

N and P will do!

An Effective Fertilizer Strategy
for Ethiopia



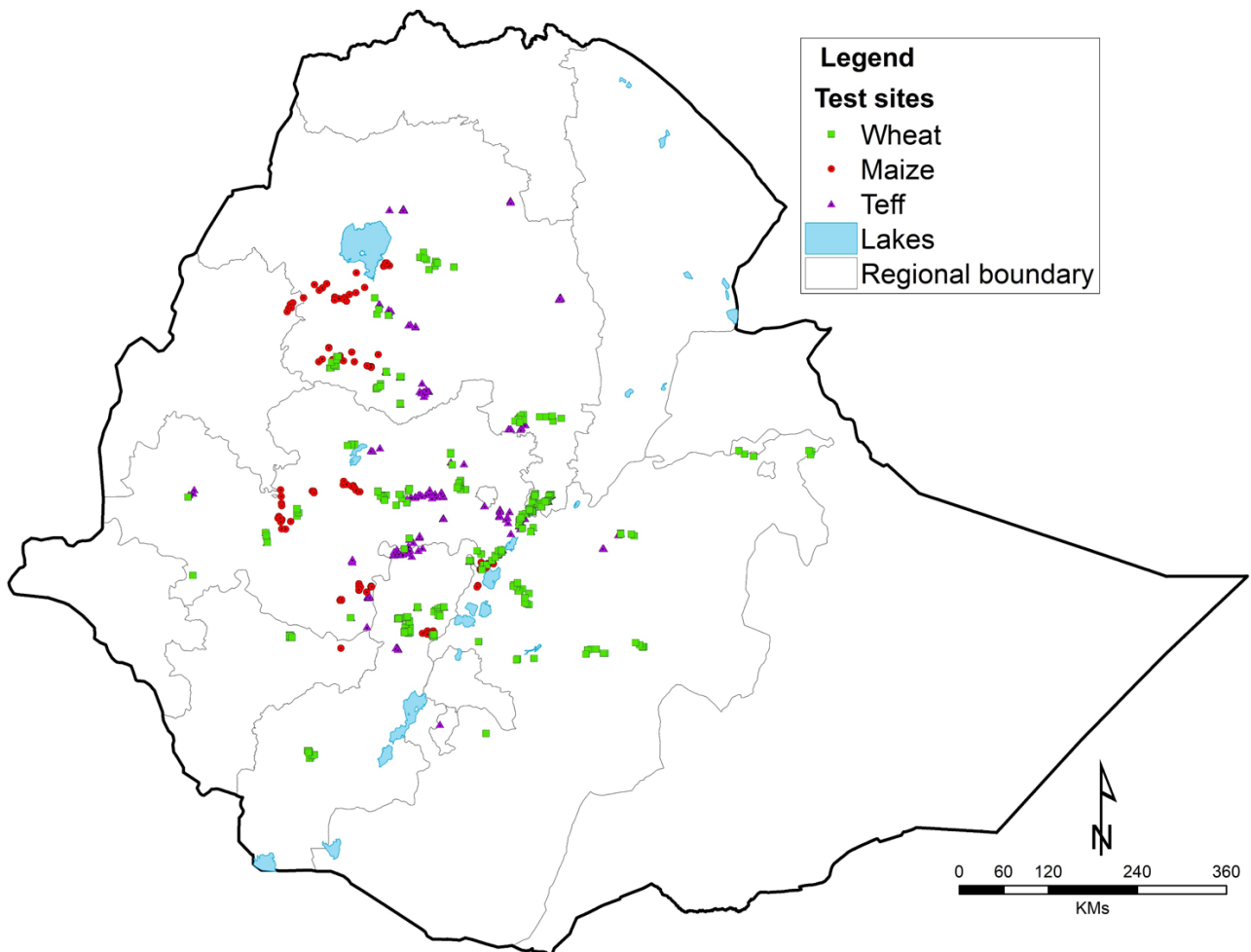
For feeding a nation, one needs fertile soils and effective and efficient use of fertilizer inputs. There are multiple options to achieve efficient use of fertilizers. A large testing program on teff, maize and wheat shows how millions of foreign currency could be saved if fertilizers containing only the nutrients that are critically needed are applied. The trials revealed that these crops strongly respond to nitrogen (N), to a lesser extent to phosphorus (P), and only to a limited extent to other macro and micro-nutrients which have been added to the fertilizer mix in Ethiopia since 2015. Concentrating on N and P supply could hence tremendously lower fertilizer costs for farmers and the whole economy. Based on these findings, a new fertilizer strategy should be developed by integrating the inorganic and organic options and other ways to keep soils fertile and yields high.

Why is it critical?

The use of agricultural inputs is key to raising crop productivity and overall agricultural production. Therefore, enhancing the availability of fertilizers to farmers is a priority of the government of Ethiopia. In 2015 the Ethiopian Soil Information System (EthioSIS) was established, which was followed by shifting from conventional Nitrogen (N) and Phosphorus (P) to multi-nutrient fertilizers, including Potassium (K), Sulphur (S), Zinc (Zn), and Boron (B) with the expectation of yield increase. However, a current study shows they do not seem to provide the anticipated added value.

How do we know?

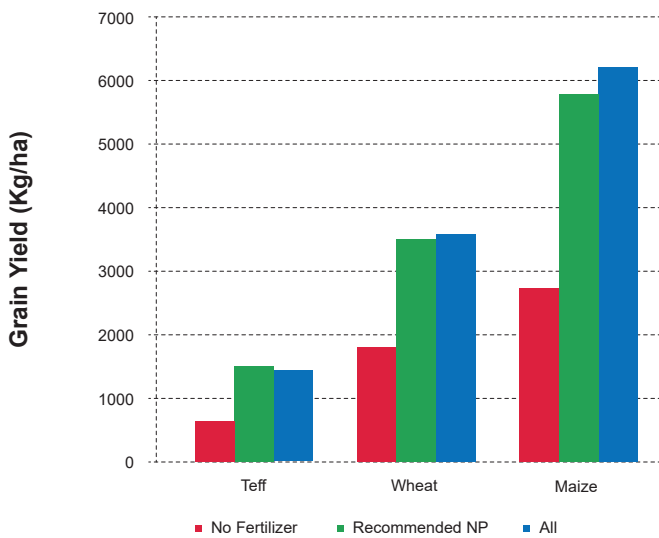
In 2021, extensive field trials covering various locations on teff, maize and wheat showcased the yield-depressing effect of each omitted nutrient. The scientists compared no use of fertilizer at all (No. fert.) to all-nutrients included (All) recommended based on EthioSIS, and every option in between to see if some nutrients could be omitted without consequences. Their benchmark was the so-called 'Recommended' N and P level which is the same as recommendations before the adoption of EthioSIS. The trials were mostly on farmers fields in order to cover a realistic situation and as many environments as possible. Hence, the results can inform good decision making.



Field trial site locations

What did we find?

Yield response



National average yield response to three different levels of fertilization for three crops.



Teff greatly responded to N and P but didn't react to micronutrients (as included in All)



For wheat, the use of all nutrients recommended after EthioSIS (All) gave a tiny advantage in pockets while not applying fertilizer halved the yield.

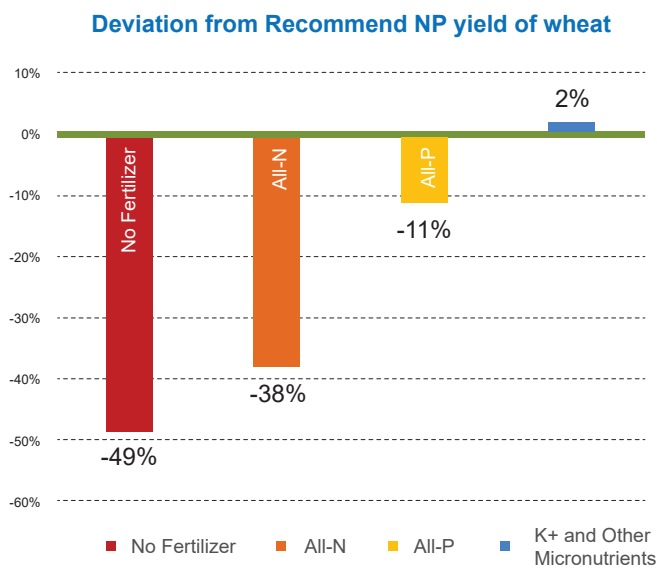


While NP is sufficient for maize production, the micronutrients show effect in some specific areas.

*Some trials show pockets of response to K, S, Zn and/or B.
The yield for only Recommended NP and All was comparable.
Yields would collapse in case of omitting all fertilizers.*



Yield penalty



Not applying fertilizer will half yield!

Missing N will reduce yield tremendously.

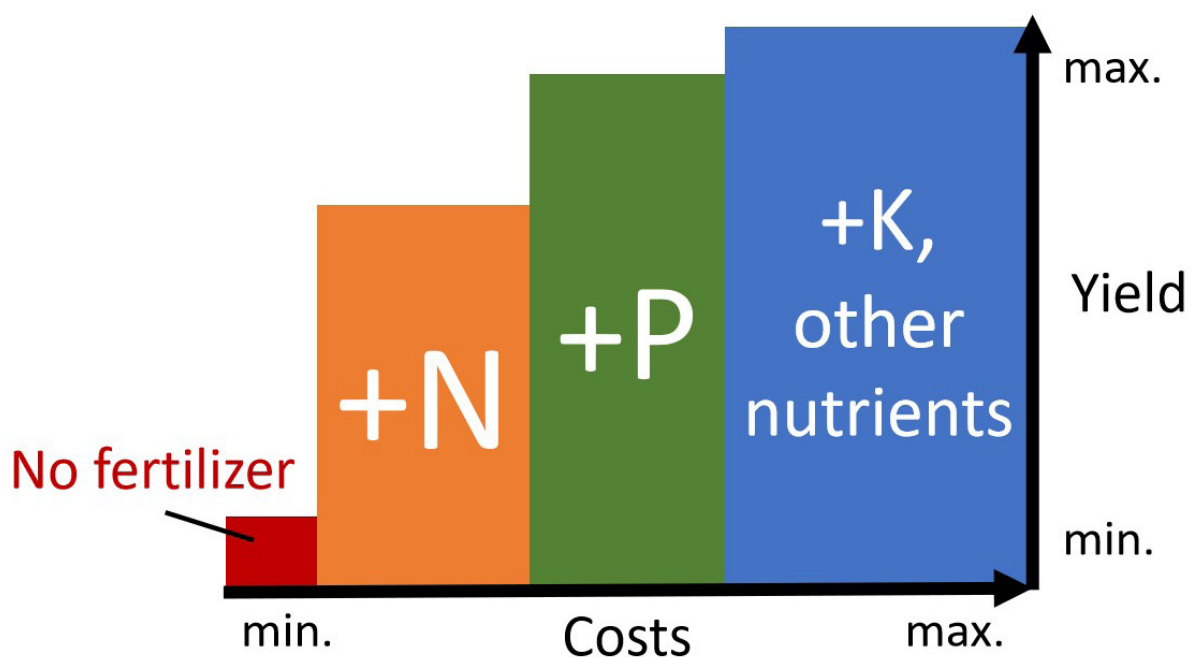
No P will not be so bad (~10% penalty) but still significant.

Omitting K, S and other micronutrients has no significant penalty (~2%).

Relative divergence from the yield achieved by applying Recommended NP when admitting certain or all nutrients and when adding micronutrients (All).

Cost Comparison

In terms of cost, the use of the previously recommended N and P was ~35% (27-41%) cheaper than using all the nutrients recommended based on EthioSIS (All).



Recommendation

Currently, no convincing case for multi-nutrient fertilizers!

- Only 0 to 10% yield increase was attained by adding K, S, Zn and B compared to Recommended NP
- Adding additional nutrients increases costs
- Leaving N out of the fertilizer mix seriously and badly affects crop yields
- P can partly be mobilized from the soil but only short-term

Make the most out of mineral fertilizers!

- Use Integrated Soil Fertility Management (ISFM) to reduce losses and recycle nutrients by utilizing other inputs;
 - organic fertilizers,
 - using species that fix nitrogen from the air,
 - integrating tree crops,
 - erosion control measures,
 - applying rock phosphates, bone meal, and cattle urine.
 - In addition, acid soils need liming, and Vertisols require measures that reduce waterlogging.
 - The use of ISFM in Ethiopia led to 67% yield increases.
- Improve fertilizer recommendations to be more soil- and crop-specific and to aim for the most economic outcome.

Keep an eye on other nutrients!

- Some sites have deficiencies, seriously affecting yields there
 - Some other crops might need additional nutrients to thrive
- **Monitor K and other nutrients to detect depletion and counter them early**



→ **Increased fertilizer efficiency and reduced need for it**

Use recommended NP levels, improve site-specific recommendations, and apply ISFM for cutting costs while increasing the productivity of crops in Ethiopia.



Summary

The fertilizer strategy should concentrate on nitrogen, followed by phosphorus while other nutrients can be supplied when required.

Ethiopia will spend more than a billion USD on fertilizer each year! Saving on the amount needed or the price of fertilizer will tremendously affect input costs faced by farmers and the government. Both will help to reduce food prices and alleviate pressure on the budgets of both government and individual households.

Ethiopia can save ~350 Million USD annually without decreasing yields by switching to the Recommended NP.



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