

Effects of Integrated Use of *Calliandra calothyrsus* and Maize Stover with Urea on Maize Yield Components under *Striga* Infestation in Western Kenya

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Abstract The effect of integrated use of *Calliandra* or maize stover with urea on *Striga* infestation and maize yield components was assessed in a field experiment carried out for five consecutive seasons on a clay loam Ferralsol in western Kenya. Urea and *Calliandra* or maize stover were combined to supply N at 75 kg ha⁻¹ from both sources in 0:0, 100:0, 80:20, 60:40, 40:60, 20:80, 0:100 ratios. A randomized complete block design (RCBD) with 12 treatments replicated four times was used with maize hybrid (WS 502) as a test crop. All the three ear traits (ears per plant, ear length, and ear diameter), kernels per row and grain yields were significantly higher under *Calliandra* (45 kg N ha⁻¹) combined with urea (30 kg N ha⁻¹) and *Calliandra* (30 Kg N ha⁻¹) combined with urea (45 kg N ha⁻¹) or maize stover (45 kg N ha⁻¹) combined with urea (30 kg N ha⁻¹) and maize stover (30 kg N ha⁻¹) combined with urea (45 kg N /ha⁻¹). Number of ears per plant was a major yield component and accounted for (R²=0.74) of the variation in grain yield under *Striga*. Stepwise regression analysis showed ears per plant to be the most important yield component under *Striga* infestation (R²=0.58) followed by kernels per row (R²=0.38).

Keywords Maize Yield Components, *Striga*, *Calliandra*, Maize Stover, Urea

1. Introduction

Striga, commonly known as witchweed, is the most economically important parasitic weed seed plant in the world. It is a genus of 28 species of parasitic plants that occur naturally in parts of Africa, Asia and Australia. The genus is now classified in the family of Orobanchaceae although it was earlier placed in the family Scrophulariaceae [1]. Four species of the parasite cause economic losses in cereal crops and these are *S. hermonthica* (Del.) benth., *S. asiatica* (L.) kuntze, *S. aspera* (Willd.) Benth. And *S. forbesii* Benth. Among these, *S. hermonthica* is the most widespread and causes the greatest losses.

Striga hermonthica has the potential to threaten food security in many countries and is particularly significant in Africa [2]. It decimates maize which is the main staple food crop for close to 300 million people in Africa [3,4] with yield loss estimated at 10 million tons grain worth \$ US 7 billion [5,6].

Striga infests about 212,000 hectares (about 15% of the arable land) in the Lake Victoria basin of Kenya [7],

causing yield losses of between 30-50% although losses of up to 100% have been reported [8]. Results of a survey on 83 farms in Western Kenya revealed that 73% of the farms are severely infected with *S. hermonthica* [9]. The potential maize yield in Western Kenya is 4-5 ton/ha [10] with the average yield loss attributed to *Striga* infection being 1.15 tons per hectare for maize [11]. *Striga* weeds are known to cause crop yield losses of between 20-100% for maize [12, 13] and 20-50% in sorghum [14, 13] although 100% yield loss is not uncommon. The build-up of *Striga hermonthica* (Del) Benth (witchweed) is associated with declining soil fertility resulting from continuous-intensive cropping without adequate fertilizer inputs [15, 10], a common phenomenon in densely populated farming systems of western Kenya [16]. This profound yield loss necessitates the identification of management systems that increase and maintain adequate levels of soil fertility while at the same time reducing the *Striga* weed infestation. Integrated Soil Fertility Management (ISFM) has been demonstrated as a strategy that can address the complexities and peculiarities of soil fertility management on smallholder farms, help low resource endowed farmers mitigate problems of poverty and food insecurity by improving the quantity of food, income and resilience of soil productive capacity [17].

Yield a quantitative trait is functionally related to yield components. Information on the effect of integrated soil fertility management on maize yield components under *Striga* infestation could be useful to physiologists, modelers and agronomists. Research evidence regarding organic resource types and fertilizer application effects on *Striga* and maize performance under small-holder farming conditions is insufficient and fragmentary in Western Kenya and multiple agro-ecozones infested with *Striga*. This information could provide a vehicle for increasing efficiency of input and resource use by the staple food security crop, reducing the risks farmers face in using purchased inputs and encourage the adoption of improved technologies. The objective of this study was therefore to assess the effect of applying *Calliandra* and maize stover with urea on maize yield components under *Striga* infestation on small-scale farming conditions in western Kenya.

2. Materials and Methods

2.1. Experimental Site

This study was conducted at Nyabeda (N 0° 08', E 34° 24') in Siaya District of western Kenya. The area is classified as midlands (LM 2) with an altitude of approximately 1330 m above sea level [18]. Rainfall is bimodal, allowing two cropping seasons a year with the long rains starting from March ending in July and the short rains starting from August ending in November, with a mean annual of 1800 mm. Mean annual temperature ranges between 22°C and 24°C. The soils are classified as

Ferralsols/Nitisols (Kandiudalfic Eutradox), clayey, reddish, deep and well drained [18]. The soils chemical and physical properties sampled from the top 0-15 cm had the following characteristics; pH=4.9, total soil organic carbon 2.33 kg⁻¹, total soil N=0.23 g kg⁻¹, Olsen P=2.75 mg kg⁻¹, exchangeable Ca=7.95 cmol_c kg⁻¹, exchangeable Mg=4.78 cmol_c kg⁻¹, exchangeable potassium=0.05 cmol_c kg⁻¹, exchangeable Na=0.40 cmol_c kg⁻¹, clay=23%, silt=14% and sand =63%.

2.2. Experimental Design, Establishment and Management

The trial had 12 treatments comprising of two plant residues applied solely, or in combination with inorganic fertilizer (urea), sole inorganic fertilizer and a control. The plant residues were maize stover and *Calliandra calothyrsus* (Table 1). The experiment was laid out in a randomized complete block design (RCBD) with twelve treatments replicated four times. A substitution type of experiment was used whereby the total N rate was fixed at the recommended rate of 75 kg N ha⁻¹ for maize in the study area. Treatments were combined in the following ratios i.e. 0:0, 100:0, 80:20, 60:40, 40:60, 20:80, and 0:100 so as to supply a total of 75 kg N ha⁻¹ per treatment except the control i.e. treatment 0:0 where no N inputs were applied. Maize stover was obtained from neighbouring farms and *Calliandra* from an established demonstration plot within the area. At the beginning of every planting season, the plant residues were weighed, chopped and incorporated into the soil at a depth of 15 cm during land preparation. Fertilizer N in the form of urea was applied in splits with 33.3% of corresponding rates applied at planting and the rest (66.6%) six weeks later. Phosphorus (P) and potassium (K) were uniformly applied to all plots at the rate of 40 kg P and 20 kg K ha⁻¹ as triple super phosphate and muriate of potash, respectively at the beginning of each season. One day after treatment application, a commercial maize variety WH 502, commonly grown by farmers in the area, was planted as a test crop at a spacing of 75 cm and 25 cm in inter and intra row spacing, respectively. Other agronomic procedures for maize production were appropriately followed after planting. Maize was harvested at physiological maturity and grain yield and yield components determined.

2.3. *Striga* Count and Collection in the Field

Data were collected on *Striga* infestation in all the plots. *Striga* shoots that emerged in the field were counted in the six middle rows (net plot area 27 m²) at 2-week intervals starting from the day of *Striga* appearance and the maximum number of shoots recorded in each plot was recorded as *Striga* infestation. *Striga* emergence data were converted to the number of *Striga* plants m⁻². Data on maize damage score was based on a scale of 1 to 9 (1=normal plant growth, no visible damage; 9= severe damage or death) at 10 weeks after planting of maize [19].

Table 1. Description of treatments used in the field trial

Treatment	Types of plant residues	N from in plant residues [kg N ha ⁻¹]	N in form of urea [kg N ha ⁻¹]	Total N [kg N ha ⁻¹]
1	None	0 (0%)	0 (0%)	0
2	<i>Calliandra</i>	75 (100%)	0 (0%)	75
3	<i>Calliandra</i>	60 (80%)	15 (20%)	75
4	<i>Calliandra</i>	45 (60%)	30 (40%)	75
5	<i>Calliandra</i>	30 (40%)	45 (60%)	75
6	<i>Calliandra</i>	15 (20%)	60 (80%)	75
7	Maize stover	75 (100%)	0 (0%)	75
8	Maize stover	60 (80%)	15 (20%)	75
9	Maize stover	45 (60%)	30 (40%)	75
10	Maize stover	30 (40%)	45 (60%)	75
11	Maize stover	15 (20%)	60 (80%)	75
12	None	0 (0%)	75 (100%)	75

Table 2. Striga rating scale interpretations

Rating	Interpretation
1	Normal plant growth, no visible symptoms,
2	Small and vague purplish-brown leaf blotches visible
3	Mild leaf blotching with some purplish-brown necrotic spots
4	Extensive blotching and mild wilting. Slight but noticeable stunting and reduction in ear and tassel size
5	Extensive leaf blotching, wilting and some scorching. Moderate stunting, ear and tassel size reduction
6	Extensive leaf blotching with mostly frays necrotic spots. Some stunting and reduction in stem diameter, ear size and tassel size.
7	Definite leaf scorching, with gray necrotic spots, and leaf wilting and rolling. Severe stunting and reduction in stem diameter, ear size, and tassel size, often causing stalk lodging, brittleness, and husk opening at a late-growing stage.
8	Definite leaf scorching with extensive gray necrotic spots. Conspicuous stunting, leaf wilting, rolling, severe stalk lodging, and brittleness. Reduction in stem diameter, ear size and tassel size.
9	Complete scorching of all leaves, causing premature death or collapse of host plant and no ear formation

2.4. Statistical Analysis

Analysis of variance (ANOVA) and mean comparisons on the data to determine the effects of treatments on *Striga* incidence and maize yield components were done using Genstat 10 for windows (Release 8.1). *Striga* emergence data were transformed to log₁₀ (n+1) before statistical analysis. Average values of the respective traits in each season were used to generate correlation coefficients between grain yields and yield components. Stepwise regression analysis was employed to determine the most important yield components under *Striga*. Mention of statistical significance refers to P<0.05 unless otherwise stated. Significant means were separated using the LSD post-hoc tests.

3. Results

3.1. Maize Damage and *Striga* Emergence

Seasonal trends in *Striga* incidence over the period of study are summarized in Table 3. There were highly significant (p<0.001) differences between seasons. The highest *Striga* densities (115 plants m⁻²) were observed in sole maize stover (75 kg N ha⁻¹) and maize stover applied at

60 kg N ha⁻¹ combined with urea at 15 kg N ha⁻¹ (114 plants m⁻²). The two treatments had significantly higher *Striga* counts than all other treatments. Averaged over five seasons, *Striga* density was higher in the control and in treatments receiving more than 80% of N from maize stover (Table 3). In 2007 and 2008, *Striga* emergence was higher during long rains than the short rain seasons. The season by treatment interaction on *Striga* intensity was not significant (p=0.65).

There were highly significant differences (p<0.001) between treatments in damage scores (Table 3). The highest damage score (6.6) was recorded in the control while the lowest (2.4) was recorded under *Calliandra* (45 kg N ha⁻¹) combined with urea (30 kg N ha⁻¹). Damage scores ranks of the maize under different treatment corresponded to the level of soil mineral nitrogen in the soil.

3.2. Effect of Treatments on Maize Grain Yield Components

3.2.1. Ear traits

The effect of treatments and seasons on the number of ears per plant, ear length, and ear diameter were highly significant (P<0.001) (Table 4). All the three ear traits (ears

per plant, ear length, and ears diameter) were significantly higher under *Calliandra* (45 kg N ha⁻¹) combined with urea (30 kg N ha⁻¹) and *Calliandra* (30 Kg N ha⁻¹) combined with urea (45 kg N ha⁻¹) or maize stover (45 kg N ha⁻¹) combined with urea (30 Kg N ha⁻¹) and maize stover at (30 Kg N ha⁻¹) combined with urea (45 Kg N ha⁻¹) compared to

sole maize stover and the control. Ears per plant were highest (0.82), under maize stover (30 kg N ha⁻¹) combined with urea (45 kg N ha⁻¹) while the lowest ears per plant (0.56) were recorded in the control. Ear length and ear diameter followed the same trend. Sole maize stover had the lowest ear diameter (0.39).

Table 3. Effect of combined use organic residues and urea on *Striga* counts (m²) at Nyabeda, western Kenya (values in brackets are transformed values of *Striga* incidence log₁₀(x+1))

Treatments	Seasons					Striga tolerance score
	2007 LR	2007 SR	2008 LR	2008 SR	2009 LR	
Plants m ²						
Control	118 (2.07)	57 (1.76)	19 (1.28)	4 (0.60)	11 (1.04)	2.8
75CC+0U	146 (2.16)	45 (1.65)	13 (1.11)	4 (0.60)	9 (0.95)	3.6
60CC+15U	128 (2.11)	65 (1.81)	16 (1.20)	7 (0.85)	14 (1.15)	2.4
45CC+30U	117 (2.07)	29 (1.46)	10 (1.0)	4 (0.60)	12 (1.08)	2.6
30CC+45U	100 (2.0)	55 (1.74)	12 (1.08)	3 (0.48)	11 (1.04)	4.1
15CC+60U	105 (2.02)	38 (1.58)	13 (1.11)	4 (0.60)	8 (0.90)	4.5
75MS+0U	89 (1.95)	115 (2.06)	15 (1.18)	3 (0.48)	15 (1.18)	4.7
60MS+15U	141 (2.15)	114 (2.06)	16 (1.20)	7 (0.85)	15 (1.18)	3.0
45MS+30U	44 (1.64)	49 (1.69)	6 (0.78)	3 (0.48)	9 (0.95)	2.6
30MS+45U	68 (1.83)	37 (1.57)	9 (0.95)	5 (0.70)	8 (0.90)	3.4
15MS+60U	154 (2.19)	40 (1.60)	8 (0.90)	4 (0.60)	14 (1.15)	3.9
75U	126 (2.10)	49 (1.69)	11 (1.04)	4 (0.60)	9 (0.95)	3.7
Mean	111(1.96)a	58(1.68)b	13(1.01)c	4(0.67)d	11(1.01)c	
P treat	0.44(0.18)	<0.001(0.003)	0.74(0.15)	0.59(0.76)	0.57(0.35)	<0.001
LSD _{0.05}	NS	38 (0.28)	NS	NS	NS	
CV	(42)8.2	(38)8.8	(25)9.3	(30)15.1	(54)19.8	20
LSD treat	<0.001					1.62
P _r (season)	<0.001					
Pr (treat x season)	0.65					NS

'LR', 'SR', mean 'long rainy season', and 'short rain season', respectively, values in brackets are transformed values of *Striga* incidence log₁₀(n+1), CC=*Calliandra*, MS =maize stover, U=urea, NS= non-significant.

Table 4. Mean grain yields and yield components of maize under *Striga* infestation averaged over five seasons at Nyabeda

Treatment	Ears/ plant	Ear length (cm)	Ear diameter (cm)	Kernel rows	Kernels/ row	100 wt (g)	Grain yield (g/plant)
Control	0.56	13.3	4.0	13.0	26.9	24.5	24.0
75CC+0U	0.77	15.1	4.2	13.2	27.5	27.1	45.0
60CC+15U	0.64	14.6	4.3	13.4	30.8	25.3	37.1
45CC+30U	0.79	15.4	4.2	13.1	33.4	25.8	54.0
30CC+45U	0.79	15.4	4.3	13.7	32.2	25.6	48.5
15CC+60U	0.76	14.6	4.2	13.4	31.7	26.2	41.9
75MS+0U	0.64	13.3	3.9	12.3	27.4	22.9	30.5
60MS+15U	0.71	14.2	4.1	13.4	30.1	23.9	37.1
45MS+30U	0.80	15.1	4.3	13.1	32.6	25.1	50.0
30MS+45U	0.82	16.1	4.4	13.2	35.0	28.7	59.9
15MS+60U	0.76	15.2	4.3	12.9	33.4	27.1	45.4
75U	0.70	14.5	4.2	12.9	30.6	25.9	39.7
Mean	0.73	14.7	4.2	13.1	31.4	25.7	42.8
P (treat)	<0.001	<0.001	<0.001	<0.05	<0.001	<0.001	<0.001
P (season)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
P (treat x season)	0.184	NS	0.135	0.29	0.277	NS	0.002
LSD (treat)	0.108	1.14	0.16	0.72	3.27	2.15	11.0
LSD (season)	0.06	0.66	0.09	0.42	1.89	1.24	6.37
LSD (treat x season)	0.21	2.28	0.31	1.44	6.55	4.30	22.05
CV	7.0	3.0	2.5	2.2	3.7	1.5	13.3

Table 5. Correlation coefficient (r) between grain yields and yield components

Yield component	Season					Overall
	LR2007	SR2007	LR2008	SR2008	LR2009	
Ears per plant	0.80***	0.60***	0.84***	0.55***	0.38**	0.76***
Ear length	0.75***	0.38*	0.43**	0.28*	0.55***	0.37
Ear diameter	0.46***	0.40**	0.52***	0.35*	0.038**	0.39***
Kernels/row	0.05	0.45**	0.37**	0.47**	0.51***	0.48
Kernel rows	0.68***	0.20	0.36*	0.16	0.50***	0.62***
100-kernel weight	0.63***	0.10	0.46**	0.06	0.39**	0.37**

*, ** and *** Significant at 0.1, 0.05, 0.01 and 0.001 probability levels, respectively

3.3. Kernel Traits and Grain Yields

3.3.1. Number of grains per row

There were highly significant differences ($p < 0.001$) between seasons and treatments in kernels per row (Table 4). The highest kernels per row (35.0) was recorded under maize stover (30 kg N ha⁻¹) combined with urea at (45 kg N ha⁻¹) while the lowest (26.9) was recorded in the control.

3.4. Grain Yield

Grain yields and 100-grain weight were optimized at *Calliandra* (45 kg N ha⁻¹) combined with urea (30 kg N ha⁻¹) and *Calliandra* (30 Kg N ha⁻¹) combined with urea (45 kg N ha⁻¹) or maize stover (45 kg N ha⁻¹) combined with urea

(30 kg N ha⁻¹) and maize stover at (30 kg N ha⁻¹) combined with urea (45 Kg N ha⁻¹). Treatments with sole maize stover and the control had the lowest maize yields.

3.5. Relationship between Maize Grain Yield and Yield Components

All yield components except ear length and kernel rows were significantly ($p < 0.1-0.001$) correlated with grain yields (Table 5). However, the degree of association for the various yield components was dependent on season. Correlations were strong in the long rainy seasons than the short rainy seasons. This may be attributed to higher stress levels (*Striga*, nutrient and moisture) in the short rainy seasons. Ears per plant showed the highest correlation with

grain yield ($r = 0.76$, $p < 0.001$).

Table 6. Regression equations relating yield components (X) to grain yield (Y) under *Striga* and coefficients of determination

X ₁	Independent variable		
	Regression equation	S.E.	R ²
Ears/plant	Y = -11.31 + 74.29X ₁	4.54	58.55
Ear diameter	Y = -52.68 + 22.58X ₂	3.91	14.95
Kernels/row	Y = Y = -33.73 + 2.43X ₃	0.22	38.95
100 kernel weight	Y = -42.27 + 3.31 X ₄	0.34	33.17

$$Y = -86.10 + 58.05X_1 + 9.27X_2 + 0.54X_3 + 1.188X_4; R^2 = 72.41\%$$

Stepwise regression analysis showed ears per plant to be the most important yield component under *Striga* infestation ($R^2 = 0.58$), followed by kernels per row ($R^2 = 0.38$) (Table 6). This indicates that yield differences under *Striga* could be explained by variation in ears per plant and kernels per row. The overwhelming proportion of yield variation accounted by ears per plant shows that this trait was a major yield component under *Striga*, and it could be useful as a selection index.

4. Discussion

4.1. Striga Emergence

The lower levels of *Striga* infestation under maize stover (30 kg N ha⁻¹) combined with urea (45 kg N ha⁻¹) and *Calliandra* (45 kg N ha⁻¹) combined with urea (30 kg N ha⁻¹) could be attributed to higher mineral N levels that was provided by these treatments. High N levels have been reported to lead to a decrease in *Striga* infestation and an increase in crop yields [20]. Many scientists however, link the effect of nitrogen to delayed germination of the *Striga* seed, reduced radicle elongation, reduced production of *Striga* stimulant by the host plant and reduction of seeds response to the stimulants [21]. Higher densities of *Striga* in the control and sole maize stover may be attributed to low nitrogen levels in these treatments. *Striga* damage has been observed to be more pronounced in host plants grown in N deficient soils compared to those grown in soils well supplied with nitrogen [22]. Host plants produced in environments that are low in N produce higher levels of the *Striga* stimulant leading to higher *Striga* germination [23].

4.2. Ear Traits

Although ears per plant is known to be a genetically controlled characteristic [24], this trait was also influenced by nutrient availability. The higher ear per pant under maize stover (30 kg N ha⁻¹) combined with urea (45 kg N ha⁻¹) was mainly influenced by higher soil mineral N levels, while the control recorded low measures due to low soil nutrients. Low numbers of ears per plant may also be

attributed to higher *Striga* numbers in the control and sole maize stover treatments (Table 3). This does suggest that *Striga* effects on maize grain yield relate more to pre-than post-flowering stress. Ear reduction from pre-flowering stress results from cessation of ear development and ear abortion [25]. This is in contrast to insidious and more delayed pathogenic effects, which have little or no effect on ears per plant [26].

The higher ear length in the above soil fertility management applications might be attributed to good photo assimilate supply. The maximum assimilate supply should be available during maize grain filling [27]. The two to three-week period after 50% silking is a critical stage in maize development that is highly dependent on assimilate supply; the period when final kernel number is determined [28]. Hussaini, [29] reported similar response where they linked this significant increase in yield to favorable effect of nitrogen on cob length and cob diameter, factors that are known have direct bearing on the final grain yield.

4.3. Kernel Traits and Grain Yields

4.3.1. Number of grains per row

Kernels per ear is a product of rows per ear and kernel per row [30]. Since rows per ear is largely genetically controlled [31], variation in the number of kernels per ear would be expected to be largely due to differences in number of kernels per row. Earlier studies have shown that ear length is highly correlated with kernels per row studies [32]. However, a greater number of grains per ear observed under higher N rates might have resulted from the greater assimilates partitioning to the seeds as a result of a longer growth period and higher photosynthate availability during grain filling period [33]. A decrease in number of grains per ear under low N application might be attributed to poor development of the sinks and reduced translocation of the photosynthate [34].

4.4. Maize Grain Yields

The higher grain yields and 100-grain weight realized under *Calliandra* (45 kg N ha⁻¹) combined with urea (30 kg N ha⁻¹) and *Calliandra* (30 Kg N ha⁻¹) combined with urea (45 kg N ha⁻¹) or maize stover (45 kg N ha⁻¹) combined with urea (30 kg N ha⁻¹) and maize stover at (30 kg N ha⁻¹) combined with urea (45 Kg N ha⁻¹), is mainly attributed to high mineral N levels in these treatments. Higher nitrogen content facilitates chlorophyll formation, photosynthesis, assimilate production and higher partitioning of dry matter to ears that resulted in optimum production of yield components which have direct bearing on the final grain yield. Hussaini, [29], reported similar response where they attributed this significant increase in yield to favourable effect of nitrogen on cob length and cob diameter, which all have direct bearing on the final grain yield. The increase in yield could be a result of good dry matter production for

grain filling mostly attributed to a higher photosynthetic area provided by the leaves.

The low grain yields in sole maize stover treatments and the control could be attributed to low mineral nitrogen levels under these treatments (Table 3). Low quality organic materials such as maize stover with high C/N ratio (70) take long to decompose and release N leading to N immobilization [35]. Low maize yields may also be attributed to high levels of *Striga* infestation under these treatments (Table 3). Yield reduction from *Striga* infestation result from a series of physiological changes in the host plants following *Striga* parasitism. These include weakening of the host, wounding of its outer root tissues and absorption of moisture, photosynthates and minerals [36]. Apart from parasitism, *Striga* impairs photosynthetic efficiency [37] and exerts toxic or phytotoxic effects [38].

4.5. Relationship between Maize Grain Yield and Yield Components

The increase in grain yield results from beneficial influence of yield contributing characters and the positive interaction of nutrients in the blended fertilizer. The association of grain yield with number of kernels per row observed in this study agreed [39], who concluded that increasing the number of kernels per row contributes to an increase in maize grain yield. The strong relationships between grain yield and number of kernels per row and between grain yield and 100 kernels weight were also in agreement with the findings [40] indicating that these two yield attributes are the most important components directly related to grain yield in maize. Similarly, a strong positive association of maize grain yield with number of kernels per row [41].

5. Conclusions and Recommendations

All the three ear traits (ears per plant, ear length, and ears diameter) were significantly higher under *Calliandra* (45 kg N ha⁻¹) combined with urea (30 kg N ha⁻¹) and *Calliandra* at (30 Kg N ha⁻¹) combined with urea (45 kg N ha⁻¹) or maize stover (45 kg N ha⁻¹) combined with urea (30 kg N ha⁻¹) and maize stover at (30 kg N ha⁻¹) combined with urea (45 kg N ha⁻¹). Early and consistent supply of nitrogen is critical for production of maize under *Striga* infested conditions. Number of ears per plant was a major yield component and accounted for ($R^2=0.74$) of the variation in grain yield under *Striga*.

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