

EFFECT OF COMBINED USE OF UREA AND GOAT DUNG MANURE ON CELOSIA

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ABSTRACT

Three field experiments were conducted to investigate the separate and combined effects of urea and goat dung manure on leaf nutrient contents, growth and yield of *Celosia argentea* in southwest Nigeria.

Each experiment involved 7 treatments namely: no treatment, 10t/ha goat dung, 125 kg/ha urea, 125 kg/ha urea + 2t/ha goat dung, 125 kg/ha urea + 4 t/ha goat dung, 125 kg/ha urea + 6t/ha goat dung and 125 kg/ha urea + 8 t/ha goat dung, replicated three times using a randomised complete block design. Goat manure increased height, number of leaves, stem girth, root length, stem and leaf weight of celosia and leaf N, P, K, Ca and Mg contents. Compared with urea or goat dung alone, combined application of urea and goat dung increased growth and yield of celosia and leaf nutrients contents. Addition of goat manure to urea increased leaf P, K, Mg status. Leaf P and K increased with increasing amount of goat manure. Compared with no treatment, 10t/ha goat dung, 125 t/ha urea and 125 t/ha urea + 6t/ha goat dung increased fresh matter yield by 66, 273 and 974% respectively.

INTRODUCTION

Due to decreased land area per farmer, vegetable cultivation is continuously done on the same piece of land in Nigeria, especially near urban settlement. This situation aggravates loss of soil fertility and inadequate supply of plant nutrients and low yield. Among the factors influencing the nutrient composition of green leafy vegetable, soil fertility and type and quantity of fertilizer are perhaps the most important (Schmidt, 1971). Nitrogen fertilizer such as urea is used on *Celosia argentea*, which is one of the most preferred leaf vegetables in Southwest Nigeria. But its scarcity and high cost hamper its adequate use. Also continuous use of urea aggravates soil acidity and nutrients imbalance, and this could lead to reduced nutrient uptake (Aduayi, 1980; Ojeniyi, 2000). To alleviate these problems, resource poor farmers combine urea and locally sourced organic manure such as goat dung. The response of celosia to goat manure, and combined use of goat manure and

urea is not known to have been investigated. Therefore this work investigates the effect of urea, goat manure and combinations of goat manure and urea on yield components and nutrient composition of celosia.

MATERIALS AND METHODS

Field experiments

Seven manurial treatments were tried on celosia grown on a sandy clay loam soil at Akure, in the rainforest zone of Nigeria. The soil had been under arable cropping for 5 years and was deficient in N and P and slightly acidic. The treatments were

No manurial treatment (control)

10t/ha goat manure. (chosen arbitrarily)

125 kg/ha Urea

125 kg/ha Urea + 2t/ha goat manure.

125 kg/ha Urea + 4t/ha goat manure
 125kg/ha Urea + 6t/ha goat manure, and
 125kg/ha Urea + 8t/ha goat manure

The treatments were replicated 3 times using a randomized complete block design in three field experiments.

The site was manually cleared and each plot was 25m². Seeds were drilled, and later thinned to 75 single plants per plot. The plants were spaced at 5cm within the row and 30cm between the rows. The urea and goat manure were incorporated 2 weeks after germination and immediately after thinning. The first, second and third experiments were commenced in April 1999, July 1999 and March 2000 respectively on the same piece of land.

Growth and Yield Parameters

Ten plants were randomly selected per plot for observation.

Growth and yield parameters such as plant height, stem girth, and number of leaves were determined weekly for 4 consecutive weeks commencing from two weeks after application of treatments,

and the mean values were calculated. Parameters such as fresh root length, and stem and leaf weight were determined at harvest (6 weeks after manurial treatment).

Leaf Analysis

In the first experiment, topmost mature (open) leaf samples collected six weeks after manurial treatments were oven-dried and ground. Total N was determined using kjeldahi method. For P, K, Ca, and Mg, ground samples were digested with nitric – perchloric – sulphuric acid mixture (AOAC, 1990). P was determined using molybdenum blue colorimetry. K was determined using flame photometer, and Ca and Mg using EDTA titration.

The crop data were subjected to analysis of variance and the means compared using the least significant difference at 5% level.

RESULT

Table 1 shows mean values of plant height, number of leaves, stem girth, root length, stem weight and leaf weight for the three experiments, and Table 2 presents data of leaf analysis for experiment 1.

Table 1: Effect of Urea (U) and Goat manure (G) on Growth and yield of Celosia Plant

Treatment	Plant Height (cm)	Number of leaves/plant	Stem girth (cm)	Root length (cm)	Stem weight (g)	Leaf Weight/ Plant (g)
No treatment	3.5	4.8	0.66	5.3	5.9	8.3
10t/ha GM	4.5	7.5	1.02	10.7	11.7	11.8
125kg/ha U	5.9	9.1	1.05	11.4	30.0	22.8
125kg/ha U + 2t/ha GM	7.4	10.1	1.11	13.0	73.2	29.4
125kg/ha U + 4t/ha GM	8.2	11.1	1.24	17.3	73.2	51.1
125kg/ha U + 6t/ha GM	9.4	11.7	2.23	17.2	86.1	65.9
125kg/ha U + 8t/ha GM	7.2	9.5	1.33	14.0	56.4	40.3
LSD (0.05)	0.3	1.5	0.47	1.4	7.6	3.2

Mean values for 3 experiments

Relative to no treatment, application of ground goat manure to soil significantly increased the height, number of leaves, stem girth, root length, stem weight and leaf fresh weight of celosia (Table 1). The mean data covering the three

experiments indicate that the effect of applying 10t/ha goat manure on plant height, number of leaves, root length, and leaf fresh weight was significant ($p = 0.05$). Table 2 shows that goat manure also increased leaf N, P, K, Ca and Mg

status. Application of Urea fertilizer increased height, number of leaves, stem girth, root length, stem fresh weight and leaf fresh weight of celosia relative to no treatment. The mean data for the three experiments show that the increases in plant height, number of leaves, root length, stem fresh weight and leaf fresh weight due to application of urea were significant compared with no treatment. Application of Urea increased N, P, K, Ca and Mg status of celosia (Table 2).

Compared with no treatment, and 10t/ha goat manure alone, combined application of each of 2, 4, 6 and 8t/ha goat manure with 125kg/ha Urea

significantly increased celosia plant height, number of leaves, stem girth, root length, stem weight and fresh; leaf weight. Therefore addition of Urea to goat manure treatments increased the growth and yield of celosia. It also implies that the quantity of goat manure required for celosia cultivation can be reduced if Urea is combined with goat manure. Compared with Urea alone, application of Urea with different quantities of goat manure increased height, number of leaves, stem girth, root length, stem weight and leaf fresh weight of celosia, (Table 1).

Table 2: Effect of Urea (U) and goat manure (GM) on leaf nutrients content of celosia. Experiment 1

Treatment	N%	P%	K%	Mg%	Ca%
No treatment	3.20	2.13	1.85	1.08	2.27
10t/ha GM	3.35	2.17	1.89	1.18	3.50
125kg/ha U	4.35	2.90	2.31	1.12	4.17
125kg/ha U + 2t/ha GM	3.86	3.10	2.33	1.27	4.57
125kg/ha U + 4t/ha GM	3.93	4.69	2.44	1.38	4.57
125kg/ha U + 6t/ha GM	4.14	4.73	2.56	1.48	4.99
125kg/ha U + 8t/ha GM	4.30	4.77	2.59	1.41	4.97
LSD (0.05)	0.40	0.08	0.93	0.04	0.02

Addition of 4 and 6t/ha goat manure to 125kg/ha urea tended to give the highest values of plant height, number of leaves, root length, and leaf weight compared with no treatment, 10t/ha goat manure, urea alone, and urea + 2 or 8t/ha goat manure. The overall mean data show that the combination of urea with 6t/ha goat manure gave the highest values of stem and leaf weight. These are the edible parts of the vegetable. The values of stem and leaf weight given by Urea + 6t/ha goat manure were significantly higher than the values given by urea + 4t/ha goat manure. Hence the 125kg/ha urea + 6t/ha goat manure is recommended compared with other urea + goat manure treatments.

The overall mean stem plus leaf yield (fresh matter) for the no treatment, 10t/ha goat manure, 125kg/ha urea, 125kg/ha urea + 2t/ha goat manure, 125kg/ha urea + 4t/ha goat manure, 125kg/ha urea + 6t/ha goat manure, and 125kg/ha

urea + 8t/ha goat manure were 14.2, 23, 5, 52.8, 76.0, 124.3, 152.0 and 96.7gm respectively. Therefore yield of celosia increased with amount of goat manure to 6t/ha. Increase in the amount of goat manure to 8t/ha reduced the yield of celosia, compared to 2, 4 and 6t/ha goat manure.

Compared with no treatment, application of 10t/ha goat manure, 125t/ha urea and combined use of 125t/ha urea and 6t/ha goat manure increased fresh matter yield by 66, 273 and 974% respectively. Therefore the 125t/ha urea + 6t/ha goat manure gave the highest fresh matter yield.

Compared with goat manure alone, adding urea to goat manure treatments increased leaf N, P, K, Ca and Mg status of celosia (Table 2). Compared with urea alone, addition of goat manure to urea increased leaf N status (Table 2). The leaf P and K status increased with amount of goat manure added to urea up to 8t/ha.

DISCUSSION

The observation that urea increased growth and yield of celosia is consistent with the fact that urea significantly increased availability of N to the crop. Urea also stimulated increase in availability of P and K, probably as a result of increased microbial activities and mineralisation of organic nutrient.

The reduced leaf N and yield when 8t/ha goat manure was added to urea compared with lesser amount of goat manure could be due to immobilization of N in urea by micro-organisms acting to decompose the manure since goat manure has very low N content (2.5%) compared

with urea (46%). The finding that addition of urea to goat manure treatments increased growth and yield of celosia and leaf N, P, K, Ca and Mg status is attributable to the fact that urea should have enhanced decomposition and mineralisation of goat manure due to its relatively high N.

This work shows that combined use of goat dung manure and urea increased availability of nutrients such as P, K, Mg and Ca to celosia rather than the use of goat manure or urea alone. This led to significant increase in growth and yield of celosia. Therefore complementary use of urea and goat manure is recommended for celosia rather than the use of urea or goat manure alone.

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