Scholars Journal of Agriculture and Veterinary Sciences OPEN ACCESS
Abbreviated Key Title: Sch J Agric Vet Sci
ISSN 2348–8883 (Print) | ISSN 2348–1854 (Online)
Journal homepage: https://saspublishers.com

Adaptation and Growth Performance Evaluation of Lowland Bamboo Species at Odo Shakiso District of Guji Zone Southern Ethiopia

Temesgen Giri[1*], Sintayo Demise[1], Aschalew Emire[1]

[1]Oromia Agricultural Research Institute, Bore Agricultural Research Center, Bore, Oromia, Ethiopia

DOI: https://doi.org/10.36347/sjavs.2025.v12i11.002 | **Received:** 28.09.2025 | **Accepted:** 14.11.2025 | **Published:** 18.11.2025

***Corresponding author:** Temesgen Giri
Oromia Agricultural Research Institute, Bore Agricultural Research Center, Bore, Oromia, Ethiopia

Abstract **Original Research Article**

Bamboo is a fast-growing plant species than other and starts to yield within three or four years of planting. Even though Ethiopia is one of the most endowed countries in having huge coverage of bamboo resource in Africa, the country has narrow genetic diversity only has two species; Yushania alpine (highland bamboo) and Oxytenanthera abyssinica (lowland bamboo). With these two species, it is very difficult to secure constant supply of bamboo benefits. So, adaptation study of lowland bamboo was conducted with objectives of to evaluate the adaptability potential of different lowland bamboo species, and to identify the best performing of lowland bamboo species in midland agroecology of Odoshakiso District of Guji zone from 2021 to 2024. Three different bamboo species namely: Oxytenanthera abyssinica, Guadua amplexofolia, Dendrocalamus hamlitoni and Dendrocalamus memebranceous were collected from Bako agricultural research center. Among those mentioned only Oxytenanthera abyssinica is indigenous while the rest are exotics. The experiment was laid out in RCBD with three replications. From these bamboo species, Dendrocalamus hamiltoni and oxythentra abysinicca performed well in the study area with all growth parameters and Dendrocalamus memebranceous performed less. Therefore, we recommend these two species for further demonstration and pre-scaling up.

Keywords: Adaptation, Growth performance, Lowland bamboo species.

Copyright © 2025 The Author(s): This is an open-access article distributed under the terms of the Creative Commons Attribution **4.0 International License (CC BY-NC 4.0)** which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.

1. INTRODUCTION

Bamboos are woody plants that belong to subfamily Bam busosidee, family Graminaceae (or Poaceae), comprising approximately 1250–1500 species among 75–107 genera (Zhu, 2001). They are spread over approximately 35 million hectares (M ha) of land, the equivalent of 0.9% of the total wooded area of the world (FAO 2020). Bamboos are broadly tolerant and adaptable to various climatic and edaphic conditions mainly in tropical and subtropical areas (Song *et al.*, 2011). In the case of Ethiopia, the increase in population directed to increased demands for forest-related products and services. The fast-growing nature of bamboo enables the fulfillment of the demand for wood-related products and is more responsible to save the forest (Mathewos 2017). It is used as a substitute for timber and plays an important role in reducing environmental degradation (Mathewos 2017). In addition to the direct benefits and environmental services, the fast-growing nature of bamboo is an important species for adapting climate change through carbon sequestration (Darabant *et al.*,2014; Mathewos ,2017).

In recent decades, bamboo has become a globally important biomass resources in many parts of the world. Bamboo forests can be planted in degraded tropical forests because they are an important component of most tropical forest ecosystems and are adaptable to adverse site conditions. While contributing to environmental sustainability, they also provide income as well as a range of goods and ecosystem services for rural households, thus, contributing to food security and poverty eradication (Solomon *et al.*,2020).

Therefore, it is important to introduce and adapt high economic value of exotic bamboos species to improve the income of small farm holder, to divers the genetic resources of bamboos species and for environmental protection in Ethiopia. Bamboo is versatile with a very short growth cycle. Bamboo is a high yield renewable natural resource for agro-forestry and engineering-based products (Robert Henrikson.2009). Based on these all-indispensable values of the species, the study of bamboo adaptation was started at shakiso condition since 2021 with the objectives of to evaluate adaptability potential of

different provenance of lowland bamboo species around shakiso condition Guji zone and to provide the best performance of lowland bamboo species.

2. METHODOLOGY

2.1 Description of study area

The study was conducted at shakiso District of Guji Zone, Southern Ethiopia for four consecutive years. The area is characterized by bimodal rainfall pattern with longest rain season (locally known as Hagayya) and a short rainy season (locally known as Ganna). The district has geographical location of 5o2'29" - 5o58'24" northing latitudes and 38o35'0" - 39o13'38" easting longitudes. The district is characterized by three agro- climatic zones, namely highland (Bada), accounting for about 33%, midland (Bada dare), accounting for about 47% and lowland (Gammojjii), accounting for about 20% district area coverage. Most of the earth surface of the district is ups and down of the land surface with an elevation ranging 1500-2000 m a.s.l. in the larger southern portion of North Western part. Plains, dissected hill plateau and mountain as well as valleys and gorges characterized the relief of the district. The mean annual rain falls about 900mm and the mean annual temperature of the district is 22.50C. The soil textural class of the experimental area is clay with pH of 6.95. The most widely cultivated crops in the district are wheat, barley, maize, teff, Haricot bean, chick peas, Linseed, rapeseed, fruits, and Vegetable (District statistical abstract of 2014/15).

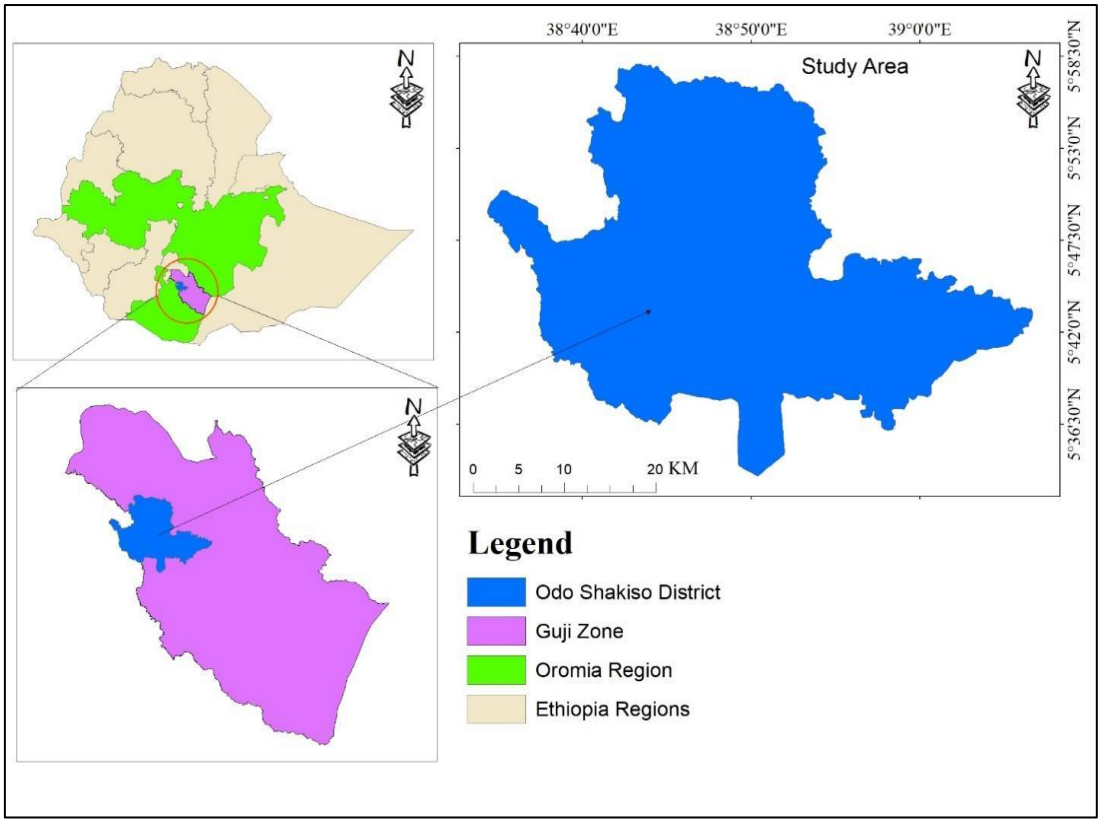

Figure 1: map of study area

2.2 Treatments and Experimental Design

The experiment was laid out in RCBD with three replications. The distance between blocks and plots was 3m and 2m, respectively. also, the space between each plant was 3m and the plot size was 9m*9m=81 m^2 with total area of 1386m^2 and with a total of 108 plants. As a treatment four lowland bamboo species was used: *Oxytenanthera abysinicca*, *Guadua amplexofolia*, *Dendrocalamus hamiltoni* and *Dendrocalamus memebranceous*. Among those mentioned species *Oxytenanthera abyssinica* is the indigenous bamboo species. Cutting of these low land bamboo species was collected from Bako Agricultural Research Center.

2.3 Data collection Method

The adaptation of lowland bamboo at Oddo Shakiso District of Guji Zone southern Ethiopia was conducted from 2021 to 2024 to evaluate the adaptability potential of different provenance of lowland bamboo species and to provide the best performing of lowland bamboo species around Oddo shakiso areas. Concerning about growth performance issues data like; culm height, culm diameter, internode length, number of nodes, new shoot emerging, and other growth parameters were considered during data collection. The data were collected every three months interval to see the changes among the species.

2.4 Data Analysis

The collected raw data were analyzed with analysis of variance (ANOVA) following the General Linear Model (GLM) procedure using GenStat Software. For significant differences, mean separation using LSD was conducted at 5 % level of significance. Therefore, for these analyses the following parameters were considered and measured; Number of new emerging shoots, Survival rate in %, root collar diameter, internodes length, number of nodes, culm height and diameter data were collected.

3. RESULT AND DISCUSSION

3.1 Survival rate

During four-year trial of lowland bamboo species at shakiso condition, Dendrocalamus hamiltoni shows high survival percentage (88.8%) followed by Oxythentra abyssinica (22.2%) while Dendrocalamus membrenecoaus shows the least survival percentage and poor adaptation which is 3.7%. This shows that temperature and soil condition of shakiso area suited for growth of Dendrocalamus hamiltoni lowland bamboo variety. From exotic lowland bamboo species, Dendrocalamus hamlitonii shows significance difference by survival percentage.

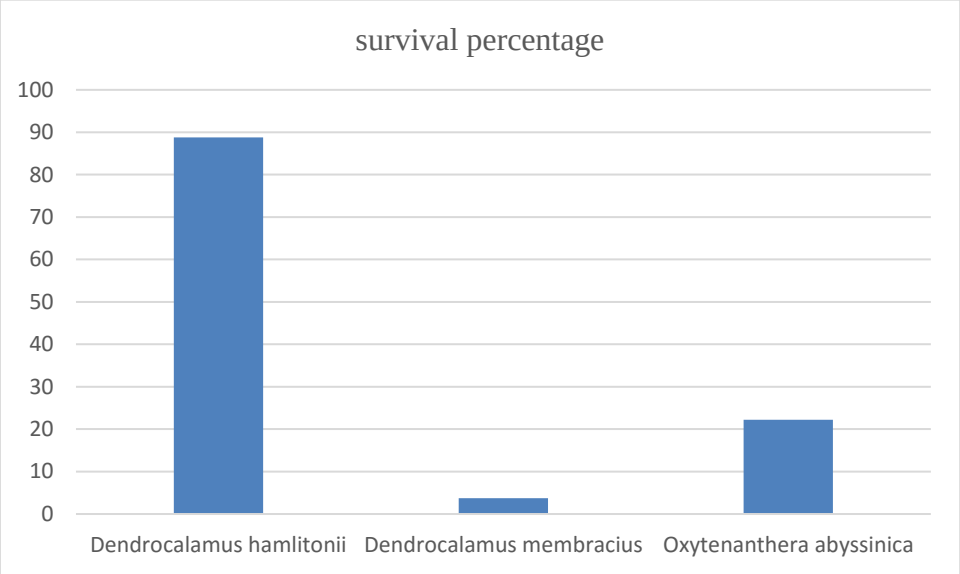

Figure 2: survival rate of lowland bamboo at Oddo Shakiso District

This result is similar with report from Bako agricultural research center by Terefe *et al.*, (2016) shows higher survival rate for Dendrocalamus hamiltoni.

3.2 New Emerging shoot.

Based on analyzed four-year data at shakiso condition, Dendrocalamus hamiltoni bamboo species shows significant difference in number of new emerging shoot (8.5) followed by Oxythentra abysinicca (3.8) (Figure.2). The least new emerging shoot was recorded from Dendrocalamus membrenecoaus which shows (1.4). This shows that condition of the study area suited for good performance and for well adaptation of Dendrocalamus hamiltoni followed by Oxythentra abyssinica.

Table 1: Average means Comparisons between treatments at 0.05 significant levels (Mean)

Treatments	Av. NNS	Av. IL (cm)	Av. CH (m)	Av. CD (cm)	Av. RCD (cm)	NON (no)
D.Membranecous	1.4^{b}	6.87^{a}	1.27^{ab}	0.43^{b}	0.433^{b}	0.43^{b}
D. Hamiltoni	8.5^{a}	19.77^{a}	3.7^{a}	1.7^{a}	2.533^{a}	16.5^{a}
O. abysinicca	3.8^{ab}	11.77^{a}	2.1^{b}	0.76^{ab}	1.167^{b}	15.3^{a}
Cv (%)	27.9	24.5	18.8	31.6	34.4	10.8
LSD (0.05)	5.6	12.8	2.7	1.6	1.4	18.9

** NNS -Average Number of New shoots*
**IL – Average Internode Length*
**CH – Average Culm Height*
**CD – Average Collar Diameter*
**RCD Average Root Collar Diameter*
** NoN- Average Number of Node*

3.3 Internode Length and Number of Node

The mean value of internode length shows significance difference at 0.5 significance level between treatments. The highest mean was recorded from Dendrocalamus hamiltoni followed by Oxythentra abyssinica, while the least mean of Internode length recorded from Dendrocalamus membrenecoaus (Table.1). In case of number of node, the highest mean was recorded from Dendrocalamus hamiltoni followed by Oxythentra abysinicca. The lowest number of node was recorded from Dendrocalamus memebranceous lowland bamboo species.

3.4 Culm Height and Diameter

Bamboo culm's structure is cylindrical and is divided into sections by diaphragms or nodes. The section between two nodes is called internodes. Internodes are hollow in most bamboos, but solid in some species. Direct or indirectly bamboo internodes length can indicate the quality of bamboo product which used for different purpose. The result showed that the highest mean of culm height and Diameter recorded from Dendrocalamus hamiltoni followed by Oxythentra abysinicca. The least bamboo culm height and diameter was from Dendrocalamus membrenecoaus. Also, Terefe *et al.,* (2016) and Yared k, 2013 reported highest culm height and diameter for Dendrocalamus hamiltoni bamboo species.

3.5 Root collar Diameter

Significant difference at ($p<0.05$) was observed between lowland bamboo species during this four-year trial for root collar Diameter. Here the highest root collar diameter was recorded from Dendrocalamus hamlitoni (2.5) followed by Oxythentra abyssinica (1.1) and the least root collar diameter was recorded from Dendrocalamus membrenecoaus (0.43).

4. Conclusion and recommendation

As conclusion during four-year trial, Dendrocalamus hamiltoni and Oxythentra abysinicca bamboo species performed and adapted well based on growth performance data. Especially Dendrocalamus hamiltoni shows great performance at Oddo shakiso condition. So as recommendation further demonstration and prescaling up must apply for both Dendrocalamus hamiltoni and Oxytenanthera abysinicca bamboo species.

Acknowledgments

The authors thanks Oromia agricultural research Institute for financial support and Bore Agricultural research center for its support with necessary facilities. Also, authors thanks Agroforestry research team members for their effort to success this project.

Conflict of Interest

Authors Declares no conflict of interest on Manuscript

REFERENCES

- Abdella, M. and Cheneke, B., 2023. Adaptation and Growth Performance of Lowland Bamboo Species at Fedis District East Hararghe Zone, Oromia, Ethiopia. American Journal of Plant Biology, 8(1), pp.6-11.
- Darabant A, Haruthaithanasan M, Atkla W, Phudphong T, Thanavat E, Haruthaithanasan K. 2014. Bamboo biomass yield and feedstock characteristics of energy plantations in Thailand. Energy Procedia. 59:134–141
- Embaye, K., 2000. The indigenous bamboo forests of Ethiopia: an overview. AMBIO: A Journal of the Human Environment, 29(8), pp.518-521.
- Eyasu, G., Gebrewahid, Y., Darcha, G. and Kassa, H., 2024. Adaptation and growth performance of different bamboo species in Dryland areas of Northern Ethiopia. Forest Science and Technology, pp.1-6.
- FAO (2020) Global Forest resources assessment 2020: main report. Rome. https:// www. fao. org/3/ ca982 5en/ ca982 5en. pdf. Accessed on 11 June 2023
- Hailu, A. and Gitima, G., Bamboo Forest in Ethiopia: roles, constraints and management strategies. Research Journal of Agriculture and Forestry Sciences ISSN, 2320, p.6063.
- Kumar, Adarsh, Meena Dhawan and B. B. Gupta.1998. Flowering and rooting of Bambusa tolda culm cuttings in response to growth regulating substances. The Indian Forester. 1998, 116:7, 574-553.
- Legesse Dadi, Gemechu Gedeno, Tesfaye Kumsa and Getahun Degu., 1987. Bako mixed farming zone, Wellega and Shewa Regions. Diagnostic survey report No. 1. Institute of Agricultural Research, Department of Agricultural Economics and Farming Systems Research, Addis Ababa, Ethiopia.
- Mathewos M. 2017. Multiple uses of bamboo species and its contribution to forest resource management in Ethiopia. J Res Dev Manage. 32:123–130.
- Ogega, M.B., 2014. Factors influencing the development of bamboo value chain in Kenya: A case study of Nairobi County (Doctoral dissertation).
- Perez, Manuel Ruiz, Zhong Maogong, Brian Belcher, Xie Chen, Fu Maoyi and Xie Jinzhong. 1998. The role of bamboo plantation in rural development: The Case of Anji Country, Zhejiang, China. Elsevier Science Ltd. World Development 27(1): 101-114pp.
- Song XZ, Zhou GM, Jiang H, Yu SQ, Fu JH, Li WZ, Wang WF, Ma ZH, Peng CH (2011) Carbon sequestration by Chinese bamboo forests and their ecological benefits: assessment of potential, prob lems, and future challenges. Environ Rev 19:418–428. https:// doi. org/10.1139/a11-015

- Temam Mama, W.N., Adaptation and Growth Performance of Lowland Bamboo Species at Haro Sabu Condition.
- Terefe, R., Samuel, D., Sanbato, M. and Daba, M., 2016. Adaptation and growth performance of different lowland bamboo species in Bako, West Shoa, Ethiopia. Journal of Natural Sciences Research, *6*(9), pp.61-65.
- Terefe, R., Senbeto, M., Lalisa, L. and Samuel, D., 2019. Effect of Different Propagation Methods on three Lowland Bamboo Species, at Bako Agro-ecology, West Shoa, Oromia, Ethiopia. Basic Research Journal of Agricultural Science and Review, *7*(5), pp.40-46.
- Zhu ZH (2001) The development of bamboo and rattan in tropical China. China Forestry Publishing House, Beijing.