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DRY MATTER YIELD AND NUTRITIVE QUALITY OF NATIVE RANGLAND FORAGES IMPROVED BY STRIP SOWN LEGUME WITH OR WITHOUT FERTILIZER TYPE IN GOMBE STATE, NIGERIA.

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ABSTRACT

Two experiments were conducted to investigate the Dry matter yield and nutritive quality of Native Rangeland forages improved by strip sown legumes with or without fertilizer harvested at early-flowering stage for hay in Gombe State, Nigeria. The result showed that Dry matter yields from the strips sown legume show that the yield was highest in S. hamata/ssp (3.79t DM/ha), both in Late rain season (LRS) and early dry season EDS. The dry matter yield from the native pasture with or without fertilizer were higher in native pasture with NPK (5.59tDM/ ha) in late rain season, the Results of Nutritive value shows no significant differences (P<0.05) in value recorded for dry matter (DM)) across the treatments.There was a significant (P<0.05) difference in crude protein (CP), crude fibre (CF), Ether extract (EE), neutral detergent fibre (NDF), acid detergent fibre (ADF), ash. and Nitrogen free extract (NFE) The content ranges from 6.57 – 11.50%, 1.39 – 2.15%, 28.44 – 35.11%, 51.50 – 59.50%, 38.50 – 47.50% , 4.93 – 13.39%, and 42.11-50.75 respectively. The result showed that total scores for hay physical characteristics were 87, 90, 89 and 90 for Stylosanthes alone, Stylosanthes/ssp, Centrocema alone and Centrocema/spp, respectively.Ranking the legume by their quality, Stylosanthes/ssp, and Centrocema/spp, scored excellent grade, while Stylosanthes alone, andCentrocema alone were scored good with respect to their physical characteristics.Use of Strip sown legumes with or without fertilizer type to rehabilitee range land are hereby recommended for smallholder farmers and livestock owners in the Northern Guinea Savanna of Nigeria.

Key Words: Dry Matter, Nutritive Value, Range Land, Legumes, Fertilizer

1.0 INTRODUCTION

Livestock production has mostly been subsistence oriented and characterized by very low reproductive and production performance; this is due to primarily shortages of quality and quantity of animal feed (Malede, 2013). Ruminant livestock are crucial to

Nigeria's industrial prosperity since they provide other essential resources for the country's growth and development in addition to feeding the country's continually increasing population (Bolaji*et al.,* 2016). In most tropical countries, inadequate supply of feeds is the bottleneck to livestock production. Basically, this is due to the dependence of livestock on naturally available feed resources and little development of forage crops for feeding to animals (Alemu*et al* 2007). The major challenge to livestock production is ensuring adequate feed supply throughout the year in terms of quality and quantity (Kallah. *et al.,* 1997). Increments in fodder production can be achieved by expansion of land areas under natural pastures or by increasing yields per unit land area. With the present trend of competitive land use, increasing forage production through expansion of land area of natural pasture is hardly feasible as a result of the demographic changes *Muhammad and Abubakar (2004)*.In lieu of this, this study was designed to assess the dry matter, proximate composition and physical characteristic of Strip sown legumes and with or without fertilizer type.

2.0 MATERIALS AND METHODS

2.1 Study area

The experiment was conducted in Akko Local Government Area of Gombe State. Its lies on 11°15'North and 10°29'East. It is located in Northern Guinea savannah with annual rainfall ranges between 787 and 960 mm usually between mid May and terminating in late October with a 140 days growing period for arable crops. The annual mean temperature is 38^0C with maximum of 41^0C obtained mostly in April and minimum 5^0C obtained mostly in January GSG (2021).The vegetation is deciduous shrubs with occasional short trees. The ground cover is exclusively annual grasses, legumes with few broad leaves Mohammed *et al* (2015.)

2.2 Forage yield measurement

Strip sown forage legumes within 0.5 m^2 quadrant placed in the middle rows of the Strip were cut at 5 cm above the ground level with a sickle to determine the forage yield at early-flowering stage. The cut forages were immediately weighed to determine fresh weight after which they were oven-dried at a temperature of 65 0^C for 48 h to determine the forage dry matter yields. Forage dry matter yields were calculated using the formula of (Teagasc, 2009) as stated: Forage dry matter yield (kg DM ha-1) = Fresh weight (kg) x Oven dried weight (DM %) × 40,000 There are 40,000 quardrat ($0.5m^{-2}$) per hectare.

2.3 Preparation of Hay for Physical and Chemical Evaluation

Hay making was carried out at early-flowering stage. The harvested fresh forages were spread under the shade of a tree in the field and the cut forages were turned twice daily for effective drying and to maintain the desired green colour.The forage materials were removed from the field when the moisture content was less than 15%, therefore, sub-samples were taken for physical and chemical quality evaluation.

2.4 Physical and Proximate analysis of Hay

Hay physical quality evaluation was carried out according to the Guideline for Visual Evaluation of hay described by (Vough, 2000). Stage of maturity, leafiness (leaf/stem ratio), colour, odour and foreign materials were evaluated by visual scoring. Five people were used for the visual assessment of hay for the strip sown legume with or without fertilizer for the various parameters. An average score for each variable was taken for

each of the strip sown forages with or without fertilizer. The scores from each variable was then added together and a total score was obtained from each forage legumes hay from where the hays were graded as excellent, good, fair and poor. Sub samples were used for proximate analysis using the Method of (AOAC. 2005) while detergent fibre analysis was carried out according to the method described by Van Soest *et al* (1994). Cellulose was calculated as ADF-ADL and hemicelluloses as NDF-ADF, NFE was calculated as 100% - (CP+EE+CF+Ash) (Rinne,*et al* 1997). Nutritive parameters such as Dry matter intake (DMI), Digestible dry matter (DDM)and Relative feed value (RFV) were calculated as follows: DMI = (120 ÷ NDF on dry matter basis), DDM = 88.9 - (0.779 x ADF% dry matter basis), = (DDM% x DMI% x 0.775) (Horrocks and Vallentine, 1999) as applied by Baba *et al.* 2018).

2.5 Data analysis

All data generated were subjected to Analysis of Variance (ANOVA). The general linear model of statistical software was used for the analyses and means were separated using DMRT

3.0 RESULTS AND DISCUSSION

3.1 Dry matter Yield (Dmtha-^{1}) of Native Range Fodder improved with Forage legumes and fertilizer type

Effect of type of fertilizer applied with or without strip sowing of legumes on dry matter yield (dmtha-^{1}) of native range fodder (Table 1) showed the treatments evaluated manifested significant differences ($P<0.05$) in all treatments. Treatment seven (T7) with NPK was statistically ($P<0.05$) superior to other treatments. Pattern of growth yield were sorted by season where no treatments examined show Significant differences ($P>0.05$). Forage yield increased from ERS to LRS and decreased by EDS.Grasses are bulky and contribute to the bulk of feed material, while legume improves the quality of herbage. The dry matter yield obtained in this study for improved strip sown legumes ranges from 1.993 to 3.790 Dmtha-^{1} wasfell within the 3.7 t DM ha-^{1} reported for the same variety (Aberherald) by Frankow-Lindberg, *et al.* (1997),Tekeli and Ateş (2005) in the UK and Turkey for forage legumes. But the value is lower than 7.8 t/ha reported by Hassan, *et al* (2016); Muhammad *et al*2002, 2006). But the result is higher than the value of 1.70 t ha) reported by (Larb i*et al.* 1999). This could be due to species difference, method of sowing, soil fertility, and amount of water, time of cutting and environmental factors (Muhammad *et al* (2002).

Table 1. Dry matter Yield (Dmtha -^{1}) of Native Range Fodder improved with forage legumes and fertilizer type

	Treatments								
Season	T1	T2	T3	T4	T5	T6	T7	SEM	LOS
ERS	2.393^{c}	2.790^{c}	2.369^{c}	2.679^{c}	2.666^{bc}	3.778^{b}	4.343^{b}	0.512	**
LRS	3.626^{b}	3.790^{b}	3.567^{b}	3.061^{bc}	3.126^{bc}	4.004^{b}	5.591^{a}	0.543	**
EDS	2.271^{c}	2.514^{c}	1.993^{c}	2.402^{c}	2.154^{c}	3.442^{bc}	4.704^{b}	0.496	**

a, b, c: Means with different superscript within rows differ **significant (P<0.01), SEM= Standard error of mean, LOS = Level of significance T1= *C. pascuorum* a, T2 = *C. pascuorum* /ssp, T3 = *S.hamata* , T4 = *S.hamata* /ssp, T5= Native range , T6 = Native range /urea, T7 = Native range /NPK , ERS = Early rain season, LRS =Late rain.

3.2 Effect of type of fertilizer applied with or without strip sowing of legumes on chemical Composition (%DM) of native range fodder

Table 2. Presenst the Effect of type of fertilizer applied with or without strip sowing of legumes on chemical composition (% DM) of native range of fodder. The result show that *Treatments T1 (C. pascourum* alone) showed significant variation on the EE content, it also had comparable values with treatment T3 *(S.hamata*), T4 (*S.hamata*/ssp) and T7 (Native range/NPK) regarding CF. Treatment T2 (*C. pascourum* /ssp) recorded the higher crude protein (CP) content of (11.50%). Treatment T4 (*S.hamata* /ssp) had significantly higher NDF compared to other treatments. Treatment T5 (Native range) had significantly higher NFE compared to other treatments. Determination of proximate and fibre constituents of feed give an idea of its feed value. Amongst the treatments evaluated, introduction of legumes with or without fertilizer revealed superior fodder compared to application of inorganic fertilizer. The CP value of 10 – 12 % obtained across the treatments were greater than the bench mark recommended for good rumen function in matured beef cattle of 7 %, yet adequate for maintenance in sheep and Goat as reported by (Wada *et al*., 2016) but would not meet the requirement for high producing dairy cows of 19 % as reported by Sebahattin*et al.* (2011). The application of compound fertilizer NPK into native range was as good as the introduction of the legumes with or without fertilizer. The crude fibre (CF) and its fractions were however lower than the values reported by Hassan *et al.* (2016). The nutrient detergent fibre (NDF) was below 60.0 % suggested by Muia, (2000) as critical limit for good utilization of roughages.

Table 2.Effect of type of fertilizer applied with or without strip sowing of legumes on chemical Composition (%DM) of native range fodder

Parameters	T1	T2	T3	T4	T5	T6	T7	SEM	LOS
DM	98.50^{a}	96.91^{a}	95.92^{a}	94.07^{a}	96.66^{a}	81.55^{a}	97.25^{a}	0.41	NS
CP	10.55^{b}	11.50^{a}	10.44^{b}	10.12^{c}	6.57^{f}	7.78^{e}	8.08^{d}	0.04	**
EE	2.15a	2.03^{b}	1.98^{bc}	1.97^{c}	1.39^{f}	1.72e	1.66e	0.04	**
CF	33.43^{ab}	30.12^{c}	33.34^{ab}	35.11^{a}	28.44^{c}	32.41^{b}	34.73^{a}	0.58	**
NDF	56.50^{bc}	53.50^{d}	58.50^{ab}	59.50^{a}	55.50^{c}	51.50^{d}	57.00^{bc}	0.57	**
ADF	47.50^{a}	45.50^{a}	47.00^{a}	44.50^{b}	39.50^{bc}	38.50^{c}	46.00^{a}	0.66	**
Ash	7.62^{c}	7.15^{c}	7.41^{c}	4.93^{d}	12.82^{b}	13.39^{a}	13.39^{a}	0.16	**
NFE	46.23^{e}	49.15^{b}	46.81^{d}	47.83^{c}	50.75^{a}	44.68^{f}	42.11g	0.03	**
Hemicelluloses	9.0^{f}	8.1^{g}	11.5^{d}	15.1^{b}	16.1^{a}	13.2^{c}	11.1^{e}	0.06	**
DMI	2.06^{a}	2.17^{ab}	2.03^{b}	2.07^{b}	2.17^{ab}	2.28^{a}	2.11^{b}	0.05	**
DDM	51.9^{g}	53.47^{d}	52.29^{f}	54.27^{c}	58.13^{b}	58.81^{b}	53.08^{e}	0.05	**
RFV	85.27^{e}	92.68^{c}	83.12^{g}	84.48^{f}	97.29^{b}	106.5^{a}	86.35^{d}	0.04	**

[a, b, c., d, e, f, g.] means with different subscripts on a row are significantly differently (P<0.05) SEM=standard error of mean; LOS=level of significant, **significant (P<0.05), NS= not significant (P>0.05)T1= *C. pascourum* alone, T2 = *C. pascourum* /ssp, T3 = *S.hamata* alone T4 = *S.hamata* /ssp,T5= Native range,.T6 = Native range/Urea,T7= Native range/NPK.

3.3. The results of physical characteristics of strip sown legume hays harvested at early-flowering stages.

The results show that scores for leafiness were 19 and 20 for *Stylosanthes/ssp and Centrocema/ssp while the score of* 17 and 19 was recorded for *Stylosanthes and Centrocema* alone. There is no difference in scores for colour with recorded 19 and 18 for both treatments. All the forage legumes recorded the same score of 9 for foreign materials and 17 and 18 for odour. The result showed that total scores for hay physical characteristics were 89, 90 87 and 90, for *Centrocema alone* and *Centrocema/spp*, *Stylosanthes alone, Stylosanthes/ssp,* respectively. Ranking the legume by their quality, *Stylosanthes/ssp, andCentrocema/spp*, *scored* excellent grade, while *Stylosanthes alone, andCentrocema alone* were scored Good with respect to their physical characteristics (Vough,2000). Ranking the legume by their quality, the strip sown legume with fertilizer *Stylosanthes/SSP and Centrocema/SSP scored* excellent grades, while the strip sown legumes without fertilizer (*Stylosanthes and Centrocema)* scored good with respect to their physical characteristics (Vough ,2000). In this regard, properly conserved improved strip sown legumes with or without fertilizer at the early-flowering stage were of better qualities.

Table 3. Physical Characteristic of stripsown Legumes hay harvested at flowering stage

	Forage legumes			
Parameters	T1	T2	T3	T4
		Scores		
Stage of harvest	25	25	25	25
Leafness	19	20	17	19
Colour	18	18	19	19
Odour	18	18	19	17
Foreign materials	9	9	9	9
Total scores	89	90	88	90
Remarks	Good	Excellent	Good	Excellent

T1= *C. pascourum* alone, T2 = *C. pascourum* /ssp, T3 = *S.hamata* alone, T4 = *S.hamata* /ssp.
Source: Field survey 2020

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

Legumes have improved the quality of the declining nutritive value of the grass species, the dry matter yield of improved Native pasture across the season was higher at T3 and T7. CP and CF contents was also higher, therefore, improving pasture usingLegumescould be best and effective utilization for livestock production. The quality of the improved fodder is enhanced especially by the legumes component which has the potential to alleviate nutrient deficiencies in poor quality grass,

4.2 Recommendations

Strip sown legumes with or without fertilizer *S.hamata* and *C.pascuorum* in Native Range land (improved pastures) enhances nitrogen content and other chemical constituenst in the forage resources which is essential to promote ruminant production. Government should intervene in rehabilitation of degraded Rangelands and grazing Reserves.

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