

## Recommendations

Land productivity under continuous cropping in the high and medium potential areas can be maintained if you do the following:

- Apply 1 lorry (5 tonnes) of manure per hectare every year to stop soil fertility decline
- Apply 2 lorries (10 tonnes) of manure per hectare every year to improve crop yields
- Apply 1 lorry (5 tonnes) of manure plus 2.5 bags TSP and 4.5 bags CAN per hectare every year to achieve high yields
- Use stover as cattle feed and return it to the farm as animal manure
- Monitor soil fertility every 5 years by taking a plant residue-free soil sample from the surface (10 – 15 cm) soil to a soil test laboratory for analysis. The actual nutritional status of the soil will be determined and a client-oriented recommendation given.

Samples are tested for a fee at the Kenya Agricultural Research Institute centres located at NARL, Muguga, Embu, Katumani, Kisii, Kakamega, Thika, Kitale and Mtwapa.



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# EFFECTS OF ORGANIC AND MINERAL FERTILISERS ON MAIZE AND BEAN YIELDS



## Soil Management Issues

*Poor soil management has led to a serious decline of soil fertility in the high and medium potential areas of Kenya*

*Smallholder farmers have problems producing enough food for household consumption*

*Declining crop yields have led to increased food insecurity, poverty, and inevitably, to reduced usage of added nutrient inputs on the farm*

## Towards Maintenance and Improvement of Soil Fertility

### Introduction

The main constraint to maize and beans productivity in the medium and high potential areas of Kenya is low availability of nutrients, particularly phosphorus and nitrogen. Fertiliser recommendations for food crops have traditionally been based on short-duration field trials, but such recommendations overlook the long-term effects of the applied inputs on soil fertility and crop yields.

One of the oldest on-going soil fertility trials in Africa is the long-term trial at the National Agricultural Research Laboratories (NARL), Kabete along Waiyaki way. It was started in 1976 with the aim of studying the long-term effects of organic and mineral fertilisers on soil fertility and crop yields particularly, maize and beans.

### NARL - Long term soil fertility trial

The soil management strategies (treatments) applied to the long term trial are:

1. Mineral fertilisers at two levels:  
2.5 bags Triple Super Phosphate (TSP) + 4.5 bags Calcium Ammonium Nitrate (CAN) ha<sup>-1</sup> (N1P1)  
5 bags TSP + 9 bags CAN ha<sup>-1</sup> (N2P2)
2. Cattle manure at two levels 5 tonnes ha<sup>-1</sup> and 10 tonnes ha<sup>-1</sup> (FYM1, FYM2)
3. Combination of treatments 1 and 2 at both rates of manure and fertiliser applications (N1P1 + FYM1, N1P1 + FYM2, N2P2 + FYM1, N2P2 + FYM2)
4. A control with nothing added (NIL)
5. Stover returned to one half of the treatments

Note: 1 ha = 2.5 acres; 1 lorry = 5 tonnes;  
1 bag of fertilisers = 50 kg; 1 bag of grain = 90 kg

Agronomic practices applied by the small-scale farmers such as land preparation by hand digging and weeding are applied. Maize hybrid – ‘H512’ – is usually planted as a sole (mono) crop during the long rains (March – June). Fertilisers and manure are applied once a year, prior to sowing, while CAN is applied as a top dress during the 7th week. Where applicable, stover is incorporated during land preparation. Bean variety ‘Mwezi moja’ is grown during the short rains, on residual fertility remaining from fertiliser and manure applied during the preceding maize growing season. These strategies have been maintained as described here for the last 26 years.

### Results



Beans cultivated with (left) and without added nutrients (right)

Analysis of results after 23 years are shown in Table 1. They can be summarised as:

- Continuous cultivation without application of mineral fertilisers or manure resulted in a steady decline of yields.

- Maize grain yields increased two-fold (200%) when manure and fertiliser were applied together.
- The higher the rate of fertiliser or manure application, the greater the yields realised.
- Incorporation of maize stover residue did not increase maize yields, but it resulted in small yield increases in beans.
- These treatments gave similar yields: 10 tonnes manure per hectare per year; 2.5 bags TSP plus 4.5 bags CAN per hectare per year plus 5 tonnes manure; 5 bags TSP plus 9 bags CAN + 5 tonnes of manure per hectare per year (Fig 1).
- Applying double the rate of fertiliser did not increase the yields of maize or beans substantially, and was uneconomical.

