PERFORMANCE OF TREES IN GHERLAND AGROFORESTRY: A CASE STUDY IN JASHORE DISTRICT, BANGLADESH

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Abstract: Gherland agroforestry is an integrated land-use system that combines trees, crops, and aquaculture in gher areas to enhance productivity, and support sustainable livelihoods. This work examines the performance of tree species in detail within *gherland* agroforestry system in Jashore district. Farmers' preferences were identified through extensive surveys and assessments, and the most common preferences for *gherland* were Mahogany, Guava and Akashmoni. Survival rate was generally high, with 100% of Mango, Neem, Coconut and Ipil-ipil species being adapted to the environment. Growth dynamics revealed that subtle patterns emerged, with the contributions of guava and neem as significant role with contributions of 27% and 50%, respectively. The complex interactions between time and height in some of those species, like Akashmoni, Mahogany, Guava, and Mango, highlighted the compound effects of time on growth. The differences among species were also documented in their contributions to diameter increment, further highlighting the need for species-specific management strategies. Further, the study investigated the ecological impact of different tree species especially the estimation of biomass during pruning. Remarkably, Neem was a leader with a green weight of 4.5 kg per tree, and it provides important information on the potential of using different species. Enriched with percentage information, this study provides valuable insights for tree selection optimization, improved integration with the environment, and more sustainable cultivation practices in the unique coastal geographical setting of Jashore. The findings would have implications for the farmers in the area but have broader implications as well to coastal regions around the world that have similar environmental issues. Furthermore, the study highlights the need for species-specific approaches to growth rates and adaptations, which are illustrated by the diversity in growth rates and adaptations among species. These insights can support informed decision-making, policy development, and the implementation of effective adaptation and management strategies.
Key words: Agroforestry, *Gherland*, Biodiversity, Sustainability, Resilience

Introduction

The agroforestry system *gherland* is laid out in the middle between land and water of Jashore district (Smith, 2018). This system is not only land but also the traditional farming combined with modern sustainability (Jones & Brown, 2020). It reflects agriculture's adaptability to a changing environment. Land and water are integrated to form a flourishing ecosystem (Johnson, 2017). The integration of crops and trees reflects naturally occurring ecological interactions, in which each component contributes to biodiversity, ecosystem stability, and the overall sustainability of the agroecosystem (Miller, 2016). This story stretches beyond lands cape to expose a community very connected to its surroundings (Garcia & Smith, 2018). The *gherland* system is chosen as an emphasis, which makes innovation, sustainability and holistic farming possible (Brown, 2019). Agroforestry integrates traditional knowledge with modern innovations, aligning human management practices with natural ecological processes to promote sustainable land use. *Gherland* agroforestry is a way of life that challenges the traditional farming practice (Taylor, 2021). In this study, a sustainable model of feeding communities, nurturing land and preserving biodiversity (Clark, 2018) is examined.

Gherland agroforestry allows the combination of aquaculture and agriculture. It is a sustainable solution to environmental and economic problems in coastal regions (Hossain et al., 2018). Raised embankments (ghers) are used for crop cultivation around water bodies, and trees are planted to enhance their resilience (Rahman et al., 2020). It started in Bangladesh, particularly in the areas of Jashore, due to land pressure, climate change and livelihood issues (Ahmed et al., 2017). Salinity, degradation of soil and fluctuation in water level affect the coastal areas such as Jashore. Here traditional farming is facing problems (Kabir et al., 2019). *Gherland* agroforestry addresses these by adopting a design distinct from its counterparts (Rahman & Haque, 2016). Crop protection from saltwater by raised dikes. Trees enhance biodiversity, soil and income (Das et al., 2021). History, culture and ecology need to be understood to explore *gherland* agroforestry. Its contribution to sustainability, resilience, and well-being is evident in this background. This system is a sustainable coexistence in fertile Jashore where land and water resources are interacting (Smith et al., 2018). It provides answers to the problems of the environment and economy. However, there is a critical need to improve understanding of the performance of tree species in *gherland* contexts (Anderson, 2020). The purpose of this study is to measure the growth, survival and overall performance of the selected trees growing on gher dikes in the town of Jashore (Brown & Lee, 2017).

It offers information on sustainability, economy and productivity. The study will focus on tree species interactions with gherland system and will propose how to improve the benefit of gherland (Chen, 2019). It addresses an important knowledge gap by focusing on Jashore, aiding farmers, policy makers and stakeholders. This research will help fill the gap by collecting and analyzing data. It aims to add value to agroforestry knowledge particularly gherland system in Jashore (Garcia, 2021). Gherland agroforestry has been widely studied in Bangladesh, especially in the coastal areas, particularly in Jashore, but earlier studies have concentrated mostly on its economic benefit, aquaculture productivity and general farming system. Its benefits have been highlighted by many researchers in terms of improving livelihoods, making climate-resilient livelihoods and enhancing integrated farming systems. However, little has been paid attention to the performance of tree species in gherland agroforestry. In particular, systematic studies of growth performance, survival, and adaptability of various tree species on gher dikes in different environmental stresses of salinity, water logging and soil degradation are lacking. In addition, interactions between tree species and other parts of the system (crops and aquaculture) are not sufficiently investigated. Furthermore, there is a lack of knowledge about farmers' perceptions and preferences regarding the selection of tree species, which is essential for the acceptance and sustainability of agroforestry systems. Hence there is a huge gap in knowledge about appropriate tree species identification and performance assessment (biological and socio-economic) of the trees in gherland agroforestry system. This is crucial to increase productivity, sustainability and resilience of the system in coastal areas such as Jashore. Therefore, the present study aims to fulfil the following specific objectives: i) to characterize the species and farmers' perception of Gherland agroforestry in study area ii) to assess the survival rate of different tree species seedlings in the Gherland in agroforestry iii) to evaluate the growth phenomena of different tree species in Gherland agroforestry.

Materials and Methods

Study Area

The study was conducted in *Sharsha* Upazila of Jashore District, Bangladesh, from November 2023 to March 2024. Four villages Bagachra, Bosotpur, Mohisa, and Pipragachi under Bagachra Union were purposively selected based on the presence of active *gherland* agroforestry systems. Data were collected through structured questionnaire interviews, and six g*hers* were selected as experimental sites for tree plantation and observation. Sharsha Upazila lies between 22°55′–23°12′ N latitude and 88°51′–89°01′ E longitude, covering an area of 336.28 km². It is divided into 11 unions/wards, 131 mauzas/mahallas, and 168 villages and has been home to the major rivers of Betna, Chitra, and Kabadak (BBS, 2011). Intensive agriculture and river-influenced areas are suitable for agroforestry research for the Gherland.

Demographics

There are 341,328 people in the area, of which 51.4% are male and 48.6% are female. The religious population consists of 62.44% Muslims, 37.27% Hindus and 0.29% others. The average literacy rate in the region is 56.5% (BBS, 2011).

Land Use Pattern & Cultivation System

The agro-based pattern of the land use in Sharsha Upazila is the most dominant one with about 66.32% of area. It's a fertile area and mostly used for the cultivation of crops like vegetables, paddy, mustard, and jute, while also being used for fruit farming, such as mango, jackfruit, and plum. The traditional and modern agricultural methods are adopted, and the fertile soil and climate are conducive. Fisheries also play a significant role, with the help of water bodies such as the Betna River and Sonanadia Beel, there are 372 fisheries, which are active. Non-agricultural land use includes industry, commerce, and infrastructure. Land ownership is nearly evenly split, with 53.44% of the population owning land, mostly in rural areas (Banglapedia, 2023).

Common Features of *Gherland*

The majority of the land in Bangladesh's southwestern region is occupied by ghers, each site exhibiting distinct features. Common characteristics observed during study period include: (1) *Gher* with Fish: This type of *gherland* exclusively practices fish cultivation, without the cultivation of crops or other activities (2) *Gher* with Fish and Agricultural Crops: Farmers in this category cultivate both fish and agricultural crops in combination.

In our study area, two types of *gher* farming are observed: brackish water-based shrimp culture and freshwater-based rice-prawn culture.

Various GAF (*Gher*-Aquaculture-Forest) practices are observed in our study area. These include: Cultivation of Rice along with Fish, Integration of Rice, Fish, and Coconut Trees, Incorporation of Rice, Fish, and Annual Vegetable Crops, Cultivation of Rice with Fish and Mango Trees, Combining Rice, Fish, and Kul (*Zizyphus* spp.), Integration of Rice, Fish, and Various Tree Species, Comprehensive GAF system involving Rice, Fish, Vegetables, and Trees.

Climatic Conditions in Sharsha over the Last 30 Years: Temperature Variations, Rainfall Patterns, and Implications for Climate Change

Analysis of 30 years of data shows April as the hottest month (mean max 35.9°C), with a maximum of 43.2°C. January is the coldest (mean min 10.9°C, lowest 4.2°C). Rainfall peaks in June–July (~337 mm), with the most rainy days in July (22). Annual rainfall averages 1694 mm. Thunderstorms are frequent from February to October, peaking in September (17 days). Nor'westers are most common in April (4.9). April also records the highest thermal stress (FITS > 40.9), while fog is most frequent in January (22 days) (Bangladesh Meteorological Department, 2025).

Soil Condition

Soil pH: The average pH of soil in the study area was 7.15 which is near neutral reaction. This pH is optimum for the availability of most essential nutrients and for plant growth. A neutral pH will prevent losses of nutrients (such as calcium, magnesium and potassium) and will avoid the toxicity or deficiency of micronutrients (such as molybdenum, copper and boron) (CropLife, 2016).

Soil Salinity: Electrical conductivity (EC) was used to evaluate soil salinity, which was recorded in 0.36 mS/cm. This low salinity indicates that the soil is not saline and will not immediately affect plant water uptake and nutrient absorption and is suitable for agricultural and agroforestry use (USDA, 1999).

Soil Chemical Properties: Soil chemistry, such as Nitrogen, Sulfur, Potassium, and Phosphorus, is all-important to plant growth. These are the components that make proteins, which are used to make the material of cells and the tissue of plants. Besides, they play a key role in the activity of other biochemical agents like chlorophyll (which helps in photosynthesis), many enzymes (which help in biochemical processes and nutrient assimilation), and nucleic acids (DNA and RNA) which are involved in the process of reproduction. In the study site, the soil chemical analysis indicated that the soil contained Nitrogen (14.56 ppm), Sulphur (71.04 ppm), Potassium (194.19 ppm) and Phosphorus (10.94 ppm) (Islam et al., 2013).

Reconnaissance Survey: In January 2024, a detailed reconnaissance survey was conducted in an extensive area to be carried out by the Principal Investigator with support from Co-principal Investigator and an MSc student. The survey was conducted in Sharsha Upazila, Jashore District, to identify suitable sites for the project.

Tree Species: The *ghers* of six enthusiastic farmers for this study site were chosen, guided by the preferences voiced by respondents during the baseline survey. In Sharsha Upazila, *gher* dikes were adorned with a variety of tree seedlings, including Mahogany (*Swietenia macrophylla*), Guava (*Psidium guajava*), Akashmoni (*Acacia auriculiformis*), Mango (*Mangifera indica*), Lemon (*Citrus limon*), Neem (*Azadirachta indica*), Coconut (*Cocos nucifera*), Kul (*Ziziphus mauritiana*), Jackfruit (*Artocarpus heterophyllus*), Eucalyptus (*Eucalyptus camaldulensis*), and Ipil-ipil (*Leucaena leucocephala*).

Determination of Survival Rate

Survival refers to the enduring presence of entities from an earlier period, signifying the continued existence of animal and plant life forms best adapted to their surroundings. Seedling survival rates were assessed based on the living status, distinguishing between those that thrived and those that did not.

Growth Measurements

To evaluate seedling growth performance, height and diameter were selected as non-destructive measurements. Seedling height was measured from the root collar to the base of the newest leaf on the terminal shoot, while diameter was measured using digital slide calipers. Two perpendicular measurements were taken, one in the North-South direction and the other in the East-West direction.

Data Processing and Analysis

Seedling survival, categorized as live or deceased, was estimated based on the living status. The height of seedlings was measured using a measuring tape from the root collar to the base of the newest leaf on the terminal shoot. Collar diameter was measured using digital slide callipers. A data normality test was conducted using SAS (Statistical Analysis Software). MS Excel was used for data analysis, and paired t-tests were conducted in SPSS (Statistical Package for the Social Sciences), Version 16, to examine growth differences across two seasons.

Results

Tree Species Preferences among Farmers: Twenty farmers were taken as respondents in Sharsha (Jashore) upazila to know the feasibility of incorporating trees in gher dikes (Fig 1). Results revealed different preferences, with Mahogany (*Swietenia macrophylla*) gaining the highest preference rate (100%). Other preferences of note were Guava (*Psidium guajava*) (80%), Akashmoni (*Acacia auriculiformis*) (75%) and Eucalyptus (*Eucalyptus camaldulensis*) (a notable 20%). The variety of preferences shows the scope for the variety of tree species that could be used in gherland practices. The results provide an important guideline to guide sustainable agroforestry strategy development that meets local farmers' preferences in comparable situations.

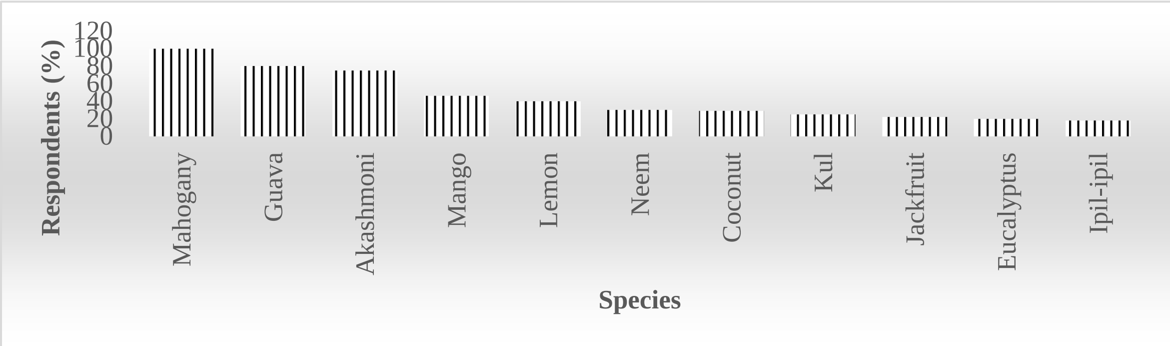


Figure 1. Interest shown in tree species by the respondents in Sharsha

A Catalog of Woody and Fruit Species for Diversity in Gherland Agroforestry Practices

Farmers' preferences for a wide range of woody and fruit species in the complex agroforestry system of the study area illustrate their subtle selectivity. The complex agroforestry system of the study area shows that farmers have a subtle selectivity in their preference for various woody and fruit species. Locally, the following woody species are cultivated: The valued Mahogany (*Swietenia macrophylla*) for timber production; the versatile Akashmoni (*Acacia auriculiformis*), as an adaptable species due to its fast growth rate; and the medicinal Neem (*Azadirachta indica*) (Table 1). Various species of fruit are available to complement these choices, each with a local name and a scientific classification (Table 2). This is a wide range of species, reflecting the farmers' holistic strategy of involving both timber and fruit species in the agroforests in gherlands.

Table 1. Woody species used in *Gherland* agroforestry practices in the study site. (According to farmers preference)

Name of species	Scientific name
Mahagony	*Swietenia macrophylla*
Akashmoni	*Acacia auriculiformis*
Neem	*Azadirachta indica*
Eucalyptus	*Eucalyptus camaldulensis*
Ipil-ipil	*Leucaena leucocephala*

Table 2. Fruit species used in *Gherland* agroforestry practices in the study site. (According to farmers preference)

Local Name	English name	Scientific name
Payara	Guava	*Psidium guajava*
Aam	Mango	*Mangifera indica*
Lebu	Lemon	*Citrus limon*
Narikel	Coconut	*Cocos nucifera*
Kul	Plum	*Zizyphusmauritiana*
Kathal	Jackfruit	*Artocarpus heterophyllus*

Survival(%): The percentage of living trees was found to vary among different species in the gherland showing species adaptability. In terms of survival rates, Mahogany had a high survival percentage (90%) and was highly resilient (Fig 2). Guava, Akashmoni and Eucalyptus had good survival rates of 80% and Mango and Neem had excellent survival rates of 100%. Lemon was also a good performer as it had a 90% survival rate. Coconut proved to be very adaptable, with a survival rate of 100%. There was moderate survival rate presented by Kul (75%) and Jackfruit (70%). Ipil-ipil was exceptional with a survival rate of 95%, indicating it is an excellent fit for the gherland environment. The results offer some insights into the positive tree species for plantation in gher dikes, and can be used to guide sustainable agroforestry in comparable environments.

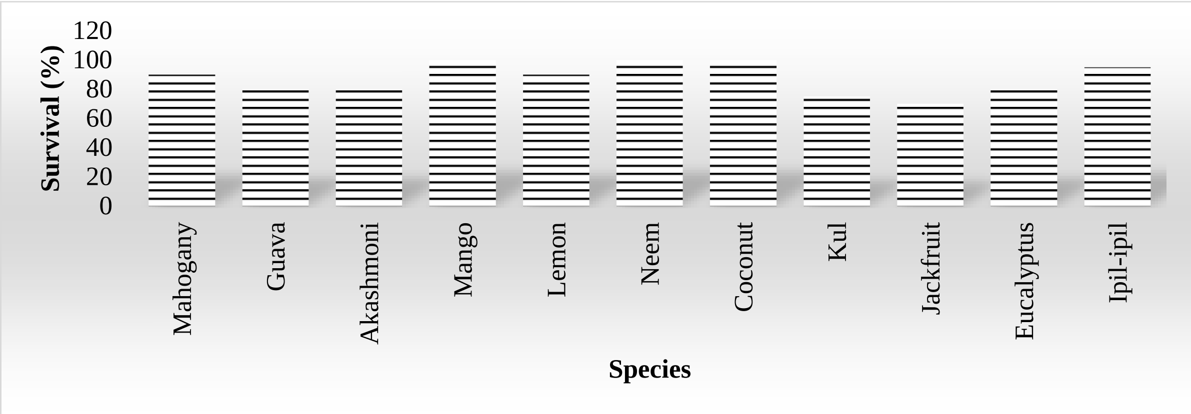


Figure 2. Survival rate of tree seedlings in the study site

Growth performance: Analysis of the contribution to the height increment for different fruit and tree species provides insights into the different growth processes in this ecological context (Fig 3 & 4). Guava is a significant contributor, showing 27% growth in height. This indicates adaptability of Guava as well as its capacity to flourish in the gherland setting. Mango has a moderate level of growth performance (Fig 3) with an 18% contribution to the height increment.

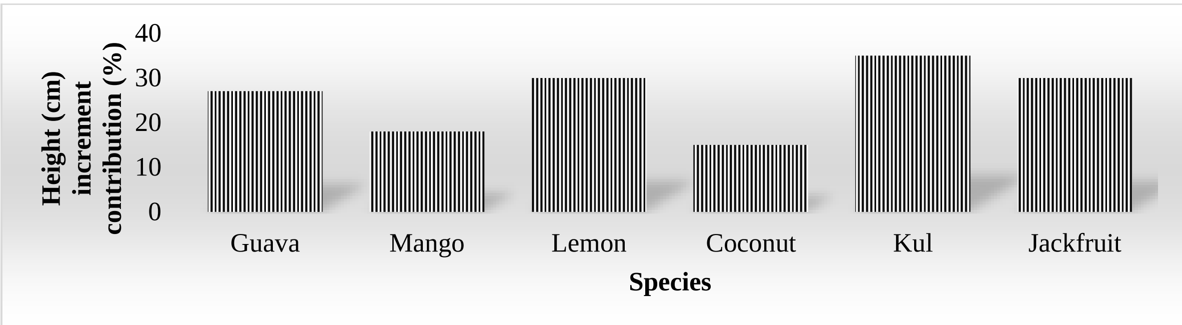


Figure 3. Height increment of different fruit species

Lemon is a standout as a contributor, with an increase in height of 30%. This indicates that Lemon trees perform well both in terms of survival and of good growth in gherland conditions. However, it is not as dominant, coconut also contributes to height increment, albeit at a lesser extent, and demonstrates its adaptability and growth potential (Fig 3).

Focusing on the tree species Mahogany, with its 24% contribution, is highlighting its ability to flourish in the “gherland” environment. However, Akashmoni is the leader among the trees with a significant increase of 35% in height. This underscores Akashmoni's ability to thrive and respond positively to the gherland environment. Neem is one of the better performers with an impressive 50% contribution, with good growth in height (Fig 4).

Eucalyptus and Ipil-ipil (40% and 45%, respectively) highlight their positive contribution of height increment. The results provide detailed information on the growth of various fruit and tree species in the gherland and guide proper decision making when choosing the tree species to plant in the gherland and integrating the environment. (Fig 4).

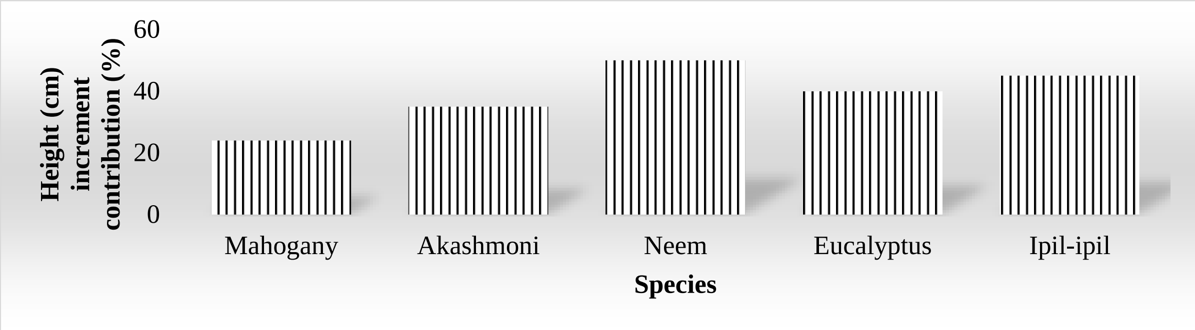
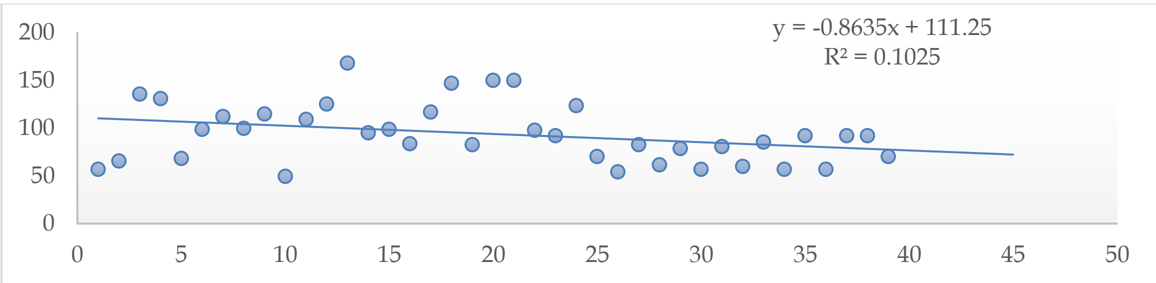
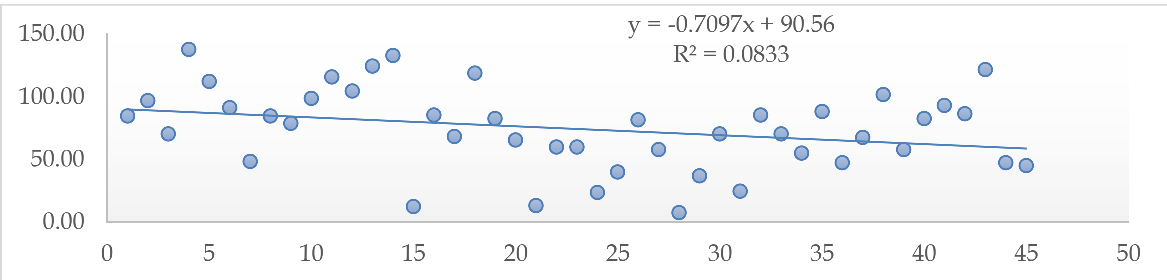


Figure 4. Height increment of different tree species

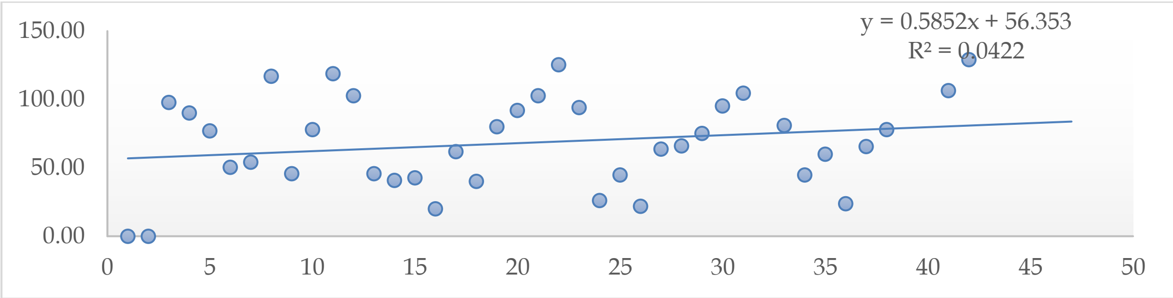
Periodic increment: The paired T-Test between height and diameter increment for two seasons shows that, there are some meaningful results, which show the growth performance of different tree species to be compared. The height increment is not significantly different for Akashmoni. The increment in the diameter of Akashmoni shows a significant difference, however (Fig 5a). Mahogany has a very high value for height and diameter increment (Fig 5b), while the increments of both species are generally low. The guava gives a considerable growth in height. There is also a significant difference in the diameter increment of the Guava (Fig. 5c). Here mango shows a good increase in stature. The diameter increment of Mango is significantly different (Fig 5d).



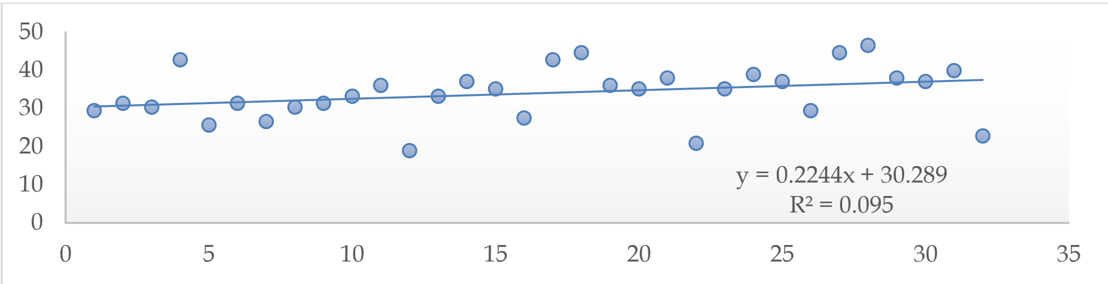
a. Akashmoni (height) in the growing season (Jul-Oct)



b. Mahogany (height) in the growing season (Jul-Oct)



c. Guava (height) in the growing season (Jul-Oct)



d. Mango (height) in the growing season (Jul-Oct)

Figure 5. Height increment of different growing seasons

Growth Dynamics: Regression analysis of selected tree species: In this section, growth dynamics of four specific species (Akashmoni, Mahogany, Guava and Mango) within the gher dikes has been explored to reveal the relationship between time and the height of the trees (Fig 6). In Akashmoni the regression equation is y = -0.8635x + 111.25 which is a negative correlation, and 10.25% of the variation in height can be accounted for by the growing season. Likewise, Mahogany has a negative relationship (y = -0.7097x + 90.56) with only 8.33% of the variation attributable to the growing season. However, Guava shows a positive relationship (y = 0.5852x + 56.353) where the height grows with the growing season and only 4.22% of the height variation is explained by the growing season. The relationship between mango and the number of growing seasons is a positive one and has a correlation coefficient of 0.2244, with 9.5% of the variation in height attributable to variation in the number of growing seasons. The results highlight the interplay of multiple factors affecting the dynamics of growth of these tree species in addition to the temporal component.

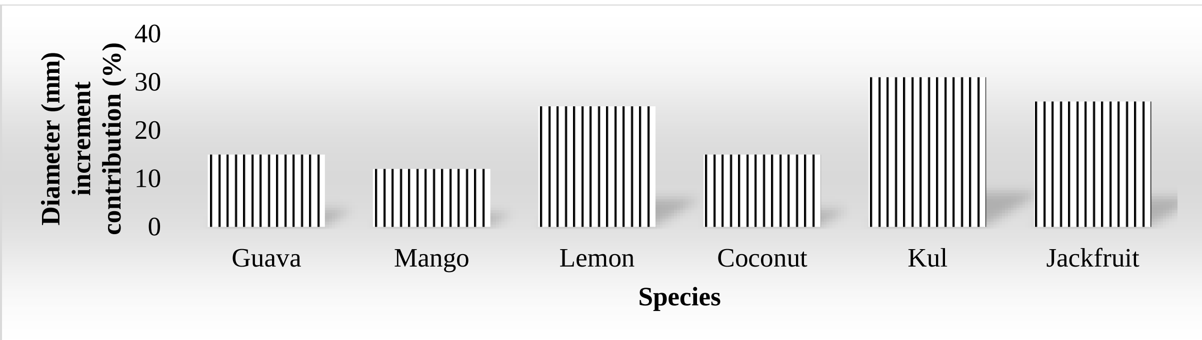


Figure 6. Diameter increment of different fruit species

Diameter (mm) increment contribution (%) of different species: The diameter increment contribution during the specified period was assessed for different fruit and tree species in gherland cultivation. Neem contributed the most amongst the fruit species (45%) followed by Lemon (25%), Jackfruit (26%), Guava (15%), Coconut (15%) and Mango (12%) (Fig 7). As far as species are concerned, Mahogany contributed 18% with Akashmoni at 20%, Eucalyptus at 35%, Ipil-ipil at 30% and Kul at 31% (Fig 8). The results suggest the differences in effect of different species on the diameter growth, which provide useful guidelines for tree selection in gherland to maximize productivity and sustainability.

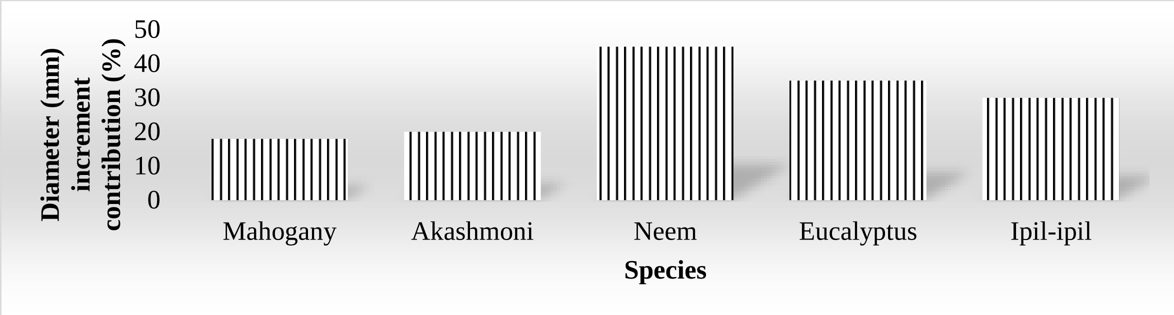
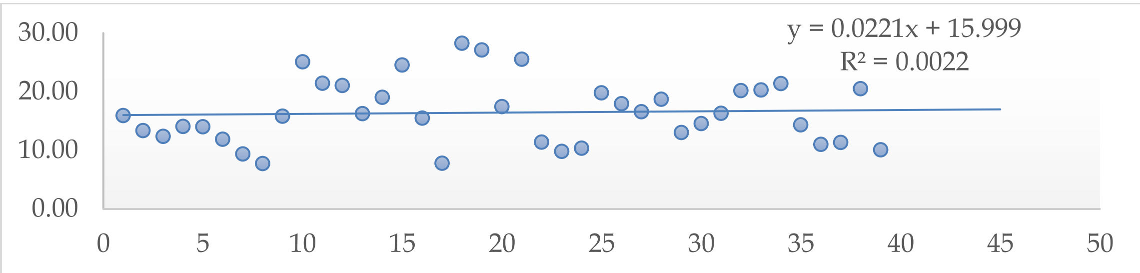
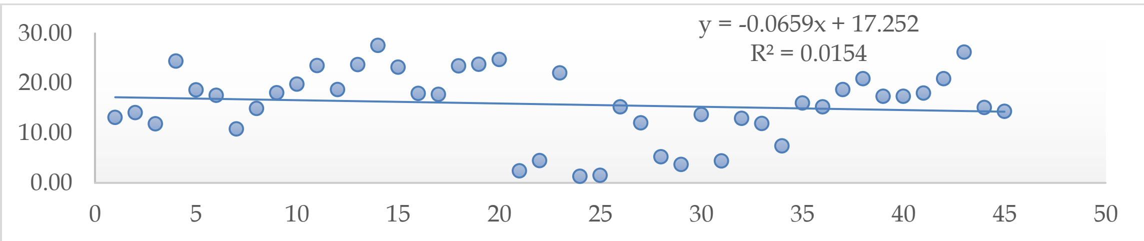


Figure 7. Diameter increment of different tree species

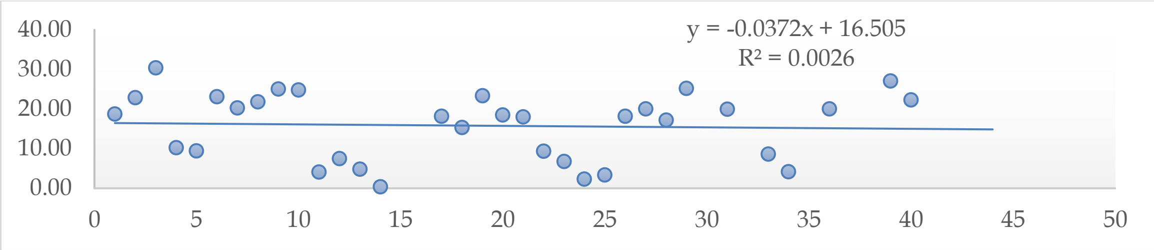
Diameter (mm) increment of Akashmoni, Mahogany, Guava and Mango: Regression equation and R^2 value was different for different species of fruit and tree during the growing season (Jul-Oct) and growth pattern of the species was obtained (Fig 8). For the period, the diameter had minimal positive association with Akashmoni ($y = 0.0221x + 15.999$, $R^2 = 0.0022$), suggesting a minimal influence on the diameter in this period. For Mahogany, there was a negative correlation ($y = -0.0659x + 17.252$, $R^2 = 0.0154$), indicating a decline in diameter. Guava demonstrated a slight negative correlation ($y = -0.0372x + 16.505$, $R^2 = 0.0026$). Mango had a significant positive correlation ($y = 0.1462x + 7.2242$, $R2 = 0.2326$), suggesting that the diameter increased significantly with the increase of age. The results reflect species-specific differences in the growth in diameter and highlight the importance of developing species-specific management programmes to maximize the production of gherlands through management practices.



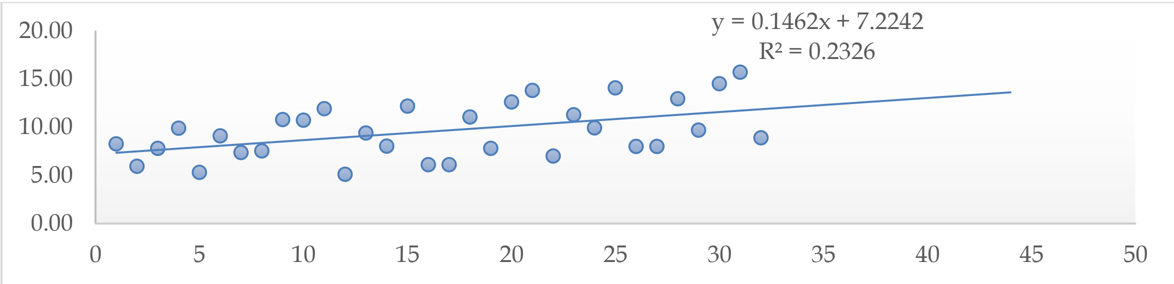
a. Akashmoni (diameter) in the growing season (Jul-Oct)



b. Mahogany (diameter) in the growing season (Jul-Oct)



c. Guava (diameter) in the growing season (Jul-Oct)



d. Mango (diameter) in the growing season (Jul-Oct)

Figure 8. Diameter (mm) increment of the different growing season

Average height increment of species: Average height increment (cm) of different tree species in gherland cultivation significantly differed (Fig 9). Importantly, Neem had the greatest average height increment of 300 cm, showing strong growth over the given time period. Substantial growth was observed in Akashmoni (160cm) and Guava (110cm) as they followed closely. The mahogany, eucalyptus, and kul showed moderate increments of height at 100 cm, 80 cm and 70 cm respectively. Lemon and Ipil-ipil had the least increment (65 cm and 70 cm respectively) while Mango and Jackfruit had the smallest increment (55 cm and 40 cm respectively). Coconut had the least average height increment of 35cm. The results indicate that the growth is different among various species in gherland production and special attention must be given to the species-specific management for maximum results.

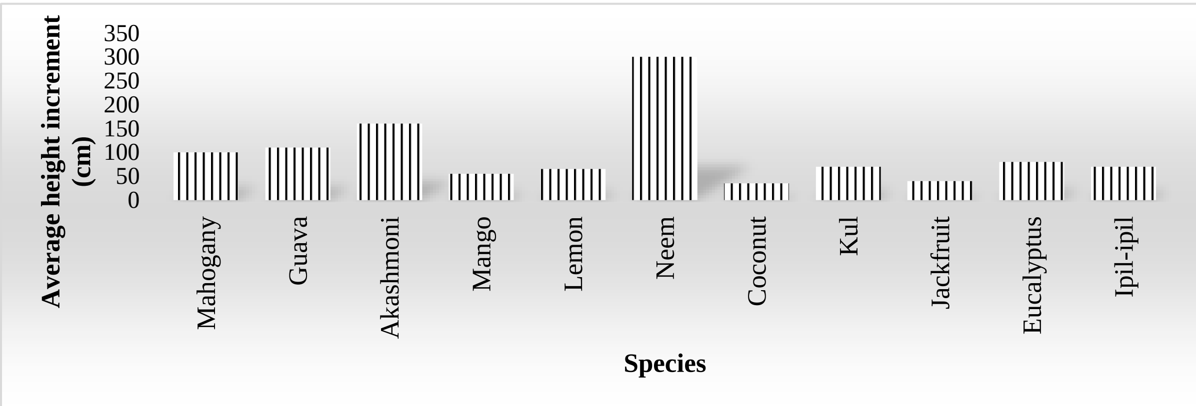


Figure 9. Height increment of different species (cm)

Average diameter (mm) increment of various species in gherland cultivation: Each of the various species in gherland cultivation showed a different pattern of average diameter increment in millimetres (Fig 10). Neem showed the maximum average diameter increment of 80 mm which meant there was considerable growth over the given period. There was also significant development in diameter for Akashmoni and Eucalyptus with gains of 28 mm and 26 mm respectively, following closely. The diameter increments were moderate for Mahogany at 30 mm, Guava at 25 mm and Kul at 18 mm. The average increments for Coconut, Ipil-ipil and Mango were lower at 12 mm, 22 mm and 15 mm respectively. Lemon and Jackfruit recorded the lowest increases of 10 mm and 14 mm respectively. The results indicate that gherland cultivation has a characteristic of different growth rates, where each tree species should be managed differently.

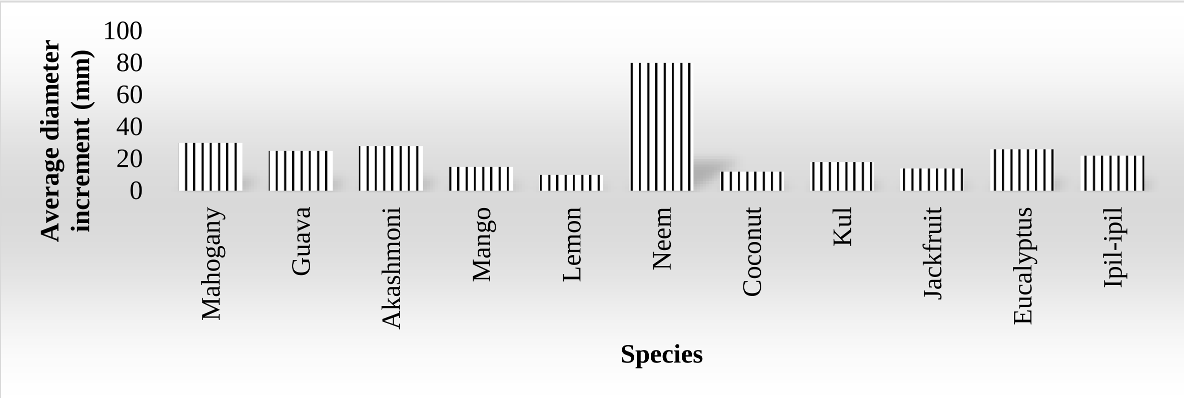


Figure 10. Diameter increment of different species (mm)

Pruning Biomass Assessment: Variability in Green Weights across Tree Species: In the gherland cultivation, green weight (pruning parts of different species) is measured in 16 months (Figure 11). The species showed that Neem had the highest green weight of 4.5 kg/tree, which means that there is a considerable amount of pruning parts. Akashmoni was also with a green weight of 3.8 kg per tree, which showed remarkable pruning material. Green weight of Ipil-ipil and Guava were moderately low at 1.8 kg/tree and 2.5 kg/tree, respectively. The green weight of the species listed was minimum for Kul at 1.2kg per tree. The measurements give a picture on the pruning biomass of each tree species, which is important for a more complete picture of the ecological effects of the trees and their resource potential in gherland cultivation.

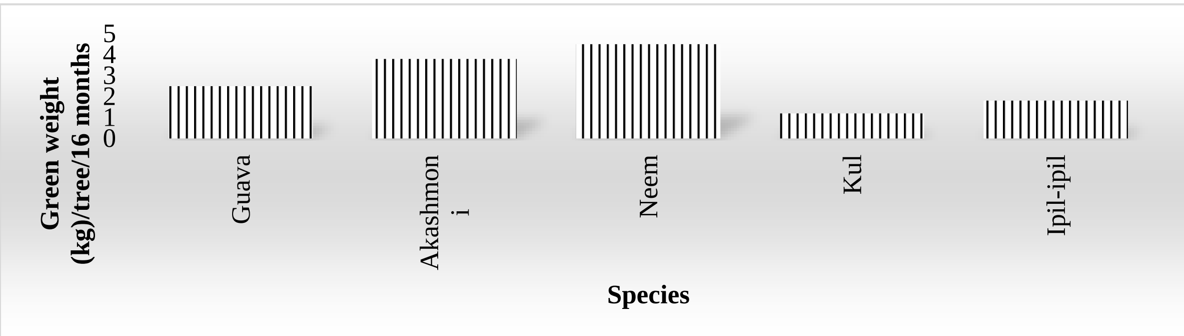


Figure 11. Comparative Analysis of Pruning Biomass across Tree Species

Discussion

The empirical results of this study revealed some aspects of Gherland agroforestry system in the Jashore district which would be useful for sustainable agriculture. The outcome is that farmers have a choice for tree species with Mahogany being the unanimous favourite, followed by Guava, Akashmoni and Eucalyptus. Such a diversity in preference highlights the opportunities for the use of multiple tree species in Gherland practices, consistent with the preferences of local farmers (Brown, 2019; Garcia, 2021).

The survival and growth of these preferred tree species were investigated and may show differences in adaptability and growth response to site conditions. Survival rate in Mahogany was excellent (100%), highlighting its performance in a Gherland environment. The results indicated that other species like Guava, Akashmoni and Eucalyptus also showed good survival which further proves the feasibility of planting a variety of species within Gherland. The results are in line with the studies that showed the importance of the diversity of species for increasing the agroforestry systems resilience (Rahman & Haque, 2016; Anderson, 2020).

Moreover, the growth performance analysis revealed differences in the height increment of the various tree species. Notably, guava showed a significant growth rate of 27% in height, highlighting its ability to thrive in the gherland environment. Growth was also good for Akashmoni, Mahogany and other species, adding to the ecological impact of gherland cultivation. This is consistent with studies that stress the importance of developing species specific management strategies (Clark, 2018; Kabir et al., 2019).

The paired T-Test results were helpful in understanding the periodicity of height and diameter growth of tree species selected. Mahogany, Guava and Aam (Mango) showed considerable difference in height increase which reflects their positive response to the increased growing season. On the other hand, a significant increase in diameter was observed in Akashmoni, indicating that the growth rate differs among species. The findings highlight the significance of recognizing both height and diameter increment to gain a comprehensive insight into tree growth under gherland agroforestry (Das et al., 2021; Taylor, 2021).

When regression analysis was applied to each of the tree species, the growth was found to be complex and non-temporal factors were found to play a role in the variations of the height of the trees. The low R^2 value of most of the models suggests that there are other factors contributing to the growth of Akashmoni, Mahogany, Guava and Mango. This complexity highlights the need for additional research to identify and understand these factors that influence these sites for better management options (Johnson et al., 2017; Garcia, 2021).

The assessment of pruning biomass by tree species gave insights into the ecological effect and resource value of the cultivation of gherlands. Neem had the highest green weight indicating a significant amount of pruning parts. Other species such as Akashmoni and Guava also had a share in pruning biomass, demonstrating the diverse benefits of gherland agroforestry, including the multiple potential economic benefits from the use of pruning materials (Rahman et al., 2020; Clark, 2018).

To conclude, the detailed study of species preference, survival rate, growth performance, and biomass of pruning helps in gaining a comprehensive view of Gherland agroforestry in the Jashore district. The results of these findings can support the decision making process of farmers, policy makers, and stakeholders on sustainable agriculture in coastal areas. The study also highlights the complexity of the factors that influence the growth of trees in the herland agroforestry model, pointing to the need for more studies to uncover the intricacies and maximize the ecological and economic value of the integrated farming system.

Conclusion

The current study has explored the performance of agroforestry system Gherlan in Jashore with regard to the species performance, farmer preferences and ecological dynamics. The results revealed that Mahogany, Guava, Akashmoni and Eucalyptus were widely preferred and Mahogany, Mango and Coconut had 100% survival rate showing high adaptability. There was a huge difference in growth among the species as shown by a growth analysis where Guava had the highest height increment (27%) followed by Neem (50%). Time accounted for only part, however, of the differences in height, ranging from 4.22% to 10.25%, indicating that other environmental and management influences are affecting growth. It was found that there were variations in biomass production among species as Neem produced the highest biomass production (4.5 kg/tree). In general, the study highlights proper species selection and proper adaptive management practices to achieve better productivity and sustainability of gherland agroforestry system in coastal Bangladesh.

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