# Morphological and biomass performance of indigenous agroforestry tree species Seedlings under different provenances at nursery level, in central Ethiopia

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# Abstract

*Multipurpose tree are significantly important for climate change resistance by in such way that climate change adaptation and mitigation. In addition they have an important economic, social and livelihood of farmers and also considerable effect on the GDO of the country. In this context, the intra-specific variability in plant functional traits can be determinant to improve species’ fitness. Therefore, this research aimed to select better provenance for indigenous tree. Indigenous multipurpose trees those are more common, important and have multipurpose were identified and their seeds were collected from different area and sowed in nursery, 10cm by 8cm (Height and Diameter) that filled with soil 2:1:1 ratio of (normal soil, organic soil and sand soil) and growth parameter like Germination (%), survival after germination at nursery, height, RCD (root collar diameter) and branch number (leaf number) seedlings and Above and below ground biomass were measured. The result shows that in growth parameter Wondo genet and Halaba provenance for* ***Cordia africana Lam.****, Arbaminch Zuria provenance for* ***Acacia abyssinica*** *and Dembi provenance for* ***Faidherbia albida*** *were performed significantly higher in two following years, respectively. Similarly in above and below ground biomass of indigenous multipurpose tree Arbaminch zuria, wondogent and Dembi provenances were shows significant performance for* ***Acacia abysinica, Cordia Africana*** *and* ***Faidherbia albida tree species.*** *According to the above result provenance variation have important effect on growth performance of those indigenous tree species. As result, to improve the germination potential selection seed source from different agro ecology is important. In spite of this Wondo genet, Arbaminch Zuria and Halaba are**seed source for* ***Cordia africana Lam., Acacia abyssinica and Faidherbia albida*** *respectively to produce seedling in meskan wereda were recommended****.*** *This work is equally important for other area with similar and different tree species by considering outfield planting in addition to nursery level.*

**Key words:** Agro ecology, Biomass, Forestry, Genetic variation and parameters

**Introduction**

Indigenous Multipurpose tree species play a key role in ecosystem resilience under climate change scenarios. According to Reta Regasa, (2013) done in Hawasa assessed that indigenous tree species importance for farmer in terms of timber, fuel wood, medicinal and construction. Those indigenous trees were had considerable value in human day to sday activities by providing services and products specifically legume tree like *Faidherbia albida* and *Acacia abyssinics* (Dubeux Junior *et al.,* 2017); *Cordia africana* have also economical and ecological advantage by providing shade (Yadessa *el al*.. 2001), soil fertility improvmrnt by adding organic matter and (Abayneh *et. al.,* 2017, Teklay and Maimer, 2004) nutrient cycling and also timber production (Mehari and Habte, 2006). Even though, until the forest biodiversity have been are under intense pressure, especially in the Ethiopia highlands. The major cause of this are Human settlement and cultivation, forest deforestation, over-grazing and growing agricultural intensification are (Lemenih and Teketay 2006; Kindu *et al*. 2013; Telila*et al.* 2015). Forest resources in Ethiopia have been declining at an alarming rate of 140,000 ha per annum (Teketay *et al*. 2010), and the biodiversity and other forest-based ecosystem services are apparently eroding (Tadesse *et al*. 2000; Kindu *et al*., 2016).

Indigenous tree species have seed germination problem as a result planting material are being scarce, and this problem is leading species to be endangered. Conservation and restoration of natural forests and indigenous trees have mixed success when the socio-economic needs of local communities are not sufficiently involved (Cayuela *et al*., 2006). In this context, the intra-specific variability in plant functional traits can be determinant to improve species’ fitness (Bischoff *et al*., 2006, 2008). This variability can result from ecotypic differentiation caused, in its turn, by specific morphological and physiological adaptations to different habitats (Hufford and Mazer, 2003).

Different provenances may vary in germination and growth, thus, screening for best provenances will be suitable for further promotion of forest plantations. A promising strategy seems ‘conservation through utilization’ by which sustainable extraction of natural resources is combined with forest protection (Schreckenberg *et. al*., 2006). Under the concept of ecological distance, the benefits of matching seed source and target site conditions have been widely reported for tree production purposes (O’Neill *et. al*., 2008, Matyas, 1994;). There are noticeable differences among tree species provenances concerning growth Abayneh Derero*et. al.* (2017) and number of trees of saleable quality (Frampton, 1998), which has considerable impact on the economic return. Differences among geographic sources in forest tree species are often substantial and economic improvement can be made by an appropriate provenance selection (Frampton, 1998; Schmidt, 2000).

Information on variation among provenances of indigenous tree species is sparse. In Ethiopia, few studies were carried out on some indigenous woody species (Mebrate and Belachew, 2004; Tinsae*et. al.,* 2014). These studies reported significant growth differences among provenances. However, only some indigenous species considered under these few studies. Thus, new studies on variation among provenances of indigenous trees, particularly tree species that are economically and ecologically important are essential for improving quality of plantation-produced to get a higher quality product thereby supporting the conservation by utilization strategy. The present study was designed to evaluate the effect of provenance on the seedling growth indigenous tree ( *Cordia africana, Faidherbia alida* and *Acacia abyssinica,****)***at nursery level.

**Materials and methods**

**Site description**

The study site, Meskan District is located in Gurage Zone of SNNP Regional State, Ethiopia. It is found 133 km south of Addis Ababa. Butajira is the capital city of the district. The major rainy season of study area is during June to September and the highest temperature is between February and March. According to climatic record near the study area, the mean annual rainfall in the district is 1058 mm (Meteorology Agency, 2005) and has altitude ranging from 1800-3500 m.a.s.l. The study area is geographically located in Central Rift Valley of Ethiopia. The main parent materials are basalt, ignimbrites, lava, gneiss, volcanic ash, and pumice (Zewdie, 2004; Itanna, 2005). According to FAO (1996), the dominant soil types of Meskan district includes Eutric Cambisols, Chromic Luvisols, Pellic Vertisols Chromic Vertisols, Eutric Fluvisol sand Leptosols.

## Research design and management

Seed collection, handling and processing were carried out. During seed collection the following points were considered. First Seed collection was done from only healthy, vigorous trees (good phenotype) not isolated and border tree, and collection form mature dominant or co-dominant; overly mature trees was avoided. Second the collecting area were had the population of not less than 50 tree and with minimum distance of 100 km between the provenance. Treated seeds with best germination percentage were used and sown direct in to the polyethylene bag. For each provenance, 100 polyethylene pots having 10cm height and 8 cm diameter was filled with 2:1:1 ratio of normal soil, sand and forest soil to raise the seedlings. Accordingly, using a Complete Randomized Design (CRD), with 4 replications was designed in the nursery for each species and appropriate nursery management undertake

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| No. | Provenance | Latitude | Longitude | Altitud(m) |
| 1 | Arbaminch zuria | 6°00'55" | 37°30'42" | 1969 |
| 2 | Dembi | 8°31'39" | 34°47'21" | 1826 |
| 3 | Durama zuria | 7°14'00" | 37°53'00" | 2101 |
| 4 | Gurage(meskan) | 8°08'43" | 38°20'45" | 2135 |
| 5 | Halaba | 7°19'05" | 38°05'19" | 1784 |
| 6 | Hawassa (Amora gedel) | 7°02'35" | 38°27'32" | 1692 |
| 7 | Hawassa (tabor) | 7°02'20" | 38°27'58" | 1810 |
| 8 | Wondo genet | 7°06'22" | 38°37'09" | 1790 |
| 9 | Aleta wondo | 6°36'46" | 38°27'49" | 2050 |

## 

## Data collection

The shoot length/height of each species seedling was measured using ruler in centimeter (cm), while root-collar diameter (RCD) was measured using caliper among the provenances and species. In line with this, the number of leaves in pairs of each seedling was counted. Seedlings’ leaf, stem and root fresh and dry weight estimation was also considered.

## Statistical analysis

The germination percentage data was first arcsine transformed before the statistical analysis to fulfill normality (Gomez and Gomez, 1984). In addition, the statistical significance difference was determined by ANOVA and multiple comparison of Least Significance Difference (LSD) to show significance difference among the treatments using SAS Computer Software Programme.

### RRESSULT AND DISCUSSION

***Cordia Africana***

Among the measured parameters root collar diameter, number of leaves per plant and shoot and root dry weight have showed significance difference among the provenance in both years (*P=0.05).* Except seedling height in the second year, Wondo genet provenance has showed highly significance in other parameters in both years followed by Hawassa zuria. On the other hand, Arbaminch zuria provenance has showed significangtly lower performance in most of provenance in both years similar with Gurage (Table 6).

**Table 1: Seedling growth performance of different provenance of *Cordia africana* in** Meskan wereda**, Gurage Z**one

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Seedling growth performance | | | | | | | |
|  | year I | | | | year II | | | |
| Provenance | Germ (%) | H (cm) | RCD (cm) | LN | Germ (%) | H (cm) | RCD  (cm) | LN |
| Wondo genet | 56.25 | 42.8 | 1.04a | 11 | 80 | 54b | 1.2a | 10.4a |
| Hawassa (amora gedel) | 85 | 42.5 | 1.03a | 11.4 | 77.5 | 61.6a | 1.2a | 10.6a |
| Halaba | 31.25 | 32.4 | 0.78ab | 9.1 | 20 | 41.8cd | 0.53b | 5b |
| Gurage(meskan) | 60 | 31.7 | 0.65b | 9.4 | 63.75 | 47bc | 1.03a | 8.2ab |
| Arbaminch-Zuria | 68.75 | 30.1 | 0.649b | 7.9 | 17.5 | 36d | 0.57b | b.8b |
| CV |  | 41.59 | 30.49 | 42.84 |  | 8.18 | 16.82 | 21.47 |
| MSD |  | NS | 0.32 | NS |  | 7.45 | 0.29 | 3.3 |

*Means value with different letters are significantly different (p≤0.05).Whereas; RCD= root collar diameter; Note: Germ=Germination; H=Height; RCD= Root Collar Diamter; LN= leaf number*

Table 2: Above and below ground biomass of different provenance of *Cordia africana* seedling In Meskan wereda**, Gurage Z**one

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| provinance | fresh and dry weight of shoot and root (gm) | | | | | | | |
| year I | | | | year II | | | |
| SFW | RFW | SDW | RDW | SFW | RFW | SDW | RDW |
| Wondo genet | 56.25a | 12.53a | 19.65a | 3.94ab | 89.07a | 7.32b | 37.16a | 0.72ab |
| Hawassa (Amora gedel) | 53.96ab | 11.41ab | 13.05ab | 5.9a | 81.54a | 11.3a | 24.24b | 0.25c |
| Halaba | 12.85c | 3.95b | 2.61b | 0.8b | 39.78b | 1.08c | 0.38c | 0.49abc |
| Guragea(meskan) | 24.08bc | 10.7ab | 5.59b | 2.05ab | 8.65d | 3.7c | 9.89c | 0.74a |
| Arbaminch Zuria | 21.68c | 7.13ab | 5.35b | 1.16b | 19.78c | 1.61c | 8.06c | 0.38bc |
| CV | 73.12 | 72.9255 | 116.3 | 121.5261 | 8.37 | 37.4 | 34 | 36.38 |
| MSD | 31.4 | 8.47 | 13.68 | 4.28 | 7.56 | 3.54 | 10.6 | 0.35 |

*Means value with different letters are significantly different (p≤0.05).Whereas; SFR= stem fresh weight, RFW= root fresh weight, SDW= stem dry weight, RDW= root dry weight.*

Except root collar diameter, other measured growth parameters of ***Accacia abysinica*** showed significant difference among provenance in the first year and only height in the second year. The biomasses of seedling have a significant difference in first year and no significance difference in the second year. Arbaminch-zuria provenance was highly significant by height and branch number in first year and by height in second year. With regard to biomass, similar provenance has also highly significant over others. Meskan provenance has no significant difference with Arbaminch and Aleta Wondo by height in both years. In most parameter Aleta wondo has significantly lower from others. The seed collected from Hawassa zuria significantly lower by height in both years (Table 10).

**Table 3: Seedling growth performance of different provenance of *Acacia abyssinica* in Meskan wereda, Gurage Zone**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Seedling growth performance | | | | | | | |
|  | year I | | | | year II | | | |
| Provenance | Germination (%) | Height (cm) | RCD (cm) | Branch number | Germination (%) | Height (cm) | RCD (cm) | Branch number |
| Arbaminch zuria  Meskan | 75  100 | 48.6a  42.8ab | 0.39  0.38 | 9a  8.4ab | 75  70 | 42a  38a | 0.29  0.27 | 12  11 |
| Wondo genet | 60 | 32.8abc | 0.35 | 7.8ab | 74 | 33ab | 0.26 | 9.6 |
| Dembi | 93.75 | 29abc | 0.31 | 7.4ab | 72 | 30.4ab | 0.256 | 12 |
| Hawassa(tabor) | 15 | 20.2bc | 0.25 | 6.4ab | 71 | 22.8b | 0.198 | 9.1 |
| Aleta wondo | 25 | 15.6c | 0.24 | 6.2b | 69 | 21.9b | 0.197 | 8.6 |
| CV |  | 42.35 | 31.9 | 19 |  | 33.37 | 45.8 | 30.66 |
| MSD |  | 26.09 | NS | 2.78 |  | 13.82 | NS | NS |

*Means value with different letters are significantly different (p≤0.05).Whereas; RCD= root collar diameter; Note: Germ=Germination; H=Height; RCD= Root Collar Diamter; BN= Branch number*

Table: Above and below ground biomass of different provenance of *A. abyssinica* seedling in Meskan wereda, Gurage Zone

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| provenances | Fresh and dry weight of shoot and root in gm | | | | | | | |
| year I | | | | year II | | | |
| SFW | RFW | SDW | RDW | SFW | RFW | SDW | RDW |
| Arbaminch zuria | 6.36a | 3.2a | 3.79a | 2.09a | 6.2 | 1.816 | 1.739 | 1.348 |
| Gurage(meskan) | 5.04ab | 2.64ab | 2.89ab | 1.68ab | 5.8 | 2.279 | 1.44 | 1.236 |
| Wondo genet | 4.88ab | 2.14ab | 2.35ab | 1.35ab | 4.06 | 1.75 | 1.43 | 1.18 |
| Dembiya (Elibabur zone) | 4.37ab | 1.43ab | 0.71c | 1.15ab | 4.5 | 1.449 | 0.78 | 1.193 |
| Hawassa | 1.64ab | 1.4b | 1.23bc | .74b | 1.85 | 1.43 | 1.12 | 0.928 |
| Aleta wondo | 3.31b | 1.82ab | 2.45ab | .67b | 2.3 | 1.39 | 1.42 | 1.03 |
| CV | 51.8 | 47.9 | 35.4 | 41.2 | 82.1 | 72.6 | 79.4 | 87.9 |
| LSD | 4.4 | 1.93 | 1.55 | 1.03 | NS | NS | NS | NS |

*Means value with different letters are significantly different (p≤0.05).Whereas; SFR= stem fresh weight, RFW= root fresh weight, SDW= stem dry weight, RDW= root dry weight.*

The seed collected from different areas were evaluated to identify better seed source for *Faidherbia albida* to use as seed source for the tested area, Meskan wereda. In the first year all growth parameter and in the second only height did not showed any significances among the provenances. The biomasses of seedlings were showed significant difference among provenance in both years. Halaba in first year significantly higher in the biomass of seedling but in second years significantly lower by the dry weight of shoot and root. Generally in second year most of provenance have no significant difference among them.

Table 4: Seedling growth performance of different provenance of *Faidherbia albida* in Meskan wereda, Gurage Zone

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Seedling growth performance | | | | | | | |
|  | year I | | | | year II | | | |
| Provenance | Germ (%) | H (cm) | RCD (cm) | B N | Germ (%) | H (cm) | RCD (cm) | BN |
| Dembi | 100 | 27 | 0.24 | 6.4 | 72 | 49.4a | 0.246 | 7.8a |
| Arbaminch Zuria | 98.75 | 23.8 | 0.22 | 6.2 | 75 | 44.6ab | 0.232 | 5.5b |
| Wondo genet | 95 | 27.2 | 0.23 | 7.6 | 69 | 40.2ab | 0.248 | 5.8b |
| Halaba | 95 | 25 | 0.23 | 6 | 71 | 40.8ab | 0.252 | 5.6b |
| Durame zuria | 97.5 | 22.6 | 0.22 | 6.8 | 74 | 42.6ab | 0.198 | 5.2b |
| Meskan | 100 | 22 | 0.2 | 6.2 | 70 | 38.2b | 0.236 | 5.4b |
| CV |  | 25 | 38.3 | 34.6 |  | 12.05 | 14 | 9.8 |
| MSD |  | NS | NS | NS |  | 10.05 | NS | 1.12 |

*Means value with different letters are significantly different (p≤0.05).Whereas; RCD= root collar diameter; Note: Germ=Germination; H=Height; RCD= Root Collar Diamter; BN= Branch number*

Table 5: Above and below ground biomass of different provenance of *Faidherbia albida* seedling in Meskan wereda, Gurage Zone

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| provenances | Fresh and Dry weight of shoot and root in gm | | | | | | | |
| year I | | | | year II | | | |
| SFW | RFW | SDW | RDW | SFW | RFW | SDW | RDW |
| Elibabur (Dembiya) | 1.7b | 1.206b | 0.914b | 0.64b | 3.39 | 2.49ab | 1.916ab | 1.36ab |
| Arbaminch-Zuria | .78d | 1.164b | 0.48b | 0.404b | 3.376 | 2.88a | 2.43ab | 1.86a |
| Wondo genet | 1.03cd | 1.528b | 0.582b | 0.524b | 2.576 | 1.626b | 1.698ab | 1.184ab |
| Halaba | 4.6a | 3.108a | 3.43a | 2.33a | 2.168 | 1.662ab | 1.28b | 0.866b |
| Durame zuria | 1.47bc | 0.75b | 0.752b | 0.446b | 3.374 | 2.25ab | 2.668a | 1.53ab |
| Gurage (Meskan) | .79d | 0.67b | 0.358b | 0.288b | 3.41 | 2.246ab | 2.346ab | 1.454ab |
| CV | 19.3 | 36.08 | 30.2 | 30.09 | 25.42 | 28.2 | 33.24 | 32.55 |
| MSD | 0.65 | 1.02 | 0.64 | 0.45 | NS | 1.24 | 1.333 | 0.85 |

*Means value with different letters are significantly different (p≤0.05).Whereas; SFR= stem fresh weight, RFW= root fresh weight, SDW= stem dry weight, RDW= root dry weight.*

**Correlation between growth performance and biomass of indigenous multipurpose tree with Altitude**

Correlation analysis between seedling traits of species and altitude variables indicated that each species had their own response. There was a negative correlation between seedling morphological characteristic and biomass with altitude for *Cordia africana*. Except Germination percent other morphological growth like Height, RCD (root collar diameter) and Number of branches per single seedling showed that negative significant correlation with altitude as shown below in figure. Above and below ground biomass of *Cordia Africana* also negatively non significant correlated with altitude. Morphological growth and biomass of *Acacia abysinica* seedlings were non significantly positively correlated with altitude. Even though the correlation was no significant, height, collar diameter and branch numbers of seedling were increase with increase altitude. Similarly, dry and fresh biomass of shoot and root of *Acacia abysinica* seedlings were increase with altitude rise.

***Faidherbia albida*** shows that there negative correlation between altitude and vegetative growth performance and biomass of seedlings. Height and collar diameters showed that negative significant correlation but germination and branch number had showed that negative non significant correlation with altitude. Fresh and dry weight of Shoot and root of *Faidherbia albida* seedlings affected by altitude but not significant that means negatively non significant correlation were recorded. Root and Shoot fresh weight in particular shows that negatively significant correlation with altitude (see fig.).

## Discussion

**Growth performance of seedlings**

There has been little systematic research on genetic variation in growth and survival of native hardwood species in world and Africa. According to Abayneh Derero*et. al.* (2017), the study done on 12 provenance of cordial in Ethiopia, Addis Abeba shows the germination percent of those provenance ranges from 16 % for Guraferda and Sekoru to 69 % for Hirna. Similarly, the research done in Holeta research center indicated that there was significant difference in mean germination percentage, mean germination rate and mean germination vigority among seed provenances at (p<0.05) (Tura *et. al.,* 2014). Similarlly Charity Fredrick (2015) identified the effect of provenance on germination percent with overall mean germination among provenances was 70.2% varying from 32.7% (Taveta) to 93.3% Hawasa Provenance in his studies. The work done on Mediterranean maritime Pines (Pinus pinaster Aiton) shows there is very low germination percent in the different provenance of the species (Natalia et. al., 2014). In the other hand, there are relatively few published reports of genetic variation in growth, survival and other commercially or adaptively important traits of native African hardwoods e.g., *Acacia nilotica* (Wolde-Mieskel and Sinclair, 2000); *Acacia Senegal* (Raddad and Luukkanen, 2006; Raddad, 2007); *Cordia africana Lam*. (Loha *et al*., 2006); *Faidherbia albida* (Dangasuk *et al.,* 1997; Roupsard *et al*., 1998). In contrast, the study done in Ethiopia, Addis abeba, shows that the germination percent of *Tamarindus indica L.* dose not affected by different agro ecology having 97% to 100%, which has no significance difference among different provenance (Tinsae*et. al.,* 2014).

Higher shoot length (seedling height) and RCD values important for better survival rate and higher growth performance with better adaptation capacity of the seedlings at field conditions. In turn, a large number of seedlings’ leaves might contribute to a higher rate of photosynthesis, which in turn resulted in a higher growth rate as also reported by (Shiferaw *et al*. 2010). Similar result was obtained from Kenya on Accacia albida (Charity *et al*,. 2015). Another study under taken at Birkina faso sought that the growth rate and germination speed of four native for the country were affected by provenance difference. Another study in Ethiopia done on *Cordia Africana* shows that from the total of 12 provenance in 290 day age 19.3cm and 5.7mm mean height and mean root collar diameters, and individually seedlings have a measure of 3.5 to 49.5 cm for height and from 1 to 12 mm for collar diameter (Abayneh*et. al.* 2017). The research conducted in great Britain on two pinus species, *P*. *tecunumanii and pinuspatula,* shows that provenance affect the height growth of these two species and also develop model that used to indicate climate dissimilarity of the site (Christoph L. *et. al.,* 2013). FAO initiated and the Danida forest seed centre analyzed several trials to identify some superior provenances from Africa particularly *Acacia Senegal, Acacia nilotica* and *A. tortilis* and on other hand *Prosopis africana* provenances tested for reforestation in Niger arid and semi-arid zones (Raebild *et al*. 2003a$b; Weber, J.C., 2008). The RCD of *Acacia abyssinica* and *Acacia seyal* were significantly affected by provenance. This work is agree with the study done at Noiweite shows that there high effect of provenance on RCD, that ranges from 0.79 cm to 1.3 cm for population 12 and 3 respectively(Charity *et al*,. 2015). Similarly the RCD of *Faidherbia albida* were affected by different provenance those were wet and dry. The result shows that provenance Geres had higher RCD than provenance Pesqueira and Aljezur (Ana Vasqus, 2013).

**Above and below biomass of seedlings**

Fresh and dry weight of shoot and root of the selected indigenous tree the present study highly affected by provenance. The research conducted on *Tamarindus indica* shows that the fresh and dry weights of shoot and root have highly affected by provenance (Tinsae *et al.,* 2014). According to the study *Faidherbia albida,* have no show any significance difference among the provenance on any of parameters. This result is agree with research conducted at Kenya by collecting sixteen provenances from different Africa country there is significance variation among them in their early growth but there is no significance difference with in provenance the same country, seed collected from Ethiopia and the same thing observed seed collected from South Africa (Dangasuk O. G., *et. al.,* 2001). Similarly, the study done in Nairobi Kenya the result shows the two (lake Hawassa and lake Koka) provenance collected from Ethiopia were no significance difference between them in their height, root collar diameter and leaf number per plant rather than they show significance difference with other African countries (Charity *et al*,. 2015). This result is similar with the study done at Burkina faso on *Khaya senegalensis* A. Juss using four provenances, this study declare that the four provenances by their leaf, stem (Bopiel=0.27g and Koyenga=0.26g) and in total biomass (Koyenga= 12.1g) (Ky-Dembele et al., 2014). According to Dao and Kabore (2015), the above ground and below ground biomass of *Moringa stenopetala* were highly affected by Provence, which is similar report with current study. Similar work in Tanzania shows that there were significance difference b/n provenances by their biomass of *Moringa oliefera* (Edward et al., 2014). Moreover, the research in Sierra Leone shows that the biomass of *Gmelina arborea, Roxb* have significant differences (p < 0.05). Seeds obtained from the East (4g) and South (3.87g) at 2 MAP (month after planting) significantly differed with those obtained from the west (2.37g). At 3 MAP seeds from the east also had the highest shoot dry weight (7.8g) significantly different from seeds sourced from the west. At 2 MAP and 3 MAP, seeds obtained from the North, South and East regions were significantly (p < 0.05) different in mean dry weight from seeds obtained from the Western area. Seeds obtained from the southern region had the highest mean dry weight (2.40g) followed by seeds from the East (2.33g) whilst seeds from the West had the lowest mean dry weight 1.4g (Yaema Fornah *et al., 2017)*. In addition to this the study done at Aride Chaco of Arjentina on two cultivar of Moringa Oleifera (Periyakalum-1 (PKM-1) which has been selected in India for start production during the first year, and their high yield, and an African accession from Tanzania of unknown selection pressure, but that were referred to as the African cultivar in that study) shows significantly difference in their Oil (gm)/tree and Kg/hac (amino acid), pod/tree, and seed/tree production. One individual, E4-9, a PKM-1 plant, had significantly (P < 0.05) higher production than all other plants. In addition, this individual was the highest extrapolated oil producer in both 2003 and 2004, with 595 and 564 kg ha−1, respectively (ave. 580 kg ha−1). Seed weight (200-seed wt.) was significantly greater in 2003 than 2004 (Richardo, 2010).

# 5. CONCLUSION AND RECOMMENDATION

## 5.1. Conclusion

From the present study, higher inter-population variability was observed in most species in the study area and some species have no any significance difference. Generally, based on this research result we concluded that the performance of seedling in nursery site highly affected by the source of seed except. Therefore, wondogenet, A/minch and Dembi provenance are can be used as seed source at Meskan site for ***Cordia africana Lam., Acacia abyssinica*** and ***Faidherbia albida*** respectively***.***

## 5.2. Recommendation

Based on their better performance wondogenet, A/minch and Dembi provenance at Meskan study site recommended for ***Cordia africana Lam., Acacia abyssinica*** and ***Faidherbia albida*** respectively. This work is equally important for other area with similar and different tree species by considering outfield planting in addition to nursery level.

**Conflict interest**: the stated that there is no any conflict interest

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