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“Solidarity in a competing world —  
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## Which Wheat for Smallholder Ethiopian Farmers? Joining Traditional Knowledge with Metric Phenotypes

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### Abstract

Africa hosts approximately 33 million smallholder farms, which account for 80 % of the continent’s farming system. Subsistence farming systems face highly variable climatic conditions that threaten locally-adapted, low-input agriculture. For the near future, they are among the most seriously affected by changing climatic conditions, posing additional risks to these systems. The benefits of modern breeding benefits may fail to reach small farming communities when broadly adapted material does not address specific local requirements. To date, participatory variety selection has only scratched the surface of the exploitability of farmers’ knowledge in breeding. Yet, considering that over 80 % of the farmers receive seeds from informal systems, making sure that well adapted material is available in production systems, seems to be a reasonable solution to quickly affect a large populations. Ethiopia is one of the most populous countries in Africa, with more than 96 million inhabitants, 80 % of whom are engaged in small-scale agriculture, and often subsistence farming. We involved 60 smallholder farmers in two locations in Ethiopia to evaluate traits of their interest in 400 wheat accessions, producing 230,400 data points. We couple this information with metric measurements of 10 agronomic traits, breaking down farmers’ preferences on quantitative phenotypes. We found that the relative importance of wheat traits is gender- and locality- dependent, and produced a ranking of the 400 varieties identifying the combination of traits most desired by farmers. The study scale and methods lead to a better understanding of smallholder farmer needs, broadening the discussion for the future of local, sustainable breeding efforts accommodating farmers’ knowledge.

**Keywords:** Climate change, decentralised breeding, participatory variety selection, traditional knowledge