Desho Grass (Pennisetum pedicellatum) Lines Evaluation for Herbage Yield and Quality under Irrigation at Wondogenet

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Desho Grass (*Pennisetum pedicellatum*) Lines Evaluation for Herbage Yield and Quality under Irrigation at Wondogenet

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Abstract: This experiment was undertaken at Wondogenet Agricultural Research center. The aim of the research was to determine the herbage yield and quality of four ecotypes of Desho grass (*Pennisetum pedicellatum*) to develop promising ecotypes as registered varieties for wider use among livestock producer communities. Randomized Complete Block Design (RCBD) with three replications was employed. The result revealed that, the agronomic performance of height, vigor, dry matter ratio, dry matter yield in ton per hectare and dry matter leaf to stem ratio were not differ significantly (P>0.05) between four Desho grass ecotypes. Even though, the dry matter yield in ton per hectare was not differ significantly (P>0.05) between harvest, large amount of dry matter yield in ton per hectare of 28.83±2.66 was produced during second harvest. Moreover, numerically high dry matter in ton per hectare was produced by the grass lines of Areka-DZF#590 (28.35 ±3.77) and Kulumsa-DZF#592 (26.52±3.77). Therefore, all lines of Desho grasses were well adapted and performed good under Wondogenet condition and in similar environments elsewhere in Ethiopia.

Key words: Desho · Ecotype · Grass · Promising · Yield

INTRODUCTION

Livestock is an integral part of the farming systems in the country. According to [1] report, the major feed resources in the country are green fodder (54.59%), crop residue (31.6%), hay (6.81%) and agricultural by product (1.53%). One of the means of climate smart agriculture which can help to reduce greenhouse gas emissions and increase livestock productivity of the country is through improved livestock feed and feeding practices [2]. Desho is an indigenous grass of Ethiopia belonging to the family of Poaceae [3,4]. Morphologically it is closer to the genus Brachiaria with which it shares the acidic wetter areas of southern Ethiopia. Moreover, the grass has a potential to control water loss effectively and recovers rapidly after watering even under severe drought conditions [3,5].

Desho grass is a very palatable species to cattle and sheep [6]. The grass was first used in Southern Nations Nationalities and Peoples' Regional (SNNPR) state of Ethiopia and now widely used in other regions of the country for soil conservation practices and animal fodder [3,7]. Its home environment is the Wolayta zone of SNNPR, where it is valued by the natives as a highly palatable forage plant and as gully stabilizing agent in soil conservation plantings. Furthermore, through sale of planting material and forage, Desho grass provides a small business opportunity for Ethiopian farmers [8].

The grass has not undergone formal investigations as to its agronomic nor quality attributes. This valuable native grass species has to be studied scientifically for its growth characteristics, herbage yield and qualities to ascertain economic contribution to the farmers in its native area and in similar environments elsewhere in Ethiopia. There is also scarcity information of Desho grass lines on agronomic requirements. Bimrew *et al.* [9] reported significant negative correlations between experience in production of Desho grass and utilization as a feed. Therefore, the present study is aimed to select the best herbage yielding and quality of Desho grass among the four ecotypes so as to develop promising ecotypes as registered varieties for wider use among livestock producer communities.

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MATERIALS AND METHODS

Description of the Study Area: The experiment was undertaken in Wondogenet Agricultural Research center. Wondogenet is located at 07°19.1' North latitude, 38°30' East longitude with an altitude of 1780 meter above sea level. The area receives mean annual rain fall of 1128 mm with minimum and maximum temperature of 11 and 26°C, respectively. The texture of the top soil (0-25cm) was sandy clay loam with pH 8.84 (1:2.5 soil water suspension) and 0.18 of total nitrogen.

Establishment: Randomized complete block design of four treatments with three replications were employed. A total of twelve experimental plots each with $12m^2$ (3m*4m) areas were used. Each treatment groups were assigned randomly and independently to each experimental block. The root split were planted 0.5m space between and within rows. DAP fertilizer was applied at the rate of 100 kg/ha to enhance sward consolidation. Management practices (weeding, pest and disease monitoring/ control) were done uniformly.

Data Collection: The collected data were includes plot cover, stand vigor, herbage yield using quadrat sampling and leaf to stem ratio. Incidence of disease, insect and weed infestation were observed and recorded.

Plant Height: The height of harvested plant was taken from the ground to the tip of the plant. The average of six plant heights was taken randomly from each plot at the time of 50% flowering.

Estimation of Biomass Yield: The biomass yield of different Desho grass lines were harvested at 50% flowering at 10cm above the ground. Weight of the total fresh biomass yield was measured from each plot in the field and a subsample was taken from each plot to the laboratory, upon arrival at laboratory it was oven dried for 72hours at temperature of 65°C. The oven dried samples were weighed to determine the total dry matter yield. Then the result was converted in to dry matter ton per hectare for comparison [10]. Sampled leaf was separated from stem to determine leaf to stem ratio.

Data Analysis: Quantitative data sets were analyzed using general linear model of statistical analysis system (SAS) [11] procedures of 2002 version 9.0.

Least significant difference (LSD) test was employed for variables whose F-values declared a significant difference (P<0.05). The statistical model for data analysis was

$$Y_{ijk} = \mu + t_i + bj + e_{ijk},$$

Where
Y_{ijk} is the response variable under examination
μ is the overall mean
t_i is the treatment effect
b_j is the block effect/ random effect of experimental plots (j =3; 1, 2, 3) and
e_{ijk} is the random error associated with the observation $_{ij}$.

RESULTS AND DISCUSSIONS

Performance of Four Desho Grass Lines: The agronomic performances of height, vigor, dry matter ratio (DMR), dry matter yield in ton per hectare (DMTPH) and dry matter leaf to stem ratio (DMLSR) were not differ significantly (P>0.05) between four Desho grass lines. However, cover was significantly (P<0.01) high for Kulumsa-DZF#592 than Kindo kosha-DZF#591and Kindo kosha-DZF#589 lines. The dry matter in ton per hectare was 28.35 ±3.77, 26.52±3.77, 23.37±3.77 and 21.95±3.77 for grass lines of Areka-DZF#590, Kulumsa-DZF#592, Kindo kosha-DZF#589 and Kindo kosha-DZF#591, respectively. The dry matter to leaf ratio was also 0.72±0.8 for Areka-DZF#590 and 0.65±0.8 Kindo kosha-DZF#589 lines. Bimrew *et al.* [12] found local sheep performed better when fed Desho grass than natural pasture hay-based diets.

Performance of Four Desho Grass Lines during First Second Harvest: First and second harvest performance of Desho grass lines presented in Table 2. Height, cover and dry matter ratio were showed significantly (P<0.001) high during second harvest than first. Even though, the dry matter yield in ton per hectare was not differ significantly (P>0.05) between harvest, large amount of dry matter in ton per hectare of 28.83±2.66 was produced during second harvest. Heuzé and Hassoun [13] reported Desho grass fodder yield of 30-109 ton green herbage/ha/year; as a year-round fodder for livestock [14]. Bimrew *et al.* [12] found increasing the proportion of Desho grass from 0 to 100 % in the basal diet significantly (P< 0.05) increased average daily body weight gain of sheep.

Table 1: Performance of four Desho grass accessions.

Treatment	Accessions	Height (cm)	Cover (%)	Vigor (%)	DMR (±SEM)	DMTPH (±SEM)	DMLSR (±SEM)
1	Kulumsa-DZF#592	96.37±3.3	99.2±0.13[a]	98.3±0.22	30.9±2.57	26.52±3.77	0.52±0.8
2	Kindo kosha-DZF#591	89.17±3.3	90.8±0.13[c]	93.3±0.22	28.43±2.57	21.95±3.77	0.40±0.8
3	Kindo kosha-DZF#589	91.63±3.3	95.0±0.13[b]	93.3±0.22	29.65±2.57	23.37±3.77	0.65±0.8
4	Areka-DZF#590	96.3±3.3	95.8±0.13[ab]	96.7±0.22	30.3±2.57	28.35±3.77	0.72±0.8
	Mean	93.37±3.3	95.2±0.13	95.4±0.22	29.82±2.57	25.05±3.77	0.57±0.8
	CV%	8.6	3.2	5.7	21.1	36.8	35.5
	Sig	ns	**	ns	ns	ns	ns

[abc] Means bearing different superscript along the column differ significantly. Sig: Significant level, **: Significant at 0.01 level, ns: non-significant, CV: Coefficient of Variation, SEM: Standard Error of Mean; DMR: Dry Matter Ratio; DMTPH: Dry Matter in Ton per Hectare; DMLSR: Dry Matter Leaf to Stem Ratio.

Table 2: Performance of four Desho grass during first and second harvest.

Harvest	Height (cm)	Cover (%)	Vigor (%)	DMR (±SEM)	DMTPH (±SEM)	DMLSR (±SEM)
First	68.2±2.31[b]	91.7±0.09[b]	95±0.16	22.59±1.82[b]	21.27±2.66	0.57±0.06
Second	118.6±2.31[a]	98.8±0.09[a]	95.8±0.16	37.06±1.82[a]	28.83±2.66	0.57±0.06
Mean	93.4±2.31	95.2±0.09	95.4±0.16	29.82±1.82	25.05±2.66	0.57±0.06
CV%	8.6	3.2	5.7	21.1	36.8	35.5
Sig	***	***	ns	***	ns	ns

[ab] Means bearing different superscript along the column differ significantly. Sig: Significant level, ***: Significant at 0.001 level, ns: non-significant, CV: Coefficient of Variation, SEM: Standard Error of Mean; DMR: Dry Matter Ratio; DMTPH: Dry Matter in Ton per Hectare; DMLSR: Dry Matter Leaf to Stem Ratio.
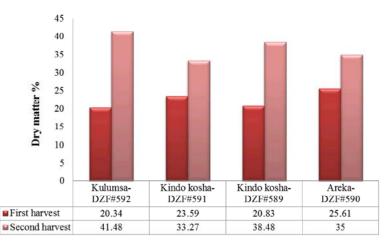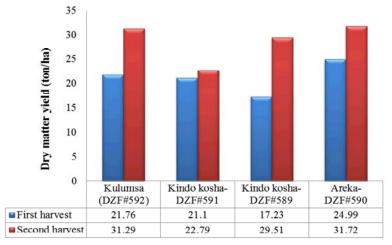

	Kulumsa-DZF#592	Kindo kosha-DZF#591	Kindo kosha-DZF#589	Areka-DZF#590
First harvest	20.34	23.59	20.83	25.61
Second harvest	41.48	33.27	38.48	35

Fig. 1: Dry Matter percent of Desho grass lines.

	Kulumsa (DZF#592)	Kindo kosha-DZF#591	Kindo kosha-DZF#589	Areka-DZF#590
First harvest	21.76	21.1	17.23	24.99
Second harvest	31.29	22.79	29.51	31.72

Fig. 2: Dry matter yield (ton/ha) of Desho grass lines.

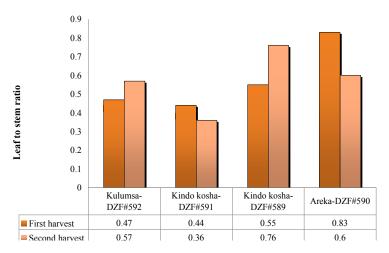|	Kulumsa-DZF#592	Kindo kosha-DZF#591	Kindo kosha-DZF#589	Areka-DZF#590
First harvest	0.47	0.44	0.55	0.83
Second harvest	0.57	0.36	0.76	0.6

Fig. 3: Leaf to stem ratio of Desho grass lines.

Average Dry Matter Percent of Four Desho Grass Lines: The average dry matter percent of four Desho grass lines showed in Fig. 1. During second harvest the dry matter ratio of Kulumsa-DZF#592 and Kindo kosha-DZF#589 lines were 41.48 and 38.48 percent, respectively.

Average Dry Matter Yield (Tons per Hectare) of Four Desho Grass Lines: The average dry matter yield in ton per hectare of four Desho grass lines is indicated in Fig. 2. Even though, there was no significant (P>0.05) differences was found between first and second harvest, large amount of dry matter in ton per hectare were obtained during second harvest than first. During first (21.76 and 24.99 kg/ha) and second (31.29 and 31.72 kg/ha) harvests the lines of Kulumsa-DZF#592 and Areka-DZF#590 were produced large amount of dry matter in ton per hectare, respectively.

Average Leaf to Stem Ratio on Dry Matter Basis of Four Desho Grass Lines: The dry matter base leaf to stem ratio was indicated in Fig. 3. Numerically large amount of leaf to stem ratio were produced by Kindo kosha-DZF#589 and Areka-DZF#590 lines. Bimrew *et al.* [12] found crude protein digestion improved significantly (P<0.05) at increasing level of Desho grass inclusion. The author also reported an increased ADF and NDF digestibility due to increasing levels of Desho grass in the basal diet.

CONCLUSIONS

The results revealed non-significant differences in dry matter percent, dry matter yield ton per hectare, dry matter leaf to stem ratio, height and vigor between the four Desho grass lines. Moreover, dry matter yield in ton per hectare and dry matter leaf to stem ratio were also not differ significantly between harvests. Therefore, all lines of Desho grasses were well adapted and performed under Wondogenet environmental conditions. Among the lines particularly Kulumsa-DZF#592 and Areka-DZF#590 were performed more in dry matter ton per hectare as well as dry matter ratio. Further research is needed to exploit its potential under a range of livestock production performances.

ACKNOWLEDGMENTS

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