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Effects of Fertilizer Type and Grass Species on Agronomic Performances and Chemical Composition in Gozamin District, East Gojjam Zone, Ethiopia

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Abstract: The field experiment was conducted in rainy season to evaluate the effects of fertilizer type and grass species on agronomic performances and nutritive value of grass. The study was conducted 3x4 factorial arrangements with 3 grass species (Buffel, Setaria and Desho) and 4 four fertilizer type (Ft); Ft1 (control), Ft2 (50 kg urea+60 quintal of compost/ha), Ft3 (100 kg urea/ha) and Ft4 (120 quintal of compost/ha) with 3 replications was used. The data were collected agronomic performances such as plant height, number tillers per plant, number leaves per plant, leaf length and dry matter yield (DMY). Chemical analysis was conducted for dry matter (DM %), Ash, crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) was quantified. Results indicated that the agronomic performances and dry matter yield were significantly affected by fertilizer types, grass species and their interactions while interactions had no significant ($P>0.05$) effect on chemical analysis. Only chemical analysis no significantly ($P>0.05$) affected by grass species was crude protein (CP). However, fertilizer type was significantly ($P<0.01$) affected CP, NDF and ADL as well as ADF and Ash content ($P<0.001$), but non-significant ($P>0.05$) effect on DM %. The highest dry matter yield (DMY), crude protein (CP) and Ash content were obtained at received Ft2 (50 kg urea+ 60 quintal of compost/ha, whereas Ft1 (control) lowest in parameter. Higher NDF, ADF and ADL were recorded for unfertilized group. It could be concluded that, combined application of urea and compost showed a positive result on agronomic performance and forage quality. It could be suggested that Desho grass can be cultivated with 50 kg urea+ 60 quintal of compost/ha is important for maximize production with forage quality and sustainability of animal production in Gozamen district.

Keywords: Biomass Yield, Urea, Compost, Nutritional Value

1. Introduction

Ethiopia has one of the largest livestock populations in Africa, which mainly depend on green fodder (grazing) followed by crops residue as feed resources [1]. The feed resources are characterized by poor quality and very low in amount, indicated that productivity per animal is very low and challenges for sustainable animal production in country [2]. livestock feed resources in gozamen district also mainly depend on natural pasture and crop residues, and in dry season crop residue was the first livestock feed source, which contributed 66.7% [3]. As a result, animals' couldn't get sufficient and balanced nutrient from natural pasture and crop residues due to high fiber and low protein content [4].

To overcome this situation, it is necessary to cultivate high quality forages with high yielding ability as a feed resource [5]. Grass is appreciated benefits due to grow low input and adaptability to the biotic and a biotic environmental stress [6, 7]. E.g. Desho, Buffle and Setaria are the most important grass species having a major role in providing a significant amount and quality of forage due to fast growing potential, drought tolerance, and are used as one of the major feeds for ruminants [8, 9]. It known that the application of inorganic fertilizer is an important for increased growth, yield and nutritional value of grasses [10]. But the most farmers are difficult to apply recommended rate at all due to continuous increment of cost [11]. Regard to this, the use of compost has been advocated by many scholars as source of organic matter for encourages plant growth capacity and helps to resist to tensile forces through its fibrous materials [12].

On the other hand, sole application of compost is constrained by low nutrient content and high labor demand for preparing and transporting. Hence, the integrated use of inorganic and organic fertilizers are the best approach for achieving higher forage yields as compared to sole for each [13]. However, there is lack of information about rate of application of compost and chemical fertilizer in the study area either apply in sole or in combination. Therefore, the current study was designed to evaluate the effect fertilizer type on agronomic performances and nutritional value of three selected grass species.

2. Materials and Methods

2.1. Description of Study Area

Filed experiment was conducted during rain fed cropping season at the teaching and research farm, department of animal sciences, Debre Markos University, East Gojjam Zone of Amhara Regional Sate. It is found 300 km North West of Addis Ababa at a geographical location of 10°17’00” to 10°21′30″ N latitude and 37°42’00” to 37°45′30″ E longitudes and at the altitude of 2350-2400 meter above sea level (m.a.s.l). The minimum and maximum temperatures are 11.07°C and 22.93°C, respectively with mean annual rain fall of 1186 mm [14].

2.2. Plot Preparation, Planting and Experimental Materials

Planting materials, grass species named as Buffel, Setaria and Desho were collected, which developed and adapted by Debre Markos University agricultural research site used as experiment. Similarly, Compost was collected from Debre Markos University dairy farm compost storage pit. Urea (46%N) was used as a source of nitrogen. A total area of 498m^2 experimental land was cleared, ploughed, harrowed, and divided of three equal blocks; each contained 12 plot which were full randomly assigned to treatments. The individual plot size was 3 × 3 m (9 m2) meters and spaces between blocks and plots were 1.5 and 0.5 meter, respectively. Compost was incorporated to the soil on prepared plots twenty days before planting; thereafter planting was done in August 2018 using root splits on spacing between row and plant were 75 cm by 50 cm, respectively. Urea fertilizer was applied in split application method, which the first half was applied at planting and second half was applied after 30 days of after planting. The other agronomic practices were kept normal and uniform for all the treatments.

2.3. Experimental Design and Treatments

The study was conducted in randomized complete block design using a 3x4 factorial arrangement and the treatments were replicated three times. A total of 12 treatment combinations (Buffel, Setaria and Desho) grass combined with Ft1 (without fertilizer), Ft2 (50 kg urea+60 quintal compost), Ft3 (100 kg urea) and Ft4 (120 quintal compost) ha^{-1} were used.

Table 1. *Treatment combinations.*

Fertilizer type (Ft)/ha	Grass species		
	Buffel	**Setaria**	**Desho**
Ft1	Ft1Bf (T1)	Ft1St (T5)	Ft1Ds (T9)
Ft2	Ft2Bf (T2)	Ft2St (T6)	Ft2Ds (T10)
Ft3	Ft3Bf (T3)	Ft3St (T7)	Ft3Ds (T11)
Ft4	Ft4Bf (T4)	Ft4St (T8)	Ft4Ds (T12)

Ft1=Control; Ft2=50 kg Urea: 60 Quintal compost/ha; Ft3=100 kg Urea/ha and Ft4=120 Quintal compost/ha; Ft1Bf (T1)=zero fertilizer with Buffel; Ft2Bf (T2)=50 kg Urea+60 Quintal compost/ha with buffel; Ft3Bf (T3)=100 kg Urea/ha with buffel; Ft4Bf (T4)=120 Quintal compost/ha with buffel; Ft1St (T5)=zero fertilizer with Setaria; Ft2St (T6)=50 kg Urea+60 Quintal compost/ha with Setaria; Ft3St (T7)=100 kg Urea/ha with Setaria; Ft4St (T8)=120 Quintal compost/ha with Setaria; Ft1Ds (9)=zero fertilizer with Desho; Ft2Ds (T10)=50 kg Urea: 60 Quintal compost/ha with Desho; Ft3Ds (T3)=100 kg Urea/ha with Desho and Ft4Ds (T4)=120 Quintal compost/ha with Desho

2.4. Data Collection Procedures

Agronomic parameters included; plant height, tillers number, leaf number, leaf length and dry matter yield (DMY) were evaluated at 120 date of after planting. Number of tillers and leaves per plant were count and averaged. Plant height was considered from the stem above ground to the end of last node in meters [15]. Leaf length was measured from base to tip of the leaf. Ten plants in each plot were randomly selected for recording data at harvesting date for all parameters.

Total herbage on each plot was harvested leaving out boarder rows, from each plot; an area of 3m^2 that contained three rows were used calculated dry matter (DM) yield. The herbage was weighed in the filed just after mowing using a filed balance and subsample of 250 gram was taken and put into an oven adjusted at a temperature of 65^{o}C for 72 hrs until constant weight was attained, thereafter herbage removed from an oven and weighed to determine DM percent. The total dry matter yield was calculated by multiplying the fresh yield by DM percent of oven dried sample. Harvesting was done by hand using a sickle, leaving a stubble height of 5 cm according to recommended practice.

2.5. Sample Preparation and Chemical Analysis

Collected grass samples were oven dried at 65°C for 72 hrs and ground. The finely ground samples were analyzed for DM and Ash content according to AOAC [16]. Nitrogen was carried out by kjeldahl method [16] and crude protein (CP) was calculated as N x 6.25. Neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) were determined using the method described by [17].

2.6. Statistical Analysis

Data obtained on agronomic parameter, yield and chemical compositions were subjected to analysis of variance using of SAS (version 9.1). The significant treatment means were separated using Duncan Multiple Range Test at (P<0.05).

3. Results and Discussion

3.1. Agronomic Performance and Dry Matter Yield

In this study, the growth attributes investigated were plant height, leaf length, number of tillers per plant and number of leaves per plant. The change in these parameters is a very important aspect for forage production.

3.1.1. Plant Height

Plant height has a main contribution in a green fodder and dry matter yield [18]. Effects of fertilizer type, grass species and their interactions on plant height are shown in Table 2. Mean plant height (66.81 cm) for Setaria was significantly (P<0.001) greater than for Buffel and Desho grass with the value (52.24 and 56.2 cm, respectively). Likewise fertilizer type had a significant on mean plant height (P<0.001) with highest (61.9 cm) at treated of Ft2 while the least plant height (55.52 cm) was recorded at Ft1 (control) without fertilizer. Plant height was also significantly affect (P<0.01) by interactions. It was the highest (74.9 cm) was recorded for Ft2St while the shortest plant height (50.65 cm) and (50.9 cm) were recorded at Ft4Bf and Ft1Bf, respectively. Setaria grass had the highest plant height under all fertilizer type compared to Buffel and Desho grass. It was observed that different grasses respond differently under similar environment.

Table 2. *Plant height (cm) as influenced by fertilizer type and grass species*

Fertilizer type (Ft)/ha	Species			
	Bf	St	Ds	Mean
Ft1	50.9^{e}	62.16^{c}	53.5^{de}	55.52^{c}
Ft2	53.6^{de}	74.9^{a}	57.2^{d}	61.9^{a}
Ft3	53.8^{de}	65.9^{b}	57.2^{d}	58.96^{b}
Ft4	50.65^{e}	64.3^{b}	56.9^{d}	57.28^{b}
Mean	52.24^{z}	66.81^{x}	56.2^{y}	58.58
Factor	P-Value			
Fertilizer types	< 0.001			
Grass species	< 0.001			
Interaction	< 0.01			

Treatments means different letters with in column and row are significantly different at P<0.05; Bf=Buffel; St=Setaria; Ds=Desho; Ft1=Control; Ft2=50k g Urea: 60 Quintal compost/ha; Ft3=100 kg Urea/ha and Ft4=120 Quintal compost/ha

The variation in plant height observed in grass species might be attributed in variation the genetic makeup of grass, soil and environmental adaptability [19]. Similarly, [20] who reported that differences within grass tillers' height are well known because different grasses have responded differently to the environment and climate. On the other hand, the least number of tillers and leaves per plant were recorded for Setaria grass in which the nutrients are used for height increment rather than tiller production. Contrary to this, the shortest plant height observed in Desho due to production of high number of tiller, which could be share the available soil nutrient for tillering.

In case of fertilizer type, the highest plant height was obtained at Ft2 might be combined application urea and compost were release balanced nutrient that could be improve soil physical condition (like porosity and moisture content) for easy movement of nutrient to be absorbed by plant root. This supported by [21] who noted that, combined application of farm yard manure and inorganic fertilizer had the highest plant height as compared to alone each other on the performances of wheat. Similarly, [22] reported that application of both organic and inorganic fertilizers result in the tallest plant. In contrary, [23] who noted that, the highest plant height was obtained urea alone as compared to combined application with farm yard manure on mott grass.

3.1.2. Leaf Length

Leaf length was significantly affected (P<0.001) by fertilizer type, grass species and their interactions are shown in Table 3. The highest mean leaf length (33.60 cm) was obtained for Setaria as compared to Buffel (18.26 cm) and Desho (14.81 cm) based on result. Similarly, mean leaf length was significantly (P<0.00.1) greater at treated Ft2 (26.63 cm) than control or without any fertilizer sources at Ft1 (18.53 cm) but there was no statistical difference between Ft1and Ft4 on leaf length. The differences of leaf length among grass might be genetic make-up of species, which are responses to environment as produced highest leaf length one way and emerged of huge tillers on the other way. Interaction was also significantly (P<0.001) the highest (44.63 cm) leaf length was obtained from StFt2 while least leaf length (13.2 cm) was obtained from DsFt1.

Table 3. *Leaf length (cm) as influenced by fertilizer type and grass species.*

Fertilizer type (Ft)/ha	Species			
	Bf	St	Ds	Mean
Ft1	15.8^{fg}	26.6^{c}	13.2^{f}	18.53^{c}
Ft2	20.58^{d}	44.63^{a}	14.7^{fg}	26.63^{a}
Ft3	19.2^{de}	35.2^{b}	15.3^{fg}	23.23^{b}
Ft4	17.49^{def}	27.99^{c}	16.07^{efg}	20.51^{c}
Mean	18.26^{y}	33.60^{x}	14.81^{z}	22.25
Factor		P-Value		
Fertilizer types		< 0.001		
Grass species		<0.001		
Interaction		<0.001		

Treatments means different letters within column and row are significantly different at P<0.05; Bf=Buffel; St=Setaria; Ds=Desho; Ft1=Control; Ft2=50 kg Urea: 60 Quintal compost/ha; Ft3=100 kg Urea/ha and Ft4=120 Quintal compost/ha

Regarded to fertilizer, Ft2 gave highest leaf length as compared to the other fertilizer groups. This might be due to integrated use of urea with compost improved soil fertility and therefore nutrient absorbed by grass root increases which leads to better leaf development, moreover, compost has a potential to increase the efficiency of chemical fertilizer by prevent losses of the nutrients through volatilization and leaching as runoff.

3.1.3. Number Tillers of Per Plant

Effect of fertilizer type and grass species were significant (P<0.001) and their interactions (P<0.05) on number of tillers per plant are shown in Table 4. The highest number of tillers (57.90) per plant was obtained for Desho grass as compared Buffel (39.07) and Setaria (23.95) grass. Likewise fertilizer type significant (P<0.001) the highest number of tillers (50.40) per plant was recorded at Ft2, whereas, the least number of tillers (28.70) per plant was obtained at Ft1. Regarding to interactions effect, the highest number of tillers (77.3 and 66.4) per plant was recorded for Ft2Ds and Ft3Ds, respectively, while the least number of tillers (18.4) per plant was obtained for Ft1St. The variation of tillers among grass might be genetic make-up of grass species. In case of fertilizer, Ft2 gave the highest number tillers as compared to other fertilizer type.

The reason might be due to presence of plentiful amounts of nutrients when mineral fertilizer was applied in combination with compost as compared to the sole application of organic and mineral fertilizer which favors plant growth. The result was supported by [24] who reported significantly higher tillers/plant when compost and inorganic fertilizer mixture was applied on vetiver forage as compared to on the sole fertilizer sources. Similarly, [25] reported that combined application of farmyard manure and mineral fertilizer resulted in increased tiller numbers of wheat compared to separate application. However, the present result contradicted with [23] who noted that maximum number of tillers per plant was obtained at urea alone as compared to combined either farm yard manure or compost on grass species.

Table 4. *Number of tillers per plant as influenced by fertilizer type and grass species.*

Fertilizer type (Ft)/ha	Species			
	Bf	**St**	**Ds**	**Mean**
Ft1	25.3^{c}	18.4^{c}	42.4^{b}	28.70^{c}
Ft2	47.7^{b}	26.2^{c}	77.3^{a}	50.40^{a}
Ft3	42.2^{b}	26.1^{c}	66.4^{a}	44.90^{ab}
Ft4	41.1^{b}	25.1^{c}	45.5^{b}	37.23^{ab}
Mean	39.07^{y}	23.95^{z}	57.90^{x}	40.33
Factors		P-value		
Fertilizer type		<0.001		
Grass species		<0.001		
Interactions		<0.05		

Treatments means different letters within column and row are significantly different at P<0.05; Bf=Buffel; St=Setaria; Ds=Desho; Ft1=Control; Ft2=50 kg Urea: 60 Quintal compost/ha; Ft3=100 kg Urea/ha and Ft4=120 Quintal compost/ha

3.1.4. Number Leaves Per Plant

Number leaves per plant, which determines the photosynthetic capacity of the plants, were significantly (P<0.001) affected by fertilizer type and grass species and their interactions (P<0.05) effect are shown in Table 5. Accordingly, the highest number of leaves (265.91) per plant was recorded for Desho grass than other grass species for Buffel (193.87) and Setaria (107.82). Likewise, mean number of leaves per plant was significantly (P<0.001) greater at Ft2 (234.63) than at Ft1 (133.53), but there were no significant difference among Ft2, Ft3 and Ft4 in parameter based on result. Interaction was also significant (P<0.05) the highest number of leaves (353.8) and (295.7) per plant were recorded for Ft2Ds and Ft3Ds, respectively, while the least number of leaves (83) per plant was recorded for StFt1. The result showed that Desho gave highest number of leaves per plant than Buffel and Setaria grass might be the variation in genetic make-up grass species, which quest the nutrient for tiller production as well as leaf produced rather than height increment.

Table 5. *Number of leaves per plant as influenced by fertilizer type and grass species.*

Fertilizer type (Ft)/ha	Species			
	Bf	**St**	**Ds**	**Mean**
Ft1	126.6^{de}	83.00^{e}	191.0^{cd}	133.53^{c}
Ft2	232.2^{bc}	117.9^{e}	353.8^{a}	234.63^{a}
Ft3	211.10^{c}	117.5^{e}	295.7^{ab}	208.1^{ab}
Ft4	205.60^{c}	112.9^{e}	204.9^{c}	174.46^{b}
Mean	193.87^{y}	107.82^{z}	261.35^{x}	187.69
Factor	P-Value			
Fertilizer types		<0.001		
Grass species		<0.001		
interaction		<0.05		

Treatments means different letters within column and row are significantly different at P<0.05; Bf=Buffel; St=Setaria; Ds=Desho; Ft1=Control; Ft2=50 kg Urea: 60 Quintal compost/ha; Ft3=100 kg Urea/ha and Ft4=120 Quintal compost/ha

All fertilizer treatments had significant effect on number of leaves per plant, compared to control (no fertilizer). Generally, fertilization increased leaf number in growing period. This result was expected since all forms of fertilizer used to positively increased tillers as well as leaf number might be improve soil physical condition and provide plant growth requirements through availability of nutrient especially nitrogen even at the early stage forage growth. This result was supported by [24] who reported that, either combined use of compost and inorganic fertilizer or sole apply was significantly increased number of leaves/plant, compared to control on vetiver forage. Similarly, [26] who noted that, the highest number leaves were obtained at manure alone, mixed with urea and urea alone than nil (control) on wheat crop. In current study, leaves number increased as mineral nitrogen was applied in combination with compost. This indicates that nitrogen is the most critical nutrient that promote tiller emerged as well as huge leaf number was recorded.

3.1.5. Dry Matter Yield

Effect fertilizer type as well as grass species (P<0.001) and interactions (P<0.01) were significant on Dry matter yield t/ha are shown in Table 6. Significantly (P<0.001) the highest dry mater yield (4.93 t/ha) was recorded for Desho while the least dry mater yield (2.63 t/ha) for Setaria grass. Likewise fertilizer type significant (P<0.001) the highest dry matter yield (5.60 t/ha) was recorded at Ft2 and the least dry mater yield (3.18 t/ha) was obtained at Ft1, but no significant difference between Ft3 (2.05 t/ha) and Ft4 (2.09 t/ha) were recoded.

With regarding to interaction effect, the highest dry matter yield (7.16 t/ha) was recorded for DsFt2 while the least Dry matter yield (3.06 t/ha) was recorded from StFt1. The reason might be increase soil moisture availability and nutrient supplying capacity of the compost as well as its tendency to improve the soil chemical properties and thus increased the uptake of nutrients by plant roots, as result, Desho have better ground cover and basal circumference at Ft2 compared to Buffel and Setaria grass. The current study agrees with [27] who reported that the combined use of organic and mineral fertilizers had the higher yields than either source used alone.

The minimum Dry matter yield was recorded from Setaria grass without applying any fertilizer sources, due to shortage of nutrients such as nitrogen which is essential for growth as it is a component of cell nucleus and production of hormones which are vital for cell growth and elongation. Therefore, an integrated nutrient management in which both organic manures and mineral fertilizers used simultaneously has been suggested as the most effective method to maintain a healthy and sustainable soil system as well as increasing forage productivity [28]. Even though, the highest Dry matter yield was obtained from Desho grass relatively to Buffel and Setaria grasses, but lowest result obtained compared to [29] who reported that 13.66 Dry matter yield t/ha for Desho grass with application of inorganic fertilizer. The difference of current finding with other may be due to agro ecological condition, season of planting, soil types in experimental field.

Table 6. *Dry matter yield as influenced by fertilizer type and grass species.*

Fertilizer type (Ft)/ha	Grass			
	Bf	St	Ds	Mean
Ft1	3.52^{de}	3.06^{e}	3.46^{de}	3.18^{c}
Ft2	5.60^{b}	4.06^{cd}	7.16^{a}	5.60^{a}
Ft3	4.16^{cd}	3.87^{cde}	4.26^{cd}	4.09^{b}
Ft4	3.76^{de}	3.54^{de}	4.85^{bc}	4.05^{b}
Mean	4.13^{y}	3.63^{z}	4.93^{x}	4.14
Factor	P-Value			
Fertilizer types		<0.001		
Grass species		<0.001		
interaction		<0.01		

Treatments means different letters within column and row are significantly different at P<0.05; Bf=Buffle; St=Setaria; Ds=Desho; Ft1=Control; Ft2=50 kg Urea: 60 Quintal compost/ha; Ft3=100 kg Urea/ha and Ft4=120 Quintal compost/ha

3.2. Chemical Composition of Grass

Overall, there were no significant interactions between the effects of main treatment variable (grass species and fertilizer types) chemical composition so main effects only are presented in Table 7.

3.2.1. Dry Matter

Dry matter percentage (DM %) of the plants was significantly affected (P<0.05) by grass species, but fertilizer type and interactions had no significant effect on the parameter (P>0.05) in Table 7. The higher dry matter percentage was recorded (91.96%) for Buffel and Setaria (91.42%) compared to (91.08%) was obtained for Desho grass. The difference may be due to species difference. The present result disagree with [10, 30] who reported, non-significance difference in DM content of the Panicum grass, and Buffel and Guinea grass, respectively with the fertilizer application.

3.2.2. Ash

The grass species showed significance difference (P<0.05) for ash content in Table 7. The higher ash content was obtained from Setaria (13.61%) and Buffel (13.33%) grass than Desho (11.98%) grass. The variation in ash% content between grass species may be due to different in genetic make-up of grass. Fertilizer type was also showed significant difference (p<0.001) on ash content, which indicated that the highest ash content was obtained in fertilized grasses than in control treatment. The reason might be grasses have a potential to absorb minerals form the fertilized soil for their growth and accumulate in their tissue. Similarly, [31] who indicated that the highest ash content was obtained under fertilized nitrogen fertilizer, compared to control (no fertilizer) on grass species. In contrary,[10] noted that the lowest means of ash content was obtained at treated differences levels of nitrogen fertilizer while the highest ash content was recorded from control groups on Buffel and Guinea grass species.

3.2.3. Crude Protein Contents

As indicated in Table 7, non-significant differences (P>0.05) was recorded among grass species on the crude protein content. Likewise, [10] who noted that non-significant differences in CP content between Buffel and Guinea grass. On the other hand, the crude protein content of grass species was influenced by fertilizer type (P<0.01), the highest crude protein value was recorded at Ft2 (13.94%CP) than the other fertilizer treatments. This might be due to integrated use of urea with compost improved soil fertility and therefore nutrient absorbed by grass root, which leads to continuous sprouting of the vegetation until harvest. This result agreed with [32] who recorded the maximum protein content (20.2%) when farm yard manure mixed with urea fertilizer. Similarly, [33] also reported that, crude protein content of significantly increases with the addition fertilizer over the control on Buffel grass. CP level of 7.5% is required for rumen function [34]. In contrary,[35] reported that the critical level of CP content for tropical herbaceous species should be greater than 10.6%. Likewise, [36] reported that the minimum of 15% CP is needed for lactation and growth. The mean values CP% obtained in present study for urea, mixed with compost and compost alone as well as without fertilizer (control) were above threshold level required for rumen function, whereas present result of CP% was below the minimum 15% CP needed for lactation and growth of cattle described by [36]. Indicating that high level of fertilizer required to significantly increase crude protein in forage grass used to supplements crop resides and natural pasture in mixed farming system Ethiopia.

3.2.4. Neutral Detergent Fiber

The maximum (P<0.01) NDF (54.29%) value was obtained from Desho and (52.70%) from Setaria grass, while lowest NDF content (46.05%) was recorded from Buffel grass showed in Table 7. The variation in NDF content among grass species might be due to species differences. The effect of fertilizer type on NDF content had showed significant difference (P<0.01) while interaction effect was not apparent (P>0.05). The highest mean value of NDF (57.40%) was recorded at Ft1 (control), compared to fertilization urea alone, mixed to compost and compost alone. The reason might be fertilizers have a potential to stimulated plant growth and raise new leaves and shoots, which NDF content is relatively low. But there is no rejuvenation leaves and tillers in non-fertilizer treatments as a result plant tissues matures and accumulate more NDF. This finding was line with [37] who reported the highest NDF value was obtained from the control treatment than those fertilized with poultry manure on Guinea grass. Similarly,[38] noted that the NDF concentration declined significantly when application of either organic or inorganic fertilizer, compared to nil rate of fertilizer on grass forages.

They attributed the decrease in NDF to increase growth rate of new leaves and shoots which are lower in plant structural component as result of urea, compost and their combined fertilizations. Therefore, each plant species grown either alone or received fertilizers having a unique NDF value in the feed. For legumes, < 40% NDF content is classified as good quality forage, while > 50% [39] is considered as poor quality forage. For grasses, < 50% NDF is considered high quality and > 60% as low-quality forage. Similarly, [40] reported that the threshold level of NDF > 60% that affects dry matter intake of forage, which is voluntary feed intake is decreased and rumination time increased. In this study, forage material from all grass species under different fertilizer types had a <60% NDF which may accounts higher dry matter intake and digestibility as indicate to improve animals productivity.

3.2.5. Acid Detergent Fiber

Acid detergent fiber was significantly (P<0.001) affected by grass species and fertilizer type but not by their interactions (P>0.05) as indicated in Table 7. The highest ADF content was recorded from Desho (39.04%) and Setaria grass (38.48%), but the lowest ADF content (33.8%) was obtained from Buffel grass. The difference ADF content might be due to difference in genetic make-up among grasses species. Regarding the treatments, the highest ADF content (44.3%) was recorded under Ft1 (control) while the lowest was obtained at Ft2 (31.61%) although significant difference was not observed among grass species grown in fertilized plots. Therefore, respective of their type, fertilizers are important for improving nutritive value of grasses by decreased the structural component of plants compared to unfertilized one. This result was line with [37, 38] who noted ADF concentration was significantly the lowest at application of fertilizer. Acid detergent fiber (ADF) is widely used to measuring the fiber contents in feeds. It may range from 20% to over 45% in very mature species of grasses [41]. Higher ADF values indicate lower nutritive value. Based this finding, the means of ADF% among grass species and under all fertilized treatment as well as control found in recommended range and categorized medium to high quality of forage, as result, it showed a positive responses to intake and digestibility for animal productivity.

3.2.6. Acid Detergent Lignin

Acid detergent lignin content was significantly affected (P<0.01) by grass species and fertilizer type, but their interactions was no significant (P>0.05) on parameter showed in Table 7. The higher ADL content was recorded from Desho (12.37%) and Setaria grass (10.1%) than Buffel grass (8.10). Lower ADL (8.48%) was obtained at Ft2 than the control and other fertilizer treatments. Generally, the mean of ADL content was significantly decline when applied different fertilizer in combined or alone, compared nil (no fertilizer). Especially, combined application of urea with compost has a potential to decrease the lignin content of the grass based on the current result. This is because the fertilizers promote the growth of new leaves and shoots resulting in low lignin, which compensates the increase lignin content of the other tissue. When lignin is lowered it has always produced a marked increase in the digestibility of the plants and lignin are highly resistant to chemical and enzymatic degradation and are not appreciably broken down by the micro flora in the ruminant digestive tract [42].

Table 7. *Means of grasses chemical composition as affected by fertilizer type and grass spices.*

Factor type	Parameter					
Grass spices	**DM**	**ASH**	**CP**	**NDF**	**ADF**	**ADL**
Buffel	91.96a	13.33^{a}	12.78	46.05^{b}	33.80^{b}	8.10^{b}
Setaria	91.42ab	13.61^{a}	11.19	52.70^{a}	38.48^{a}	10.10^{a}
Desho	91.08b	11.98^{b}	12.51	54.29^{a}	39.04^{a}	12.37^{a}
p-value	<0.05	<0.01	NS	<0.01	<0.05	<0.01
Fertilizer type						
Ft1	91.39	10.87^{b}	10.60^{c}	57.40^{a}	44.31^{a}	12.21^{a}
Ft2	91.83	13.67^{a}	13.94^{a}	45.71^{b}	31.61^{b}	8.48^{b}
Ft3	91.39	13.87^{a}	12.82^{ab}	48.55^{b}	35.57^{b}	11.31^{a}
Ft4	91.33	13.49^{a}	11.36^{bc}	52.38^{b}	36.94^{b}	11.02^{a}
P-value	NS	<0.001	<0.01	<0.01	<0.001	<0.01

Treatments means different letters within column and row are significantly different at P<0.05; NS=Non significant, DM=Dry matter, CP=Crude protein, NDF=Neutral detergent fiber, ADF=Acid detergent fiber, ADL=Acid detergent lignin, Ft1=Control; Ft2=50 kg Urea: 60 Quintal compost/ha; Ft3=100 kg Urea/ha and Ft4=120 Quintal compost/ha

4. Conclusions and Recommendations

Based on the result, it could be concluded that the highest agronomic performances, biomass yield and nutritional value like CP and ash, and the lowest NDF, ADF and ADL were recorded at Ft2 (50kg urea: 60 quintal compost/ha) with grass species. Thus, among grass species, Desho was more preferred grass as compared to Buffel and Setaria grass in biomass yield. Overall in studied grass had a higher biomass yield and better nutritional value than the main feed of natural pasture and crop resides in the region, especially cultivation of Desho grass with application of inorganic and organic fertilizer mixture at different level may have a great potential as an alternative ruminant feed around the study area was recommended.

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References

[1] Central Statistical Agency (CSA) (2019). Agricultural Sample Survey. Livestock and livestock characteristics (private peasant holdings) (Addis Ababa Ethiopia). Stat Bull. 587 (2): 35–9.

[2] Alemayehu. M, Kebede. G, Feyissa. F, Assefa. G. (2017). Review on Major Feed Resources in Ethiopia: Conditions, Challenges and Opportunities. *Acad. Res. J. Agri. Sci. Res.* 5 (3): 176-185.

[3] Gashe A, Zewdu T, Kassa A. (2017). Feed Resources Gozamen District, East Gojjam Zone, Amhara Region. J Environ Anal Toxicol 7: 437. doi: 10.4172/2161-0525.1000437.

[4] Mekuanint Gashaw and Girma Defar (2017). Livestock feed resources, nutritional value and their implication on animal productivity in mixed farming system in Gasera and Ginnir Districts, Bale Zone, Ethiopia. *Int. J. Livest. Prod*. 8 (2): 12-23.

[5] Shiferaw. A, Puskur. R, Tegegne. A and Hoekstra. D. (2011). Innovation in forage development: Empirical evidence from Alaba Special District, Southern Ethiopia. *Development in Practice.* 21 (8): 1138-1152.

[6] Cook, B. G.; Pengelly, B. C.; Brown, S. D.; Donnelly, J. L.; Eagles, D. A.; Franco, M. A.; Hanson, J.; Mullen, B. F.; Partridge, I. J.; Peters, M.; Schultze-Kraft, R. (2005). Tropical forages. CSIRO, DPI&F (Qld), CIAT and ILRI, Brisbane, Australia.

[7] February, E. C. and Higgins, S. I. (2010). The distribution of tree and grass roots in savannas in relation to soil nitrogen and water. *South African J. of Bot*., 76: 517-523.

[8] FAO (Food and Agriculture Organization of the United Nations). 2010. Grassland Index. A searchable catalogue of grass and forage legumes. FAO, Rome, Italy. https://goo.gl/Qsx0gi.

[9] Asmare B. 2016. Evaluation of the agronomic, utilization, nutritive and feeding value of desho grass (Pennisetum pedicellatum). Ph.D. Dissertation. Jimma University, Jimma, Ethiopia. http://hdl.handle.net/10568/77741.

[10] Abdi hassun (2014). Effect of nitrogen fertilizer application on agronomic traits, biomass yield and nutritive value of cenchrus ciliaris and panicum maximum grown under irrigation at Gode, Somali region. M.Sc. thesis Alemaya University. 41 p.

[11] Endale K (2011). Fertilizer Consumption and Agricultural Productivity in Ethiopia. Ethiopian Development Research Institute, Addis Ababa, Ethiopia.

[12] Goldsmith W, Silva M, Fischenich C. (2011). Determining optimal degree of soil compaction for balancing mechanical stability and plant growthcapacity. ERDCTN- EMRRP-SR 26.

[13] Girma. C and Gebreyes. G. (2017). Effect of Organic and Inorganic Fertilizers on Growth and Yield of Teff (*Eragrostis tef*) in the Central Highlands of Ethiopia. Ethiop. *J. Agric. Sci.* 27 (1) 77-88.

[14] Western Amhara Meteorological Services in Bahir Dar, 2018.

[15] Enujeke, E. C. (2013). Effects of variety and spacing on growth characters of hybrid maize. Retrieved may 25, 2016, from http://ageconsearch.umn.edu/bitstream/198125/2/6-234-ajard-3(5)2013-296-310.

[16] AOAC (Association of Official Analytical Chemists) (1990). Official methods of analysis of the Association of Official Analytical Chemists, 15^{th} ed. Association of official analytical chemists, Washington Dc.

[17] Van Soest, Robertson and Lewis (1991). Methods for dietary fibber and non starch polysaccharides in relation to animal nutrition. *Journal of Dairy Science*. 74: 3583-3597.

[18] Dhumale, D. N. and Mishra, S. N. (1979). Character association between forage yield and its components in oats. *Indian J. Agric. Sci.,* 49 (12): 918-924.

[19] Zaman Q, M N Hussain, A Aziz and K Hayat (2006). Performance of high yielding Oat varieties under Agro-Ecological condition of D. I. Khan. *J. Agric. Res.* 44: 29-35.

[20] Anwar. M, Akmal. M, Shah. A, Asim. M and rabia gohar (2012). Growth and yield comparison of perennial grasses As rainfed fodder production. *Pak. J. Bot*., 44 (2): 547-552.

[21] Abbas, G., Khattak, J. Z., Mir, A., Ishaque, M., Hussain, M., Wahedi, H. M., Ahmed, M. S. and Ullah, A. (2012). Effect of organic manures with recommended dose of NPK on the performance of wheat (*Triticum aestivum* L.). *The Journal of Animal and Plant Sciences*, 22 (3): 683-687.

[22] Nigist Bekele (2013). Growth and Yield of Amaranthus hybridus L. subsp. cruentus (L.) Thell. Grown on Fields Treated with Different Levels of Urea and Compost. A Thesis Addis Ababa University, Ethiopia. 64p.

[23] Bilal Qamar. M, Saeed. M and Sarwar. M. (2000). Effect of varying levels of nitrogen and farmyard manure application on tillering and height of mott grass. *International Journal of Agriculture and Biology.* 2: 1-2.

[24] Priyadarshani N. D. N, Amarasinghe. M. K. T. K, Subasinghe. S, Palihakkara. I. R and Kumarasinghe H. K. M. S. (2013). Effect of organic and inorganic fertilizers on biomass production, oil yield and quality of vetiver (vetiveria zizanioides l.) Department of Crop Science, Faculty of Agriculture, University of Ruhana, Mapalana, Kamburupitiya, Sri Lanka. The Journal of Agricultural Sciences. 8 (1): 1-8.

[25] Manna. M. C, Swarup. A, Wanjari. R. H, Ravankar, H. N, Mishra. B, Saha. M. N, Singh. Y. V, McDonald, Edwards, J. F. D. Green halgh and C. A. Morgan (2002). Animal Nutrition (6th ed). Long man Group UK Ltd, England. 693 p.

[26] Mulata Kassaye (2015). Influence of farmyard manure and mineral nitrogen and phosphorus fertilizers on the productivity of bread wheat Gozamin District, in north-western Ethiopia.

[27] Makinde. E. A., 2007. Effects of an Organo-Mineral Fertilizer Application on the Growth and Yield of Maize. Journal of Applied Sciences Research. 3 (10): 1152-1155.

[28] Tilahun Tadesse, Nigussie Dechassa, Wondimu Bayu, Setegn Gebeyehu (2013). Effects of Farmyard Manure and Inorganic Fertilizer Application on Soil Physico-Chemical Properties and Nutrient Balance in Rain-Fed Lowland Rice Ecosystem. American Journal of Plant Sciences, 4 (2): 309-316.

[29] Worku. B, Denbela. H and T/yohanis. B. (2017). Effect of Planting Space and Fertilizer Rate on Productivity of Desho Grass (Pennisetum Pedicellatum) in Jinka Agricultural Research Center, Southern Ethiopia ", International Journal of Research in Agriculture and Forestry. 4 (11): 14-19.

[30] Sodeinde, Asaolu, and Akingbade (2006). Feed utilization and growth performance of wad sheep fed space Imposed and Nitrogen fertilizer Panicum maximum in the derived savanna Zone. *Research Journal of Biological Science* 1 (1-4) 93-97.

[31] Tessema. Z, Ashagre. A & Solomon. M. (2010). Botanical composition, yield and nutritional quality of grassland in relation to stages of harvesting and fertilizer application in the highlands of Ethiopia, African Journal of Range & Forage Science. 27: 3, 117-124, DOI: 10.2989/10220119.2010.530460.

[32] Akbari P., Ghalavand, A., Modarres Sanavy, A. M. and M. Agha Alikhani (2011). The effect of biofertilizers, nitrogen fertilizer and farmyard manure on grain yield and seed quality of sunflower (Helianthus annus L.). Journal of Agricultural Technonogy. 7 (1): 173-184.

[33] Kizima. JB, Mtengeti. EJ and Nchimbi-Msolla. S. (2014). Seed yield and vegetation characteristics of *Cenchrus ciliaris* as influenced by fertilizer levels, row spacing, and cutting height and season. *Livestock Research for Rural Development Volume 26, Article#148.*

[34] Van Soest (1982). Nutritional Ecology of Ruminants. O and B Books, Corvallis, Oregon, USA.

[35] Minson (1990). Forage in Ruminant Nutrition. (Academic Press: London).

[36] Norton (1982). Differences between species in forage quality. In: Hacker JB (eds), Nutritional limits to animal production from pastures. Farnham Royal: Commonwealth Agricultural Bureaux. pp 89–110.

[37] Alalade J. A., Akinlade, J. A., Muraina, T. O., Salami, S. A., Adebisi, I. A., Adams, T. O., Oseni, T. A and Oladepo, O. (2015). Effect of Manure Application on Herbage Yield, Nutritive Value *Panicum maximum. Journal of Natural Sciences Research*, 5 (13): 1-6.

[38] Ahmed S. A., Halim, R. A. and Ramlan, M. F. (2012). Evaluation of the Use of Farmyard Manure on a Guinea Grass (Panicum maximum) - Stylo (Stylosanthes guianensis) Mixed Pasture. Pertanika J. Trop. Agric. Sci. 35 (1): 55–65.

[39] Van Saun RJ. (2006). Determining forage quality: understanding feed analysis. Lamalink.com. 3 (8): 18–9.

[40] Meissner, Koster, Nieuwuodt, and Coertze (1991). Effects of energy supplementation on intake and digestion of early and mid season ryegrass and panicum / smuts finger hay, and *in sacco Disappearance of various forage species. South African journal of animal Science. 21: 33-42.*

[41] McDonald, Edwards, J. F. D. Green halgh and C. A. Morgan (2002). *Animal Nutrition* (6th ed). Long man Group UK Ltd, England. 693 p.

[42] Ranjhan SK (1993). Animal Nutrition in the Tropics (3rd ed). Vikas Publishing House Pvt. Ltd., New Delhi.