Repeated cuttings under farmer management effect on growth and yield performance of *Pennisetum glaucifolium* varieties in major agro-ecological zones of Ethiopia

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ABSTRACT

Feed supply, in terms of energy and protein, has been not sufficient to feed the Ethiopian livestock population. On farm trials of repeated cuttings assessing growth and dry matter yield of Desho (*Pennisetum glaucifolium*) varieties was undertaken in trials run in different agro-ecologies of Southwestern Ethiopia during 2019 and 2020. Field trials of three varieties (Areka-DZF#590, Kulumsa-DZF#592, and Kindokoisha-DZF #589) established at six planting sites with an altitude variation of 832−1797 m above sea level were laid out in a randomized complete block design with three replications. Four cuttings were taken, in June, August, October and December 2020, after an establishment period of 16 months. Plant height, leaf morphology (leaf length, leaf width, leaf number per plant), and tiller number per plant, leaf to stem ratio, dry matter yield and farmers perception were measured to identify the best adapted and yielding Desho variety. There was significant variation (P < 0.01) in dry matter yield and plant height recorded due to variety, harvesting frequency, agro-ecological zone and management variation, and their interaction in the trial. Leaf morphology varied across agro-ecological zones and farms in the trial. The variety Kulumsa-DZF#592 performed the best across both agro-ecological zones and farms. The highest dry matter yield recorded at the interaction between variety, harvesting frequency, agro-ecological zone and trial farm, was 39.70 t/ha, with a mean value of 22.56 t/ha. Scaling up of the varieties in the experimental area and similar agro-ecologies is recommended for the forages contribution to filling the energy feed gap in farming system of Southwestern Ethiopia. Assessing the productivity of the varieties under irrigation after each cut and under intensive management could be warranted for the future.

1. Introduction

Ethiopian livestock populations have been reported as 70.3 million cattle, 52.5 million goats, 42.9 million sheep and 8.1 million camels (MOA, 2021). Natural pasture based feed supply, inadequate and generally of poor quality in Ethiopia, especially in the dry season, has been predominantly responsible for the low productivity of livestock in crop livestock farming systems (Hidosa and Getaneh, 2021). Improved feed production is required to support climate resilient agriculture, reduce greenhouse gas emission and increase livestock productivity in these agricultural systems (Jirata et al., 2016). The major feed requirements in dairy production, to support the production of 250 days of milk and a calf every year, are energy and protein rich feeds (Mhier et al., 2002).

Desho grass (*Pennisetum glaucifolium*) is a forage crop which is palatable to cattle and sheep and is used widely in Southern Ethiopia for animal feed, soil conservation and small business development (Shiferaw et al., 2011) due to its high biomass yield compared with other grasses, except for Napier grass. However, a negative correlation between Desho grass production experience and its utilization as an animal feed has been reported (Asmare et al., 2016). This was validated by community level participatory planning (CLPP) at agricultural growth program (AGP-II) working sites in Gofa zone (Melkoza and Basketo special districts) of Southern Nations Nationalities and People Regional State (SNPPRS). Hence, this study aimed to identify and select optimum yielding Desho varieties in major agro-ecologies under farmer management condition and repeated cuttings with no supplemental irrigation.

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2. Materials and methods

2.1. Description of study sites

The field experiment was conducted across the major agro ecological zones of Basketo special and Melokoza districts (Figure 1). Trials were planted at Zaba kebele farmers’ training center (BFTC - N 60°16’58.8” E 36°03’54.6”), on four farms (Simeneh Agizew - N 6°16’39.6” E 36°03’69.7”; Bisrat Legese – N 6°16’57” E 36°03’51”; Badeg Masresha – N 6°16’40.9” E 36°03’25.9”; Lakech Endilalaw – N 6°16’41.7” E 36°03’31.3”) with altitudes of 1777–1797 m above sea level (masl) in Basketo special district, and Salayish Village 1 (ZFTC - N 6°23’56” E 36°26’54.2”) with an altitude of 832 masl in Melokoza district.

Weather data including 40 years mean monthly rainfall and maximum and minimum temperatures in the lowland (A) and midland (B) condition are presented in Figure 2. The lowland (altitude 832 masl) trial sites are characterized by lower precipitation with higher maximum temperature than midland (altitude 1797 masl) sites (Table 1). Rainfall was in a bimodal pattern with the lowest precipitation and highest minimum and maximum temperatures in January, February, March, June, July, August and September and December, while the highest precipitation with lowest minimum and maximum temperatures were in April, May, October and November with peak rainfall in April and May. No supplemental irrigation during the low moisture months of the trials.

2.2. Treatment layout and experimental design

The experiment involved three varieties of Desho, namely: Areka-DZF#590, Kulumsa-DZF#592, and Kindokoisha-DZF #589 planted during 2019–2020 at six planting sites (four farmers with similar management and two farmer training centers, in the midlands and lowlands). Plots were laid out in randomized complete block design with four replications. The plots were planted in December 2019 and took five months to be fully established as there were three dry months (January, February and March) between the planting and harvesting period. All the treatments were randomly allocated to different plots in each replication. Splits of planting materials were planted with a spacing of 75 cm (cm) (between rows)*50 cm (between plants) in four rows of 3 m *2 m = 6 m² plot. The spacing between plots and blocks were 1 and 1.5 m respectively. Blended nitrogen, phosphorus and sulfur (NPS) fertilizer (100 kg/
2.3. Cost: benefit analysis

A partial budget analysis was performed to evaluate the economic advantage of Desho grass production by using a standard procedure previously reported (Upton, 1979). Desho grass productivity (grand mean 20.68 t/ha) obtained in the present experiment was compared with management intensive rotational grazing (MIRG) of pastureland productivity (1.96 t/ha) among dairy farmers (Paine et al., 1999) to assess the differences in cost: benefit ratio under partial budget analysis.

2.5. Statistical analysis

For all statistical analysis R programming software (R core team, 2021) version Rx64 4.0.4 was used. Means of significant variation were separated using least significance difference (LSD) at a 95% probability level.

3. Results and discussion

3.1. Combined analysis of variances

The mean square values of growth and yield parameters of the Desho varieties are presented in Table 2. The variation in dry matter yield, plant height, and leaf width of the varieties was significant while leaf length, leaf number per plant, tiller number per plant and leaf to stem ratio did not show any significant difference. The crop was harvested four times and the harvesting round (CR) had a significant effect on yield and growth attributes, except for leaf width and leaf to stem ratio. The farmer management (FM) also contributed significantly to the variation in yield and growth parameters of Desho in the study. The interaction between variety (V) and harvesting round contributed significantly to the variation in dry matter yield, variety with farmer management interaction contributed significantly to the variation in dry matter yield, plant height, leaf width and leaf to stem ratio, while farmer management affected all of the growth and yield attributes except for leaf width and leaf to stem ratio. The interaction of variety*farmer management*harvesting round of Desho also contributed significantly to the variation in the present experiment.

3.2. Dry matter yield (DMY t/ha)

Mean values of dry matter yield of the Desho varieties due to the interaction between variety*farm management*harvesting round (V*FM*CR) in the present study are presented in Table 3. DMY varied due to different varieties and, variation in farm management and harvesting season/interval and also the interaction of all factors. DMY per cut ranged from 1.31 t/ha, for variety Kuluusa-DZF#592 at Basketo farmer training center (BFTC) harvested in December 2020, to 20 t/ha for variety Areka-DZF#590 at Badeg farm harvested in August 2020. Annual dry matter yield in the experiment also ranged from 11.49-39.7 t/ha/year. The results obtained demonstrated that the same variety

| Source of variation   | DF | DMY | PH | LL | LNPP | TNPP | LW | LSR |
|-----------------------|----|-----|----|----|------|------|----|-----|
| Replication           | 3  | 3.57| 251.9 | 30.05 | 0.51 | 153.1 | 0.01 | 0.19 |
| variety (V)           | 2  | 22.1*** | 256.7* | 74.79 | 4.39 | 592.4 | 0.05 | 0.07 |
| harvesting round (CR) | 3  | 568.6*** | 12368*** | 3933.4*** | 246.4*** | 17420.1*** | 0.005 | 0.0002 |
| farmer management (FM)| 5  | 521.9*** | 5471.8*** | 1437.9*** | 41.1*** | 33479.4*** | 0.45*** | 1.04*** |
| V*CR                  | 6  | 6.21* | 27.4 | 21.33 | 0.59 | 35.2 | 0.0001 | 0.004 |
| V*FM                  | 10 | 12.6*** | 134.9 | 46.97 | 1.37 | 346.3 | 0.01* | 0.74*** |
| FM*CR                 | 15 | 152.5*** | 1429.9*** | 472.17*** | 9.562*** | 2561.9*** | 0.001 | 0.001 |
| V*FM*CR              | 30 | 4.64** | 56.8 | 13.3 | 1.58 | 126.5 | 0.001 | 0.001 |
| Error                 | 213 | 2.347 | 51.5 | 25.1 | 1.94 | 315 | 0.005 | 0.1 |
| CV%                   | 23.2 | 22.1 | 13.4 | 17 | 20.6 | 6.6 | 20.4 |

*a significant at P < 0.05, ** significant at P < 0.01, *** significant at P < 0.001 DF: degrees of freedom, DMY: dry matter yield, PH: plant height, LL: leaf length, LNPP: leaf number per plant, TNPP: tiller number per plant, LW: leaf width, LSR: leaf to stem ratio, CV%: coefficient of variation.
gave different yields under different management options and season of harvest. In this regard, variety Areka-DZF#590 produced a higher yield (20.14 t/ha) in August 2020 at Badeg farm while it produced the lowest yield (1.74 t/ha) at Simeneh farm in June 2020. Kindokoisha-DZF#589 variety produced a higher yield (15.84 t/ha) in August 2020 at Badeg farm while it produced the lowest yield (1.31 t/ha) at the same farm in June 2020. Similarly, variety Kulumsa-DZF#592 produced a higher yield (19.21 t/ha) at the farm of Badeg in August 2020 while it produced its lowest yield (1.31 t/ha) at the farm of Basketo farmers’ training center (BFTC) in December 2020. The variation in yield under different environmental conditions and among varieties under similar or/and different environmental conditions in the present study may imply that the varieties with high yielding potential could produce greater yields with better management and at an appropriate season of harvest. The highest mean annual dry matter yield (39.7 t/ha/year) obtained in the current experiment was by far better than previous reports of 28.83 t/ha/year (Yirgu et al., 2017), 28.74 t/ha/year (Birmaduma et al., 2019) and 35.09 t/ha/year (Hidosa and Getaneh, 2021) for the same varieties. The dry matter yield dynamics of Desho grass in different harvesting rounds after establishment in the present study was similar to results obtained for other perennial forages, which showed the ability to be harvested frequently after establishment and where the yield was predominantly affected by the season/frequency of harvest (Atumo and Jones, 2021) and by management practices.

3.3. Plant height (PH cm)

Mean values of plant height are presented in Table 4. The interaction effect of Desho variety and farm management on plant height variation, ranging from 24.0 cm to 54.2 cm, was significant ($P < 0.05$). The highest plant height was recorded for the interaction of variety Kindokoisha-DZF#589 followed by Kulumsa-DZF#592 at Badeg farm while the lowest interaction effect was recorded for Areka-DZF#590 at Basketo farmers training center (BFTC). Plant height of forages is a contributing factor to dry matter accumulation in crop livestock production systems (Maleko et al., 2019). The correlation between plant height and dry matter accumulation has been presented previously by other scholars (Halim et al., 2013) and the findings of the present study agrees with this.

### Table 3. Mean dry matter yield (DMY t/ha) as a result of the interaction between variety, growing site and harvest round of Desho grass.

| Variety          | Farm Management | 20-Jun | 20-Aug | 20-Oct | 20-Dec | Mean | Year Total |
|------------------|-----------------|--------|--------|--------|--------|------|------------|
| Areka-DZF#590    | Badeg           | 2.68*  | 20.14* | 15.01* | 7.59*  | 12.61| 37.82 |
|                  | Bisrat          | 2.90*  | 6.00*  | 4.41*  | 6.48*  | 4.50| 14.33 |
|                  | Lakech          | 2.01*  | 6.48*  | 5.77*  | 2.19*  | 4.75| 14.25 |
|                  | Simeneh         | 1.74   | 6.96   | 3.81   | 3.09*  | 4.17| 12.51 |
|                  | BFTC            | 6.68   | 2.42   | 2.42   | 2.42   | 3.84| 11.52 |
|                  | MFTC            | 1.85   | 16.00  | 10.95  | 10.95  | 9.60| 28.81 |
|                  | Mean            | 2.98   | 9.68   | 7.06   | 5.76   | 6.58| 19.72 |
| Kindokoisha-DZF#589 | Badeg      | 3.08   | 15.03  | 15.26  | 9.07   | 11.13| 33.38 |
|                  | Bisrat          | 2.44   | 5.70   | 4.08   | 3.44   | 4.07| 12.21 |
|                  | Lakech          | 2.00   | 6.83*  | 7.05   | 2.62   | 5.29| 15.87 |
|                  | Simeneh         | 2.07   | 6.74*  | 4.04   | 2.27   | 4.28| 12.84 |
|                  | BFTC            | 9.85   | 3.46   | 3.46   | 2.96   | 5.59| 16.76 |
|                  | MFTC            | 1.34   | 15.84  | 10.37  | 10.37  | 9.18| 27.54 |
|                  | Mean            | 3.46   | 8.93   | 7.38   | 5.44   | 6.59| 19.77 |
| Kulumsa-DZF#592  | Badeg           | 2.45   | 19.21  | 18.04  | 10.94  | 13.23| 39.70 |
|                  | Bisrat          | 2.95   | 6.36   | 5.80   | 5.74   | 5.06| 15.18 |
|                  | Lakech          | 2.34   | 13.50  | 9.04   | 5.00*  | 8.29| 24.88 |
|                  | Simeneh         | 1.98   | 7.10   | 2.42   | 2.66   | 3.83| 11.49 |
|                  | BFTC            | 7.92   | 2.58*  | 2.5    | 1.31   | 4.37| 12.10 |
|                  | MFTC            | 2.24   | 17.88  | 10.91  | 10.91  | 10.34| 31.03 |
|                  | Mean            | 3.32   | 11.11  | 8.14   | 6.09   | 7.52| 22.56 |
| Harvesting month (Grand Mean) | | 3.25 | 9.91 | 7.53 | 5.76 | 6.89 | 20.68 |

LSD0.05 = variety*harvesting round*farm management (farm) (V*CR*FM) = 2.14.

3.4. Tiller number, leaf number, leaf length, leaf width and leaf to stem ratio

Tiller number per plant, leaf number per plant, leaf length and leaf width are all contributing factors to fodder yield in forage crop production (Patel et al., 2018) and the growth and development of these factors can be affected by moisture conditions and other farm management options (Yegrem et al., 2019). Mean values for tiller number, leaf number, leaf length, leaf width and leaf to stem ratio of the Desho varieties are presented in Table 5. Tiller number varied significantly ($P < 0.01$) across harvesting rounds in the present study. Different growing conditions have been shown to affect the number of tillers in Desho grass previously (Heliso et al., 2019). The highest number of tiller per hole was recorded in the October harvest (101.5/plant hole) while the lowest tiller number 70.4 per plant hole was recorded in August 2020. There was no significant variation observed among the varieties for tiller number, however, Kindokoisha-DZF#589 (88.4) consistently produced a higher number of tiller than the others. The highest tiller number (68.6–104.7 tillers per plant) recorded in different harvesting rounds for three varieties in the present study was greater than previous reports including, 49.17–69.83 tillers per plant hole (Hidosa and Getaneh, 2021), and, 49.6–79.1 tillers per plant (Bedekte et al., 2017) for the same varieties and 51.2 (Yegrem et al., 2019) for other varieties. Leaf number per plant was counted and the calculated average value did not vary significantly among the varieties, although the highest value was obtained for Kindokoisha-DZF#589 (8.37). The mean value in different harvesting rounds showed significant variation ($P < 0.001$) between rounds. The highest (10.61) number of leaves per plant was produced in June 2020, while the lowest number was recorded in October and December. Mean values for leaf length, 37 cm for variety Areka-DZF#590 and Kindokoisha-DZF#589 and 38.5 cm for...
Kulumsa-DZF#592, were not significantly different and similar to the previous report on some of the same varieties (Jabessa et al., 2021), while it differed significantly ($P < 0.001$), ranging from 28.9 cm in the December harvest to 45.6 cm in the August harvest, between harvesting rounds. Varieties Areka-DZF#590 (1.07 cm) and Kulumsa-DZF#592 (1.08 cm) had significantly ($P < 0.001$) wider leaves than Kindokosha-DZF#589 (1.04 cm). The variations in leaf to stem ratio were not statistically significant ($P > 0.05$) between varieties and that is similar result to those reported by other scholars (Jabessa et al., 2021) for the present varieties.

### Table 4. Mean plant height (PH (cm)) of Desho varieties under frequent harvesting and trial farms during 2019 and 2020.

| Variety (V)          | Harvesting round (CR) | Badeg | BFTC | Bisrat | Lakech | MFTC | Simeneh | Mean (V*CR) |
|----------------------|-----------------------|-------|------|--------|--------|------|---------|-------------|
| Areka-DZF#590        | Jun-20                | 56.7  | 42.1 | 34.0   | 29.6   | 34.1 | 26.4    | 37.1        |
|                      | Aug-20                | 79.9  | 10.6 | 55.4   | 32.7   | 55.1 | 43.8    | 46.2        |
|                      | Oct-20                | 35.2  | 10.6 | 20.0   | 12.7   | 30.2 | 13.4    | 20.3        |
|                      | Dec-20                | 21.0  | 18.3 | 22.5   | 15.5   | 30.2 | 12.6    | 20.0        |
|                      | Mean (V*FM)           | 48.2  | 20.4 | 32.9   | 22.6   | 37.4 | 24.0    | 30.9        |
| Kindokosha-DZF#589   | Jun-20                | 57.6  | 53.9 | 31.3   | 32.2   | 35.7 | 28.7    | 39.9        |
|                      | Aug-20                | 86.2  | 15.8 | 47.6   | 32.4   | 50.8 | 42.7    | 45.9        |
|                      | Oct-20                | 34.2  | 15.8 | 16.9   | 16.7   | 26.3 | 13.0    | 20.5        |
|                      | Dec-20                | 38.8  | 17.6 | 22.7   | 18.0   | 26.3 | 11.7    | 22.5        |
|                      | Mean (V*FM)           | 54.2  | 25.7 | 29.6   | 24.8   | 34.7 | 34.0    | 32.2        |
| Kulumsa-DZF#592      | Jun-20                | 52.7  | 65.8 | 28.1   | 37.4   | 34.0 | 29.0    | 41.1        |
|                      | Aug-20                | 86.8  | 17.0 | 51.5   | 47.1   | 55.5 | 42.9    | 56.1        |
|                      | Oct-20                | 34.9  | 17.0 | 15.5   | 18.6   | 30.2 | 12.5    | 21.4        |
|                      | Dec-20                | 41.7  | 17.6 | 20.4   | 21.0   | 30.2 | 12.9    | 23.9        |
|                      | Mean (V*FM)           | 54.0  | 29.3 | 28.9   | 31.0   | 37.5 | 24.3    | 34.2        |
|                      | Mean (FM)             | 52.1  | 25.1 | 30.5   | 26.1   | 36.5 | 24.1    | 32.4        |

Farmers’ experience in producing improved forage prior to this participatory evaluation of newly released Desho grass varieties in the targeted areas was little to none. The evaluation trials started with six farmers from two districts, Melokoza and Basketo. Bisrat Legese (Figure 3) from Basketo district is one of the farmers who are benefited from the grass technology. Farmers use the grass as basic feed for milking cows, oxen, heifers, bulls and small ruminants like sheep, together with atela (residue of local drinks) and the residues of legume crops. According to the Table 5.

### Table 5. Mean values of tiller number (TNPP), leaf number (LNPP), leaf length (LL cm), leaf width (LW cm) and leaf to stem ratio (LSR) at pooled farm samples from the mid and lowlands during the 2019 to 2020 cropping season.

| Variety (V)  | Harvesting round (CR) | TNPP | LNPP | LL cm  | LW cm  | LSR |
|--------------|-----------------------|------|------|--------|--------|-----|
| Areka-DZF#590| Jun-20                | 86.5 | 10.28| 41.0   | 1.07   | 1.54|
|              | Aug-20                | 69.8 | 8.38 | 45.2   | 1.07   | 1.54|
|              | Oct-20                | 101.7| 6.37 | 33.2   | 1.06   | 1.54|
|              | Dec-20                | 88.2 | 6.76 | 28.5   | 1.07   | 1.55|
|              | V. Mean               | 86.6 | 7.95 | 37.0   | 1.07a  | 1.54|
| Kindokosha-DZF#589 | Jun-20 | 88.1 | 10.82| 40.2   | 1.04   | 1.59|
|              | Aug-20                | 72.8 | 8.73 | 44.1   | 1.04   | 1.59|
|              | Oct-20                | 104.7| 7.03 | 34.7   | 1.03   | 1.60|
|              | Dec-20                | 88.1 | 6.93 | 29.3   | 1.05   | 1.58|
|              | V. Mean               | 88.4 | 8.37 | 37.0   | 1.04b  | 1.59|
| Kulumsa-DZF#592 | Jun-20 | 83.9 | 10.73| 42.7   | 1.09   | 1.55|
|              | Aug-20                | 68.6 | 8.73 | 47.4   | 1.09   | 1.55|
|              | Oct-20                | 98.1 | 6.46 | 35.2   | 1.08   | 1.54|
|              | Dec-20                | 83.3 | 6.91 | 28.9   | 1.09   | 1.55|
|              | V. Mean               | 83.5 | 8.21 | 38.5   | 1.08a  | 1.55|
|              | LSD0.05               | NS   | NS   | NS     | 0.02   | NS  |
|              | P Value               | 0.2  | 0.11 | 0.1    | <0.001 | 0.51|
| Harvesting round (CR) mean | Jun-20 | 86.1b| 10.61a| 41.3a  | 1.07   | 1.56|
|              | Aug-20                | 70.4c| 8.61b| 45.6a  | 1.07   | 1.56|
|              | Oct-20                | 101.5a| 6.62c| 34.3b  | 1.06   | 1.56|
|              | Dec-20                | 86.5b| 6.87c| 28.9c  | 1.07   | 1.56|
|              | Grand Mean            | 86.2 | 8.18 | 37.5   | 1.06   | 1.56|
|              | LSD0.05               | 5.8  | 0.46 | 1.7    | NS     | NS  |
|              | P Value               | <0.001| <0.001| <0.001 | 0.31   | 0.97|
|              | CV%                   | 20.6 | 17   | 13.4   | 6.60   | 20.40|

Kulumsa-DZF#592, were not significantly different and similar to the previous report on some of the same varieties (Jabessa et al., 2021), while it differed significantly ($P < 0.001$), ranging from 28.9 cm in the December harvest to 45.6 cm in the August harvest, between harvesting rounds. Varieties Areka-DZF#590 (1.07 cm) and Kulumsa-DZF#592 (1.08 cm) had significantly ($P < 0.001$) wider leaves than Kindokosha-DZF#589 (1.04 cm). The variations in leaf to stem ratio were not statistically significant ($P > 0.05$) between varieties and that is similar result to those reported by other scholars (Jabessa et al., 2021) for the present varieties.

3.5. Farmer perception

Farmers’ experience in producing improved forage prior to this participatory evaluation of newly released Desho grass varieties in the targeted areas was little to none. The evaluation trials started with six farmers from two districts, Melokoza and Basketo. Bisrat Legese (Figure 3) from Basketo district is one of the farmers who are benefited from the grass technology. Farmers use the grass as basic feed for milking cows, oxen, heifers, bulls and small ruminants like sheep, together with atela (residue of local drinks) and the residues of legume crops. According to the Table 5.
to the discussion with participants, before this intervention all farmers that participated in the trials were destocking their cattle due to the insufficiency of feed supplements. Now the farmers have started to rear improved breeds and milk productivity has improved due to supplementation with Desho grass. The previous milk productivity was an average of three liters per day whereas after feeding improved Desho grass, milk production increased to an average of six liters per day and farmers started supplying milk to nearby hotels to earn over USD 54.00 per month. This shows that the intervention has contributed about 50% of total income to support the farmer’s livelihoods. However, it was difficult to control the variation of varieties used while supplying feed to the cows in this period under farmer conditions. When comparing the production benefit (Table 6) of Desho grass with management intensive rotational grazing (MIRG) of pastureland among dairy cows, producing Desho grass could produce a benefit of about 566.78 USD while MIRG pasture produced a benefit of 6.34 USD. This is only if the farmer sells the product at the market price and not invests the money in dairy cows and converts to livestock products. In addition to its feed purpose, the farmers have been using Desho grass as a soil conservation mechanism. Consequently, it was recommended to advance the development of the technology and scale up to other farmers in similar agro-ecologies.

4. Conclusion and recommendation

This study showed the yield potential of Desho grass, together with the repeated harvesting, in the lowlands and midlands of Ethiopia. The variation in growth and yield recorded for different varieties and cutting periods was mainly due to the moisture availability of the growing season which could determine the growth of the grass. To maintain Desho grass productivity during repeated cuttings, it needs intensive management of the field throughout the production period. All growth parameters and dry matter yield, except for leaf number per plant, were shown to increase incrementally from the June to August harvest, then to decrease to the last harvest in December. Due to the interaction between variety, farm management and cutting frequency the dry matter yield variation of Desho grass ranged from 1.31 to 20 t/ha/cut. Kulumsa-DZF#592 variety performed the best across the major agro-ecologies and cuttings in the present study. Farmer’s preference also aligned with the selection of the high yielding variety and they will benefit by an 88 fold increase in new revenue when compared to MIRG pastureland. Productivity of the varieties under irrigation and quality assessment of the grass across production zones and cutting frequency is warranted to develop a better profile of the grass.

Declarations

Author contribution statement

Tessema Tesfaye Atumo: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

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Data availability statement

Data included in article supplementary material/referenced in article.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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