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Nutrient Composition of *Stylosanthes hamata* cv Verano Fertilized with Some Animal Manure in Makurdi, Benue State, Nigeria

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Abstract: To supply the soil nutrient requirement for forages to increase their composition that will meet animal needs in Makurdi, Benue State, a study was conducted to know the nutrients that can be added to *Stylosanthes hamata cv Verano* when fertilized using different sources of animal manures available such as poultry droppings, cattle dung, sheep and goats droppings and rabbit faeces, which were arranged in a complete randomized designed (CRD). In this trial there were significant differences between the fertilized plots and the control, the fertilized plots recorded the highest values expect for ash and NDF and where T_0 recorded more values than the fertilized treatments. The DM ranged from 92.20% to 93.49%, ash recorded between 5.61% to 6.07%, EE ranged from 7.07% to 11.47%, CF from 36.09% to 45.06%, CP varied between 9.06% to 15.19%, P values ranged from 1.97% to 3.12%, Na recorded 0.18% to 0.40%, Ca ranged from 0.97% to 1.31%, Mg 0.07% to 0.08% and K was between -0.29 to 0.31%. Rabbit faeces [T_4] is recommended for fertilization of forages at Makurdi, in Benue State of Nigeria.

Keywords: Nutrient Composition, *Stylosanthes hamata* cv Verano, Animal Manure, Benue State

1. Introduction

The use of inorganic fertilizer has not been helpful under intensive agriculture because it is often associated with reduced crop yield, soil acidity, nutrient imbalance; it's also scare and expensive for the farmers to purchase [3]. Most nutrients are sometimes naturally supplied to plant by the soil. However, some nutrient like Nitrogen, Phosphorus and Potassium are often limiting if the soil is deficient. It may be necessary to add these nutrients through an application of manure, chemical fertilizer, or by seeding legumes to fix Nitrogen [4].

Green pasture supplies animals with all the necessary nutrition and energy. By grazing lush grassland, they take in adequate protein, energy, vitamins and minerals (unless soils are very low in certain important trace minerals). An exception may be early spring grass just starting to grow making fast growth in which plants have high water content and lower percentage of actual nutrients by weight and volume [2]. Hitherto *Stylosanthes hamata* cv Verano a genus of flowering plants in the legume family, which is characterized by trifoliate leaves and small yellow flowers, [1]. Species may be annual or perennial and the nutrients composition is improved favorably when fertilized. Once established it can produce between 10 and 17 t DM/ha in pure stands under favorable conditions; like other legumes, is a valuable fodder for providing protein to livestock fed grasses or low-protein feeds.

2. Materials and Method

This study was conducted using four different manures and the control viz, treatment zero [T_0] - control, treatment one [T_1] - poultry droppings, treatment two [T_2] - cattle dung, treatment three [T_3] - sheep and goat droppings and treatment four [T_4] - rabbit faeces. The forage legume *Stylosanthes hamata* cv Verano was obtained from the National Animal Production Research Institute (NAPRI) Ahmadu Bello University, Shika near Zaria. In August when rainfall was

fully established, the seeds were sown measuring 1.50 x 2.0m. Thus, the layout was a 5 treatment with 3 replication each laid out in a complete randomized design (CRD). At harvest sub-samples of the fresh herbage were oven dried at 80°C and analyzed.

3. Result

3.1. Proximate, Neutral Detergent Fiber and Acid Detergent Fiber Composition of *Stylosanthes hamata* cv Verano

The result of the proximate composition, neutral detergent fiber and acid detergent fiber of *S. hamata* cv Verano is presented in Table 1. The percent DM varied from 93.49% in T_4 to 92.20% in T_2. The highest value recorded was in treatment four (T_4)(93.49%) which was significantly ($P<0.05$) different from the remaining four treatments observed. Treatment T_1 had the second highest percent DM but it was not significantly ($P>0.05$) different from the remaining three treatments.

The percent ash ranged between 6.07% (T_0) to 5.61% (T_4). The highest was the control treatment (T_0) which was significantly ($P<0.05$) different from the remaining four treatments. It was followed by treatment three (T_3) which had 5.88% ash content that was significantly ($P<0.05$) different from the remaining three treatments. Treatment one (T_1) recorded the third highest in ash value that was also significantly ($P<0.05$) different from T_2 and T_4. It was noted that there was not significant ($P>0.05$) difference between T_2 and T_4.

Table 1. *Effect of Four Types of Animal Manure on Proximate, Neutral Detergent Fiber and Acid Detergent Fiber Composition of S. hamata* cv Verano.

Treatments	DM	Ash	EE	CF	CP	NDF	ADF
T_0	92.54^{b}	6.07^{a}	10.02^{c}	36.09^{c}	12.00^{d}	41.64^{a}	30.58
T_1	92.57^{b}	5.72^{c}	$9..61^{d}$	42.70^{b}	15.19^{a}	38.25^{bc}	27.84
T_2	92.20^{b}	5.63^{d}	11.47^{a}	45.06^{a}	15.06^{b}	40.03^{ab}	28.25
T_3	92.47^{b}	5.88^{b}	11.33^{b}	42.74^{b}	14.69^{c}	32.62^{d}	31.73
T_4	92.49^{a}	5.61^{d}	7.07^{e}	42.59^{b}	9.06^{e}	36.25^{c}	23.35
SEM	0.79	0.027	0.05	0.10	0.07	1.59	5.50^{ns}

a, b, c, d, e Means in column with different superscript(s) are significantly different at the 5% level of probability
T_0- soil without animal manure
T_1- soil fertilized with poultry droppings
T_2- soil fertilized with cattle dung
T_3- soil fertilized with sheep and goat droppings
T_4- soil fertilized with rabbit faeces

The results obtained in percent ether extract varied from 11.47% in T_2 to 7.07% in T_4. It was observed that treatment T_2 had the highest EE of 11.47% that was significantly ($P<0.05$) different from the remaining four treatments. The second highest observed was T_3 with EE of 11.3% that was significantly ($P<0.05$) different from the remaining three treatments also. The control had the value of 10.02% which was the third highest observed which was also significantly ($P<0.05$) different from the value of treatment T_1 and T_4. Treatment T_1 and T_4 were not significantly ($P<0.05$) different from each other with EE value of 9.61% and 7.07%, respectively.

The ranged of percent CF in was from 45.06% in T_2 to 36.09% in T_0. It was observed that treatment T_2 was the highest in CF with 45.06% that was significantly ($P<0.05$) different from the remaining four treatments. The second highest recorded value was T_3 (42.74%) which was not significantly ($P>0.05$) different from T_1 (42.70%) and T_4 (42.59%) but it was observed that the three values were significantly ($P<0.05$) different from the control T_0 (36.09%).

The variation in CP content ranged from 15.19% (T_1) to 9.06% (T_4). The highest CP content was recorded in treatment T_1 which had 15.19% whichwas significantly ($P<0.05$) different from the remaining four treatments observed. The second highest values was noted in treatment T_2 with 15.06% CP that was significantly ($P<0.05$) different from the remaining three treatments values, it was followed by treatment T_3 as the third highest treatment with CP of 14.69% which was significantly ($P<0.05$) different from the T_0 and T_4. It was noted that percent CP in the control treatment 12.00% was also significantly ($P<0.05$) different from T_4 (9.06%).

The NDF varied from 41.64% (T_0) to 32.62% (T_3). The control treatment (T_0) with 41.64% recorded the highest NDF value which was not significantly ($P>0.05$) different from the NDF found in T_2 but was significantly ($P<0.05$) different from the remaining three treatments. The second highest was T_2 with NDF value of 40.03% that showed no significant ($P>0.05$) difference from T_1 (38.25%) but was seen to be significantly different ($P<0.05$) from T_4 and T_3. Treatment T_1 was the third highest value recorded but it was not significantly ($P>0.05$) different from T_4 but it was significantly ($P<0.05$) different from T_3. The NDF found in treatment T_4 (36.25%) was significantly ($P<0.05$) different from T_3 which recorded the least values.

The ADF ranged from 31.73% in T_3 to 23.35% in T_4. The highest recorded value was treatment T_3 with 31.73% ADF percent which was not significantly ($P>0.05$) different from the values of the remaining four treatments T_0 (30.58%), T_2 (28.25%), T_1 (27.84%) and T_4 (23.35%).

3.2. Mineral Content of *Stylosanthes hamata* cv Verano

The result of the percent mineral content of *S. hamata* cv

Verano is presented in Table 2.

The phosphorus percent ranged from 3.12% in T_4 to 1.97% in T_3. It noted that treatment four (T_4) was the highest with 3.12% of phosphorus which was significantly ($P<0.05$) different from the remaining four treatments. It was observed that treatment T_2 was the next with 2.41% that was not significantly ($P>0.05$) different from T_0 and T_1 but was significantly ($P<0.05$) different from T_3. The control treatment was the third highest value with 2.31% phosphorus which was not significantly ($P>0.05$) different from T_1 but was it significantly ($P<0.05$) different from T_3. It was also observed that there was no significant ($P<0.05$) difference between T_1 (2.17%) and T_3 (1.97%).

The sodium percent found varied from 0.40% (T_1) to 0.13% (T_2). The sodium in treatment T_1 had the highest value of 0.40% which was significantly ($P<0.05$) different from the remaining four treatments. Treatment T_4 recorded the second highest sodium value with 0.33% that showed no significant ($P>0.05$) difference from T_0 but it was observed to be significantly ($P<0.05$) different from the remaining two treatments. The third noted value was in treatment T_0 (0.31%) which was significantly ($P<0.05$) different from T_3 and T_2. The sodium found in treatment T_3 0.18% was seen to be significantly ($P<0.05$) different from T_2 (0.13%).

Table 2. *Effect of Four Types of Animal Manure on Percent Mineral Content of S. hamata* cv Verano.

Treatment	P	Na	Ca	Mg	K
T_0	2.31^{b}	0.31^{b}	1.06^{d}	0.08^{ab}	-0.01^{d}
T_1	2.17^{bc}	0.40^{a}	1.19^{c}	0.07^{c}	0.13^{c}
T_2	2.41^{b}	0.13^{d}	0.97^{e}	0.08^{a}	0.29^{b}
T_3	1.97^{c}	0.18^{c}	1.31^{a}	0.07^{bc}	-0.29^{e}
T_4	3.12^{a}	0.33^{b}	1.23^{b}	0.08^{a}	0.31^{a}
SEM	0.17	0.01	0.0	0.004	0.01

a, b, c, d, e Means in column with different superscript(s) are significantly different at the 5% level of probability
T_0- soil without animal manure
T_1- soil fertilized with poultry droppings
T_2- soil fertilized with cattle dung
T_3- soil with fertilized sheep and goat droppings
T_4- soil fertilized with rabbit faeces

It was observed that the calcium percent ranged from 1.31% in T_3 to 0.97% in T_2. The highest noted was treatment T_3 (1.31%) which was significantly ($P<0.05$) different from the remaining four treatments. It was observed that T_4 was the second value with 1.23% calcium content that was significantly ($P<0.05$) different from the remaining three treatments.

It was followed byT_1 with 1.19% which was significantly ($P<0.05$) different from T_0 and T_2. The calcium percent in T_0 (1.06%) was significantly ($P<0.05$) different from T_2 (0.97%).

It was observed that the magnesium percent found varied from 0.08% to 0.07% in T_4 and T_1, respectively. It was observed that treatment T_4 had the highest notable value among the treatments with 0.08% which was not significantly ($P>0.05$) different from T_2 and T_0 but it was significantly ($P<0.05$) different from the remaining two treatments. The second recorded value was T_2 (0.08%) which was not significantly ($P>0.05$) different from T_0 but was significantly different from the remaining two treatments. The control (T_0) was the third highest observed with the value of (0.08%) that was not significantly ($P>0.05$) different from T_3 but it was significantly ($P<0.05$) different from T_1. It was finally observed that T_3 (0.07%) was higher in magnesium level than T_1 with (0.07%) but there was no significant ($P>0.05$) difference between them.

The potassium percent was ranging from 0.03% in T_4 to -0.29% in T_3. Treatment four (T_4) recorded the highest value of 0.03% which was significantly ($P<0.05$) different from the remaining four treatments. Treatment T_2 recorded the second highest potassium content of 0.29% which was significantly ($P<0.05$) different from the remaining three treatments. It was observed that T_1 recorded the third highest value with 0.13% potassium content that was significantly ($P<0.05$) different from T_4 and T_3. It was also observed that there was significant ($P<0.05$) difference between T_0 and T_3.

4. Discussion

Percent dry matter was high in T_4 than other treatments and this agrees with the works of [5] which recorded highest% DM in treatment fertilized with rabbit faeces on *Centrosema pascuorum* and with the findings of Hamdy *et al*. [6] who results revealed that application of FYM and N fertilizer as alone or in combinations significantly ($P>0.05$) increases forage DM% of sorghum.

The ash percent decrease with increase level of N, P, K, the control had the highest content which could be as a result of age at harvest and the fertilizer applied. This is in-line with the work of [7] reported a higher ash content of *clitoria* in control than treatments that were applied fertilizer.

The EE percent in the treatment fertilized with cattle dung was higher than other treatments which is in agreement with the findings of Mohan *et al*. [8] which noted maximum (2.12%) and minimum (1.01%) EE content of teosinte fodder was recorded with the application of 160 kg N ha-1 and control respectively.

The CF percent observed was highest in treatment T_2 and was higher in some of the fertilized treatments than the control which could be as a result of the availability of nitrogen in the manure, this work agrees with the findings of [9] recorded maximum percent crude fiber in forage oat fertilized with inorganic and organic fertilizer than the control treatment and also with the works of [10] recorded maximum value of (32.06%) crude fiber on forage sorghum with fertilizer than the control.

In this study it was observed that the highest CP percent was recorded from poultry droppings with 15.19%. This work is similar with the findings of [5] which reported that crude protein content increased when *Centrosema pascuorum* was fertilized with animal manure. The CP percent is within the range for small ruminants as recommended by [11] which is 9%-16% varying for growth, pregnancy, lactation and maintenance.

The control recorded the highest value in NDF contentthan the fertilized treatments and this is in agreement with the works of [7] reported a higher NDF content of *clitoria* in control than treatments that were applied fertilizer. [8] also reported that NDF content decreased with nitrogen application.

There is no significant difference (P>0.05) in the ADF percent in all the treatments. This is in agreement with the work of [12] reported that the effect of phosphorus and nitrogen fertilization on ADF content of jumbo grass was non-significant (P>0.05). The findings in this study is in contrast with the works of [7] which reported a higher ADF content of *clitoria* in control than treatments that were applied fertilizer.

The phosphorus percent of the legume was increased substantially by fertilizer application, this agrees with the works of [13] on alfalfa fertilized and [14] reported that phosphorus content was highest in amaranths with NPK treatment than the control [15]. The phosphorus content of forages in almost all the treatments exceeded the critical level varying for growth, pregnancy, lactation and maintenance of ruminants [16].

The sodium percent was higher in treatments which are richer in NPK content. [17] reported that sodium fertilizers will increase the Na content of forages which will improve the palatability of herbage and may reduce the chance of forage staggers. This work is in contrast with the study of [18] reported that organic fertilization didn't influence the forage Na content of permanent meadow.

The calcium percent was higher in fertilized treatments. This is similar with the findings of [14] reported that calcium content was highest in amaranths with NPK treatment than the control. This finding is in contrast with the works of [5] which reported that the calcium (Ca) content of *Cenrosema pascuorum* was higher in the control than the fertilized treatments. The Ca percent of the all the forages are higher than the level for growth, lactation, pregnant and maintenance of ruminants 0.18%-0.55% [16].

Magnesium percentage of the forage was not significantly affected by the application of animal manure. This agrees with the findings of [19] who reported that Mg content of forage decreased significantly when P dose increased from 0 to 11 kg/ ha in clover dominant meadow. This disagrees with the work of [20] who observed N fertilization increased forage Mg in midland Bermuda grass than the control treatment.

The potassium percent decreased with the application of fertilizer. Treatment four had higher value than other treatments recorded which is similar with the findings of [19] who reported that the K content of forage decreased significantly when P dose increased from 0 to 11 kg/ ha in clover dominant meadow. The result obtained is below recommended dose for ruminants, [21] recommended dietary K levels ranging from 1.0% to 1.2% of the dry matter for dairy cows.

5. Conclusion

While the other fertilized treatments exhibit lower levels of nutrient values, which is an indication of the amount of the nitrogen, phosphorus and potassium content in the manures and could also be the level or rate of decomposition of these manures. Rabbit faeces recorded the highest parameters observed compared to other animal manures used; cow dung alongside sheep and goats droppings recorded the second highest values and the least values were observed in poultry droppings and the control treatment. The result obtained in this research revealed *Stylosanthes hamata* cv Verano fertilized with rabbit faeces has the potential to supply adequate nutrients for ruminant animal production and is therefore recommended for use in forage fertilization programme.

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