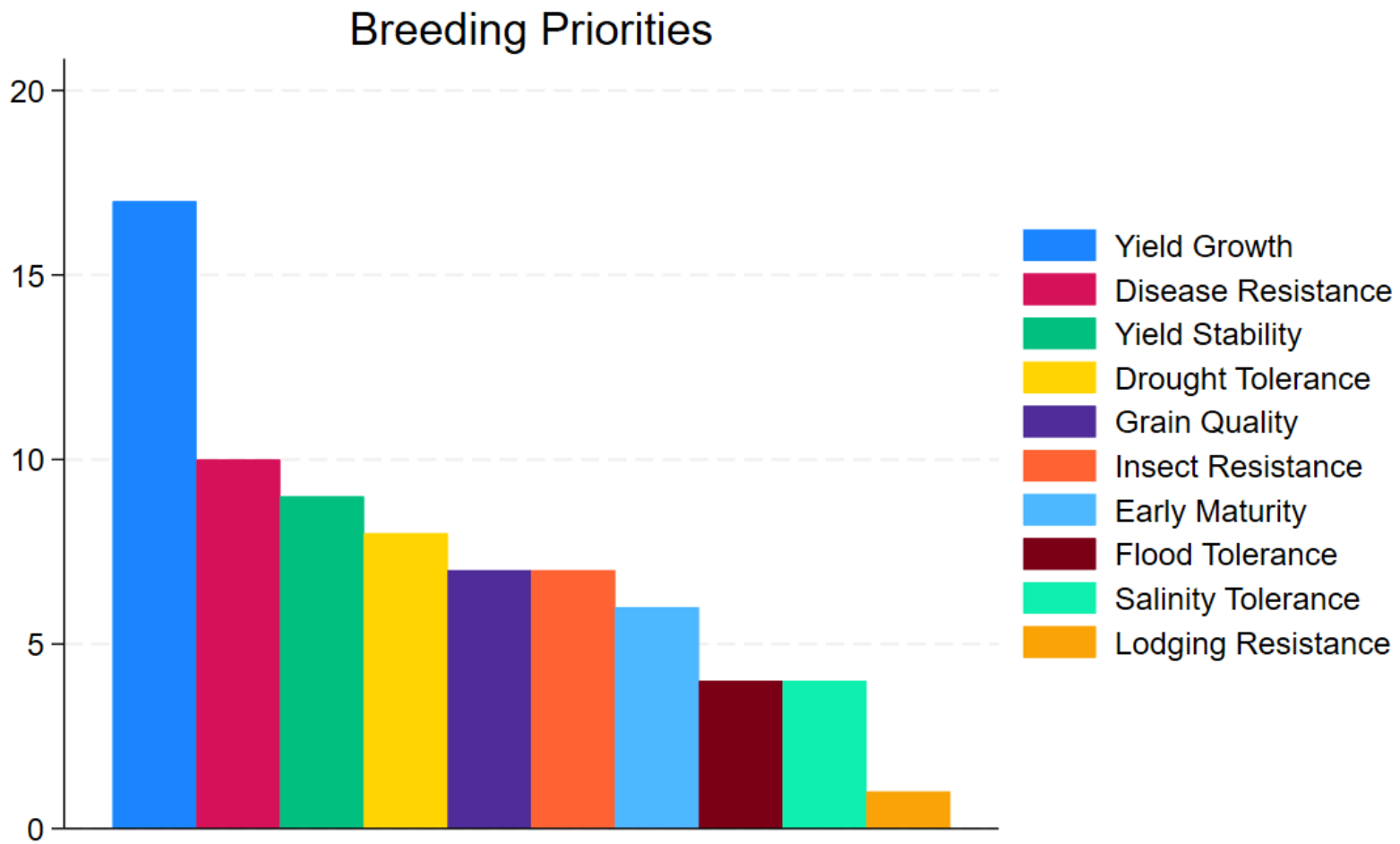
Note:Only countries with greater than 3 responses are included.


Gene Material Sources
20
15
10
5
0
National Varieties from Own Country
Own Program
IRRI
Local Farms
National Gene Bank
Other Gene Banks
Wild Relatives
Private Companies

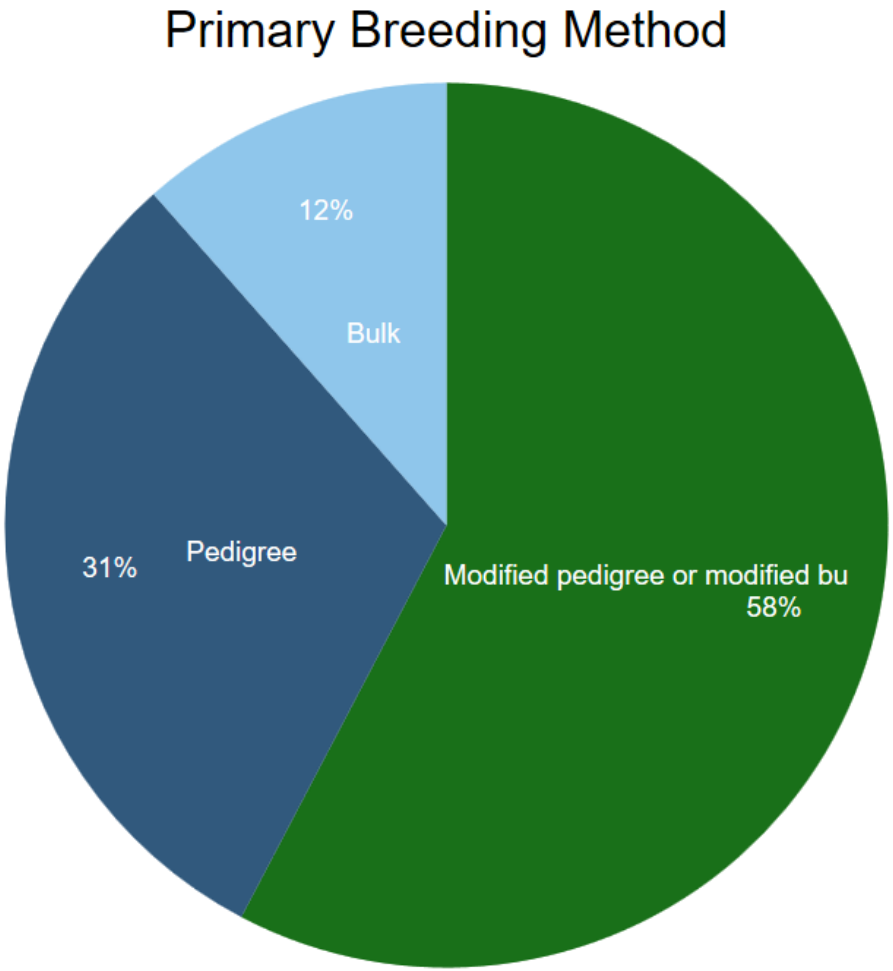
Characteristics of Breeding Context

Breeding Ecology

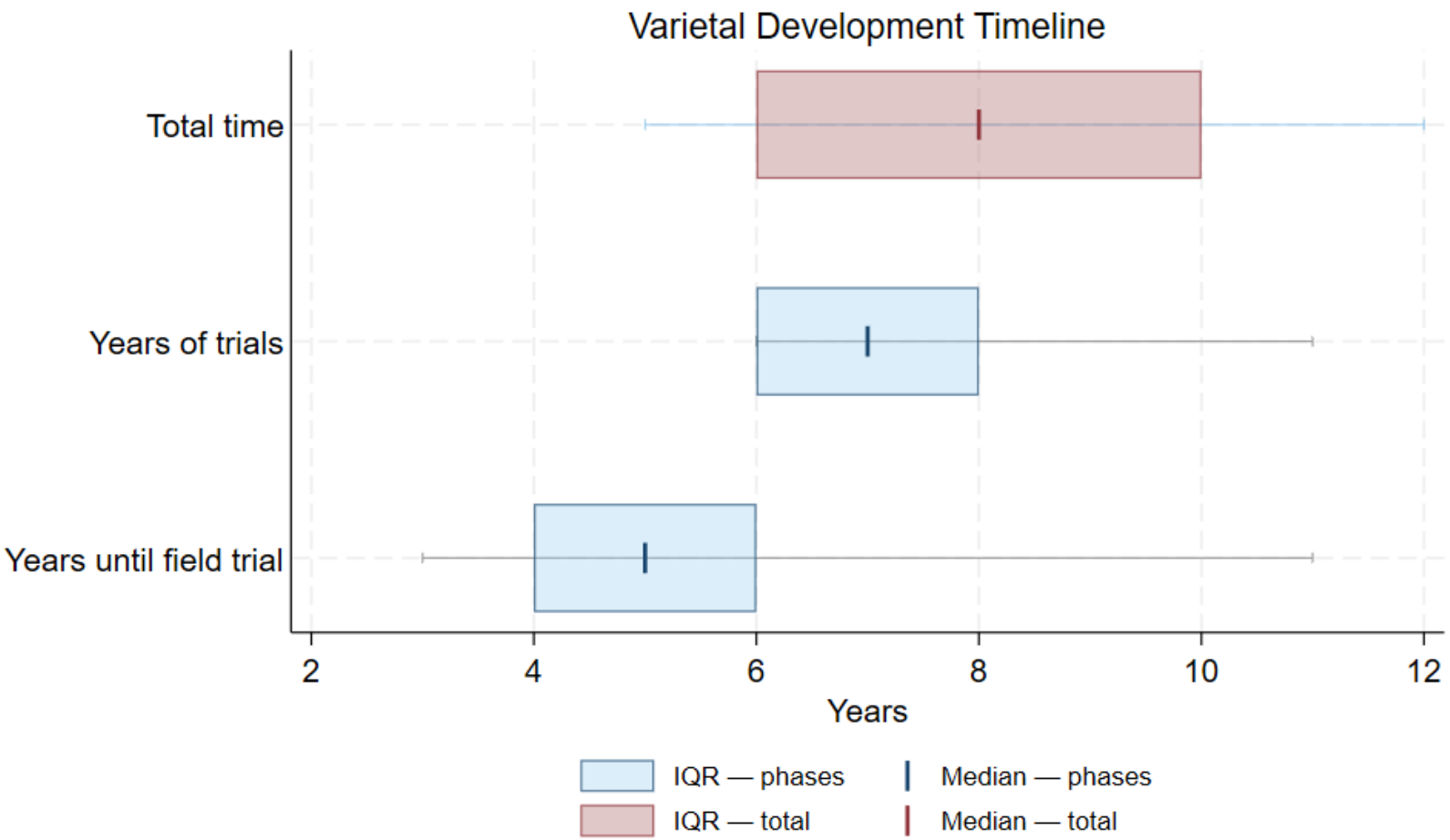
Ecology	Pct
Irrigated lowland	60.6%
Rainfed lowland	54.5%
Upland	30.3%
Flood-prone / deepwater	33.3%
Saline / coastal areas	39.4%

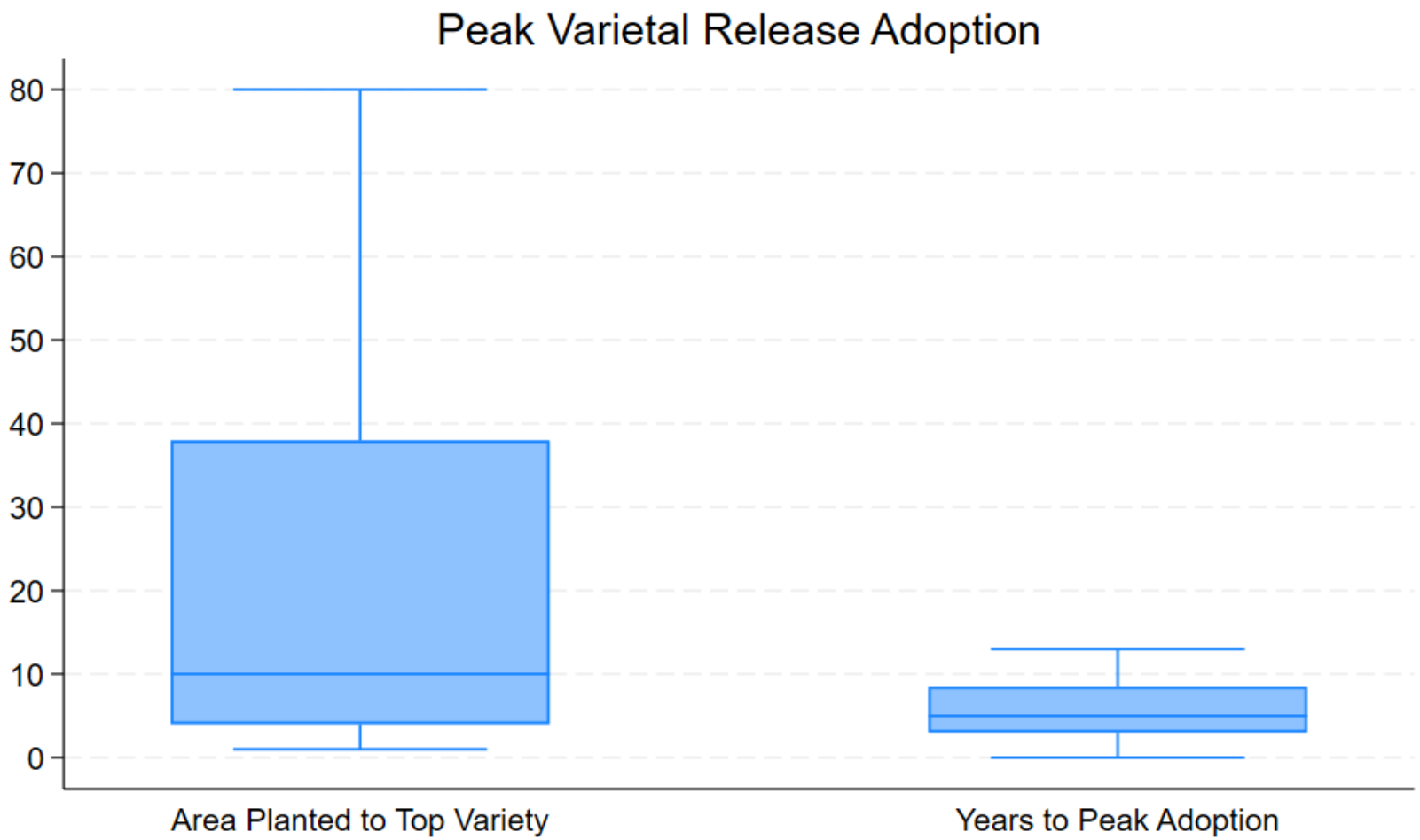

Breeding Priorities
20
15
10
5
0
Yield Growth
Disease Resistance
Yield Stability
Drought Tolerance
Grain Quality
Insect Resistance
Early Maturity
Flood Tolerance
Salinity Tolerance
Lodging Resistance

Characteristics of Rice Varieties



Pedigree used to dominate the breeding methods (78%)

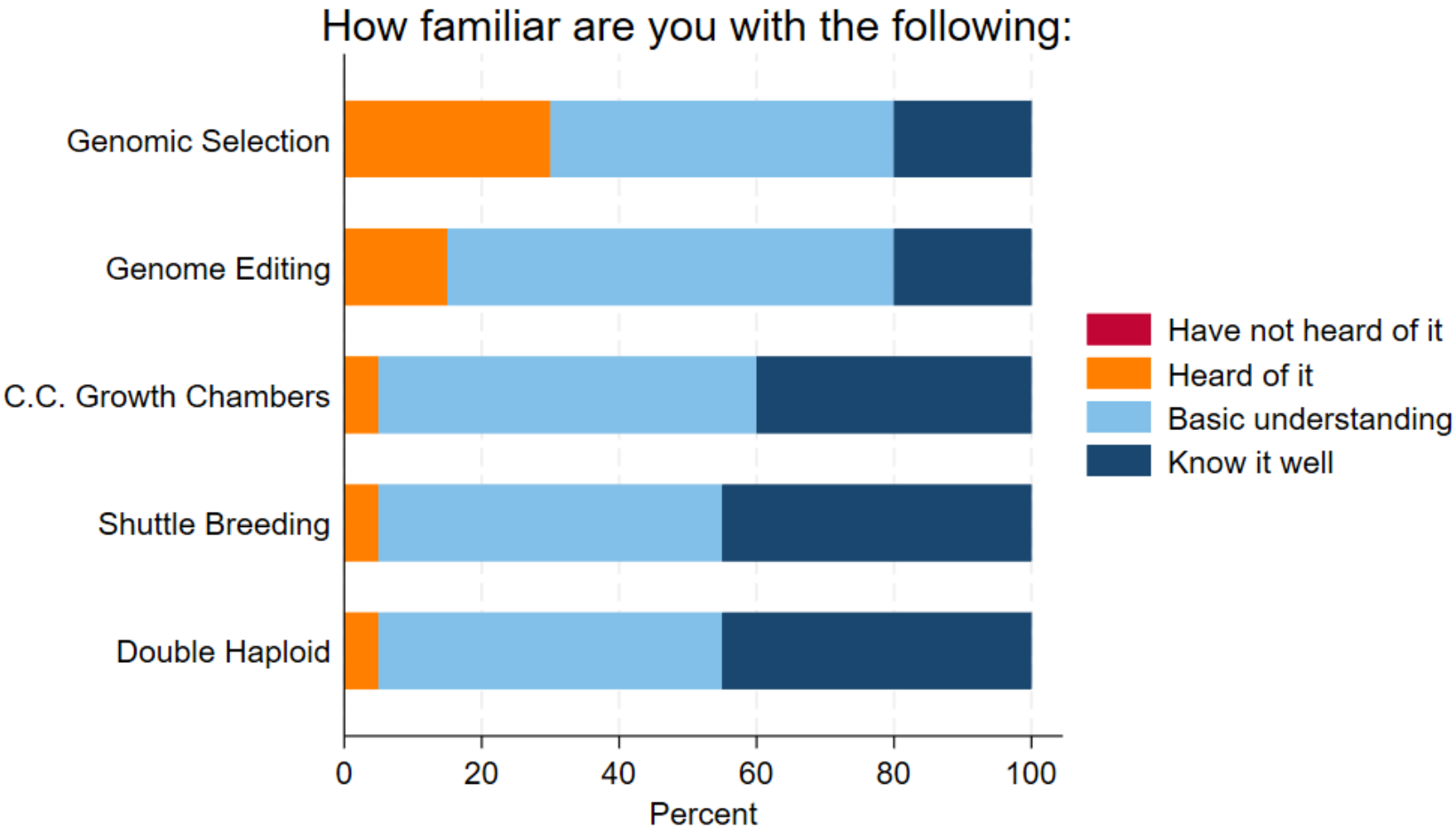

Varietal Development Timeline
Total time
Years of trials
Years until field trial
2
4
6
8
10
12
Years
IQR — phases
IQR — total
Median — phases
Median — total

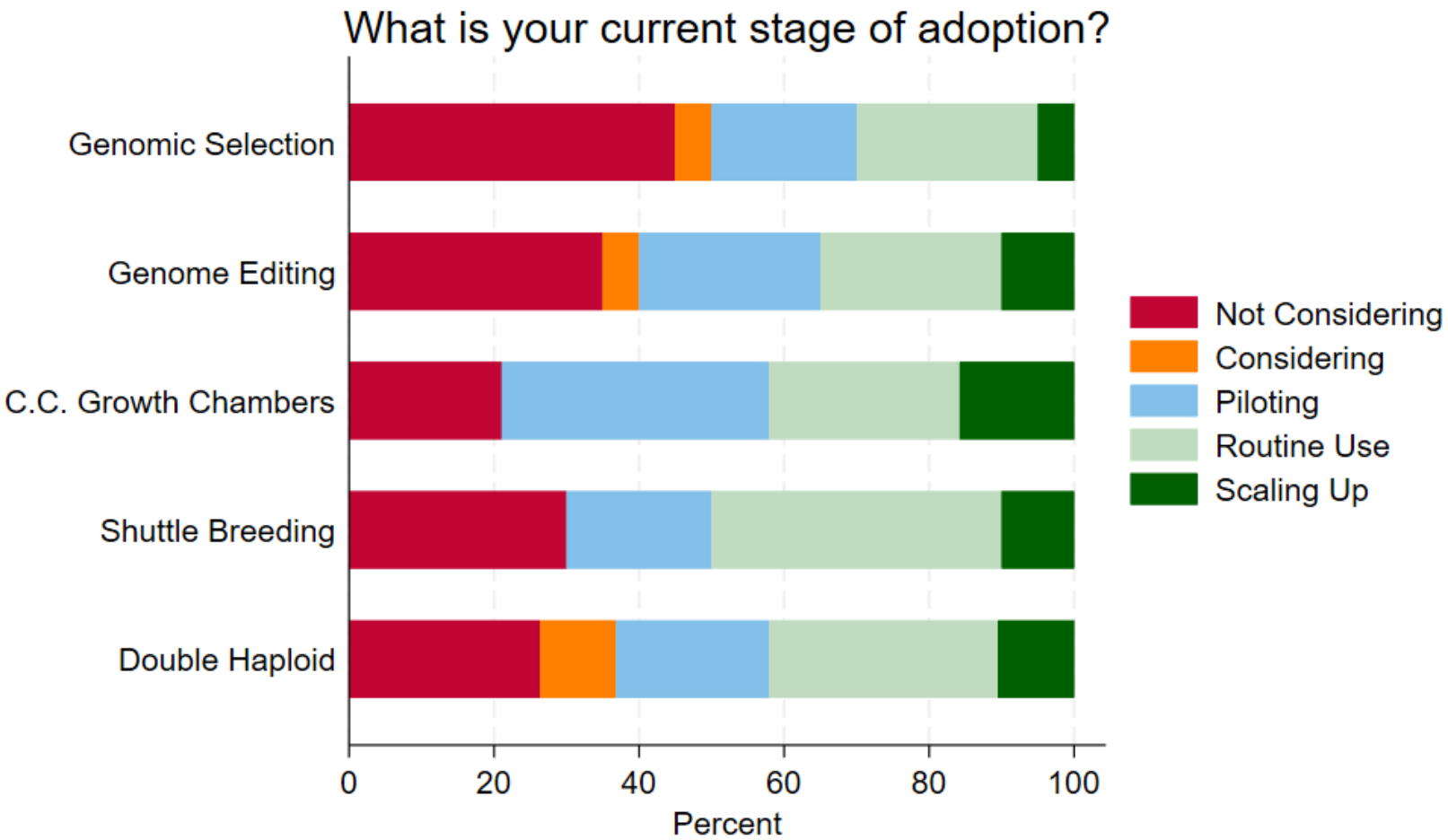

Peak Varietal Release Adoption
80
70
60
50
40
30
20
10
0
Area Planted to Top Variety
Years to Peak Adoption

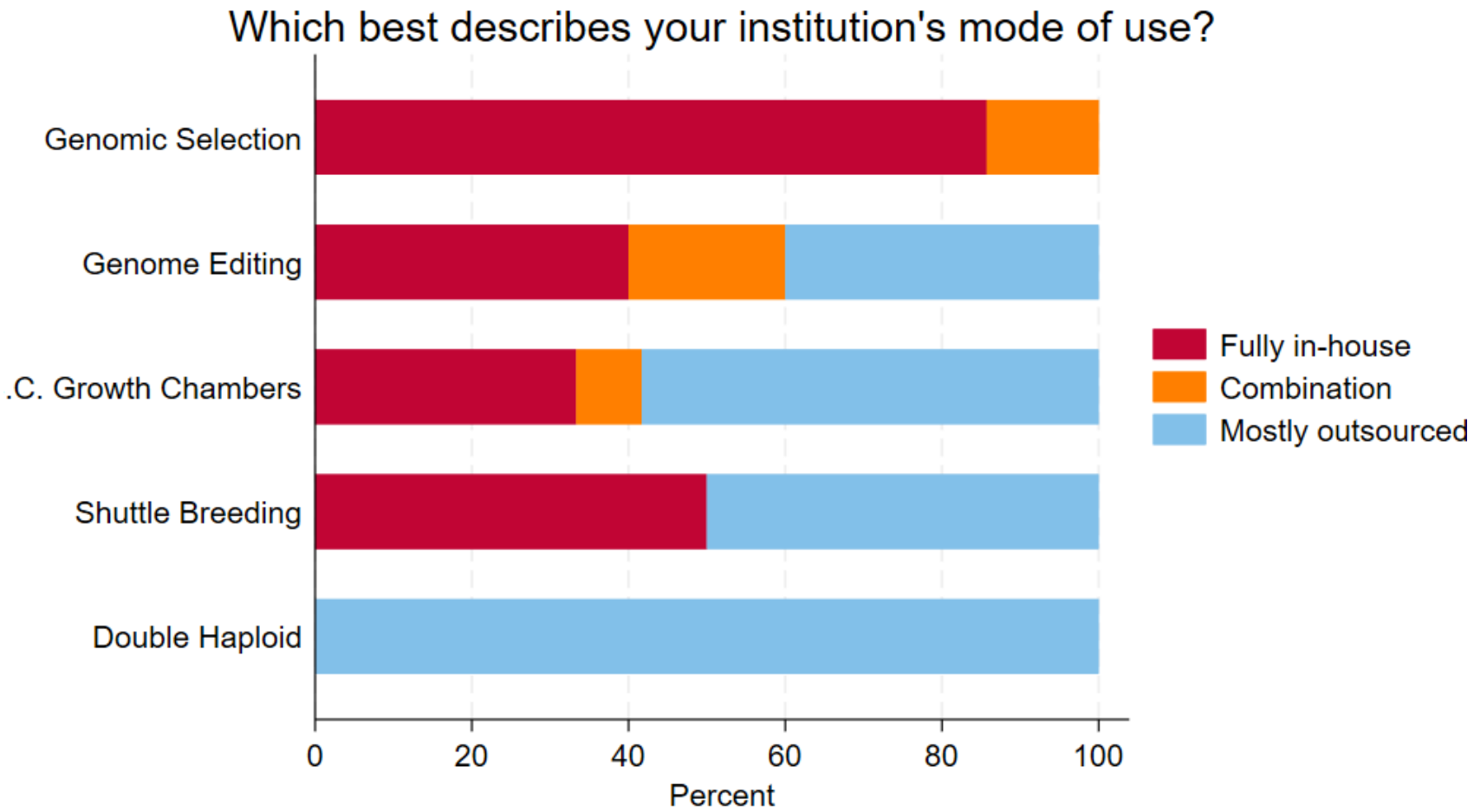
State of Accelerated Breeding

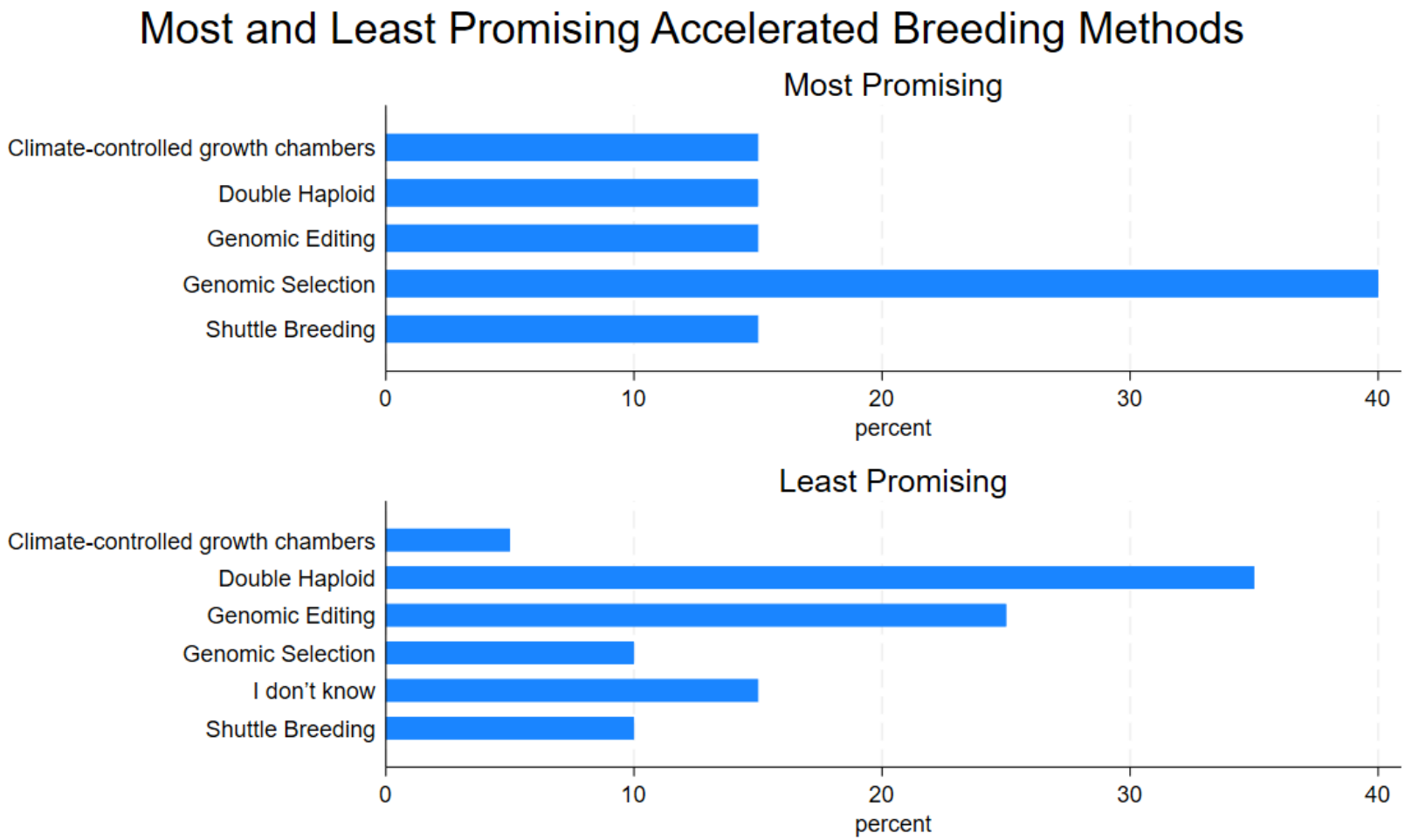
Accelerated Breeding Methods Considered

- *Genomic Selection* - using genome-wide DNA markers and a prediction model to estimate how good a line will be
- *Genome Editing* - making targeted changes in the DNA of a rice variety using gene-editing technology such as CRISPR-Cas
- *Climate-controlled Growth chambers (incl. Rapid Generation Advance, RGA)* - using controlled or off-season growing to produce multiple rice generations per year
- *Shuttle breeding* - advancing and selecting breeding lines by growing successive generations in two or more locations or seasons within a year to shorten the breeding cycle
- *Doubled haploid (DH) technology* - producing fully homozygous lines in one step


How familiar are you with the following:
Genomic Selection
Genome Editing
C.C. Growth Chambers
Shuttle Breeding
Double Haploid
0
20
40
60
80
100
Percent
Have not heard of it
Heard of it
Basic understanding
Know it well

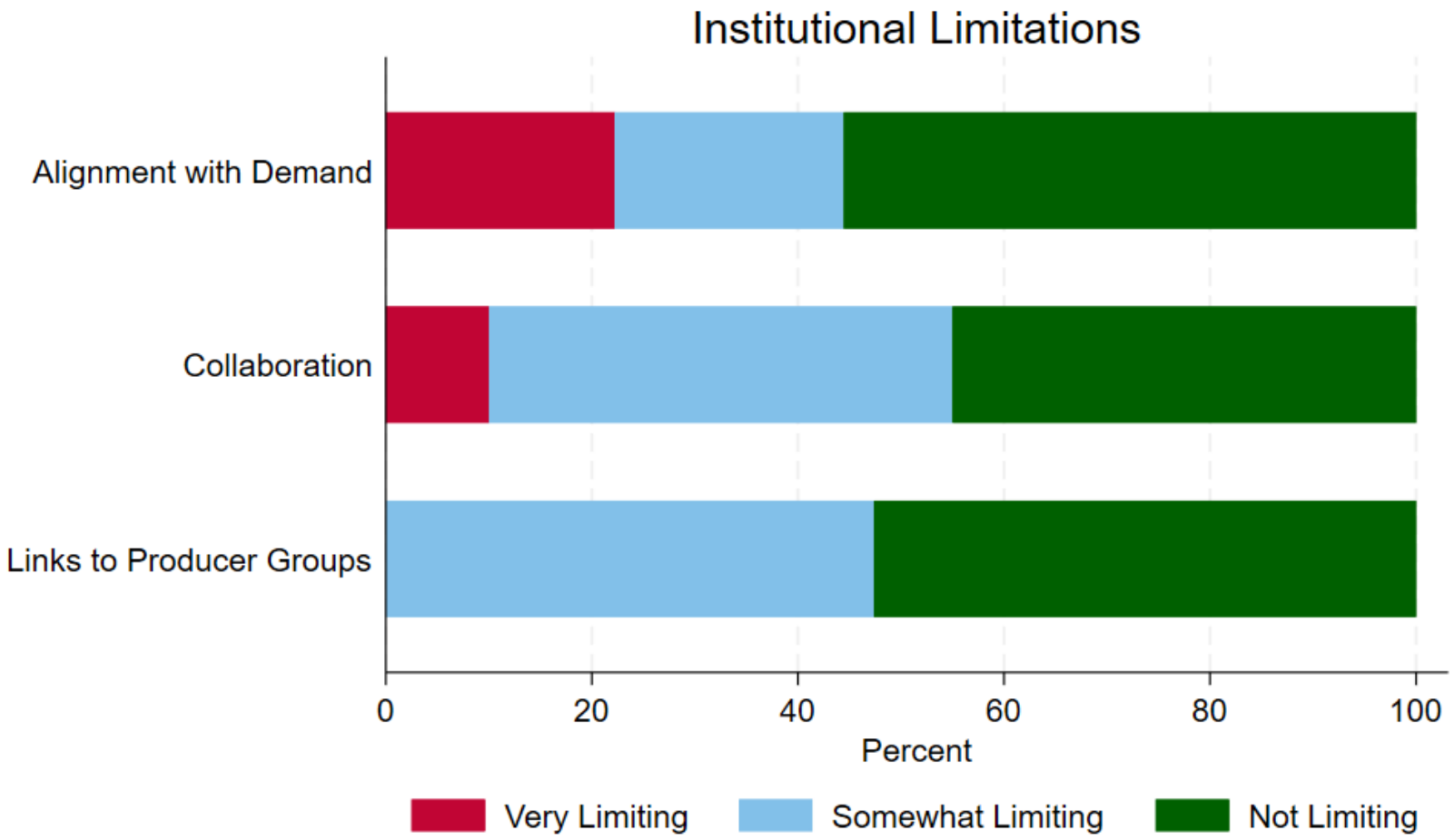

What is your current stage of adoption?
Genomic Selection
Genome Editing
C.C. Growth Chambers
Shuttle Breeding
Double Haploid
0
20
40
60
80
100
Percent
Not Considering
Considering
Piloting
Routine Use
Scaling Up


Which best describes your institution's mode of use?
Genomic Selection
Genome Editing
.C. Growth Chambers
Shuttle Breeding
Double Haploid
0
20
40
60
80
100
Percent
Fully in-house
Combination
Mostly outsourced

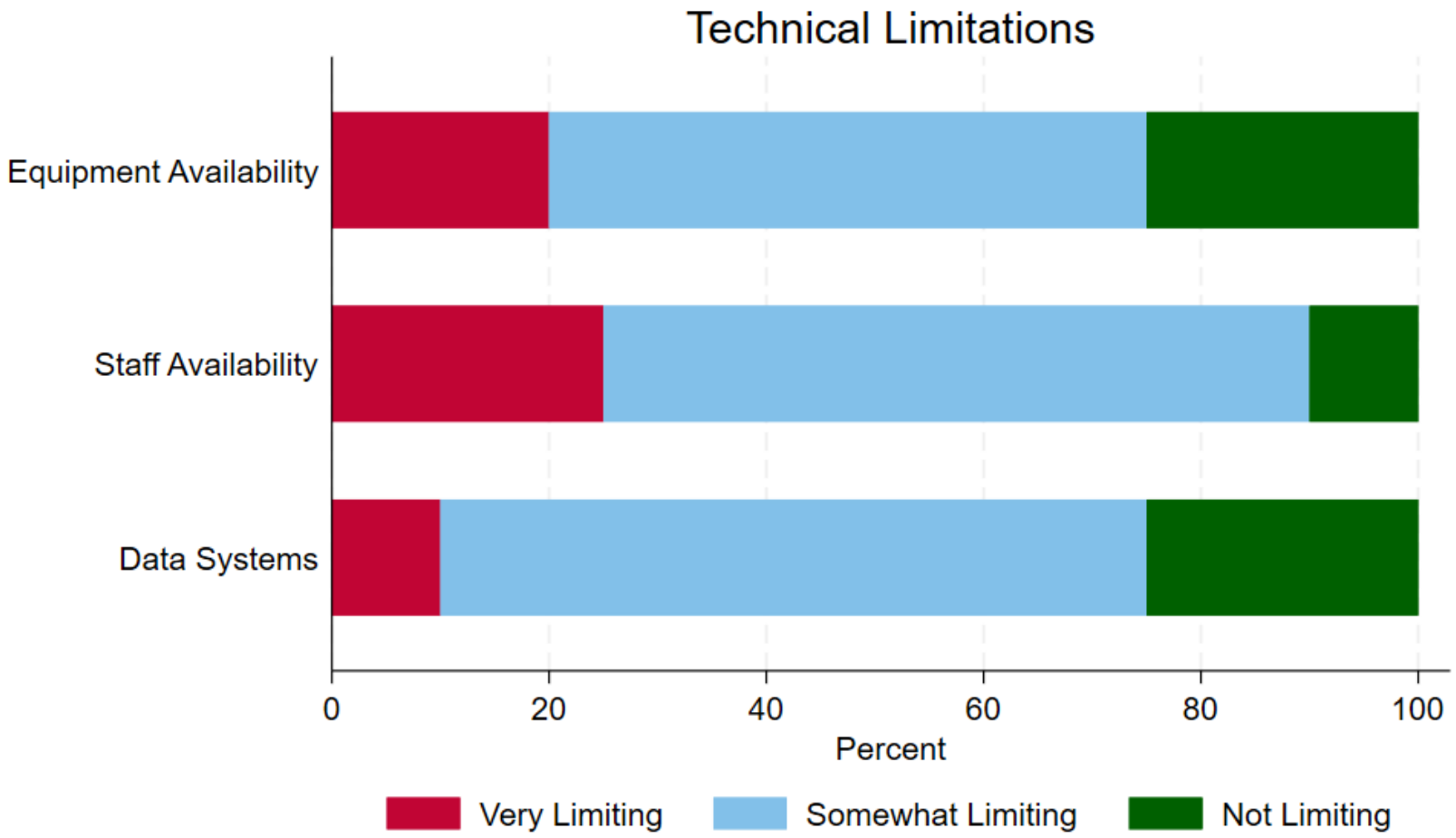

Most and Least Promising Accelerated Breeding Methods
Most Promising
Climate-controlled growth chambers
Double Haploid
Genomic Editing
Genomic Selection
Shuttle Breeding
0
10
20
30
40
percent
Least Promising
Climate-controlled growth chambers
Double Haploid
Genomic Editing
Genomic Selection
I don't know
Shuttle Breeding
0
10
20
30
40
percent

Barriers to Adoption of Accelerated Breeding Methods

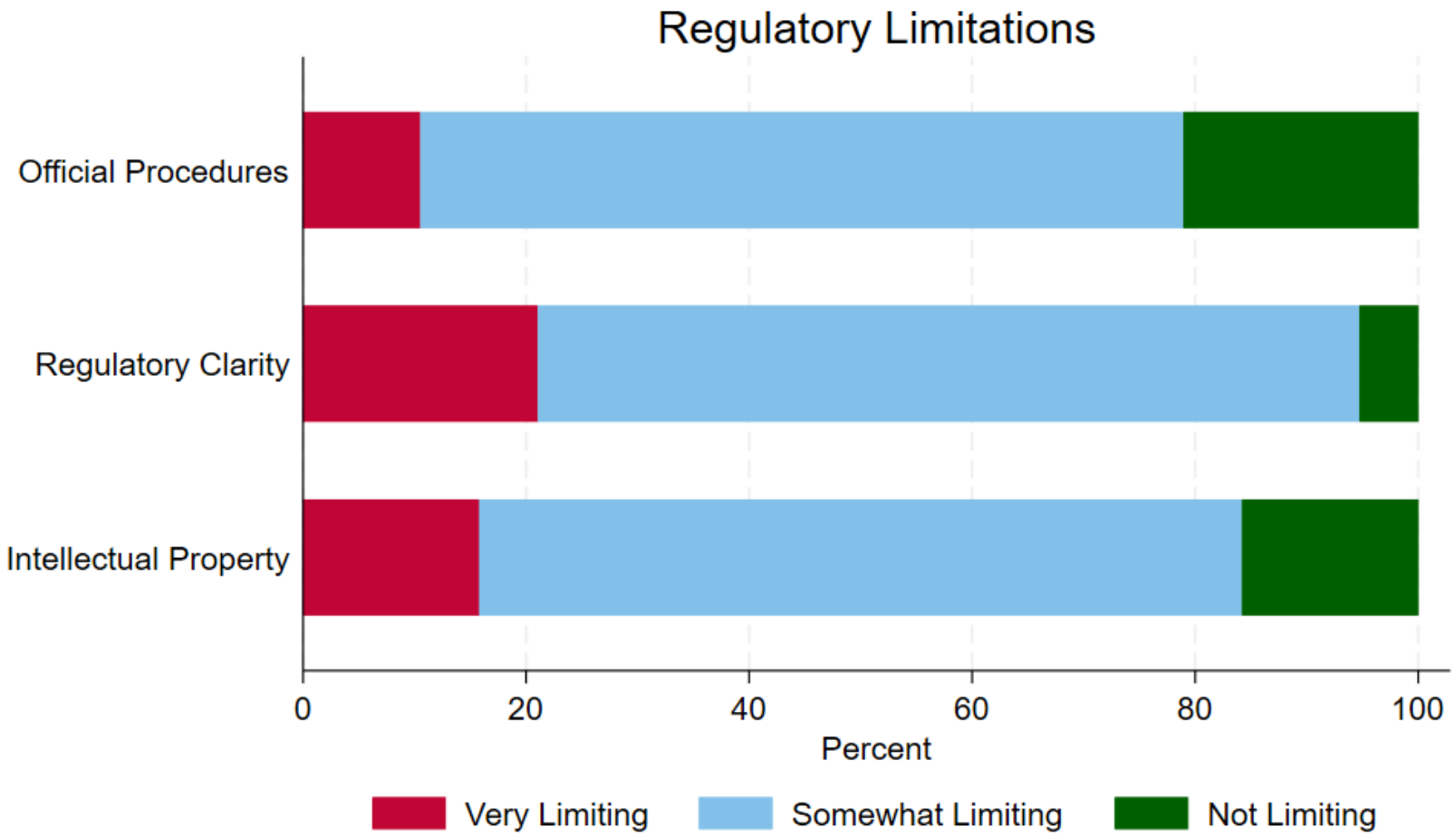
Limitations – *Institutional and Organizational*



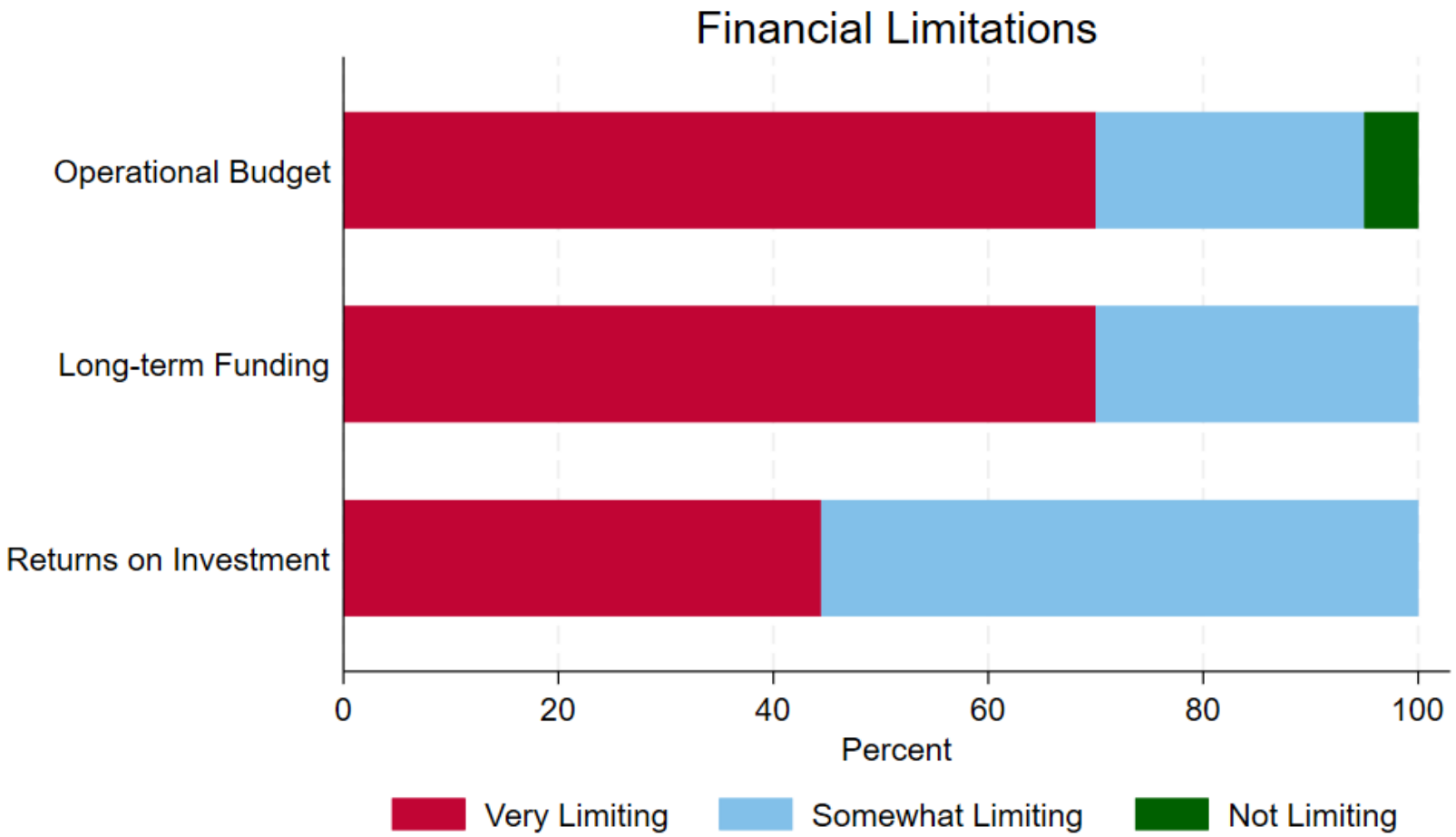
Limitations – *Technical*



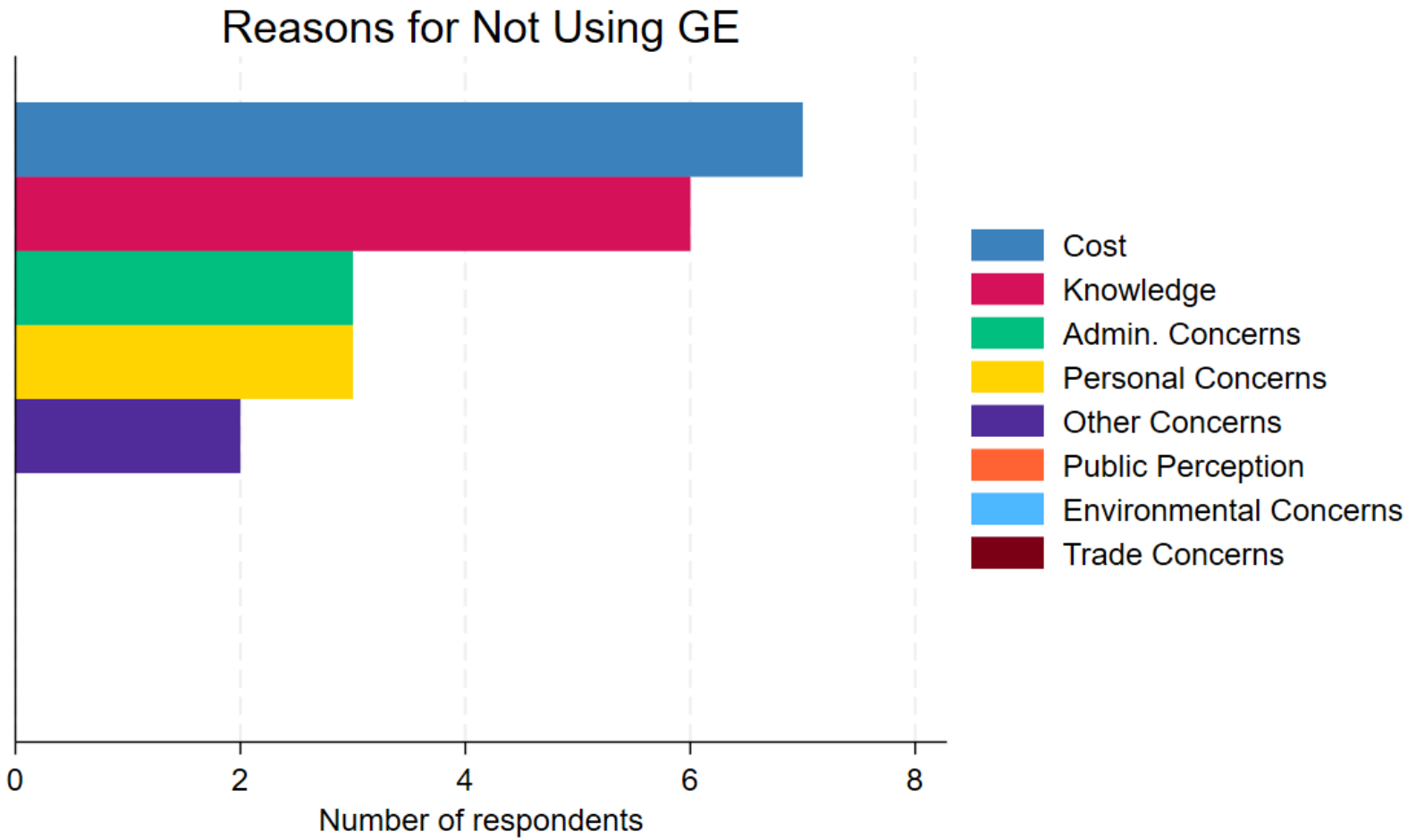
Limitations – *Regulatory*



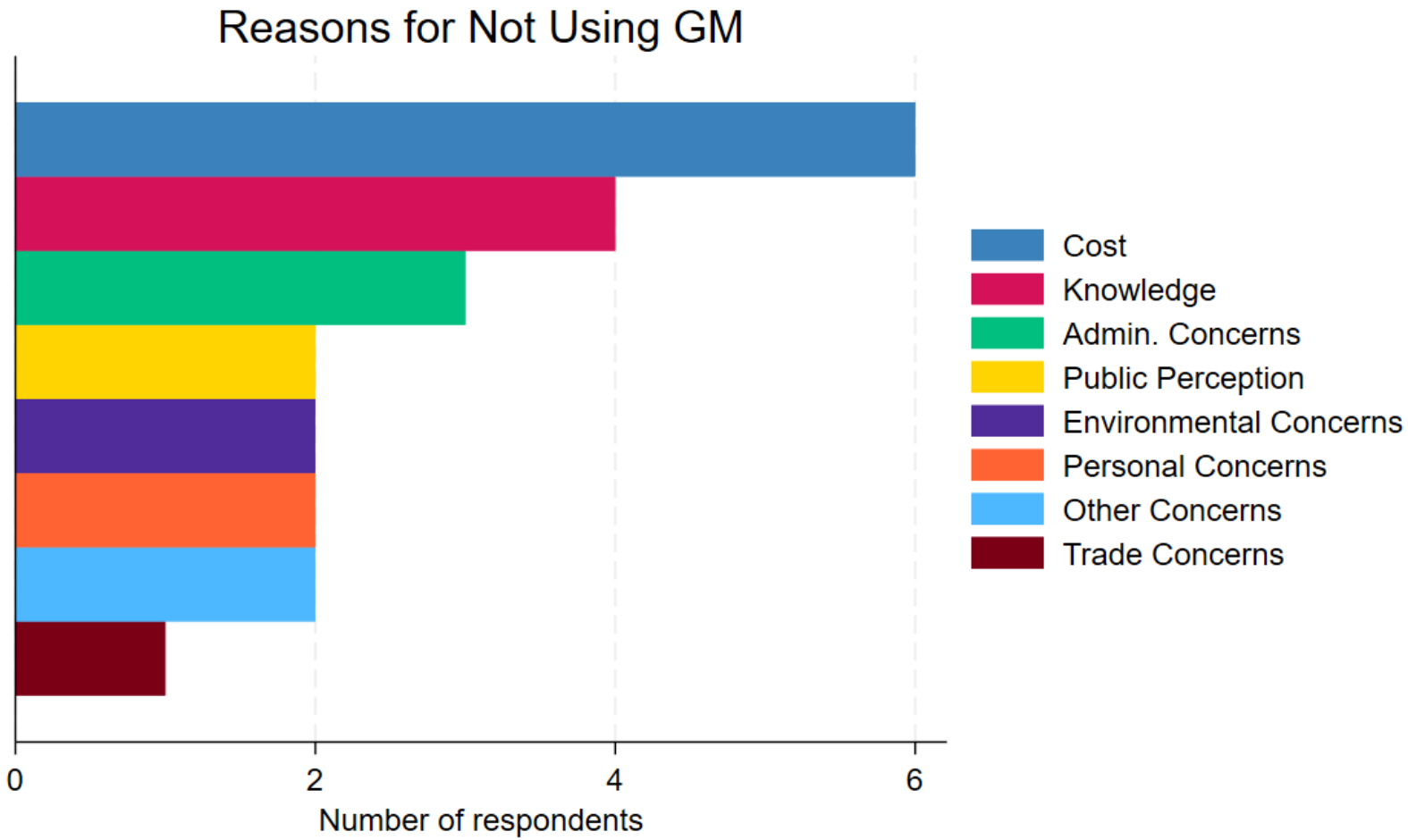
Limitations – *Economic & Financial*



Why have you not used *gene editing*?

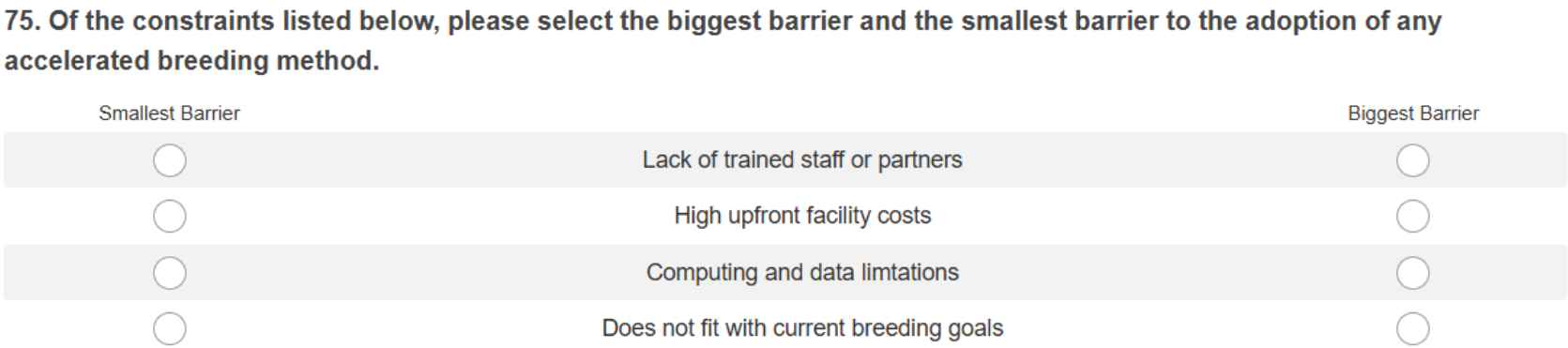


Why have you not used *genetic modification*?



How are we able to rank barriers to adoption?

Remember answering many repeated questions asking about the biggest and smallest barriers?



75. Of the constraints listed below, please select the biggest barrier and the smallest barrier to the adoption of any accelerated breeding method.

Smallest Barrier		Biggest Barrier
○	Lack of trained staff or partners	○
○	High upfront facility costs	○
○	Computing and data limtations	○
○	Does not fit with current breeding goals	○

- Economics studies **trade-offs** using *variation*
- Multiple questions? $\rightarrow$ Different trade-offs with more variation

Ranking Constraints Results

	Biggest Barrier	Smallest Barrier
Ongoing Costs	37.9%	13.6%
Upfront Cost	32.9%	19.3%
Trained Staff	14.3%	4.3%
Resistance to Change	6.4%	25.7%
Lack of Support	5.0%	0.0%
Computing/Data	2.9%	17.1%
Fit for Goals	0.0%	1.4%

Lack of financial resources and staff have always been a concern, but limited support from supervisors has decreased (20% $\rightarrow$ 5%)

Limitations Summarized

1. Money
   - Operating/Ongoing
   - Upfront Costs
   - Consistency
2. Trained Staff $\rightarrow$ Opportunities with proposed RESILIENT-ASEAN project

Other concerns?

- Is the added cost worth it?
- Are there additional regulatory hurdles?
- Will farmers accept this?

Next Steps

We need more observations!

- Help us to strengthen our dataset.
- Share the survey with rice breeding colleagues worldwide, and particularly in ASEAN member states.
- Forward it today to expand our reach - link available at www.acceleratedbreeding.ca.

Together, we can develop stronger insights!

Panel Discussion

Panel Members

- **Dr. Sobir Ridwani**, Professor of Plant Breeding at Bogor Agricultural University, Indonesia
- **Nitin Verma**, Agriculture Counsellor at Canada's Indo-Pacific Agriculture Office (IPAAO), Philippines
- **Dr.Nguyen Ngoc Thuy**, Head, Office of International Cooperation (NLU) at Nong Lam University, Vietnam

Questions?

Thank you!