Scaling foundational and adapted yield gap strategies

One Acre Fund
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Presentation summary

1. What we do and where we work (~5 minutes)

2. Working to adapt the program to heterogeneous conditions (~15 minutes)
    - Variety recommendations
    - Topdress fertilizer application timing
    - Improving biotic and abiotic stress feedback mechanisms
    - Addressing soil acidity

A bundled approach to agricultural development

Inputs:
- Improved seed
- Fertilizer
- Post-harvest products
- Non-agricultural products (solar lamps, cook stoves, menstrual pads)

Financing:
- Group loan
- Flexible repayment cadence

Distribution:
- Trucks deliver purchased products to distribution sites
- All sites are within walking distance

Training:
- Row and plant spacing at planting
- Efficient fertilizer use (microdosing, timing, placement)
- Land and soil management (composting, tillage, erosion mgmt.)
- Post-harvest (drying, storage)

A bundled approach to agricultural development

FINANCING

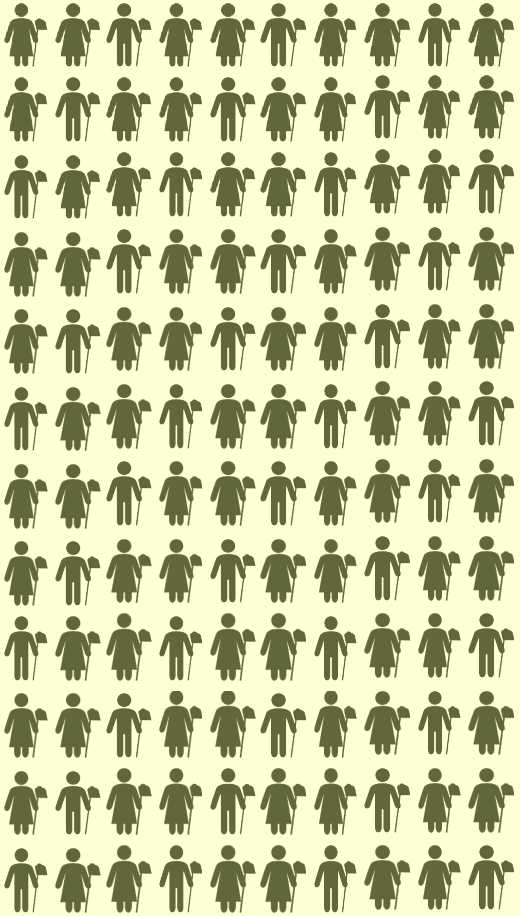
DISTRIBUTION

TRAINING

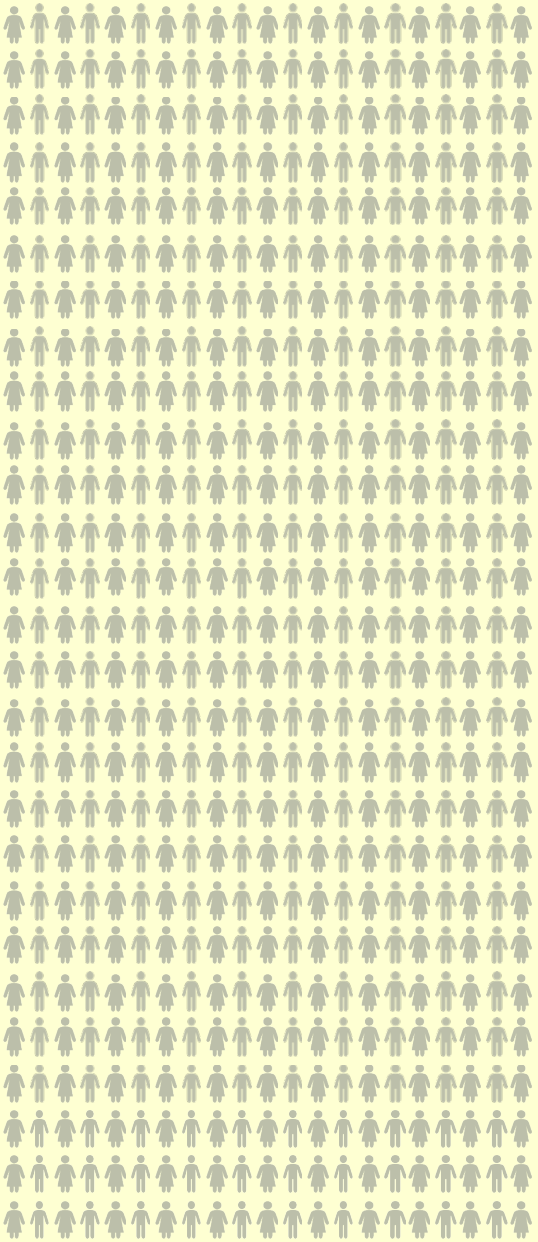
MARKET FACILITATION

1 field officer

provides service bundle



to 200 smallholder farmers



reaching 1,000 people

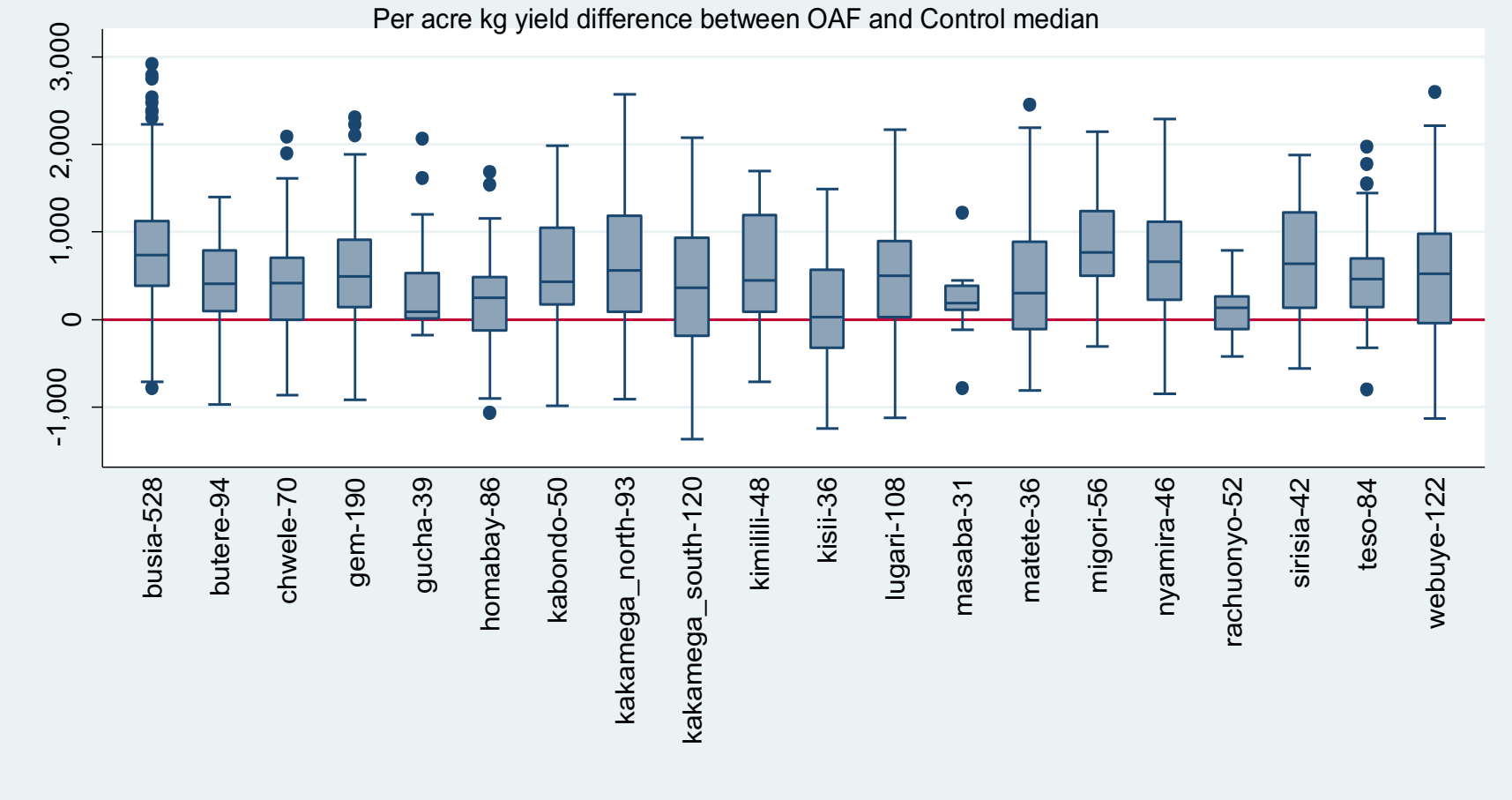
Where we work

Program specifics

Country	Launched	Clients	Crops	Maize Yield	Maize Profit
Kenya	2006	210,500	Maize, bean, red onion, collards, grevillea	4.16 t/ha (15LR)	+ $112 / farmer
Rwanda	2007	127,000	Maize, bean, banana, potato, grevillea	3.32 t/ha (15A)	+ $32 / farmer
Burundi	2012	45,900	Maize, bean, potato	2.43 t/ha (15A)	+ $56 / farmer
Tanzania	2013	17,600	Maize	4.08 t/ha (2015)	+ $189 / farmer
Uganda	2016	3,800	Maize	TBD	TBD
Malawi	2016	2,700	Maize	TBD	TBD

Adapting the program to localized conditions

Agronomic responsiveness to the program is a function of geospatially variable agroecological conditions – soil, rainfall, temperature, biotic stresses, etc.



Variety trials and area-specific recommendations

Rationale:

- The improved maize varieties that we sell have different maturity periods and biotic / abiotic stress resistances, making certain varieties more suitable for particular areas than others.

Approach:

- Use a combination of breeder input, meteorological data, farmer preference data, and distributed yield data to develop area-specific variety recommendations.
- Ground-truth findings with field staff and train them on how to effectively provide variety recommendations.
- Field staff provide area-specific guidance during program enrollment as to which improved maize varieties may be most suitable for the farmer.

Variety trials and recommendations

Results to date:

- We estimate that ~30% of 1AF farmers in Kenya would achieve an 8-15% maize yield increase by changing the variety they are currently growing to another (better suited for the conditions) that we offer.

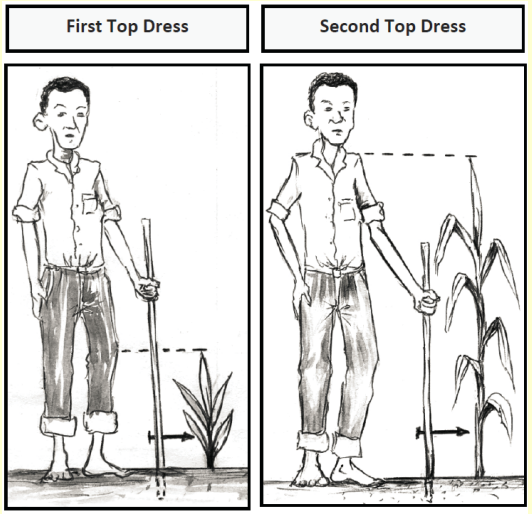
District	Optimal (t/ha)	Sub-Optimal (t/ha)	Difference (t/ha)	Difference (%)	# Sub-Optimal
Busia	4.00	3.51	0.49	14.0%	1,594 (14%)
Teso	4.24	3.92	0.32	8.2%	1,252 (14%)
Butere	4.94	4.54	0.40	8.8%	3,454 (44%)
Kakamega	5.41	4.70	0.71	15.1%	6,248 (56%)
Lugari	5.57	4.98	0.59	11.8%	2,312 (20%)
TOTAL	4.84	4.48	0.36	8.0%	14,860 (29%)

- Group leaders who grew demonstration plots during the 2015 long rains were about 2.5x as likely to purchase that variety during the 2016 long rains as were group leaders in that same district who did not grow the variety as a demonstration plot. Similarly, farmers who did not grow demonstration plots themselves, but whose group leaders grew demonstration plots were about 2.5x as likely to purchase that variety during the 2016 long rains as were non-demonstration plot farmers in the same district.

Adapting maize topdress timing

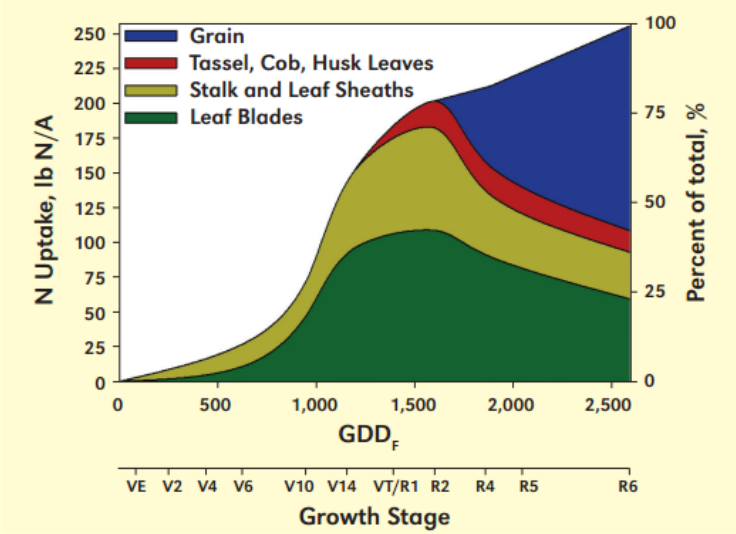
Rationale:

- Variable temperature and variety genetics result in inconsistencies in how well days-after-planting and height-based topdress timing guidance lines up with timing of maize nutrient requirements. Leaf count is a more reliable proxy.



Approach:

- Shifting from “knee height” and “shoulder height” in Kenya to V6 and V10 applications of CAN.
- Considering single V8 application in areas where split topdress application may not be necessary.



Adapting maize topdress timing

Results to date:

- 1AF on-farm trials (n=200) around Bungoma, Kenya have shown 7-26% maize yield increases, depending on the site, when applying topdress at V6 and V10 rather than knee height and shoulder height.
- We are currently running a larger-scale evaluation in western Kenya focusing on training quality and farmer compliance; we do not yet have final results.
- This training focuses on identifying which leaves should be counted, how many leaves to count, and how many plants to count.

We are exploring the use of SMS as a medium for providing more localized topdress timing guidance, specified to the meteorological conditions of the area and the variety that the farmer is growing. This may come in the form of a prompt to begin counting leaves in the next few days.

Tracking drought, pests, and disease

Rationale:

- The incidence and severity of various insects and plant diseases, as well as moisture stress, can vary between locations. In order to effectively recommend genetic, agronomic, or chemical management products and recommendations we must understand the geographic variability of these biotic and abiotic stresses.

Approach:

- Crop health hotline – we have a dedicated number for farmers to call when they are experiencing some sort of “crop health” issue. We log the issue, provide a tentative diagnosis, and suggest a potential way to address it.
- Crop health response team – once hotline calls about a particular topic reached a defined threshold, an agent is sent to the field to verify the issue.
- Crop health app – we are looking in to opportunities to use smart phones and image recognition algorithms to facilitate the process of stress identification.

Addressing soil acidity

Rationale:

- Soil acidity inhibits plant growth, but the extent to which soil acidity is an important factor varies geographically. Agricultural lime is an effective way to reduce soil acidity and, by extension, increase yields. However, the value of lime geographically varies with underlying soil characteristics.

Approach:

- Sample soils across the program to better understand where acidity is prevalent.
- Run agronomic trials to better understand the economic value of applying small quantities of lime.
- Work with farmers to better understand their perception of lime and what drives adoption.
- Draw upon soil data and use SMS as a medium for precision lime recommendations.

Addressing soil acidity

Results:

- Impact: 1AF on-farm trials (n=900) have shown that application of small quantities of lime can increase maize yields by anywhere from 1% to 40% in the first season, depending on the location.
- Adoption: In Rwanda, farmer surveys revealed that 43% of farmers in Kibogora and 83% of farmers in Nyamasheke believed they did not need lime despite soils in both districts being predominately acidic. 1AF then randomly administered in-field pH tests for farmers in these districts. Farmers who received the test purchase an additional 19kg of travertine, increasing from 7kg to 26kg.

In Kenya we are also in the process of reviewing results from trials in which we promoted lime purchase via individualized SMS, through one-time free giveaways, and through field staff and farmer education initiatives.

Wrap up

We've followed a somewhat step-wise yield gap strategy, focusing on seed and fertilizer initially, and increasing our focus on organic resource management.

The next area we are investing in is this idea of local adaptation of the One Acre Fund program. We'd like to investigate the extent to which this step can further close yield gaps in the areas we work.

This requires a focus on balancing economic value and operational complexity – developing simplified strategies to adapt to heterogeneous conditions.

- Yield gap analyses
- SMS recommendations
- Field staff use of tablets
- Bypassing spatial variability

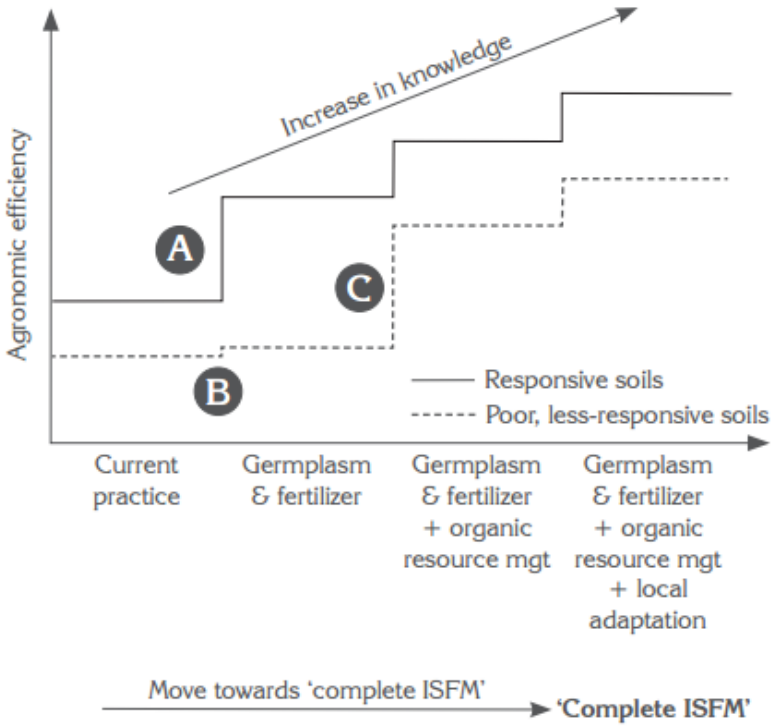


Figure 4. Conceptual relationship between the agronomic efficiency of fertilizers and organic resources and the implementation of various components of integrated soil fertility management (ISFM). "Current practice" assumes the use of the current average fertilizer application rate in sub-Saharan Africa of 8 kg of fertilizer nutrients per hectare.

SOURCE: Adapted from Vanlauwe et al. (2011).

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