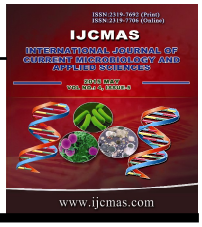
*Int.J.Curr.Microbiol.App.Sci* (2015) 4(5): 50-56

*International Journal of Current Microbiology and Applied Sciences*
***ISSN: 2319-7706*** **Volume 4 Number 5 (2015) pp. 50-56**
**http://www.ijcmas.com**




**Original Research Article**

# Fruit Production of *Prosopis africana* (G. et Perr.) Taub., An Overexploited Species in the Southeastern Niger

**Laouali Abdou[1]*, Iro Dan Guimbo[2], Issa Chaibou[3] and Ali Mahamane[4]**

[1]Faculté des Sciences et Techniques, Université Dandicko Dankoulodo de Maradi, BP : 465
[2]Faculté d'Agronomie, Université Abdou Moumouni de Niamey, BP: 10960
[3]Faculté d'Agronomie et des Sciences de l'Environnement, Université Dandicko Dankoulodo de Maradi, BP: 465
[4]Laboratoire Garba Mounkaila, Département de Biologie, Faculté des Sciences et Techniques, Université Abdou Moumouni de Niamey, BP: 10662

**Corresponding author*

**Keywords**

*Prosopis Africana*, Fruit, Productivity, Dendrometric parameters, Niger

**A B S T R A C T**

In Niger, *P. africana* is a forest species with multiple uses. All parts of the tree (wood, leaves, fruits, bark) are used by the rural population. Its exploitation exposes it to degradation and regeneration problem. The global objective of this study is to assess the fruits production of *P. africana* in this sahelian part. The data collection method was based on a count and weighing of fruits from a sample of feet. One hundred feet, at which the dendrometric parameters are previously measured, are involved in total. The average weight of 10 pods is 95.42 ± 18.56 g and the average production is 2.85 ± 1.38 kg/foot. The relationship between this production and dendrometric parameters were determined. The production is more correlated to the crown diameter and the stem diameter than to the height of the feet. Productivity is higher in individuals with average diameter. This study revealed a weakness in fruits production of *P. africana* in Niger, which allowed proposing measures to mitigate it.

## Introduction

Like many woody species in Niger, *P. africana* provides countless products and services to rural populations (Larwanou *et al.*, 2010a). The services they render expose them to high human pressure leading to their degradation. The particularity of *P. africana* is that it is the species most preferred in several uses in this zone (Laouali *et al.*, 2014) and is already facing a regeneration problem, especially because of the low rate germination of seeds (Ahoton *et al.*, 2009; Niang-Diop *et al.*, 2010). Among the main uses of this species there is that of its wood, very resistant, in the manufacture of household items (mortar, pestle ...) and good quality coal for blacksmiths, for the closing of the houses, laying sheds and attics. The leaves, roots and bark are mainly used in

traditional medicine. The leaves and pods pulps are used in fodder and seeds in food (Larwanou *et al.,* 2012; Laouali *et al.,* 2014). Overexploitation and the regeneration problem, plus the climatic conditions increasingly difficult, have as consequences the gradual decline of the species population in its range. *P. africana* would be endangered in the Southern Sahel and adjacent Savannas (Maydell, 1983) and in the south-western Burkina Faso (Guinko, 1984). In Niger, *P. africana* is present in the south of the country and to face the threats to this species, have data on its fruits production and so on seed availability is essential. The main objective of this study is to evaluate the fruits production of *P. africana* in Niger.

## Materials and methods

### Study sites

This study was conducted in the village terroirs of Elguéza in the Gazaoua department, south of Maradi region and Zagawa in the Kantché department, south of the Zinder region (Figure 1). The socio-economic activities of the local populations are dominated by agriculture, livestock, crafts and trade. The climate is of sahelo-sudanian type at both sites.

In the south of Maradi region (site of Elguéza), the average annual temperature is 28°C. The average annual rainfall from 1981 to 2010 to the Gazaoua station (nearest the site) is 446.32 mm ± 117.95. The soils are mainly dunal and the flora is dominated by Mimosaceae (*Prosopis africana, Albizia chevalieri, Faidherbia albida*), Caesalpiniaceae (*Piliostigma reticulatum, Cassia singueana, Bauhinia rufescens*), Combretaceae (*Combretum glutinosum, Guiera senegalensis, Anogeissus leiocarpa*) and Anacardiaceae (*Sclerocarya birrea, Lannea microcarpa*).

In the south of Zinder region (site of Zagawa), the average annual rainfall is 525 mm ± 77.6 and the annual average temperature is 22.5°C. The soils are mainly sandy, sandy loam and clay loam. The flora is dominated by Mimosaceae (*Faidherbia albida, Prosopis africana*) and Anacardiaceae (*Lanea microcarpa*).

Each of these areas is shared between the south sahelian central and north sudanian central compartments, according to the Saadou (1990) subdivisions and the vegetation consists of Combretum thickets, steppes, low dry forests, gallery forests and savannas.

The choice of these sites is based on the presence of relatively dense populations of *P. africana*.

### Data collection

Data were collected in December 2013, period in which the fruits are mature. A sample of 50 feet per site, with no physical damage has been retained. These feet have been targeted randomly before maturity and precautions have been taken in collaboration with farmers to monitor and prevent possible fraudulent harvests and to pick up the fallen pods without mixing these of the different feet. However, surveillance began only from the beginning of the period of maturity and therefore not considered immature pods fallen before. Data collection has been counting all the pods on the tree and harvesting 10 pods randomly on each foot. The number of pods per plant is thus known and 1000 total harvested pods are transported to the laboratory, dried more and weighed. The pods were harvested mostly by shaking down branches because fruits healthy of *P. africana* persist for long on the tree even after maturity (Bonnet *et al.,* 2005). Weighing was performed on samples

of 10 pods, totaling 100 samples. The choice of counting on the tree and partial harvesting instead of the full harvesting was motivated by low fruits density observed on the field and a desire to limit the waste of these fruits that will eventually serve as seed or any other use locally. On each foot, trunk diameter at 1.30 m from the ground, the tree height and the crown diameter were previously measured. Among the trees with fruits, the smaller diameter seen on the field is 15 cm and therefore the measurements were started from this level.

**Data analysis**

The average weight of 10 pods was calculated and the total weight of the pods (production) of each tree was determined. Pearson correlations and linear regressions between dendrometric parameters measured and the weight of fruits produced were established with the Minitab 16 software. The diameter, which is the most stable parameter over time, has been divided into 16 classes and the average fruits production has been calculated for each of them. The ratio of the average production of each class and the center of the latter was then calculated to compare the productivity of different classes. The results are presented in graphs, established with the Excel 2007 software.

**Results and Discussion**

**Fruits production**

The average weight of 10 pods is 95.42 ± 18.56 g. The average production is 2.85 ± 1.38 kg/foot. Photo 1 shows the aspect of harvested pods.

**Correlation between fruits production and dendrometric parameters**

All dendrometric parameters concerned are significantly correlated with fruits production ($P < 0.05$). The correlation is stronger with the crown diameter ($R^2 = 0.654$), then the trunk diameter ($R^2 = 0.557$) and in the end, the height of the tree ($R^2 = 0.453$) (Figure 2). The tests on residues have shown that they are independent, normally distributed, their mean is null and their variance is constant.

**The productivity of the feet according to diameter class**

The productivity of *P. africana*, expressed as the ratio production/diameter, grows from the class [30 35], reaches its maximum to the class [40 45], then gradually decreases until the class [60 65], from which it remains substantially constant (Figure 3).

Tree fruits production in the Sahel is determined by several factors, including soil and climatic conditions (soil type, rainfall), the intrinsic characteristics of the species and anthropogenic factors (Larwanou *et al.*, 2010b). Fruits production of *P. africana* found in this study is highly variable depending on the feet. However, even the maximum value is very small compared to that obtained by Larwanou *et al.* (2010b), 71.52 to 92.38 kg/foot for the same species in the department of Kollo, southwestern Niger (average rainfall 500 mm). This low fruits production of *P. africana* may be related to:

- The low number of pods produced but also and mostly their size and weight. Indeed, Adigun and Alonge (2000) found in the southern Sudan area in Nigeria for the same species an average weight 24.72 g/pod, 247.2 g for 10 pods, which is about 2.6 times the weight found in this study. This may be related to weather conditions or genetic factors;

- Parasites attack whose agents are mainly caterpillars and nocturnal birds. Indeed, a significant loss of immature fruits observed during various field missions is a parameter that would have contributed to the decline in production. This loss is caused by larvae that penetrate and destroy the pods and by nocturnal birds. This has direct consequences on the stock of seeds and thus on the survival of the species by exacerbating its regeneration problem highlighted by several authors (Ahoton *et al.*, 2009; Niang-Diop *et al.*, 2010; Laouali *et al.*, 2014).

The fruits production of *P. africana* is more correlated with the diameter of the crown, which is quite logical because this parameter represents the size of the branches and it is these which wear fruits. The diameter of the trunk is not far behind the crown in this correlation because it also expresses the size of the tree if the branches are not pruned.

**Figure.1** Location of the study sites

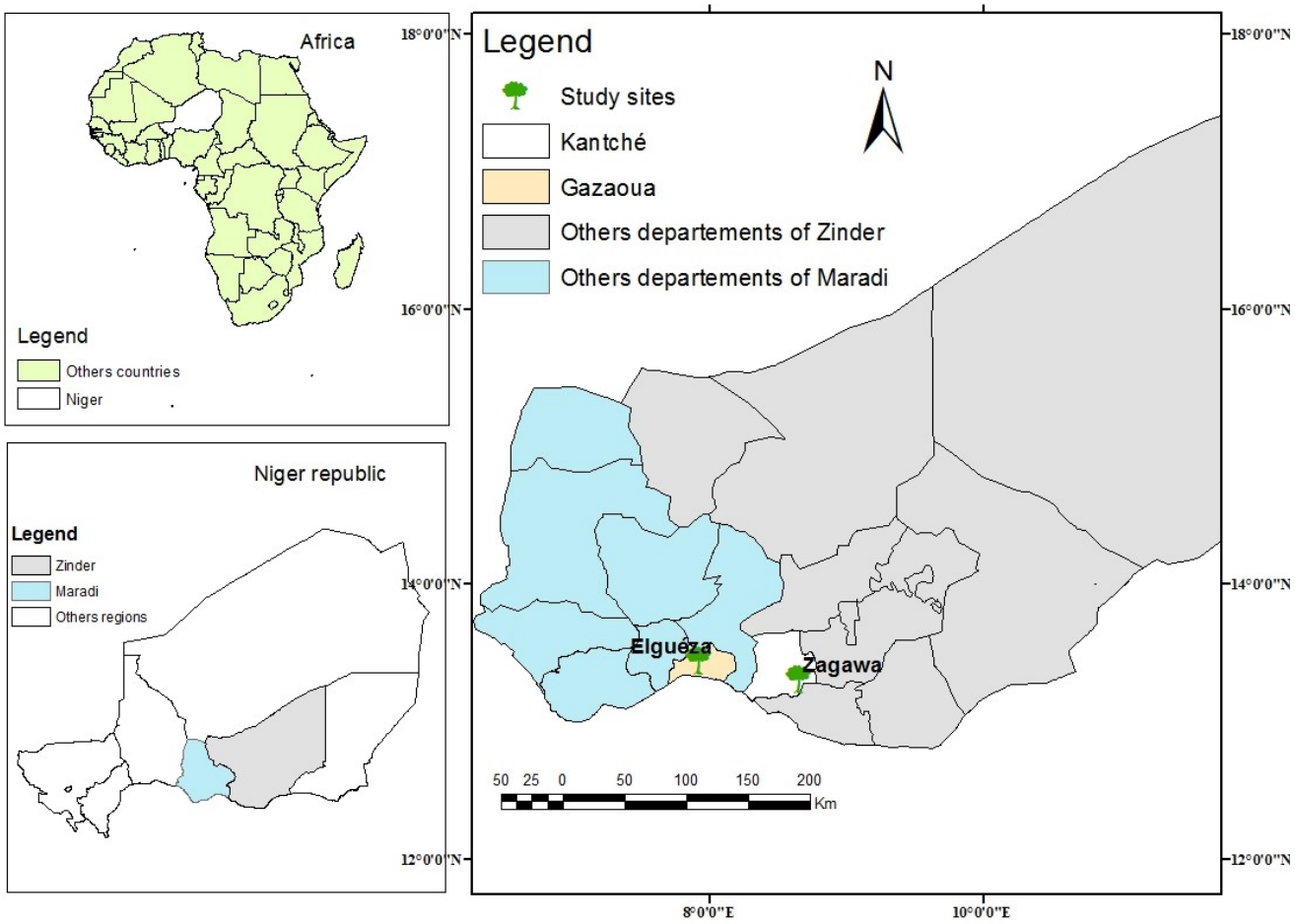


**Photo.1** Pods of *P. africana*: a pod showing signs of attack (a) and a lot of pods showing that most are attacked (b)

**Figure.2** Regression between fruits production of *P. africana* and dendrometric parameters (a: trunk diameter; b: crown diameter; c: height)

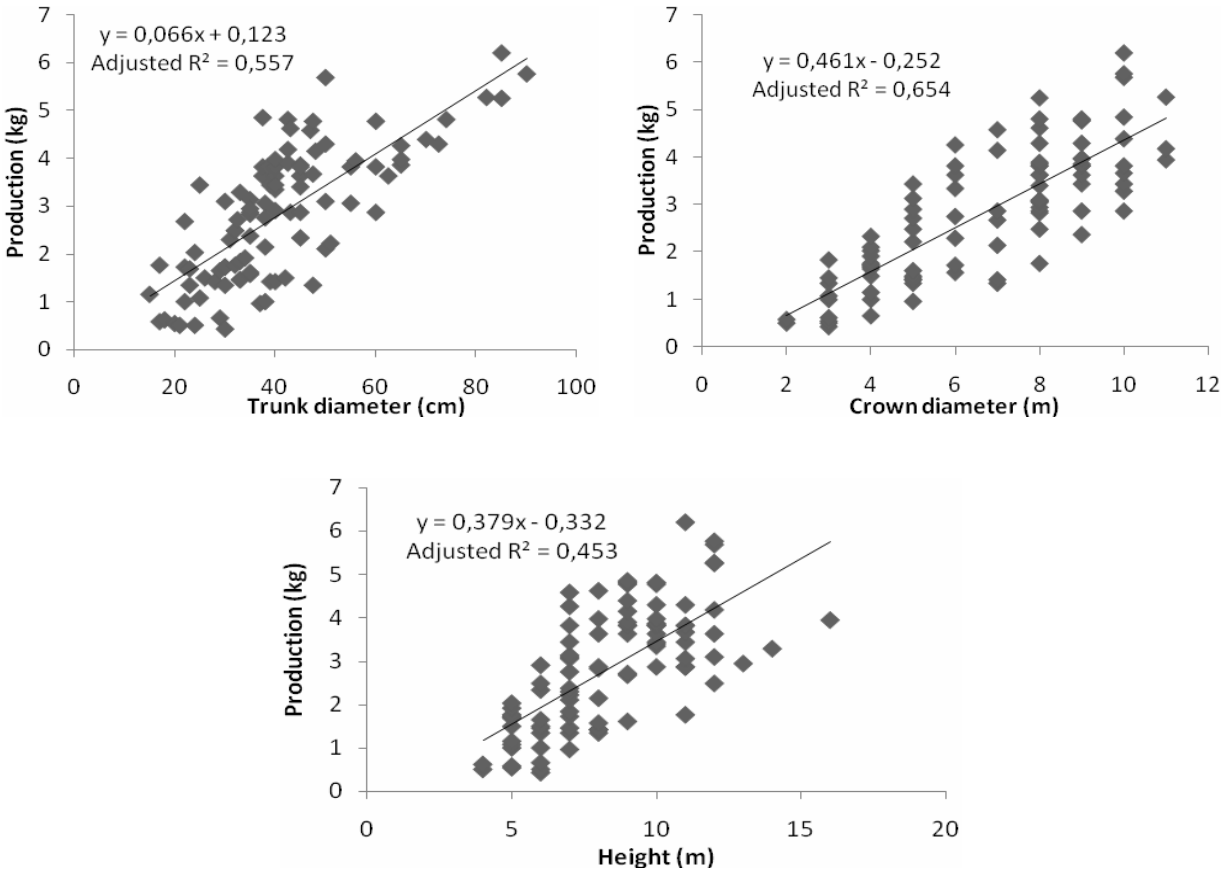
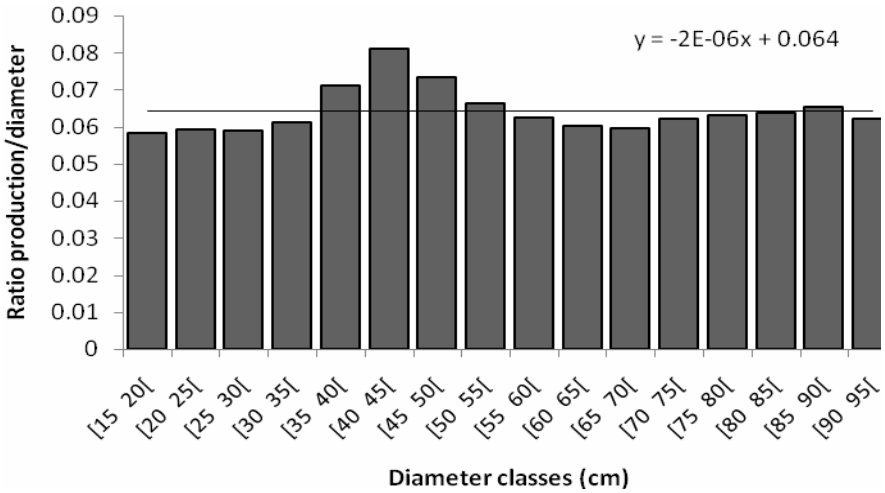


**Figure.3** Relationship between the fruits production of *P. africana* and the diameter class




The weakness of the correlation with the height, compared to others dendrometric parameters, can be explained by the fact that there are very high feet with small stretch and small diameter and short feet with large stretch and big diameter, so that the height does not allow to estimate the fruits production.

In all cases, the correlation between fruits production of *P. africana* and dendrometric parameters is not strong and these results corroborate those found by Larwanou *et al.* (2010b). This is related to the fact that some feet have the same dendrometric characteristics but very different fruits productions. This difference could be explained by the genetic heritage of different individuals.

The correlation, which shows that production increases with the diameter, expresses only the general situation but the tree's productivity is optimal for medium diameters. This could be explained by the age of individuals that reach their maximal productivity after a number of years and lose this productivity as they age.

Fruits production of *P. africana* in the southeastern Niger varies among individuals and is low, limiting the stock of seeds. The productivity of the feet is highest among individuals with average age and decreases with aging. This study, being conducted on only one season, must be repeated to achieve more conclusive results, but we can already realize the need to undertake some activities. We must therefore conduct studies on parasites of this species on the one hand in order to effectively fight against them and its genetic variability secondly to select the most productive varieties.

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