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# Recovery of Crop Residues in the Feed of N'Dama Dairy Cows in Periods of Last Food in Modiya Urban Commune of Faranah

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**Abstract.** In order to evaluate the effects of supplementation of N'Dama dairy cows through potato vines ($V_1$ = 366 kg) and rice straw ($V_2$ = 366 kg) in times of scarcity, a trial was set up in Modiya, from March 3 to April 28, 2023 with 18 dairy cows from the 4th and 5th lactation divided into three (3) variants ($V_0$; $V_1$ = supplemented with potato vines; $V_2$ = supplemented with straw rice) with (3) repetitions ($R_1$, $R_2$, $R_3$) in a random block with simple classification. Each animal received its supplementary ration once a day after milking. A weekly milk sample for eight (8) weeks provided the average production: $V_0$ = 13.67; $V_1$ = 16.20 and $V_2$ = 18.44 liters. A chemical analysis of the milk gave the protein and fat levels which are respectively for $V_0$: 4.48 and 3.20%; $V_1$: 7.10 and 3.90%; $V_2$: 5.60 and 3.89 %. The results show that in Modiya supplementation increased the quantity and quality of the milk of the cows which received the supplement compared to the control group.

**Keywords:** recovery, harvest residues, dairy cow, food shortage, Faranah

## Introduction

The needs of animals for rich and varied foods are steadily increasing; environmental degradation through poor logging practices is increasing at a rapid rate. It is urgent for all developed and developing countries to apply the principles of sustainable agriculture (Diallo, 2022).

In the Republic of Guinea, cattle herds are fed mainly from natural pastures. Animals are subject to a period of plenty of fodder and water during the rainy season and a period of shortage during the dry season.

While there is an increase in the consumption of livestock products in developed countries, there is on the other hand a continuous increase in demand in developing countries due to rapid population growth and low production. Livestock productivity is limited by inadequate forage supply leading to severe seasonal food deficits.

The use of crop residues following certain recovery techniques during the food shortage period is one of the means of ensuring the profitability of animal production throughout the year (Diallo, 2021).

However, an inappropriate feed automatically reduces the performance of dairy cows and affects the composition of the milk and therefore its quality. This is why it is necessary to call on other resources to deal with this period of fodder shortage. In this prefecture, there is a fairly wide variety of crops, which leave both residues during harvesting and processing waste, which is worth recovering. Cereal straws, or legumes or cassava fans can be used as a source of fiber and must be supplemented with foods richer in energy or protein (Gaëlle, 2004).

Indeed, a study conducted by the National Directorate of Livestock in 2000 showed that the food resources available around urban and peri-urban areas in terms of agricultural and agro-industrial by-products amount to more than 115,000 tons for groundnut tops, tuber peelings, fruit remains, and more than 886,000 tons of rice, fonio and corn straw. But their use in their entirety in animal feed is still unknown to local agro-pastoralists.

The general objective in this research work is to enhance rice straw and potato vines in the diet of dairy cows.

The specific objectives are to:

- Perform a bromatological analysis of rice straw and potato vines;
- Evaluate the quantitative and qualitative effects of the use of rice straw and potato vines on the milk production of N'Dama cows in Modiya.

## Materials and Methods

### Materials

***Summary presentation of Faranah prefecture***

*Location and limits*

Faranah prefecture is located between 10°02' and 10°50' North longitude and between 10°42' and 10°50' West longitude at an average altitude of 340m.

It covers an area of 13,000 km$^2$ for a population of 211,115 inhabitants, i.e. a density of 16 inhabitants per km$^2$ (RGPH April 2020). It is limited:

- to the north by the prefecture of Dabola;
- to the south by the prefectures of Kissidougou and Guéckédou
- to the east by the prefecture of Kouroussa
- to the west by the prefecture of Mamou and the Republic of Sierra Leone

*Relief*

The prefecture of Faranah has a varied relief and presents a vast plateau cut by large plains and dotted with hills.

There are also some more or less high massifs in the North-East such as that of Fitaba which is a gold-bearing zone covering the sub-prefectures of Marella and Passaya.

However, it is undulating in the south by the presence of the Forokonia massif (1007 m) in the Kobikoro Sub-Prefecture where the Niger River has its source.

To the east is the Zone of plateaus dotted with hills with vast plains along the Niger River.

*Climate*

The climate of the Faranah prefecture is of the Sudano-Guinean type characterizing all of Upper Guinea with an alternation of two (2) very distinct seasons: a dry season of six (6) months (November to April) and a rainy season of six (6) months (May to October).

***Presentation of the site***

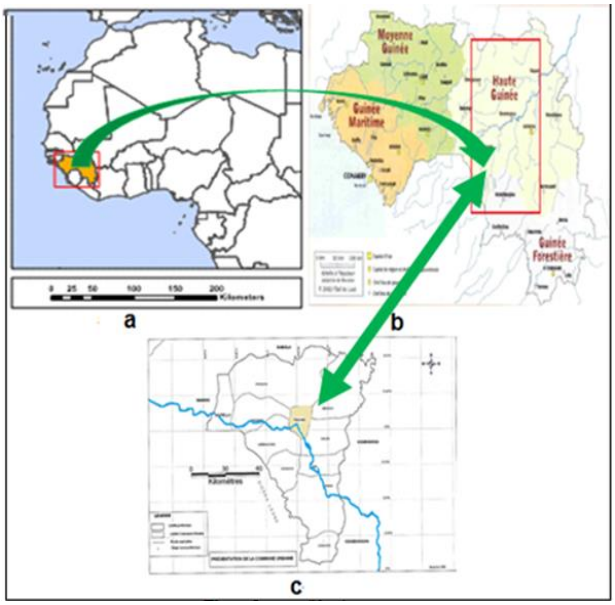
Modiya is located in the urban commune of Faranah at PK6, on the national road Faranah - Dabola.

*Brief knowledge of the urban commune of Faranah*

Faranah is a city in Guinea located on the banks of the Niger as well as on the main road axis of the country, between Conakry and Kissidougou. It is located in the natural region of Upper Guinea. It is the capital of Faranah Prefecture and the capital of Faranah Region.

The Urban Commune of Faranah on the decentralized administrative level was created in 1991. It is located 460 km from the capital Conakry, it is one of the sixteen (16) communities in the prefecture of Faranah.

It extends over an area of 47 km$^2$ and classified in the category of type B municipalities, it covers a population of 95,784 inhabitants including 45,976 men and 49,808 women, i.e., an average density of 10 inhabitants per km$^2$ (Prefectural Directorate of Faranah Plan 2020). It is made up of twelve (12) urban districts, twelve (12) rural districts and 117 sectors, the city is growing thanks to urban planning and demography. It is limited.




- To the North by the CR of Passaya;
- In the South by the RC of Songoyah and that of Tindo;
- To the West by the CR of Dantilia;
- To the east by the Bantou RCs.

The ethnic composition of the urban commune of Faranah is as follows: the Malinke; the Djallonkes; the Kourankos; the Sankarankas; the Fulani; the pennies; the Kissians; the Guerzes; the Thomases; etc…. This explains the cultural mix of which the urban commune of Faranah makes.

*Socio-economic activities*

Agriculture and livestock are the main activities of the populations of the study area. These mainly develop cereal crops, legumes, tubers and cash crops. Residues from different crops, especially cereals and legumes, allow agro-pastoralists to feed livestock in the dry season.

- *Agriculture:* it is an activity which occupies most of the population; depending on the means of the farmer, one encounters mechanized, harnessed and manual forms of agriculture. All crops are grown: rice, fonio, maize, millet, yam; vegetable crops, citrus fruits, etc.
- *Stockbreeding:* the prefecture in general and the urban commune in particular is favorable to stockbreeding thanks to its climate, its plains, its lowlands and grassy and wooded savannahs. Animal husbandry ranks second after agriculture. It is characterized by a traditional mode of exploitation; housing is limited to overnight pens, reproduction is free, but health checks are carried out by certain breeders.

According to the Prefectural Section Animal Resources of Faranah (SPRA/F, 2020) livestock farming is mainly focused on cattle (8,078), sheep (1,931), goats (1,184), and poultry (17,500).

***Materials used***

*Animal material:*

Eighteen (18) dairy cows of the 4th and 5th lactation selected in four (4) parks with four (4) agro-breeders were used.

*Plant material:*

For the purposes of the test, 366 kg of dried potato vines and 366 kg of rice straw after harvesting and threshing were used.

*Laboratory materials:* Sieve, wz113 refractometer, laboratory bottles, coats, etc.

Specific laboratory materials for:

1. The determination of the protein level;
2. Fat determination;
3. Determination of sugar level.

**Methods**

***General objective:*** Promote rice straw and potato vines in the diet of dairy cows,

***Specific objectives:***

- Perform a bromatological analysis of rice straw and potato vines;
- Collect and use dried potato vines and rice straw to supplement dairy cows in times of scarcity;
- Evaluate the quantitative and qualitative effects of the use of crop residues in dairy production.

**Methodology**

To achieve these objectives the following methodology was adopted.

- Consultation of documents, frameworks and archives of the urban municipality
- Contacting resource persons for:
  - Have previous information on the use of crop residues for dairy cows.
  - Know the availability of crop residues.
- Sensitization of breeders on the objective of the theme and the provision of the experimental nucleus.
- Collection and storage of potato vines and rice straw on watchtowers
- Sample collection and analysis
- Assembly of the Experimental scheme
- Preparation and distribution of the complementary animal.

For the trial, eighteen (18) dairy cows from the 4th and 5th lactation were used and divided into three (3) variants with three (3) repetitions, i.e. (6) cows per variant at the rate of two (2) per replicates in a single-classified random block.

$V_0$ = control batch

$V_1$ = batch supplemented with potato vines

$V_2$ = batch supplemented by rice straw

***Feeding method***

There was an adaptation period of eight (8) days and an experimental period of fifty-seven (57) days.

During the adaptation period each dairy cow would receive 1.5 kg of supplementary feed.

During the experimental period, each received 1 kg of supplement.

Feed was lightly moistened with salt water and served in an individual trough each day after milking.

***Milking method***

The milking is manual, it is done once every 24 hours for each milkmaid. The calf is left to be treated to accelerate milk secretion. The dairy cow has its hind limbs shackled throughout the operation.

*Amount of milk produced per day*

After each milking, the quantity of milk obtained is passed through a sieve to be filtered and measured using a plastic test tube graduated at 1000 ml.

***Milk quality***

*Determination of the sugar content of fresh milk:*

This rate was determined by a wz-113 refractometer. The determination follows the following steps:

- Collection of the sample using a 13 ml plastic ladle;
- Depositing a drop using a pipette on the beak of the refractometer;
- Closure of the beak and reading of the rate on the blue screen graduated from 0 to 30%.
- For each sample, the operation was carried out twice immediately after milking.

*Determination of protein content and milk fat:*

- Protein and fat levels were determined by the Kjeldhal method at the central veterinary diagnostic laboratory at the National Directorate of Livestock in Conakry.

*Determination of protein level:*

Object and scope:

- This procedure specifies the Kjeldhal method for the determination of nitrogen for the calculation of crude protein content
- By convention, the protein content is obtained by multiplying the nitrogen content by the factor 6.25.
- This method applies to animal feed.
- It does not make it possible to distinguish protein nitrogen from non-protein nitrogen.

*Fat determination*

Object and scope:

- The method makes it possible to determine the crude fat content of animal feed.
- The process described in this operating mode is capital B from standard NF V18 – 117. It is for simple foods of animal origin applies to simple foods of animal and plant origin.
- Process B: applied to foods from which fats cannot be completely extracted by diethyl ether without prior hydrolysis, to foods of vegetable origin (glutens, pulp, dried potatoes, dried grains from breweries and distilleries, yeasts, waste from biscuits, bread and cooked foods, dairy products and foods containing a high proportion of these (at least 40%) and compound foods enriched with fat)
- *Fat content:* mass fraction of the substances extracted from the sample according to the procedure specified in this document. There
- Fat content is expressed in %.
- Method B: the sample is heat-treated with hydrochloric acid. The mixture is cooled and filtered. After having been washed and dried, the residue is subjected to extraction with petroleum ether according to method A; the solvent is distilled off and the residue is dried and weighed.

**Results**

At the end of this research work, the following results were obtained:

***1. Consultation of resource persons:***

It appears that crop residues exist in abundance in the municipality. These harvest by-products, despite their abundance, are abandoned in the fields and consumed only by stray animals, they are not used in the supplementation of dairy cows in times of scarcity.

***2. Raising awareness among breeders***

After the sensitization of breeders based on the objectives of the theme, a sufficient experimental core at the level of four (4) neighboring parks was obtained.

***3. Bromatological analysis:***

In accordance with the analysis result, it appears that potato vines are richer in nutrients than rice straw, particularly in mineral matter, crude protein and fat (Table 1).

***4. Milk production*** (Table 2)

$V_2 = 18.44$ a

$V_1 = 16.20$ b

$V_0 = 13.67$ c

**Table 1: Bromatological Analysis of Forages**

| Principle / Forages | Water content (%) | MS (%) | Materials Minerals (%) | Proteins gross (%) | Materials fat (%) |
|---|---|---|---|---|---|
| Rice straw | 6.60 | 93.40 | 4.21 | 6.53 | 2.03 |
| Potato vine | 7.29 | 92.71 | 16.23 | 10.10 | 2.20 |

**Table 2: Average milk production by variant (in litres/day)**

| Replicas / Variants | R1 | R2 | R3 | Total | Production Mean |
|---|---|---|---|---|---|
| $V_0$ | 13,980 | 13,520 | 13,520 | 41,020 | 13.67 |
| $V_1$ | 17,060 | 15,840 | 15,720 | 48,620 | 16.20 |
| $V_2$ | 18,960 | 18,260 | 18,100 | 55,320 | 18.44 |
| **Total** | | | | 144.96 | 48.31 |

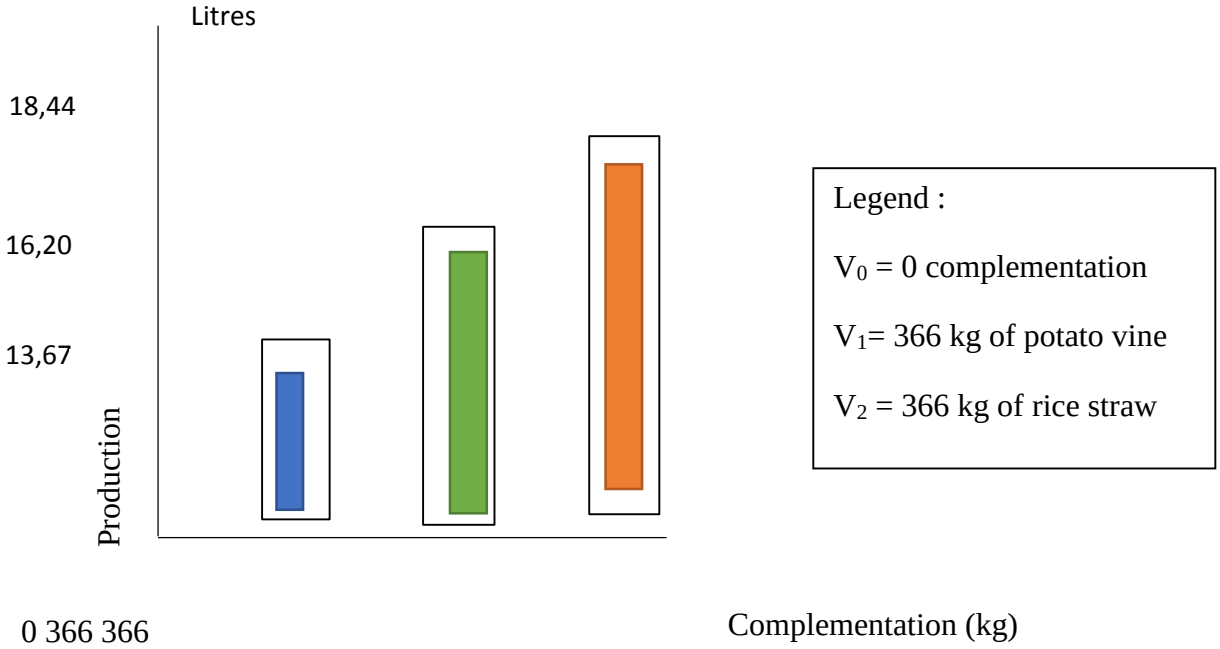



**Figure 1: Milk production**

**Table 3: Variant analysis of milk production**

| Variant Source | Square sum | Degree of freedom | Medium square | F. calculated | F. total | |
|---|---|---|---|---|---|---|
| **Total** | 35.76 | 8 | - | 60.89 | 0.5 | 0.1 |
| **Variant** | 34.10 | 2 | 17.05 | | | |
| **Error** | 1.66 | 6 | 0.28 | | | |

**Table 4: Comparison of means**

| | 18.44 | 16.20 | 13.67 |
|---|---|---|---|
| 13.67 | 4.77 | 2.53 | - |
| 16.20 | 2.44 | - | |

**Table 5: Qualitative analysis of milk**

| Replicas / Variants | Sugar (%) | Protein (%) | Fat (%) |
|---|---|---|---|
| $V_0$ | 11.70 | 4.48 | 3.20 |
| $V_1$ | 12.35 | 7.10 | 3.90 |
| $V_2$ | 12, 08 | 5.60 | 3.89 |

The results show that in Modiya the supplementation made it possible to increase the quantity and the quality of the milk of the cows which received the supplement compared to the control group which received nothing. Rice straw increased milk quantity from 0.85 to 1.15 liters per dairy cow. Potato vines improved milk quality from 4.48 to 7.10% for protein and from 3.20 to 3.90% for fat.

Consider a daily individual production of 0.85 liters for $V_0$; 1.01 liters for $V_1$ and 1.15 liters for $V_2$.

**Discussion**

The breeders interviewed mainly use cereal straw (maize, sorghum, rice) and legumes (cowpea, soybean, groundnut, voandzou) for animal feed in the dry season. These results are similar to those obtained by Autfray et al. (2012), Vodounon et al. (2016), Sanou et al. (2016), Krätli et al. (2017), who showed that residues from cereal and leguminous crops occupy a prominent place in livestock feed during the period.

After comparing the averages, it appears that all three (3) variants studied differ significantly from each other.

The highest milk production is obtained by the $V_2$ variant (18.44 liters) followed by the $V_1$ variant (16.20 liters). This would be due to the digestive characteristics of rice straw. This idea coincides with the idea of Rivière (1978) who says that rice straw is an excellent ballast food necessary for the proper functioning of the digestive tract of ruminants for the production of milk and meat.

This is also consistent with the idea put forward by Chillard et al. (2001), who say that rice straw has a cereal content which gives it a high energy value for the maintenance and production of ruminants.

$V_1$ variant milk is richer in nutrients (sugar, protein and fat) followed by $V_2$.

**Conclusion**

At the end of this research, it appears that crop residues exist in abundance from crops present on the ground after harvest and are not used in the supplementation of dairy cows during the dearth period. These crop residues are in high demand by agro-pastoralists during the dry season, between December and February, in addition to livestock feed.

After testing, an improvement in the quantity and quality of the milk produced was observed, which proves that the use of residues as a food supplement has had a beneficial effect on milk production.

Opportunistic management of pastures by reducing animal pressure on existing fodder resources can ensure the protection of biodiversity. This forage balance of the study area provides information to livestock sector actors and policy makers to improve their planning and prospective studies of the sector, in order to improve the resilience of cropping systems and breeding.

Taking these results into account in the development of agricultural and pastoral policies would contribute to better management of all the fodder resources available for livestock.

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