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Evaluation of Rhodes Grass (*Chloris gayana*) cultivars for forage yield and yield componentsat highland and midland of Guji Zone southern Oromia

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ABSTRACT

Aim: The aim of this study was to identify and select better adaptable, higher herbage yielding forage variety.
Materials and Methods: Five Rhodes grass cultivars (Masaba, ILRI- 6633, ILRL-7384, ILRL-13325 and Dz-253) were used and arranged in RCBD with three replications. All agronomic characteristics and biomass yield data were collected and the collected data were analyzed using SAS statistical analysis version 9.1.
Results: The results of analyzed data indicated that dry matter yield was showed statistically significant (P<0.05) difference among Rhodes grass cultivars. Seed yield (qt/ha) was showed statistically significant (P<0.05) variation among the treatments at both agro-ecologies. The highest herbagedry matter yield and seed yield were recorded from ILRI-7384 (15.44 t/ha) followed ILRI-6633 (14.9 t/ha). The highest seed yield at high land agro-ecologies were recorded from ILRI-6633 cultivar 1 (qu/ha) and Masaba0.83 (qu/ha) variety.
Conclusion: It was concluded that based upon adaptability, Dry matter yield and seed yield cultivar ILRI- 6633 and ILRI- 7384 for midland areas and ILRI- 6633 and Masaba varieties for highland areas of Guji zone.

Keywords: Cholorisgayana; Evaluation; Guji; Masaba; Rhodes.

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Introduction

Ethiopia has a massive livestock population andthe demand for livestock products is aggregatebecause of urbanization, population growth and animproving economic situation. However, thecontribution of this sector to country's economy is much lower than its potential due tomanagement and breed related factors. Thus, to exploit huge potential of livestock sector Ethiopia has to address major constraints of sector. One of major constraints is shortage offeed in terms of both quality and quantity. The problem is especially severe during long dry season (Mengistu, 2006).

Rhodes grass (*Chlorisgayana*) is now wide spread in tropical and subtropical areas worldwide. Rhodes grass is a perennial or annual tropical leafy grass 1-2m in height, highly variable in habit. The culms are tufted or creeping, erect or decumbent, sometimes rooting from the nodes. The inflorescences are light greenish brown (rarely yellow) in color and turn darker brown as they mature (Cook *et al.*, 2005). Rhodes grass thrives in places where annual temperatures range 25 to 30°C (day/night temperature). Optimal annual rainfall ranges between 600-750mm with a summer-rainfall period (Moore, 2006; Ecocrop, 2014).Rhodes grass grows better in areas where with an altitude ranges from 1400-2400 m.a.s.l (Ecocrop, 2014). Due to its deep roots, Rhodes grass can withstand long dry periods (over 6 months) and up to 15 days of flooding (Cook *et al.*, 2005; FAO, 2014).

Rhodes grass grows on a wide range of soils from poor sandy soils to heavy clayey alkaline and saline soils. Rhodes grass grows better on fertile, well-structured soils and it prefers soil pH between 5.5 and 7.5; even if, establishment on acidic soils is challenging. Rhodes grass survives on infertile soils although it is unproductive and may eventually die out particularly if grazed regularly. Rhodes grass is a full sunlight species, which does not grow well under shady environments (FAO, 2014; Eco crop, 2014).

Growth performance of Rhodes grass varies with type of cultivar, age of plant and other environmental factors (FAO, 2009).

Rhodes grass yieldmostly ranges from 7 - 25 tons of DM/ha per year, depending on variety, soil fertility, environmental conditions and cutting frequency. Based on a study conducted on farmers‟ fields in the central highlands of Ethiopia, on average the herbage yield of Rhodes grass was from 8.74 to 9.1 tons DM/ha per year on rain-fed conditions (Cook *etal*., 2005; CASCAPE, 2015; HARC, 2004). Though, feed and food arepressing problems in Ethiopia, introduction of Rhodes grass and the evaluation of their adaptability to Ethiopian condition have not been done. This adaptation trial was conducted to evaluate the adaptability and productivity of different cultivars in highland and midland of the study area

To overcome this bottleneck problem of livestock sector introducing of improved forages to stakeholders should have to be an obligatory and persistent activity that is expected from responsible service providers. Therefore, the study was aimed to select/recommend adaptable and high biomass yielding Rhodes grass cultivars for the study area and other areas having similar agro-ecologies.

Materials and Methods

Description of the study area

The experiment was carried out at Songo Baricha on station and Adola sub-site of Bore Agricultural Research Center in Guji Zone. Bore district is located at 385 km from fromFinfinne and 220 km from the Guji Zone capital city (Negele) with geographical location of 557'23" to 626'52" N latitudes and 3825'51" to 3856'21" E longitudes, South-eastern Oromia. The annual rain fall is about 1400-1800mm and the annual temperatures of the district ranged from 10.1 to 20 C. The major soil type of the site is mostly black soil. Bore Agricultural Research station is located at 7 km from Bore district which is geographically located at 624'37" N latitude and 3834'76" E longitudes. The research site represents highlands of Guji Zone with an altitude of 2736 m.a.s.l. receiving high rainfall characterized by bimodal distribution. The first rainy season extends from April to October and the second season starts late November and ends at the beginning of March.

Adola sub-site is located at Midland area of Bore Agricultural Research center located at Adoladistrict and located at distance of 470 km from Addis Ababa and 120 km from the Zonal capital city. It is an area of a mixed farming and semi-nomadic economic activity takes place, which is the major livelihood of the local people. The total area of the District is 1254.56 km^2 and situated at $5^o44'10"$ - $6^o12'38$ N Latitudes and $38^o45'10"$ - $39^o12'37"$ E Longitudes. The District is characterized by three agro-climatic, namely highland (11%), midland (29%) and lowland (60%). The major soil type of the district is nit sols (red basaltic soils) and orthicAcrosols (Yazachew and Kasahun, 2011).

Experimental treatments and design

The experiment was conducted using five Rhodes grass varietiesMasaba, DZ-253, ILRI- 6633 and ILRI-13325 using randomized complete block design (RCBD) with three replications. The seed were sown in rows spaced 20cm between rows and 1m, 1.5m between plots and blocks respectively on plot size of 2m x 1m (2 m^2). Seed rate, 15kg/ha^{-1}, fertilizer and other agronomic forage crop production practices were adopted uniformly as per recommendation.

Methods of data collections

All relevant data like days to days to emergence, days to flowering, plant height, and leaf to stem ratio, fresh biomass and dry matter yield were carefully recorded.Plant height was taken from five plants randomly selected from each plot using a steel tape from the ground level to the highest leaf. For biomass yield dataplants were cutting at 5-10cm from the ground level from two central rows. In order to measure dry matter yield, the harvested fresh sample was measured right in field by sensitive balance and 300g subsample per plot was brought to Bore Agricultural Research Center and the sampled sample was placed to oven dried for 72 hours at a temperature of $65c^o$ for dry matter determination. Then dry matter yield (t/ha) was calculated by James (2008) formula.

The dry matter yield (t/ha) = TFW × (DWss /HA × FWss) ×10

Where TFW = total fresh weight kg/plot

DWss = dry weight of subsample in grams

FWss = fresh weight of subsample in grams

HA = Harvest plot area in square meters and 10 is a constant for conversion of yields in kg/m to t/ha.

Leaf to stem ration, the morphological parts were separately weighed to know their sample fresh weight, oven dried for 72 hours at a temperature of 65^{o}C and separately weighed to estimate the proportions of these morphological parts.

Methods of statistical analysis

Data on statistical parameters of Rhodes grass accession were subjected to ANOVA based on the modeldesigned for a randomized complete block design (RCBD) according to Gomez and Gomez (1984) and using thecomputer software package of SAS version 9.1. Mean separations were tested using the least significancedifference (LSD) and significant level was considered at ($P < 0.05$).The statistical model used for the RCBD design was:

$Yijk= \mu + A_j + B_i + e_{ijk}$

Where; Y_{ijk}= response of variable under examination, μ = overall mean, A_j = the jth factor effect of treatment/ cultivar, B_i = the ith factor effect of block/ replication, ei_{jk} = the random error.

Results and Discussion

Days to 50 % emergency

The over year statistical data analysis results indicated that days to emergencywas a significant difference *(P<0.05)* among the cultivars at both highland and midland agro-ecologies. This studyrequired a range of 8.33-10.4 days for first emergence which is almost similar with the study conducted at Deghabour district of Ethiopian Somalia region (Mohamed and Gebeyew, 2018), which was recorded 10.66 days. According to the result of (Cook *et al*., 2005) Rhodes grass germinates was 7 days after planting. The differences observed on day to emergencymay probably due tothe attributed to soil moisture content, soil fertility and other environmental factorstogether.

Days to 50% flowering

The analyzed dataof days to 50% flowering were shown highly significant (P<0.01) differences among the Rhodes grass cultivars at midland agro-ecologies. The shortest days to 50% flowering was recorded from ILRI- 6633 cultivar (72.67) and the late days of 50% flowering was recorded from Masabavariety (82 days) at midland agro-ecologies. This difference in days to 50% flowering among treatments could be due to the attributed to genetic variation among cultivars and their interaction with the environment.

Plant height (cm)

Plant height were shown non-significant (P>0.05)differences among the cultivars of Rhodes grass at both highland and lowland agro-ecology.The mean highest plant height (PH) of Rhodes grass (*Chlorisgayana*) cultivars was (181.7 cm) recorded from DZ-253 cultivars. The average plant height of Rhodes grass cultivars recorded from the current study was almost different with result of (Mohamed and Gebeyew, 2018) which was 139.10cm and Yesihak (2008) revealed that plant height of Rhodes cultivars grown sole on savannah regions of Ethiopia at 8 weeks after sowing varied from 100.7 to 121.0 cm. The differences of plant height occurred from the current study might be due to genetic variation among cultivars and soil fertility differences.

Leaf to stem ratio

Leaf to stem ratiowere non-significant (P>0.05) differences among the cultivars of Rhodes grassfrom both highland and midland agro-ecologies. The highest values of leaf to stem ratio of Rhodes grass cultivars were recorded from Masaba and ILRI- 6633 which were (0.83) obtained at the midland agro-ecologies.

Dry matter Yield (t/ha^{-1})

The result of combined data analysis showed that dry matter yield was shown a significant (P<0.05) differences among the cultivars at the midland agro-ecology (Table 2). The highest dry matter yield was recorded from ILRI-7384 cultivar (15.44 t/ha^{-1}) followed by ILRI- 6633 cultivars (14.9 t/ha^{-1}). The result of the current result was higher than the work conducted at Adami Tulu Agricultural Research Center and Negele Arsi farmers training center (FTC) also indicated that the average herbage dry biomass yield of Rhodes grass was range from 7.8- 9.16 tons DM/ha^{-1} per year without manure application (Tesfaye *et al*., 2020). Also the current result obtained is higher than result obtainedon farmers' fields in the central highlands of Ethiopia, on average the herbage dry matter yield of Rhodes grass ranges from 8.74-9.1 tons DMha^{-1} per year on rain-fed conditions (Cook et al., 2005; CASCAPE, 2015; HARC, 2004).

Seed yield (qu/ha^{-1})

The results of over year statistical data analysis indicates that seed yield were shownsignificant *(P<0.01)* difference among the cultivars at both midland and highland agro-ecologies (Table 1 and 2).

Table 1. The mean value of yield and yield related components of year and location of Rhodes grass cultivars at highland agro-ecologies.

Cultivars	DE	DF	LSR	DMYt/ha	FBMt/ha	PH (cm)	SYI qt/ha
ILRL-7384	20^{b}	130	0.75	7.9	27^{ab}	108.3	0.68^{ab}
Masaba	22^{ab}	128.7	0.83	9.6	25.83^{ab}	109	0.66^{ab}
ILRL-13325	22.33^{ab}	129.3	0.6	8.4	28.8^{ab}	101.2	0.83^{ab}
DZ-253	23.33^{a}	128.3	0.7	10.2	23.67^{b}	97.1	0.5^{b}
ILRI-6633	20.33^{ab}	132.7	0.83	8.6	31^{a}	113.2	1^{a}
Mean	21.6	129.8	0.74	8.94	27.2	106.8	0.74
CV	7.1	2.1	28.7	26.2	10.1	8.8	30
LSD (5%)	*	NS	NS	NS	*	NS	*

DE=days to emergence, DF=days to flower, DM=days to maturity, LSR=leaf to stem ratio, DMY=dry matter yield, PH=plant height, CV=coefficient variation, LSD=least significant different, NS =non-significant, *=significant and SYI= Seed yield.

Table 2. The mean value of yield and yield component over year and location of Rhodes grass cultivars at midland agro-ecologies

Cultivar	DE	DF	LSR	DMY t/ha	FBM t/ha	PH (cm)	SYI qt/ha
ILRI-7384	8.33^{b}	77^{b}	0.59	15.44^{a}	75	164.7	2.5^{ab}
Masaba	10.67^{ab}	82^{a}	0.56	13.8^{ab}	50.83	171	0.917^{b}
ILRI-13325	10^{ab}	77.6^{b}	0.76	9.73^{b}	58.42	171.7	2.66^{a}
DZ-253	10.33^{ab}	78.3^{ab}	0.86	12.83^{ab}	58.33	181.7	1.83^{ab}
ILRI-6633	12.67^{a}	72.67^{c}	0.8	14.9^{a}	52.92	171.7	2.66^{a}
Mean	10.4	77.5	0.66	13.34	59.1	172.1	2.12
CV	13.5	2.8	26	18.8	22	5.5	39.7
LSD (5%)	*	**	NS	*	NS	NS	**

DE=days to emergence, DF=days to flower, DM=days to maturity, LSR=leaf to stem ratio, DMY=dry matter yield, PH=plant height, CV=coefficient variation, LSD=least significant different, NS=non-significant, *=significant, ** highly significant, and SYI= Seed yield.

The highest seed yield was recorded from ILRI-6633 cultivar (2.66 qu/ha^{-1}) and ILRI- 13325 cultivar (2.66 qu/ha^{-1}) at midland agro-ecologies. The current result was lower compared with the result studied by (Tesfaye *et al*.,2020; Dawit *et al*., 2020) which means seed yield recorded were 3.7055 and 3.1388 Kg/ha^{-1} which was conducted at Adami Tulu Agricultural Research Center (ATARC) and NegeleArsi Farmers Training Center (FTC). The variation observed in the current study in seed yield might be due the difference in soil fertility and soil moisture content. On the other hand, climate and soil types or their interactions have effects on the performance of forage crops (Diriba *et al*., 2014).

Conclusions

The forage and seed yields of most of theRhodes grass cultivars evaluated were relatively good. The result of this study indicated that ILRI-6633 and ILRI-7384 at midland areas and ILRI-6633 and Masabavariety for highland agro-ecologies were well adapted and being productive regarding to dry matter yield and seed yield. Those cultivars are hopefully adapted to fill the gap of low quantity ruminant feed supply of the community. Therefore, based upon its adaptability, Dry matter yield and seed yield cultivar ILRI- 6633 and ILRI- 7384 for midland areas and ILRI- 6633 and Masaba varieties for highland areas of Guji zone.

References

Akinola JO and Olorunju SAS (1990). Changes in herbage yield and quality of indigenous and introduced forage species with age. Journal Animal Production Research 10(1): 1-20.

CASCAPE (2015). Capacity building for Scaling up of evidence-based practices in Agricultural Production in Ethiopia.

Cook BG, Pengelly BC, Brown SD, Donnelly JL, Eagles DA, Franco MA, Hanson J, Mullen BF, Partridge IJ, Peters M and Schultze-Kraft R (2005). Tropical forages. CSIRO DPI&F(Qld), CIAT and ILRI, Brisbane, Australia.

ESAP (Ethiopian Society of Animal Production), Addis Ababa, Ethiopia. 21. (2015).

FAO (2014). Grassland Index. A searchable catalogue of grass and forage legumes. FAO, Rome, Italy.

Fekede F (2000) Natural pasture management, feed production and utilization techniques.

HARC (Holetta Agricultural Research Center) (2004). Feed Resources Development and Utilization: Possible Options and Recommendations under Ethiopia Condition.

James K, Daniel M and Mugendi N (2008). Combining Napier grass with leguminous shrubs in counter hedgerows controls soil erosion without competing with crops.

Mengistu A (2006). Country pasture/forage resource profiles, Ethiopia. FAO forage resources country profile

Mohamed A and Gebeyew K (2018). On-farm Performance Evaluation of Selected Perennial Grass under Rain-Fed Conditions at Deghabour District, Cherer Zone, Ethiopian Somali Region. Poult Fish WildlSci 6: 201. doi: 10.4172/2375-446X.1000202.

Moore G (2006). Rhodes grass.Dept. Agric. Food Western Australia. Bull. 4690, Perth.

Tesfaye A, Girma C, Daniel W and Dawit A (2020). Effect of Different Levels of Cattle Manure on Biomass, Seed Yield and Crude Protein Content of Rhodes Grass. Journal of Natural Sciences Research.Vol.10, No.9.ISSN 2224-3186.

Yesihak K (2008). Effect of seed proportion of Rhodes grass (ChlorisgayanaKunth) and White seed clover (*Melilotusalba*) at sowing on agronomic characteristics and nutritional quality. Livestock

Yvan O and Tessema Z (2007). An assessment of grazing lands potentialities in Ordola surroundings (Ererdistricts) of Shinile zone. Handicap International, Dire Dawa, Ethiopia. pp.75.

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