VARIETAL PERFORMANCE OF JUTE MALLOW AS AFFECTED BY DIFFERENT RATES OF COW DUNG MANURE ON AN ULTISOL, KOGI STATE, NIGERIA

(Corchorus olitorius)

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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 whichwere *Onyan*, *Angbadu* and *Oniyaya*. The experiments were laid out in a randomized complete block design and replicated three times. The plots sizes were 3m x 4m ($12m^2$), with plants spaced at 50cm x 25cm intra and inter rows respectively. 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 per plant. Data collected were subjected to the statistical analysis of variance procedure while, the mean treatments were separated using least significant difference. 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.

Key words: Cow dung, Growth, Jute mallow, Yield

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 (Fayemi, 1999; Schippers, 2000). *Corchorus olitorius* are annual or short-lived perennial crop (Schippers, 2000). 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 (Akoroda, 1985). 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 (Akoroda, 1985).

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 µg, thiamin 0.15 mg, riboflavin 0.53 mg, niacin 1.2 mg, ascorbic acid 80 mg (Samra *et al*., 2007). 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 (Zakaria *et al*., 2006). The leaf extract of the plant is also employed in folklore medicine in the treatment of gonorrhea, pain, fever and tumor (Ndlovu and Afolayan 2008).

The nutrient status of the soil plays a unique and significant role in the quality of eventual crop performance and output (Law-Ogbomo and Nwachokor, 2010). 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 (Adeniyan and Ojeniyi, 2003; Njoku and Mbah, 2012). Several agricultural wastes improved crop yield, on pepper (Odedina *et al.,* 2003), neem residues on maize (Ogundare, 2012), bagasse ash on wheat yield (Jamil *et al.,* 2004), cocoa pod ash on tomato yield (Ayeni, 2010). When applied repeatedly, the organic matter leads to build-up of soil organic matter, thus providing a capital of nutrients that are slowly released (Giller *et al*., 1997), and at the same time increasing the soil's buffering capacity for water, cations and acidity (De Ridder and van Keulen, 1990). 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 mallowin 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

Materials and Methods

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% (Meterological data, 2011). The major soil order within the experimental site is Gleysol (Higgins, 1957; Babalola, 2010).

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 [Bremner, 1982]. Available P (ppm) was determined using the Bray I method according to Olsen [Olsen, 1982]. 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 [Nelson and Sommers, 1982].

Planting Materials

The experiment was a factorial in a randomized complete block design with three varieties of *Corchorus olitorius* (V1 = *Angbadu*, V2 = *Oniyaya*, V3 = *Onyan (Eleti eku)* 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 ($12m^2$), 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.

RESULTS AND DISCUSSION

4.1 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 Nnaji *et al.* (2005) and Aberger (2006) 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 mglkg-1), and Mg++ with value as 2.23 cmolkg-1 (Table 1b).

4.2 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.

4.3 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.

4.4 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.

4.5 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. Ibeawuchi *et al*. (2006) 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 (Nnaji *et al*., 2005) and (Aberger, 2006).

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 Odeleye and Odeleye (2001) who stated that differences in crop growth and yield might be attributed to specific genetic make up. 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.

4.6 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 then 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 Emuh (2013) who worked on effect of different levels of poultry manure on jute mallow.

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 make up of the cultivars.

Conclusion

Jute mallow treated with 10t/ha cow dung had better fresh weight and highest number of seeds. Though, it was not significantly better than plots treated with 5t/ha. Among the three varieties considered *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.

Table 1a: Pre planting soil analysis

Properties	
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

Table 1b Composition of cow dung used

Nutrient (%)	Cow dung
Organic carbon	23.80
Total N	2.1
C:N ratio	11.3
Phosphorus	3.68
Potassium	0.36
Calcium	3.87
Magnesium	2.23

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

Cow dung rate t/ha	3week	6week	9week	12week
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
0niyaya	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	3week	6week	9week	12week
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
0niyaya	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

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

Cow dung rate t/ha	3week	6week	9week	12week
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
Varieties				
Agbadu	3.23	7.81	16.41	20.43
0niyaya	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
0niyaya	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
0niyaya	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

REFERENCES

1. Aberger A (2006). Soil fertility and plant nutrition in the Tropics and subtropics. http://www.fertilizer.org/ifacontent/down/

2. Adeniyan, O. N. and Ojeniyi, S. O. (2003). Comparative effectiveness of different levels of poultry manure with NPK fertilizer on residual soil fertility, nutrient uptake and yield of maize. *J. Agric.Res*. 2: 191-197

3. Akoroda, M.O. 1985. Morphotype diversity in Nigeria land-races of *Corhorus olitoriusJ. Hort Sci.* 60, 557-562.

4. Ayeni, L. S. (2010). Effect of cocoa pod ash, NPK fertilizer and their combinations on soil chemical properties and yield of tomato (*Lycopersicon lycopersicum*) on two soil types. *New York Journal* 3(4): 1-11

5. Babalola, T. S. (2010): Land Evaluation Studies of Two Wetland Soils in Nigeria. An M. Sc. Thesis Submitted to the Department of Crop, Soil and Environmental Sciences, University of Ado –Ekiti. Pp 141.

6. Bremner, J.M. (1982). Total nitrogen. In, C.A. Black (Ed) Methods of Soil Analysis Part II. Chemical and Microbiological Properties. *Am. Soc. of Agron.* Madison Wisconsin. 1149-1178.

7. De Ridder, N and van Kuelen, H. (1990). Some aspects of the role of organic matter in sustainable intensified arable farming systems in the West African Semi-Arid tropics (SAT). *Fertilizer Research,* 26: 299-310.

8. Emuh, F.N., 2013. Growth and yield performance of *Corchorus olitorious* L. influenced by levels of poultry manure in Niger-Delta, Nigeria. *African Journal of Biotechnology*, 12(19): 2575-2580.

9. Fayemi, P. O. (1999). Nigerian Vegetables. Heinemann Educational Books, Nig. Plc. Ibadan, pp 17 – 18.

10. Giller, K.E., Cadisch, G., Ehaliotis, C., Adams E., Sakala, W.D. and Mafongoya, P.M. (1997). Building Soil Nitrogen Capital in Africa. In: Buresh, R.J., Sanchez, P.A. and Calhoun, F. (Eds). Replenishing soil fertility in Africa. Soil Science Society of America Special Publication No. 51. Soil Science Society of America, Madison, Wisconsin, USA. Proceedings of an International Symposium, Indianapolis, USA. 6th Nov. 1996. pp. 151-192.
11. Higgins, G. M. (1957): Preliminary Report on the Detailed Land, Soil and Contours Survey of Riverine Area of School of Agriculture, Kabba. Soil Survey Bulletin No 31: 28p.
12. Ibeawuchi, I.I., E.U. Onwerenmadu, N.N. Oti, (2006). Effect of poultry manure on green (*Amaranthus cruentus*) and water leaf (*Talinum triangulare*) on degraded ultisol of Owerri, South Eastern Nigeria. *J. Anim. Vet. Adv.*, 5(1): 53-56.
13. Jamil, M., Qasim, M., Umar, M. and Subhan, A. (2004). Impact of organic wastes (bagasse ash) on the yield of wheat (*Triticumaestivum* L.) in a calcareous soil. *International Journal of Agriculture andBiology*6(3): 468-470
14. Law-Ogbomo KE, Nwachokor MA (2010) Soil physico-chemical properties of five soils formed on different parent materials in South Eastern Nigeria. http:www.insipub.com/rjabs.pdf/
15. Mbah, C. N. (2006). Influence of organic wastes on plant growth parameters and nutrient uptake by maize (*Zea mays* L.). *Nigeria J. Soil Sci*. 16: 104-108
16. Nelson, D.W. and Sommers, L.E. (1982): Total Carbon, Organic Carbon and Organic Matter. In: Page A.L. Miller R.H. and Keeny D.R. (Eds.). Methods of Soil Analysis. Part-2, 2nd Ed. Agronomy Monograph No. 9. ASA and SSSA, Madison, WI. pp. 539-579.
17. Ndlovu, J. and A.J. Afolayan, 2008: Nutritional analysis of the South African wild vegetable *Corchorus olitorius* L. *Asian J of Plant Science,* 7(6): 615-618.
18. Njoku, C. and Mbah, C.N. (2012). Effect of burnt and unburnt rice husk dust on maize yield and soil physico-chemical properties of an Ultisol in Nigeria. *InternationalJournal for Sustainable ProductionSystems* 28(1): 49-60
19. Nnaji GU, Asadu CLA, Mbagwu JSC (2005). Morphology and physical characteristics of soil profile under cultivation and Natural forest. Proceedings of the 19th Annual conference of Farm Management Association of Nigeria. pp. 395-399.
20. Odedina, S.A., Odedina, J.N., Ayeni, S.O., Arowojolu S.A., Adeyeye, S.D. and Ojeniyi, S.O. (2003). Effect of types of ash on soil fertility, nutrient availability and yield of tomato and pepper. *NigerianJournal of Soil Science* 13: 61-67
21. Olsen S.R. (1982). Phosphorus. In: Page A.L. Miller R.H. and Keeny D.R. (Eds.).Methods of Soil Analysis. Part-2, 2nd Ed. Agronomy Monograph No. 9. ASA and SSSA, Madison, WI. *pp*. 403-430.
22. Samra, I., S. Piliz and C. Ferdag, 2007. Antibacterial and antifungal activity of *Corchorus*
23. Schrippers, R. R. (2000). African indigenous vegetables. An overview of the cultivated species. U.K. S National Resources Institute. Technical Report. Chatam. 56pp.
24. Steel, R.G.D and Torrie, J.H. (1987). Principles and procedures of statistic.McGram-Hall Book co.of int. New York. 276pp.
25. Zakaria, Z.A., M.N. Somchit, H. Zaiton, A.M. Mat- Jais, M.R. Suleiman, W. Farah, M.R. Nazaratul- and C.A.Fatimah, 2006. The invitro antibacterial activity of *Corchorous olitorius* extracts. *Int. J. of Pharmacology,* 2(2): 213-215.