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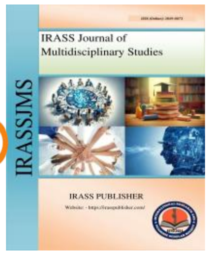

Effect of Manures on Growth and Yield of Jute Mallow (Corchorus Olitorius) and Storage Period in Benue, Nigeria

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Abstract: The field experiment was carried out at the teaching and research farm, Joseph Sarwuan Tarka University Makurdi, the experiment was to study the effect of organic manure on the growth and yield and the postharvest storage of fresh jute mallow in Makurdi. The experiment was laid out in a randomized complete block design (RCBD) replicated three times and the treatments were poultry droppings, cow-dung, goat dung and control. The data were observed and collected from growth parameters on leaf length, numbers of branches, leaf area, leave weight and yield for analysis. Data collected was subjected to analysis of variance (ANOVA) using GENSTAT statistical software version 17.1DE (2015) and significant means were separated using fisher's least significant differences at 5% level of probability. Significant differences ($P<0.05$) were observed among the organic manure for all parameters both for growth and yield. Poultry droppings, cow dung, goat dung and control from the result obtained, poultry droppings had the highest growth parameters on plant height (23.70) leaf length (5.01), numbers of branches (14.00), leaf area (66.50), leave weight (0.41) and yield (0.0727) kg/ha while control had the least increase and on weight lost and decay tray had the highest with (10.25) and (14.94) respectively. I therefore recommend the application of poultry droppings at 15t/ha for jute mallow production which gave the highest value of 0.0727 kg/ha. Jute mallow was protected from microbial assault and spoiling for eight days while maintaining its color and other physicochemical characteristics by treatments applied at a tropical ambient temperature of 30 ± 2°C and a liter of water.

Keywords: Jute mallow, organic manure, growth, yield.

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Introduction

Jute mallow (*Corchorus olitorius*), also known as Jew's mallow, nalta jute, or tossa jute, is a plant species belonging to the family Malvaceae. Originating from Africa and Asia, *Corchorus olitorius* has become an important crop for both industrial and culinary purposes. *Corchorus olitorius* is the primary source of jute fiber, which is extracted from the stem. The fibers are long, soft, and shiny, and they are used to make burlap, hessian cloth, sacks, ropes, and other products. Jute is one of the most important natural fibers in the world, second only to cotton in terms of production volume. The leaves of jute mallow are also rich in nutrients, including beta-carotene, vitamin C, and minerals such as iron and calcium (Steyn *et at* 2001, Matsufuji *et al* 2001, Adeniyi 2012, Nyadanu & Lowor 2015), making it a valuable food source. Jute mallow is not only valued for its nutritional benefits but also for its medicinal properties. The plant contains various bioactive compounds, including flavonoids, phenolic acids, and alkaloids, which contribute to its anti-inflammatory, antioxidant, and antimicrobial activities. Studies have shown that extracts from *Corchorus olitorius* leaves can be beneficial in managing diabetes, hypertension, and digestive issues (Adedapo *et al*., 2022). Traditional farming systems often rely heavily on synthetic fertilizers to address these issues, but long-term use of chemical fertilizers has led to negative impacts on soil health, biodiversity, and the environment (Bhardwaj *et al*., 2020). As a result, sustainable agricultural practices, including the use of organic manure, are gaining attention as alternatives for improving crop production and reducing environmental harm. The leaves are cooked into thick viscous soup added to stews and eaten with starchy staples (Aluko *et al* 2014) Aside from its use as a leafy vegetable, Jute mallow plays a significant role in sustainable agriculture due to its adaptability to different environmental conditions. It is a fast-growing plant that thrives in tropical and subtropical climates, making it a vital crop for subsistence farming in regions prone to food insecurity. Furthermore, the plant requires relatively low input in terms of fertilizers and pesticides, making it an environmentally friendly crop. It is endowed with higher fiber contents and highly perishable vegetables, also one of the main fiber crops in the world (Mikail & Mustapha 2022). Its high fiber content is beneficial for digestive health, while its antioxidant properties help combat oxidative stress. Additionally, its role in crop rotation systems enhances soil fertility and promotes biodiversity Organic manure, derived from plant and animal waste, plays a pivotal role in promoting sustainable agriculture and improving soil fertility. While organic manure may not deliver the immediate nutrient supply that synthetic fertilizers provide, its long-term benefits on crop yield and quality are noteworthy.

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Organic manure has been shown to improve both the yield and nutritional quality of crops. For example, studies have demonstrated that crops grown with organic manure tend to have higher levels of vitamins, minerals, and antioxidants compared to those grown with synthetic fertilizers (Joshi *et al.,* 2021). Furthermore, the slow-release nature of organic manure helps prevent nutrient imbalances and ensures a steady supply of nutrients throughout the growing season (Meena *et al*., 2023).

From a sustainability perspective, organic manure is a renewable resource that contributes to circular farming practices. It allows for the recycling of farm waste, reducing the need for external inputs and minimizing waste disposal issues. In terms of economic viability, organic manure can be a cost-effective option for smallholder farmers who often face financial constraints in purchasing synthetic fertilizers (Amare *et al*., 2020). Moreover, as demand for organic and sustainably grown food increases globally, farmers using organic manure are well-positioned to access premium markets and improve their income. Post-harvest losses are a significant issue in jute mallow production, particularly in regions where infrastructure for processing and storage is inadequate. The leaves of jute mallow are highly perishable, and without proper storage, they lose their nutritional value and marketability soon after harvest (Osei *et al*., 2023). It ripens rapidly depending on temperature and humidity, which ultimately leads to poor quality as the fruit is soft and unappealing. Transpiration, postharvest infections, enhanced ripening, and senescence are some of the processes that limit storage life after harvest and cause quality degradation. Fresh produce continues to breathe after harvesting, in contrast to other chilled perishable items (Padmini, 2006). Fresh produce's inherent qualities as well as a number of external variables, such as the surrounding temperature, have an impact on respiration. Fresh fruit and vegetable packaging is a novel technology in Nigeria and Africa. Growing conditions have a significant impact on fresh product quality, reducing bruising and other damage during harvest and processing (Galic et al. 2011). Producers have the issue of extending the shelf life of harvested food supply due to the high incidence of spoiling, which is made worse by increased respiration and ethylene production in tropical regions of the world. The study's goals are to ascertain how organic manure affects the growth and output of jute mallow produced in the study area as well as how storage materials affect fresh jute mallow.

Materials and Methods

The experiment took place The experiment was conducted during the rainy season of 2020 at the Teaching and Research Farm, Joseph Sarwuan Tarka University, Makurdi (7° 41'N and 8° 37'E) The goal of the experiment is to investigate the effect of organic manure in the growth and preservation of jute in Makurdi during the rainy season of 2024. Spacing of 75x 90cm was used, and organic sources (poultry droppings, cow dung and goat manure and control). Poultry dropping (100% Dry Matter, Organic Material 50 %, Total Nitrogen 5.1 %, Total Phosphorus 1.01 %, and Total Potassium 2.0 %), Cow dung (Dry matter 20 %, Organic Material 16 %, Total Nitrogen 10.0 %, Total Phosphorus 0.5 %, and Total Potassium 0.3 %), and Goat manure (Dry matter 18%, Organic Material 20%, Total Nitrogen 12.0%, Total Phosphorus 0.4%, and Total Potassium 0.10 %), and All of the organic manure was kept under strict conditions and allowed to partially decompose for four months before being used in the experiment and as a control, as recommended by Yusuf and Paul (2018). A 3 by 4 experiment with three replicates on a 4m2 A randomized complete block design was set up with 1m between plots and 1m between blocks (RCBD). To ensure weed-free plots, manual weeding was performed 2 and 6 weeks after planting, and all data was collected within a 4m2 net plot with a total of 5 plants tagged for data collection within each net plot. During the investigation, some physiological variables, such as growth, Plant Height (cm): Plant height was measured with the aid of a meter tape from the tagged plants, from the base to the tips of the plants the average was used for data analysis. Number of Leaves per Plant: Number of leaves was counted from the tagged plants and the average was used. Number of Branches per Plant: Number of branches was counted from the tagged plants and the average was used. Leaves Area: Leaves area was measured from the tagged plants and the average was used. Leaf Length: Leaf length was measured from the tagged plants and the average was used. Leaf Weight (g): length was measured from the tagged plants and the average was used. Leaf Yield (kg/ha): Total yield was taken from the tagged plants on the entire area/plot used for the experiment converted to ha. Days to First Flowering: Number of days from sowing to first flower was counted from the tagged plants and average was used. Days To 50% Flowering: This was determined by counting the number of days from the sowing date to the date when at last flowers had opened on the tagged plants and the average was used. Days of Maturity: Number of days from sowing date to maturity was counted from the tagged plants and the average was used. Yield: Total yield was taken from the tagged plants on the entire area/plot used for the experiment converted to ha. were also recorded. Data collected was subjected to analysis of variance (ANOVA) using GENSTAT statistical software version 17.1DE (2015) and significant means were separated using fisher's least significant differences at 5% level of probability Physiological weight loss (%): Jute mallow samples were weighed on the first day and at the end of each storage interval. The difference between the initial and the final fruit weight was considered as the total weight loss during each storage interval. The weight loss percentage is then calculated on the initial weight (wet basis) using the method applied by AOAC (2007).

The weight loss percentage was determined using the following formula:

$$Weight\ loss(\%) = \frac{Initial\ weight - Final\ weight}{Initial\ weight} \times 100$$

Postharvest deterioration (%): Using the technique outlined by El-Mougy et al. (2012), jute mallow was visually inspected for signs of decay at the conclusion of each storage interval. Samples exhibiting chilling injury symptoms were tallied.

$$\text{PDP} = \frac{\text{Number of Decayed Fruits}}{\text{Number ofTotal Fruits}} \times 100\%$$

Results and Discussion

Table 1: Effect of Organic Manure on Growth Parameters of Jute Mallow

Organic Manure	Plant Height at Harvest (cm)	Number of Leaves	Number of Branches	Leaves Area
Poultry Dropping	23.70	5.01	14.00	66.50
Cow Dung	16.40	4.00	8.00	55.90
Goat Dung	15.10	3.89	8.23	56.75
Control	13.83	3.52	6.73	46.74
F-LSD (0.05)	**2.62**	**3.02**	**2.11**	**11.05**

F-LSD – Fishers' least significant difference at 5% level of probability

To evaluate the impact of organic manure on the vegetative parameters of jute mallow grown in Makurdi, Nigeria. A field experiment was conducted to assess the effects of two organic manure (Poultry droppings, Cow dung and goat dung) on plant height, number of leaves, number of branches, and leaf area index of jute mallow.

Significant differences were observed among the organic manure for all parameters. On poultry droppings application, plant height, number of leaves, number of branches, and leaf area index also increased and gave 23.70, 5.01, 14.00 and 66.50 respectively while goat dung gave 15.10, 3.89, 8.23 and 56.75 respectively. The highest values for all parameters were recorded on poultry droppings. This could be related to the facts that poultry droppings releases its nutrients through-out the growing reason. this is true due to the ability of poultry droppings to enhance photosynthetic activities thereby affecting plants producing taller plants, higher number of leaves higher number of branches and leaf area index, On poultry droppings application, plant height, number of leaves, number of branches, ands leaf area index also increased. The highest values for all parameters were recorded on poultry droppings. This finding is in agreement with (Omololu *et al* 2023) who reported that poultry manure treatment significantly increase the number of leaves in okra production. This also agreed with the work of (Direkvandi *et al* 2008 and Ayeni *et al* 2010 who reported a significant increase in plant height as a result of the application if poultry manure. this is supported by the finding of (Oti 2014 and Alo 2018) who reported same trend starting that wide range of nutrient enhancing both vegetative and reproductive indices. The results indicate that the application poultry droppings can significantly enhance the growth, development, of jute mallow in Makurdi, Nigeria.

Table 2: Effect of Organic Manure on Days of First, 50% Flowering and Days to Maturity of Jute Mallow Grown in Makurdi

Organic Manure	First Flowering	50% Flowering	Days to maturity
Poultry Droppings	35.04	60.14	55.11
Cow Dung	30.13	56.32	48.22
Goat Dung	28.45	57.28	50.23
Control	26.87	50.36	42.63
F-LSD (0.05)	**1.01**	**1.99**	**3.01**

LSD=Least Significant Differences at 5% Level of Probability.

A field experiment was conducted to assess the effects of organic manure (Poultry dropping and Cow dung kg/ha) on days to first flowering, days to 50% flowering, and days to maturity of jute mallow.

Significant differences were observed among the nutrient source for all parameters. On poultry dropping application, there was increase on days to first flowering, days to 50% flowering and days to maturity, while goat dung had the least. Results indicate that the application of poultry droppings can significantly enhance the growth and yield of jute mallow in Makurdi, Nigeria. this is not far from the fact that poultry droppings has ability to dissolve fast and been utilized by plant for both vegetative/floral and yield related characters. This is collaborated by the finding of (Obatiju 2012) who stated that poultry manure especially the application of macro element gotten from compound manure improves floral growth and Initiate yield and yield related characters, (Oyedele 2013) also reported that poultry dropping also have fast ability to release its nutrient and environmental friendly and can produce as the use of chemical fertilizer which can lead to both vegetative and yield of Jute, he added that poultry dropping released their nutrient a bit slower but through-out the plant growth life, and poultry manure has corrective effects on the soil structure, texture and colour and improves microbial activities. It also collaborates with the finding of that chemical nutrients are rapidly assimilated by plants for physiological and morphological activities, which affects overall yield, as reported by Madina et al., 2022. He further reported that poultry dropping can be rapidly dissolved and utilized by plants for fruits, shoot weight, calyx weight, calyx number, 100 seed weight, and even maturation.

Table 3: Effect of Organic Manure on Yield Parameters of Jute Mallow Grown in Makurdi

Organic Manure	Leaf Length (cm)	Fresh Leaf Weight (g)	Leaf Yield (kg/ha)
Poultry Droppings	15.23	0.41	0.0727
Cow Dung	12.76	0.23	0.0461
Goat Dung	12.18	0.25	0.0564

Control	10.85	0.20	0.0321
F-LSD	**0.05**	**0.54**	**0.0120**

LSD=Least Significant Differences at 5% Level of Probability.

Results indicate significant differences among the nutrient source across all yield parameters. Among the organic manure application, poultry droppings had higher increase on leaf length, fresh leaf weight and leaf yield, (15.23, 0.41 and 0.0727 respectively) while goat dung had the least increase, (12.18, 0.25 and 0.0564 respectively). Results indicate that the application of poultry droppings can significantly enhance the growth and yield of jute mallow in Makurdi, Nigeria.

On yield parameters, poultry droppings had higher increase on leaf length, fresh leaf weight and leaf yield, while cow dung had the least increase. Results indicate that the application of poultry droppings can significantly enhance the growth and yield of jute mallow in Makurdi, Nigeria. A similar result was found in the findings of (Sigh *et al* 2020 and Agbede *et al* 2008), who found that the application of poultry manure led to an increase in the number of tomato leaves. Poultry dropping on yield which is a factor of applying appropriate nutrient source at an appropriate spacing, seed formation and seed production is the products of nutrients, environment factors, soil and spacing as reported by (Akinyemi et al., 2024 and Madina et al., 2024) Stating that spacing, nutrients and environmental factors play a major part in seed formation and seed/crop yield

Table 4: Effect of Storage Materials on Jute mallow weight loss

Storage Materials	Day 2	Day 4	Day 6	Day 8
Tray	10.25	7.77	6.12	4.90
Basket	10.02	8.16	6.78	5.87
1 liter bucket of water	9.97	9.58	8.85	8.27
F-LSD	**0.12**	**0.19**	**0.17**	**0.29**

LSD=Least Significant Differences at 5% Level of Probability.

Harvested fresh Jute mallow at different storage place affected physiological loss in weight (PLW) in Table 4, there was a progressive and continuous increase in PLW of leaves with an increase in storage period up to 8 days. All the treatments were found to be effective in reducing PLW of leaves in comparison to the control which exhibited maximum PLW and it was significantly higher in comparison to other treatments. Minimum percentage of PLW was observed in jute mallow stored 1-liter bucket of water in all the 8 days during storage. This minimum weight loss in jute mallow might be due to short growth in the process of metabolic process through closing of lenticels and stomatal cell wall of the fruits. The primary source of the weight and moisture content losses is transpiration, which causes water to migrate out and gives the rind a shriveled appearance. The physiological weight observed on the second day of storing jute mallow in a basket and tray was consistent with the findings of Yadav et al. (2003), who suggested that the combination of the wax coating's microbiological and moisture-inhibiting properties may be the cause of spoiling (loss). Yadav as al. (2003) showed minimal decay loss utilizing wax and wax-like safe fungicide during storage, while Gautam et al. (2003) reported similar findings for mango and kinnow mandarin.

Table 5: Effect of Storage Materials on Decay of Jute mallow

Packaging Materials	Day 2	Day 4	Day 6	Day 8
Tray	6.67	14.17	12.50	14.94
Basket	5.83	12.78	13.89	12.22
1 liter bucket of water	5.83	10.56	13.89	11.94
F-LSD	**0.82**	**0.58**	**1.02**	**0.07**

The results of effect of storage on jute mallow decay presented in Table 5, The result indicates that the extent of decay varied considerably under various treatments at different storage intervals**.** Also in Table 5, the decay loss increased significantly with the prolongation of storage period all storage materials except 1liter bucket of water. The decay loss was noticed from the fourth day of the storage of jute mallow on basket and tray, this finding is in collaboration with the work of Akinyemi et al., (2023) who started that vegetables lost it quality and quantity when not stored properly and when exposed to micros, causing harm to the consumers and changing the taste, Gautam *et al.* (2003) also reported that exposing vegetable in tray and baskets mostly leads to reduction in moisture content and may also lead to nutrient element lost.

Conclusion and Recommendation

Results showed significant difference among the organic manure applications (Poultry droppings and Cow dung) used in the research, were poultry droppings shows superiority over other organic manure used, followed by cow dung application, goat manure and control recorded the least on growth and yield parameters. Results on postharvest showed significant difference on storage materials (1 liter bucket of water, basket and tray) used in this research, Jute mallow stored in 1 liter bucket of water did better than other storage materials.

Based on the findings in the study, it is therefore recommends that;

Farmers should adapt the use of poultry droppings followed by cow dung and goat manure as nutrient source in jute mallow production to boost vegetative growth and yield of jute mallow, also use 1 liter bucket of water followed by tray and basket to store Jute mallow will extend the shelf life in Makurdi.

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