Agriculture Challenges

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Increase Effective Use of Fertilizer

Increasing fertilizer use has the potential to lift millions of smallholder farmers out of poverty. Done effectively, fertilizer use has potential to increase yields for farmers in sub-Saharan Africa. In three months, pilot an evidence-based model that increases effective fertilizer use and reliably boosts the standard of living for 50 smallholder farmers, growing to 1000 farmers in two years. A successful plan will include continuous monitoring and testing, and a commitment to change if evidence suggests your approach is not working.

The Problem

Most of the world's poorest people are smallholder farmers. There are at least 570 million farms worldwide, and at least 475 million of these being family farms less than 2 hectares in size.[1] In sub-Saharan Africa, agriculture accounts for 64% of the labor force. In rural areas, 75% of people living on $1 a day work in agriculture.[2]

Unfortunately, crop yields produced by smallholder farmers in sub-Saharan Africa remain well below their potential. For example, cereal crops grown in sub-Saharan Africa average 1.2 tons per hectare, while the developing world average is about 3 tons/ha.[3] It is possible to bridge this gap. Farmers in South Asia during the "Green Revolution" implemented modern farm practices, and between 1961-2001 increased crop yield by 145%. Smallholder farmers in sub-Saharan Africa during that same time period increased crop yield by only 30%.[4] Increasing the productivity of African smallholder farms has potential to lift millions of people out of extreme poverty.[5]

The Proven Solution

Fertilizer, when used effectively, has increased crop yields throughout most of the world. For example, increased fertilizer use contributed to 50% of the yield growth in Asia during their

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[1] Lowder, Sarah K., Jakob Skoet, and Saumya Singh. "What do we really know about the number and distribution of farms and family farms in the world?." Background paper for the State of Food and Agriculture 8 (2014).

[2] Jack, B. Kelsey. "Market inefficiencies and the adoption of agricultural technologies in developing countries." (2013). p. 2

[3] http://www.fao.org/fileadmin/templates/wsfs/docs/Issues_papers/HLEF2050_Africa.pdf

[4] From figure in World Bank. Independent Evaluation Group, ed. World Bank assistance to agriculture in Sub-Saharan Africa: an IEG review. World Bank Publications, 2007. p. 70

[5] World Bank. Independent Evaluation Group, ed. World Bank assistance to agriculture in Sub-Saharan Africa: an IEG review. World Bank Publications, 2007. p. 64

"Green Revolution" and is responsible for 33% of recent growth in worldwide cereal production.[6] Currently fertilizer is used at a much lower rate among sub-Saharan African farms. African farmers use just 9 kg per hectare, compared to 104 kg in South Asia and 86 kg in Latin America.[7] Increasing effective use of fertilizer in sub-Saharan Africa has potential to radically increase crop yields.

However, how to increase effective use of fertilizer in sub-Saharan Africa is still unclear. Many approaches have been tried, with mixed results. One reason is that fertilizer's effectiveness highly depends on local variables, like crop type and region. A second reason is that local pricing and market conditions matter, and increased yield does not always result in increased profitability.

Your Challenge

We will award up to $20,000 to a Distribution Entrepreneur who will reliably boost the standard of living of 50 smallholder farmers (cultivating land of 2 hectares or less) by increasing effective use of fertilizer. This must occur without causing increased risk to any of the farmers. Winning entrepreneurs will have a vision for growing to support 1,000 farmers over two years.

You must have a localized plan that can manage uncertainty, including:

- An evidence-based approach which identifies the strongest factors that cause low earnings for farmers, specific to the region in which you will operate
- An model of how and why your intervention will boost earnings in the long run
- A plan for continuous testing and evaluation of the program
- A commitment to change the plan if the evidence suggests that the approach isn't working

Other Market Information

These are the local conditions we've encountered in our research that can impact effectiveness:

- Local variables can impact effectiveness. Because fertilizer's effect can vary widely, farmers can have low incentives:[8]
    - Crop type matters: some crops have a much lower response to fertilizer.
    - Region and season matter: response to fertilizer varies considerably between locations and seasons.
    - Other factors can matter: crop response is often limited by other factors such as lack of water.

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[6] Morris, Michael L. Fertilizer use in African agriculture: Lessons learned and good practice guidelines. World Bank Publications, 2007. p. 33

[7] World Bank. Independent Evaluation Group, ed. World Bank assistance to agriculture in Sub-Saharan Africa: an IEG review. World Bank Publications, 2007. p. 75 Morris, Michael L. Fertilizer use in African agriculture: Lessons learned and good practice guidelines. World Bank Publications, 2007. p. 18

[8] Morris, Michael L. Fertilizer use in African agriculture: Lessons learned and good practice guidelines. World Bank Publications, 2007. p. 61

- High cost of fertilizer can reduce farmer ROI. High transport costs, small markets lacking economies of scale, lack of a rural dealer network, and a lack of a competitive private sector can all lead to high input prices.[9, 10]
- Farmers are exposed to high risk.[11] Bad weather can completely wipe out crop yields, and as can volatility in crop prices.[12] Because investing in fertilizer inputs might not pay off, farmers can face a disincentive to use it.[13]

This challenge includes unanswered questions which could significantly alter the potential of your program. Your successful solution will need to address these unanswered questions:

- What are the factors contributing to low fertilizer use in your operating region, and how strong is each factor?
- How optimal are existing levels of fertilizer use in your operating region (accounting for the rational risk aversion that farmers have)?
- Given high variation in yields and soil nutrient availability, are farmers able to choose profitable amounts of fertilizer?
- How dependent is the profitability of fertilizer on other inputs, such as irrigation on better seed varieties?

Research you may find helpful:

- World Bank Assistance to Agriculture in Sub-Saharan Africa: An IEG Review by the World Bank
- Fertilizer Use in African Agriculture: Lessons Learned and Good Practice Guidelines by the World Bank
- J-PAL's agriculture research
- Our folder of agriculture papers
- yieldgap.org - an atlas of yield gaps
- Atlas of African Research and Development

It may be possible to combine this challenge with other D-Prize Agriculture challenges, such as Teach Microsoding Technique or Scale Up Distribution of Quality Seeds.

Ready To Apply?

Download a Round 1 application packet at
https://www.d-prize.org/s/Round-1-Application-Packet-September-2019.pdf

Questions? Email the D-Prize team at help@d-prize.org

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[9] World Bank. Independent Evaluation Group, ed. World Bank assistance to agriculture in Sub-Saharan Africa: an IEG review. World Bank Publications, 2007. p. 75

[10] Morris, Michael L. Fertilizer use in African agriculture: Lessons learned and good practice guidelines. World Bank Publications, 2007. p. 73

[11] Morris, Michael L. Fertilizer use in African agriculture: Lessons learned and good practice guidelines. World Bank Publications, 2007. p. 68

[12] https://www.povertyactionlab.org/sites/default/files/publications/Swarna.pdf Morris, Michael L. Fertilizer use in African agriculture: Lessons learned and good practice guidelines. World Bank Publications, 2007. p. 68

[13] Morris, Michael L. Fertilizer use in African agriculture: Lessons learned and good practice guidelines. World Bank Publications, 2007. p. 70