Herbage Yield Evaluation of Desho Grass *(Pennisetum Pedicellatum L)*Lines under Rain Fed Condition at Sinana Agricultural Research Center, Ethiopia

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ABSTRACT

This experiment was undertaken at Sinana Agricultural Research center. The aim of the research was to select the best herbage yielding Desho grass (Pennisetum pedicellatum L.) among the four ecotypes. Randomized Complete Block Design (RCBD) with four replications was used. The result revealed that the agronomic performance of height and dry matter yield in ton per hectare were not significantly varied (p>0.05). Other parameters such as the number of tillers per plant and stem thickness differed significantly (P<0.05) between four Desho grass ecotypes. Despite, the dry matter yield per hectare was not differed significantly (P>0.05) a large amount of dry matter yield in ton per hectare of 11.88±1.77 was yielded by Areka DZF# 590 ecotype. Moreover, the highest plant high (45.75±6cm) was obtained on Areka DZF# 590 and the highest number of tillers per plant (206.30±17.68) was observed on Kindu Kosha DZF# 589. Therefore, all lines of Desho grasses were well adapted and performed well under Sinana Condition southeast Ethiopia.

***Key words*:** *Ecotypes, Grass lines, Desho.*

INTRODUCTION

The availability and nutritional quality of feed resources are the most important factors that determine the productivity of livestock. In Bale highland contribution of grazing land to livestock production is declining from time to time due to poor management systems and continued advance of crop farming into native grazing lands. The continued expansion of crop farming in Bale high land is resulting in the increasing share of crop residues as livestock feed resource. This has resulted high dependency of livestock production on low quality feed such crop straw and high slop land for grazing purpose. Utilization of high slop land and over stocking of communal and private grazing land has resulted serious land degradation in the area. As reported by the Ethiopian Highland Reclamation Study (EHRS FAO, 1984) 27 % (over 14 million hectare) of the highland area of Ethiopia were seriously eroded and some 6 million hectare should be completely withdrawn from agricultural use to be re-afforested.

To rehabilitate and improve the productivity of degraded area replacement of local grass with perennial improved grasses was sated as best option in high land rain fall sufficient area and it is very palatable species to cattle and sheep (FAO, 2010). Multipurpose grasses and trees such as Desho grass, Vetiver grass and different forage trees are among recommended materials.

Desho is an indigenous grass of Ethiopia belonging to the family of Poaceae(Smith, G.,2010 and welle S. *et al., 2006).* Under its Agro-ecological zone this grass has a *high* potential of biomass production and control water loss effectively and recovers rapidly after watering even under severe drought conditions (Smith, G., 2010). Desho grass adapts best to high-rainfall areas and has highest dry matter yield compared to other grasses. It is a benched type reproduces through vegetative propagation in the altitude of 1500-2800 ma.sl. This technology can also respond to cropland encroachment onto communal grazing areas and overstocking of livestock that has led to overgrazing, causing further land degradation and serious pasture shortages. It has a high biomass production capacity 30–109 t/ha (Ecocrop, 2010) under irrigation and grows upright with the potential of reaching 90–120 cm based on soil fertility (SLM Ethiopia; Shiferaw et al. 2011).

However; adaptation study of this valuable grass was not yet studied. Therefore, this study was aimed to select the best herbage yielding Desho grass among the four ecotypes so as to recommend for livestock producer in the area.

MATERIALS AND METHODS

Description of the Study Area: The experiment was undertaken at Sinana Agricultural Research center (SARC). SARC is located in Oromiya Regional State, Bale Administrative Zone at (7°N latitude and 40°E longitudes; and 2400 m.a.s.l) 463km south east of Addis Ababa and east of Robe, the capital of Bale zone in bimodal rain fall area.

Establishment: Four Desho grass ecotypes Kulumsa DZF# 592, Areka DZF# 590, Kindu Kosha DZF# 591 and Kindu Kosha DZF# 589 with Randomized complete block design of four treatments with four replications were employed. A total of sixteen experimental plots each with $12m^2$ (3m*4m) 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 and Urea fertilizer was applied at the rate of 100 kg/ha and 50kg/ha respectively during establishment as well as 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 quadrate, plant height, number of tiller per plant and stem thickness. Incidence of disease, insect and weed infestation were observed and recorded. Plant Height: The height of harvested plant was taken the ground to the tip of the plant. The average of six plant heights was taken randomly from each plot at the 90 days after establishment or 90 days after urea top dressing for re-growth data. Estimation of Biomass Yield: The biomass yield of different Desho grass lines were harvested 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 (Aklilu, M., 2007). Sampled leaf was separated from stem to determine leaf to stem ratio. Since SARC is located in bimodal rain fall area the required data was collected twice a year for three Consecutive years (2018-2020). The total of six harvesting season's data were used for this paper writing.

Data Analysis: Quantitative data sets were analyzed using general linear model of GenStat Discovery Edition 4. Least significant difference (LSD) test was employed difference ($P<0.05$).
The statistical model for data analysis was
$Y = \mu + t + bj + e$,
Where: Y is the response variable under examination
μ is the overall mean
t is the treatment effect
b is the block effect/ random effect of experimental plots ij.
(j =3; 1, 2, 3) and
e_{ijk} is the random error associated with the observation

RESULTS AND DISCUSSIONS

The agronomic performances of Dry Matter Yield (DM) and plant height (PH) were not significantly different ($P>0.05$) (Table 1). The Dry matter yield variation of the four grass lines agree with the result by Tekalegn Y. *et al.*, (2017) but the largest dry matter yield at Sinana was much lower than the result at Wondogenet which was 28.83±2.66 and 11.57±1.77 ton/ha respectively. This high variation was related to the agro-ecology variation of the places where the grass ecotypes were collected in which the Desho grass adapts best to high-rainfall (hot and Humid) areas and has highest dry matter yield compared to other grasses.

Table 1: Over all Agronomic performance of Desho grass lines

No.	Treatment Accessions	Major Agronomic parameters			
		PH (cm) ±SE	ASC±SE	ANT±SE	DM ±SE
1	Kulumsa DZF# 592	43.17±6.00	2.54±0.20	194.70±17.68	11.57±1.77
2	Areka DZF# 590	45.15±6.00	2.78±0.20	198.40±17.68	11.88±1.77
3	Kindu Kosha DZF# 591	44.67±6.00	2.71±0.20	201.3±17.68.	10.69±1.77
4	Kindu Kosha DZF# 589	45.75±6.00	2.18±0.20	206.30±17.68	11.63±1.77
	Mean	45.18±6.00	2.38±0.20	201.10±17.68	11.44±1.77
	CV%	13.30	8.60	8.80	18.10
	Sig	ns	*	**	Ns

PH: Plant height**, ASC:** Average stem circumference in cm**, DM:** Dry Matter**, ANT:** Average Number of Tillers per plant**, Sig:** Significant level**, **:** Significant at 0.01 level**, *:** Significant at 0.05**, ns:** non-significant**, CV:** Coefficient of Variation**, SE:** Standard Error of Mean

However, the Average stem circumference (ASC) and Average Number of Tillers per plant (ANT) were significantly different ($P<0.05$) between four Desho grass lines. High number of tiller per plant (206.30±17.68) were recorded by DZF# 589 ecotype were as the lowest (194.70±17.68) were observed on PZF# 592

Desho grass is perennial grass; once the mother plants were established the bio-mass harvesting from re-growth were carried out with optimum management such as fertilizer application applied during rainy season. Accordingly, the re-growth data results were indicated some changes on major parameters.

During the six consecutive harvesting seasons the trends of Average number of tiller per plant was shown increment up to 4th harvesting season (Fig.1). However; the flattened trend were observed on the graph at 5th to 6th harvesting season. The result was related to plant population climax attained at 5th harvesting season which creates high computation on nutrient, water and sun light.

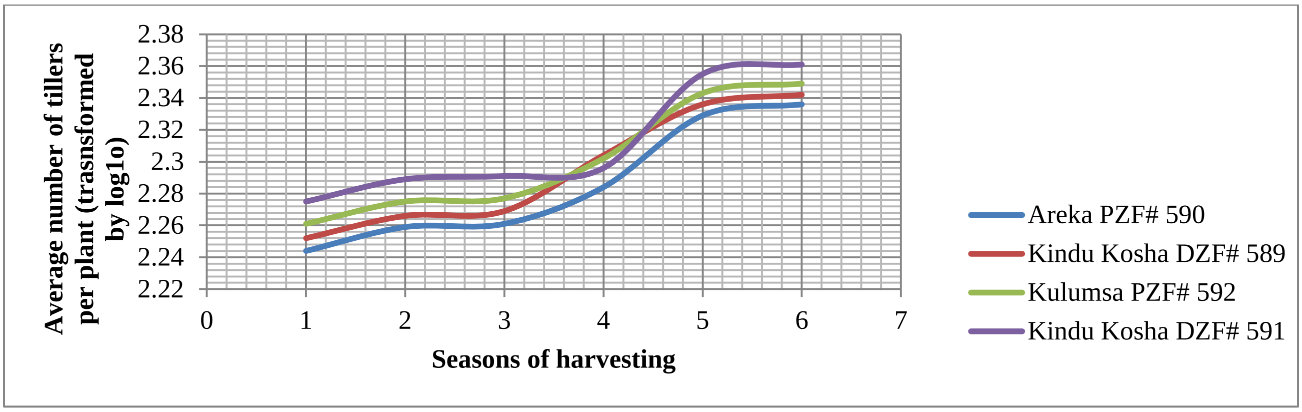

Fig. 1: Trends of number of tillers per plant of Desho Grass lines

The trends of dry bio-mass yield were indicated increment up to 4th harvesting season (Fig. 2). However; the bio-mass yield turning down were observed during 5th and 6th harvesting season.

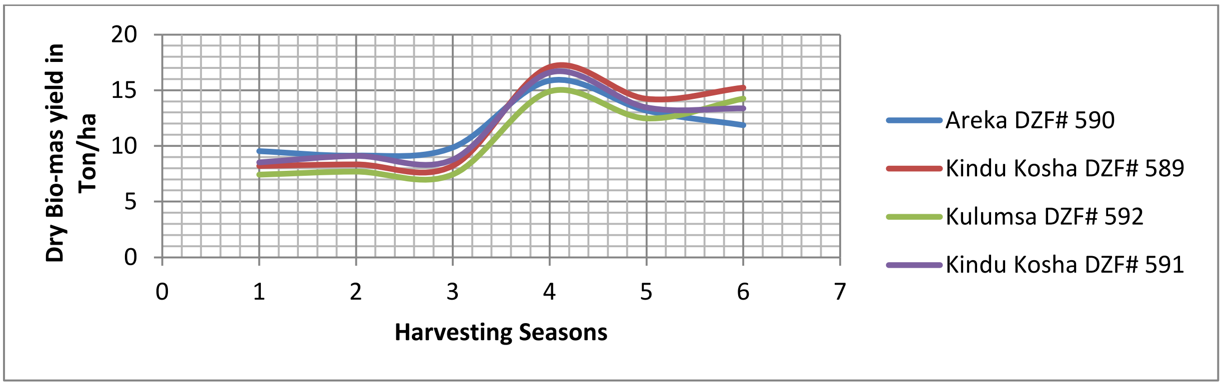

Fig. 2: Trends of Dry matter yield (ton/ha) of Desho grass lines

In addition the undulated and decreasing patterns were observed on graph showing the trend of plant stem thickness (Fig. 3). Both thickness and Bio-mass yield falling were related to climax attained as the plant population increases which creates high computation on nutrient, water and sun light.

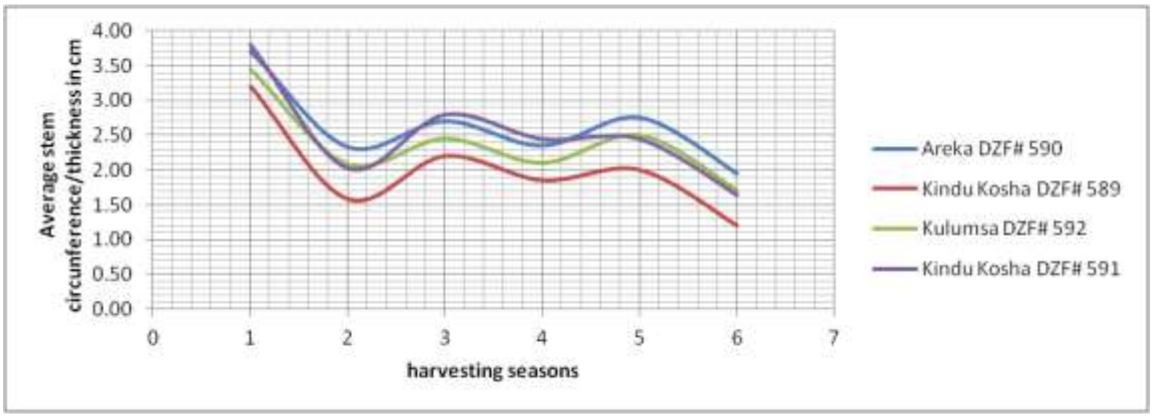

Fig. 3: Trends of average Stem Circumference/Thickness (cm) of Desho grass lines

CONCLUSIONS AND RECOMMENDATIONS

The results revealed non-significant differences in plant height and dry matter yield and the average maximum and Minimum Dry matter yield were 11.88 and 10.69 ton/ha respectively. However, the Average stem circumference (ASC), Average Number of tillers per plant (ANT) were significantly different ($P<0.05$) between four Desho grass lines. Therefore, all tested lines of Desho grasses were well adapted and performed under Sinana environmental conditions. Desho grass is heavy feeder and high biomass producer forage plant. For sustainability of production; continues soil fertility management and adequate moisture availability maintenance is crucial. Further research is needed to exploit its potential under a range of livestock production performances and how to determine the fertilizer requirement in amount and types and water requirement of this grass.

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