

Results from Maize On-Farm Demonstrations CREATE/Rwanda 2015-2019



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1. Background

Supported by the Netherlands Ministry of Foreign Affairs, HEINEKEN International, and the International Finance Corporation (IFC), the Community Revenue Enhancement through Agricultural Technology Extension (CREATE) Project aims to reduce poverty in Rwanda through increasing capacity in rural households and limiting the dependency on imported commodities such as maize.

EUCORD started implementing the CREATE project in Rwanda in 2014 training farmer cooperatives on improved agronomic practices, facilitating access to improved inputs (seed and fertilizer), arranging contracts between cooperatives and the buyer (ProDev), and facilitating maize collection, drying, shelling, storage and transport. After the first full year of the project, several other challenges were identified that were important for the long-term sustainability of the value chain. The key areas identified included cooperative business skills development, resilience to drought and improved practices to reduce post-harvest losses (which was reaching up to 30%, currently estimated to be 15%). This led to a collaboration between the CREATE project and IFC, which started in 2015 with an expanded scope to include: 1) enhancing the leadership and management of cooperatives; 2) improving climate resilience with the introduction of small-scale irrigation technologies; and 3) initiating contacts to assist cooperatives to gain access to finance.

Since the start of CREATE/Rwanda in 2014, the number of cooperatives increased from 20 to 50, and the number of participating households from 3,256 to 15,598. The volume of maize sold to ProDev has increased from 693 tons in 2015 to 4,718 tons in 2018 due primarily to the increases in cultivated area and maize productivity improvement from less than 2 MT/ha to an average of 3 MT/ha.

2. On-farm demonstrations

A major challenge limiting the competitiveness of Rwandan maize is the current high yield gap between actual and potential maize yields. Farmers' average maize yields are still far below those that can be achieved when the full package of recommended inputs and best agronomic practices is applied. As shown in below graph, average national maize yields in Rwanda during the 2015-19 period are stagnant around 1.5 tons/ha. In order to stimulate farmers to adopt improved agronomic practices, the CREATE project conducted a program of on-farm demonstrations, field days, trainings and on-farm coaching between 2014 and 2019. These interventions have led to an approximate doubling of yields to 3 t/ha among cooperatives participating in the CREATE project. On-farm demonstrations conducted by the CREATE project show that it is feasible to obtain yields of up to 8 t/ha.

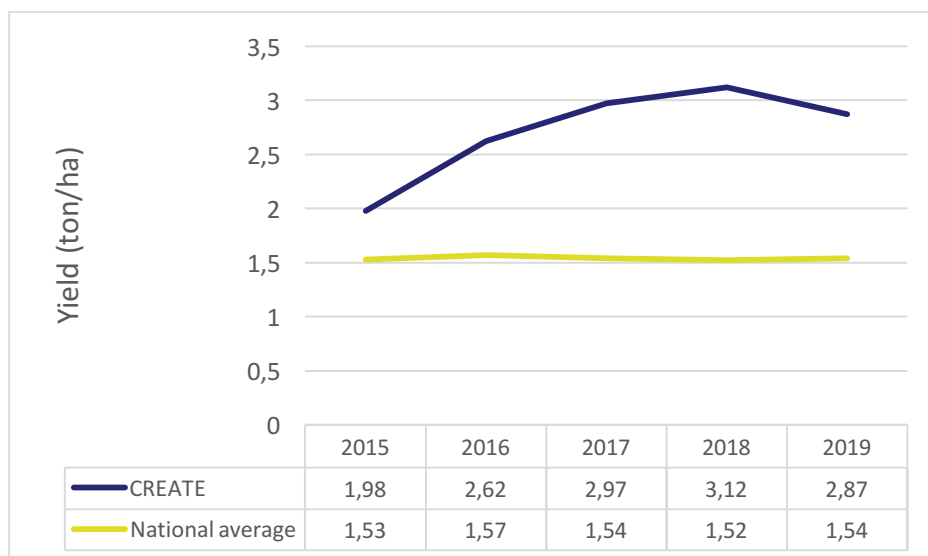


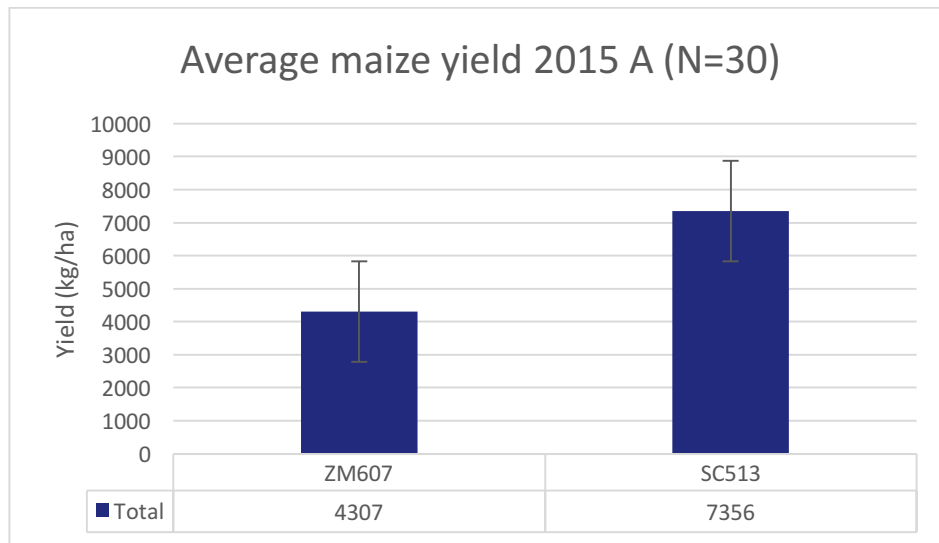
Figure 1: Average maize yields of CREATE cooperatives versus national average in Rwanda

This report provides a summary of yield results obtained from on-farm demonstrations carried out in farmers' fields in Kayonza and Rwamagana districts. The purpose was to demonstrate that the use of fertilizer combined with high yielding maize hybrids and good agricultural practices such as optimal plant spacing, weeding, pest control can lead to higher yields.

3. Results

3.1.1 2015 A Season

During the 2015 A season a total of 30 on-farm demonstrations were carried out. Results from these first demonstrations showed that there is high potential to increase maize yields during the A season from 4 t/ha, using an open pollinated variety (OPV) without fertilizer, to more than 7 t/ha using hybrid maize varieties in combination with the standard fertilizer application recommended by the Rwanda Agriculture Board (RAB) of 100 kg/ha DAP (di-ammonium phosphate) and 100 kg/ha Urea. However, the standard error bars in below graph indicate a high variance between yields.

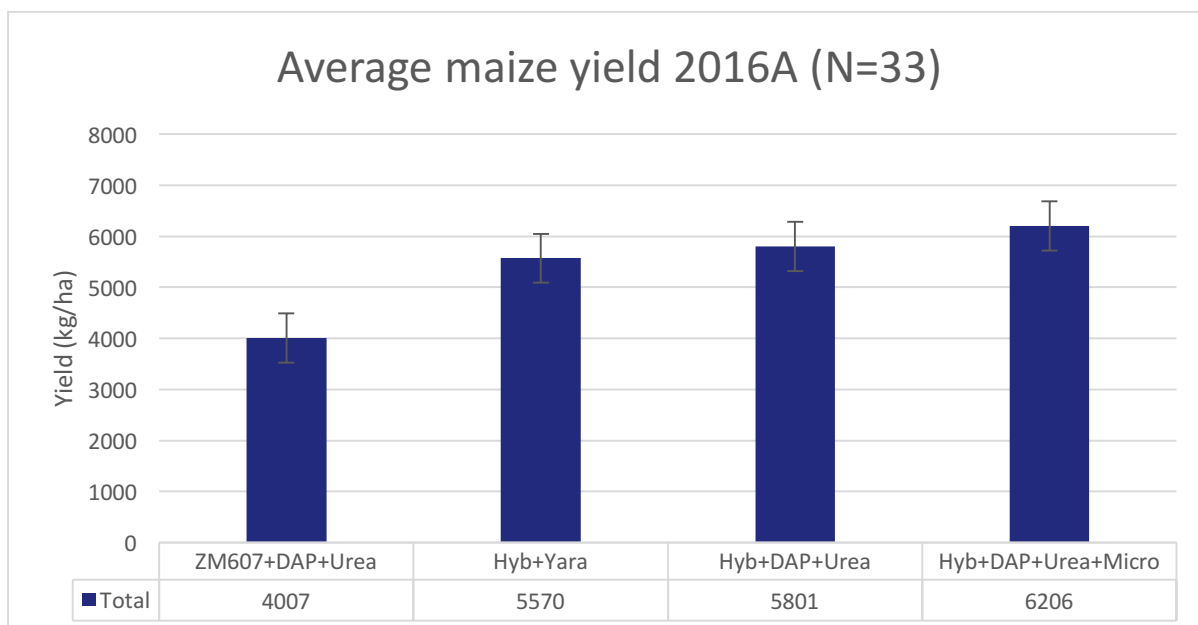


Treatments:

- ZM607 (OPV), no fertilizer
- SC513 (hybrid), organic fertilizer, 100 kg/ha DAP, 100 kg/ha Urea

3.2 2016 A Season

Results from the 2016A on-farm demonstrations (33) reconfirmed that maize yields of 4 to 6 t/ha are feasible and that the use of maize hybrids increases yields by about 1.8 t/ha compared with ZM 607, a widely used open-pollinated variety (OPV). The addition of micronutrients to the standard fertilizer recommendation of 100 kg/ha DAP and 100 kg/ha Urea leads to an additional yield increase of about 400 kg/ha. The treatments using the hybrid variety PAN 53 and Yara's fertilizer (which also includes micronutrients) or standard fertilizer with micronutrients did not show a significant yield difference compared with treatment including hybrid seed plus the standard fertilizer recommendation without micronutrients.



Treatments:

- ZM607 (OPV), 100 kg/ha DAP, 100 kg/ha Urea
- PAN 53 (hybrid), Yara Cereal fertilizer
- PAN 53 (hybrid), 100 kg/ha DAP, 100 kg/ha Urea
- PAN 53 (hybrid), 100 kg/ha DAP, 100 kg/ha Urea, micronutrients

Yara Cereal fertilizer:

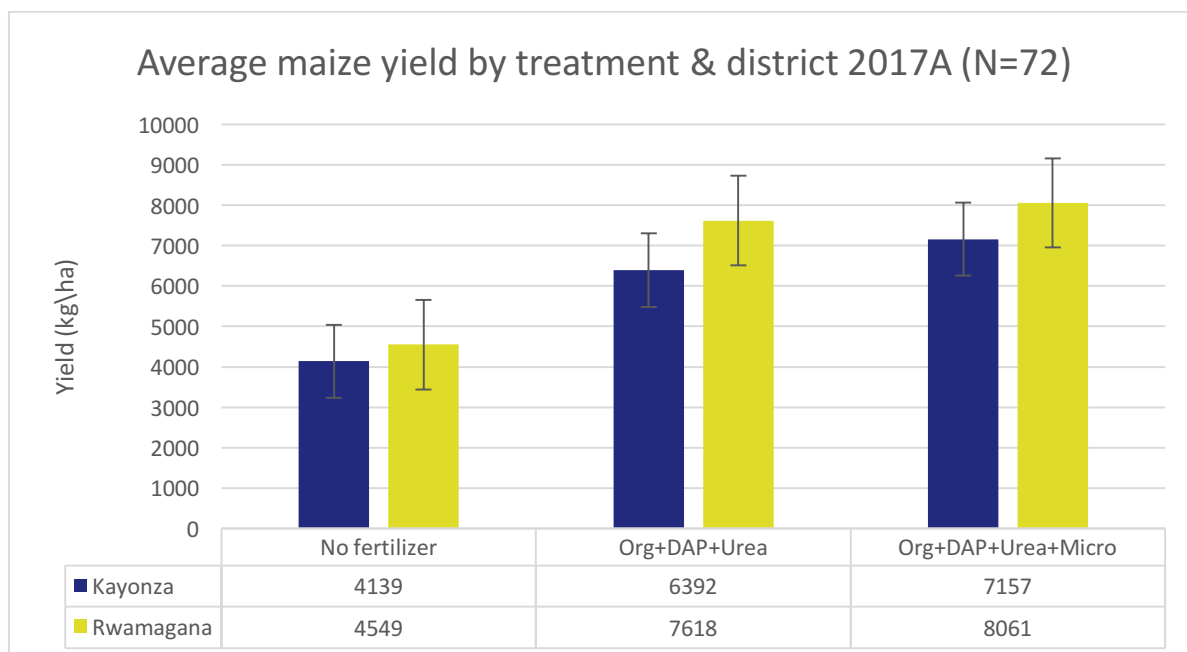
- Basal dressing: Yara miller (23-10-5 and micronutrients MgO: 2%, S: 3%, Zn: 0.3%), 100 kg/ha (basal dressing)
- Top dressing: Amidas (40 N + 5.5 S), 50 kg/ha (top dressing)

Micronutrients:

- 35 kg/ha ammonium sulphate, 4 kg/ha zinc sulphate, 7 kg/ha borax, 2 kg/ha copper sulphate.

3.3 2017 A Season

A total of 72 demonstrations on different fertilizer treatments were again conducted during the 2017 A season in Rwamagana and Kayonza districts. The control results below show the potential to improving yields to 4.5 t/ha by just using hybrids without fertilizer but applying good agricultural practices and often benefitting from residual fertilizer from previous seasons. Yields of 6-7 t/ha can be obtained when fertilizers are applied. When micro-nutrients are added to the standard fertilizer recommendation of DAP and Urea, this resulted in an average yield of between 7 to 8 t/ha. Yields were slightly lower in Kayonza district mainly because of the lower rainfall in that District.



Treatments:

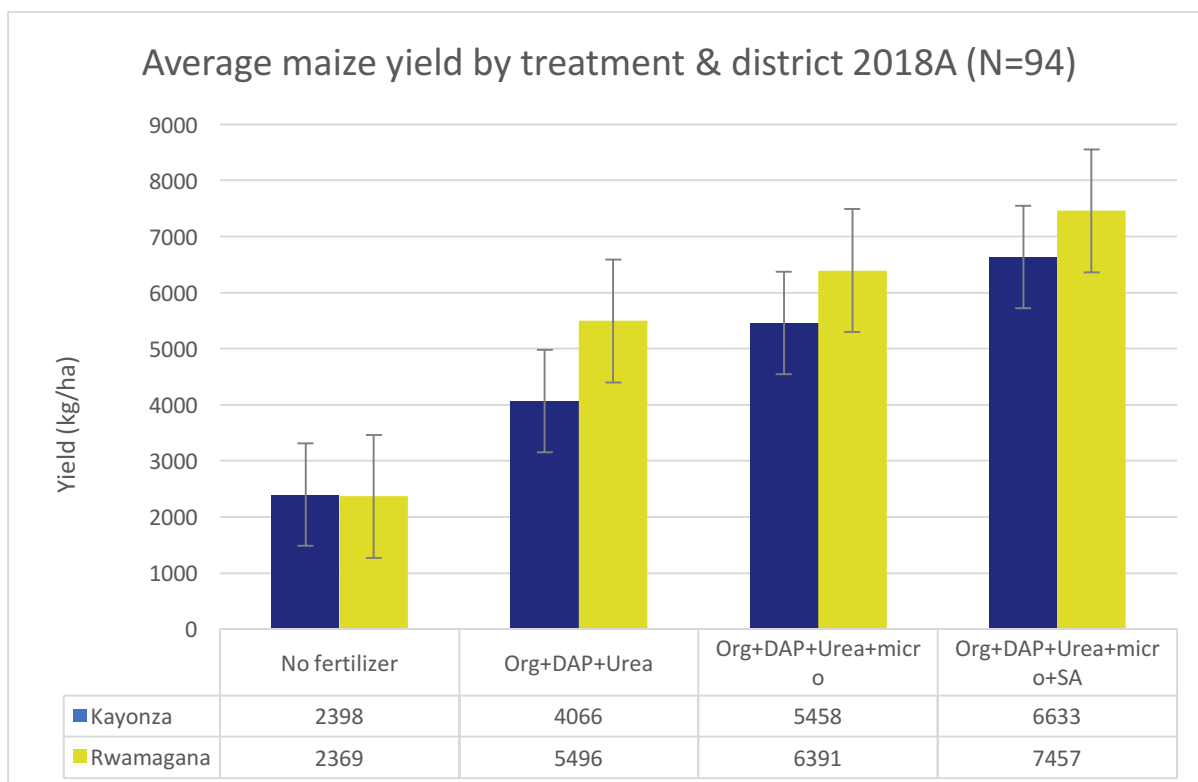
- PAN 4M21 (hybrid), no fertilizer
- PAN 4M21 (hybrid), organic fertilizer, DAP 100 kg/ha, Urea 100 kg/ha
- PAN 4M21 (hybrid), organic fertilizer, DAP 100 kg/ha, Urea 100 kg/ha, micronutrients

Micronutrients:

- 35 kg/ha ammonium sulphate, 4 kg/ha zinc sulphate, 7 kg/ha borax, 2 kg/ha copper sulphate

3.4 2018 A Season

The project conducted 94 demonstrations during the 2018 A season, combining hybrid maize and different fertilizer regimes (i.e. no fertilizer, standard recommendation of DAP and Urea and standard recommendation plus micronutrients and Soil Activator). By using RAB's standard fertilizer recommendation (hybrid maize and fertilizers), the yield is doubled compared to the control of no fertilizer. When applying the full package is applied, maize yield can be tripled (from 2.5 to 7.5 ton/ha). Currently, the use of micronutrients and Soil Activator is not yet widespread due to the lack of availability of these inputs. In addition, farmers are still reluctant to apply the full dose of standard fertilizer due to erratic rainfall. It is worthy to note that the 2018 A control yield (no fertilizer) is only around half of the 2017 A control yield. The cause of this difference is not clear but likely linked to site selection.



Treatments:

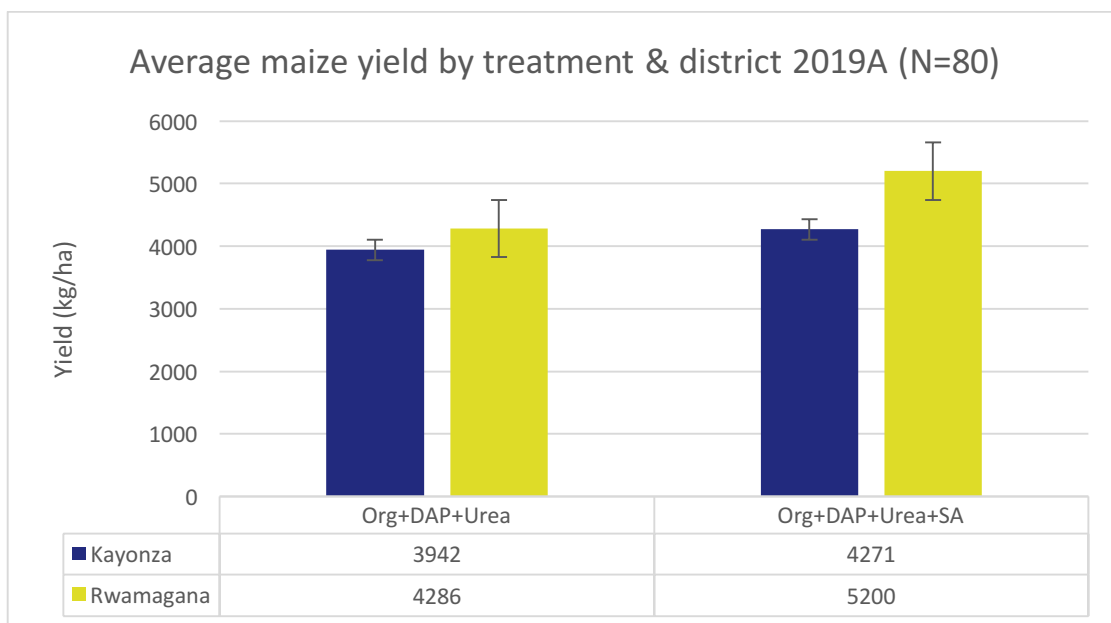
- PAN-4M21 (hybrid), no fertilizer
- PAN-4M21 (hybrid), organic fertilizer, DAP 100 kg/ha, Urea 100 kg/ha
- PAN-4M21 (hybrid), organic fertilizer, DAP 100 kg/ha, Urea 100 kg/ha, micronutrients
- PAN-4M21 (hybrid), organic fertilizer, DAP 100 kg/ha, Urea 100 kg/ha, micronutrients, Soil Activator 5 kg/ha

Micronutrients:

- 35 kg/ha ammonium sulfate, 4 kg/ha zinc sulfate, 7 kg/ha borax, 2 kg/ha copper sulfate

3.5 2019 A Season

During the 2019 A season the project conducted 80 on-farm demonstrations comparing the standard fertilizer rates with and without Soil Activator. Yields are lower than in previous years, yet still higher than before the project, mainly due to the late start of the rains.



Treatments:

- PAN-4M21 (hybrid), organic fertilizer, DAP 100 kg/ha, Urea 100 kg/ha
- PAN-4M21 (hybrid), organic fertilizer, DAP 100 kg/ha, Urea 100 kg/ha, Soil Activator 5 kg/ha

3. Conclusions

During the CREATE/Rwanda project, average maize yields at cooperative level increased from 2 to 3 t/ha but are still falling short of the yields which have been achieved in the on-farm demonstrations (4-8 t/ha). The main challenges include:

- Farmers' reluctance to invest in improved inputs (primarily seed and fertilizer) as a result of climatic uncertainties but also low adoption of other good agricultural practices: planting date, weeding, pest control, and post-harvest handling.
- Unreliable input supply, mainly for seeds (quality and timeliness) resulting from changes in government policy. During the first half of the project, government subsidies helped to make fertilizer and hybrid maize seed available to many smallholder farmers. However, in 2018 the Government decided to shift from importing seeds to local seed production. The immediate effect is a reduction of yields as farmers had to revert to open-pollinated varieties.

The CREATE project has been able to address the market access issue by linking cooperatives to a guaranteed buyer, yet input supply and weather uncertainties were largely beyond the control of this project. While efforts were made by CREATE to introduce small scale irrigation technologies, many farmers are still dependent on rain fed agriculture and do not have access to irrigation facilities.

Recommendations

In future, agricultural insurance and climate information services may help to mitigate the effects of climate change on crop production. It is also expected that locally produced hybrids will become available in the future when the local seed sector takes off. Improved coordination among the main maize buyers, particularly through the Farmer to Market Alliance facilitated by WFP, is also expected to improve incentives for farmers to adopt improved practices.