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Participatory on - Farm Evaluation and Demonstration of Improved Forage Species under Rain Fed Condition in Hamer Woreda of South Omo Zone

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Keywords: dry matter yield, lablab intoritum, lablab purpureus vigna unguiculata.

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PARTICIPATORYONFARMEVALUATIONANDDEMONSTRATIONOFIMPROVEDFORAGESPECIESUNDERRAINFEDCONDITIONINHAMERWOREDAOFSOUTHOMOZONE

Strictly as per the compliance and regulations of :

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Keywords: *dry matter yield, lablab intoritum, lablab purpureus vigna unguiculata.*

I. Introduction

Ethiopia is home, excluding some non sedentary area of country such as pastoral areas of Afar and Somali regions, to approximately 56.71 million of cattle, 29.33 million of sheep, 29.11 million goats, 1.16 million camels, 56.87 million chickens, and 2.03 million horses 7.43 million donkey and 0.40 million mules (CSA, 2015). However, productivity achieved from livestock is very much lower than other African countries or world (Belete et al., 2010; Gebremedhin et al., 2004; FAO, 2009). Many studies confirmed that feed shortage both in quality and quantity is a critical and major cause for a low productivity of livestock in Ethiopia particularly in dry seasons (Mengistu, 2002; Mengistu and Amare, 2003; Zegeye, 2003; Amede et al., 2005; Duguma et al., 2012; Seyoum and Zinash, 1995; Ørskov, 1998; Tolera, 2007; Solomon, 2010 and Alemayehu, 2004). In the study area, which is pastoral and agro pastoral production system, livestock population is entirely depend on the feed from natural pastures is estimated to covers 80-90% of the livestock feed resource (Mengistu, 2006). Especially, in the dry season the availability and quality of natural pasture reduced to such an extent that livestock may not fulfill the energy requirement to maintain their bodyweight. This results in body weight loss and reduction of production and productivity (Galmessa et al., 2013) and made pastoral communities less benefit from prevailed production system in the study area. Improving the feed resource base by identifying alternative and more nutritious feeds is necessary to alleviate the prevailing nutritional constraints of livestock in the study area. One way of improving the production from livestock is by improving the nutritional constraints through the development of improved forage species and proper supplementation with leguminous forages (Poppi and McLennan, 1995) which are rich in crude protein(CP) content usually the most limiting nutrients in tropical livestock diets. Among them *Lablab purpureus* Lablab is drought hardy, and has been grown in arid, semi-arid and humid regions with rainfalls between 200 and 2500 mm (Hendricksen and Minson, 1985b; Cameron, 1988). Dry matter production potential per hectare varies with rainfall, soil condition and time of seeding and it could be yield 3-10 t / DM per ha (Denbela et al., 2015; Alemayehu, 2003; Cameron, 1988; Mayer et al., 1986). Conversely, Vigna unguiculata is one of the most important legume food and feed crops (Bennett-Lartey and Ofori, 1999) and it is widely grown and planted under rain fed conditions in in sub- Saharan Africa (Allen, 1983). However, in the study district, study on evaluation the adaptability of tested forage species is not has been carried out due to remoteness and mobile nature of pastoralists. The on farm evaluation and introduction of these species imperative in order to overcome the feed constraints

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both in quality and quaintly to the study area therefore, this study was aimed to evaluate the high yielding improved legume species and demonstrates to pastoralists' communities.

II. Material and Methods

a) Description of study area

The study area is located in Hamer Woreda of South Omo Zone, the Southern Nations, Nationalities and Peoples Regional state of Ethiopia which is bordered on the South by Kenya, on the South West by Dasenchi woreda, on the West by Nyangatom woreda, on the North by Bena-tsemay woreda and on the East by the Oromia Regional State. The average temperature is above 37°C in most parts of Woreda and altitude varies from 450 meters to 1765 meters above sea level. The average annual rainfall is 400 mm. It is estimated that 66% of the population lead a pastoral production system and 34% of the population practice a crop livestock mixed production system.

b) Selection of trial site and trial pastoralists

Demeka zuria peasant association was selected for on farm participatory evaluation of improved legume forage species in collaboration with Woreda pastoral affairs' office experts and Developmental agents after undertaken in-depth discussion on the objectives of the research activity. Three trial pastoralists' households were selected after community meeting. The criteria for selection of trial pastoralists were availability of land and interest of pastoralist in research process. Finally, training was delivered to Agricultural extension workers, pastoralists (trial and non trial) who involved in research, peasant administrative leaders on Participatory research approach, role of gender in research and forage production strategies and utilizations.

c) Experimental Design and Treatment

After delivery of the training, each trial pastoralist contributed a 0.125 hectare of land. The area was divided in to three plots which have 3m x 4m area and each tested species was planted in each plots using randomized complete block design (RCBD) with three replications. Each trial pastoralists planted *Lablab intoritum, Lablab purpureus and Vigna unguiculata* by using participatory approach at on farm level for their adaptability test. The experimental materials were planted at a spacing of 30 cm and 50 cm between plants and rows respectively by using a seed rate 15 kg per hectare.

d) Crop management and Data collection

The planted species management activity such as hoeing, weeding, Diseases and Pest inspection carried out and trial farms were continuously monitored. The growth performance data like germination (emergence) date, stem height growth, number of leaf, days to 50 % of heading were collected. In order to measure the length of steam and number of leaf per each species at 50% heading age, five plant from middle of two row per plots were randomly taken for height of plant and number of leaf per plant were measured. The average height of plant and number of leaf per plant had been considered for their growth potential of the tested species. Conversely, each tested species were harvested eight week after planting to determine fresh biomass (FBY) and dry matter yield (DMY) production potential. Three samples were randomly taken per plot at quadrates of 50cm x50 cm area by cutting using sickle and weighed samples and transported to Jinka Agriculture research Center and allotted to cut in to small pieces and made pooled it. The representative samples were subjected to oven dried at 105°c for 24hrs at Jinka Agricultural Research Center Animal Feed evaluation Laboratory. The dry matter yield of each species was calculated by the final weight collected from oven dried divided by initial weight before the subjecting to the oven dried.

e) Statistical Analysis

Analysis of data like date of emergence, stem height, number of leaf, days to 50 % of heading and yield data like fresh and dry matter yield were performed by using general liner model (GLM) procedure of SAS statistical soft ware version 9.1. Effect of tested species were considered as significant in all statistical calculation if ($P \leq 0.05$). Means were separated using Duncan's least significant difference (LSD) test with following model.

$$Y_{ij} = A + ß_i + t_j + e_{ij}$$

Where: Y_{ij} = dry matter yield,

A = General mean of the treatments,

$ßi$ = block effects,

tj = treatment(species) effects and

eij = experimental (random) error

VI. Results and Discussion

Table 1 : The fresh biomass yield, dry matter yield, Coefficients of variance and least significance difference tested species

Tested Species	FBY/plot/g ±SE	DMY/plot/g ±SE
Lablab purepureus	504±32[c]	180±27[c]
Lablab intoritum	371±32[b]	113±27[a]
Vigna unguiculata	292±32[a]	170±27[b]
LSD 0.05	8.50	7.90
CV (%)	6.75	5.70

(Means with the same letter in column for fresh biomass yield and dry matter based to 50% flowering stage are not significantly different P<0.05) FBY = Fresh biomass yield (t/ha), DMY = dry matter yield (t/ha), SE = standard error, g= gram, LSD = least significance difference and CV = Coefficients of variance.

The mean value of tasted species biomass yield and other agronomic traits measured were presented in Table 1 and 2 . There were significant difference (P < 0.05) in fresh biomass yield (FBY) and dry matter yield (DMY) production potential between among the *Lablab purpureus, Lablab intoritum and Vigna unguiculata* in the trial peasant association (Table 1). The average fresh biomass yield potential of tested species in to the study area were 20 t/ha, 14.84 t/ha and 12 t/ha respectively for *Lablab purpureus, Lablab intoritum and Vigna unguiculata* which attested that *Lablab purpureus* produced higher fresh biomass than *Lablab intoritum and Vigna unguiculata*. On the other hand conversely, the *Lablab intoritum* is better yielder than *Vigna unguiculata* in the current study. Meanwhile, on the other hand, the dry matter yield (DMY) obtained in this study was revealed that there were also significance difference (P < 0.05) among the *Labalab purpureus, Lablab intoritium and Vigna unguiculata in the study area (*Table 1).

The dry matter production potential of the tasted species to the study area is 7. 2 t /ha, 4.5 t/ha and 6.8 t /ha for *Labalab purpureus, Lablab intoritum and Vigna unguiculata.* The result obtained from this study in the case of *Lablab purpureus* was not corroborated to what Denbela et al. (2015) reported that *Lablab purpureus* produced on average 4.5t/ha at kako trial location and also Amodu *et al*. (2005) reported that Lablab *purpureus* produced dry matter range 4.5 to 4.9 t/ha in November at a location in the Northern part of Nigeria. On the other hand, result obtained in the current study for lablab purpureus corroborated to what Cameron (1988), Mayer et al. (1986) and Alemayehu (2003) reported that it can produced dry matter yield on average 3-5 t/ha in lowland area of Ethiopia. The variability in dry matter yield production might be attributed variability in rainfall, Soil fertility, Agro ecological location and pastoralist adopted management practice (Cameron, 1988; Mayer *et al*., 1986). On the other hand, the dry matter yield obtained from the *Vigna unguiculata* in current study is not corroborated with previous finding reported by Geleti et al. (2014) which indicated that the dry matter yield on average for *Vigna unguiculata* accession grown under rain fed condition ranges from the 10. 74 – 12.57 t/ha. However, it also controversial to what Bilatu et al. (2012) reported which indicated that value obtained in our current study higher dry matter yield (2 t/ha) than what they reported. Likewise, the variation source for dry matter yield b/n our current study *when it was compared with Bilatu and others finding* for *Vigna unguiculata,*which *might* be variation in accession potential which was reported by Anele UY. et al.(2011a) and Rivas -Vega et al.(2006) or it might be seasonal, agro ecological and soil variations (Anele UY. et al. , 2011a ; Anele UY. et al., 2011b) or other factors like trial pastoralists management.

Table 2 : The growth potential of tested species in study area in 2014 cropping season

Species	PH(cm) ± SE	Number of leaf at 4 week ±SE	Number of leaf at 8 week ±SE	Date of germination ± SE	Days to 50% flowering ±SE
Lablab purepureus	67±0.75[a]	12±0.43[a]	17±0.67[c]	5.23±0.23[a]	48.5±0.89[a]
Lablab Intoritum	80±0.7[b]	8.5±0.43[b]	12±0.67a	5.65±0.23[a]	85.4±0.89[b]
Vigna unguiculata	69.5±0.75[a]	10±0.43[a]	15±0.6[b]	6.7±023[a]	45.8±0.89[a]
LSD 0.05	5.80	7.45	12.32	1.55	25.45
CV (%)	3.70	6.80	6.34	5.25	8.87

(Means with the same letter in a column for each steam and leaf height base are not significantly different at α = P<0.05LSD = least significance difference, CV = Coefficients of variance cm = centimeter, PH = plant height and SE =Standard error

Pertaining to the result obtained in this study on plant height depicted that there were significant difference (P < 0.05) between the *Lablab intoritum* and *Lablab purpureus* and also *Lablab intoritum* and *Vigna unguiculata presented* (Table 2). However, there was none significance difference (P > 0.05) between *Lablab*

Purpureus and *Vigna unguiculata* at 8 week. The plant height recorded for the *Lablab species* was 67±0.75 - 80±0.75 cm at 50 % (8th weeks) which was lower than the value reported by different authors such as M. R. Hassan et al. (2014) (161cm), Yusufali (2005) (150cm) and Omokanye et al. (2000) and Adesoji et al. (2013) (229cm). Meanwhile, the height growth in length obtained for *Vigna unguiculata* in this study revealed that *Vigna unguiculata grown similar to the lablab purpureus not lablab intoritium and* however, it was in line with earlier study that reported by I.A. Ekpo.et al.(2012) . The leaf part of forage very important due to leaf contained better crude protein content and low in structural carbohydrate than any other part (fraction) of forages and played significant role to rumen microbe (Van Soest, 1994). Legumes forges with high biomass of leaf would seem to be those of highest nutritional value (Norton and Poppi, 1995). Therefore, the result on the number of leaf (leaf biomass) per tested species demonstrated that the number of leaf differs significantly ($p< 0.05$) at fourth week of growth period between *Lablab Purpureus* and *Lablab intoritum*, *Lablab intoritum* and *Vigna unguiculata* presented in Table 2. However, on the other hand, the number of leaf count b/n *Lablab Purpureus and Vigna unguiculata* was not significantly differ ($P > 0.05$). The values for number of leaves of experiential in this study on average at 4^{th} week were 12±0.43, 8.5±0.43 and 10±0.43 respectively for Lablab *purpureus, Lablab intoritium* and *Vigna unguiculata.* The value obtained in our current study for *Lablab purpureus* was in line with previous finding reported by Adesoji et al. (2013) at 6 week and however lower than what M. R. Hassan et al. (2014) reported under irrigated condition after sowing in Samaru and the slightly increase in when the week at 8 week (18±0.67, 12±0.67 and 15±0.60) which were higher than the values that reported by M. R. Hassan et al. (2014) at 9 week after sowing under rain-fed conditions. On the other hand, understanding at what stage of forage development is important for harvesting forage with good quality in order to boost the livestock production. One of the important stage is to be advised to farmers/pastoralist to harvest forage is when forage has been started blooming up to 50%, this is due to forage at 50% blooming characterized by high nutrient composition. Therefore, it is highly important to evaluate the exact days of the 50% blooming stage of tested species in order to quantify the dry matter production potential of tested species in to the testing environment, which is noticed that when the forage species are not harvest at appropriate stage it is associated with a decrease in the nutrient content, digestibility, and subsequent nutritional value of the forage. As a plant matures the contents of water, protein, nonstructural carbohydrates, minerals, and vitamins decrease. The current study declared that the there were significant difference ($P < 0.05$) was observed in the days to 50% flowering (blooming) between *Lablab intortum* and *Lablab purpureus*, *Lablab intortum* and *Vigna unguiculata*. However, there is none significance difference ($P > 0.05$) was observed between *Lablab purpureus* and *Vigna unguiculata* presented in Table 2. The first species flowered was *Vigna unguiculata* and *Lablab purpureus* with mean of 45.8 and 48.50 days respectively and which is not corroborated to what Fassil Berhe (2014) reported that *Vigna unguiculata bloomed at 50% within 53 days and whereas, Lablab purpureus was bloomed within 64 days. This is may be attributed due to variation in species* is a fast growing potential (Mark and Paul, 2007) or environmental variation (Anele UY. et al. , 2011a ; Anele UY. et al. , 2011b). While *Lablab intoritum* flowered last with a mean of 85.40.

VII. Conclusion and Recommendation

The current study revealed that the tested improved legume species well performed and adapted to tested Agro ecology with yielded both high fresh and dry matter. The Lablab purpureus (7.2 t/ha) and *Vigna unguiculata* (6.80t/ha) were produced highest dry matter yield and highly important to study area than Lablab intoritum which was produced 4.50 t/ha which was less important to the study area in term of dry matter production potential. The result reported in the current study is from data of one year cropping season. However, for the forage species yields may be variable in other seasons. Likewise, the further research should be conducted to identify their feeding value under different intervention, chemical composition and their response to the disease and pest resistance. Moreover, pastoralists' perceptions need to be studied to incorporate local technical knowledge in future forage varieties evaluation trials and to confirm suitability of the varieties under farmer circumstances. The information obtained would benefit in promotion of the forage varieties in wider scale (through pre-scale-up programs).

VIII. Acknowledgment

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