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Evaluation of Women's Contribution in Agroforestry Demonstration through Moringa Species Introduction in Western Oromia, Ethiopia

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ABSTRACT

Agroforestry technologies are very keen practices in most small-scale farming systems where gender issues are not well considered in most developing countries. Moringa is a tropical plant that consists of 13 species, while five of them are found in Ethiopia. This study aimed to evaluate the potential and contribution of women in agroforestry demonstrations where *Moringa oleifera* and *Moringa stenopetala* are introduced in farmers' fields. Selection of the best performing moringa species and preferred by farmers for further scaling up was also another objective. The activity was conducted in five districts of west and east Wallagga zones. A total of 10 FREG comprising 150 farmers were established. The two moringa species were planted on 100 farmers' fields where 50 women and 50 men were purposively selected and given responsibilities of moringa demonstration. Leaflets and practical training on moringa production, importance and utilization were prepared and given to all concerned bodies. 84% of women and only 32% of men effectively demonstrated the moringa species. A total of 200 farmers were interviewed to evaluate and select the best from the two species depending on their growth performance, fresh leaf taste and odor, and survival rate. Based on the above criteria, 143 (71.5%) farmers preferred *Moringa oleifera*. In general, the two moringa species were performed well in most places, and its utilization started at household level. Finally, the authors recommend that women are the potential for demonstrating agroforestry technologies, and *Moringa oleifera* is a more preferred species in western Oromia.

Keywords: Agroforestry; Demonstration; Feedback; Growth performance; Moringa; Women

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1. Introduction

Agroforestry practices are gender sensitive where the roles and responsibilities of women and men are critical. For instance, women and men have different understandings of and knowledge about the natural resources in their environment while linking knowledge with action for sustainable development should consider gender issues ^[1]. Due to cultural belief, ploughing is specifically categorized as a male chore while women's rights to tree products are usually limited to products that are considered to have little or no commercial value; men reserve higher value products for themselves. Many studies reveal that the products that women control are mainly homestead trees, fuel wood sources, fruits and vegetables, fodder and mulch. However, medicinal and commercial plants and trees are mostly preferred and managed by men ^[2-4].

Within the gender issues, the adaptation of two moringa species namely *Moringa stenopetala* and *Moringa oleifera* was conducted at Bako some years back and well adopted in the environment ^[1-3,5]. *Moringa oleifera* and *Moringa stenopetala* are the two most common species among the 13 species of the Moringa family, Moringaceae. *Moringa oleifera* originates from the Himalaya (northwestern India), while *Moringa stenopetala* is endemic to East Africa, where it occurs in northern Kenya and in Ethiopia. Both species have many characteristics in common. For both species the uses as a vegetable and water purifier are similar. They share several medicinal uses and both have high contents of oil in the seeds between 32%-42%. *Moringa oleifera* has a faster development and yields bearing fruits and seeds quickly ^[5]. *Moringa stenopetala* is better suited to a drier climate; yields of seeds are higher and they have a higher coagulant content ^[6]. The two most common English vernacular names for the tree are 'drumstick' (describing the shape of its pods) and 'horseradish' (describing the taste of its roots ^[7]. Additional names have been given to them such as "Never Die Tree", "The Magic Tree", "The Tree of Paradise" or "Best Friend" based on the multipurpose behavior of the trees. In Ethiopia it is widely cultivated ^[8].

People have different nutritional requirements at different stages in their lives. The leaves from moringa are exceptionally nutritious for people of all ages and the use of the plant as side dishes or sauces provides daily allowances of important nutrients. The leaves have a high content of Vitamin A and Vitamin C when they are raw. Vitamin A is required for good eyesight and Vitamin C strengthens the gums. The content of minerals like Calcium is very high, which is rare among plants. Calcium is used for strengthening bones. 100 grams of moringa leaf powder contains: four times the calcium of milk, four times the vitamin A in carrots, two times the protein in milk, three times and the potassium in bananas and seven times the vitamin C in oranges ^[9].

Since moringa is very important in the food context and medicinal values and we want to identify its performance among gender management, we need to demonstrate and scale up/out it in its agroecological ranges. Accordingly, we addressed a total of 5 districts in west Shawa and east Wallagga zones, west Oromia, Ethiopia, and equally distributed its management for men and women.

2. Materials and methods

2.1 Description of the study area

Traditional agroforestry practices are well known in western parts of Ethiopia, but not well studied in the cases of gender roles and dominant niches while moringa species which are highly valuable agroforestry trees are not well known in the areas. Therefore, in this study we incorporated the gender issues and moringa species introduction and demonstration in the western parts of Oromia, Ethiopia. Five (5) districts were randomly selected based on their agroecology and accessibility for this activity. These districts were Bako Tibe, Guto Gida, Diga, Wayu Tuqa and Boneya Boshe (**Figure 1**).

2.2 Methodologies

Phase 1 of the implementation

Areas (districts and/or zones) that have the same

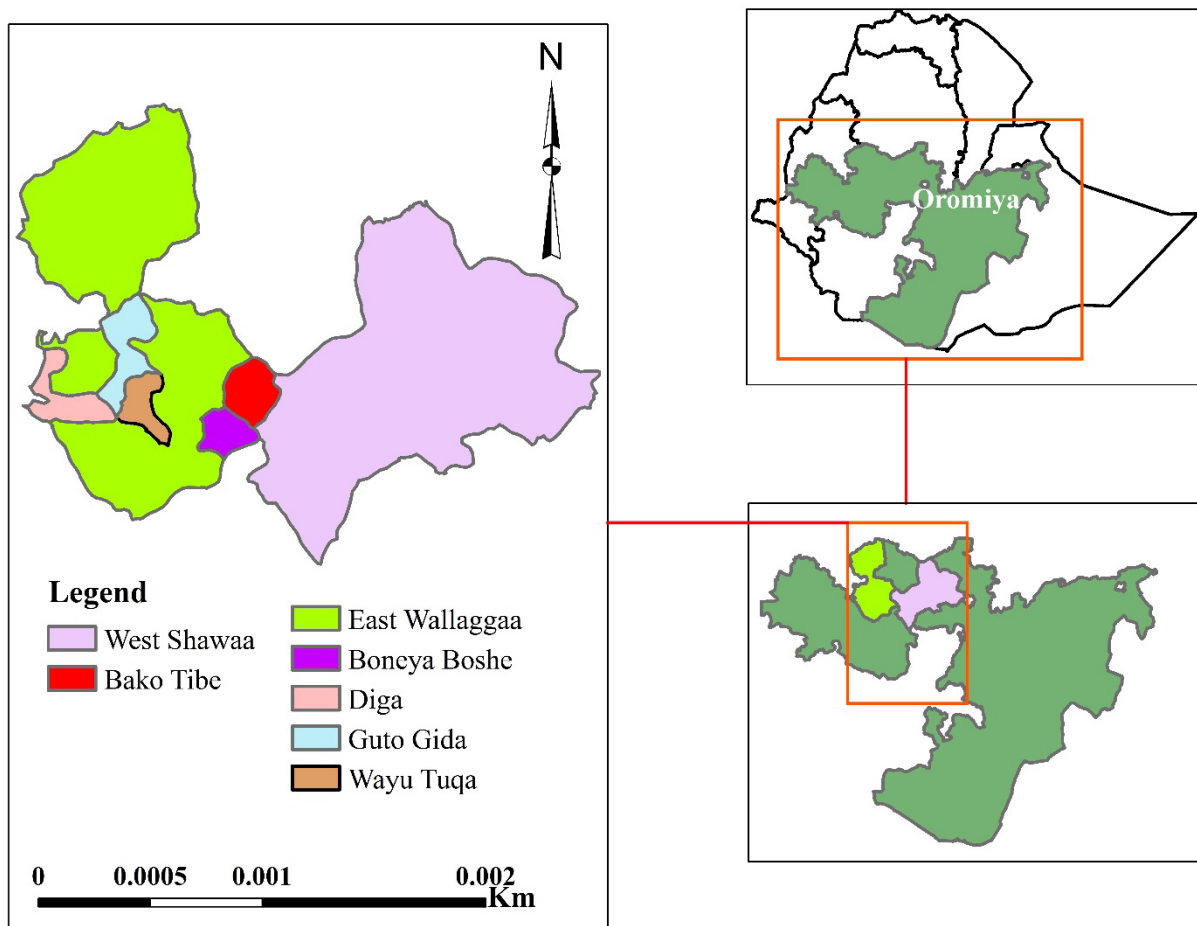


Figure 1. Site descriptions of Moringa species demonstration sites.

agro-ecological zone with Bako agricultural research center (BARC), from west Shawa Zone Bako Tibe district and from east Wallagga Zone Guto Gida, Diga, Wayu Tuqa and Boneya Boshe districts were selected for the pre-demonstration activity of the two moringa species. After the selection of the districts, we decided to pick purposively based on accessibility and potential, one or two kebeles from each district. After all, we form the Farmers' Research Extension Group (FREG) which comprises ten to fifteen members per kebele. A total of 10 FREG comprising 150 farmers (75 males and 75 females) were established. The two moringa species were planted on 100 farmers' fields on an area of $10\text{ m} \times 10\text{ m} = 100\text{ m}^2$ each and 2 m spacing between plants.

Theoretical and practical training was organized; manuals and leaflets were prepared on Moringa's importance and conservation methods for farmers of

FREG members and Development Agents (DAs) of respective kebeles and also for experts of each district.

Five to ten farmers of FREG members were selected to plant those moringa species (the known *Moringa stenopetala* and the exotic *Moringa oleifera*), and they planted them. Survival count, growth performance, disease occurrence and farmers' perception of the two moringa species were recorded.

Phase 2 of the implementation

Training leaflets and manuals on moringa utilization and importance were produced and FREG member farmers were awarded about all. Farmers were organized and asked to visit, use, evaluate and put their feedback on the survival count, growth performance, leaf color, odor and seed bearing duration of the two moringa species. A hint of all important components of growth and uses were provided to

the FREG member and non-members. Additionally, practical training on moringa planting, management, silvicultural operations, seed collection, seed storage, leaf utilization and other moringa benefits were given to the FRG members including neighbor farmers, DA's and other experts. In the practical training, farmers and other participants have also given chance to evaluate both moringa species and select a better one based on the above criteria. The FREG member farmers have been also sharing their experiences with others on moringa planting and management methods.

Data management and statistical analysis

All the necessary data were collected and analyzed. Farmers' assessment/feedback on the technology (growth performance, affordability, complexity, applicability) were collected through regular interaction with farmers and rapid feedback surveys. Simple descriptive statistics by SPSS and Excel tools and matrix while ranking and qualitative analysis of farmers' assessment/feedback were also subjected to SPSS.

3. Results and discussion

3.1 Survival count and growth performance

From the total of 10,000 seedlings of *Moringa oleifera* and *Moringa stenopetala* species which were planted on 100 farmers' fields and the last survival rate of *Moringa oleifera* shows 84% and this survival rate is greater by 4% from the 1st survival count for the same species on average of over all locations. This may be due to regenerating potential of dormant seedlings of moringa during the winter (drier) seasons. This survival rate shows for *Moringa stenopetala* 72.6% on average. *Moringa oleifera* has also evaluated by bearing seeds within less than 8 months after planting. We have observed that the survival rate, fast growth and good stand performances of both moringa species show better at all sites under farmers whose management activities are controlled

by women and children (**Figure 2**). This result is in line with Orwa et al.'s study ^[10], which defines it as *Moringa oleifera* requires mean annual temperature of 12.6 °C to 40 °C and a mean annual rainfall of at least 500 mm. Adapted to a wide range of soil types but does well in well drained clay or clay loam without prolonged waterlogging which prefers a neutral to slightly acidic soil reaction. It is quite a drought tolerant but yields much less foliage where it is continuously under water stress. It is not harmed by frost, but can be killed back to ground level by a freeze. It quickly sends out new growth from the trunk when cut, or from the ground when frozen. On the other hand, *Moringa stenopetala* is also mentioned by its intolerance of cold temperatures for the cultivation of the species in Ethiopia because it does not tolerate frost ^[10,11].

From the above picture, we can evaluate the growth performances of the two moringa species, and we observed that *Moringa oleifera* bears seed and can be seen by its biomass advantage.

3.2 Gender performance for the implementation

Moringa demonstration under women management

From the total of 50 women selected for the moringa demonstration, about 42 (84%) of them have recorded high performance, and there is no significant difference across the locations (**Figure 3**). However moringa is newly introduced and is demonstrated in the current study areas, women are very happy and actively participated in the activity. This finding is in line with the results ^[2], which say women's participation is very high in enterprises that are considered to be women's domain, such as indigenous fruit and vegetable products and processing. We assured that women are very keen on their responsibility in agroforestry practices, and they are more careful and tolerant than men in tree management, especially during the tedious silvicultural operations.



Figure 2. Growth and stand performances of *Moringa oleifera* and *Moringa stenopetala*.

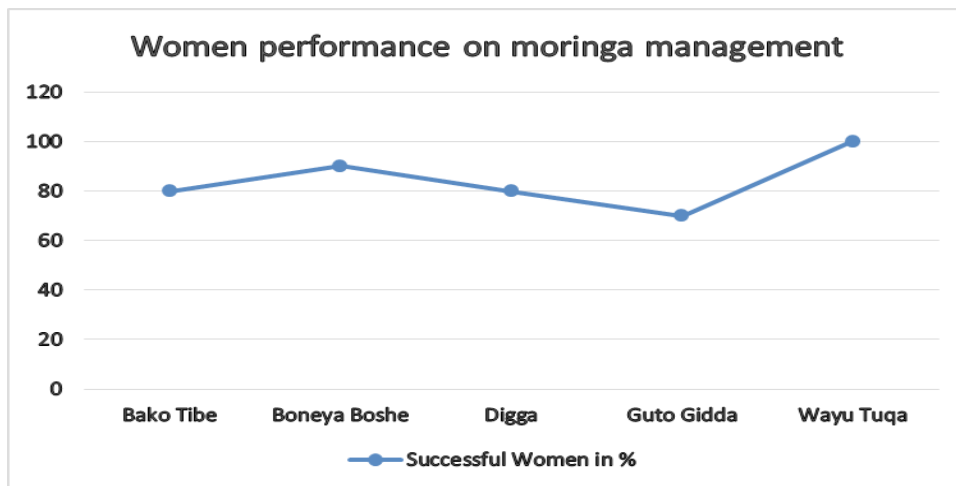


Figure 3. Performance of women on moringa demonstration.

Moringa demonstration under men management

Of the total of 50 men selected for the moringa demonstration, about 16 (32%) of them have recorded high performance, and there is no significant difference across the locations (Figure 4). This result agrees with the study that reveals. Men ranked trees that grow straight so that timber is their number one priority, and straightness is followed by trees that grow fast among men [2].

3.3 Farmers perception and species selection

A total of 200 farmers were interviewed to evaluate and select the best from the two species depending on their growth performance, fresh leaf taste and odor, and survival rate. Of the total 100 (50%) farmers were women. Based on the above criteria, 143 (71.5%) farmers preferred the *Moringa oleifera*. The most attractive result here is that from the total women interviewed, about 92% preferred the *Moringa oleifera*, due to its leaf biomass and good odor

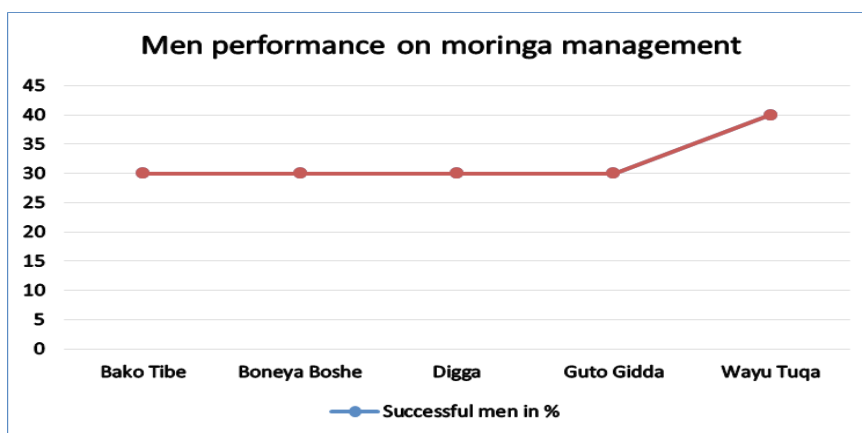


Figure 4. Performance of men on moringa demonstration.

over *Moringa stenopetala* (Table 1; Table 2). The farmers refer *Moringa oleifera* species, which taste like local cabbage and are simple to grow in a short period of time. They also utilized it and witnessed that they are being cured of headaches, gastric, pressure, diabetes and wounds of different causes. This preference for the *Moringa oleifera* also agrees with the study [10], which will state its contents and uses. Its leaves are a good source of protein, vitamins A, B and C and minerals such as calcium and iron, which are used as a spinach equivalent. They are an excellent source of the sulfur-containing amino acids methionine and cystine, which are often in short supply. Young plants are eaten as a tender vegetable and the taproots as an alternative for horseradish. Young pods are edible and reportedly have a taste reminiscent of asparagus [11].

Table 1. Household information and feedback responses.

Households	Frequency (%) (N=200)
Sex	Male 100 (50%) Female 100 (50%)
District	Bako Tibe 40 (20%) Boneya Boshe 40 (20%) Digga 40 (20%) Guto Gida 40 (20%) Wayu Tuqa 40 (20%)

From the above table, we can discuss that most of the assessed farmers were preferred *Moringa oleifera* to *Moring stenopetala*, which may be because of its odor, color, fast-growing, taste and overall growing performance.

Table 2. ANOVA table of feedback responses.

Assessment	Variation	Sum of Squares	df	Mean square	F	Sig.
Did you plant moringa species? 1. Yes 2. No	Between Groups	5.581	31	0.180	1.101	0.342
	Within Groups	22.884	169	0.163		
	Total	28.465	200			
Among moringa species, which one is best for you? 1. <i>M. stenopetala</i> 2. <i>M. oleifera</i>	Between Groups	9.174	25	0.296	1.400	0.097
	Within Groups	29.588	175	0.211		
	Total	38.762	200			
What is/are your selection criteria? 1. Their growth performance 2. Their fresh leaf taste and odor 3. Survival rate 4. Others (specify)	Between Groups	12.568	29	0.405	0.872	0.663
	Within Groups	65.124	171	0.465		
	Total	77.692	200			

4. Conclusions and recommendations

We have observed from the research that women and men have specific forms of knowledge and different productive strategies, but these tend to be complementary and even synergistic in agroforestry practices. In this specific objective of moringa species demonstration among the men and women management, we have assessed the varying performances of gender across the different locations and household types.

Additionally, we have identified that moringa species are extremely fast-growing and highly valued agroforestry trees where trees reach 2.5 m within 1-3 months. In addition to its medicinal value, moringa will help as a supplementary food, and therefore, it is one of the food security tree/shrub species, especially preferred by women over men. From the two moringa species demonstrated and evaluated here, *Moringa oleifera* was mostly preferred by farmers considering its growth performance, survival rate, odor, color and taste. The duration for seed bearing was also another criterion for the farmers to prefer the *M. oleifera* species. Moringa species were well performed under practices where hot pepper, bean and vegetables were incorporated in. We have also observed it was better survived and performed where women and children control its overall management than men from the household members. As far as it is well known that of the three countries in eastern Africa, Ethiopia is the only country that has widely domesticated in its southern landscape as a garden and tree on a farm, we need to demonstrate and scale up/out it further into different parts of the country.

Since women are very close to homestead, and are very responsible in home garden agroforestry management, it is necessarily important to empower them by providing educational and practical extension services to expand agroforestry knowledge and skills, as well as guidance on marketing and selling agroforestry products. Therefore, we highly recommend that women are very potential in agroforestry demonstration, specifically; in moringa-based agroforestry management, and hence they should be invited to participate in projects and training activities.

Finally, we call for forestry extension systems to ensure women's stronger performance in decision-making and enjoy the full benefits of agroforestry.

Author Contributions

The first author has participated from the beginning to the end of this article preparation. He did all about the modification of the project from the beginning, training, the implementation, data collection, and processing, analysing, interpretation and report preparation. The second author has put his active participation from the data processing to the article preparation, and the third author has initiated the project's idea and the project was modified to the current description by the first author.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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