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RESEARCH ARTICLE

COMPARATIVE STUDY OF THE CHEMICAL COMPOSITION OF SOME CULTIVATED FODDERS IN THE PERI-URBAN ZONE OF THE BAMAKO DISTRICT

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Abstract

Semi-intensive breeding with productive and commercial orientations towards milk production, meat production and the sale of live animals, as reported by several authors (Coulibaly, 2003; Bonfoh et al., 2005; Kouadja,et al 2018; Toure et al., 2019). They constituted an illustrative example. The practice of fodder cultivation around large urban centers is a better alternative for feeding livestock (Diarra et al., 1993). Agro-breeders are forced over years to modify their livestock systems due to the reduction in pastoral resources resulting from urbanization and the expansion of agricultural land. Cultivated fodder is suitable for semi-intensive and intensive livestock farming systems (Sommet del'Elevage , 2025). This study aims to determine the chemical composition of herbaceous and leguminous species selected and used in feeding practices of agro-breeders, at the time of distribution, in the semi-intensive breeding system of the peri-urban area. To carry out this study, five peri-urban axes around Bamako were selected: Bamako-Kangaba, Bamako-Kassela, Bamako-Tienfala-Koulikoro, Bamako-Sanankoroba-Ouelessebougou and Bamako-Kati. Nine species of grasses and fourteen species of legumes were identified among agro-breeders in the study area.References were made from foreign, older tables or others related to local forages. Data collected from fourteen agro-breeders along the five axes around Bamako were entered into Microsoft Excel and analyzed using SPSS.

Field surveys showed that semi-intensive livestock farming is the most widespread system in the peri-urban area of the Bamako district, followed by the less frequent intensive system. The average protein content in fresh Miscanthus giganteus (7.87%) was higher than that of dry Miscanthusgiganteus (5.16%). Fresh Panicum maximum had an average protein content of 7.49%, while its dry form had a significantly lower protein content (4.77%). This study revealed significant potential for the production of fodder cultivated in the peri-urban area of the communes of Bamako. Panicum maximum was the most frequently encountered species along the different axes, followed by

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Miscanthus giganteus. All herbaceous forages, includingStylosantheshamata, were distributed all times without considering their growth stages, while legumes were distributed in dried form.

Introduction:-

Nowadays, peri-urban livestock exploitation policies are used to meet the growing demand for animal products from urban populations and agro-processing industries. Thus, semi-intensive livestock farming with productive and commercial orientations toward milk production, meat production, and live animal sales, as reported by several authors (Coulibaly, 2003; Bonfoh et al., 2005; CIRAD, 2013; Toure et al., 2019), represents an illustrative example. The practice of cultivating forages around major urban centers is therefore recognized as a better alternative for feeding cattle (Diarra et al., 1993).Agro-livestock farmers in the peri-urban zone of the Bamako district have understood that cattle production can only develop under intensive or semi-intensive livestock systems. Weight gains in herds during the rainy season (July–October) increase on grazing lands or fallows due to the high protein content of green forage (up to 87%) along certain axes of the peri-urban area of Bamako. However, forage values decline significantly and often fail to reach 50% across all axes of the peri-urban zone (Diarra et al., 1993).Foddercrops also face significant challenges related to rainfall variability, which negatively affects both the quality and quantity of cultivated forages (Sommet de l'Elevage, 2025).

Understanding fodder chemical composition is crucial in semi-intensive livestock systems. It allows optimization of animal feeding through balanced nutritional inputs (proteins, fibers, and energy). Knowledge of foddernutritive value directly influences ration balance, improves animal health and performance (milk and meat production), reduces feeding costs by limiting the need for supplementary feeds, and improves soil fertility through nutrient inputs from legumes. It also enables the formulation of complete rations that meet animal requirements. High-quality fodder provides essential nutrients for growth, health, and performance, reducing deficiencies and health problems. Moreover, it reduces dependence on imported concentrates, lowering costs and improving farm autonomy (Roberge et al., 1999; Lhoste, 1997; Toutain et al., 2009; Cesar et al., 2004).The peri-urban livestock system, or commercial production system, is an integral part of sedentary livestock systems and is evolving toward significant development of off-ground livestock farming (Ouloguem et al., 2008). Rapid urbanization, increasing demand for milk and meat, and environmental constraints challenge existing practices, particularly fodder intensification in areas heavily degraded by climate change, pasture scarcity, and bush fires (Coulibaly, 2003).

The peri-urban zone of Bamako, like other African cities, represents an ideal area for experimenting with livestock and agricultural innovations. These systems currently supply the city of Bamako. Peri-urban livestock farming has also resulted in land expropriation by wealthy traders or civil servants, significantly affecting dairy cattle farming (Bonfoh et al., 2003). Around Bamako, a substantial number of farmers practice intensive dairy production models (up to 500 L/day) with herds of 20–50 crossbred dairy cows or more, distributed along four of the five main exit axes of the city (Koulikoro, Segou, Sikasso, Guinea). However, the fifth axis (Kita) remains dominated by traditional livestock systems (Raux, 2017).The objective of this study was to determine the chemical composition of selected herbaceous species and legumes used in the semi-intensive peri-urban livestock system of the Bamako district, according to agro-livestock farmers' feeding practices at the time the cultivated fodder is distributed.

Materials and Methods:-

Study Area:-

The study was conducted in the peri-urban zone of Bamako (Figure 1), located within a radius of approximately 100 km around the city. Administratively, this zone lies within the districts of Koulikoro and Kati. Relative to the city of Bamako, the area was subdivided into five axes in 1987, corresponding to raw milk production basins identified by the Agricultural Productivity Enhancement Project in Mali (PAPAM) and the West Africa Agricultural Productivity Program (WAAPP), within the framework of fodder seed dissemination aimed at improving animal, particularly cattle, production.The study was conducted from April 1, 2022, to March 1, 2023, with a six-month data collection period from April to September 2022.

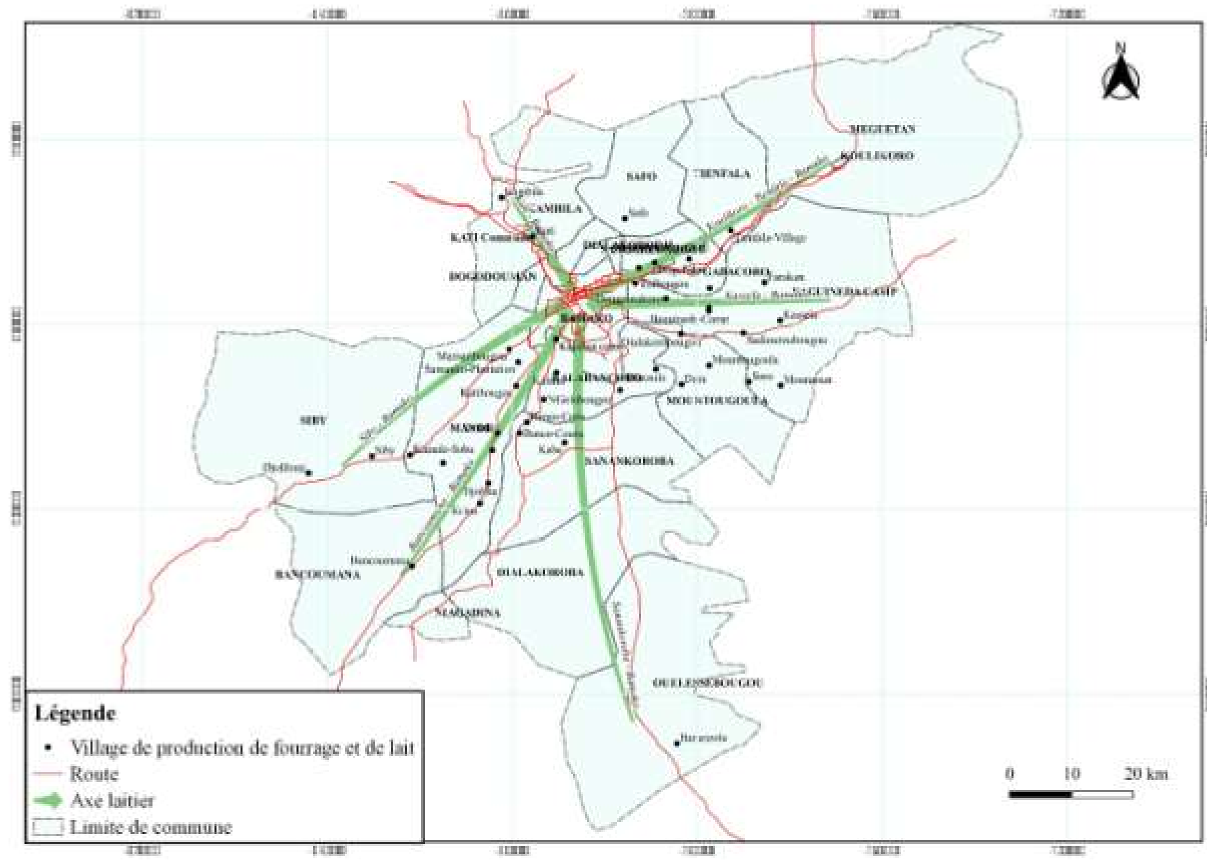

Figure 1: Map of the Peri-Urban Zone of the Bamako District Showing the Study Axes

The delimitation of the grazing belt area was carried out in 1987 following a study conducted by the Ministry of Natural Resources and Livestock (MRNE). Five test perimeters were identified: Mouzoum in the Baguineda district; Tabou in the Siby district; Nyansana-Falan extending over part of the Sanankoroba and Ouelessebougou districts; Donyoumana–Dialakoro located in the Kalabankoro and Koula districts; and Nonsombougou–Tamani located in the Nonsombougou and Koula districts.The study area lies between longitudes 7°30′ and 8°30′ on the one hand, and latitudes 12°00′ and 13°10′ on the other. The climate is of the Sudanian type, characterized by a rainy season from June to October, a cool season from December to February, and a hot season from March to May. The area is located between the 800- and 1100-mm isohyets, with an average annual rainfall of approximately 900 mm. It covers the following administrative areas:Part of the Kati district, including the eight sub-districts of Kati-Central, Neguela, Baguineda, Sanankoroba, Ouelessebougou, Kourouba, Kalabancoro, and Siby.The Nossombougou sub-district in the Kolokani district, and the Koulikoro Central sub-districts (Tienfala and Koula).The grazing belt project, which formed the basis for this delimitation, aimed to promote agro-sylvo-pastoral development, particularly dairy production, to supply the city of Bamako (MRNE, 1987).

Type and Period of Study:-

This was an evaluative study of the chemical composition of selected herbaceous species and legumes within the semi-intensive livestock system of the Bamako district.The study was conducted from April 1, 2022, to March 1, 2023, with a six-month data collection period from April to September 2022.

Sampling:-

The study population consisted of fodder herbaceous species and legumes used by agro-livestock farmers in the peri-urban zone of the Bamako district. Along the five different axes, 1 kg samples of forage grasses and legumes were collected from the farms of available and consenting agro-livestock farmers.For data collection from agro-livestock farmers, a purposive sampling method was applied to 89 agro-livestock farmers, mainly those practicing fodder cultivation, based on references obtained from the Regional Directorate of Agriculture, Livestock and

Fisheries (DRPIA) of the Bamako District. From this group, 14 agro-livestock farmers were selected according to their availability, accessibility, financial feasibility, and active practice of cultivated forages. Samples were collected at the exact time of distribution of the cultivated forage.

In total, thirty-three (33) samples were collected and distributed as follows:
Thirteen fresh samples, including seven from the Bamako–Kangaba axis comprisingAndropogongayanus, Miscanthusgiganteus from three farms, Panicum maximum, alfalfa (Medicago sativa), and Stylosantheshamata; two from the Bamako–Kassela axis including chopped maize (Zea mays) and Panicum maximum; two from the Bamako–Tienfala–Koulikoro axis including chopped maize and Panicum maximum; and two Panicum maximum samples from the Bamako–Sanankoroba–Ouelessebougou axis collected from two farms (Table 1).Twenty dry samples, including eleven from the Bamako–Sanankoroba–Ouelessebougou axis comprising two cowpea haulm samples from two farms, one maize residue sample, one sorghum residue sample, one rice straw sample, four Dolichos lablab haulm samples, one chopped maize sample, and one Miscanthus giganteus sample; eight samples from the Bamako–Kassela axis comprising three dry Panicum maximum samples from three different farms, one dry Miscanthusgiganteussample, one Brachiaria sample, one Stylosantheshamata sample, and two Dolichos lablabhaulm samples from two farms; and one Panicum maximum sample from the Bamako–Kati axis.During sampling, it was observed that some agro-livestock farmers enriched forage plots with organic manure, while others used chemical fertilizers (Table 2).

Table 1: Nature and Distribution of Fresh Cultivated Forage Samples According to the Study Axes

Axis	Plant species	Forage status	Type of conservation
Bko- Kangaba	Andropogon gayanus	Natural	Not preserved
	Miscanthus giganteus	Natural	Not preserved
	Miscanthus giganteus	Natural	Not preserved
	Miscanthus giganteus	Natural	Not preserved
	Panicum maximum	Natural	Not preserved
	Medicagosativa (alfalfa)	Natural	Not preserved
	Stylosantheshamata	Natural	Not preserved
Bko-Kassela	Zeamays (maize)	Chopped	Not preserved
	Panicum maximum	Natural	Not preserved
Bko-Tienfala-Koulikoro	Zeamays (maize)	Chopped	Not preserved
	Panicum maximum	Natural	Not preserved
Bko-Sanankoroba-Ouelessebougou	Panicum maximum	Natural	Not preserved
	Panicum maximum	Natural	Not preserved

Table 2: Nature and distribution of dry fodder samples according to the study axes

Axis	Plant species	Forage status	Type of conservation
Bko-Sanankoroba - Ouelessebougou	Cowpeahaulm(Vignaunguiculata)	Natural	preserved
	Maizeresidues	Natural	preserved
	Sorghumresidues (Sorghumbicolor)	Natural	preserved
	Ricestraw (Oryzasativa)	Natural	preserved
	Lablabhaulm (Dolichoslablabpurpureus)	Natural	preserved
	Lablabhaulm(Dolichoslablab)	Natural	preserved
	Lablabhaulm(Dolichoslablab)	Natural	preserved
	Lablabhaulm(Dolichoslablab)	Natural	preserved
	Cowpeahaulm(Vignaunguiculata)	Natural	preserved
	Miscanthus giganteus	Natural	preserved
	Maize	Chopped	preserved
	Panicum maximum	Natural	preserved

Bko-Kassela	Miscanthus giganteus	Natural	preserved
	Brachariaruziziensis	Natural	preserved
	Panicum maximum	Natural	preserved
	Panicum maximum	Natural	preserved
	Sylosantheshamata	Natural	preserved
	Lablab(Dolichoslablab)	Natural	Preserved
	Lablab(Dolichoslablab)	Natural	Preserved
Bko-Kati	Panicum maximum	Natural	Preserved

Analysis of fodderSamples:-

The study revealed variations in nutritive values according to the results obtained from the Animal Nutrition Laboratory of Sotuba (LNS). It was considered necessary to use the average values of protein content and gross energy (kcal/kg) for grasses and herbaceous fodder.

The collected samples were analyzed at the Animal Nutrition Laboratory (LNA) of the Regional Center for Agronomic Research (CRRA) of Sotuba.

- **Laboratoryanalyses**

Bromatological analyses were carried out at the Animal Nutrition Laboratory of the Institute of Rural Economy (IER), located at the Regional Center for Agronomic Research of Sotuba.

The analyses focused on the determination of Dry Matter (DM), Ash or Total Mineral Matter (MM), Crude Fiber (CF), Crude Protein (CP), Ether Extract (EE), Calcium, Phosphorus, and Gross Energy (GE). The analytical protocols for the different nutrients are summarized as follows:

- **Determination of dry matter**

The principle consists of eliminating the moisture contained in the sample (2 g) by heating it in a drying oven at 105 °C for two hours. The results are expressed as a percentage.

- **Determination of Ash (Mineral Matter)**

The sample is incinerated at 550 °C for six hours in a muffle furnace. The residue is weighed, and the weight difference gives the ash content, which is expressed as a percentage.

- **Determination of crudefiber**

The sample is successively treated with boiling solutions of sulfuric acid and sodium hydroxide at determined concentrations. The residue is separated by filtration on asbestos or washed sand, dried, and then incinerated at 700 °C.

- **Determination of nitrogen (Crude Protein)**

Nitrogen determination requires prior mineralization of the test portion (0.3 g), which consists of converting organic substances into mineral substances. This mineralization is carried out in the presence of sulfuric acid and hydrogen peroxide.Nitrogen is then determined using the Micro-Kjeldahl method. The nitrogen contained in the sample is collected in a boric acid solution and titrated with a potassium bi-iodate solution. The crude protein content is obtained by multiplying the nitrogen content by 6.25.

- **Determination of crude fat (lipids)**

Crude fat is extracted from a 2 g sample using a volatile solvent (petroleum ether, acetone, etc.) with a Soxhlet apparatus. The extracted fat is collected in a flask of known weight. The weight difference gives the fat content, which is expressed as a percentage.

- **Determination of minerals (Calcium and Phosphorus)**

The sample is mineralized using concentrated sulfuric acid and hydrogen peroxide until a clear solution is obtained. The mineralized solution is then analyzed by comparison with standard solutions prepared from stock solutions. Calcium is determined by flame photometry, while phosphorus is determined by spectrophotometry.

- **Determination of grossenergy**

Gross energy content is determined by calorimetry. The principle consists of combusting the sample (0.100–0.180 g) placed in a crucible inside a bomb calorimeter. Combustion is carried out in the presence of oxygen using an ignition wire and fuse attached to the electrodes. The heat produced is converted into energy, corresponding to the calorific value of the sample.

Results:-

Livestock Farming Systems Practiced by Agro-Livestock Farmers in the Peri-Urban Zone of the Bamako District
Semi-intensive livestock farming is the most widely adopted system among agro-livestock farmers in the peri-urban zone of the Bamako district. It is particularly predominant along the Bamako–Kati and Bamako–Kangaba axes, followed in decreasing order by agro-livestock farmers along the Bamako–Sanankoroba–Ouelessebougou axis, the Bamako–Kassela axis, and the Bamako–Koulikoro axis.The intensive livestock farming system is less common and is mainly observed along the Bamako–Tienfala–Koulikoro, Bamako–Kassela, and Bamako–Ouelessebougou axes.

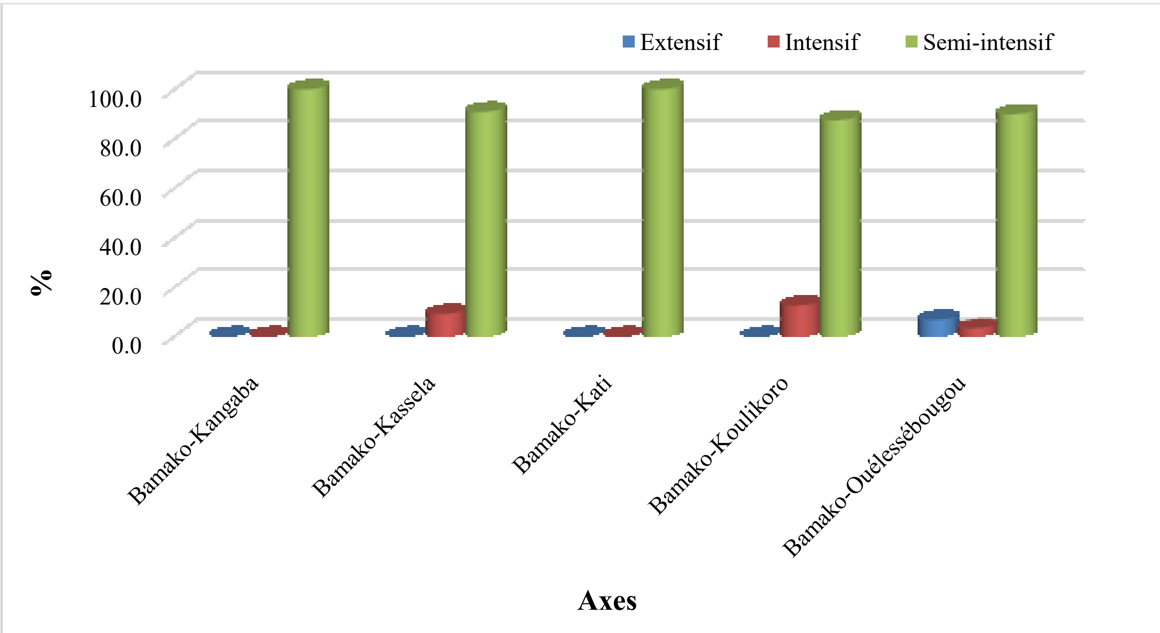

Figure 12: Livestock farming system

Bromatological composition of dry fodders analyzed by the animal nutrition laboratory of Sotuba:-
The chemical composition of these forages is highly variable, as the samples were collected at different stages of plant growth during field investigations.

Bromatological composition of fresh forages analyzed by the animal nutrition laboratory of Sotuba (Table 3):-
The analytical results presented in Table 3 indicate that the average crude protein content of fresh herbaceous fodders, such as fresh Brachiaria (12.11%), was higher than that of other herbaceous species. This was followed, respectively, by fresh alfalfa (Medicago sativa) with an average crude protein content of 10.89%, Andropogongayanus (8.28%), Miscanthusgiganteus (7.87%), and finally Panicum maximum (7.49%).The crude protein content of ensiled maize (4.34%) was equal to that of chopped maize (4.34%). The gross energy content (kcal/kg) of ensiled maize (3,993.66 kcal/kg) was considerably higher than that of all herbaceous fodders, followed by fresh Brachiaria (3,959.55 kcal/kg), alfalfa (3,882.35 kcal/kg), chopped maize (3,824.63 kcal/kg), Miscanthus giganteus (3,813.19 kcal/kg), and finally Panicum maximum (3,777.89 kcal/kg).In contrast, maize straw lost approximately half of its protein content (2.13%) compared with chopped maize and ensiled maize (4.34%). Panicum maximum showed an average calcium content of 0.66%, which was close to that observed in Andropogongayanus.The average phosphorus content of legumes, such as Dolichos lablab (0.36%), was comparable to that of Mucuna (0.34%). The average calcium content of Mucuna (0.45%) was lower than that of Miscanthus giganteus (Table 3).

Table 3: Bromatological composition of fresh foddersanalyzed by the animal nutrition Laboratory of Sotuba

Sample type	Variables	DM*(%)	Ash(%)	Crudefiber (%)	CrudeProtein (%)	Fat(EE) (%)	P*(%)	Ca* (%)	GE* (Kcal/kg)
Fresh Andropogon gayanus	**N: 1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
	Mean	22,9	12,62	38,76	8,28	1,8	0,08	0,69	3 695,54
	Standard deviation	-	-	-	-	-	-	-	-
	Median	22,9	12,62	38,76	8,28	1,8	0,08	0,69	3 695,54
	Minimum	22,9	12,62	38,76	8,28	1,8	0,08	0,69	3 695,54
	Maximum	22,9	12,62	38,76	8,28	1,8	0,08	0,69	3 695,54
Freshbrachiariaspp.	N: 1	1	1	1	1	1	1	1	1
	Mean	96	10,31	25,68	12,11	0,63	0,13	0,35	3 959,55
	Standard deviation	.	.	.	.	.	.	.	.
	Median	96	10,31	25,68	12,11	0,63	0,13	0,35	3 959,55
	Minimum	96	10,31	25,68	12,11	0,63	0,13	0,35	3 959,55
	Maximum	96	10,31	25,68	12,11	0,63	0,13	0,35	3 959,55
Freshalfalfa (Medicagosativa)	N: 1	1	1	1	1	1	1	1	1
	Mean	27,53	9,39	43,57	10,89	2,61	0,73	0,77	3 882,35
	Standard deviation	.	.	.	.	.	.	.	.
	Median	27,53	9,39	43,57	10,89	2,61	0,73	0,77	3 882,35
	Minimum	27,53	9,39	43,57	10,89	2,61	0,73	0,77	3 882,35
	Maximum	27,53	9,39	43,57	10,89	2,61	0,73	0,77	3 882,35
Freshstylosantheshamata	N: 2	1	2	2	2	2	2	2	2
	Mean	26,18	8,16	37,9	7,36	2,33	0,51	0,5	3 894,34
	Standard deviation	.	2,74	0,63	6,92	0,17	0,08	0,31	90,11
	Median	26,18	8,16	37,9	7,36	2,33	0,51	0,5	3 894,34
	Minimum	26,18	6,22	37,45	2,47	2,21	0,45	0,28	3 830,62
	Maximum	26,18	10,1	38,34	12,25	2,45	0,56	0,72	3 958,05
Fresh Miscanthus giganteus	N: 2	1	2	2	2	2	2	2	2
	Mean	19,29	11,14	31,6	7,87	1,54	0,16	0,61	3 813,19
	Standard deviation	.	1,3	4,53	2,02	0,64	0,04	0,32	200,24
	Median	19,29	11,14	31,6	7,87	1,54	0,16	0,61	3 813,19
	Minimum	19,29	10,22	28,39	6,44	1,08	0,13	0,38	3 671,60
	Maximum	19,29	12,06	34,8	9,29	1,99	0,19	0,84	3 954,78
Maizesilage (zeamays)	N: 1	1	1	1	1	1	1	1	1
	Mean	36,42	5,38	34,82	4,34	1,37	0,05	0,55	3 993,66
	Standard deviation	.	.	.	.	.	.	.	.
	Median	36,42	5,38	34,82	4,34	1,37	0,05	0,55	3 993,66

	Minimum	36,42	5,38	34,82	4,34	1,37	0,05	0,55	3 993,66
	Maximum	36,42	5,38	34,82	4,34	1,37	0,05	0,55	3 993,66
Choppedmaize (Zeamays)	N: 2	1	2	2	2	2	2	2	2
	Mean	31,43	6,05	30,19	4,34	1,9	0,06	0,42	3 824,63
	Standard deviation	.	1,59	3,51	1,49	0,18	0,03	0,26	126,63
	Median	31,43	6,05	30,19	4,34	1,9	0,06	0,42	3 824,63
	Minimum	31,43	4,92	27,7	3,28	1,77	0,04	0,23	3 735,09
	Maximum	31,43	7,17	32,67	5,39	2,02	0,08	0,6	3 914,17
Fresh Panicum maximum	N: 6	6	6	6	6	6	6	6	6
	Mean	30,82	8,56	40,89	7,49	1,78	0,18	0,66	3 777,89
	Standard deviation	7,64	2,04	2,33	2,21	0,43	0,04	0,19	92,32
	Median	28,2	8,2	41,58	7,16	1,76	0,16	0,64	3 757,18
	Minimum	25,78	6,25	36,84	5,19	1,2	0,14	0,45	3 678,61
	Maximum	45,94	12,14	43,68	10,88	2,41	0,24	0,95	3 901,00

Abbreviations:
N: number of samples; DM: Dry Matter; EE: Ether extract (fat); P: Phosphorus; Ca: Calcium; GE: Gross Energy.

Bromatological composition of dry Forages analyzed by the animal nutrition laboratory of Sotuba (Table 4):-
The average crude protein content of Mucuna haulm (11.75%) was higher than that of Dolichos lablab haulm (11.03%), followed by cowpea (Vigna unguiculata) haulm (10.88%). The gross energy content (kcal/kg) of fresh Stylosantheshamata (3,894.34 kcal/kg) was higher than that of Dolichos lablab haulm (3,788.12 kcal/kg), followed by cowpea haulm (3,729.88 kcal/kg) and Mucuna haulm (3,658.84 kcal/kg).The average crude protein content of rice straw (5.96%) was considerably higher than that of Miscanthus giganteus straw (5.16%), followed by sorghum straw (4.94%) and Panicummaximum straw (4.77%), whereas maize straw (2.13%) lost more than half of its crude protein content. Our results showed that the gross energy content (kcal/kg) of Panicum maximum straw (3,746.64 kcal/kg) was higher than that of all other straw types analyzed, followed by Miscanthus giganteus straw (3,718.30 kcal/kg), rice straw (3,656.98 kcal/kg), and sorghum straw (3,499.49 kcal/kg).

The average phosphorus content of fresh alfalfa was 0.73%, and its average calcium content was 0.77%. These values were higher than those of all fresh and dry samples analyzed and were comparable to the average phosphorus content of Stylosantheshamata (0.51%). The average calcium content of Stylosantheshamata was very low (0.50%). However, the average calcium content of Andropogongayanus (0.69%) was close to that of Miscanthus giganteus (0.61%).Field observations indicated that Stylosantheshamata, Panicum maximum, Miscanthusgiganteus, and Brachiariaspecies were directly grazed by cattle near the barns. All forage crop fields were located close to cattle sheds within the peri-urban zone of the Bamako district. Legume fields were also an integral part of the farms and belonged to land-owning agro-livestock farmers. The barns, forage crop fields, as well as maize and groundnut fields, were often enclosed by cement walls or by live or dead hedges. In many cases, crops were left with minimal management due to limited financial resources of the agro-livestock farmers.

Overall, cowpea, Mucuna, and Dolichos lablab haulms were directly spread on racks under the sun for drying and later stored in warehouses located within the farms. Several storage facilities of varying sizes, as well as multiple silos for chopped maize, were commonly observed. In some cattle farms, three to four silos were observed, particularly in farms raising crossbred cattle such as Holstein and Montbeliarde, along with local breeds such as the Azawak Zebu, originally from northern Mali and introduced into the south, recognized for their milk and meat production.

Table 4: Bromatological composition of dry Forages analyzed by the animal nutrition laboratory of Sotuba

Sample type	Variables	DM* (%)	Ash (%)	CrudeFiber (%)	Crudeprotein (%)	Fat (EE)* (%)	P* (%)	Ca* (%)	GE* (Kcal/kg)
Dried dolichos haulms (Lablab purpureus)	N: 5	5	5	5	5	5	5	5	5
	Mean	95,6	6,78	36,43	11,03	2,05	0,36	0,33	3 788,12
	Standard deviation	0,59	2,11	8,62	3,17	0,66	0,1	0,23	85,16
	Median	95,52	5,85	40,81	11,06	1,87	0,33	0,29	3 829,26
	Minimum	94,95	5,1	25,86	6,56	1,47	0,28	0,13	3 644,36
	Maximum	96,25	10,35	43,87	15,44	3,17	0,52	0,72	3 849,55
Dried cowpea haulms (Vigna unguiculata)	N: 3	3	3	3	3	3	3	3	3
	Mean	96,1	6,45	30,38	10,88	1,58	0,17	0,29	3 729,88
	Standard deviation	0,39	1,24	8,53	5,82	0,49	0,09	0,07	50,43
	Median	95,95	6,26	32,36	13,25	1,57	0,19	0,29	3 706,25
	Minimum	95,8	5,32	21,03	4,25	1,09	0,07	0,22	3 695,60
	Maximum	96,55	7,77	37,75	15,13	2,07	0,25	0,35	3 787,79
DriedMucunahaulms	N: 1	1	1	1	1	1	1	1	1
	Mean	95,77	8,7	33,41	11,75	2,51	0,34	0,45	3 658,84
	Standard deviation	.	.	.	.	.	.	.	.
	Median	95,77	8,7	33,41	11,75	2,51	0,34	0,45	3 658,84
	Minimum	95,77	8,7	33,41	11,75	2,51	0,34	0,45	3 658,84
	Maximum	95,77	8,7	33,41	11,75	2,51	0,34	0,45	3 658,84
Maizestraw (Zeamays)	N: 1	1	1	1	1	1	1	1	1
	Mean	96,5	2,83	41,19	2,13	0,52	0,03	0,09	3 656,98
	Standard deviation	.	.	.	.	.	.	.	.
	Median	96,5	2,83	41,19	2,13	0,52	0,03	0,09	3 656,98
	Minimum	96,5	2,83	41,19	2,13	0,52	0,03	0,09	3 656,98
	Maximum	96,5	2,83	41,19	2,13	0,52	0,03	0,09	3 656,98
Dried Miscanthus giganteus	N: 2	2	2	2	2	2	2	2	2
	Mean	94,76	8,27	39,18	5,16	1,37	0,08	0,49	3 718,30
	Standard deviation	2,03	1,15	7,71	2,26	0,13	0,04	0,32	112,54
	Median	94,76	8,27	39,18	5,16	1,37	0,08	0,49	3 718,30
	Minimum	93,32	7,46	33,73	3,56	1,28	0,05	0,26	3 638,72
	Maximum	96,2	9,08	44,63	6,76	1,46	0,1	0,72	3 797,87
Ricestraw (Oryzasativa)	N: 1	1	1	1	1	1	1	1	1
	Mean	96,88	13,05	40,98	5,96	1,08	0,06	0,18	3 367,45
	Standard deviation	.	.	.	.	.	.	.	.

	Median	96,88	13,05	40,98	5,96	1,08	0,06	0,18	3 367,45
	Minimum	96,88	13,05	40,98	5,96	1,08	0,06	0,18	3 367,45
	Maximum	96,88	13,05	40,98	5,96	1,08	0,06	0,18	3 367,45
Sorghumstraw (Sorghumbicolor)	N: 1	1	1	1	1	1	1	1	1
	Mean	96,4	10,72	36,88	4,94	3,48	0,06	0,35	3 499,49
	Standard deviation	.	.	.	.	.	.	.	.
	Median	96,4	10,72	36,88	4,94	3,48	0,06	0,35	3 499,49
	Minimum	96,4	10,72	36,88	4,94	3,48	0,06	0,35	3 499,49
	Maximum	96,4	10,72	36,88	4,94	3,48	0,06	0,35	3 499,49
Dried Panicum maximum	N: 4	4	4	4	4	4	4	4	4
	Mean	95,1	8,16	41,27	4,77	1,01	0,18	0,18	3 746,64
	Standard deviation	2,82	1,06	4,01	0,47	0,31	0,11	0,08	205
	Median	96,27	7,75	40,97	4,72	1,07	0,18	0,18	3 771,94
	Minimum	90,9	7,42	36,86	4,26	0,62	0,04	0,09	3 496,52
	Maximum	96,98	9,71	46,3	5,39	1,27	0,31	0,25	3 946,16

Abbreviations:
N: number of samples; DM: Dry Matter; EE: Ether extract (fat); P: Phosphorus; Ca: Calcium; GE: Gross Energy.

Discussion:-

The average crude protein content of dry Panicum maximum (4.77%) observed in the present study was close to that reported by Zoungrana (2010), who recorded values of 4.69% and 3.67% at the primary and secondary stages of lignification, respectively. However, our results were lower than those reported by Bamouni (2016), who obtained a crude protein content of 12.22% in Panicum maximum hay during on-farm trials with agro-livestock farmers. The differences observed between our results and those reported in the literature may be explained by several factors, including the use of organic fertilizers (cattle manure and others) and chemical fertilizers (urea, cotton complex fertilizers, etc.), site selection, and climatic conditions.Legumes received particular attention from agro-livestock farmers in the peri-urban zone of Bamako because they were cultivated during the rainy season mainly for conservation and subsequent use during the dry season and periods of feed scarcity. Special care was given to legumes at the time of sowing. Our results on the crude protein content of Mucuna haulm (11.75%) were consistent with those reported by Zoungrana (2010) for fertilized Mucuna haulm, which ranged between 12.56% and 10.80%.

The crude protein content of improved sorghum straw (8.45%) reported by Zorma (2017) was higher than that observed in our study (4.94%). Conversely, the crude protein content of cowpea haulm (13.14%) reported by Zorma (2017) was slightly lower than our value (13.25%). The calcium content of Dolichos lablab haulm (0.33%) recorded in our study was very low compared with the calcium content (8.50%) reported by Nantoume et al. (2000). Similarly, the phosphorus content of Dolichos lablab haulm was lower than that reported by Nantoume et al. (2000) in a trial conducted at the Toronkezootechnical research station in Kayes.The average cellulose content of cowpea haulm (30.38%) was lower than that reported by Bamouni (2016). The average dry matter content of Panicum maximum (95.10%) was comparable to that reported by Bamouni (2016), who found a value of 36.57%. Data reported by Zoungrana (2010) showed that the dry matter content of Panicum maximum 1 (95.5%) and Panicum maximum 2 (94.5%) were consistent with those obtained in our study.Fresh alfalfa is a forage plant that meets most nutritional requirements for both animals and soil improvement. The average crude protein content of fresh alfalfa observed in this study (10.89%) was lower than that reported by Deere (2010), who indicated that alfalfa contains between 15% and 25% crude protein depending on the growth stage and cutting period.

Conclusion:-

Cultivated forages are increasingly occupying an important place in peri-urban livestock farming systems in the district of Bamako. The collected samples included more herbaceous species than legumes. Panicum maximum was the most commonly encountered species along the different axes, followed by Miscanthus giganteus.In most cases, agro-livestock farmers in the peri-urban zone of the Bamako district practiced forage cultivation without considering the chemical composition of forages when formulating animal diets. There is therefore a need to raise awareness among agro-livestock farmers on the importance of balanced ration formulation to meet the nutritional requirements for milk and meat production.

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