BADEGGI JOURNAL OF AGRICULTURAL RESEARCH AND ENVIRONMENT, 2024, 06(02), 24-31

NCRI Press

Available online: www.ncribjare.org
ISSN: 2695-2122, e-ISSN: 2695-2114
DOI: https://doi.org/10.35849/BJARE202402/168/003
Journal homepage: www.ncribjare.org

Research Article

Enhancement of Ensiling Quality of Gamba Grass (*Andropogon gayanus* Kunth.) with Tropical Legume Forages

Ahmad, M. Y[1]., Muhammad, I. R[2]. and Shehu, B[3].

[1]Department of Agricultural Education, Federal College of Education, Kano
Department of Animal Science, Faculty of Agriculture, Bayero University, Kano
[3]Department of Animal Health and Production, Binyaminu Usman Polytechnic, Hadejia.
Correspondence e-mail: myahmaddukawuya@gmail.com

Abstract

The study examined the effects of legume forage for improving the nutritional quality of gamba grass silage, determine most compatible legume with gamba grass for ensilage and to establish the optimum inclusion rates for silage making. Field grown gamba grass (GG) was incorporated with either cowpea (CW) or alysicarpus (AL) legume forages at three graded levels; 0%, 20%, 40% and 60%. The mixtures were ensiled for 21 days incubation period in the laboratory. Following the fermentation periods, colour and aroma was scored by three independent scorers on a scale of 1 – 4 while pH value determined using a digital pH meter. Proximate and fiber analysis was determined, digestible matter and reference feed value (RFV) were estimated. The result revealed that the compounded silages were moderately acidic, pale yellow and sweet. Inclusion of legume regardless of the specie increases CP, Ash, EE, NFE, ME, DMI, DCP, DDM, TDN and RFV contents with corresponding decline in CF, NDF and ADF contents. Incorporation of CW at 60% had higher CP, EE, ME, TDN, DDM, DMI and RFV values and thus recommended for large scale production. Mineral analysis and feeding trial were also recommended to evaluate mineral composition and animal performance fed on such silages.

Keywords: *Alysicarpus, Cowpea, Gamba, Proximate analysis, Silage*

Introduction

The recurrent malnutrition of ruminant animals particularly in the semi-arid zones of Nigeria originates from inadequate forage supply during the long dry season (8 to 9 months) of the year to meet the nutritional requirements of the animals. This reflected on seasonal weight loss, emaciation, poor reproductive performance, low output and death under severe conditions. These suggests the need for the production of high yielding quality forages, such as gamba grass as well as their conservation for future use is essential to improve productivity and sustainability of the animals. Conserved forages harvested during the growing season can be fed to animals particularly during the long dry season to attests partially zero grazing system during the dry season. This may, in fact, be the only way that would ensure satisfying high demand of nutrients for such livestock production system. The two principal forage conservation methods are hay and silage. Though, silage making is not a common practice in the semi-arid regions, yet it is a viable option for conserving succulent feeds (Muhammad *et. al.,* 2008). Ensilage permits conservation of quality forages during wet-humid condition, which is practically impossible for hay making, at best, secured feed against combustion, rodent destructions and re-growth following harvesting will provides additional feeds for *in*

Received on 24th April, 2024; Revised on 13th July, 2024; Accepted on 11th August, 2024 and Published on 30th August, 2024

situ grazing and or haymaking (Kallah *et. al*., 1997). Previous studies showed that tropical grasses are not suitable silage materials due to poor nutrient content while legumes was noted with low level of water soluble carbohydrates (WSC) and higher buffering capacity which render their proteins susceptible to proteolysis (Wilkins, 2001; Lattemae and Tamm, 2002). Incorporation of legumes with grasses for ensilage will reduce buffering capacity, prevent proteolysis and improve nutritional quality of the resultant silages (Baba *et al.,* 2016), the deficiency of protein in cereals and the absence of carbohydrate in legumes are thus overcome (Muhammad *et. al.*, 2008). The aim of the experiment was to determine the most suitable combination of gamba grass with either alysicarpus or cowpea legume forages for better silage production and to establish optimum inclusion level for incorporation with gamba grass for ensilage.

Materials and Methods

Experimental Site: The study was conducted at Teaching and Research Farm, Faculty of Agriculture, Bayero University, Kano. Kano is situated between latitude 11^o 59″N and longitude 8^o 36″E at an altitude of 460m above sea level. The climate is characterized by a well-defined wet season (May to September) and dry season (October to April). The mean annual rainfall varies from 600 to 1000 mm (KNARDA, 2001).

Silage preparation: Field grown gamba grass (*Andropogon gayanus* Kunth.) was sampled at full inflorescence; whole plants were harvested 10 cm above the ground level while cowpea *(Vigna unguiculata* L.*)* and alysicarpus (*Alysicarpus vaginalis* L.) were sampled at flowering to early pod stages with over 90% fresh leaves. The harvested forages were separately chopped to 1 to 2 cm length and mixed as follows: 100% gamba grass (GG), 80% GG + 20% cowpea (CW), 60%GG + 40%CW, 40%GG + 60%CW, 80%GG + 20% alysicarpus (AL), 60%GG + 40% AL and 40%GG + 60%AL and designated as GG, GGCW20, GGCW40, GGCW60, GGAL20, GGAL40 and GGAL60 respectively. Each of the treatment combination was compressed in laboratory silos in three replicates. The lid of the silos were greased and screwed back tightly to provide anaerobic condition suitable for fermentation and kept at room temperature for 21 days. Thereafter, the silos were opened and the content from the first 3cm were scooped to safeguard possible contamination of the grease used as air sealant. The contents were then scored by three independent scorers for colour and aroma on a subjective scale of 1 to 4 (Table 1) (Muhammad *et. al*., 2008) and pH determined using digital pH meter. Sample from each replicates were collected, oven dried at 60^{0}C for 48 hours and milled to pass 1mm sieve for later chemical analysis.

Chemical and Statistical Analysis: The procedures outlined by AOAC (1999) was used for proximate analysis, fiber fractions was determined as described by Van Soest *et al.,* (1991), Organic matter (OM) was calculated as difference between dry matter (DM) and ash. Metabolizable energy (ME) was estimated using the equation (%ME = 36 * %CP + 81.8 * %EE + 35.5 * %NFE) (Pauzenga, 1985), dry matter intake (DMI = 120 / %NDF) and digestible dry matter [DDM= 88.9 - (0.779 * % ADF)] according to (Jeranyama and Garcia, 2004) and total digestible nutrients [TDN= (-1.291 * ADF) + 101.35] and relative feed value (RFV= % DDM * % DMI *0.775) according to Kocer and Albayraks (2012). The data collected were analyzed using the General Linear Model of Statistical Analytical System (SAS, 1999-2000) package. Differences between means were considered significant at 0.05 level of significance.

Results and Discussion

Silage characteristics: Colour, Aroma and pH of the resultant silages were presented in Table 2. The compounded silages were pale yellow, sweet and moderately acidic (4.58 – 3.68). Inclusion of cowpea with gamba grass had higher impact on silage pH compared to alysicarpus forage (Table 2). Higher (3.68) and lower (4.41) pH values were recorded from GGCW60 and GGCW20 treatments respectively.

Proximate composition: The proximate composition of the resultant silages were presented in Table 3. There were no significant (P>0.05) difference in DM concentration. However, sole gamba treatment (GG) had the higher DM with corresponding lower values from GGAL60 treatment. Ash contents varied (P<0.05) significantly from 4.62 to 5.48%. Treatment combination that had GGAL60 had higher ash contents with corresponding lower value from GG treatment. Other variations among other treatments were comparable (P>0.05). The %CP varied significantly (P<0.05) from 9.84 to 12.19%. Significant (P<0.05) higher CP was recorded in GGCW60 treatment. Sole gamba treatment had the least CP value. Crude fiber (CF) varied significantly (P<0.05) from 22.10 – 30.14%. Sole gamba grass (GG) silage had significantly higher CF, however, comparable (P>0.05) to GGCW20. The least CF was noted from GGAL60. The percentage EE differed significantly ranging 1.05 to 2. 17 with higher values observed in GGCW60 and the least in GG. Other variation were statistically (P>0.05) comparable. The variations in %NFE ranged from 52.95 to 60.65%. Significant higher NFE was observed in GGAL40 while the least NFE was recorded in GG treatment however, comparable (P>0.05) to GGCW20, GGCW40, GGCW60 and GGAL20 treatments**.**

Fiber Fractions, Organic Matter and Energy Concentrations of Gamba grass (name)-Alysicarpus / Cowpea legume forages silage: Neutral detergent fiber (NDF), Acid detergent fiber (ADF), Organic matter (OM) and Metabolizable energy (ME) ($MJkg^{-1}$) of gamba grass silages fortified with graded level of cowpea and alysicarpus legumes were presented in Table 4. Percent OM revealed significant variations among the treatments evaluated, the disparities were from 89.08 to 91.89%. Sole GG silage had higher (P<0.05) OM content however, statistically comparable (p>0.05) to GGAL20 and GGCW20. The least OM content was recorded in GGAL60. The treatments varied (P<0.05) in NDF concentration. Sole GG treatment had higher NDF contents and was comparable (p>0.05) to GGAL20. Variations among other treatments were comparable (p>0.05). Acid detergent fiber varied from 45.75% to 53.21%. Statistically (P<0.05) higher ADF value was noted from GG and GGCW20 treatments with corresponding lower values in GGAL60. The ME ($MJkg^{-1}$) ranges from 15.46 to 18.76. Mixture of GGCW60 had significant highest (p<0.05) ME value compared to other treatments. Variations among other treatments were comparable (p>0.05).

Digestible matter, Dry matter intake and Reference feed value of Gamba grass-Legume silage: Shown in Table 5 were Total digestible nutrient (TDN), Digestible dry matter (DDM), Dry matter intake (DMI) and Reference feed value (RFV). The results indicated that the TDN varied significantly (p<0.05) among the treatments evaluated. Significantly (p<0.05) higher TDN were recorded in GGCW60 treatment and corresponding lower value from GG and GGAL20 treatments. There was no statistical variation in DDM contents however, higher and lower values were observed from GGCW40 and GG treatments respectively. The Dry matter intake varied from 53.24% to 47.45% with GGCW60 treatment being significantly higher (DMI) but comparable (p>0.05) to GGCW40 treatment. The least DMI values were recorded in GG and GGAL20. The resultant silage differed statistically (p<0.05) for Reference feed value (RFV). The variation ranged from 84.63% in GGCW60 treatment to 69.06% GG treatment. Variations among other treatments were comparable (p>0.05).

Yield and rate of dry matter (DM) accumulation of forage per unit area, rate of DM accumulation at ensiling and the quality of the resultant silages were among the determining factors of forage suitability for ensilage. The silage quality is judged by its physical characteristics and its nutritional contents (Penn State Extension, 2014). The favourable colour, aroma and moderate acidity of the resultant silages are indices for good quality silages. A mixture of grasses and legumes resulted in silages with moderate pH, fine texture, good aroma and higher quality compared to sole Gamba silage. This finding is consistent with report of Ridwan *et al.*, (2015) and Abdulrahaman *et. al.*, (2018). The essence of legumes incorporation for ensilage is to supply N-protein for microbial protein synthesis, reduce protein degradation in the rumen and enhance amino acid absorption in the intestinal tract (Ridwan *et al.* 2015). According to Steurm *et al.*, (2007), mixture of grasses and legumes in ruminant feed is very effective for a highly nutritive diet. Increased legume level regardless of the specie improved

CP, Ash, EE, NFE, ME, TDN, DDM, DMI and RFV values with corresponding decline in CF, NDF and ADF. These could be attributed to higher nutrients and palatability of legumes compared to grasses. The results revealed that gamba grass silage fortified with cowpea legume had higher EE, CP, ME, TDN, DDM, DMI and RFV compared to alysicarpus treatments which could be due to inherent differences between in nutrients in the forages. This finding agreed with the report of Muhammad *et al.,* (2008), Ahmad *et al,* (2012), Ahmad (2018), Baba *et. al.,* (2016), Copani *et. al.,* (2016) and Abdurrahaman *et. al,* (2018) who reported higher nutritive value, palatability and digestibility of mixed grass-legume silages compared to sole grass silages. Fibre is the slowly digestible or indigestible feed component, typically the structural portions of the plant that give it support.

Crude fibre is a gross estimate of the energy content of feed. The higher the CF, the lower the digestible energy, (Marchen, 2011). Higher NDF negatively influence voluntary feed intake, as it is negatively correlated to DMI which may affect TDN and RFV (Horrocks and Vallentine, 1999). The decline in NDF observed could be due to hydrolysis of hemicelluloses to monosaccharide that provides additional sugars for lactic acid production during ensiling. This decline observed were in agreement with the report of Muhammad *et. al.,* (2009), Ahmad *et. al.,* (2012), Ridwan *et. al.,* (2015), Baba *et. al.,* (2016), Copani *et. al.,* (2016), Ahmad (2018), and Abdulrahaman *et. al.,* (2018). However, the NDF noted in the present study meets the minimum requirement for normal physiological function of the rumen. The CP value recorded for all the treatments evaluated was above 7% minimum requirement desirable for good rumen fermentation (Rego, *et. al*., 2010) and meets gestation and lactation requirements of matured goat (Yami, 2008). Metabolizable energy is the energy for maintenance and production. The percentage ME differed significantly from 15.46 – 18.76. Higher ME% was recorded from GGCW60 treatment, variations among other treatments were comparable ($p>0.05$). The metabolizable energy of the resultant silages were above the daily maintenance requirement of 50_kg pregnant goat (Yami, 2008), satisfied the daily requirement of cow at 6 – 8 months pregnancy (Moran, 2005) and maintenance requirement of 800_kg cow (Herdt, 2018). Dry matter intake is the amount of feed an animal consumed per day on dry matter basis. It is a factor that must be estimated before an animal's diet can be properly calculated; the DMI needed to meet the energy requirements is determined by the physiological stage and depends on the energy density of the diet. For a specific diet offered ad-libitum, current DMI is equivalent to the amount that meets the daily energy requirements or that completely fills the alimentary tract whichever is reached first (Martinez-Marin *et. al.*,2012). Nevertheless, DMI of growing goats can be reached when the ME content of the diet is about 12.55 MJ/kg DM. The RFV is a predictor of forage intake and energy value (Lithourgidis *et. al.,* 2006). With the exception of sole GG, GGCW20 and GGAL20 treatments, other treatments satisfied 75% minimum RFV value as a yardstick for its acceptance (Kocer and Albayrak, 2012).

Conclusion

The use of legume forages for conserving grasses as silage had significant effects on the nutritional quality of the resultant silages. Mixing gamba grass and legume forages at 40:60 ratios had higher nutritional value and digestibility. Cowpea forage is more compatible with gamba grass and 60% inclusion is recommended for large scale production. Further research focusing feeding trial and mineral analysis were also recommended to validate voluntary intake, animal performance and mineral composition of such silages.

Declaration of Competing Interest

The authors have no relevant financial or non-financial interests to disclose

References

Abdurrahaman, S. L., Dahiru, M., Salisu, I. B., Gumel, I. A., Ahmad, M. Y. and Muhammad, I. R. (2018). Effects of Inclusion Levels of Tropical Legumes on Ensiling Quality of Irrigated *Andropogon gayanus. Nigerian Journal of Applied Animal Science.* 1 (1):67 – 74

Abubakar, M., Adegbola, T.A., Abubakar, M.M.

and Shehu, Y. (2010). Nitrogen Balance of Dry Season Grazing by Yankasa Sheep Supplemented with Different Nitrogen Sources. Proceeding of the 24th Annual National Conference of Farm Management Association of Nigeria. 11th- 14th, October, 2010. Pp 229-231.

Ahmad, M.Y. (2018). Effects of Alysicarpus (*Alysicarpus vaginalis* L (DC.)) Inclusion on the Ensiling Quality of Three Tropical Grasses. *Dutse Journal of Agriculture and Food Security*. 8 (2). Pp 218 – 227

Ahmad, M.Y., Muhammad I.R. and Abdurrahaman, S. L. (2012). Enhancement of the Ensiling Quality of Pearl Millet (*Pennesetum typhoides* Burm. F.) with Different Proportion of Groundnut (Arachis hypogea. L.) Forages. Proceeding of the 17th Annual Conference of the Animal Science Association of Nigeria. 9th-13th September, 2012 Held at Abuja. Pp.599-602.

AOAC, Association of Official Analytical Chemists (1999). Official Methods of Analysis of the Association of Official Analytical Chemists. 14th Edn. Washington D.C., USA, Pp: 1094

Baba, M., Gumel. I. A. and Muhammad, I. R. (2016). Productivity and Nutritive Value of Three Grass-Legume Mixtures in the Sudan Savannah Zone Kano State, Nigeria. *Bulletin of Animal Health and Production in Africa.* 64 (3): 273-279

Copani, G., Niderkorn, V., Anglard, F., Quereuil, A. and Ginane, C. (2016). Silages Containing Bioactive Forage Legumes: a Promising Protein-rich Feed Source for Growing Lambs. *Grass and Forage Science*, 71, 622–631

Herdt, H. T. (2018). Nutritional Requirements of Dairy Cattle. MSD Veterinary Manual.

Horrocks, R.D. and Vallentine, J.F. (1999). Harvested Forages. Academic Press, London, UK 439 pp. www.worldcat.org/title/dairy-nutrition-management/oclc/24090052.

Jeranyama, P. and Garcia, A.D., (2004). "Understanding Relative Feed Value (RFV) and Relative Forage Quality (RFQ)". Extension Extra. Paper 352. http://openprairie.sdstate.edu/extension_extra/352.

Kallah, M.S., Baba, M., Alawa, J.P., Muhammad, I.R. and Tanko, R.J. (1997). Ensiling Quality of Columbus Grass (*Sorghum almum)* Grown in the Northern Nigeria. *Animal Feed Science and Techno*logy. 68: 153 – 163.

Kano Agricultural and Rural Development Authority; KNARDA, (2001). Meteorological Station Reports**:** Temperature Record Book and Management Unit. 11: 1-3

Kocer, A. and Albayraks S. (2012). Determination of Forage Yield and Quality of PEA (Pisum sativum L.) Mixtures with Oat and Barley. *Turkish Journal of Field Crops*. 17(1):96-99

Lattemae. P and Tamm, U. (2002). Influence of Different Alfalfa-Grass Mixtures and the use of Additives on Nutritive Value and Fermentation of Silage. The Estonian Research Institute of Agriculture, 75501 Saku, Estonia.

Lithourgidis, A.S., Vasilakoglou, I.B., Dhima, K.V., Dordas, C.A. and Yiakoulaki, M.D. (2006). Forage Yield and Quality of Common Vetch Mixtures with Oat and Triticale in two Seeding Ratios, *Field Crops Res*. 99, 106-113.

Marchen, R. (2011). Goat Nutrition-Energy: Texas Agricultural Extension Service. Small Ruminant Series. ASWeb-078

Martínez-Marín, A.L., Pérez-Hernández, M., Pérez-Alba, L.M., Carrión-Pardo, D. and Gómez-Castro, A. G. (2012). Nutrient Limits in Diets for Growing Dairy Goats. *Arch Med Vet* 44, 13-20

Muhammad, I. R., Abdu, M. I., Iyeghe-Erakpotobor, G. T. and Sulaiman, K. A. (2009). Ensiling Quality of Gamba fortified with Tropical Legumes and its Preference by Rabbits. Research *Journal of Applied Sciences* 4(1): 20-25.

Muhammad, I. R., Baba, M., Mustapha, A, Ahmad, M. Y. and Abdurrahman, L. S. (2008): *Use of Legume in the Improvement of Silage Quality of Columbus Grass (Sorghum almum* Parodi.*).* Research Journal of Animal Science 2(4): 109-112.

Owen, M, Maasdorp, B. and Titterton, M. (2010). Dry Season Feeding of Smallholder

Livestock Forage Conserved as Silage. http://www.lpp.uk.com. Pp. 1-2

Pauzenga, U. (1985). Feeding Parent Stock. *Zootecnica Internation.* Pp. 22-24

Penn State Extension (2014). Agronomic Facts 30. Forage Quality in Perspective. Pp 1 - 4

Rêgo, M.M.T., Neiva, J.N.M., do Rêgo, A.C., Cândido, M.J.D., Carneiro, M.S.S., and Lôbo. R.N.B. (2010). Chemical and Bromatological Characteristics of Elephant Grass Silages with the Addition of Dried Cashew Stalk. R. Bras. Zootec. vol.39 no.2 Viçosa

Ridwan, R., Rusmana, I., Widyastuti, Y., Wiryawan, K. G., Prasetya, B., Sakamoto, M., and Ohkuma, M. (2015) Fermentation Characteristics and Microbial Diversity of Tropical Grass-legumes Silages. *Asian Australian Journal of Animal Science*. Vol. 28, No. 4: 511 – 518. http://dx.doi.rg/10.5713/ajas014.0622

SAS (1999-2000). Statistical Analysis System SAS/STAT. Guide for Personal Computers, Cary N.C, USA, pp. 965-978.

Steurm, C.D., Tiemann, T.T., Lascano, C.E., Kreuzer, M. and Hess, H.D. (2007). Nutrient Composition and *in vitro* Ruminal Fermentation of Tropical Legume Mixtures with Contrasting Tannin Contents. *Animal Feed Science and Technology*, 138:29–46.

Van Soest, P.S., Robertson, J.B. and Lewis, B.A. (1991). Methods of Dietary Fiber, Neutral Detergent Fiber and Non-Starch Polysaccharides in Relation to Animal Nutrition. *Journal of Dairy Science*, 74: 3583-3597.

Wilkins, R.J. (2001). Legume Silages for Animal Production: Increasing Profits with Forage Legumes. Proceedings FAL Agricultural Research Special Issue Held at a Workshop in Braunschweig in July 2001. Christian Paul, Institute of Crop and Grassland Science, FAL, Bundesallee 50, D-38116 Braunschweig, Germany

Yami, A. (2008). Nutrition and Feeding of Sheep and Goats. In Yami, A. and Merkel, R.C .(Eds.). Sheep and Goat Production Handbook for Ethiopia. **(**Pp 347) Produced by Ethiopia Sheep and Goat Productivity Improvement Program (*ESGPIP*). https://issuu.com/**esgpip**/docs/**esgpip**_sheep_and_goat_handbook

Table 1: Description of colour and aroma rating used as indices of silage quality

Rating	Colour	Aroma
1	Dark or deep brown	Putrid or rancid
2	Light brown	Pleasant
3	Pale yellow	Sweet
4	Yellowish green	Very sweet

Muhammad *et al,* (2018)

Table 2. Physical characteristics and pH of mixed gamba-legume silages

Treatment	Colour	Aroma	pH
GG	3	3	4.38
GGCW20	3	3	4.41
GGCW40	3	3	3.84
GGCW60	3	3	3.68
GGAL20	3	3	4.04
GGAL40	3	3	4.29
GGAL60	3	3	4.31

GG = gamba grass, GGCW = gamba grass + cowpea, GGAL = gamba grass + alysicarpus, 20, 40 and 60 = legume inclusion levels

Table 3: Proximate composition (%) of gamba grass silages with cowpea or alysicarpus legume

Treatment	DM	ASH	CP	CF	EE	NFE
GG	96.54	4.65^{b}	9.84^{c}	30.12^{a}	1.05^{c}	52.95^{c}
GGCW20	96.12	5.10^{ab}	10.10^{c}	30.14^{a}	1.71^{ab}	53.31^{c}
GGCW40	95.41	4.75^{b}	11.94^{ab}	27.99^{b}	2.01^{ab}	54.34^{c}
GGCW60	95.33	4.62^{b}	12.19^{a}	25.05^{c}	2.17^{a}	55.97^{abc}
GGAL20	96.12	4.84^{b}	10.00^{c}	28.10^{b}	1.53^{b}	55.53^{bc}
GGAL40	95.96	5.17^{ab}	10.21^{bc}	22.25^{d}	1.72^{ab}	60.65^{a}
GGAL60	94.56	5.48^{a}	11.15^{b}	22.10^{d}	1.89^{ab}	59.38^{ab}
SEM	2.00	0.50	1.00	2.00	0.50	5.00

Means with different letter superscripts within the same column differ significantly ($P<0.05$).

Table 4: Effects of legume on organic matter (%), fiber fractions (%) and metabolizable energy ($MJkg^{-1}$) gamba grass silages

Treatment	OM	NDF	ADF	ME
GG	91.89^{a}	63.40^{a}	53.21^{a}	15.46^{b}
GGCW20	91.02^{ab}	59.85^{b}	53.21^{a}	15.59^{b}
GGCW40	90.66^{b}	59.72^{b}	51.67^{ab}	15.61^{b}
GGCW60	90.71^{b}	59.80^{b}	49.45^{bc}	18.76^{a}
GGAL20	91.28^{a}	62.50^{a}	50.20^{b}	15.56^{b}
GGAL40	90.79^{b}	59.19^{b}	46.60^{cd}	15.58^{b}
GGAL60	89.08^{c}	58.50^{b}	45.78^{d}	15.52^{b}
SEM	1.00	2.00	3.00	2.50

Means with different superscripts within the same column differ significantly ($P<0.05$).

Table 5: Digestible matter, dry matter intake and reference feed value (%) of mixed gamba grass - alysicarpus or cowpea forages

Treatment	TDN	DMI	DDM	RFV
GG	32.66^{cd}	1.89	47.45^{c}	69.60^{d}
GGCW20	36.54^{bc}	1.92	49.80^{b}	74.09^{cd}
GGCW 40	41.19^{a}	2.03	52.64^{a}	82.64^{ab}
GGCW 60	42.25^{a}	2.05	53.24^{a}	84.63^{a}
GBAL20	32.66^{cd}	2.00	47.45^{c}	73.73^{cd}
GBAL40	34.64^{c}	2.00	48.65^{bc}	75.76^{c}
GBAL60	37.51^{b}	2.02	50.38^{b}	78.74^{bc}
SEM	2.00	0.15	2.00	5.50

Means with different letter superscripts within the same column differ significantly ($P<0.05$)