# Influence of Different Mulching Materials on Growth of *Adansonia Digitata* Linneous Seedlings

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**Abstract:** *Adansonia digitata* seedlings face challenges due to harsh environmental conditions; mulching can mitigate these effects and enhance growth performance significantly always. This study investigated the effect of mulching materials on the growth performance of Adansonia digitata seedlings in the nursery unit of Department of Forestry and Wildlife Management, Federal University Dutse. Four treatments including $T_1$ (Sawdust); $T_2$ (Rice bran); $T_3$ (Moringa leave) and $T_4$ (Control) were formulated. The treatments were arranged in a Completely Randomized Design (CRD) with six replications. The mulching materials were weighted 20g and carefully spread on the soil surface. Plant height, diameter (stem girth) was measured, leaf production (leaf count) counted and leaf area was assessed through formular. Analysis of Variance (ANOVA) was carried out and the means were separated using Least Significance Difference (LSD). The results showed that the mulches evaluated have significance effects on the seedlings parameters of *Adansonia digitata*. However, the mean values obtained for all the parameters considered revealed the sawdust as the best performing mulching materials. For the shoot height, mean value ranged between 26.08cm and 35.62cm, a range from 0.58cm to 0.75cm was recorded for diameter, a range from 38.50 and 43.92 was recorded for the leave area, while the mean values between 19.5 and 32.25 were obtained for number of leaves among the treatments at week 10. It concluded from the study, that sawdust should be used as mulch in the nursery for the production of *Adansonia digitata* seedlings.

**Key words:** *Adansonia digitata*, Mulching, Sawdust, Moringa Leaves, Rice bran, Growth.

## Introduction

*Adansonia digitata* (Linn) is a forest product that has both ecological and socio-economic importance. The tree is one out of the nine species of baobab which belong to the family (Malvaceae), subfamily (bombaceae) and genus of Adansonia [1,2]. Baobab is commonly found in the part of Africa especially in Madagascar [3]. Mulches affect not only the soil environment but also change the plants' environment depending on the properties of the mulches and the level of the physical contact between the mulching materials and the soil. Various mulching materials such as *Chromolaena odorata* [4], rice bran and sawdust [5] can be used to ensure optimum growth of tree seedlings. The Organic mulching materials and other crop residues used as mulch are biodegradable [6]. Mulch can facilitate fertilizer placement and reduce the loss of plant nutrient through leaching and can also provide a barrier to soil pathogens [7]. *Adansonia digitata* seedlings face challenges in survival and growth due to soil temperature, moisture, and weed competition, leading to poor establishment and low forest generation rates. Widespread decline of baobab populations would have negative effects on African societies with locals losing nutritional, pharmaceutical and income-generating resources [8]. Despite the economic values of *Adansonia digitata*, the population of the plant is declining at a geometric rate and there are no replacing measures [9]. One of the reasons for this decline is uncontrolled bush burning which is a common feature in Nigeria during the dry season. Another factor is excessive grazing by cattle and other domestic stock.

The high economic values of *Adansonia digitata* seedlings justifies the need to enhance its seedling production through application of different mulching types to suppress weed and conserve the moisture near the root of the seedlings.

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However, the study's findings were contributed to development of the optimal mulching practices for *Adansonia digitata*, enhancing seedlings survival and growth. The main objective of the study is to investigate the effect different of mulching materials on the growth of *Adansonia digitata* seedlings.

## Materials and Methods

The study was carried out in the nursery site of the Department of Forestry and Wildlife Management, Federal University Dutse, Dutse Jigawa State. Dutse is a city located in Northern Nigeria. It is the capital city of Jigawa State. Dutse, is located at latitude 11°42'04"N and longitude 9°20'31"E [10]. It experiences low rainfall throughout the year, with an annual precipitation of 743mm and average temperature of 26.5°C [11,12]. The area has a population of approximately 153,000 [13] and is known for its date trees and undulating topography. The soil is fertile, with a pH range of 6.07-6.72, and nutrient content including nitrogen (0.63-1.64g/kg), phosphorus (6.25-12.04mg/kg), and potassium (0.18-0.63 cmol/kg). The area receives 10-11 hours of sunshine daily, depending on the season [14,10].
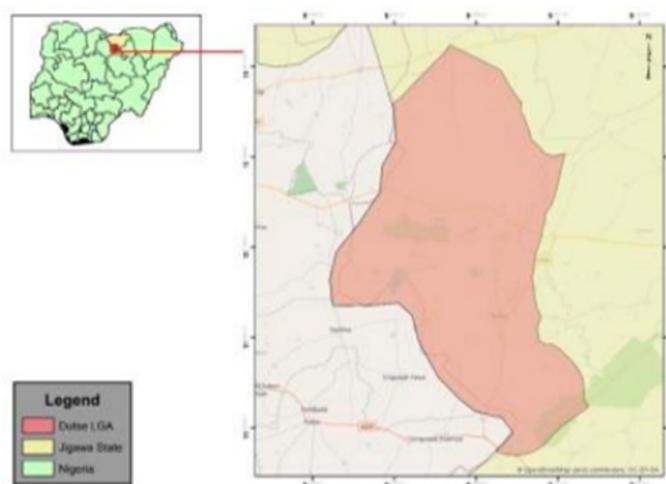


**Figure 1:** Showing the map of Dutse [15].

### Seed and Soil Collection

The mature seed of *Adansonia digitata* were collected from Jaudi village under Dutse Local Government area Jigawa state in plantation species to avoid In-Breeding for proper cross breeding. The dormancy of the seeds was first broken using hot water at 100°C according [9].

### Preparation of mulch materials

The moringa leaves, Rice bran and Sawdust (Mulching materials) were procured within Dutse. The seeds were raised for three weeks before transplanting into polythene pots. The mulch materials were weighted 20g of each applied mainly to cover the top soils two weeks after transplanting.

The parameters assessed were: shoot height, stem diameter and pod length. Shoot height of seedlings was measured from collar to the tip of the terminal bud and this was done with the aid of a metric ruler. The collar diameter of each seedling was measured with the aid of a vernier calliper. Leaf area was calculated was calculated using model of [29].

Area = (4.41 + 1.14) L*B...........................................................................................................eqn 1

### Experimental design

The experiment was laid out in a Completely Randomized Design (CRD). There were four treatments which were replicated six times respectively. $T_1$ (sawdust), $T_2$ (Rice bran), $T_3$ (Moringa leave) and $T_4$ (Control).

### Data Analysis

The following growth characteristics were observed biweekly for the period of the experiment. Shoot height (cm): Measurements were taken from the base to the apex of the plant using a ruler. Diameter (mm): Measurements were taken at the base of the plant using Vernier caliper. Leaf production: Measurement taken by counting the number of leaves on the seedlings. Analysis of Variance (ANOVA) was carried out to test for significant difference among the treatments for the growth variable observed. However, where there were significances, means were separated using the Least Significant Difference (LSD).

## Results

Table 1 showcasing the biweekly measurements from 2 to 10 weeks across four treatments ($T_1$, $T_2$, $T_3$, and $T_4$). Upon analyzing the data, it's evident that all treatments exhibit a steady increase in growth over the 10-week period, with T1 consistently demonstrating the highest values, followed closely by T2. Notably, shows the treatment with sawdust (T1) recorded the highest mean value among the treatments at week 10 with 35.62cm followed by rice bran (T2) with 33.21, control (T4) with 31.78cm and the lowest mean 26.08cm was observed in moringa leave (T3).

**Table 1:** Mean of shoot height (cm) on the effects of different of treatments on the growth of *Adansonia digitata* seedlings based on biweekly basis.

| Treatment | 2wk | 4wk | 6wk | 8wk | 10wk |
|---|---|---|---|---|---|
| T1 | 14.22 | 19.68 | 25.24 | 32.38 | 35.62±0.11 |
| T2 | 12.15 | 16.73 | 22.68 | 30.38 | 33.21±0.12 |
| T3 | 11.70 | 14.82 | 19.45 | 22.87 | 26.08±0.15 |
| T4 | 12.13 | 19.41 | 22.35 | 27.33 | 31.78±0.13 |

In table 2, the mean leaf count of Adansonia digitata seedlings across four treatments (T1, T2, T3, and T4) over a 10-week period, measured biweekly, reveals distinct growth patterns. At 2 weeks, T1 exhibits the highest leaf count (5.83), followed closely by T4 (5.0), while T2 and T3 trail behind. By 4 weeks, T1 continues to lead with a significant increase (10.25), whereas T2 and T3 display moderate growth, and T4 remains relatively steady. At 6 weeks, T1's leaf count surges to 22.75, establishing a substantial lead, while T2 and T4 show notable increases, and T3's growth slows. The 8-week mark sees T1 maintaining its lead (28.75), with T2 and T4 continuing to grow steadily, and T3's growth stagnating. By 10 weeks, T1 reaches a leaf count of 32.25, solidifying its position as the most effective treatment, followed by T2 (26.50), T4 (22.1), and T3 (19.50), indicating that T1 and T2 the most suitable treatments for promoting healthy leaf growth in Adansonia digitata seedlings.

**Table 2:** Mean of the leave count on the effects of different of treatments on the growth of *Adansonia digitata* seedlings based on biweekly basis.

| Treatment | 2wk | 4wk | 6wk | 8wk | 10wk |
|---|---|---|---|---|---|
| T1 | 5.83 | 10.25 | 22.75 | 28.75 | 32.25±0.12 |
| T2 | 4.33 | 8.42 | 16.0 | 21.42 | 26.50±0.15 |
| T3 | 4.17 | 8.60 | 13.17 | 16.64 | 19.50±0.21 |
| T4 | 5.0 | 8.67 | 16.89 | 19.33 | 22.17±0.18 |

Table 3 shows the results of the effect of all the treatments on *Adansonia digitata* seedlings. For the period of assessment, the mean of leaf area (cm) across four treatments (T1, T2, T3, and T4) over a 10-week period, measured biweekly, reveals intriguing growth dynamics. At 2 weeks, T1 exhibits the largest leaf area (14.34cm), followed by T4 (11.67cm) and T2 (10.79cm), while T3 trails behind (6.28cm). By 4 weeks, T1 and T3 display notable increases, with T3 surprisingly leapfrogging T2 and T4. At 6 weeks, T4 takes the lead with a leaf area of 34.94, closely followed by T1 (30.67cm) and T3 (30.21cm), while T2 continues to grow steadily. The 8-week mark sees T4 maintaining its lead (39.54cm), with T1 and T3 closely behind, and T2 narrowing the gap. By 10 weeks, T4 and T1 are virtually tied (44.23cm and 43.92cm, respectively), with T2 (42.33cm) and T3 (38.50cm) following closely, indicating that T1 and T4 are the most effective treatments for promoting leaf expansion in *Adansonia digitata* seedlings, while T3's initial slow growth is compensated by its subsequent rapid development.

**Table 3:** Mean of the leave area on the effects of different of treatments on the growth of *Adansonia digitata* seedlings based on biweekly basis.

| Treatment | 2wk | 4wk | 6wk | 8wk | 10wk |
|---|---|---|---|---|---|
| T1 | 14.34 | 22.42 | 30.67 | 36.86 | 43.92±0.09 |
| T2 | 10.79 | 18.19 | 27.47 | 35.71 | 42.33±0.10 |
| T3 | 6.28 | 21.08 | 30.21 | 36.44 | 38.50±0.11 |
| T4 | 11.67 | 20.56 | 34.94 | 39.54 | 44.23±0.09 |

Table 4 shows the results of the effect of all the treatments on Adansonia digitata seedlings. For the period of assessment. At 2-week, treatment with T1 exhibits the highest diameter (0.63cm), followed closely by T2 (0.56cm), while T3 and T4 trail behind with similar values (0.42cm and 0.43cm, respectively). By 10 weeks, T1 maintains its lead with a highest diameter of 0.75cm, indicating a 19% increase from the initial measurement. T2 and T4 also display significant growth, with T2 reaching 0.72cm (28% increase) and T4 reaching 0.68cm (58% increase), while T3 shows a modest increase to 0.58cm (38% increase). The results suggested that T1 and T2 are the most effective treatments for promoting stem girth in Adansonia digitata seedlings, while T4's substantial growth indicates potential benefits from its treatment. Conversely, T3's relatively slower growth may indicate limitations or areas for improvement in its treatment approach.

**Table 4:** Mean of the diameter (cm) on the effects of different of treatments on the growth of *Adansonia digitata* seedlings based on biweekly basis.

| Treatment | 2wk | 10wk |
|---|---|---|
| T1 | 0.63 | 0.75±0.18 |
| T2 | 0.56 | 0.72±0.18 |
| T3 | 0.42 | 0.58±0.16 |
| T4 | 0.43 | 0.68±0.17 |

## Discussion

The growth of *Adansonia digitata* seedlings was significantly influenced by different treatments, as evident from the biweekly measurements of shoot height from 2 to 10 weeks (Table 1). Consistent with the findings of [16], who investigated the effects of organic amendments on plant growth, the treatment with sawdust (T1) recorded the highest mean value among the treatments at week 10 with 35.62cm. This is likely due to the improved soil structure and fertility provided by the sawdust amendment [17]. In contrast, the treatment with moringa leave (T3) exhibited the lowest mean value of 26.08cm, which may be attributed to the potential allelopathic effects of moringa on plant growth [18]. The control treatment (T4) and rice bran treatment (T2) showed intermediate growth responses, with mean values of 31.78cm and 33.21cm, respectively. These findings are consistent with the work of [19], who reported significant improvements in plant growth and yield in response to organic amendments. Overall, the results suggest that the choice of treatment can significantly impact the growth of *Adansonia digitata* seedlings. Table 2, demonstrated the significant impact of different treatments on leaf development. Consistent with the findings of [20], who investigated the effects of organic manure on plant growth, the treatment with sawdust (T1) exhibited the highest leaf count throughout the 10-week period, reaching a maximum value of 32.25cm at 10 weeks. This is likely due to the improved soil structure and fertility provided by the sawdust amendment [21]. In contrast, the treatment with moringa leave (T3) showed the slowest growth rate, with a final leaf count of 19.50cm at 10 weeks, which may be attributed to the potential allelopathic effects of moringa on plant growth [22]. The control treatment (T4) and rice bran treatment (T2) displayed intermediate growth responses, with final leaf counts of 22.17cm and 26.50cm, respectively. These findings are consistent with the work of [23], who reported significant improvements in plant growth and yield in response to organic amendments. Table 3, shows the impact of different treatments on leaf expansion. Consistent with the findings of [24], who investigated the effects of organic amendments on plant growth, the treatment with sawdust (T1) exhibited a rapid increase in leaf area throughout the 10-week period, reaching a maximum value of 43.92cm at 10 weeks. This is likely due to the improved soil structure and fertility provided by the sawdust amendment [25]. In contrast, the treatment with moringa leave (T3) showed an initial slow growth rate, but surprisingly leapfrogged T2 and T4 by 4 weeks, and maintained a steady growth rate thereafter, reaching a final leaf area of 38.50cm at 10 weeks. The control treatment (T4) displayed a consistent growth pattern, with a final leaf area of 44.23cm at 10 weeks. These findings are consistent with the work of [26], who reported significant improvements in plant growth and yield in response to organic amendments. Table 4 demonstrate the significant impact of different treatments on stem girth development. Consistent with the findings of [27], who investigated the effects of organic amendments on plant growth, the treatment with sawdust (T1) exhibited the highest diameter throughout the 10-week period, reaching a maximum value of 0.75cm at 10 weeks. This is likely due to the improved soil structure and fertility provided by the sawdust amendment [21]. In contrast, the treatment with moringa leave (T3) showed the slowest growth rate, with a final diameter of 0.58cm at 10 weeks, which may be attributed to the potential allelopathic effects of moringa on plant growth [22]. The control treatment (T4) displayed a substantial growth rate, with a final diameter of 0.68cm at 10 weeks. These findings are consistent with the work of [24], who reported significant improvements in plant growth and yield in response to organic amendments. Our findings also align with the study by [28], which demonstrated that mulching materials significantly impacted the seedling height of *Parkia biglobosa*. Notably, their research highlighted sawdust as the top-performing mulching material, based on mean values across various parameters.

These results corroborate our own study, suggesting that sawdust mulch can be an effective tool in promoting the growth of *Parkia biglobosa* seedlings, and reinforcing the potential benefits of incorporating sawdust mulch in similar environmental and agricultural contexts.

Based on the results of the study, which investigated the effects of different mulching materials on *Adansonia digitata* seedling growth, there were significant findings that emerged. The research, conducted over a 10-week period using sawdust (T1), rice bran (T2), moringa leaves (T3), and a control group (T4), demonstrated that mulching materials significantly influenced various growth parameters of the seedlings. Sawdust consistently proved to be the most effective mulching material, producing superior results in shoot height (35.62cm), leaf count (32.25), and stem diameter (0.75cm), likely due to its ability to improve soil structure and fertility. Rice bran emerged as the second most effective treatment, showing promising results across all measured parameters. While the control group performed moderately well, particularly in leaf area development (44.23cm at 10 weeks), the moringa leaves treatment generally showed the lowest performance across most parameters, possibly due to allelopathic effects.

## Conclusion

The study demonstrated that different mulching materials significantly impact the growth of *Adansonia digitata* seedlings. Sawdust emerged as the most effective treatment, enhancing shoot height, leaf count, and stem diameter, likely due to improved soil structure and fertility. Rice bran was the second most effective treatment. Moringa leaves showed potential allelopathic effects, resulting in lower growth performance. These findings suggest that sawdust and rice bran can be viable options for promoting the growth of *Adansonia digitata* seedlings.

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