



## REVIEW ARTICLE

# Review of Valuable Local Feed Resources for Poultry Nutrition in Burkina Faso: The Cases of *Cirina butyrospermi*, *Senegalia macrostachya* Seeds and *Parkia biglobosa* Fruit Pulp

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### Abstract

This review examines three locally available feed resources from Burkina Faso as sustainable and cost-effective alternatives to conventional commercial poultry feeds, which account for more than 70% of poultry production costs and are often characterized by high prices and inconsistent availability. The first resource, the shea caterpillar (*Cirina butyrospermi*), is widely harvested from June to September in the Sudanian and Sudano-Guinean zones. Rich in crude protein (50 to 65% of dry matter) and essential amino acids, it has a nutritional value comparable to that of fishmeal and has been reported to improve growth performance while enhancing poultry immune function. However, its utilization is constrained by seasonal availability and reduced digestibility associated with its chitin content. The second resource, *Senegalia macrostachya* seeds (Zamné), is obtained from a shrub well adapted to the poor soils of the Sudanian and Sudano-Saharan regions. The seeds provide a valuable source of protein (30 to 40% of dry matter), particularly lysine but require heat treatment, such as boiling or roasting, to inactivate antinutritional factors, including tannins and trypsin inhibitors. The third resource, the fruit pulp of *Parkia biglobosa* (Néré), which is abundant in the southern and western regions of Burkina Faso, serves primarily as an energy source because of its high sugar content (60 to 80%) and also supplies important micronutrients, including vitamins C and A. Although, relatively low in protein, it enhances feed palatability and improves egg yolk pigmentation owing to its carotenoid content. Nevertheless, its quality may be compromised by moisture exposure and contamination during traditional processing and storage. Overall, the integration of these locally available feed resources has the potential to improve poultry production performance while reducing feed costs. However, their sustainable utilization will require improved organization of collection and supply systems, together with the standardization of processing methods to effectively eliminate biological hazards and antinutritional factors.

## INTRODUCTION

Poultry production plays a vital role in the rural economy and household food security in Burkina Faso. It provides a high-quality source of animal protein and serves as an

important driver of income generation and poverty alleviation<sup>1</sup>.

Despite its socioeconomic importance, the poultry sector continues to face several production constraints, among which the high cost and inconsistent availability of feed

ingredients are the most critical<sup>2</sup>. Feed accounts for more than 70% of total poultry production costs. Moreover, reliance on conventional feed ingredients, such as maize and soybean meal, creates direct competition between human consumption and animal feeding, while exposing producers to fluctuations in global commodity prices<sup>3</sup>. In this context, the utilization of locally available resources, particularly Non-timber Forest Products (NTFPs), has emerged as a sustainable and economically viable strategy for reducing feed costs and improving the resilience of poultry production systems<sup>4-6</sup>.

Among the indigenous feed resources available in Burkina Faso, three have attracted increasing attention because of their abundance, nutritional value and economic potential<sup>7</sup>. The larvae of *Cirina butyrospermi* (shea caterpillars) constitute an excellent source of protein, lipids and micronutrients. Their high content of essential amino acids makes them a promising alternative to conventional protein sources, such as fishmeal and soybean meal<sup>8,9</sup>. Likewise, the seeds of *Senegalia macrostachya*, which are widely harvested in the Sahelian region, represent a valuable source of dietary protein with promising characteristics for incorporation into poultry diets, although their digestibility and utilization require appropriate processing. In addition, the fruit pulp of *Parkia biglobosa*, which is widely consumed in many regions of the country, has potential as a dietary supplement and source of dietary fiber that may contribute to improved digestive health in poultry<sup>10-12</sup>.

Despite their recognized nutritional potential, the incorporation of these locally available feed resources into poultry diets remains limited. Therefore, this review aims to evaluate the nutritional value of *Cirina butyrospermi*, *Senegalia macrostachya* seeds and *Parkia biglobosa* fruit pulp and to examine the available evidence regarding their effects on poultry zootechnical performance.

## MATERIALS AND METHODS

This review includes literature published up to 2026. Information on the nutritional composition, effects on zootechnical performance and antinutritional factors of the three feed resources, *Cirina butyrospermi*, *Senegalia macrostachya* seeds and *Parkia biglobosa* fruit pulp, used in poultry nutrition in Burkina Faso was compiled through a comprehensive literature search using databases and search engines, including Google Scholar, NCBI, Scientific Research and ScienceDirect.

### Characterization of the resources

#### *Cirina butyrospermi* (shea caterpillar):

- Taxonomy and Geographical Distribution
- The taxonomic position of *C. butyrospermi* is as follows<sup>13</sup>:

- Kingdom : Animalia
- Phylum : Arthropoda
- Class : Insecta
- Order : Lepidoptera
- Suborder : Glossata
- Superfamily : Bombycoidea
- Family : Saturniidae
- Subfamily : Saturniidae
- Genus : *Cirina*
- Species : *Cirina butyrospermi* Vuillet (1960)

In Burkina Faso, the shea caterpillar (*Cirina butyrospermi*) is widely distributed throughout the Sudanian and Sudano-Guinean phytogeographical zones, corresponding to the natural distribution of its exclusive host plant, the shea tree (*Vitellaria paradoxa*)<sup>14</sup>. The species is particularly abundant in the southern, western, especially the Hauts-Bassins and Cascades regions and Centre-Ouest areas, where it is extensively harvested by rural communities for human consumption because of its high protein content<sup>15</sup>. Its occurrence is highly seasonal, coinciding with the defoliation period of the shea tree between June and September. Population abundance varies according to local climatic conditions and the intensity of harvesting pressure.

#### *Senegalia macrostachya* (Zamné seeds in the local Mooré language):

- Taxonomy and Geographical Distribution<sup>16</sup>
- Kingdom: Plantae
- Subkingdom: Tracheobionta (Vascular plants)
- Division: Magnoliophyta (Angiosperms)
- Class: Magnoliopsida (Dicotyledons)
- Order: Fabales
- Family: Fabaceae (Legumes)
- Subfamily: Mimosoideae
- Genus: *Senegalia* Raf.
- Species: *Senegalia macrostachya* (Reichenb. ex DC.) Kyal. and Boatwr

*Senegalia macrostachya* (formerly *Acacia macrostachya*) is a thorny shrub belonging to the family Fabaceae<sup>17</sup>. It is characterized by recurved thorns arranged along its branches, alternate bipinnate leaves and flattened pods<sup>18</sup>. In Burkina Faso, the distribution of *S. macrostachya* is closely associated with the country's climatic zones, occurring predominantly in the Sudanian and Sudano-Sahelian regions. The species is mainly distributed in the Plateau-Central, Est, Centre-Est and Sud-Ouest regions<sup>19</sup>. It thrives on gravelly soils, lateritic plateaus and hillside slopes, where it frequently forms dense

stands commonly referred to as "tiger bush" or protective thickets. Owing to its ability to establish on nutrient-poor and lateritic soils, *S. macrostachya* serves as an important pioneer species for soil stabilization and ecosystem restoration in these environments<sup>20</sup>.

***Parkia biglobosa* (Néré Pulp)**

**Taxonomy and geographical distribution:** The botanical classification of *Parkia biglobosa* is as follows<sup>16</sup>:

- Kingdom: Plantae
- Subkingdom: Tracheobionta
- Division: Magnoliophyta
- Class: Magnoliopsida
- Subclass: Rosidae
- Order: Fabales
- Family: Fabaceae
- Genus: *Parkia*
- Species: *Parkia biglobosa* (Jacq.) R.Br. ex G.Don, 1830

In Burkina Faso, *Parkia biglobosa* (commonly known as néré) is distributed primarily across the Sudanian and Sudano-Sahelian climatic zones, reflecting the country's rainfall gradient. The species is particularly abundant in the southern and western regions, including Cascades, Hauts-Bassins and Sud-Ouest, where the annual rainfall exceeds 900 mm. Its abundance gradually declines toward the northern regions as aridity increases, with its northern distribution limit occurring near the 600 mm isohyet, where it is generally restricted to lowland areas or sites with access to groundwater. As a characteristic species of traditional agroforestry parkland systems, *P. biglobosa* is protected and actively maintained by local communities because of the socioeconomic importance of its seeds, which are used in the production of *soumbala* and its valuable ecological functions. Consequently, it constitutes a key structural component of agricultural landscapes in Burkina Faso<sup>21,22</sup>.

**Nutritional potential:** The utilization of locally available feed resources in Burkina Faso represents an important strategy for reducing poultry production costs while promoting the sustainable use of indigenous biodiversity. The three feed resources reviewed exhibit distinct nutritional characteristics that, when appropriately incorporated into poultry diets, have the potential to improve growth performance and production efficiency.

Table 1 summarizes the nutritional composition of these three important West African feed resources. They are characterized by high nutritional value, particularly their elevated protein content in *Cirina butyrospermi* larvae and *Senegalia macrostachya* seeds and their abundance of sugars and vitamins in *Parkia biglobosa* fruit pulp.

***Cirina butyrospermi*:** The shea caterpillar is an excellent source of high-quality protein, with crude protein concentrations frequently exceeding 50% on a dry matter basis. Its amino acid profile is well balanced and rich in essential amino acids, making its nutritional value comparable to that of fishmeal. In addition to its high protein content, *C. butyrospermi* is a valuable source of lipids, particularly unsaturated fatty acids, as well as essential minerals such as iron and magnesium. Its inclusion in poultry diets has been associated with improved growth performance and enhanced immune function, owing to its high nutrient bioavailability<sup>8,23</sup>.

***Senegalia macrostachya*:** *Senegalia macrostachya* seeds represent a valuable alternative source of plant protein for poultry feeding. They effectively complement cereal-based diets, such as those formulated with millet or sorghum, by supplying lysine, an essential amino acid that is often limiting in cereal grains. Although, the seeds contain substantial protein levels, typically ranging from 30-35%, their nutritional value largely depends on adequate thermal processing. Heat treatments, including boiling or roasting, are essential to inactivate antinutritional compounds, such as tannins and trypsin inhibitors, which can impair nutrient digestibility and

Table 1: Summary of the nutritional composition of the three resources

| Component (per 100 g of dry matter) | <i>Cirina butyrospermi</i> (Shea caterpillar)                                                                                             | <i>Senegalia macrostachya</i> (Zamné seeds)                       | <i>Parkia biglobosa</i> (Néré pulp)                                                                                   |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Energy (kcal)                       | 450-600                                                                                                                                   | 350-400                                                           | 300-380                                                                                                               |
| Proteins (g)                        | 50-65                                                                                                                                     | 30-40                                                             | 3-6                                                                                                                   |
| Lipids                              | 15-30                                                                                                                                     | 5-10                                                              | 1-3                                                                                                                   |
| Carbohydrates                       | 5-10                                                                                                                                      | 35-50                                                             | 60-80                                                                                                                 |
| Fibers                              | 5-8                                                                                                                                       | 10-15                                                             | 10-20                                                                                                                 |
| Key Minerals                        | Iron, Magnesium, Zinc, Calcium                                                                                                            | Potassium, Magnesium                                              | Vitamin C, Potassium                                                                                                  |
| Predominant Amino Acids             | Very rich in Essential Amino Acids (EAA) (~47% of total AA). Predominant: Lysine, Glutamic acid, Glycine, Aspartic acid, Valine, Arginine | Contains a good proportion of hydrophobic and acidic amino acids. | Contains traces of essential amino acids (Leucine, Isoleucine, Lysine) but in low concentrations compared to its seed |
| References                          | 8, 23, 27, 28, 29, 7                                                                                                                      | 7, 30, 24, 26, 31, 32                                             | 24, 33                                                                                                                |

Table 2: Impact of local resources on zootechnical performance

| Resources                                      | Target species          | Recommended Incorporation rate    | Impact Performance                                                                                             | References |
|------------------------------------------------|-------------------------|-----------------------------------|----------------------------------------------------------------------------------------------------------------|------------|
| <i>Cirina butyrospermi</i> (Shea caterpillars) | laying hens "Isa-Brown" | Up to 5% (fish meal substitution) | No significant difference in laying rate, egg weight and feed conversion ratio (FCR) compared to fish meal.    | 34         |
|                                                | Local chickens          | Variable (protein source: ~5%)    | Excellent growth due to high protein content (50.2%) and fatty acids (omega-3). Reduces feed costs.            | 7, 30      |
| <i>Senegalia macrostachya</i> seeds            | Broilers                | 10% to 15% (boiled seeds)         | Better weight gains and profit margins with 15% boiled seeds. Avoids the antinutritional factors of raw seeds. | 35         |
|                                                | Local chickens          | 3% (supplementation)              | Improvement in Average Daily Gain (ADG: 11.29 g/d) and FCR (4.61). Reduction of abdominal fat.                 | 30         |
| <i>Parkia biglobosa</i> fruit pulp             | Laying hens             | 2.5 to 5%                         | Improved egg yolk coloration (carotenoids). Rich in energy (sugars ~60%) but low in protein                    | 36         |
|                                                | Poultry                 | Partial substitution of maize     | Economical energy source. Improves ration palatability due to its sweet taste                                  | 37         |

Table 3: Constraints and antinutritional factors

| Resources                                      | Constraints (Technical, Socio-economic, Sanitary)                                                                                              | Antinutritional Factors (ANFs)                                                                         | References     |
|------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------|
| <i>Cirina butyrospermi</i> (Shea caterpillars) | Marked seasonality (July-September); Preservation difficulties (mould risks); Strenuous harvesting, Socio-cultural prejudices in certain areas | Tannins, Phytic acid (in low quantities); Potential presence of chitin (reduces protein digestibility) | 8, 38, 39      |
| <i>Senegalia macrostachya</i> (Zamné seeds)    | Very long cooking time (requires the addition of potash/ash); Limited local availability; High price in urban markets                          | Phytates, Tannins, Saponins; Trypsin inhibitors (can hinder protein digestion)                         | 31             |
| <i>Parkia biglobosa</i> (Néré pulp)            | Sensitivity to moisture (caking); Risks of contamination during open-air drying; Low standardization of artisanal processing                   | Condensed tannins, Oxalates (can interfere with calcium absorption); phytates                          | 40, 11, 41, 12 |

utilization in poultry. Following appropriate processing, the seeds provide a stable source of metabolizable energy and contribute to diversifying dietary protein sources<sup>24,25</sup>.

**Parkia biglobosa:** Unlike the other two feed resources, *Parkia biglobosa* fruit pulp functions primarily as a source of dietary energy and micronutrients. It is rich in soluble sugars and vitamins, particularly vitamin C and provitamin A, which enhance feed palatability and may stimulate voluntary feed intake in poultry. Its high potassium and dietary fiber contents may also contribute to maintaining normal gastrointestinal function. Although relatively low in protein, *P. biglobosa* fruit pulp can be effectively combined with *C. butyrospermi* to achieve a more balanced dietary energy-to-protein ratio, thereby supporting efficient nutrient utilization and poultry performance<sup>24,26</sup>.

**Effects of the three feed resources on zootechnical performance:** The incorporation of these three locally available feed resources into poultry diets, particularly those of indigenous chickens and broilers in West Africa, represents a promising strategy for reducing feed costs while maintaining or improving production performance.

Table 2 summarizes the reported effects of *Cirina butyrospermi*, *Senegalia macrostachya* seeds and *Parkia biglobosa* fruit pulp on poultry zootechnical performance. These feed resources contribute to improvements in growth performance, feed conversion ratio, body weight and egg production through the provision of essential nutrients and bioactive compounds.

**Constraints and antinutritional factors:** Despite their high nutritional value, the utilization of these three feed resources in poultry nutrition is constrained by several biological limitations and the presence of antinutritional factors (ANFs). Table 3 summarizes the major biological constraints and antinutritional factors associated with *Cirina butyrospermi*, *Senegalia macrostachya* seeds and *Parkia biglobosa* fruit pulp.

## CONCLUSION

The utilization of locally available feed resources, including *Cirina butyrospermi* larvae, *Senegalia macrostachya* seeds and *Parkia biglobosa* fruit pulp, represents a promising strategy for enhancing the sustainability and profitability of poultry production in Burkina Faso. Owing to their high

contents of protein, minerals and dietary energy, respectively, these feed resources constitute economically viable alternatives to conventional imported protein sources, such as soybean meal and fishmeal, the rising costs of which substantially increase poultry production expenses. Their effective incorporation into poultry feed formulations has the potential to reduce feed costs, improve resource utilization and contribute to national food and nutritional security through the sustainable use of locally available biodiversity. Nevertheless, the long-term success of this approach depends on the development of efficient collection and supply systems, together with the standardization of processing techniques to ensure consistent nutritional quality, minimize antinutritional factors and maximize their safe and effective utilization in poultry diets.

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