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# Contribution of *Gliricidia sepium* green leaf biomass on maize grain nutrient properties

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## Introduction

Agroforestry practices improves soil health which in turn improves crop nutrient concentrations and quality. This study examined how agroforestry tree (*Gliricidia sepium)* green leaf biomass manure incorporation improved maize grain nutrient compositions.

## Objective

The study primary objectives was to:

- Assess the impact of agroforestry-based interventions on the nutrients of the selected maize food crop
- Determine if agroforestry practices result in healthier and nutrient-rich maize produce.

## Materials and Methods

The study was conducted in five chiefdoms of Eastern Zambian for three crop-growing seasons (2019–2022) on 13 farmer-led demonstration trial sites.

Three treatments were tested that included Maize under *Gliricidia* alleys with green leaf biomass incorporated at the onset of the cropping season (T1), Chemical fertilized maize (T2) and Unfertilized maize (T3) .

Grain samples were analysed for crop nutrients contents using standard laboratory methods. Grain samples were collected and analysed for crop nutrients.

**Figure 1: *Gliricidia* leaf biomass incorporation into the soil** (*credit-Njoloma Joyce*)

**Figure 2: Maize from *Gliricidia* leaf biomass incorporated plot at harvest** (*credit-Njoloma Joyce*)

**Table 1: Crop nutrients and functional properties analysed**

| Properties | Parameter analyzed |
|---|---|
| ▪ *Nutritional properties* | Fat, Ash, Protein, Starch, Crude Fibre, Sugar, Amylose, Total carbohydrate |
| ▪ *Antinutritional properties* | Phytates and Tannins |
| ▪ *Functional properties* | Water absorption capacity, Oil Absorption Capacity, Bulk Density of grains, Swelling power and Solubility |
| ▪ *Mineral properties* | Nitrogen, Sodium, Potassium, Magnesium, Manganese, Copper, Iron and Zinc |

## Results and Discussion

**Table 2: Nutritional, antinutritional, and functional properties of maize by Treatment (N=111 )**

| Parameters | Maize + Gliricidia (T1) | Maize + mineral fertilization (T2) | Maize only (T3) |
|---|---|---|---|
| **Nutritional (NP)** | | | |
| % MC | 6.66 b | 6.70 b | 5.82 a |
| %Ash | 1.29 a | 1.35 b | 1.29 a |
| %Protein | 7.57 a | 8.28 c | 7.68 b |
| %Sugar | 3.09 a | 3.51 c | 3.36 b |
| %Starch | 72.23 b | 71.49 a | 71.70 a |
| %Amylose | 25.04 b | 24.19 a | 25.64 c |
| %Amylopectin | 74.96 b | 75.81 c | 74.36 a |
| **Antinutritional (ANP)** | | | |
| %Phytic acid | 6.04 a | 5.41 a | 5.82 a |
| Tannin (mg/g) | 6.27 b | 6.78 a | 6.34 b |
| **Functional (FP)** | | | |
| % WAC | 159.53 a | 163.81 b | 163.78 ab |
| BD (g/ml) | 1.61 c | 1.51 b | 1.25 a |
| SP | 7.68 b | 7.46 a | 7.20 a |
| %Soluble | 14.59a | 15.81 ab | 18.38 b |
| Dispersibility | 70.64 b | 67.369 a | 66.32 a |

Table 2 shows that Treatments had significant effects ($P<0.0001$) on all NPs, ANPs, and FPs except %Crude fibre, %Fat, %Total carbohydrate (CHO), and %Metabolizable Energy (ME). Maize under T1 (Gliricidia alleys) had higher starch and reduced tannin contents compared T2 (mineral fertilizer) and T3 (maize only).

**Table 3: Effect of treatment on the mineral composition of maize (N =111 )**

| Parameter | Gliricidia + Maize (T1) | Fertilized Maize (T2) | Maize only (T3) |
|---|---|---|---|
| N (%) | 1.21 b | 1.40 c | 1.21 b |
| P (mg/100g) | 253.06 b | 237.12 a | 240.90 b |
| Ca (mg/100g) | 133.48 a | 184.00 b | 229.58 c |
| Mg (mg/100g)) | 73.60 c | 71.45 b | 59.78 a |
| K (mg/100g) | 351.61 c | 275.21 a | 220.38 a |
| Na (mg/kg) | 20.57 a | 24.17 b | 25.88 c |
| Mn (mg/kg) | 15.51 c | 11.91 b | 6.15 a |
| Fe (mg/kg) | 20.22 c | 18.85 b | 16.44 a |
| Cu (mg/kg) | 3.35 a | 3.78 b | 3.52 b |
| Zn (mg/kg) | 14.19 a | 22.90 b | 31.61 c |

Table 3 shows that Gliricidia + maize (T1) had higher values for P, Mg, K, Mn and Fe content than both the Fertilized maize (T2) and the control (T3)

## Conclusion

The results implies that Gliricidia sepium leaf biomass incorporation has potential to improved the basic nutritional properties and reduced the antinutritional component of maize compared to maize only (Control).. Thus, ensuring healthier and nutrient rich maize produce for smallholder farmers

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