Journal of Food and Nutrition Sciences
2024, Vol. 12, No. 5, pp. 234-238
https://doi.org/10.11648/j.jfns.20241205.14

Research Article

Agromorphological Characterization of the Main Sesame Varieties Grown in the Sahelian Zone of Chad

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Abstract

Sesame (*Sesamum indicum* L.) would be one of the oldest cultivated plants in the world. Currently in Chad, its cultivation is in vogue and constitutes one of the priorities of farmers. The objective of this study was to highlight the agronomic and morphological characteristics of two varieties of sesame grown in the Sahelian zone of Chad. The experiment was conducted in open fields in the natural site of Kournari, around thirty kilometers from the capital N'Djamena. The local black seed and white seed S-42 varieties were grown in a randomized Fisher block design with 3 replicates. Plant height, number of leaves, number of capsules, number of seeds per capsule, average seed weight, weight of 1000 seeds, and grain yields per plant were determined. The measured parameters showed that vegetative development is greater in the S-42 variety than in the local variety. While in terms of yield per plant, the local variety is more productive with 33.01 g per plant compared to 20.08 g per plant for the S-42 variety. Plant height had a negative effect on grain yield per plant. It would be interesting to study the characteristics of other varieties in order to identify those which would best respond to the Sahelian climate.

Keywords

Sesame, Varieties, Agro-Morphological, Yield, Sahelian Zone, Chad

1. Introduction

Sesame (Sesamum indicum L.) would be one of the oldest cultivated plants in the world and therefore one of the ancient oilseeds known and used by man. Worldwide, sesame ranks ninth among the top thirteen oilseed crops and its demand continues to increase [1, 2]. It is an annual herbaceous plant, standing erect, 0.5 to 2.5 m tall [3]. It adapts easily to growing conditions and is drought resistant [4]. Sesame is grown in tropical and subtropical regions of Asia, Africa and South America for its edible seeds from which oil is also extracted. Its seeds are used in human food in various forms as well as in the pharmaceutical and cosmetic industries. They are also used in the production of oil [5].

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Received: 17 August 2024; **Accepted:** 4 September 2024; **Published:** 20 September 2024

In Chad, there are multiple varieties of sesame, of different colors: red, black or white. Yields, length of the growing cycle, resistance to insects, fungi, diseases and climatic conditions, etc. are different for each variety [6]. Sesame is considered a promising sector [7]. It is renowned for its cultural, nutritional, economic and therapeutic value. Currently, sesame cultivation is in vogue and constitutes one of the priorities of Chadian farmers. It is increasingly cultivated, also due to the problems encountered with the main cash crops of cotton and peanuts. This trend is reinforced by the existence of a lucrative, albeit informal sector. However, its production has remained on the traditional scale due to the lack of suitable technologies. Research has not yet succeeded in initiating a real strategy for maximizing the production of this species.

It is with this in mind that the present study was initiated, in order to determine the agronomic and morphological characteristics of the two main varieties of sesame cultivated in the Sahelian zone of Chad. The S42 variety is preferred for its high yields, its resistance and its whiteness, while the local variety remains mainly used [6].

2. Materials and Methods

2.1. Study Area

The experiment was conducted in open fields in the natural site of Kournari about thirty kilometers from N'Djamena, the capital of Chad. The study area enjoys a Sahelian climate characterized by the succession of dry seasons and rainy seasons. The rainy season extends from June to September. However, the rainiest months are July and August. Maximum precipitation is observed in August.

2.2. Plant Material

The plant material consists of two (2) varieties of sesame (*Sesamum indicum* L.): the local variety with black seeds from Guera, Central Province of Chad and the S42 variety with white seeds produced by the Chadian Institute of Agronomic Research for Development (ITRAD). These varieties have an average cycle of 90 days. A sample of the upper soil horizon (0-20 cm) was taken from the field and analyzed at the ITRAD Laboratory.

2.3. Experimental Design

The research was conducted in a randomized complete block design. It is made up of one main factor which is the variety of sesame with three repetitions. The blocks were spaced by paths of two meters (2 m), and were each made up of three elementary plots, separated from each other by one meter (1 m). The dimensions of an elementary plot were 24 m long and 16 m wide, i.e. a useful area of 384 m^2 per elementary plot. The system comprised a total of nine (9) elementary plots and measured 50 m in length and 50 m in width, i.e. an area of 2,500 m^2.

2.4. Cultural Operations

The soil was prepared by plowing then the mottes of land were leveled with a harrow. The planting was done on July 12, 2023. The feet spacing was 60 cm * 20 cm. The depth of sowing was approximately 2 cm, the soil was lightly packed to ensure good contact of moisture with the seed.

The thinning of one plant per pocket was done on the 21st Day After Sowing (DAS), followed by transplanting the thinned plants into missing or poorly emerged pockets.

An application of NPK fertilizer was made on the same day at a dose of 1 g per seed on the seedling lines and one week later for transplanted plants.

2.5. Agronomic Measures

During the cycle, measurements focused on the height of the plant and the total number of leaves, from the 33rd DAS and at a weekly frequency, on ten labeled plants chosen randomly and located on the central lines of each plot. The height of the plants was measured using a graduated ruler while the number of leaves was determined by manual counting.

The weight of one thousand seeds was weighed using an electronic precision balance for the different treatments of all replicates. The grain yield per plant is calculated according to the Garfius' formula:

$$W = XYZ \text{ [8]}$$

Where X: is the number of capsules per plant; Y: average number of grains per capsule; Z: average seed weight.

2.6. Statistical Analysis of Data

The data collected on the various parameters observed and measured were recorded and processed using Excel 2016 software.

3. Results

3.1. Analytical Characteristics of the Soil

Soil analysis results (Table 1) showed that the soil had a slightly acidic to neutral reaction (pH of 6.75), not salty, relatively poor in organic matter (0.97%) and in mineral elements, especially in carbon (0.56%) and phosphorus (7.06 mg/kg).

Table 1. *Table caption.*

	Parameters	Valor
Soil reaction	pH	6.75
	Conductivity (µs/cm)	44
Chemical parameters	Carbon (%)	0.56
	Organic matter (%)	0.97
	Total nitrogen (%)	0.014
	Potassium (mg/l)	365
	Phosphorus (mg/kg)	7.06

3.2. Plant Height Evolution

Figure 1 presents the results of monitoring the height of the sesame varieties studied from the 33rd DAS until harvest (96th DAS). The analysis shows that plant height varied considerably depending on the sesame variety. The S 42 variety was the highest during the entire development cycle of the plants) with a maximum of 137.17 cm at maturity while the local variety presented the smallest size with a maximum of 131.87 cm at the end of the cycle.

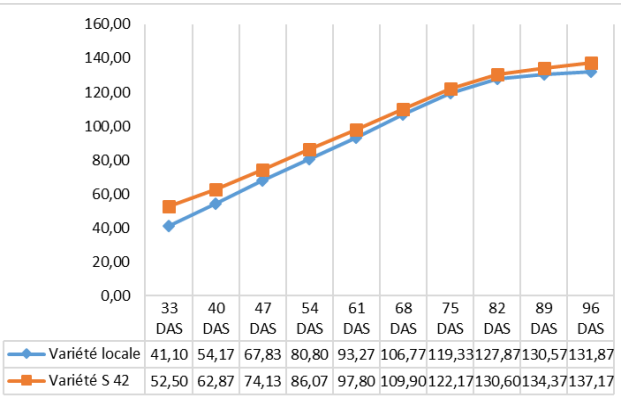

Figure 1. *Evolution of plant height (in cm).*

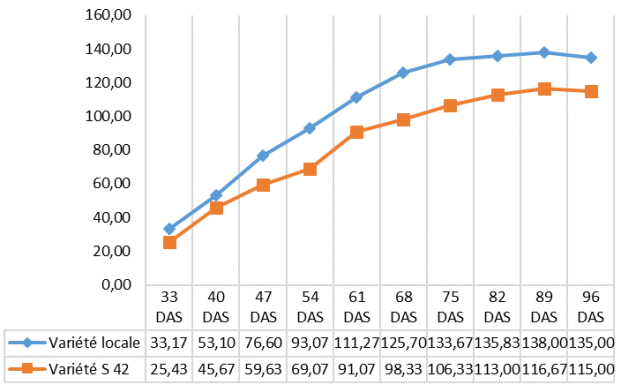

Figure 2. *Evolution of the number of leaves from the 33rd to the 96th DAS.*

3.3. Number of Sheets

In terms of leaf number, the local variety had more leaves throughout the plant's development cycle (Figure 2). The maximum average number of leaves of the local variety is 138. For the variety S 42, this number is 116.67. After 89 DAS a decrease in the number of leaves was observed for all varieties.

3.4. Yields and its Components

The Table 2 presents the results of yield and its components for the two varieties.

The local variety produced more capsules per plant (133.45), more seeds per capsule (77.3) and had the highest 1000 seeds weight (3.2 g). Despite its smaller size, the local variety has a higher seed yield per plant (33.01 g per plant) compared to the S 42 variety (20.08 g per plant).

Table 2. *Fruit and seed yields depending on the varieties.*

	Local variety	Variety S 42
Number of capsules per plant	133.45	98.18
Number of seeds per capsule	77.3	65.98
Average seed weight (g)	0.0032	0.0031
1000 seeds weight (gm)	3.2	3.1
Yield (g per plant)	33.01	20.08

4. Discussion

The study showed overall a difference in the agro-morphological characteristics of the sesame varieties studied. The height of the plants at maturity was 137.17 cm for the S 42 variety and 131.87 cm for the local variety. These results corroborate those of Macoumba (2002) for whom the height of the plant would be between 87 and 223 cm. [3] found heights between 160 and 169.42 cm for the varieties studied. [9] noted an average height of 120 cm for the S-42 variety. This shows that vegetative development is more important in our study area.

The results of the growth parameters showed that if the variety factor is important, the environmental factor is also important. Many studies have highlighted the environmental factors that most affect the growth and development of sesame and other species. [9-11] showed that the height, vigour and leaf area of sesame plants increase when the amount of available water increases. Similarly, [12] observed that application of water stress during vegetative development reduces stem expansion in maize. [13, 14] also showed that plant growth is reduced due to the reduction in photosynthesis caused by water stress.

The weight of 1000 seeds in this study is 3.2 g for the local variety and 3.1 g for the S 42 variety. These results are in contrast to [3, 15] which stated that the weight of 1000 seeds would be between 3.88 and 3.25 g and between 2.75 and 3. 08 respectively. This difference could be due to the moisture content of the grains at weighing linked to the level of drying [16, 17].

The calculation of the seed yield per plant made it possible to obtain different results depending on the varieties: 33.01 g/plant for the local variety and 20.08 g/plant for the S 42 variety. Plant height had a negative effect on grain yield per plant. Which seems to be the case at [15]. The weight of 1000 grains and the number of grains per capsule appeared to be decisive in sesame yield. Indeed, the capsules of the S 42 variety contained fewer seeds (65.98 seeds/capsule on average) than those of the local variety (77.3 seeds/capsule on average). These results for the S-42 variety are low compared to those of [3, 9] which reported respectively 31.38 g/plant and 30.68 g/plant for this variety. This difference could be explained by poor seed emergence and also differences linked to the edaphic and climatic conditions in which the experiments were conducted.

5. Conclusions

This study allowed to characterize and evaluate their agronomic and morphological performances of two varieties of sesame in the Sahelian zone of Chad. It appears from the results obtained that although the S 42 variety grows quickly in height, its yields are lower compared to the local variety. This work of characterizing sesame varieties has led to convincing results in the knowledge and behavior of sesame cultivation, especially in the Sahelian zone of Chad. In perspective, it would be interesting in the continuation of the research, to study the characteristics of other varieties in order to identify those which would best respond to the Sahelian climate and to evaluate the organoleptic, physico-chemical and microbiological qualities of the seeds of the different varieties of sesame.

Abbreviations

DAS	Day After Sowing
g	Gram
cm	Centimeters
ITRAD	Chadian Institute of Agronomic Research for Development

Author Contributions

Yacoub Mahamat Allamine: Conceptualization, Methodology, Resources, Writing – original draft

Hisseine Mahamat Allamine: Data curation, Formal Analysis

Alhadj Markhous Nazal: Data curation, Writing – review & editing

Soudy Imar Djibrine: Project administration, Validation

Abdelsalam Adoum Doutoum: Data curation, Visualization

Data Availability Statement

The data supporting the outcome of this research work has been reported in this manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

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