

Varietal Performance of Jute Mallow (*Corchorus olitorius*) as Affected by Different rates of Cow Dung Manure on an Ultisol, Kogi State, Nigeria

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Original Research Article

ABSTRACT

Field experiments were conducted at Horticulture Section of Kabba College of Agriculture to investigate the effects of different rates of cow dung manure on the growth and yield of three varieties of jute mallow. The experiment was a factorial, consisted of four levels of cow dung, which were 0t/ha, 2.5t/ha, 5t/ha and 10t/ha and three varieties of jute mallow which were *Onyan*, *Angbadu* and *Oniyaya*. The experiments were laid out in a randomized complete block design and replicated three times. Fifteen plants from each plot were randomly selected and used for the assessment of growth characters and fruit characters. Data collected were subjected to the statistical analysis of variance procedure while, the mean treatments were separated using least significant difference. The result shows that all the cow dung amended plots were significantly better than the control plots in terms of growth characters irrespective of the rate of its application. Among the cow dung rates, cow dung applied at 10t/ha had the highest plant height, number of leaves, fresh and dry weight, though this was not significantly different from cow dung applied at 2.5t/ha and 5t/ha. Plots without

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cow dung (control) produced the least plant height (39.7cm), number of leaves, fresh and dry weight. *Onyan* produced highest growth characters; this was closely followed by *Oniyaya* while *Agbadu* recorded the least value of growth characters. Interaction of cow dung rate and variety on plant height was not significant throughout the period of experiment. The result also shows that numbers of pod produced were higher in plots with 10t/ha, (17) though, plots with 5t/ha produced the greatest number of seed (198) and seed weight per plot (3.92 kg). However, all these were significantly better than the control plots. Among the cultivars considered in this experiment, *Onyan* had better growth and yield character which was significantly better than either *Agbadu* or *Oniyaya* varieties. The result indicated that leaf production, fresh weight and seed yield were highest in variety *Onyan* when cow dung was applied at 5t/ha. It is therefore recommended to farmers growing jute mallow in the study area.

Keywords: Cow dung; growth; jute mallow; yield.

1. INTRODUCTION

Jute mallow (*Corchorus olitorius* L.), belongs to the family *Tiliaceae*. It is a leafy vegetable, grown in Nigeria and in many other tropical countries for its nutritious leaves. It is used for soup and eaten with starchy staple foods, especially in South-Western Nigeria (1); (2). *Corchorus olitorius* are annual or short-lived perennial crop (2). In Nigeria only four species have been described and these are *C. aestuans*, *C. olitorius*, *C. tridens* and *C. capsulari*, *C. olitorius* is cultivated while the remaining three are regarded as wild. There are great variations among the genus (3). There are many varieties of *C. olitorius* at various markets in Nigeria; a mixture of different species can be seen. Different taxa are not only seen in the same market stall but are frequently mixed together within the same bunch (3).

The composition of *Corchorus olitorius* leaves per 100 g fresh edible portion is: water 80.4 g (74.2–91.1), energy 243 kJ (58 kcal), protein 4.5 g, fat 0.3 g, carbohydrate 12.4 g, fiber 2.0 g, Ca 360 mg, P 122 mg, Fe 7.2 mg, β -carotene 6410 μ g, thiamin 0.15 mg, riboflavin 0.53 mg, niacin 1.2mg, ascorbic acid 80 mg (4). The vegetable is cultivated for the stem bark which is used in the production of fiber (Jute) and for its mucilaginous leaves which are also used as food vegetable (5). The leaf extract of the plant is also employed in folklore medicine in the treatment of gonorrhea, pain, fever and tumor (6).

In Nigeria, its vegetation zones and agroecologies varies from the humid tropical rainforest to the savanna. However, soils of the southern guinea savanna zones are inherently low in soil nitrogen and organic matter and crop yields on these soils are low (7). The nutrient status of the soil plays a unique and significant role in the quality of eventual crop performance

and output (8). Application of organic manure on soil had shown to help crops to withstand drought, increased soil organic matter, nitrogen, pH, phosphorus, and cation exchange capacity (CEC), and reduced soil exchangeable acidity (9; 10). Several agricultural wastes improved crop yield, on pepper (11), neem residues on maize (12), bagasse ash on wheat yield (13), cocoa pod ash on tomato yield (14). When applied repeatedly, the organic matter leads to build-up of soil organic matter, thus providing a capital of nutrients that are slowly released (15), and at the same time increasing the soil's buffering capacity for water, cations and acidity (16). However, there is dearth of information on effect of different rate of cow dung manure on the growth and yield of three varieties of jute mallow in Kabba, Kogi State, Nigeria. Hence the objective of this study was to evaluate the effect of different rate of cow dung manure on the growth and yield of the three varieties of jute mallow.

2. MATERIALS AND METHODS

2.1 Area of the Study

The experiment was carried out for two consecutive growing seasons (2014 and 2015) at the Research Site of Horticulture Section, Kabba College of Agriculture, Kabba. The site is located at latitude of 07° 35' N and longitude of 06° 08' E and is 435m above sea level, in Southern Guinea Savanna Agro Ecological Zone of Nigeria, where the dry seasons are dry and hot while, wet seasons are cool. The rainfall spans between April to November with peak in June. The dry season extends from December to March. The mean annual rainfall is 1570mm per annum with an annual temperature range of 18°C - 32°C. The mean relative humidity (RH) is 60% (17). The major soil order within the experimental site is Gleysol (18; 19).

2.2 Soil Sampling and Analysis

In order to determine some chemical properties of the soil before the treatments were applied, 20 random soil samples were collected from the field and bulked to form a composite sample. The sample was air-dried and sieved with a 2 mm sieve and analyzed in the laboratory for N, P, K, pH and Organic carbon. Total N (%) was determined by the macro-Kjeldahl method (20). Available P (ppm) was determined using the Bray I method according to Olsen (21). Soil pH values were obtained by using a HI9813-5 portable pH/EC/TDS/°C meter (HANNA instruments, Romania, 2002). Soil organic carbon was determined by the Walkley-Black procedure (22).

2.3 Planting Materials

The experiment was a factorial in a randomized complete block design with three varieties of *Corchorus olitorius* (V1 = *Anghadu*, V2 = *Oniyaya*, V3 = *Onyan (Eletieku)* and four levels of cow dung manure (2.5 t/ha, 5 t/ha, 10 t/ha and control). The plot sizes were 3m by 4m (12m²), with plants spaced at 50cm by 25cm intra and inter rows respectively. The cow dung manure was incorporated into the soil two weeks before planting.

Seeds were sown at the rate of five seeds per hole and a depth of about 1cm deep and were thinned down to one plant per hole at two weeks after germination. Fifteen plants from each plot were randomly selected and used for the assessment of growth characters such as number of leaves produced, plant height (cm), number of branches, stem girth(cm), number of nodes and leaf area. Fruit characters observed were number of pods per plant, pod length, pod diameter, number of seeds per plant, 1000 seed weight and seed yield/plant.

Data collected were subjected to the statistical analysis of variance and treatment means were compared using LSD at 0.05.

3. RESULTS AND DISCUSSION

Table 1b. Composition of cow dung used

Nutrient (%)	Values
Organic carbon	23.8
Total N	2.1
C:N ratio	11.3
Phosphorus	3.68

3.1 Pre Planting Soil Analysis

The properties of the soils at the site of the experiment are shown in Table 1a. The soils are sand clay loam. Soil of Kabba is slightly acidic (6.3). The soils are high in bulk density. Organic matter, total N, available phosphorus (P) and exchangeable potassium (K) were low. Exchange Mg is adequate in soil of Kabba.

Pre-planting soil analysis showed that the soil of the experimental site was low in soil nutrient status. The low nutrient status may be due to leaching of basic cations due to intensive rainfall or perhaps due to the parent materials of quartz and sesquioxides which are poor in plants nutrients. This agreed with the findings of (23) and (24) who reported large losses of basic cations due to leaching and high intensity and duration of rainfall.

The chemical properties of cow dung used in the study are indicated in Table 1b. The pH was slightly alkaline (7.20) while the percentage of organic carbon and organic matter contents were 23.80 and 35.42, respectively (Table 1b). The cow dung was moderate in total N, high in K⁺ (0.36 cmolkg⁻¹), high in Ca (3.87 cmolkg⁻¹), high in available P (3.68 mg/kg), and Mg⁺⁺ with value as 2.23 cmolkg⁻¹ (Table 1b).

Table 1a. Pre planting soil analysis

Properties	Values
Sand (%)	60.2
Clay (%)	21.7
Silt (%)	18.1
Soil texture	Sand clay loam
pH	6.35
Bulk density (g/cm ³)	1.43
Total porosity (%)	34.8
Organic matter (%)	1.26
Total N (%)	0.17
Available P (mg/kg)	3.14
Exchangeable K (cmol/kg)	0.14
Exchangeable Ca (cmol/kg)	1.77
Exchangeable mg (cmol/kg)	1.72

Potassium	0.36
Calcium	3.87
Magnesium	2.23

3.2 Plant Height (Cm)

Effect of different cow dung rates on plant height of jute mallow are presented in Table 2. Significant difference was observed in plant height due to application different rates of cow dung at 6, 9 and 12 weeks sampling. However, no significant difference was observed at 3 weeks after planting.

Among the cow dung rates, cow dung applied at 10t/ha had the highest plant height, though this was not significantly different from cow dung applied at 2.5t/ha and 5t/ha. Plots without cow dung (control) produced the least plant height (39.7cm). All the amended plots were significantly better than the control irrespective of the rate of its application.

There was significant difference in the height of the varieties of jute mallow considered at 9 and 12 weeks after planting. However, there was no significant difference at 3 and 6 WAP. *Onyan*

produced highest plant height (67.4cm), this was closely followed by *Oniyaya* (52.1cm) while *Agbadu* recorded the least value of plant height. Interaction of cow dung rate and variety on plant height was not significant throughout the period of experiment.

3.3 Number of Branches

Significant difference was observed in number of branches produced by the three varieties of jute mallow at 9 and 12 WAP. At 12 weeks after planting, 5t/ha produced highest number of branches, followed by plots with 10t/ha cow dung while plots with 2.5t/ha had the least values of branches among the treated plots. No significant difference was observed among the treated plots. Though, all these were significantly better than control plots Table 3.

Table 2. Effect of cow dung on plant height (cm) of three varieties of Jute mallow

Cow dung rate t/ha	3 week	6 week	9 week	12 week
0	3.1	12.6	24.8	39.7
2.5	3.3	18.4	34.6	52.4
5	3.1	20.3	40.5	51.8
10	3.1	19.8	38.9	53.8
LSD	NS	2.61	5.21	7.44
Varieties				
Agbadu	3.0	21.4	41.6	41.8
Oniyaya	3.2	19.8	34.8	52.1
Onyan	3.0	21.8	36.8	57.4
LSD	NS	NS	3.66	8.74
Interaction				
Cow dung rate vs Variety	NS	NS	NS	NS

Table 3. Effect of cow dung on number of branches of three varieties of Jute mallow

Cow dung rate t/ha	3 week	6 week	9 week	12 week
0	0.42	3.06	6.61	09.04
2.5	0.41	3.09	7.11	11.44
5	0.44	3.21	8.31	12.83
10	0.41	3.11	8.44	11.98
LSD	NS	NS	0.46	1.43
Varieties				
Agbadu	0.68	3.10	8.66	11.98
Oniyaya	0.41	2.61	4.63	07.64
Onyan	0.74	3.14	8.74	12.13
LSD	0.08	0.09	1.02	0.39
Interaction				
Cow dung rate vs Variety	NS	NS	NS	NS

3.4 Number of Leaves

Table 4 presents effect of cow dung application on number of leaves of jute mallow. The result shows there was significant difference in the number of leaves produced by the three varieties

of jute mallow at 6,9 and 12 weeks after planting as a result of different rate of cow dung applied. At 6, 9 and 12 weeks after planting, plots with 10t/ha consistently produced higher number of leaves when compared with other rates. Number of leaves increased with increase rate of cow

dung manure. Among the varieties, *Onyan* produced highest number of leaves. This was followed by *Agbadu* while *Oniyaya* had the least value of number of leaves.

3.5 Fresh and Dry Weight

Table 5 present the effect of application of cow dung on fresh and dry weight of jute mallow. Significant difference were observed in both fresh and dry weight at maturity, plots with 5t/ha and 10t/ha were not significantly different in fresh and dry weight but these were significantly better than plots with application of 2.5t/ha and control plots. The least values of fresh and dry weight occurred in control plots. *Onyan*, had the greatest value of fresh (31.40g/plant) and dry weight (8.11(g/plant) while *Agbadu* had the least of these values. There was no significant interaction between cow dung rate and variety.

The better plant height, number of branches, number of leaves, fresh and dry weight could be attributed to cow dung which is a potential source of nutrients for crop. (25) Reported that organic manure increased the nutrient status of the soil through gradual release of nutrient to the soil.

All the growth characters observed were highest in cow dung amended plots which suggested that nutrient status of soil was low or poor. The low soil nutrient could be attributed to high intensity of rainfall, leaching of basic cations and parent material that form the soil (23) and (24).

The varietal results showed that *Onyan* recorded the highest values of growth characters. The

varietal differences were due to their genetical make up. The results of this work supported the work of (26) who stated that differences in crop growth and yield might be attributed to specific genetic makeup. There was significant difference among the varieties at 3,6,9,12 WAP. Consistent higher number of branches was observed in *Onyan* which was closely followed by *Agbadu* while *Oniyaya* had the least values of number of branches.

3.6 Yield and Yield Characters

The influence of different rates of cow dung on yield and yield components of three varieties of jute mallow are presented in Table 6. Significant difference was observed in number of pods produced per plant, length of pod, number of seed and seed yield per plant. However, no significant difference in diameter of pods and 1000 seed weight. Numbers of pod produced were higher in plots with 10t/ha, (17) though, plots with 5t/ha produced the greatest number of seed (198) and seed weight per plant (g). However, all these were significantly better than the control plots.

Among the cultivars considered in this experiment, *Onyan* had better growth and yield character which was significantly better than either *Agbadu* or *Oniyaya* varieties. The result was in line with the findings of (27) who worked on effect of different levels of poultry manure on jute mallow.

Table 4. Effect of cow dung on number of leaves of three varieties of Jute mallow

Cow dung rate t/ha	3 week	6 week	9 week	12 week
0	3.11	6.18	11.31	16.74
2.5	3.26	7.14	16.44	21.86
5	3.31	7.96	18.56	22.94
10	3.24	8.51	19.89	23.56
LSD	NS	1.88	2.46	3.21
Varities				
Agbadu	3.23	7.81	16.41	20.43
Oniyaya	3.01	6.27	11.59	15.97
Onyan	3.19	8.23	18.63	23.66
LSD	NS	0.56	3.26	4.42
Cow dung rate vs Variety	NS	NS	NS	NS

Table 5. Effect of cow dung on fresh and dry weight of three varieties of Jute mallow

Cow dung rate t/ha	Fresh weight (g/plant)	Dry weight ((g/plant))
0	20.56	5.86
2.5	26.48	7.22
5	29.63	7.34

10	30.46	8.11
LSD	3.17	1.78
Varieties		
Agbadu	27.46	7.86
Oniyaya	21.39	4.93
Onyan	31.40	8.11
LSD	3.24	1.77
Cow dung rate vs Variety	NS	NS

Table 6. Effect of cow dung on pod and seed characters of three varieties of Jute mallow

Cow dung rate t/ha	Number of pod	Pod length (cm)	Pod diameter (cm)	Number of seed	1000 seed weight (kg)	Seed yield/ plot (kg)
0	07	4.6	3.94	116	1.62	2.13
2.5	13	4.3	4.14	112	1.83	3.64
5	15	4.6	4.13	198	1.86	3.92
10	17	4.1	4.08	164	1.92	3.84
LSD	1.61	0.21	NS	22.34	NS	0.39
Varieties						
Agbadu	11	4.0	3.88	138	1.72	2.36
Oniyaya	11	4.2	2.32	106	1.73	2.41
Onyan	18	4.6	3.62	206	2.21	3.61
LSD	3.41	Ns	0.46	16.41	0.32	0.68
Cow dung rate vs Variety	NS	NS	NS	NS	NS	NS

Onyan had yield and yield characters better than either *Agbadu* or *Oniyaya*. The best performance of *Onyan* could be attributed to factor earlier mention that is variation in genetic makeup of the cultivars.

4. CONCLUSION

Though jute mallow is an important crop, its performance under naturally available cow dung manure application is poorly understood. In this study the effect of different rates of cow dung manure incorporation on the growth and yield of the three varieties of jute mallow was investigated. At 12 weeks after planting variety *Onyan* produced growth and seed yield better than either *Agbadu* or *Oniyaya* varieties. For optimum leaf production, fresh weight, dry weight and seed production of *Cochurus olitorus*, cow dung should be applied at the rate of 5t/ha. Variety *Onyan* had better performance of growth and yield characters, it is therefore recommended to farmers in the study area.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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