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Production and Use Sorghum: A Literature Review

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Abstract

Sorghum bicolor (L). Moench is the crop for grain for human and animal consumption.

The aim of this study is to document the production and use Sorghum in Senegal through a literature review.

Medline database and scholar Google were used. To be selected, the manuscripts were to address the use and production of sorghum and their health implications.

World sorghum production is about 60 million tons per year; the main producing countries are the USA, Nigeria, and India. In Senegal there is on the one hand of traditional sorghum varieties and on the other, those improved by the Senegalese Institute of Agricultural Research (ISRA) that are adapted to our soil and productive. Sorghum grains are used by people in semi-arid countries in Africa and Asia, for consumption as pasta, boiled and traditional drinks. Studies have shown the virtues of this cereal on the health of men, hence the need for further studies to be eligible for any of the therapeutic potential of the latter.

Keywords: Sorghum; Use; Production and Senegal

Introduction

Sorghum bicolor (L). Moench is the crop for grain for human and animal consumption. Sorghum is produced in areas that are too hot, a minimum average temperature of 25°C is necessary to ensure maximum grain production. The morphological characteristics of the culture make it one of the currently cultivated cereals that have the best drought tolerance. During the drought, it rolls its leaves to reduce water loss due to perspiration. If the drought continues, it becomes dormant instead of dying. The leaves are protected by a waxy cuticle to reduce evapo transpiration.

Sorghum is the fifth most important cereal crop in the world after rice, wheat, corn and barley. It is the main cereal food for over 750 million people living in semi-arid tropical regions of Africa, Asia and Latin America (CCCF, 2011) [2].

The largest producers are the United States (almost 17% of world production), with yields obviously much higher, followed by India, Nigeria, China, Mexico, Sudan and Argentina (ICRISAT, 2006) [3].

In Senegal, as in many semi-arid countries of Africa and Asia, grains occupy an important place in the food and feed. Sorghum grains are used by these people (especially farmers), who often do not have the means to feed themselves with food sources of energy, rich in protein, vitamins, minerals. Sorghum grains are rich in energy and non-energy nutrients. In these areas, they are intended for consumption as pasta, boiled and traditional beverages (Kayodé, 2006). Sorghum grains, in addition to the mentioned use are also consumed in Senegal as semolina accompanied sauce.

By cons in industrialized countries, it is used in the form of grain or fodder in animal feed and for the production of bio ethanol. The sorghum demand increases more and more in many developing countries, particularly in West Africa (especially Nigeria, Ghana and Burkina Faso) .This is linked both to population growth and partly , politics of these countries that aim to develop the industrial use of sorghum (brewery) to replace the barley malt (BA, K. et al) [1].

The presence of a testa, seed coat, brown in color, is an indication of impairment. In some sorghum genotypes the testa is sometimes partial, not visible or even missing while in others it is highly pigmented (Evers et al., 2002) [4]. Phenolic compounds (phenolic acids, flavonoids and tannins) are the most widely represented and ubiquitous secondary metabolites in the plant kingdom but among cereals, sorghum is the richest and can contain up to 6% (Beta et al . 2000; Dicko et al, 2005; Awika et al., 2004) [5-7], although it has been shown that only varieties with a pigmented testa contain tannins (Dykes et al, 2006, Rooney, 2003) [8,9], They play an important role in the defense mechanisms vis-à-vis plant fungi and pests, such as insects and birds. It is now recognized that phenolic compounds are also involved in human health (BA, K. et al) [1].

Phytic acid has a strong binding capacity and can therefore form complexes with proteins and multivalent cations. Most

complex phytate - metal are insoluble at physiological pH and therefore make more biologically unavailable minerals for animals and humans (FAO, 1995) [11].

After analyzing several sorghum varieties (white and red), it appears that in the whole seed phytic phosphorus varies between 170 and 380 mg per 100 g and it represents over 85% of total phosphorus in the whole grain (Hadbaoui Zineb, 2007) [10].

This literature review provides a selection and compilation of available information in the literature on the composition, grain sorghum uses and molds them. This is a general summary for better understanding of the potential of this production.

Methodology

This work consisted of a literature review on the Sorghum, its production and use in Senegal. We mainly used two search engines:

• Medline database with the key words «Sorghum and micronutrients and Production and Use and Senegal».

• The basic data with scholar goggle the words «Sorghum, micronutrients, production and use «sorghum grain mold, fungi

The research period was not defined and the documents should be written in French or English.

To be selected, the manuscripts were to address the use and production of sorghum and their health implications.

Results

A number of scientific papers, theses, papers, books, reports and press clippings on sorghum, its production and use were consulted.

The exploitation of these documents allowed to describe the structure of the plant, varieties, production areas, myco toxins and nutritional implications.

Botanical plant structure

Sorghum bicolor (L). is a plant of 1 to 3 meters high, solid cylindrical rod with a terminal inflorescence compact panicle. This includes one or two spike lets bisexual flowers. The seed is a caryopsis of about 4 mm (Hadbaoui Zineb, 2007) [10]. It produces an upright stem 50 to 70 cm for the present forms cultivated and elongate leaves similar to those of maize. At the end, develops a panicle of flowers and fruits containing seeds that mature in autumn.

Structure sorghum seed

CAM 1995. The values found by BA et al [1] in 2010 fall into these intervals given above.

The quantitative and qualitative analysis of amino acids performed by HPLC shows the existence of 8 The principal anatomical components are pericarp, germ or embryo and endosperm. The pericarp is the outer structure of the caryopsis (the largest component of the cereal grain is the endosperm, which is a major storage tissue) the embryonic axis and the

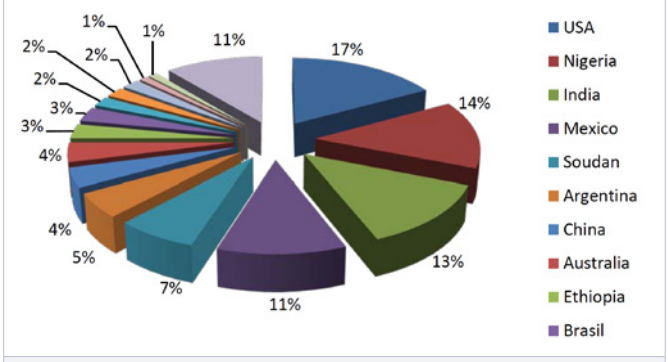

Figure 1: Sorghum production in 2005 (FAO).

Figure 2:

Table 1: Documents Reviewed.

Documents	Numbers
Scientifics articles	16
Books	3
Reports	4
Thèses	6
Memory	4
Cuts presses	2

scutellum are the two major parts of the germ (Sorghum and millets in human nutrition, FAO 1995).

The protein content of grain sorghum are between 7 and 17%, starch between 60 and 75% and the weight of 1000 grains between 25 and 30 g according to the results of the essential amino acids. The amount of amino acids is around 168.42 mg / g in red sorghum and 126.72 mg / g in white sorghum (A-M. LINKO et al, 2005) [12].

Production areas

World sorghum production is 60 million tons in 2000, and a little less specifically 58,626,758 tons in 2005 (FAO). The table below shows the main producer of sorghum grain with their production quantities and the corresponding percentages.

Found below the graph of the production quantities worldwide. With still leading the first five sorghum-producing countries in the world.

Table 2: The varieties grown in Senegal.

Improved varieties	Description
CE151-262	Approval Date: 1994 Location selection: Bambey , Senegal Breed: caudatum Plant height : 140 cm Nature Genetics : Lineage Color caryopsis after threshing : White Cultural vocation irrigated winter crops ; rain (areas between 400 and 600 mm of rain) potential grain yield : Irrigated 5 to 6.5 t / ha potential grain yield : pluvial 2 to 4.3 t / ha
CE196-7-2-1	Approval Date: 1994 Location selection: Bambey , Senegal Breed: caudatum Plant height : 190 cm Nature Genetics : Lineage Color caryopsis after threshing : Yellow Cultural Vocation: pluvial (areas between 400 and 600 mm of rain) potential grain yield : 2.8 to 5 t / ha
Darou (622B)	Approval Date: 2009 Location selection: Bambey , Senegal Breed: caudatum Height of plant : 170 cm Nature Genetics : Lineage Color caryopsis after threshing : white Cultural Vocation: pluvial (Between zones 600 and 800 mm of rain) potential grain yield : 2.5 to 3 t / ha
F2-20	Approval Date: 1994 Location selection: Bambey , Senegal Breed: caudatum Plant height : 210 cm Nature Genetics : Lineage Color caryopsis after threshing : Ivory Cultural Vocation: pluvial (areas between 600 and 900 mm of rain) potential grain yield : 3 - 5.3 t / ha
Faourou (621B)	Approval Date: 2009 Location selection: Bambey , Senegal Breed: caudatum Plant height : 175 cm Nature Genetics : Lineage Color caryopsis after threshing : white Cultural Vocation: pluvial (areas between 600 and 800 mm of rain) potential grain yield : 2.5 to 3 t / ha
Nganda (622A)	Approval Date: 2009 Location selection: Bambey , Senegal Breed: caudatum Plant height : 170 cm Nature Genetics : Lineage Color caryopsis after threshing : white Cultural Vocation: pluvial (areas between 600 and 800 mm of rain) potential grain yield : 2-3 t / ha
Nguinthe (621A)	Approval Date: 2009 Location selection: Bambey , Senegal Breed: caudatum Plant height : 165 cm Nature Genetics : Lineage Color caryopsis after threshing : white Cultural Vocation: pluvial (areas between 600 and 800 mm of rain) potential grain yield : 2-3 t / ha
CE145-66	Approval Date: 1986 Location selection: Bambey , Senegal Breed: caudatum Plant height : 190 cm Nature Genetics : Lineage Color caryopsis after threshing : Ivory White Cultural Vocation: pluvial (areas between 500 and 700 mm of rain) potential grain yield : 2.9 to 5.4 t / ha
CE180-33	Approval Date: 1994 Location selection: Bambey , Senegal Breed: caudatum Plant height : 180 - 200 cm Nature Genetics : Lineage Color caryopsis after threshing : Matte White Cultural Vocation: pluvial (areas between 400 and 700 mm of rain) potential grain yield : 2.8 to 5 t / ha

Sorghum World production in 2005 (FAO annual sorghum production in Senegal is around an average of 140000 tons since 1996, it is exactly 92 029 tons during the period 2013/2014 (ANSD).

The varieties grown in Senegal

There are a multitude of sorghum varieties grown in Senegal, traditional ones and those improved by the Senegalese Institute of Agricultural Research. We quote some in the table below:

Faced with improved varieties, We Have These Traditional As the name indicates, they have no records Varietals but still cultivated by farmers in May on some each Quote:

Tigne	Bazaromba
Weyde 1	Nienike Bis 16-81
BamberiBodedjo	Bassi S4
Niéniko	SL 516
Congossane N°57	SL 179
SL 456	Flattie Ba
Fellah Blanc 2	Sorghum Panicula N°6

The sorghum mycotoxins

In the case of molds, high values of relative humidity (RH) during the early growth phase on the one hand, and between the end of flowering and the second crop, were strongly correlated with the incidence of mold. Relations between HR max and mold damage marks were clearly non-linear, showing a net increase in notes when the RH exceeded a threshold of about 95% (Alain RATNADASS, 2007) [13].

Like many grain sorghum grain hosts at harvest time a very varied composition of mycoflora. Sorghum grain molds are now well recognized as the first pathological problem of this plant in the world and particularly in Senegal. The most important elements of mycoflora are Fusarium, Curvularia, Alternaria , Helminthosporium and Phoma . The most common genera in Senegal are Curvularia and Fusarium, for the latter, five species were identified: F.solani ,

F.moniliforme, F.cquiseti , F.fLocciferum and F.sporotrichoïdes (D LOUVEL, 1981-1984) [14].

Nutritional and medicinal implications

In a study by De Morais Cardoso L1 and its allies in 2015 and on "Sorghum: nutrients, bioactive compounds, and the potential impact on human health," the authors talk about the composition of this cereal and especially the virtues of these on human health. We know that sorghum is mainly composed of starch that is digested more slowly than other cereals that are low digestibility, protein and unsaturated fat and is a source of some vitamins and minerals. In addition, most sorghum varieties are rich in phenolic compounds, especially 3 – deoxyanthocyanidins and tannins. The results obtained in vitro and in animals have shown that phenolic compounds and the soluble compounds (polycosanols) highlighted in sorghum balance or stabilize the intestinal microbiota and the parameters associated with obesity, oxidative stress, inflammation, diabetes, dyslipidemia, hypertension and cancer. In conclusion, sorghum would be a source of nutrients and bioactive compounds, especially 3 - deoxyanthocyanidins, tannins and polycosanols, which advantageously modulate, in vitro and in animals, the parameters of certain non communicable diseases (of Morais Cardoso L1 al, 2015) [15].

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