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Research Article

Performance of tree leaf mulch compared with traditional mulch on potato growth, yield, and weed infestation

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A B S T R A C T

A field experiment was conducted at the Agroforestry Farm under the Department of Agroforestry at Bangladesh Agricultural University, Mymensingh, from November 2019 to February 2020. The aim was to assess and compare the performance of tree leaf mulching with traditional mulching materials on potato cultivar Diamant growth, yield, and weed dynamics. Diamant. The experiment followed a Randomized Complete Block Design with three replications and seven different treatments: T_0= Control (no mulch), T_1= Water hyacinth (*Eichhornia crassipes*) mulch, T_2= Akashmoni (*Acacia auriculiformis*) tree leaf mulch, T_3= Minjiri (*Cassia siamea*) tree leaf mulch, T_4= Eucalyptus (*Eucalyptus spp*) tree leaf mulch, T_5= Sada koroi (*Albizia procera*) tree leaf mulch, T_6= Kalo koroi (*Albizia lebbeck*) tree leaf mulch. There were 21 plots (7 treatments with 3 replications), each measuring 1.5 m × 1.5 m. Ten plants from each plot were randomly chosen to collect data on potatoes' vegetative and reproductive characteristics and weed parameters such as the type of weed species and the number of weeds. The results indicated that Akashmoni tree leaf mulch (T_2) obtained the highest values for potato growth characteristics, while the control treatment (T_0) showed the lowest values. The highest yield of potato tuber (18.66 t/ha) was obtained from treatment T_2, while the control treatment (T_0) yielded the lowest (14.08 t/ha). Treatment T_2 had the lowest average number of weed species (2.33), whereas treatment T_0 had the highest (4.33). Based on these findings, it appears that tree leaf mulch may be a viable alternative to traditional mulches in potato fields, while also helping to reduce weed infestation. Therefore, it is suggested that the tree leaf mulch used in this study could be beneficial for mulching in potato cultivation.

INTRODUCTION

Potato (*Solanum tuberosum* L.) is a tuber crop in the Solanaceae family. In Bangladesh, it is the third most significant crop after rice and wheat (Illias, 1998). The tuber is high in carbohydrates, starch, protein, vitamins C and B, potassium, phosphorus, and iron. Due to its carbohydrate content, potatoes can partially replace rice as a staple food. In the fiscal year 2018-2019, Bangladesh produced 9.6 million tons of potatoes from 0.468 million hectares of land, with an average yield of 20.61 tons per hectare (BBS, 2019). Over the past decade, Bangladesh has seen significant growth in potato cultivation area, output, and yield. In 2019-2020, the country achieved a cultivation area of 461 thousand hectares, producing 9605 thousand metric tons with an average yield of 20.8 tons per hectare. This is an increase from 2009-2010 when the cultivation area was 435 thousand hectares, production was 7930 thousand metric tons, and the average yield was 18.25 tons per hectare. The growth rates during the same time were 6%, 21%, and 14%, respectively. In 2016, annual potato consumption per capita in Bangladesh rose to 25.66 kg from 23.65 kg in 2010, indicating an 8.5% increase over six years (HIES, 2016). While potatoes are primarily used as a vegetable in Bangladesh, they are a staple

food in many countries worldwide, providing over 90% of the carbohydrate food source.

Mulch is a layer of material placed on the soil surface, which can be organic (such as crop leftovers and stubble) or inorganic (like plastic sheeting and gravel). It acts as a barrier, reducing the impact of environmental factors on the soil, and improving soil structure and water conservation. Mulch also alters the soil microclimate, promotes seedling emergence and root growth, and suppresses weed growth without herbicide application (Asif *et al.*, 2020). Organic mulches contribute nutrients to the soil; improve water holding capacity, enzymatic activities (Roy *et al.*, 2022), and help in carbon sequestration which leading to enhanced agricultural output and reduced pollution (Kluepfel, 2010). Mulching is an effective way to conserve soil moisture, suppress weeds, improve soil stability, and avoids insect pest attacks, which is essential for potato production. It can be achieved using various materials such as crop residues, plant species, or polyethene sheets. Mulching also contributes to soil fertility and erosion prevention. Additionally, it helps in managing nitrogen loss and has a considerable impact on potato growth and output. Organic farming practices can incorporate mulching and fertilizer control as critical factors in potato development.

Agroforestry is an environmentally friendly and ecologically balanced agricultural practice. It involves using tree leaves as mulch in potato farming to enhance soil moisture and fertility. Research has shown that using leaf mulch has a positive impact on potato yield, soil fertility, moisture retention, nutrient availability, and weed management. Several studies have been conducted by researchers such as Bharati *et al.* (2020), Chettri and Goswami (2018), Begum (2018), Quee *et al.* (2017), Pulok *et al.* (2016), Urmee (2014), Rahman *et al.* (2008), and Islam *et al.* (2007) to understand the effects of mulching materials on crop growth and yield. However, there is still a research gap in understanding the effects of tree leaf mulching compared to traditional mulching materials on potato growth, yield, and weed infestation in Bangladesh. Therefore, a study was undertaken to assess the performance of tree leaf mulching comparing the traditional mulching on the growth, yield, and weed infestation of potato cv. Diamant. It is expected that this study will provide valuable information on the effects of tree leaf mulching on yield and weed infestation in potatoes.

MATERIALS AND METHODS

Experimental field location, soil, and climate

The experiment was conducted at Agroforestry Farm under the Department of Agroforestry, Bangladesh Agricultural University, Mymensingh from November 2019 to February 2020. The experimental site is located at 24°75' North latitude and 90°50' East longitude (Islam *et al.*, 2009). The experimental site soil is silty loam in texture and it belongs to the Old Brahmaputra Flood Palin under Agro Ecological Zone 9. It's distinguished by non-calcareous, dark grey floodplain soil with a pH ranging from 6.5 to 6.8 (Hasan *et al.*, 2007). The land relief is flat and above flood level, and there is enough sunlight during the experiment time. From April to September, the experimental region experiences subtropical rainfall, with scattered rainfall 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.

Experimental design and treatment

The experiment was set up in a Randomized Complete Block Design (RCBD) with three replications and seven different treatments. Thus, there were 21 (7 × 3) unit plots altogether in the experiment. The size of the unit plot is 1.5 m × l.5 m. The five tree leaf and one traditional mulches were used in this experiment. The seven (7) treatments were as follows:

T_0= Control (no mulch)

T_1= Water hyacinth (*Eichhornia crassipes*) mulch

T_2= Akashmoni (*Acacia auriculiformis*) tree leaf mulch

T_3= Minjiri (*Cassia siamea*) tree leaf mulch

T_4= Eucalyptus (*Eucalyptus spp.*) tree leaf mulch

T_5= Sada koroi (*Albizia procera*) tree leaf mulch

T_6= Kalo koroi (*Albizia lebbeck*) tree leaf mulch

Tree leaf mulch collection and application

The selected tree leaf mulches such as *Acacia auriculiformis, Cassia siamea, Eucalyptus spp, Albizia procera, and Albizia lebbeck* were collected from the specific trees of the Bangladesh Agricultural University Campus. The selected traditional mulching material *Eichhornia crassipes (*water hyacinth), an aquatic plant was collected from the Bangladesh Agricultural University Campus Lake adjacent to the rail line. The collected tree leaf and water hyacinth were allowed to sun dry for some days. Then the dried materials were laid on the soil surface immediately after potato tuber planting for the proper emergence of seedlings. The mulches were applied at the rate of 10 tons/ha maintaining proper thickness in each plot.

Land Preparation

The experimental land was initially tilled using a power tiller on November 4, 2019, to ensure well-prepared soil and good tilth for commercial crop production. The land was ploughed with a spade and then ploughed three more times, followed by laddering to achieve the desired tilth. The corners of the land were spaded and larger clods were broken into smaller pieces. All stubble and uprooted weeds were removed, leaving the land ready for planting.

Application of Manure and Fertilizers

The recommended doses of fertilizer and manure, such as cow dung, Urea, TSP, MoP, and Gypsum, were applied in the experimental unit according to Ahmed *et al.* (2018). All fertilizers and manure, except Urea, were applied during the final land preparation. Urea was applied in three equal instalments at 15, 30, and 45 days after tuber planting. Below are the recommended doses of fertilizer and manure (Ahmed *et al.*, 2018):

Types of manures or fertilizers	Dose/ha	Dose/plot
Well-decomposed cow dung	10 tons	1.80 kg
Urea	220 kg	49.5 gm
Triple Super Phosphate (TSP)	120 kg	27.0 gm
Muriate of Potassium (MoP)	220 kg	49.5 gm
Gypsum	100 kg	22.5 gm

Planting of Potato Tubers

The local Diamant potato variety was used as planting material. Healthy and uniform-sized potato tubers with emerged eyes were collected from Shambhuganj Bazar, Mymensingh. These tubers were planted in the experimental fields on November 25, 2019, at a spacing of 40 cm × 20 cm, planting them below 2.5 cm from the soil surface and covering them with loose and fertile soil.

Intercultural Operations

Weeding was done in all the plots as and when required to keep the plants free from weeds. Additionally, earthing up was carried out twice during the growing period in selected plots (except water hyacinth and control plots). The first earthing up was done 30 days after planting, and the second one was done 25 days after the first earthing up. To protect against late blight disease, Dithane M 45 was sprayed at an interval of 15 days after the complete emergence of the crop. Furadan 5G was also applied against soil insects during the final land preparation at a rate of 10 kg/ha.

Plant Sampling, Harvesting, and Data Collection

Ten randomly selected potato plants in each plot were sampled and marked with a bamboo stick for data collection. The selected plants were uprooted very carefully from each unit plot at the time of harvest, which occurred on February 23, 2020. A spade was initially used to pick ten sample plants from each plot, followed by the use of a country plough to harvest the entire plot. Various parameters of potatoes such as plant height, number of plants per tuber, number of branches per plant, length of branch, number of leaves per plant, length of leaf, number of leaflets per leaf, number of tubers per plant, average weight of tuber, and yield of tuber were recorded from each unit plot. Plant height was also recorded at 30, 50, 70, and 90 days after planting. Additionally, weed parameters such as weed species and their numbers were recorded from each plot. To record the data for weeds parameters, randomly 1 m^2 quadrate was used in each plot and the weeds number was counted.

Statistical Analysis of Data

The recorded data on different growth and yield parameters of potatoes were statistically analyzed using the STATIX10 program. The analyses of variances (ANOVA) for most of the characters under consideration were performed. Treatment means were separated by the Least Significant Difference (LSD) values for interpreting the results.

RESULTS AND DISCUSSION

Performance of tree leaf and water hyacinth mulching materials on vegetative parameters of potato cultivar Diamant

Plant Height (cm)

The results showed that the height of potato plants was significantly affected by the type of mulching materials used at 30, 50, 70, and 90 days after plantings (DAPs) (Table 1). At 30 DAPs, the tallest potato plant (22.16 cm) was recorded in the T_2 treatment (Akashmoni tree leaf mulch), which was statistically similar to the T_4 treatment (Eucalyptus tree leaf mulch). The shortest plant (14.66 cm) was found in the control treatment T_0 (no mulch), which was statistically similar to the T_3 treatment (refer to Table 1). Similarly, at 50, 70, and 90 DAP, the highest plant heights (35.0 cm, 48.33 cm, and 56.66 cm) were observed in the Akashmoni tree leaf mulch-treated plots, followed by T_4 and T_5 treatments. The lowest plant heights (23.33 cm, 34.66 cm, and 46.33 cm) of potatoes were obtained from the control treatment (T_0), which was statistically similar to the T_3 treatment (Table 1). Water hyacinth, traditional mulch, performed lower compared to tree leaf mulch treatments at various DAPs (Table 2). Among the tree leaf mulch treatments, the Akashmoni tree leaf mulch contributed the most to conserving sufficient soil moisture, resulting in maximum plant height. Begum (2018) found that at 35 DAPs, the highest plant height (71.67 cm) of potato was measured with plants grown over straw mulch, while the lowest plant height (65.81 cm) was found in the control plot. Similarly, at 55 DAPs and 75 DAPs, the highest plant heights (74.41 cm and 76.1 cm) of potatoes were found in straw mulch, and the lowest (67.6 cm and 69.6 cm) plant heights were obtained in the control condition. Rahman (2007) reported that at 90 DAPs, the highest plant height (77 cm) of potato was measured with plants grown over black polythene mulch, while the lowest (71 cm) was in the no mulch treatment (control), which aligns with the present findings. Akter *et al.* (2018) found that the interaction effect of variety and mulching showed significant in relation to yield and yield components of wheat. The tallest plant (93.20 cm) was obtained from the interaction of BARI Gom-28 and rice straw mulch which was supportive to the present findings.

Table 1. Effect of mulching materials on plant height of potato cv. Diamant at different DAPs

Treatment	Plant height (cm)			
	30 DAPs	50 DAPs	70 DAPs	90 DAPs
T_0	14.66e	23.33e	34.66e	46.33d
T_1	17.83d	26.66cd	36.33de	49.16bcd
T_2	22.16a	35.00a	48.33a	56.66a
T_3	15.83e	25.33de	35.00e	48.00cd
T_4	21.00ab	33.00a	45.66ab	54.50ab
T_5	19.83bc	30.00b	42.66bc	52.00abc
T_6	18.70cd	29.00bc	40.33cd	50.16bcd
Level of sig.	*	*	*	*
CV (%)	3.80	5.82	7.08	6.02

Note: Figures in the same column with identical letters (s) do not have significant differences; sig. = significance; * = Significant at 5% level of probability; CV = Coefficient of Variation; T_0 = Control (No mulch); T_1 = Water hyacinth mulch; T_2 = Akashmoni tree leaf mulch; T_3 = Minjiri tree leaf mulch; T_4 = Eucalyptus tree leaf mulch; T_5 = Sada koroi tree leaf mulch; T_6 = Kalo koroi tree leaf mulch

Table 2. Performances of different mulching materials on vegetative characteristics of potato

Treatment	Number of plants/ tuber	Number of branches / plants	Length of branch (cm)	Number of leaves/ plants	Length of leaf (cm)
T_0	1.96a	1.13b	5.53b	15.20c	15.43b
T_1	2.00a	2.00ab	5.93b	16.06bc	18.58a
T_2	2.46a	2.46a	8.46a	18.20a	20.30a
T_3	2.06a	1.46ab	7.30ab	16.60bc	18.76a
T_4	2.40a	1.66ab	5.86b	15.93c	18.06ab
T_5	2.26a	1.66ab	7.56ab	15.60c	18.53a
T_6	2.13a	1.30ab	7.80ab	17.53ab	19.87a
Level of sig.	NS	*	*	*	*
CV (%)	14.41	19.02	19.94	5.17	8.24

Note: Figures in the same column with identical letters (s) do not have significant differences; sig. = significance; NS = Non-significant; * = Significant at 5% level of probability; CV = Coefficient of Variation; T_0 = Control (No mulch); T_1 = Water hyacinth mulch; T_2 = Akashmoni tree leaf mulch; T_3 = Minjiri tree leaf mulch; T_4 = Eucalyptus tree leaf mulch; T_5 = Sada koroi tree leaf mulch; T_6 = Kalo koroi tree leaf mulch

Number of Plants per Tuber

The use of different mulching materials did not significantly influence the number of plants per potato tuber, as shown in Table 2. The Akashmoni tree leaf mulch (T_2 treatment) resulted in the highest number of plants per tuber (2.46), while the control plot (T_0) had the lowest (1.96) number of plants per tuber (Table 2). Similarly, Tabassum (2008) reported that the number of main stems per hill was highest in T_1 (seedling tuber from TN) and T_3 (traditional tuber) treatment led to the lowest number of main stems, which aligns with the present results.

Number of Branches per Plant

The number of branches per plant varied significantly due to the effect of mulching materials, as indicated in Table 2. The maximum number of branches per potato plant (2.46) was observed in the Akashmoni tree leaf mulch-treated plot, whereas the control plot with no mulch yielded the minimum (1.13) number of branches per plant (Table 2).

Length of Branch

The mulching materials had a statistically significant effect on the length of potato plant branches, as shown in Table 2. The T_2 treatment (Akashmoni tree leaf mulch) resulted in the longest branch length (8.46 cm), while the control plot, with no mulching materials, had the shortest branch length (5.53 cm) (Table 2). Additionally, the T_6 treatment (Kalo koroi tree leaf mulch) produced the second longest branch length (7.80 cm), which was statistically similar to the T_4 (Eucalyptus tree leaf mulch) and T_5 (Sada koroi tree leaf mulch) treatments (Table 2).

Number of Leaves per Plant

The influence of different mulching materials on the number of leaves per potato plant was statistically significant (Table 2). The T_2 treatment resulted in the highest number of leaves per plant (18.20), while the treatment T_0 yielded the lowest (15.20) number of leaves per plant. Additionally, the T_6 treatment (Kalo koroi tree leaf mulch) recorded the second highest number of leaves per plant (17.53), followed by T_4 and T_5 treatments (Table 2).

Length of Leaf

The use of various tree leaves and traditional mulching materials had a statistically significant difference in the length of potato leaves, as indicated in Table 2. The T_2 treatment produced the longest leaf length (20.30 cm), while the control treatment T_0 produced the shortest leaf length (15.43 cm) (Table 2). Additionally, the T_6 treatment recorded the second-longest leaf length (19.87 cm) (Table 2).

Performance of tree leaf mulching vs. traditional mulching on reproductive characteristics of potato

Number of Tubers per Plant

The number of tubers per plant varied significantly due to the influence of tree leaf mulches and water hyacinth, as shown in Table 3. The Akashmoni tree leaf mulch had the highest number of potato tubers per plant at 6.26, which was statistically similar to the T_4, T_5, and T_6 treatments. Conversely, the T_0 treatment, which had no mulch, had the lowest number of tubers per plant at 3.13.

Table 3. Impact of tree leaf and traditional mulching materials on reproductive characteristics of potato

Treatment	Number of tubers/ plant	Average weight of tuber (g)	Tuber yield /plant (g)	Tuber yield (t/ha)
T_0	3.13c	50.50d	158.06d	14.08e
T_1	4.23b	71.00c	315.27c	15.32cde
T_2	6.26a	102.30a	637.60a	18.66a
T_3	4.16b	64.70cd	300.47c	14.29de
T_4	5.60a	91.33ab	481.80b	17.64ab
T_5	5.56a	81.30bc	459.76b	16.54bc
T_6	5.26a	73.90bc	358.24bc	15.49cd
Level of sig.	*	*	*	*
CV (%)	11.69	13.01	20.56	4.71

Note: Figures in the same column with identical letters (s) do not have significant differences; sig. = significance; * = Significant at 5% level of probability; CV = Coefficient of Variation; T_0 = Control (No mulch); T_1 = Water hyacinth mulch; T_2 = Akashmoni tree leaf mulch; T_3 = Minjiri tree leaf mulch; T_4 = Eucalyptus tree leaf mulch; T_5 = Sada koroi tree leaf mulch; T_6 = Kalo koroi tree leaf mulch

Average Weight of Tuber (g)

A noteworthy variation was observed in the weight of potato tubers due to the effects of tree leaf mulches and water hyacinth. The T_2 treatment (Akashmoni tree leaf mulch) had the highest weight of potato tubers at 102.30 grams, which was statistically similar to the T_4 and T_5 treatments. On the other hand, the T_0 treatment had the lowest weight of tubers at 50.50 grams, followed by the T_3 treatment (Minjiri tree leaf mulch) (Table 3). The present finding is similar to Rahman (2014) where he reported that the maximum (43.53 g) weight of the mean tuber was obtained from M_3 (black

polythene mulch) and the lowest (30.72 g) was recorded from M_2 (water hyacinth mulch) treatment. Petr *et al.* (2010) concluded that straw mulch increases the weight of potato tubers.

Tuber Yield per Plant (g)

A significant variation was observed in potato tuber yield per plant due to the influence of tree leaves and traditional mulching materials. As for tuber yield per plant, the maximum yield of 637.60 grams of potato tubers per plant was recorded from the T_2 treatment (Akashmoni tree leaf mulch), while the minimum yield of 158.06 grams was found in the T_0 control treatment. Tabassum (2008) found that the highest weight of tubers per hill (377.8 g) was found from M_3 (black polythene mulch) and the lowest weight of tubers per hill (239.0 g) was found in M_0 (no mulch) treatment which is supportive of the present findings. Islam *et al.* (2007) found that the maximum (230.00 g) weight of tubers per hill was recorded from M_1 (black polythene) which was closely followed (215.00 g and 210. 50 g) by M_3 (sawdust) and M_4 (water hyacinth), respectively and the minimum (108.50 g) weight of tubers per hill was found from M_0 (no mulch).

Tuber Yield (t/ha)

The results showed that tuber yield per hectare was significantly varied by the influence of different mulching materials (Table 3). The highest yield of potato at 18.66 tons per hectare was found in the T_2 treatment, which was statistically similar to the T_4 and T_5 treatments. Meanwhile, the T_0 treatment obtained the lowest yield at 14.08 tons per hectare. Begum (2018) reported that the maximum yield of potato (24.57 t/ha) was found in straw mulch and the lowest yield (17.68 t/ha) was found in no mulch treatment. Jalil *et al.* (2004) reported that the maximum yields for Cardinal and Lai Pakri varieties of potato were obtained from water hyacinth mulching (47.70 and 28.4 t ha^{-1}, respectively) and the lowest yields were recorded for the control (38.54 and 19.79 t ha^{-1}, respectively) which is supportive to the present results.

Effect of tree leaf and traditional mulching materials on weed infestation at potato field

Composition and Richness of Weed Species

During the research period, we observed a total of 14 weed species in the experimental field. Among these, 9 species were classified as perennial and 5 as annual (refer to Table 4). In a study by Urmee (2014), 10 weed species from 6 families were found in the wheat field, with 3 being perennial and the remaining 7 being annual. Haque (2011) identified seventeen weed species in the wheat crop at the Bangladesh Agricultural University Farm, with some dominant species including *Chenopodium album, Vicia sativa, Cynodon dactylon, Cyperus rotundus, Eclipta alba*, and *Lindernia procumbens*.

In Table 5, it was observed that the Poaceae family was the most dominant, as it had a species richness of 5, which was higher than any other family. The next most dominant families were Amaranthaceae and Brassicaceae, each with a species richness of 2. Following them were Cyperaceae, Asteraceae, Polygonaceae, Portulacaceae, and Araceae, each with a species richness of 1 (Table 5).

Table 4. A list of identified weed species in the experimental plots

SL No.	Local name	Scientific name	Family	Life cycle
1	Nuniashak	*Portulaca oleracea*	Portulacaceae	Annual
2	Shepherd's-purse	*Capsella bursa-pastoris*	Brassicaceae	Annual
3	Laska plant	*Persicaria odorata*	Polygonaceae	Perennial
4	Khetpara	*Pennisetum purpureum*	Poaceae	Perennial
5	Bon mula	*Raphanus raphanistrum*	Brassicaceae	Annual
6	Malancha	*Alternanthera philoxeroides*	Amarantheceae	Perennial
7	Dhan	*Oryza sativa*	Poaceae	Perennial
8	Bathua	*Chenopodium album*	Amaranthaceae	Perennial
9	Biskata	*Gutierrezia sarothrae*	Asteraceae	Perennial
10	Fingergrass	*Digitaria sanguinalis*	Poaceae	Annual
11	Shama	*Echinochloa colona*	Poaceae	Annual
12	Kachu	*Colocasia esculenta*	Araceae	Perennial
13	Mutha gash	*Cyperus rotundus L.*	Cyperaceae	Perennial
14	Bermuda grass	*Cynodon dactylon* Pers.	Poaceae	Perennial

Table 5. Ranking of family according to species richness in the experimental plots

Family	Species richness	Ranking
Poaceae	5	1st
Amaranthaceae	2	2nd
Brassicaceae	2	2nd
Cyperaceae	1	3rd
Asteraceae	1	3rd
Polygonaceae	1	3rd
Portulacaceae	1	3rd
Araceae	1	3rd

In all the experimental units, 14 weed species were found which comprises the total number of individuals was 549. Among the 21 plots, Khetpara weed had the highest individual number which was 149 (Figure 1). The second-highest individual number was found in the Bonmula (96) weed which was followed by Nuniashak (90), Malancha (35), Laska Plant (32), Kachu (30), and Bathua (29) weeds (Figure 1). Both shepherd's-purse and Biskata weeds comprised 24 individuals which were also followed by Dhan (19), Shama (9), Fingergrass (5), and Muthagash (4) weeds. Bermuda grass weed was found with the lowest individual number which was only 3 (Figure 1). Nwosisi *et al.* (2019) found that Bermuda grass (*Cynodon dactylon* (L.) Pers.), Johnson grass (*Sorghum halepense* (L.) Pers.), Dallis grass (*Paspalum dilatatum* Poir.), Carpetweed (*Mollugo verticillata Kunth*), Prickly sida (*Sida spinosa* L.), Musk

thistle (*Cardus nutans*), and Rhombic copperleaf (*Acalypha rhomboidea* Raf.) were the dominant weed at the sweet potato experimental field.

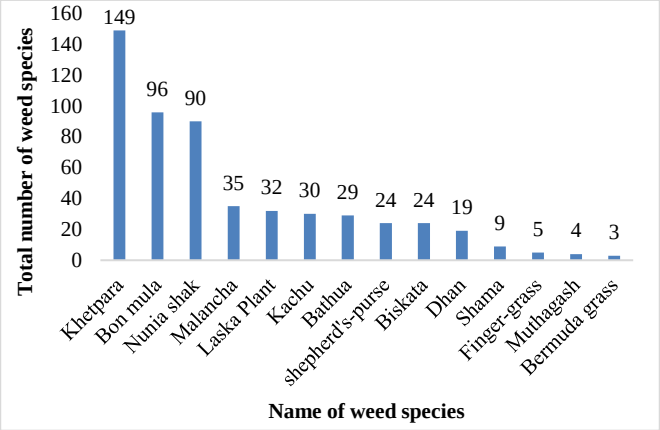

Figure 1. Bar graph showing the total number of individual weed species in all experimental plots

Average Number of Weed Species and Individuals' Number as per Treatment

The impact of tree leaves and traditional mulching materials on the average number of weed species varied significantly (Table 6). The results revealed that treatment T_2 (Akashmoni tree leaf mulch) had the lowest average number of weed species (2.33), while treatment T_0 (no mulch) had the highest (4.33). Treatment T_3 had the second highest number of weed species (3.33), followed by treatments T_1, T_4, T_5, and T_6, which showed statistically similar results (Table 6). The average number of individual weed species also varied significantly (Table 6). Treatment T_2 (Akashmoni tree leaf mulch) had the lowest average number of individual weed species (3.33), while treatment T_0 (no mulch) had the highest (24.13), followed by treatment T_3 (Minjiri tree leaf mulch) with 8.66 weed species (Table 6). Urmee (2014) stated that the maximum weed population per square meter (13.50) was found in M_0 (no mulch, control), while the minimum (8.33) was found in M_2 (polythene mulch) which was statistically similar (8.58) to M_1 (rice straw mulch). Jodaugiene *et al.* (2006) found that in soil mulched with various organic materials, the number of germinating weeds per square meter during the entire vegetation period ranged from 289.0 to 522.5. In soil without mulch, this number reached 1378.9. Uwah and Iwo (2011) mentioned that weed infestation was more than 6 and 11 times higher in un-mulched plots compared to plots with 6 and 8 t/ha of mulch, respectively, in terms of maize productivity. The current findings indicate that mulching with tree leaves yielded positive results in controlling weeds in potato fields.

Table 6. Effect of tree leaf and traditional mulching materials on weed species and individuals' number by treatment

Treatment	Number of weed species	Total individuals of weeds
T_0	4.33a	24.13a
T_1	3.00bc	5.27bc
T_2	2.33c	3.33c
T_3	3.33b	8.66b
T_4	3.00bc	4.66bc
T_5	2.66bc	4.25c
T_6	2.66bc	4.20c
Level of sig.	*	*
CV (%)	15.47	21.80

Note: Figures in the same column with identical letters (s) do not have significant differences; sig. = significance, * = Significant at 5% level of probability; CV = Coefficient of Variation; T_0 = Control (No mulch); T_1 = Water hyacinth mulch; T_2 = Akashmoni tree leaf mulch; T_3 = Minjiri tree leaf mulch; T_4 = Eucalyptus tree leaf mulch; T_5 = Sada koroi tree leaf mulch; T_6 = Kalo koroi tree leaf mulch

CONCLUSION

The following conclusions can be taken from the experiment's findings:

- The use of tree leaf mulch (Akashmoni, Eucalyptus, Sada koroi, Kalo koroi, Minjiri) and traditional mulch (water hyacinth) had a positive impact on the growth characteristics, yield components, yield, and weed infestation of potatoes. Akashmoni tree leaf mulch created the most favourable conditions for maximum potato yield compared to traditional mulching (water hyacinth) and no mulch conditions. Therefore, the treatments can be ranked in terms of high yield as follows: $T_2 > T_4 > T_5 > T_6 > T_1 > T_3 > T_0$.
- Regarding weed suppression effects on potato production, Akashmoni tree leaf mulch showed the highest suppression capacity compared to other treatments used in the experimental field. This suggests that tree leaf mulch could be a viable alternative to traditional mulching in potato fields, while also reducing weed infestation.

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