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# Collection, Characterization and Evaluation of Forage Grass Landraces in Kellem, West and East Wollega Zones of Oromia, Ethiopia

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## Abstract

A forage improvement program requires the collection, characterization, and evaluation of forage landraces in order to achieve sustainable livestock production. The study was conducted at Haro Sabu Agricultural Research Center with the objective of collection, characterization and evaluation of grass landraces for forage production improvement. Seed collection of grass landraces was done in midland and lowland agro-ecologies of the West, Kellem and East zones of Oromia region, Ethiopia. During collection about sixty-three (63) grass landrace seeds were collected. The collected grasses were sown in a single plot. Agronomic and morphological characterization and yield data were determined. The grasses were sampled and botanically identified using standard methods. The findings indicate 54 grass accessions emerged out of 63 landrace seeds sown. Various landraces showed different morphological and agronomic characteristics, dry matter yield, and seed yield. The results of the herbarium laboratory showed that *Panicum maximum* Jacq was the most dominant grass species, followed by *Pennisetum polystachion* (L.) Schult. As a result, the dominated grasses had a variety of species, allowing them to be used for breeding programs to improve forage.

**Keywords:** Collection; Characterization; Grass landraces; Forage yield; Species identification

## Introduction

Ethiopia is known to be the center of diversity for pasture and forage species [1] and origin for several cultivated grasses such as *Chloris* spp., *Panicum* spp., *Setaria* spp. etc. [2]. Large numbers of indigenous grass species and the very great variation within the species make the country a rich potential source of new and better tropical pasture grasses. Until now there are a total of 736 grass species from 181 genera that are documented in Ethiopia, of which 164 species from 68 genera are reported to be important for pasture and forage purpose [2]. Furthermore, Ethiopia is a center of diversity for herbaceous legumes. There are a total of 358 herbaceous forage legume species from 42 genera documented in Ethiopia, out of these about 58 species from 31 genera are potentially important for pasture and forage [2].

However, it appears that Ethiopia's cattle productivity cannot be supported by this vast genetic resource for fodder. Only a few species were suggested as being the greatest fit for the various agro ecologies in western Oromia. Nevertheless, examination of numerous grass and legume species from foreign sources has revealed limited promise for many production and productivity-related features. This illustrates unequivocally that native species of forages may be best studied in their natural habitat. This is due to the fact that they have endured the climatic, edaphic, and grazing pressure of their natural habitat for centuries. According to numerous sources, Ethiopia is blessed with a variety of agro-ecologies that also serve as habitat for various species of grasses and legumes. However, the majority of the research on pasture improvement done in Ethiopia neglected these native resources and failed to reap the same benefits by choosing suitable improved cultivars, especially for stressful environments, where the emphasis should be on most adaptable and productive species selection. Utilizing natural forage grasses and legumes by gathering, assessing, and selecting them is crucial for solitary cropping or pasture improvement programs. As a result, there is relatively little attention paid to identifying and utilizing local fodder landraces in the area. The availability of suitable, productive, and adequate forage landraces for the selection of promising lines typically determines the outcome of forage research, development, and improvement programs. The development of adapted and fruitful plants for livestock feed, which improves animal nutrition and productivity, depends heavily on forage landrace species. It is crucial to develop high-yielding fodder landrace species for both small and large-scale production and use, especially in agro-ecology. Western Oromia is rich in various forage landraces. Therefore, it is a paramount important to collect and maintain the forage accessions from the different forage belt of the areas. This will be used for further variety development program after characterization and evaluation identifying the promising ones from the collected landraces. The major objectives of the present study were i) to collect and maintain forage grass landraces from West, Kellem and East Wollega zone areas, ii) to characterize and evaluate the landraces for future breeding program to develop improved forage varieties with good quality.

## Materials and Methods

### Description of the Study Area

Forage land race seed collection was carried out in three selected




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districts of West Wollega zone (Gimbi, Mana Sibu and Kondala), four selected districts of Kellem Wollega zone (Dale Sadi, Lalo Kile, Anfilo and Jimma Horro) and Arjo Gudatu district from East Wollega zone of Oromia region from different agro ecologies and locations during 2015/16. Characterization and evaluation of the collected grass landraces were evaluated at On-station of Haro Sabu Agricultural Research Centre in 2016/17. The area receives average annual rain fall of 1000 mm and its distribution pattern is uni-modal.

### Forage Grass Landrace Collection

Collection was done from natural forest, protected areas, mountains, communal grazing areas, road sides. During collection the necessary passport data was recorded. In order to choose sites with varied altitudinal ranges, cropping and rainfall patterns, farming systems, and fair accessibility, purpose sampling techniques were used. Collection was done mostly at the intervals of 5 to 10 km distances. Additionally, during the collection process farmers with indigenous knowledge were questioned about the collected fodder landraces. Presumably toward the end of November or early December, it was appropriate for seed collection, when the majority of pasture landraces were matured. The collected landraces were maintained at Haro Sabu Agricultural Research Center, and characterization and evaluation of the landraces were made at On-station of Haro Sabu Agricultural Research Center.

### Forage Grass Establishment and Experimental design

Collected grass landraces were sown at on station of Haro sabu Agricultural Research Center under rain fed condition. The experiment consists of 63 landraces and it was laid out in a single plot. A plot consisting of two rows each 2 m long with spacing of 0.30 m between rows. Each landrace was sown at rate of 10 – 15 kg/ha for grasses and had fertilizer rate of 100 kg/ha DAP at planting and 50 kg/ha of urea was applied at knee height in the row. Each plot was kept free from weeds with frequent hand weeding.

### Data Collected

Detailed observations regarding agronomic characteristics like days of emergence, plant growth habit, lodging, drought resistance, days to flowering, days to maturity, branch arrangement, inflorescence color, seed size, leaflet color, seed size, drought resistance, disease and pest resistance were collected. At physiological maturity, five random plants within a plot were manually uprooted or tagged to determine plant height, number of nodes, inter node length, stem thickness, leaflet length, leaflet width. Seed yield and forage yield were determined after harvesting the entire net plot area of 0.3 and 0.9 $m^2$, respectively.

### Herbarium Samples for Species Identification

For species classifications of the collected landraces, sample from each plant species were collected, packed and preserved. Then after, the taken samples were gone to the national herbarium of Addis Ababa University for botanical name identification.

### Data Analysis

Data obtained during characterization and evaluation was analyzed by descriptive statistics.

## Results and Discussion

### Collected Grass Landraces

During 2015/16, various grass landrace species were collected from different areas of Western Oromia. The maximum number of landrace accession was collected from West Wollega zone (31 accessions) followed by Kellem Wollega zone (29 accessions), whereas the least was from East Wollega zone (3 accessions). The zones-wise forage grass landrace collection is presented in Table 1.

**Table 1:** Passport sheet of collected grass landraces.

| Source/area of grasses collected | Accessions | Local name (Afan oromo) | Altitude (a.s.l m) | Longevity |
|---|---|---|---|---|
| | NG-0045 | - | 1672 | Perennial |
| | NG-0046 | Bokona | 1672 | Perennial |
| | NG-0049 | Choommoo | 1672 | Perennial |
| | NG-0050 | Ashuffee | 1647 | Annual |
| | NG-0051 | Sudan | 1619 | Perennial |
| | NG-0053 | Jajjaba | 1631 | Perennial |
| | NG-0054 | Sudan | 1631 | Perennial |
| | NG-0056 | Ashuffee | 1663 | Annual |
| West Wollega | NG-0057 | Bokonaa | 1671 | Perennial |
| | NG-0058 | Bokonaa | 1622 | Perennial |
| | NG-0059 | Choommoo | 1622 | Perennial |
| | NG-0062 | Jajjaba | 1786 | Perennial |
| | NG-0063 | Citaa | 1788 | Perennial |
| | NG-0064 | Muujjaa | 1786 | Perennial |
| | NG-0065 | Ashuffee(fura) | 1536 | Annual |
| | NG-0066 | - | 1530 | Perennial |
| | NG-0067 | Citaa | 1544 | Perennial |
| | NG-0068 | Coqorsa | 1551 | Perennial |
| | NG-0071 | Sarbaammuxa | 1326 | Perennial |
| | NG-0088 | - | 1490 | Perennial |
| | NG-0107 | - | 1186 | Perennial |
| | NG-0108 | Jajjabaa | 1186 | Perennial |
| | NG-0109 | Jajjabaa | 1196 | Perennial |
| | NG-0110 | Jajjabaa | 1328 | Perennial |
| | NG-0111 | - | 1332 | Perennial |
| | NG-0112 | - | 1464 | Perennial |
| | NG-0113 | - | 1464 | Perennial |
| | NG-0114 | - | 1464 | Perennial |
| | NG-0116 | - | 1640 | Perennial |
| | NG-0117 | - | 1640 | Perennial |
| | NG-0118 | - | 1673 | Perennial |
| | NG-0073 | - | 1327 | Perennial |
| | NG-0074 | Marga Gogorrii | 1327 | Perennial |
| | NG-0075 | Marga | 1336 | Perennial |
| | NG-0076 | Mujjee | 1336 | Perennial |
| | NG-0077 | - | 1468 | Perennial |
| | NG-0078 | - | 1487 | Perennial |
| | NG-0079 | - | 1524 | Perennial |
| | NG-0080 | Marga | 1501 | Perennial |
| | NG-0081 | Muujjaa Arbaa | 1513 | Perennial |
| Kellem Wollega | NG-0083 | Muujjaa Arbaa | 1497 | Perennial |
| | NG-0085 | - | 1503 | Perennial |
| | NG-0090 | Qaamboo | 1509 | Perennial |
| | NG-0091 | - | 1500 | Perennial |
| | NG-0092 | Marga | 1500 | Perennial |
| | NG-0093 | Qaamboo | 1505 | Perennial |
| | NG-0094 | Muujjaa | 1505 | Annual |
| | NG-0095 | Marga | 1505 | Annual |
| | NG-0097 | - | 1465 | Perennial |
| | NG-0098 | Muujjaa | 1497 | Annual |
| | NG-0099 | - | 1452 | Perennial |
| | NG-0101 | Marga gogorrii | 1450 | Annual |
| | NG-0102 | Marga | 1450 | Perennial |
| | NG-0121 | Qamaxee | 1424 | perennial |
| | NG-0122 | - | 1424 | Perennial |
| | NG-0123 | - | 1418 | Perennial |
| | NG-0124 | Jajjaba | 1537 | Perennial |
| | NG-0126 | - | 1592 | Perennial |
| | NG-0127 | Addooyyee | 1820 | Perennial |
| | NG-0128 | Jajjaba | 1694 | Perennial |
| | NG-0103 | - | 1259 | Perennial |
| East Wollega | NG-0104 | Jajjabaa | 1259 | Perennial |
| | NG-0105 | - | 1288 | Perennial |

**Figure 1:** Grass landrace seed emergence.

According to local farmers' testimony and firsthand experience with the forages, the collected landraces are native, natural forages that animals most likely eat and love. The genetic forage materials were gathered from protected locations including mountains, natural forests, and protected areas like schools, churches, and enclosure areas. Forage grasses were assigned an accession number during the collection period, and local names, elevations, and life span (longevity) of the forages were noted. Perennial forages predominated among the grass landraces that were collected as opposed to annual plants. The forage collection sites were spread over lowland and midland agro ecologies.

## Characterization and Evaluation of Grass Landraces

Characterization of genetic resources refers to the process by which accessions are identified, distinguished according to their character or quality traits [3]. Characterization of each sample involves a careful description of the special characteristics that are inherited, easy to score and expressed consistently in all environments [4].

## Grass Seed Emergence

The collected grass landrace seeds were planted at On-station of the Haro sabu Agricultural Research Center, during the 2016/17 main cropping season, during a rainy season (at the end of June). Sixty-three grass landrace accessions were sown and as of the seeded landraces, 54 accessions (85.71%) had emerged, while 9 accessions (14.29%) had not. These un-emerged seeds may have been caused by an issue with seed dormancy in the individual forages.

## Phenology of Grass Landraces

Variation was found in days to emergence, days to 50% flowering and days to maturity of grass landraces (Figure 2). Collected native grasses were emerged within a range of 8-14 days. Accession number NG-0063 and NG-0067 were the earlier emerged native grasses while NG-0121 accession was late emerged grass. The variations of days of emergence observed among the accessions are because of species differences of the collected grasses. The earlier days to 50% flowering was obtained from NG-0090 (115 days) while late flowering was obtained from NG-0126 and NG-0123 accessions (187 days). Similarly, NG-0126 (210 days) followed by NG-0123 (208 days) were had longer days to mature whereas the earliest maturity (150 days) of grass obtained from accession of NG-0072.

## Qualitative Characters

Characterization in the basis of qualitative traits provides

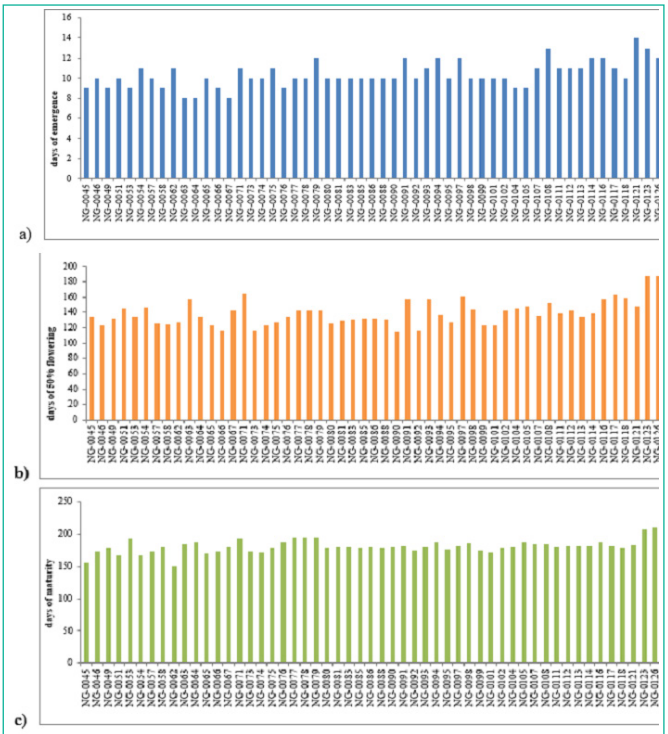
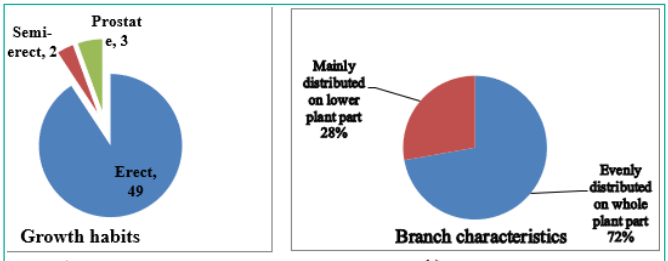



**Figure 2:** phonological traits of grass landraces a) days of emergence, b) days of 50% flowering, c) days of maturity.

information on diversity within and between genotypes. Since most of the traits recorded during characterization are those that can be seen, the person responsible for managing the germpalsm material is best placed to carry out the work of documenting these characteristics [5]. Germplasm characterization was centered on qualitative traits. Forage grass landraces characterized in this study showed a broad variation for most of the qualitative traits. From the present study, three phenotypic classes of growth habits (erect, semi-erect and prostrate), two phenotypic classes for leaf shape (linear and lanceolate), two phenotypic classes for branch arrangements (evenly distributed throughout whole part and mainly distributed on lower part of the plant) and small seed sizes were observed. These traits also allow for the identification of promising landraces of grass and the variations were easily recognizable with visual appraisal in the material.

Grass landraces displayed great diversity in their growth habits because of differences in their species, locations, agro ecologies and climate factors. The growth habit of the forage grass accessions were categorized as erect, semi erect and prostate habits based on their descriptors. Of the collected landraces, the landraces NG-0045, NG-0071 and NG-0093 had prostrate growth habit. The landraces NG-0049 and NG-0080 had semi-erect growth habit. While, all the rest landraces had erect growth habit. Most of the accessions (91%) had erected while few of them had prostate (5%) and semi erect (4%) growth habit characteristics (Figure 3).

Most of landrace grasses were branched evenly distributed throughout whole part of the plant (72.2 %) and others are mainly distributed on lower part of the plant (27.8 %). The majority of characterized landraces were small sized and leaves were linear and lanceolate in shape. The apparent variation in qualitative traits could probably be due to the fact that the genotypes used in this study were




a) b)

**Figure 3**: Growth habits and branch characteristics of grass landraces.

**Table 2:** Morphological characteristics of collected grass landraces.

| Accession | PH (cm) | NPP | IL (cm) | ST ($cm^2$) | NPB | LPB (cm) | NSB | LL (cm) | LW (cm) |
|---|---|---|---|---|---|---|---|---|---|
| NG-0045 | 97.1 | 7 | 10.51 | 3.15 | 11 | 94.1 | 3 | 31.4 | 1.3 |
| NG-0046 | 149 | 7 | 16.5 | 3.84 | 53 | 14.2 | 4 | 29 | 1.2 |
| NG-0049 | 82.6 | 8 | 7.9 | 2.02 | 34 | 96 | 0 | 23.2 | 0.95 |
| NG-0051 | 304.1 | 11 | 19.7 | 6.08 | 27 | 283.2 | 6 | 81.1 | 2.09 |
| NG-0053 | 137.5 | 8 | 16.9 | 3.63 | 81 | 122 | 4 | 53 | 0.84 |
| NG-0054 | 297.3 | 14 | 15.1 | 6.34 | 20 | 259.8 | 9 | 82.4 | 2.4 |
| NG-0057 | 164 | 7 | 21.3 | 3.73 | 37 | 159.2 | 5 | 49.4 | 2.4 |
| NG-0058 | 156.8 | 8 | 15.2 | 4.76 | 23 | 135.6 | 6 | 53.2 | 1.42 |
| NG-0062 | 173.2 | 5 | 28.6 | 4.79 | 151 | 159.2 | 2 | 59.6 | 2.8 |
| NG-0063 | 194 | 6 | 14.9 | 3.11 | 77 | 97.2 | 2 | 66.4 | 0.8 |
| NG-0064 | 205.2 | 11 | 24.4 | 4.51 | 38 | 46 | 7 | 35 | 2.1 |
| NG-0065 | 125.6 | 8 | 10.5 | 2.42 | 151 | 95 | 2 | 14.3 | 1 |
| NG-0066 | 174.6 | 7 | 25.6 | 3.47 | 58 | 149.8 | 3 | 34.2 | 0.7 |
| NG-0067 | 212.2 | 12 | 20.8 | 3.56 | 43 | 87.4 | 7 | 71 | 1 |
| NG-0071 | 56.4 | 4 | 6.2 | 5.59 | 12 | 51.3 | 1 | 34.1 | 1.62 |
| NG-0073 | 168.6 | 5 | 29.2 | 3.34 | 35 | 146.2 | 4 | 29 | 1 |
| NG-0074 | 145.4 | 8 | 8.4 | 2.42 | 19 | 129 | 5 | 15.4 | 0.9 |
| NG-0075 | 194.8 | 6 | 18.7 | 4.42 | 29 | 189 | 1 | 56.2 | 2.3 |
| NG-0076 | 239.8 | 11 | 28.2 | 4.63 | 23 | 208.6 | 8 | 22.1 | 1.3 |
| NG-0077 | 205.4 | 10 | 19.8 | 4.49 | 31 | 188.4 | 2 | 73.4 | 2.5 |
| NG-0078 | 207.5 | 7 | 19.9 | 4.71 | 49 | 151.4 | 6 | 62.8 | 2.5 |
| NG-0079 | 208.2 | 7 | 8 | 3.11 | 41 | 64 | 2 | 39.5 | 3 |
| NG-0080 | 196 | 5 | 25.6 | 4.24 | 39 | 187.6 | 2 | 64 | 2.6 |
| NG-0081 | 195 | 6 | 22 | 3.92 | 37 | 191 | 2 | 89 | 2.3 |
| NG-0083 | 221 | 6 | 22.9 | 4.42 | 44 | 208 | 4 | 73.3 | 2.6 |
| NG-0085 | 192 | 4 | 27.5 | 4.09 | 44 | 217.2 | 1 | 66 | 2.6 |
| NG-0086 | 191.8 | 6 | 21.8 | 4.36 | 39 | 299 | 2 | 88.2 | 3 |
| NG-0088 | 186 | 5 | 22 | 4.24 | 39 | 186.4 | 2 | 88.8 | 2.9 |
| NG-0090 | 163.4 | 6 | 19.3 | 2.8 | 24 | 130.6 | 4 | 28 | 1.1 |
| NG-0091 | 178.2 | 12 | 14 | 6.22 | 38 | 200.4 | 6 | 67.2 | 1.5 |
| NG-0092 | 183 | 7 | 22.4 | 3.47 | 56 | 152.6 | 5 | 41 | 0.95 |
| NG-0093 | 49.6 | 3 | 4.1 | 4.56 | 9 | 87 | 1 | 38.7 | 1.7 |
| NG-0094 | 196.6 | 11 | 26 | 4.79 | 66 | 177 | 8 | 42 | 1.9 |
| NG-0095 | 166.2 | 4 | 23.1 | 3.33 | 76 | 160 | 2 | 48.4 | 2.3 |
| NG-0097 | 53.3 | 2 | 5.2 | 4.89 | 8 | 89 | 1 | 37.4 | 1.6 |
| NG-0098 | 194.4 | 14 | 12 | 2.66 | 53 | 130.2 | 9 | 33 | 1.2 |
| NG-0099 | 180.2 | 5 | 21.6 | 3.59 | 73 | 182 | 2 | 69.4 | 2.8 |
| NG-0101 | 141.2 | 8 | 14.3 | 2.33 | 31 | 114.4 | 3 | 18 | 0.9 |
| NG-0102 | 212.8 | 5 | 26.5 | 4.02 | 58 | 182.4 | 1 | 41.8 | 2.2 |
| NG-0104 | 227.4 | 8 | 24.4 | 4.19 | 64 | 219.6 | 1 | 81.9 | 2 |
| NG-0105 | 227.6 | 9 | 26.7 | 4.8 | 16 | 183.2 | 2 | 69.4 | 2.9 |
| NG-0107 | 181 | 8 | 19.7 | 4.98 | 27 | 172.6 | 1 | 102 | 2.8 |
| NG-0108 | 136.3 | 7 | 17.2 | 3.2 | 61 | 105 | 5 | 32 | 1.1 |
| NG-0111 | 181.4 | 6 | 18.2 | 3.45 | 30 | 165.2 | 0 | 80.2 | 3 |
| NG-0112 | 167.8 | 7 | 21.8 | 2.72 | 15 | 152.6 | 4 | 28.4 | 1 |
| NG-0113 | 218 | 7 | 17.8 | 4.1 | 24 | 189 | 2 | 86.2 | 3 |
| NG-0114 | 187 | 6 | 23.4 | 3.91 | 120 | 160 | 2 | 53 | 2.4 |
| NG-0116 | 138 | 4 | 17.1 | 4.09 | 49 | 155.6 | 1 | 47.8 | 2.4 |
| NG-0117 | 171 | 8 | 22.5 | 3.4 | 90 | 163.6 | 3 | 45.4 | 1.4 |
| NG-0118 | 190.2 | 8 | 23.4 | 5.13 | 29 | 184 | 2 | 64 | 2.2 |
| NG-0121 | 165.4 | 6 | 21.8 | 3.28 | 43 | 145 | 4 | 29.2 | 1 |
| NG-0123 | 36.2 | 1 | 4 | 4.79 | 33 | 30.2 | 1 | 33 | 2.4 |
| NG-0126 | 30 | 4 | 4.4 | 4.26 | 81 | 15 | | 32 | 2.8 |
| NG-0127 | 114.4 | 4 | 6.6 | 2.16 | 106 | 75 | 1 | 30.1 | 0.3 |

*PH: Plant Height, NPP: Number of nodes Per Plant, IL: Inter node Length, ST: Stem Thickness ($cm^2$), NPB: Number Primary Branches, LPB: Length of Primary Branches, NSB: Number of Secondary Branches, LL: Leaflet Length (cm), LW: Leaflet Width (cm).*

the indigenous landraces and hence distinctly variable with respect to qualitative traits.

## Quantitative Characters

Results indicated that there is variation among the tested grass landraces on all measured agronomic and morphological traits, and this indicates the presence of genetic/species variability among the tested landraces. Plant height varied from 304.1 cm to 30 cm for the landrace NG-0051 and NG-0126, respectively. Plant height is a good indicator of forage herbage yield.

Number of nodes per plant, length between inter node and stem thickness were measured and they were varied among the grasses. Node has direct relationship with plant height, and node number of the tested grass landraces was ranged 4-14 cm recorded from NG-0123 and NG-0054, respectively. Maximum length between nodes at heading stage was recorded from the landrace of NG-0073 (29.2 cm) followed by NG-0062 (28.6 cm) and NG-0076 (28.2 cm), whereas minimum inter-node length was obtained from NG-0123 (4 cm). Stem thickness of the tested landraces are ranged 2.02 cm obtained from NG-0049 to 6.34 cm obtained from NG-0054 accession (Table 2). The variation of stem characteristics among the collected landraces is due to the species differences of the grasses.

Number of primary branches per plant, number of Secondary branches per plant and length of the primary branches were measured and different among the grass landraces (Table 2). Higher number of primary branches was obtained from accession NG-0114 (120) followed by NG-0127 and NG-00117 (106), whereas lower number of primary branches was obtained from NG-0097 (8) and NG-0093 (9), respectively. Higher number of secondary branches was nine (9) recorded from both NG-0054 and NG-0098. This showed that grasses had more primary branches than secondary branches. The maximum length of primary branches of the collected grass landraces measured from NG-0051 (283.2 cm) followed by NG-0054 (259.8 cm) whereas lower length was measured from NG-0126 (15 cm). The difference of branch characteristics of landraces is due to the species discrepancies of the grasses.

**Figure 4:** Pictorial of grass landraces during characterization and evaluation.

**Table 3:** Dry matter and seed yield of grass landraces.

| Accession | DMY (kg/0.3m²) | SY (kg/plot) | Accession | DMY (kg/0.3m²) | SY (kg/plot) |
|---|---|---|---|---|---|
| NG-0045 | 0.38 | 35.6 | NG-0088 | 0.82 | 69.5 |
| NG-0046 | 0.58 | 113.4 | NG-0090 | 0.63 | 110.3 |
| NG-0049 | 0.5 | 129.2 | NG-0091 | 0.62 | 112.8 |
| NG-0051 | 2.63 | 180.8 | NG-0092 | 1.62 | 98.6 |
| NG-0053 | 0.6 | 65.7 | NG-0093 | 0.57 | 33.4 |
| NG-0054 | 1.32 | 178.1 | NG-0094 | 0.65 | 19.5 |
| NG-0057 | 1.13 | 119.9 | NG-0095 | 1.35 | 75.5 |
| NG-0058 | 1.49 | 121.7 | NG-0097 | 0.51 | 31.2 |
| NG-0062 | 0.8 | 78.7 | NG-0098 | 0.71 | 17 |
| NG-0063 | 0.65 | 53.5 | NG-0099 | 1.04 | 121.8 |
| NG-0064 | 0.6 | 57.6 | NG-0101 | 1.18 | 63.8 |
| NG-0065 | 0.65 | 62.3 | NG-0102 | 1.53 | 86.7 |
| NG-0066 | 1.34 | 106.2 | NG-0104 | 1.74 | 162.4 |
| NG-0067 | 1.72 | 51.7 | NG-0105 | 2.3 | 25.9 |
| NG-0071 | 0.4 | 49.9 | NG-0107 | 1.86 | 63 |
| NG-0073 | 2.06 | 66.2 | NG-0108 | 0.64 | 114.4 |
| NG-0074 | 0.91 | 31.2 | NG-0111 | 1.44 | 50.2 |
| NG-0075 | 1.53 | 177.2 | NG-0112 | 0.8 | 79.5 |
| NG-0076 | 0.68 | 30.7 | NG-0113 | 1.61 | 85.3 |
| NG-0077 | 1.25 | 56.9 | NG-0114 | 1.31 | 34.2 |
| NG-0078 | 1.16 | 62.4 | NG-0116 | 1.21 | 46.4 |
| NG-0079 | 0.51 | 74.4 | NG-0117 | 1.07 | 52.3 |
| NG-0080 | 0.61 | 73.2 | NG-0118 | 1.71 | 130.9 |
| NG-0081 | 0.66 | 156.2 | NG-0121 | 1.35 | 56.1 |
| NG-0083 | 1.14 | 92.5 | NG-0123 | 0.35 | 42.2 |
| NG-0085 | 0.59 | 48.2 | NG-0126 | 0.18 | 32.7 |
| NG-0086 | 0.81 | 76.1 | NG-0127 | 0.25 | 30.5 |

DMY: Dry Matter Yield (kg/0.3 m²), SY: Seed Yield gm/plot (1.2 m²)

Leaf is part of plant mostly used for forages. Leaf length and width of the recorded and measured grasses were different among the collected landraces. Higher average leaflet length was recorded from NG-0081 (89 cm) followed by NG-0088 (88.8 cm) & NG-0086 (88.2 cm) respectively, whereas the lower was recorded from NG-0074 (15.4 cm). Wider leaflet was measured from NG-0079 (3 cm) than other native grass landraces followed by NG-0088 (2.9 cm), whereas NG-0127 (0.3 cm) had narrower leaflet. Leaf characteristics are varied among the grass landraces are due to genetic/species variability of the grasses.

### Dry Matter and Seed Yield

Forages of the collected grass landraces were harvested at 50% heading stages from 0.3 m² area. Data regarding mean Dry matter yield was different between the grasses gathered and presented (Table 3). Amongst forage landrace species, NG-0051 was produced maximum dry matter yield (DMY) of 2.63 kg/0.3 m² followed by NG-0105 (2.3 kg/0.3 m²) and NG-0073 (2.06 kg/0.3 m²) respectively, while minimum dry matter yield of 0.18 kg was recorded from NG-0126. Seed yield was collected after well matured/ripened and the mean seed yield was different among the plant species. Among the grass landraces, higher seed yielder was recorded from NG-0051 with 180.8 gm/ plot followed by NG-0054 with 178.1 and NG-0075 with 177.2 gm/ plot while the yield of NG-0098 was lower than the rest grass landraces tested with 17 gm/ plot. Yield differences were observed between the collected grass landraces because of species and lifespan variations.

### Herbarium Identified Grass Landraces

The samples were taken from each grass landraces for botanical name identification at 50% heading stage. Fifty-four (54) took samples were goes to national herbarium laboratory, Addis Ababa University. From the samples taken for herbarium, forty-three (43) samples of botanical name of grasses were identified under poaceae family name whereas the rest samples were incapable to identify. In addition, the laboratory result showed that *Panicum maximum* jacq. Grass species were more dominated followed by *Pennisetum polystachion* (L.) Schult (Table 4). Similar to the present result, Geleti et al. (2012) stated that three perennial grass species; *Hyparrhenia rufa, Pennisetum polystachion* and *Brachiaria humidicola* were observed to be dominant grass species in the western Oromia, Ethiopia.

**Table 4:** Botanical and family name of grass landrace species.

| Accession | Vernacular name (Afan Oromo) | Botanical Name (English) | Family Name |
|---|---|---|---|
| NG-0046 | Bokona | *Pennisetum polystachion* (L.) Schult | Poaceae |
| NG-0049 | Chomo | Brachiaria sp. | Poaceae |
| NG-0051 | Sudan | Pennisetum sp. | Poaceae |
| NG-0054 | Sudan | Pennisetum sp. | Poaceae |
| NG-0057 | Bokona | *Pennisetum polystachion* (L.) Schult | Poaceae |
| NG-0058 | Bokona | *Pennisetum polystachion* (L.) Schult | Poaceae |
| NG-0063 | Chita | *Exotheca abyssinica* (Hochst. Ex A. Rich) Anderss | Poaceae |
| NG-0065 | Ashufe | *Melinis repens* (Willd.) Zizka | Poaceae |
| NG-0066 | Bokona | *Pennisetum polystachion* (L.) Schult | Poaceae |
| NG-0067 | Chita | *Exotheca abyssinica* (Hochst. Ex A. Rich) Anderss | Poaceae |
| NG-0073 | - | *Pennisetum polystachion* (L.) Schult | Poaceae |
| NG-0074 | Marga gogori | *Melinis repens* (Willd.) Zizka | Poaceae |
| NG-0075 | Marga | *Panicum maximum* Jacq. | Poaceae |
| NG-0076 | Muja | Pennisetum sp. | Poaceae |
| NG-0077 | Marga | *Exotheca abyssinica* (Hochst. Ex A. Rich) Anderss | Poaceae |
| NG-0079 | Marga | Panicum sp. | Poaceae |
| NG-0080 | Marga | *Panicum maximum* Jacq. | Poaceae |
| NG-0081 | Muja arba | *Panicum maximum* Jacq. | Poaceae |
| NG-0083 | Muja | *Panicum maximum* Jacq. | Poaceae |
| NG-0085 | - | *Panicum maximum* Jacq. | Poaceae |
| NG-0086 | - | *Panicum maximum* Jacq. | Poaceae |
| NG-0088 | - | *Panicum maximum* Jacq. | Poaceae |
| NG-0090 | Kambo | *Pennisetum polystachion* (L.) Schult | Poaceae |
| NG-0091 | Jajaba | *Pennisetum polystachion* (L.) Schult | Poaceae |
| NG-0092 | Bokona | *Pennisetum polystachion* (L.) Schult | Poaceae |
| NG-0094 | Muja | Pennisetum sp. | Poaceae |
| NG-0095 | - | *Panicum maximum* Jacq. | Poaceae |
| NG-0098 | Muja | Pennisetum sp. | Poaceae |
| NG-0099 | - | *Panicum maximum* Jacq. | Poaceae |
| NG-0101 | Ashufe | *Melinis repens* (Willd.) Zizka | Poaceae |
| NG-0102 | - | *Panicum maximum* Jacq. | Poaceae |
| NG-0104 | - | *Panicum maximum* Jacq. | Poaceae |
| NG-0105 | - | *Panicum maximum* Jacq. | Poaceae |
| NG-0107 | - | *Panicum maximum* Jacq. | Poaceae |
| NG-0108 | Jajaba | *Pennisetum polystachion* (L.) Schult | Poaceae |
| NG-0111 | - | *Panicum maximum* Jacq. | Poaceae |
| NG-0112 | - | *Pennisetum polystachion* (L.) Schult | Poaceae |
| NG-0113 | - | *Panicum maximum* Jacq. | Poaceae |
| NG-0114 | - | *Panicum maximum* Jacq. | Poaceae |
| NG-0117 | - | *Pennisetum polystachion* (L.) Schult | Poaceae |
| NG-0118 | - | *Panicum maximum* Jacq. | Poaceae |
| NG-0121 | Kamate | *Pennisetum polystachion* (L.) Schult | Poaceae |
| NG-0127 | Adoye | *Pennisetum polystachion* (L.) Schult | Poaceae |

**Source**: National Herbarium, Addis Ababa University, 2017

## Conclusion

Different forage grass landraces were collected from different locations of Western Oromia. Morphological characterization and evaluation the landraces were tested under Haro Sabu Agricultural

Research Center of midland climates condition. Phenological, morphological and yields of the forage grass landraces were varied among each other and had their own unique characteristics. Based on herbarium laboratory result, among the identified forage landrace species of the study area, *Panicum maximum* Jacq grass was dominant forage grass species followed by *Pennisetum polystachion (L.)* Schult, and they has greater performances and feed resources for animals. Therefore, further forage breeding research on the dominant forage species of the study area is needed to evaluate the economic significance of species.

## Author Statements

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## References

1. Mengistu A. Country Pasture/Forage Resource Profiles. Ethiopia View Article PubMed/NCBI Google Scholar. 2006.
2. IBCR. Stock Taking for Biodiversity Conservation Natural Strategy and Action Plan Project, Working Paper, Addis Ababa, Ethiopia. 2001.
3. Merriam-Webster, Inc. The Merriam-Webster new book of word histories. Merriam-Webster. 1991.
4. Day-Rubenstein KA, Heisey PW. Plant genetic resources: New rules for international exchange. Amber Waves: The Economics of Food, Farming, Natural Resources, and Rural America. 2003.
5. De Vicente MC, Guzman FA, Engels J, Rao VR. Genetic characterization and its use in decision-making for the conservation of crop. The role of biotechnology in exploring and protecting agricultural genetic resources. 2006: 129-138.
6. Geleti D, Mekonen Hailemariam AM, Tolera A. Herbage yield, species diversity and quality of native grazing land vegetation under sub humid climatic conditions of Western Ethiopia. Journal of Agricultural Research and Development. 2012; 2: 96-100.