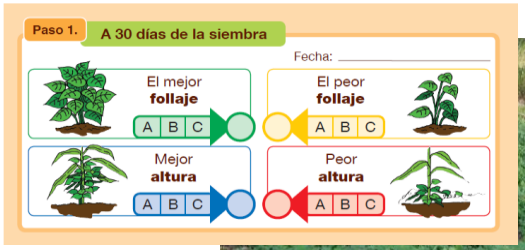
Farmers' generated data for climate adaptation: evidence from three continents

Bioversity International, Information Services and Seed Supplies

The cycle of tricot research

1. A broad set of varieties (10-25) is evaluated

2. Each farmer gets a combination of 3 varieties



3. Farmer plants a trial and makes observations

4. Project managers collect farmers' observations by phone

6. Farmers receive variety recommendations and can order seeds

5. Data are used to evaluate varieties and to detect demand for new varieties and traits

van Etten et al. (2016) *Expl. Agric.*
Beza et al. (2017) *PloS ONE* **12**(5):e0175700

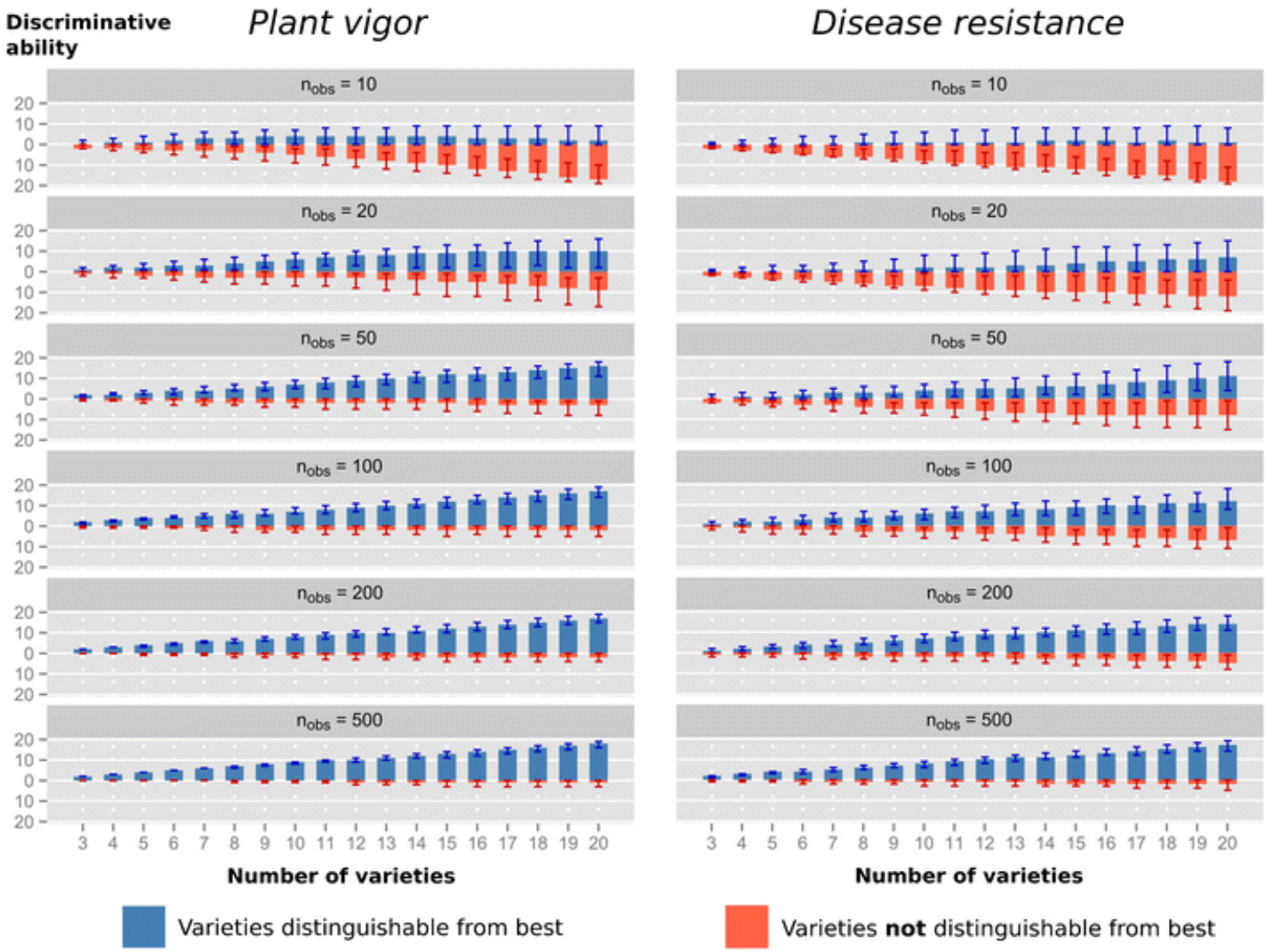
> 22k on-farm trails

> 170 varieties

3 continents

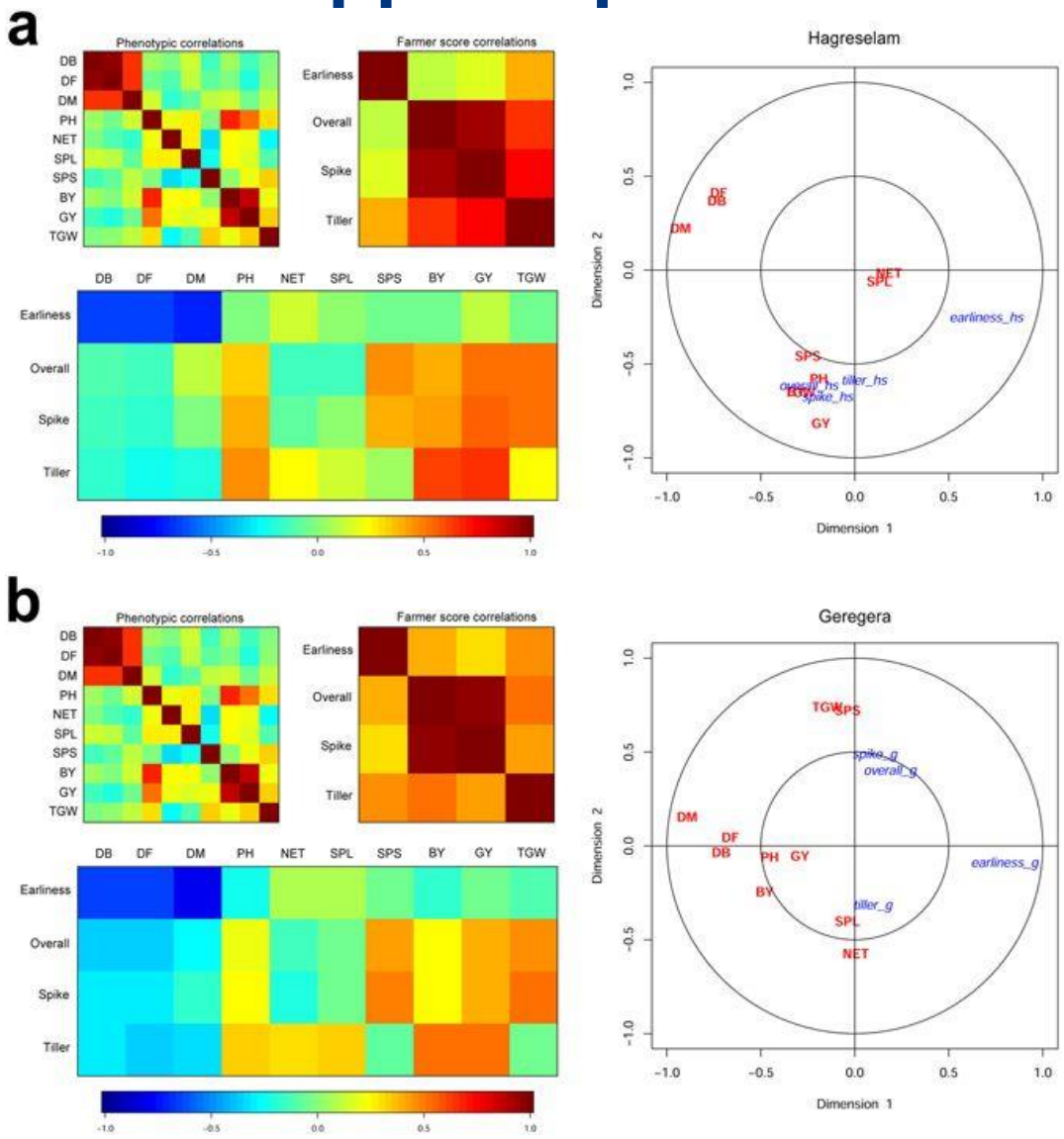
What we learned

Farmers' generated data is reliable



Steinke et al. (2017) *Agron. Sustain. Dev*. (2017)37:32

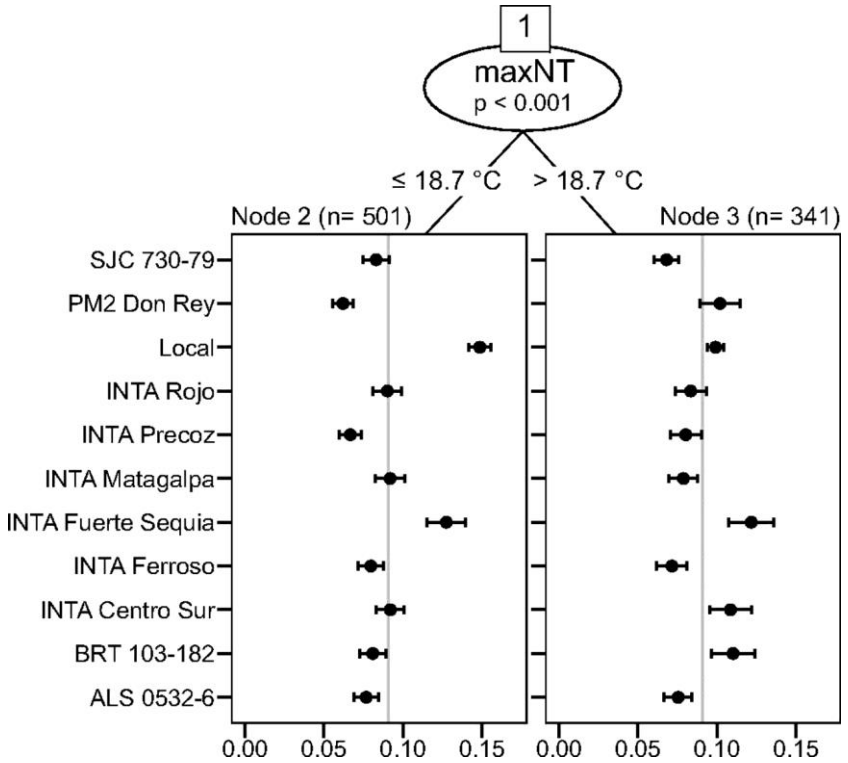
Farmers supports plant breeding initiatives



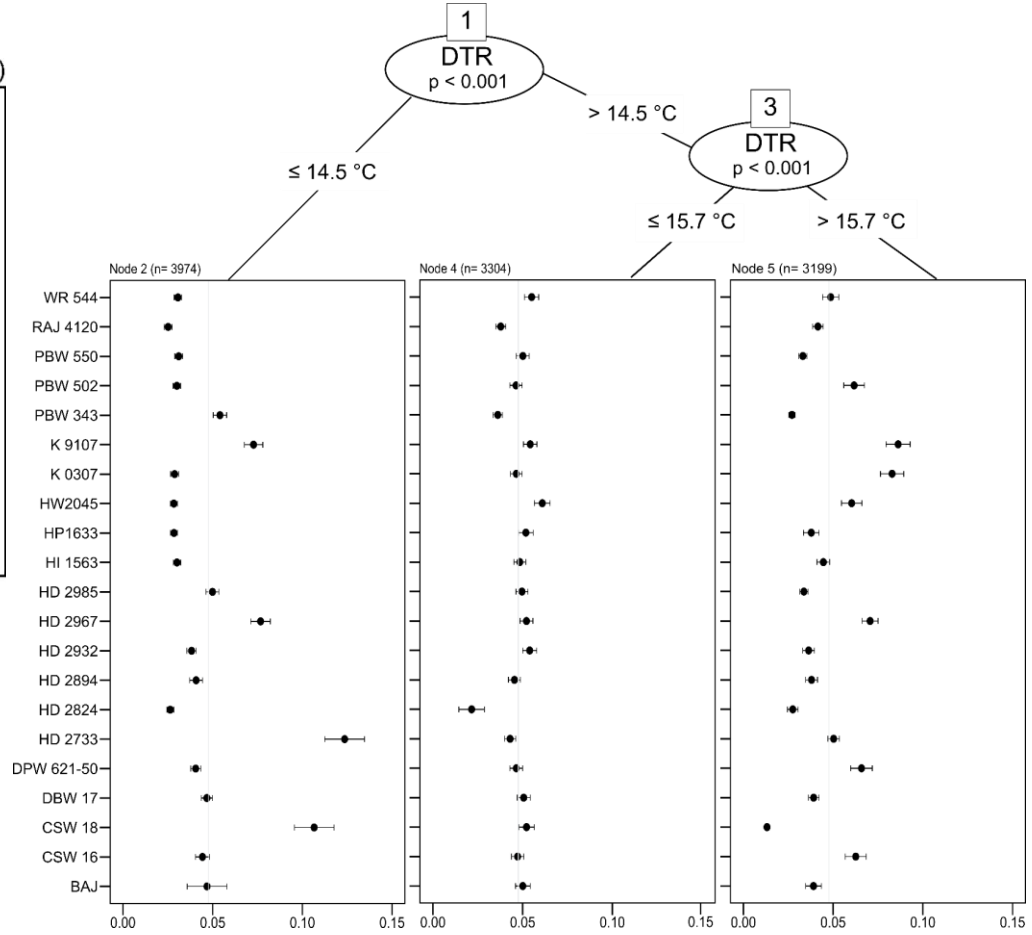
Linear combinations of phenotypes and farmers' evaluations in (a) Hagreselam and (b) Geregera, Ethiopia

Mancini et al. (2017) *Sci. Rep.* 7: 9120

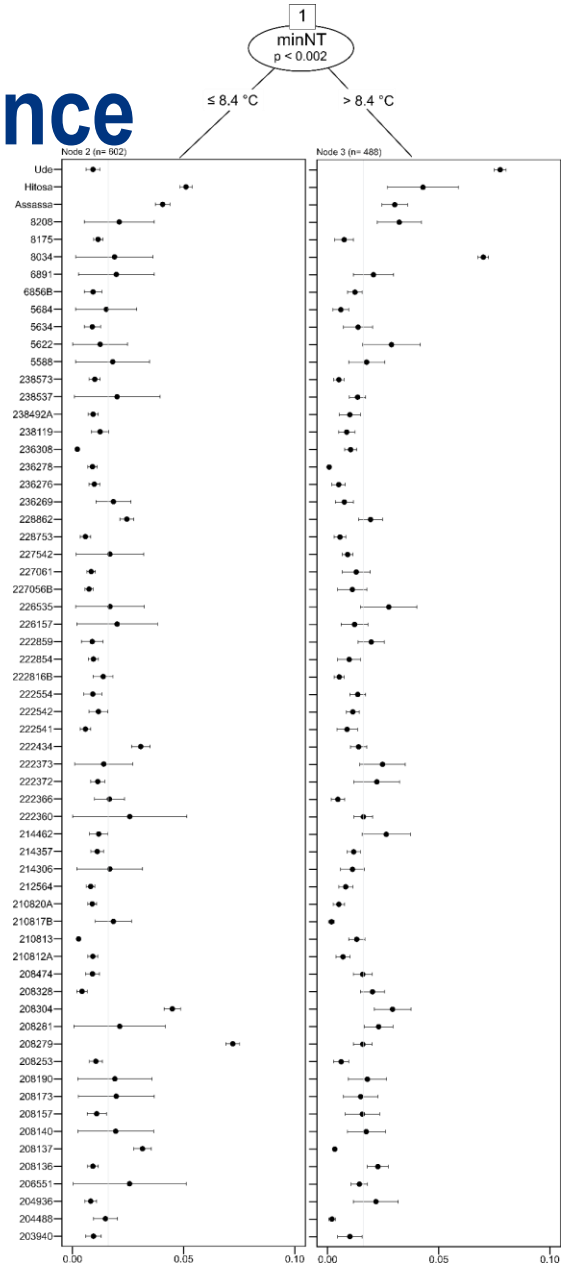
Register the effects of climate on crop performance



Common beans - Nicaragua



Bread wheat - India



Durum wheat - Ethiopia

van Etten et al. (2019) PNAS **116**(10):4194-4199

Improve variety recommendations by incorporating seasonal forecasts

Table 2. Goodness of fit (pseudo-R^2) of generalizable PLT models

Model	Nicaragua	Ethiopia	India
No covariates	0.1533	0.4280	0.0611
Average season	0.1536	0.4290	0.0694
Perfect forecast	0.1749	0.4442	0.1065

Model average season corrects for climatic sampling bias by averaging predictions over a base period of seasonal climate data. Model perfect forecast uses observed climatic covariates in the predicted seasons. Values represent cross-validated pseudo-R^2 values averaged across blocks and weighted with the square root of the sample size of each block.

van Etten et al. (2019) PNAS **116**(10):4194-4199

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Support risk analysis

Table 3. Expected probability of winning (average of all farms over the base period) and worst regret measures of a subset of the varieties

Case study and variety	Probability of winning	Worst regret
Common bean (Nicaragua)		
Local variety	**0.130**	0.023
INTA Fuerte Sequía	0.125	**0.021**
INTA Centro Sur	0.098	0.057
BRT 103-182	0.092	0.068
INTA Rojo	0.088	0.082
INTA Matagalpa	0.087	0.057
Durum wheat (Ethiopia)		
208279	**0.059**	0.062
Hitosa	0.049	**0.035**
208304	0.041	0.048
8034	0.030	0.053
Ude	0.025	0.063
222360	0.023	0.061
Bread wheat (India)		
K 9107 (Deva)	**0.077**	0.051
HD 2967	0.068	0.047
HD 2733	0.066	**0.036**
K 0307 (Shatabadi)	0.063	0.095
CSW 18	0.042	0.073
HI 1563 (Pusa Prachi)	0.041	0.093

The results show how different criteria of variety selection can lead to different recommendations (best value according to each criterion is indicated in bold). Using the probability of winning as a criterion maximizes the average performance but ignores risk. Minimizing worst regret (the loss under the worst possible outcome) is a criterion that takes a conservative approach to risk.

van Etten et al. (2019) PNAS **116**(10):4194-4199

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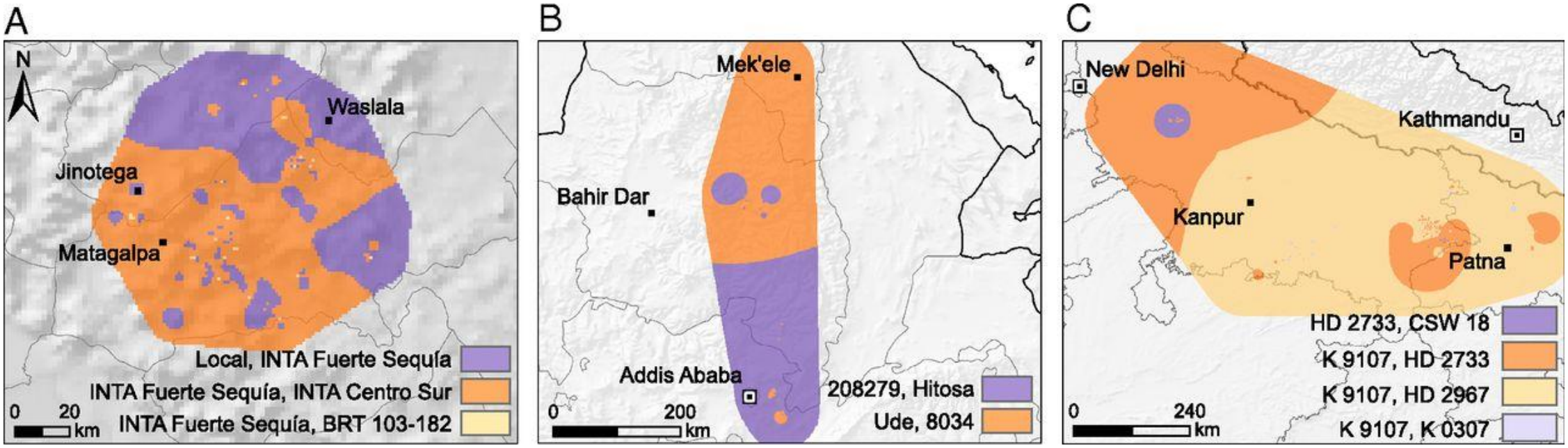
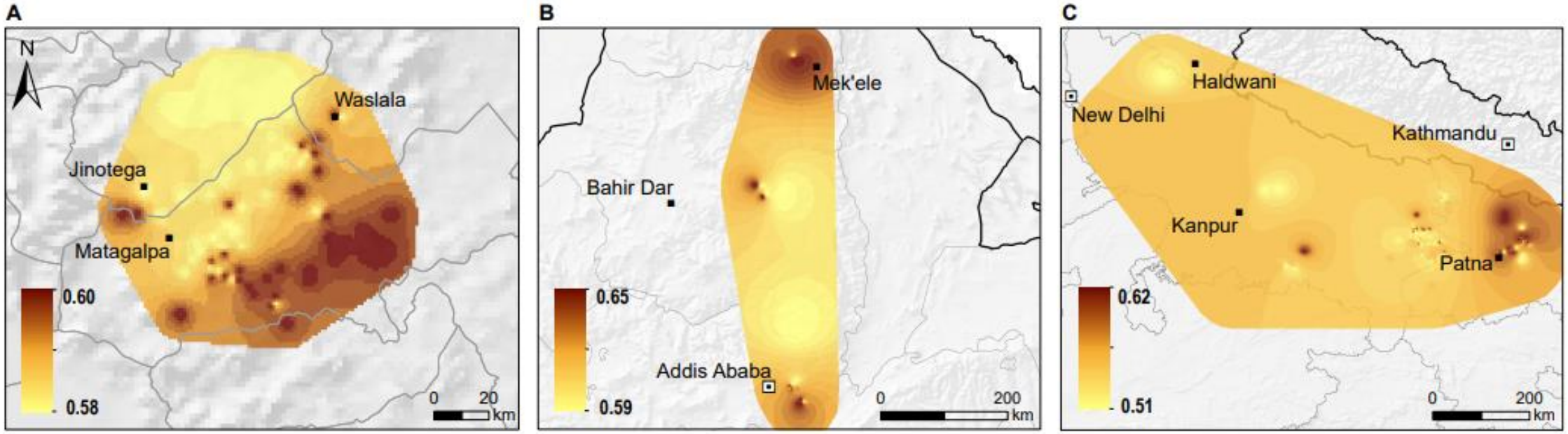
Improve variety recommendation for climate adaptation



Variety recommendation

van Etten et al. (2019) PNAS **116**(10):4194-4199

Improve variety recommendation for climate adaptation

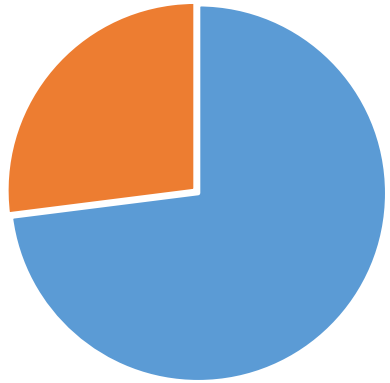


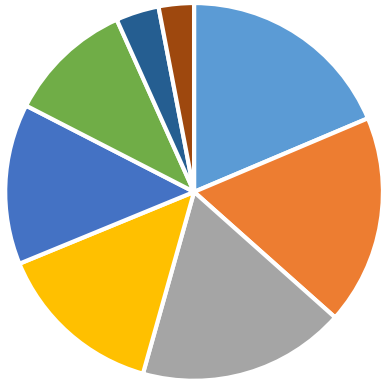
Probability of outperforming

van Etten et al. (2019) PNAS **116**(10):4194-4199

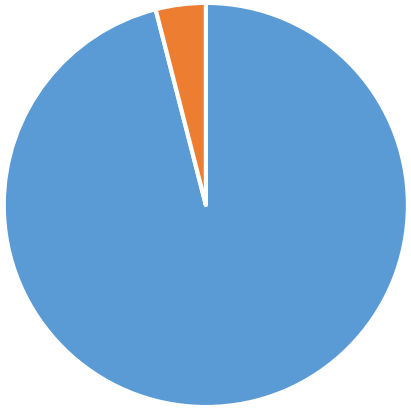
Farmers keep crop diversity

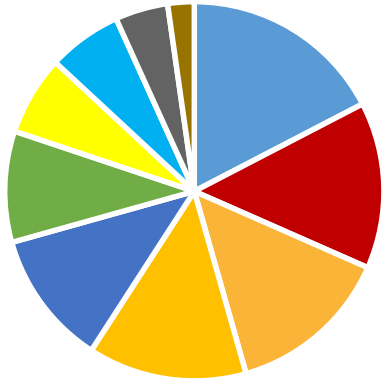
Vaishali (486 farmers)





Samastipur (250 farmers)





Want to save seeds Don't want to save seeds

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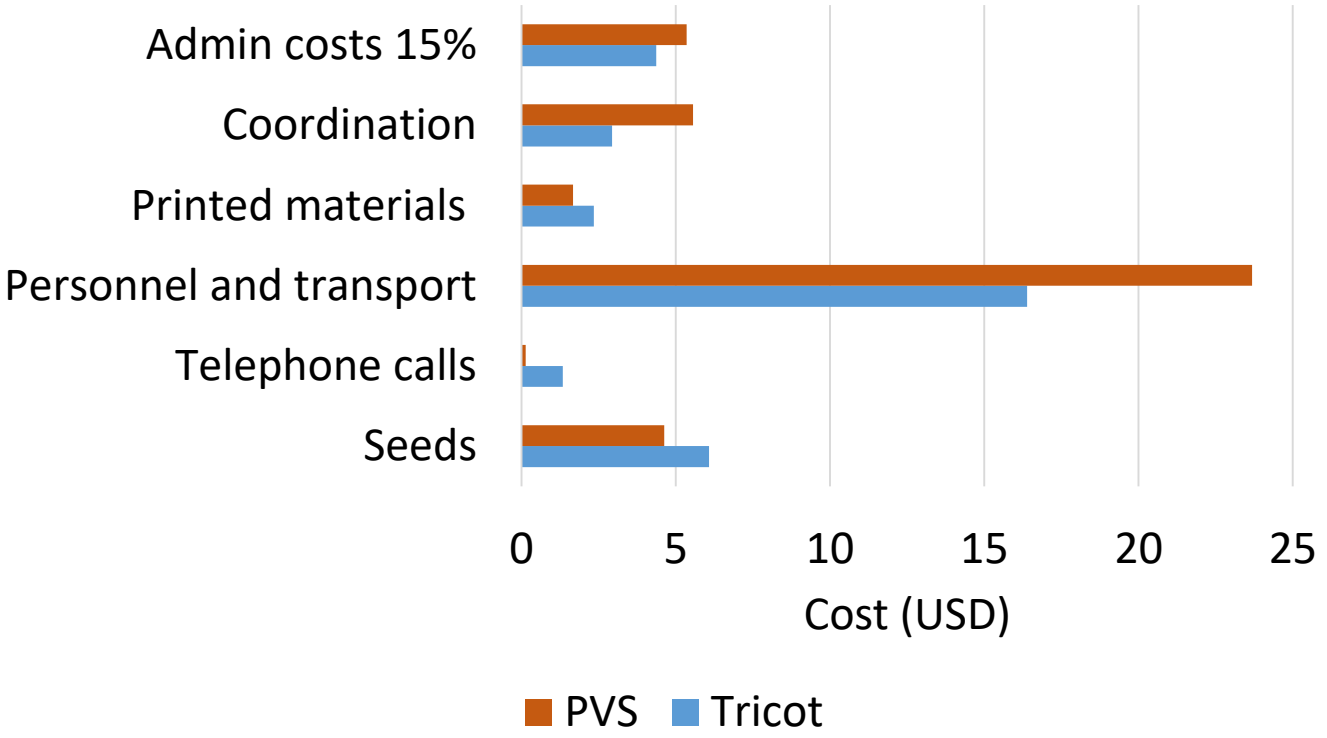
Effects: Up-scaled diverse seed production in Honduras

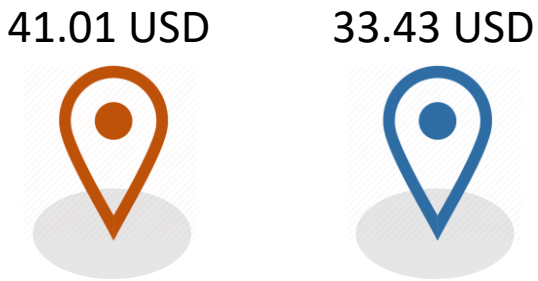
- Many more farmers want to participate in crowdsourcing
  - Local NGO sells tricot packages as “diversity test kits”
  - “Local farmer research committees” now produce seed of many varieties commercially

- National seed law recently changed – CIAL-produced seed can be sold
- First official release of common bean variety after multiple seasons of tricot trialling

Is a cost-effective approach

Common beans projects in Central America





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Science for a food secure future

Thank you!

This is a compilation of several presentations of the members of Bioversity International's "Information Services and Seed Supplies" Team. If you intend to cite it please do it as:

de Sousa, K; Steinke, J.; van Etten, J. (2019) Farmers' generated data for climate adaptation: evidence from three continents

Other materials used in this training course are available at:

https://github.com/kauedesousa/ClimMobTools

For the editable .ppt files, please send a request to
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