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Mulching Tree Leaves Improve the Growth, Yield, and Yield Components of Hybrid Maize

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ABSTRACT

The experiment was carried out at the Agroforestry Farm, Department of Agroforestry, Bangladesh Agricultural University, Mymensingh from November 2019 to March 2020 to assess the impact of tree leaf mulching on the growth, yield attributes, and yield of maize. The study used a Randomized Complete Block Design with three replications and six treatments. These treatments were: T_0=Control (no mulch), T_1=Akashmoni (*Acacia auriculiformis*) tree leaf mulch, T_2=Segun (*Tectona grandis*) tree leaf mulch, T_3=Kalo koroi (*Albizia lebbeck*) tree leaf mulch, T_4=Jhau (*Casuarina equisetifolia*) tree leaf mulch, and T_5=Jackfruit (*Artocarpus heterophyllus*) tree leaf mulch. The results showed that the Kalo koroi tree leaf mulch (T_3) led to the highest values for various parameters such as plant height, number of effective tillers per plant, number of leaves per plant, leaf length, leaf diameter, number of cobs per plant, length, and diameter of cob, the weight of single cob, number of grains per cob, grain weight per cob, 100-grain weight, and grain yield of maize (221.18 cm, 0.93, 17.29, 79.26 cm, 7.30 cm, 4.18, 1.70, 21.11 cm, 6.08 cm, 212.12 g, 453.85 g, 138.91 g, 30.60 g, and 11.81 t/ha). Conversely, the lowest values were obtained in the control (T_0) (no mulch), followed by T_2 and T_1 treatments (209.39 cm, 0.37, 12.5, 72.48 cm, 4.62 cm, 1.50, 15.03 cm, 4.44 cm, 202.19 g, 421.56 g, 111.55 g, 26.46 g, and 8.35 t/ha). Among the various tree leaf mulch treatments, it was found that the Kalo koroi tree leaf mulch performed better for vegetative growth, yield, and yield-contributing attributes in maize compared to the no mulch treatment. Therefore, it was suggested that tree leaf mulches could be a potential alternative to traditional mulches in maize cultivation.

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INTRODUCTION

Maize (*Zea mays*) is one of the most important cereal crops globally, serving as both human food and animal feed. It is often referred to as the "Queen of Cereals" due to its high yield potential. Maize has become a staple food in many parts of the world, with its total production surpassing that of wheat or rice. In addition to direct human consumption, maize is used for producing corn ethanol, animal feed, and various maize products such as corn starch and corn syrup. Its average production is higher than that of other cereals. Maize is widely cultivated worldwide and consistently yields more production than any other grain. In Bangladesh, many people live below the poverty line and struggle to obtain adequate calories. This presents a challenge for policymakers trying to address malnutrition in the country. Maize is a crucial crop in this context due to its nutritional content, including carbohydrates, protein, fat, fiber, vitamin A, vitamin E, and more, in greater quantities than wheat. Therefore, maize is highly nutritious and should receive serious attention for cultivation in Bangladesh. The cultivation of maize is significant as it helps alleviate pressure from rice and wheat, traditional crops that struggle to meet the nutritional requirements of the expanding population. Approximately 1.2 million tons of maize are used each year, mostly in the poultry industry, of which only 42% is produced domestically, with the rest being imported (use citation). Under these circumstances, introducing hybrid maize in Bangladesh for human consumption can be a viable alternative for ensuring food security due to its higher yield productivity compared to rice and wheat. maize is grown in 325455 hectares, producing 2.28 million tons of grains annually (BBS, 2016).

Water shortage is a significant limitation for crop production, making irrigation essential for successful crop growth (Annon, 2008). In Bangladesh, winter experiences unpredictable rainfall and high evapotranspiration, with only 40% of arable land suitable for irrigation (Islam and Kaul, 1986). Maize is known to have high irrigation requirements (Rhoads and Bennett, 1990). The agricultural sector faces the challenge of producing more food with less water, and mulching is a highly effective solution. It enhances irrigation water efficiency and allows for the cultivation of larger areas. Mulching materials can be organic (such as tree leaves, straw, hay, and compost) or inorganic (like polythene or plastic sheeting). While organic mulches are advantageous due to easy accessibility and low cost, excessive use of unsorted inorganic materials may alter soil properties. Additionally, agroforestry systems, including different tree leaves, are valuable sources of organic matter that can enhance soil fertility by providing nutrients like nitrogen, phosphorus, potassium, and sulfur.

There have been numerous studies confirming the benefits of mulches, including moderating soil temperature, improving soil porosity, controlling runoff and erosion, suppressing weed growth, and maintaining high crop yields (Khurshid *et al.*, 2006; Anikwe *et al.*, 2007; Essien *et al.*, 2009; Glab and Kulig, 2008). Many studies have examined the effects of mulching materials on the growth and yield of various crops and vegetables in Bangladesh and around the world (Bharati *et al.*, 2020; Chettri and Goswami, 2018; Begum, 2018; Quee *et al.*, 2017; Pulok *et al.*, 2016; Urmee, 2014; Rahman *et al.*, 2008; Islam *et al.*, 2007). However, there hasn't been any research on the effects of tree leaf mulches on maize growth and yield in Bangladesh. Therefore, it is essential to determine the effects of agroforestry tree leaf mulches on vegetative growth parameters, yield-contributing characters, and maize yield. Additionally, it is important to identify the most effective tree leaf mulches for enhancing maize growth and yield performance.

MATERIALS AND METHODS

Description of the experimental site

The experiment was conducted at the Agroforestry Farm, Department of Agroforestry, Bangladesh Agricultural University, Mymensingh from November 2019 to March 2020. The experimental field is located at 24°75' North latitude and 90°50' East longitude. The soil of the experimental field had a pH value ranging from 6.5 to 6.8 (Hasan *et al.*, 2007), and it was characterized by non-calcareous dark grey floodplain soil belonging

to the Sonatola soil series under the Old Brahmaputra Floodplain, AEZ 9. The land type was medium-high with silty loam in texture. The experimental area is situated in the sub-tropical climatic zone with heavy rainfall from April to September (Kharif Season) and scanty rainfall during the rest of the year. The Rabi season (October to March) is characterized by comparatively low temperatures and plenty of sunshine from November to February.

Plant material

Maize thrives in clayey loam soils and requires a temperature between 12ºC and 29ºC for growth. The hybrid variety used in the study, Rocket 55, is known for high yield and disease resistance. Maize seeds were obtained from Alpha Seed International Company Limited, and collected from Nadim seed store, Natun Bazar, Mymensingh.

Experimental design and treatments

The experiment followed a Randomized Complete Block Design (RCBD) and included six treatments with three replications. There were 18-unit plots in total, each measuring 1.5 m × 1.5 m. The treatments, which included five different tree leaf biomass mulches as well as a control (no mulch), were randomly assigned to the unit plots in each block. The treatments used in the experiment were as follows: T_0= Control (no mulch), T_1= Akashmoni (*Acacia auriculiformis*) tree leaf mulch, T_2= Segun (*Tectona grandis*) tree leaf mulch, T_3= Kalo koroi (*Albizia lebbeck*) tree leaf mulch, T_4= Jhau (*Casuarina equisetifolia*) tree leaf mulch, and T_5= Jackfruit (*Artocarpus heterophyllus*) tree leaf mulch.

Mulch Materials Collection and Preparation

The chosen tree leaf species - *Acacia auriculiformis, Tectona grandis, Albizia lebbeck, Casuarina equisetifolia,* and *Artocarpus heterophyllus* - were gathered from the Akashmoni, Segun, Kalokoroi, Jhau, and Jackfruit trees on the Bangladesh Agricultural University Campus. These collected tree leaves were then left to dry in the sun for a few days.

Land Preparation

In the first week of November 2019, the designated land for the experiment was tilled with a power tiller and exposed to the sun for a week. Subsequently, the land was ploughed and cross-ploughed to achieve good tilth. Deep ploughing was carried out to ensure good tilth, which was crucial for obtaining a better crop yield. Laddering was performed to break up the soil clods into small pieces after each ploughing. All weeds and stubbles were removed from the experimental field.

Application of Manure and Fertilizers

The recommended manure and fertilizer dosage of cow dung, urea, TSP, and MoP was applied in the experimental unit plot (see Table 1) (Ahmed *et al.*, 2018). The total quantity of cow dung, TSP, and MoP was applied during the final land preparation. Urea fertilizer was applied in three equal splits: during final land preparation, and 30 and 60 days after sowing (DAS) of seeds.

Table 1. Recommended dosage of fertilizer and manure for maize cultivation

Types of Manures/Fertilizers used	Dose/ha	Dose/plot
Well-decomposed cow dung	4-6 tons	1.35 kg
Urea	120 Kg	27 gm
Triple Super Phosphate (TSP)	60 Kg	13.5 gm
Muriate of Potassium (MoP)	40 Kg	9.0 gm

Seed Sowing and Application of Mulch Materials

Seeds were treated with Vitavex at a rate of 0.2% to 0.3% of seed weight before sowing. They were sown on November 28, 2019, in rows 20 cm apart. Two to three seeds were sown per hill, maintaining a plant-to-plant spacing of 20 cm. After sowing, the seeds were covered with soil and lightly pressed by hand. Mulches of Akashmoni, Segun, Kalo koroi, Jhau, and Jackfruit tree leaves were collected and immediately applied after sowing to promote the proper emergence of seedlings. The mulches were applied at a rate of 10 tons/ha, ensuring proper thickness in each plot.

Inter-Cultural Operations

Gap filling was conducted on the 6th and 7th days after sowing. Seedling emergence was completed within 15 days after sowing. Overcrowded seedlings were thinned out twice. Weeding was carried out twice during the growing period: the first weeding occurred 20 days after sowing, and the second weeding took place 40 days after sowing. Earthing up was performed at 32 days after sowing to prevent lodging and enhance nutrient uptake. Irrigation was provided using pipes according to the treatment. Parrots are the main pests in the maize field, and regular visits were made for crop protection. The field boundary was also utilized for maize crop protection.

Sampling and Data Collection

Five plants were randomly chosen from each plot to record the growth and yield-contributing characteristics of maize. Data was collected before crop harvest, and information on grain yields was recorded and expressed as tons per hectare. Parameters such as plant height (cm), number of effective tillers per plant, number of leaves per plant, leaf length (cm), leaf diameter (cm), number of cobs per plant, length of cob (cm), diameter of cob (cm), weight of cob (g), number of grains per cob, weight of grain per cob (g), 100-grain weight (g), and grain yield (tons per hectare) were recorded from each unit plot at the time of harvest.

Statistical Analysis

The recorded data underwent statistical analysis. Analysis of variance was conducted using a randomized complete block design with the assistance of STATISTIX10 software. The mean differences among the treatments were determined by the Least Significant Difference (LSD) values for interpreting the results.

RESULTS AND DISCUSSION

Tree leaf mulching influences on vegetative characteristics of maize cv. Rocket 55

Plant Height (cm)

There was a significant variation in plant height due to the application of various tree leaf mulches during the growth phase of maize plants (Table 2). The tallest maize plant (221.18 cm) was recorded in treatment T_3 (Kalo koroi tree leaf mulch), while the smallest plant (209.39 cm) was in treatment T_0 (no mulch) (Table 2). The second-highest plant height (219.34 cm) was obtained in treatment T_2 (Segun tree leaf mulch), followed by treatments T_1, T_5, and T_4 (Table 2). The plant height of maize obtained in the Kalo koroi tree leaf mulch-treated plots was better among the tree leaf mulches (Table 2). The results are consistent with the research findings of Asif *et al.* (2020) who found that the application of plastic and wheat straw mulch produced the maximum plant height (215.67 cm and 208 cm) and the minimum plant height (165 cm) observed under the control treatment. Khurshid *et al.* (2006) reported similar results regarding mulch levels, with the mean maximum height of 217.67 cm of maize plant obtained when mulch was applied @ 12 Mg ha^{-1}, followed by

217.35 and 205.71 cm in 8 and 4 Mg ha^{-1}, while the minimum plant height, 185.63 cm, was obtained in the control treatment. The mean increase in plant height was 17.26%, 17.08%, and 6.2% in treatments where mulch was applied @ 12, 8, and @ 4 Mg ha^{-1}, respectively, which supports the present study findings.

Number of Effective Tillers per Plant

The number of effective tillers per plant of maize varied significantly due to the application of different tree leaf mulches (Table 2). The maximum (0.93) number of effective tillers per plant of maize was produced in treatment T_3, which was statistically similar to treatment T_2 (Segun leaf mulch), while the minimum (0.37) number of effective tillers was found in the control treatment (T_0), where no mulches were applied (Table 2). Rahman (1999) reported that the number of tillers plant^{-1} of maize was positively and significantly influenced by all mulches. Karimuna *et al.* (2022) showed that the interaction between maize variety and bokashi plus fertilizer had a significant effect on the growth and yield of maize intercropped with peanuts under three years of teak trees in an agroforestry system in Indonesia.

Number of Leaves per Plant

The effects of different tree leaf mulching materials on maize growth in terms of the number of leaves per plant varied significantly (Table 2). The maximum (17.29) number of leaves per plant was attained in treatment T_3, which was statistically similar to treatments T_2 and T_1. The minimum (12.51) number of leaves per plant was obtained in the T_0 treatment (no mulch), which was statistically similar to the T_5 and T_4 treatments (Table 2). The significant increase in leaf number in the mulch plots over unmulched could imply that the mulch plots contained higher mineral nutrients from decomposed mulch. The plots treated with 120 kg ha-1 of *Gliricidia sepium* leaves mulch produced the maximum number of leaves (7.8) at 1 MAP (the month after planting) and (9.8) at 2 MAP, followed by 90 kg ha^{-1} mulch rate where the minimum number of leaves (5.0) at 1 MAP (the month after planting) and (6.0) reported by Quee *et al.* (2017) support the present findings.

Table 2. Effect of tree leaf mulching on the vegetative characters of maize cv. Rocket 55

Treatments	Plant height (cm)	Number of tillers/plants	Number of leaves/plants	Leaf length (cm)	Leaf diameter (cm)
T_0	209.39c	0.37d	12.51c	72.48b	4.62c
T_1	215.91ab	0.67bc	15.30abc	76.33ab	5.67bc
T_2	219.34a	0.80ab	16.26ab	78.53a	6.13ab
T_3	221.18a	0.93a	17.29a	79.26a	7.30a
T_4	210.22bc	0.57c	13.48bc	74.20ab	4.90c
T_5	212.61bc	0.63bc	14.19abc	75.00ab	5.78bc
Level of sig.	*	**	*	*	*
CV (%)	1.61	10.93	13.63	4.07	11.51

Note: Figures in the columns sharing the same letter(s) are not significantly different; * and ** indicate significance at the 5% and 1% levels of probability, respectively; CV= Coefficient of Variation; T_0= Control (no mulch), T_1= Akashmoni (*Acacia auriculiformis*) tree leaf mulch, T_2= Segun (*Tectona grandis*) tree leaf mulch, T_3= Kalo koroi (*Albizia lebbeck*) tree leaf mulch, T_4= Jhau (*Casuarina equisetifolia*) tree leaf mulch, and T_5= Jackfruit (*Artocarpus heterophyllus*) tree leaf mulch.

Leaf Length (cm) and Diameter (cm)

From Table 2, it was found that the leaf length and leaf diameter of maize varied significantly due to the effects of different tree leaf mulching materials (Table 2). The highest leaf length and leaf diameter (79.26 cm and 7.30 cm) were recorded for treatment T_3, whereas the smallest leaf length (72.48 cm and 4.62 cm) was recorded in the control treatment (Table 2). Similar results were found by Rahman (1999) regarding the positive and significant influence of all mulches on the leaf diameter of maize. Karimuna *et al.* (2022) also showed that the interaction between maize variety and bokashi plus fertilizer had a significant effect on the growth characteristics of maize intercropped with peanuts under three years of teak trees in an agroforestry system in Indonesia.

Influence of tree leaf mulches on the yield contributing characteristics and yield of maize cv. Rocket 55

Number of Cobs per Plant

The number of cobs per plant of maize showed a significant variation due to the use of different tree leaf mulching materials (Table 3). The results indicated that the treatment T_3 (Kalo koroi leaf mulch) resulted in the highest number of cobs per plant (1.70), which was statistically similar to the numbers for treatments T_2 and T_1. In contrast, the control treatment (T_0) showed the lowest number of cobs per plant (1.50), and this was statistically similar to treatments T_4 and T_5 (Table 3). Karimuna *et al.* (2022) demonstrated that the combination of maize variety and bokashi plus fertilizer significantly influenced the growth and yield of maize intercropped with peanuts in an agroforestry system under three years of teak trees.

Table 3. Effects of tree leaf mulches on yield contributing characteristics of hybrid maize

Treatments	Cob/ plant (no.)	Length of cob (cm)	Diameter of cob (cm)	Weight of cob (g)	Number of grain/ cob	Grain weight/ cob (g)	100-grain weight (g)
T_0	1.50c	15.03d	4.44c	202.19b	421.56d	111.55c	26.46c
T_1	1.58abc	18.26bc	5.21abc	207.81ab	440.22bc	126.49b	28.74ab
T_2	1.63ab	19.89ab	5.85ab	210.78a	449.50ab	131.58ab	29.27ab
T_3	1.70a	21.11a	6.08a	212.12a	453.85a	138.91a	30.60a
T_4	1.57bc	16.03cd	4.67c	204.92ab	432.56cd	113.60c	26.27c
T_5	1.52bc	17.26bcd	4.93bc	206.20ab	435.89c	121.72bc	27.93bc
Level of sig.	*	**	*	*	*	*	*
CV (%)	4.61	5.83	11.53	2.17	1.46	4.57	4.39

Note: Figures in the columns sharing the same letter(s) are not significantly different; sig= significance; * and ** indicate significance at the 5% and 1% levels of probability, respectively; CV= Coefficient of Variation; T_0= Control (no mulch), T_1= Akashmoni (*Acacia auriculiformis*) tree leaf mulch, T_2= Segun (*Tectona grandis*) tree leaf mulch, T_3 = Kalo koroi (*Albizia lebbeck*) tree leaf mulch, T_4= Jhau (*Casuarina equisetifolia*) tree leaf mulch, and T_5= Jackfruit (*Artocarpus heterophyllus*) tree leaf mulch.

Length (cm) and Diameter (cm) of Cob

The length and diameter of maize cob increased significantly due to the effects of tree leaf mulches, as shown in Table 3. The maximum length and diameter of the cob, 21.11 cm and 6.08 cm respectively, were recorded in the treatment T_3 (Kalo koroi leaf mulch), while the minimum length and diameter, 15.03 cm and

4.44 cm, were obtained in the T_0 treatment (Table 3). The highest cob length was recorded in maize with straw mulches, as reported by Quayyum and Ahmed (1993), and the application of rice straw mulch was found to produce significantly higher cob diameter and grain yields (Pinjari, 2007). Karimuna *et al.* (2022) showed that the highest cob length and cob diameter were consistently achieved with a combination of maize hybrid variety and bokashi plus fertilizer treatment when maize was intercropped with peanut under three years of teak trees in an agroforestry system.

Weight of Single Cob (g)

Statistically significant variation was found for cob weight due to the effects of tree leaf mulching. The maximum cob weight, 212.12 g, was recorded in the T_3 treatment, similar to the T_2, T_1, T_4, and T_5 treatments, while the minimum, 202.19 g, was recorded in the T_0 treatment (Table 3). Asif *et al.* (2020) found that the application of plastic and wheat straw mulch increased grain yield per cob over the weedy check control. Karimuna *et al.* (2022) demonstrated that the maximum cob weight was recorded in the combination of a maize hybrid variety and bokashi plus fertilizer treatment, and the minimum weight was recorded in the control treatment when maize was intercropped with peanut under three years of teak trees in an agroforestry system.

Number of Grains per Cob

A significant difference was observed for the number of grains per cob under different treatments. The number of grains per cob ranged from 421.56 to 453.85. The highest number of grains per cob, 453.85, was observed in Kalo koroi tree leaf mulch, while the minimum number, 421.56, was observed in the control (Table 3). Panday *et al.* (2000) described that total grains per cob are significantly influenced by mulching, and Khurshid *et al.* (2006) found that the mean maximum number of maize grains was influenced by the amount of mulch applied. Gill *et al.* (1992) found that there was more than a 50% increase in the seed yield of maize in the presence of straw mulch. Khera and Singh (1998) also found that the number of seeds is higher in the plot that contains mulching in comparison with unmulched treatment.

Grain Weight per Cob (g)

The mean comparison for grain weight per cob of maize among different treatments is varied due to the application of tree leaf mulching presented in Table 3. The grain weight per cob ranged from 111.55 to 138.91 g. The maximum grain weight per cob, 138.91 g, was recorded under the T_3 treatment, similar to the T_2 treatment, while the minimum weight, 111.55 g, was recorded under the control treatment (Table 3). The present findings are similar to the findings of Asif *et al.* (2020) described that plastic mulch contributes to maintaining high maize yield by increasing grain weight per cob, and Kalaghatagi *et al.* (1990) showed that grain weight per cob is higher with mulching treatment compared to unmulched treatment.

100-Grain Weight (g)

A significant difference was found for 100-grain weight under different tree leaf mulching treatments in maize. The 100-grain weight ranged from 26.27 to 30.60 g. The highest 100-grain weight, 30.60 g, was obtained with the application of Kalo koroi tree leaf mulch which was comparable to Segun tree leaf mulch (29.27 g) and Akashmoni tree leaf mulch (28.74 g). The lowest 100-grain weight (26.27 g) was observed under control conditions (no mulch) (Table 3). Asif *et al.* (2020) also reported that sawdust mulch increases the 100-grain weight of maize crops. Similarly, Quayyum and Ahmed (1993) found that seed weight was significantly influenced by mulching treatment compared to the control.

Grain Yield (t/ha)

The use of different tree leaf mulches had a significant impact on the maize grain yield per hectare (Figure 1). The grain yield of maize varied from 8.35 to 11.81 tons per hectare (Figure 1). The results indicated that the highest grain yield of maize (11.81 t/ha) was achieved with the application of Kalo koroi tree leaf mulch,

followed by Segun tree leaf mulch, while the control (no mulch) resulted in the lowest grain yield of maize (8.35 t/ha) (Figure 1). The use of Kalo koroi tree leaf mulch increased soil moisture percentage and nutrient availability, leading to higher values of yield components and overall maize yield compared to other treatments (Figure 1). These findings are supported by previous studies. Tolk *et al.* (1999) reported that transparent plastic mulch increased grain yield by 17% and 14% over bare soil. Tian *et al.* (1993) also found significant improvements in maize production with the application of mulch compared to the weedy check (control) treatment. Asif *et al.* (2020) noted that the use of plastic and wheat straw mulch in maize production increased grain yield by 33.13% and 14.57%, respectively over the control condition. The increased grain yield with the application of tree leaf mulch can be attributed to higher soil moisture percentage and nutrient availability, which promote proper growth and enhance the yield components and grain yield of maize.

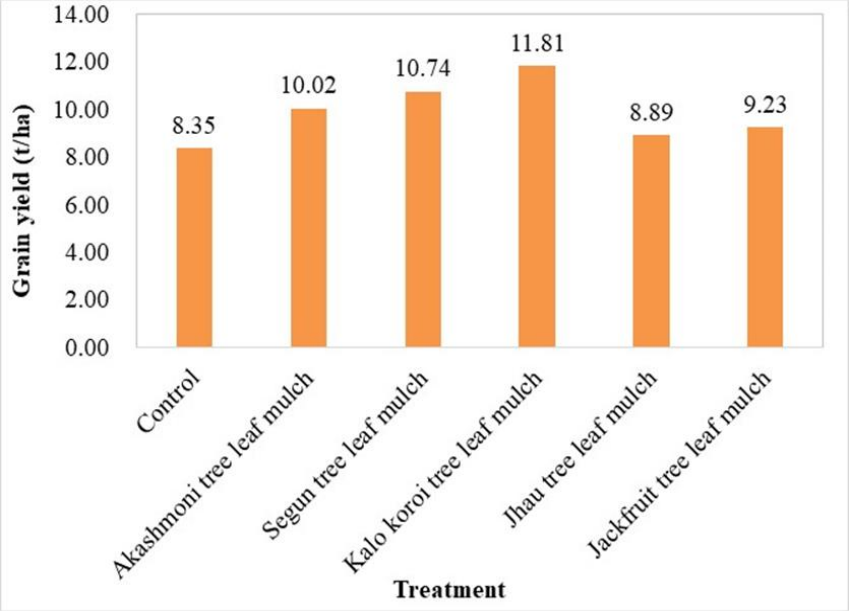

Figure 1. Grain yield of maize with the application of tree leaf mulches

CONCLUSION

Based on the results above, it was found that using mulch from the Kalo koroi tree leaves had a significant influence on the growth, yield, and yield-contributing characters of maize. The highest maize grain yield was 11.81 t/ha with Kalo koroi tree leaf mulch and 10.74 t/ha with teak tree leaf mulch. In contrast, the grain yield of maize was 8.35 t/ha with the control treatment. These findings indicate that Kalo koroi tree leaf mulch is effective in achieving the highest grain yield of maize compared to other mulches.

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CONFLICT OF INTEREST

All the authors stated that they have no conflicting interests.

REFERENCES

1. Ahmed S, *et al.* 2018. Fertilizer Recommendation Guide-2018. Bangladesh Agricultural Research Council (BARC), Farmgate, Dhaka 1215. p. 223.
2. Anikwe MAN, CN Mbah, PI Ezeaku and VN Onyia, 2007. Tillage and plastic mulch effects on soil properties and growth and yield of cocoyam (*Colocasia esculenta*) on an ultisol in south-eastern Nigeria. Soil and Tillage Research, 93(2): 264-272.
3. Annon, 2008. Optimizing maize yield under irrigation. Grain Research and Development Corporation, Australian Government.
4. Asif M, MA Nadeem, A Aziz, ME Safdar, M Adnan, A Ali, N Ullah, N Akhtar and B Abbas, 2020. Mulching improves weed management, soil carbon and productivity of spring-planted maize (*Zea mays* L.). International Journal of Botany Studies, 5(2): 57-61.
5. BBS (Bangladesh Bureau of Statistics) 2016. Annual Agricultural Statistics 2009–10. Statistics and Informatics Division (SID), Ministry of Planning, Government People's Republic of Bangladesh, Dhaka. p. 37.
6. Begum A, 2018. Effects of potassium and mulching on growth and yield of potato. MS Thesis, Department of Horticulture, Sher-e-Bangla Agricultural University, Sher-e--Bangla Nagar, Dhaka-1207. pp: 1-82
7. Bharati S, B Joshi, R Dhakal, S Paneru, SC Dhakal and KR Joshi, 2020. Effect of different mulching on yield and yield attributes of potato in Dadeldhura district, Nepal. Malaysian Journal of Sustainable Agriculture, 4(2): 54-58.
8. Chettri P and SB Goswami, 2018. Effect of crop and non-crop mulch management under varying moisture regimes on the growth and yield of zero tillage potato in rain-fed low land rice ecosystem. International Journal of Current Microbiology and Applied Sciences, 7(9): 2334-2339.
9. Essien BA, JB Essien, JC Nwite, KA Eke, UM Anaele and JU Ogbu, 2009. Effect of organic mulch materials on maize performance and weed growth in the derived savanna of south-eastern Nigeria. Nigeria Agricultural Journal, 40(1-2): 255-262.
10. Gill KS, MA Arshad, BK Chivunda, B Phiri and M Gumbo, 1992. Influence of residue mulch, tillage and cultural practices on weed mess and corn yield from three field experiments. Soil and Tillage Research, 24: 211-23.
11. Glab T and B Kulig, 2008. Effect of mulch and tillage system on soil porosity under wheat (*Triticum aestivum*). Soil and Tillage Research, 99(2): 169-178.
12. Hasan MK, GMM Rahman and MM Rahman, 2007. Effect of tree leaf biomass on the performance of rice cv. BR11 and subsequent soil health. Journal of Agroforestry and Environment, 1(2): 7-10.
13. Islam MJ, AKMM Hossain, F Khanam, UK Majumder, MM Rahman and MS Rahman, 2007. Effect of Mulching and Fertilization on Growth and Yield of Garlic at Dinajpur in Bangladesh. Asian Journal of Plant Sciences, 6(1): 98-101.
14. Islam TMT and AK Kaul, 1986. Prospects of maize in Bangladesh. FAO/UNDP. Dhaka, Bangladesh. pp: 1-59,109.
15. Kalaghatagi SB, GN Kulkarni and SM Mutanal, 1988. Effect of various mulches and scheduling of irrigation on growth and yield of summer maize. Journal of Maharashtra Agricultural University, 13(2): 223-224.
16. Karimuna L, Halim, A Ansi, WE Marfi, T Wijayanto and L Hasanuddin, 2022. Growth and yields of two varieties of maize (*Zea mays* L.) intercropped with peanut (*Arachys hypogaea* L.) applied by bokashi plus fertilizer between the rows of teak trees-based agroforestry system. IOP Conference Series: Earth and Environmental Science 951 (2022) 012041.

17. Khera KL and G Singh, 1998. Effect of crop cover and field slope on soil erosion in northern plain hot sub-humid Punjab. Indian Journal of Soil Conservation, 26(1): 19-21.
18. Khurshid K, M Iqbal, MS Arif and A Nawaz, 2006. Effect of tillage and mulch on soil physical properties and growth of maize. International Journal of Agriculture and Biology, 8(5): 593-596.
19. Pandey RK, JW Maranville and MM Chetima 2000. Deficit irrigation and nitrogen effects on maize in a Sahelian environment: II. shoot growth, nitrogen uptake and water extraction. Agricultural Water Management, 46(1): 15-27.
20. Pinjari SS, 2007. Effect of integrated nutrient management and polythene mulch on the performance of sweet corn under lateratc soils of Konkan. Ph. D. (Agri.) Thesis, Dr. Balasaheb Sawant Konkan KrishVidyaeeth, Daoli and Dist. Ratnagiri.
21. Pulok MAI, TS Roy, MSR Bhuiyan, MN Haque and N Nahar, 2016. Effect of potassium and mulches on growth, yield and economics of potato, Potato Journal, 43(2): 200-210.
22. Quee DD, A Mansaray, SM Kanneh, PJ Kamanda, AR Conteh, EJ Ndoko and K Serry, 2017. Effect of *Gliricidia sepium* leaf mulch on weed growth and productivity of maize (*Zea mays* L.) in Southern Sierra Leone. International Journal Agricultural Forestry, 7(2): 35-41.
23. Quayyum MA and A Ahmed, 1993. Effect of tillage and mulching methods on growth and yield of maize. Bangladesh Journal of Agricultural Research, 18(2): 161-165.
24. Rahman MA, 1999. Morpho–physiological adoption of quality protein maize (QPM) as influenced by indigenous mulches. MS Thesis, Department of Crop Botany, Bangladesh Agricultural University, Mymensingh-2202.
25. Rahman MA, H Yahata, MG Miah, T Ahamed and MN Begum, 2008. Effectiveness of tree leaf mulch comparing with conventional mulches on common bean at different irrigation levels: Growth, yield, water use efficiency and weed infestation. Archives of Agronomy and Soil Science, 54(3): 331-342.
26. Rhoads FM and JM Bennett, 1990. Corn. In Irrigation of Agricultural Crops, Eds., Stewart, B.A. and D.R. Nielsen, pp: 569-596, Agronomy Monograph 30, American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America, Madison, Wisconsin.
27. Tian G, BT Kang and L Brussaard, 1993. Mulching effect of plant residues with chemically contrasting compositions on maize growth and nutrient accumulation. Plant Soil, 153: 179-187. https://doi.org/10.1007/BF00012990
28. Tolk JA, TA Howell and SR Evett, 1999. Effect of mulch, irrigation and soil type on water use and yield of maize. Soil and Tillage Research, 50(2): 137-147.
29. Urmee SA, 2014. Effect of tillage depth and mulch materials on weed management, yield attributes and yield of wheat. MS Thesis, Department of Agronomy, Bangladesh Agricultural University, Mymensingh, Bangladesh.