Journal of Scientific Agriculture 2025, 9: 266-271
doi: 10.25081/jsa.2025.v9.9825
https://updatepublishing.com/journal/index.php/jsa

Research Article

ISSN: 2184-0261

Pre-extension demonstration of *Moringa olifera* pollarding technology at Derashe District, Gardula Zone of South Ethiopia

Lakamo Liben*, Abebaw Bergena, Melese Ejamo, Anteneh Bulke

South Ethiopia Agricultural Research Institute, Arba Minch Agricultural Research Center, Agricultural Technology Transfer and Communication Research Directorate, Arba Minch, Ethiopia

ABSTRACT

Native to northern India, Moringa oleifera is grown all over the world. Little is known about the plant's management and pollarding techniques in Ethiopia. The main objective of this study was to improve the moringa pollarding technology's adoption and diffusion, collect farmer feedback, and investigate cost-benefit analysis conducted at 20 farmer fields in 2022-2024. 12 month-old, hardened tree seedlings were planted in a 10x20 m plot with 2x2 m spacing and a 50 cm cutting after a year of planting. Spacing of 2 m x 2 m and cutting on 50 cm after one year of planting the plantation was pollarded at 0.5 m above the ground to promote multiple branch regeneration prior harvest, and then 60 days duration allowed for hardening-off the shock of pollard as a new technology and 1.75 m farmers practice (standard check) used for this demonstration.Twenty-six months after planting, data on the fresh weight of leaf biomass per tree were collected and converted to hectare. The data collected from 200 m^2 demonstration plots of five selected trees was evaluated using matrix rankings and simple descriptive statistics. Farmers assessed the demonstration plots three times: at the seedling, six-month, and harvesting periods. Pollarding at 0.5 m and farmers' practice (1.75 m) produced an average of 16.3 tons per hectare and 10.3 tons per hectare, respectively, in farmers' fields. When it comes to the yield of new leaf biomass, pollarding at 0.5 m performs better than farmer techniques. Net benefits from pollarding at a 0.5 m farmer practice were 179,000 ETB and 107,600 ETB, respectively. Finally, the demonstration sites hosted a farmer's field day. Based on a number of criteria, including ease of harvesting, the number of branches per tree, fresh leaf biomass, and protection from steam breaks while harvesting, farmers ranked the 0.5 m pollarding practices first. Finally, it is better to scale up pollarding at a larger scale by 0.5 m in order to boost the adoption and distribution of the moringa pollarding strategy in the study area and similar agro-ecology.

KEYWORDS: Demonstration, Derashe, Leaf biomass yield, *Moringa olifera*, *Moringa Stenopetala*, Pollarding

Received: November 05, 2025
Revised: December 23, 2025
Accepted: December 23, 2025
Published: December 28, 2025

***Corresponding Author:**
Lakamo Liben
E-mail: libenlakamo79@gmail.com

INTRODUCTION

The tropical plant Moringa (*Moringa oleifera* Lam.) is a member of the Moringacea family. *Moringa stenopetala* is native to East Africa, while *M. oleifera* is native to the Himalayas (Grubben & Denton, 2004). The crop was then cultivated all over the world. It grows best in well-drained soils and cannot sustain prolonged periods of flooding, even though it can tolerate the dry season rather well and is suitable to a variety of soil types (Orwa *et al.*, 2009).Thirteen species make up the Moringa family: *M. oleifera*, *M. arborea*, *M. rivae*, *M. ruspoliana*, *M. drouhardii*, *M. hildebrandtii*, *M. concanensis*, *M. borziana*, *M. longituba*, *M. pygmaea*, *M. ovalifolia*, *M. peregrina* and *M. stenopetala*. Of these, *M. oleifera* is well-known for its use in fertilizer, biogas production, and nutrition (Gandji *et al.*, 2018). It grows quickly, is small to medium in height, and with bi- or tri-pinnate leaves. Each leaflet has a leaf area of one to two centimeters. Flowers are zygomorphic and range in hue from white to cream. The tree produces 20 to 40 cm long pods that, when fully grown, turn brown from green, exposing a large number of round or triangular seeds with three papery wings (Dao & Kabore, 2015).

Moringa can be propagated using both seeds and cuttings (Morton, 1991). *M. oleifera* is a multipurpose tree with significant market value. The Moringa tree is considered one of the most beneficial trees in the world since almost every portion of it can be used for industrial, medicinal, and food reasons (Khalafalla *et al.*, 2010). *M. oleifera* was shown to contain a variety of essential elements, including substantial amounts of calcium, potassium, protein, and vitamins (Fahey, 2005; Hsu *et al.*, 2006; Kasolo *et al.*, 2010). It goes by several colloquial names, including "Shiferaw" in Amharic, "Haleko" in Wollaytegna and Gamogna, and "Shelaqta" in Konso. There are numerous possible uses for *M. olifera*, including industrial, medical, nutritional, and ecological ones. Animal feed is another application for the tree. In the warm, semi-arid climate of the Rift Valley (South Ethiopia), the indigenous communities have created an ornament and shade.While the seeds are used to purge murky water, the blossoms are wonderful sources of nectar for honey. Traditionally, the various plant parts have been used to treat asthma, diabetes, hypertension, stomach issues, and other conditions.One of the components required for the best and highest-quality production of Moringa leaves is appropriate silvicultural management. For instance, Sanchez (2006) recommended that 50 to 75 plants per square meter and leaf cutting every 75 days be used for large-scale biomass production in Nicaragua. Despite its importance, *M. oleifera* remains unpopular in Ethiopia, where it was just recently introduced as a vegetable tree because of its edible leaves.

M. oleifera is not native to this area; however, for its abundant expansion in the world, it is definitely the most well-known species of the whole genus. Ethiopian farmers must therefore increase their leaf production by using appropriate techniques that would yield sufficient and reliable leaf production without eroding the foundation of natural resources. Several studies have been conducted that have increased the production of moringa leaves overseas (Sanchez, 2006; Sanchez *et al.*, 2006; Adebayo *et al.*, 2011; Edward *et al.*, 2013). Despite all of these studies, Ethiopia lacks scientific data since regional management needs and agroecology are often different. To further understand how pollarding height influences biomass production, more empirical research on the management of Moringa plants is necessary. The purpose of this study was to raise farmers' awareness of the pollarding application of *M. olifera*, evaluate farmers' practices, and examine the advantages and disadvantages of moringa pollarding heights on biomass yield in Southern Ethiopia's Derashe District.

MATERIALS AND METHODS

Descriptions of the Study Area

Derashe is one of the districts in Southern Ethiopia. According to astronomy, the district is located between 5°22′30° and 5°33′00° N and 37°10′30° and 37°31′30° E (Figure 1). Its altitude varies from 501 to 2500 meters above sea level. It is separated into three agro-climatic Zones according to agroecology: Lowland, midland, and highland. The long-term average maximum and minimum temperatures were 27.50 °C and 15.10 °C, respectively. Annual rainfall ranges from 601 mm to 1600 mm (CSA, 2018). Derashe district is situated in the Great Rift Valley, honors the Derashe people, whose homelands are found in this district. There are 142,758 residents in this district, with 70,111 men and 72,647 women, according to the Central Statistical Agency of Ethiopia's (CSA, 2018). Derashe has 1,487.38 square kilometers area in size and has a population density of 95.98; 13,184 people, or 9.24%, reside in urban areas. There are 26,838 households and 26,102 residential units in the district, with an average of 5.32 people per household (unpublished district agricultural office statistics, 2014).

Site and Farmers Selection

The experiment was conducted in the Derashe district. Development, agents, experts, researchers, and farmers collaborated during site selection. The district was purposefully selected due to its ability to cultivate moringa and the area's suitability for it. Farmers from the kebele were selected in collaboration with Kebele development agents spoke and ten farmers were selected based on their availability of land and willingness. Gender parity was closely observed.

Stakeholder Capacity Building and Responsibility Sharing

Farmers, development agents, and researchers got training and held discussions to increase awareness before the research trial began. Both theoretical and practical training were provided in order to increase awareness and enhance work effectiveness. The training title focuses on the agronomic and management practices of moringa technology, particularly cutting procedures, pollarding height, harvesting time, and fresh leaf harvesting techniques. Multi-disciplinary stakeholders got training regarding land preparation, planting, pollarding techniques, weed control, disease prevention, leaf harvesting, nutritional significance, and post-harvest management. Thus, a total of 27 people engaged in the Derashe District: 19 farmers, 3 researchers, 3 development agents, and 2 experts (Table 1). The proposal's development was greatly aided by agricultural extension and communication as well as agroforestry researchers from the natural resource research directorate of the Arba Minch Agricultural Research Center, who provided training, increased farmer knowledge, logistics, and input delivery. Finally, district agriculture office experts and development agents chose model farmers.

Research Design

Arba Minch Agriultural Research Center main station supplied the *Moringa oliefera* seeds. In July 2020, the trails' seedlings were spread on seedbeds at the Arguba Nursery Site. The seedlings were pricked out into 30 cm long, 12 cm diameter white polythene tubes after germination. Once it was selected, a shed was built to provide shade and removed as needed. The seedlings were watered twice a day in the morning and evening while they were in the nursery, with the exception of rainy days. But this was reduced to once every other day for hardening three weeks prior to planting. 20 seedling per farmer was provided. The date of planting was maintained the same for 0.5 m above ground and 1.75 m pollarding practices. After a year of planting, the cutting of 0.5 m above ground after one year of planting to

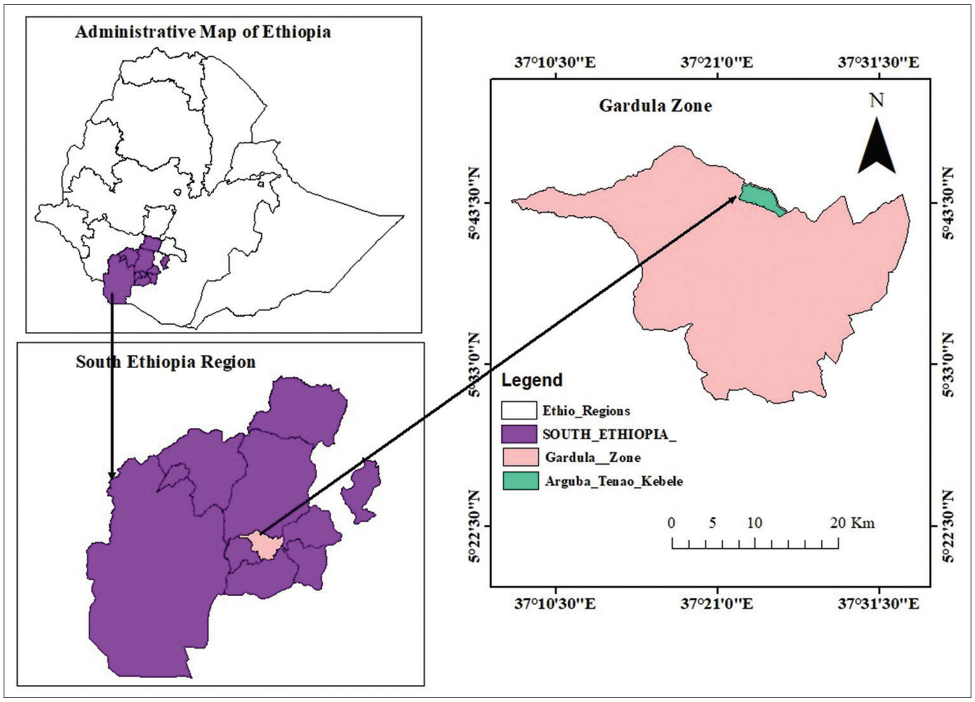

Figure 1: Map of the study area

Table 1: Number of participants during training at the study area

S. No.	Participants	Male	Female	Total
1	Farmers'	15	4	19
2	Experts	2	-	2
3	Development agent	2	1	3
4	Researchers	3	-	3
5	Total	22	5	27

promote multiple branch regeneration prior harvest, and then 60 days duration allowed for hardening-off the shock of pollard as a new technology and 1.75 m farmers practice (standard check) used for this demonstration

Methods of Data Collection and Analysis

Data on fresh leaf yield, including fresh leaf biomass production, was collected from five trees. 30% of the plants' leaf biomass was retained for the improvement of the photosynthetic process, while the remaining 70% was harvested. As soon as the leaves were collected in the field, a weighing scale was used to determine the fresh weight of each plot.The total number of farmers who participated in extension/promotional activities including training and field mini-field days was recorded by gender. Feedback on farmers' preferences (likes and dislikes) and their choice of the technology's performance was also ascertained by gathering the average.Finally, SPSS Version 26 software was used to summarize and evaluate the gathered data. The descriptive statistics methods used were mean, maximum, and minimum. The number that appears in each Likert scale response is used to gauge farmers' preferences. A Likert scale, an ordinal measure ranging from extremely poor to good, was used to analyze it. To measure the preferences under investigation, a numerical value would be provided to each of the ten responses. The following formula was used to determine the technology's yield advantage:

$$\text{Yield Advantage} = \frac{\text{Yield of improved variety (kg ha}^{-1}\text{) - Yield of standard check (kg ha}^{-1}\text{)}}{\text{Yield of standard check (kg ha}^{-1}\text{)}}$$

Monitoring and Evaluation

Following the sowing, a thorough follow-up with the stakeholders undertaken. Farmers were responsible for land preparation, planting, agronomic management, and harvesting. From the start of land preparation to the final harvest, farmers got support and periodic follow-up from members of the farmers' research group in collaboration with kebele development agents.Active participation in team activities was another duty of the farmer's research group members. Researchers, development agents, and district professionals watched and evaluated the activities at key moments. During the stages of flowering, germination, and harvesting, varieties are monitored and evaluated.However, at the maturity stage, a researcher and farmers were evaluated the activity (Figure 2). Because they enable farmers to learn by watching and sharing their experiences in the field, field evaluations are crucial to the demonstration of new technology. Therefore, in order to thoroughly illustrate the moringa pollarding technique, mini field day was conducted in the study area. Field days are essential for disseminating technology and increasing farmers' awareness of it. During the moringa maturity stage, stakeholders such as district-level specialists, farmers, development agents, and researchers took part in a field day. Thus, as shown in Table 2, a total of 34 individuals attended the field day: 25 farmers (male 20 and female 5), 4 researchers (male 3 and no female), 2 experts (male 2 and no female), and 4 development agents (male 3 and female 1).

RESULTS AND DISCUSSION

The activity was implemented at Derashe district namely Arguba Tanao Kebele. A result showed that pollarding *M. olifera* at the height of 0.5 meter was gave a good fresh leaf biomass yield relatively with farmer practices with 16.3 tone ha^{-1} of pollarding at 0.5 meter and 10.3 tone ha^{-1} of farmers practice respectively (Figure 3). The result is consistent with the result of Hamore *et al.* (2021) at Gamo Zone, Southern Ethiopia. The pollarding of the plant at a height of 0.20 m above ground and harvesting interval of 2 weeks resulted in good fresh leaf yield in Nigeria.

Yield Increase, Advantage, and Yield Gap

The yield advantage was calculated using the formul suggested by Rajashekhar *et al.*: As the above table pollarding at 0.5 meter showed a 6000 kg ha^{-1} yield increase and a 58.25% yield advantage over the standard check at Derashe District (Table 3). The yield gap of the demonstration is 163-103 = 60 quintal per hectare. This might be due to low adoption of new method of pollarding technique. The higher yield gap (60 quintal/ha) indicates a strong need to mobilize the farmers for adoption of improved pollarding technologies over their farmer practices.

Figure 2: During *M. olifera* pollarding field evaluation period

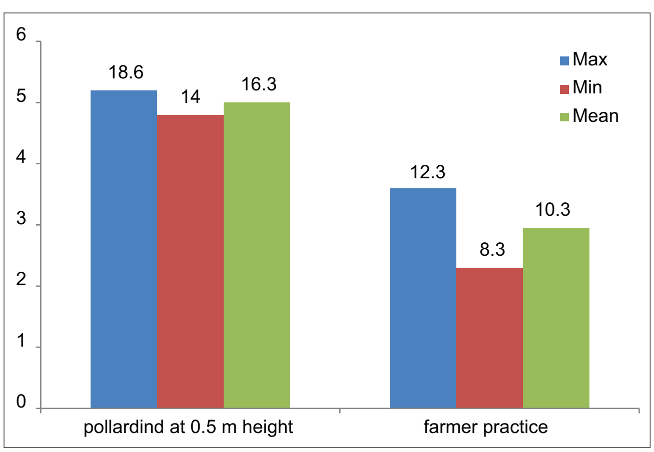

Figure 3: Mean *Moringa olifera* leaf biomass yield of pollarding technology (ton/ha) in Derashe District

Farmers' Preference Ranking

Farmers were asked to respond from 1-5 level of preference on each attribute of the crop, wit indicating, 1 = Very poor, 2 = Poor, 3 = Good, 4 = Very good, and 5 = Excellent; for the given technology based on the seven criteria listed below. After scoring, each value of the score was summed and divided by the number of parameters to get the mean score and results showed that pollarding *M. olifera* at 0.5 m have got excellent with all citerias (Table 4).

Costs and Benefit Analysis

Farmers had got 72,000 ETB in one year and 3 months from 400 m^2/farmer area of land by pollarding *M. olifera* at the height of 0.5 meter over farmers practice (Table 5). This shows moringa one of the major income generating activity in the study area.

Table 2: Participants at the field day at Derashe District

S. No.	Participants	Male	Female	Total
1	Researcher	3	-	3
2	Experts from the District	2	-	2
3	Development Agent	3	1	4
4	Farmers	20	5	25
5	Total	28	6	34

Table 3: Mean yield advantage and yield increases yield (kg/ha)

Pollarding heights	Location	Yield increase (kg)	Yield advantage (%)
	Arguba Tanao	Pollarding at 0.5 m	Pollarding at 0.5 m
Pollarding at 0.5 m	16,300	6,000	58.25%
Farmer practice (1.75 m)	10,300		

Table 4: Farmers preference of Moringa Polardizing Technology

Characteristics	Arguba Tanao kebele (n=10)	
	0.5 m height	Farmer practice (1.75 m height)
Easiness for cutting (pollarding)	5	2
Confortable for Harvest	5	3
Harvesting frequency	5	4
High number of branch	5	3
Leaf biomass yield	5	3
Total score	25	15
Mean score	5	3
Rank	1st (excellent)	2nd (good)

Table 5: Cost benefit analysis of the *M. olefira* pollardizing technology

S. No.	Variables	Units	0.5 m height pollarding	Farmer practices
1	Yield obtained (Qt ha^{-1})	Qt/ha	163	103
2	Leaf biomass Sale price	(ETB/Qt)	1200	1200
	Total Returns	ETB	195,600	123,600
3	Nursery preparation	person	3,000	3,000
4	Land preparation and pollarding	Person (ETB)	8,000	8,000
5	harvesting	Person (ETB)	5,000	5,000
6	Total cost	ETB	16,000	16,000
7	Net benefit	NR-TC (ETB)	179,600 ETB	107,600 ETB
	Difference		72,000 ETB/farmer practice	

CONCLUSION AND RECOMMENDATION

M. olifera pollarding with a height of 0.5 meter was demonstrated and exhibited on 10 farmers' fields in Derashe District, Arguba Tanao Kebele. Farmers received inputs from Arbaminch Agricultural Research Center. To create awareness and common understanding, farmers, development agents, and District Agricultural Extension personnel's participated in training on the commodity's agronomic methods. To find out how farmers felt about the technologies, field evaluation was conducted at various stages of the crop. Farmers, Development Agents, District and Zone chiefs of Agriculture, Subject Matter Specialists, and researchers attended field days when moringa reached maturity stages. Farmers compared 2 different pollarding heights and shared their thoughts on the pollarded moringa performance. As regards the finding, fresh biomass leaf yield of *M. olifera* increased from 10.3 to 16.3 tons/ha in farmers practice (1.75 m) above ground and 0.5 m above ground. It was suggested that in order to quickly disseminate the technology, it is preferable to address large areas with the same technical gap to a large number of farmers, train farmers to apply technologies, including agronomic practices, and provide efficient trend exchange mechanisms.

ACKNOWLEDGEMENT

The authors would like to acknowledge the South Ethiopia Agricultural Research Institute, Arba Minch Agricultural Research Center, for financing this study. The authors would like to thank colleagues in the Derashe District office of Agriculture for helping with site and farmer selection as well as data collection of the study. The authors also acknowledge farmers for their participation from the beginning to the final data collection of the activity

AUTHORS' CONTRIBUTION

LL: Conceptualization, material preparation, writing the original draft and editing analyzed data and wrote the whole manuscript, ANB, ME and AB: field investigation, data curation, reviewed the whole manuscript. All authors approved the complied and submitted version manuscript.

ETHICS OF APPROVAL

All the farmers and stakeholders have been informed of the objective of the study in general and the purpose of collecting the data in particular. Participants were also informed about the data obtained from them will be kept confidential and all farmers who participated in the study were fully acknowledged.

REFERENCES

Adebayo, A. G., Akintoye, H. A., Olufolaji, A. O., Aina, O. O., Olatunji, M. T., & Shokalu, A. O. (2011). Assessment of Organic Amendments on Vegetative Development and Nutrient Uptake of *Moringa oleifera* Lam in the Nursery. *Asian Journal of Plant Sciences, 10*(1), 74-79. https://doi.org/10.3923/ajps.2011.74.79

CSA. (2018). *Annual Statistical Abstract*. Bureau of Finance and Economic Development for the Southern Nations, Nationalities and Peoples' Regional State. Hawassa, Ethiopia: Central Statistical Agency.

Dao, M. C. E., & Kabore, K. H. (2015). Morphological characteristic variation of eleven provenances of *Moringa oleifera* seedlings grown in the Northern Sudanese area of Burkina Faso. *African Journal of Plant Science, 9*(10), 401-411. https://doi.org/10.5897/AJPS2015.1334

Edward, E., Chamshama, S. A. O., Mndolwa, M. A., & Ngaga, Y. M. (2013). Effect of spacing and cutting management on survival, growth, and biomass production of *Moringa oleifera* intercropped with maize on-station at Gairo inland plateau and Ruvu, Coast region – Tanzania. *Greener Journal of Agricultural Sciences, 3*(4), 254-261.

Fahey, J. W. (2005). *Moringa oleifera*: a review of the medical evidence for its nutritional, therapeutic, and prophylactic properties. Part 1. *Trees for Life Journal, 1*, 5.

Gandji, K., Chadare, F. J., Idohou, R., Salako, V. K., Assogbadjo, A. E., Glèlè Kakaï, R. L. (2018). Status and utilisation of *Moringa oleifera* Lam: A review. *African Crop Science Journal, 26*(1), 137-156. https://doi.org/10.4314/acsj.v26i1.10

Grubben, G. J. H., & Denton, O. A. (2004). *Plant Resources of Tropical Africa 2 Vegetable*. Netherlands/CTA, Wageningen, Netherlands: PROTA Foundation.

Hamore, D., Yakob, G., Bashura, T., Asfaw, D., Anjulo, A., & Debella, A. (2021). Effect of pollarding on growth and leaf biomass production of *Moringa oliferia* Lamin Arba Minch Zuriya Woreda, Southern. *Journal of Biology, Agriculture and Healthcare, 11*(18), 1-5. https://doi.org/10.7176/JBAH/11-18-01

Hsu, R., Midcap, S., & Arbainsyah, D. W. L. (2006). *Moringa oleifera: Medicinal and Socio-Economical Uses*. The Netherlands: International Course on Economic Botany, National Herbarium Leiden.

Kasolo, J. N., Bimenya, G. S., Ojok, L., Ochieng, J., & Ogwal-okeng, J. W. (2010). Phytochemicals and uses of *Moringa oleifera* leaves in Ugandan rural communities. *Journal of Medicinal Plants Research, 4*(9), 753-757. https://doi.org/10.5897/JMPR10.492

Khalafalla, M. M., Abdellatef, E., Dafalla, H. M., Nassrallah, A. A., Aboul-Enein, K. M., Lightfoot, D. A., El-Deeb, F. E., & ElShemy, H. A. (2010). Active principle from *Moringa oleifera* Lam leaves effective against two leukemias and a hepatocarcinoma. *African Journal of Biotechnology, 9*(49), 8467-8471.

Morton, J. F. (1991). The horseradish tree, *Moringa pterygosperma* (Moringaceae)-A boon to arid lands? Economic Botany, 45, 318-333. https://doi.org/10.1007/BF02887070

Orwa, C., Mutua, A., Kindt, R., Jamnadass, R., & Anthony, S. (2009). *Agroforestry Database: a tree reference and selection guide version 4.0*.

Sanchez, N. R. (2006). *Moringa oleifera and Cratylia argetea: Potential Fodder Species for Ruminants in Nicaragua*. Doctoral Dissertation, Swedish University of Agricultural Sciences.

Sanchez, N. R., Ledin, S., & Ledin, I. (2006). Biomass production and chemical composition of *Moringa oleifera* under different management regimes in Nicaragua. *Agroforestry Systems, 66*, 231-242. https://doi.org/10.1007/s10457-005-8847-y