



Physiological and agronomic evaluation of the tolerance to continuous water deficit of two varieties of sesame (*Sesamum indicum* L.) grown in Burkina Faso

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ABSTRACT

Objective: The objective of this study is to analyze the physiological and agronomic responses of two local sesame varieties (*Sesamum indicum* L.), HB168 and SN103, when subjected to continuous water stress under controlled conditions, in order to determine their adaptability and tolerance to water stress.

Methodology and Results: A Fischer block design with two factors (variety and water regime) and three replicates was set up in a greenhouse. The variety factor has two categories (SN103 and HB168) while the water regime factor has three: watering every two days at soil water retention capacity, the control without deficit (T0); watering every two days at 3/4 of the soil water retention capacity, moderate deficit (T1); and watering every two days at 1/4 of the soil water retention capacity, severe deficit (T2). The results showed that, regardless of the level of water deficit, a significant reduction in collar diameter, plant height, and number of branches was observed, particularly under T2 in both varieties. On the 32nd day of stress, an increase in chlorophyll content was noted for both varieties under T1. All yield parameters including the number of pods per plant, number of seeds per pod, seed weight, and dry biomass decreased significantly as water stress intensity increased ($P < 0.0001$) in both varieties. Moderate water deficit induced a decrease in seed yield per plant of 15.5% for SN103 and 21.8% for HB168, while severe stress reduced seed yield by approximately 52.8% for both varieties. The HB168 variety proved to be more sensitive to moderate water deficit, while SN103 showed better overall tolerance, making it a promising variety for the genetic improvement of sesame in drought conditions.

Conclusion and application of results: SN103 and HB168 exhibit different growth strategies: SN103 prioritizes biomass and seed number, while HB168 is characterized by a higher number of pods and heavier seeds. Water stress reduces the performance of both varieties, but SN103 shows better overall tolerance, unlike HB168, which is more sensitive despite relative chlorophyll

stability. Thus, SN103 appears better adapted to Sahelian conditions and constitutes a promising resource for plant breeding programs.

Keywords : Sesame, Variety, Water stress, moderate, severe.

INTRODUCTION

Sesame (*Sesamum indicum* L.), one of the oldest cultivated plants in the world, is an annual oilseed whose seeds contain high levels of oil (45 to 57%), approximately 19 to 25% protein, vitamins (B, E) and minerals (Ca, P, Mg, etc.) (WHFOODS, 2011). Global sesame production has seen a significant increase in recent years. It rose from 4.22 million tons in 2010 to 6.64 million tons in 2020, with an average annual growth rate of approximately 15% during that period (FAOSTAT, 2020). In Africa, sesame is grown in 23 countries, with the three largest producers being Sudan, Uganda, and Nigeria. Sesame production on the continent accounts for 50% of global production in 2020. In 2019, according to FAO statistics, Burkina Faso was the 8th largest sesame producer in the world' accounting for 5.3% of global production, it ranks fourth among African producers, behind Sudan, Tanzania, and Nigeria. Sesame is Burkina Faso is second largest agricultural export after cotton, but production has not been consistent in recent years. From 22,887 tons in 2006, national production jumped significantly to 100,488 tons in 2013. It then fell sharply in 2014 and 2015 to 21,773 and 15,055 tons respectively due to poor soil and climate conditions and disease. In 2016, production jumped again to 235,079 tons, an increase of 1,561% in one year (DGESS/MAAH, 2016), and then reached 374,703 tons in 2020 (DGESS/MAAH, 2020). This growing interest among Burkinabe farmers in sesame cultivation can be attributed both to favourable trends in international markets and to the fact

that sesame farming remains accessible to the most vulnerable producers, particularly women. However, sesame production remains unevenly distributed across Burkina Faso, with some regions showing significantly higher production levels than others (DGPER, 2013). In addition, sesame yields per hectare remain low, estimated at approximately 1,000 kg/ha in in experimental trials compared to 450 kg/ha on smallholder farms (RONGEAD, 2013). This low production is linked to various constraints, including insufficient and poorly distributed rainfall and a lack of innovation in cultivation techniques (Kabore, 2007). It has been reported that water stress in sesame seedlings leads to significant reduction in yield (Compaore, 2011; Hassanzadeh *et al.*, 2009; Tantawy *et al.*, 2007). In order to contribute to the identification of parameters that can be exploited by varietal improvement programs and the promotion of sesame cultivation, this study focused on the physiological and agronomic evaluation of the resistance to continuous water deficit of two sesame varieties (*Sesamum indicum* L.) grown in Burkina Faso. The overall objective of this study was to evaluate the physiological and agronomic responses of two sesame varieties originating in Senegal (HB168) and Niger (SN103) grown in Burkina Faso, when faced with continuous water deficit. Specifically, the aim was to (i) evaluate the growth of these varieties under conditions of continuous water deficit; (ii) evaluate the seed yield of these varieties under the same conditions of water deficit.

MATERIAL AND METHODS

Material Plant material: The plant material was provided by the Institute for the Environment and Agricultural Research (INERA) in Kamboinsé, Burkina Faso. It

consisted of seeds from two varieties of branched sesame: SN-103 from Niger and HB-168 from Senegal. The characteristics of the different varieties are listed in Table 1.

Table 1 : Some characteristics of the two sesame varieties

Varieties	SN103	HB168
Source	Niger	Sénégal
CG	White	Cream
CFe	Green	Dark green
CFI	White + slight purple tint	
PTFC	Very hairy	
DL (DAS)	3	
DFI (DAS)	36	36
DFI50% (DAS)	41	38
FFI (DAS)	65	66
DC (DAS)	90	

Legend: SC: seed color; LC: leaf color; FC: flower color; HSC: hairiness on stem, leaves, and capsules; DL: emergence date; DFI: start of flowering; DFI50%: date of 50% flowering; FFI: end of flowering; DC: cycle duration; DAS: days after sowing.

Methods

Experimental site: The experiment was conducted in the research garden of the Life and Earth Sciences Training and Research Unit (UFR/SVT) at Université Joseph Ki-Zerbo in Ouagadougou. The study area is characterized by a Sudano-Sahelian climate (Figure 1). The plants were grown in pots in

a greenhouse located at latitude 12° 37' North and longitude 01° 49' West. The greenhouse is protected by a mesh screen that prevents insects from entering and has a translucent metal roof that allows good light penetration while reducing the direct impact of solar radiation.

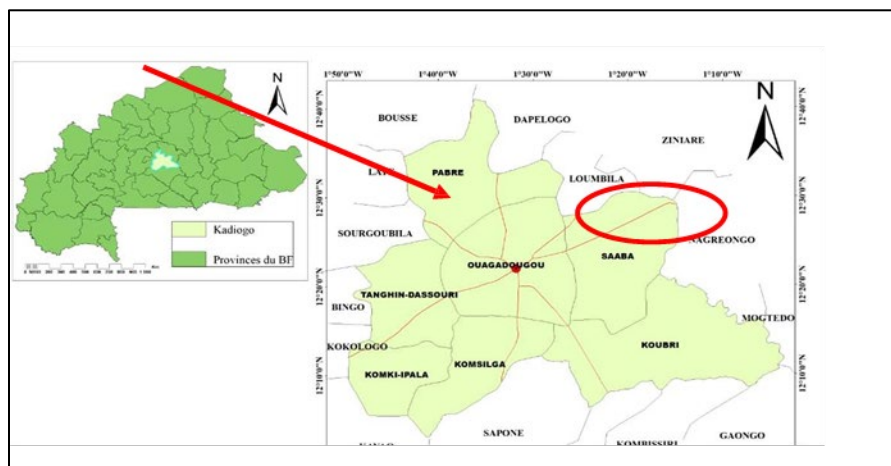


Figure 1: Location of the experimental site

Conduct of the trial: The plants were grown in plastic pots measuring 20 cm in diameter at the bottom, 28 cm in diameter at the top, and 30 cm in height. The substrate used was soil extracted from a depth of 0 to 30 cm. A sample of this soil was taken and analysed at the National Soil Laboratory (BUNASOLS) to determine its grain size and mineral composition. After drying and homogenization, the soil was distributed among the pots at a rate of 13 kg per pot. The bottom of each pot is perforated to allow excess water to drain and prevent any risk of root asphyxia. The experiment took place from April 8 to July 26, 2023. Seeds were sown at a rate of five seeds per pot, at a depth of about 2 cm. The first thinning was performed 15 days after sowing (DAS), leaving only two seedling per pot. A second thinning was carried out on the 19th DAS to leave only one plant per pot.

Experimental setup and water treatment:

The experiment was conducted using a randomized complete block design (RCBD) with three replicates. Two factors were studied: water treatment (main factor) with three levels (T0, T1, T2) and variety with two levels (HB-168 and SN-103). The water stress levels represent the sub-blocks and the pots constitute the elementary plots. The blocks served as replicates. Three water regimes were applied during the experiment: the control treatment (T0), corresponding to watering every 2 days at the soil's water retention capacity; moderate water deficit

(T1), corresponding to watering every 2 days at three-quarters (3/4) of the soil's water retention capacity; and severe water deficit (T2), corresponding to watering every 2 days at one-quarter (1/4) of the soil's water retention capacity. All plants were subjected to the same water regime (watering at full capacity in the field) until 21 days after sowing, at which point the different treatments were applied.

Determination of soil water retention capacity:

To determine the amount of water needed for watering, a pot containing 13 kg of dry soil was weighed to obtain the dry soil weight (Ps). The pot was watered until the soil was thoroughly saturated, then covered with plastic wrap to minimize water evaporation from the surface. After 24 hours of rest, the pot was weighed again to obtain the saturated weight (SW). The water retention capacity of the soil (WRC) is determined using the equation:

$$WRC = [(SW - Ps) / Ps] \times 100.$$

Physical and chemical characteristics of the growing medium:

The results of the physical and chemical analysis of the soil, presented in table 2, indicate that the soil used is slightly alkaline (pH = 7.4), with a silty-sandy texture containing 17.67% clay, 41.17% silt, and 41.18% sand. It is relatively rich in phosphorus (8.31 ppm) and potassium (144.69 ppm), but poor in organic matter (0.922%), nitrogen (0.045%), and magnesium (0.62 ppm). The C/N ratio of 11.88 indicates low degree mineralization of the organic matter.

Table 2: Physical and chemical characteristics of the growing medium

Particle size distribution									
Clay %			Slit %				Sand %		
17.67			41.17				41.18		
Mineral composition									
pH KCl	C %	MO %	N %	C/N	P ppm	K ppm	Fe ppm	Ca ppm	Mg ppm
7.4	0.535	0.922	0.045	11.88	8.31	144.69	7.81	1.55	0.62

Legend: C: carbon; N: nitrogen; P: phosphorus; K: potassium; Fe: iron; Ca: calcium; Mg: magnesium

Measured parameters: The impact of the two sowing methods was assessed based on phenological, morphological, nutritional, and plant yield parameters in the four sesame varieties. Phenological observations were conducted taking into account the duration of emergence, the start and end dates of flowering, the time required for the capsules to mature, and the length of the growing season. In terms of morphology, the collar diameter (DC) was measured using an electronic calliper. Plant height (PH) was measured using a graduated ruler; the number of leaves (NL) and branches (NB) per plant was counted; and the dry weights of the aboveground biomass (DWA) and roots (DWR) were determined using a precision electronic scale (0.001 g; Denver AC-1200D). The yield per plant index (HI) was calculated as the ratio of the total dry weight of seeds produced by a plant to the total dry weight of that plant. The number of pods per plant (NPP) and the number of seeds per pod (NSP) were determined by manual counting. The weight of 1,000 seeds (WTS) was

measured using the scale mentioned earlier. Seed yield per plant (SYP) was estimated using Garfius's formula [7]: $W = X \times Y \times Z$ (where X represents the number of capsules per plant, Y the average number of seeds per capsule, and Z the average weight of a seed). The nutritional quality of the seeds was assessed by determining the protein content (PCS) using the Bradford method [8], the lipid content (LCS) using the Soxhlet method, and the mineral composition. Leaf sodium (NaCF) and potassium (KCF) contents were determined by flame photometry, while magnesium (MgCF) content was measured by atomic absorption spectrometry.

Data analysis: The collected data were entered using Excel 2016, which was also used to create the graphs. An analysis of variance (ANOVA) was performed using XLSTAT 2016 to evaluate performance and compare differences among varieties under different treatments. The comparison of means was performed using the SNK test at a significance level of 5%.

RESULTS

Phenological observations: Table 3 presents the analysis of variance of the phenological characteristics of the two varieties under different water treatments. The results show that the interaction between variety and water regime did not result in any significant differences in the parameters observed. In

fact, flowering began on the 36th day after sowing (DAS) for all treatments ($P = 0.978$), the date of 50% flowering occurred around the 40th DPS ($P = 0.162$), and the duration of the vegetative cycle was identical for all plants, i.e., 108 days ($P = 1.000$).

Table 3: Analysis of variance of the phenology of the two varieties, in interaction with water treatments

Variety*Treatment	DDF (DAS)	D50%F	DC (DAS)
SN103*T0	36.000 a	40.000 a	108 a
HB168*T0	36.000 a	39.000 a	108 a
SN103*T1	36.000 a	40.000 a	108 a
HB168*T1	36.000 a	38.667 a	108 a
SN103*T2	36.333 a	40.333 a	108 a
HB168*T2	36.333 a	39.333 a	108 a
F	0.145	1.933	0.625
Pr > F	0.978	0.162	1

Legend: DDF: start of flowering; D50%F: start of 50% flowering; DAS: days after sowing; DC: cycle duration

Collar diameter: Figure 2 illustrates the effect of continuous water deficit on the collar diameter of plants. Statistical analysis revealed a highly significant difference between treatments ($P < 0.0001$). In fact, water restriction to 1/4 of the soil's retention

capacity (T2) caused a clear reduction in collar diameter compared to water restriction to 3/4 (T1). However, no significant difference ($P > 0.05$) was observed between the varieties under this same water regime.

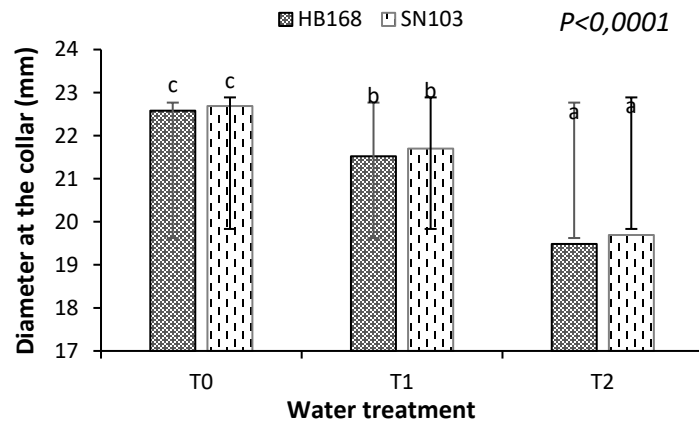


Figure 2: Average collar diameter of mature plants under the effect of water stress

Legend: T0: control plants; T1: watering every 2 days at 3/4 of soil retention capacity (moderate stress); T2: watering every 2 days at 1/4 of soil retention capacity (severe stress)

Plant height: Figure 3 shows the effect of continuous water deficit on plant height. Analysis of variance revealed no significant difference ($P > 0.05$) between the two varieties, indicating that the reduction in plant height was similar in SN103 and HB168. However,

a highly significant difference ($P < 0.0001$) was observed between treatments. Water restriction to 1/4 of soil retention capacity (T2) caused a noticeable decrease in plant height compared to water restriction to 3/4 (T1).

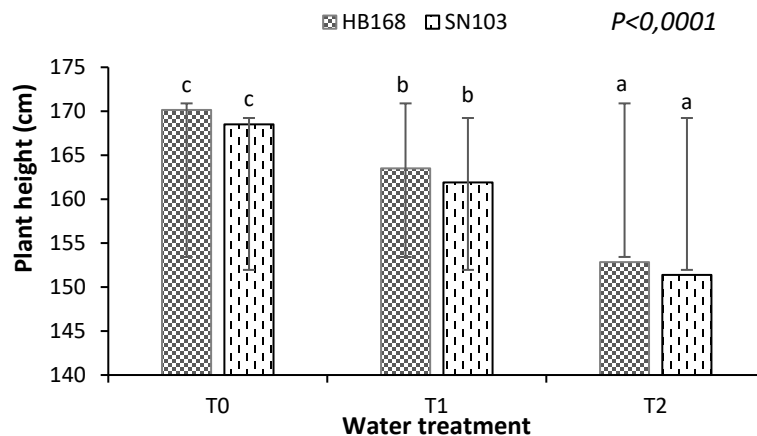


Figure 3: Average plant height under water stress

Legend : T0: control plants; T1: watering every 2 days at 3/4 of soil retention capacity (moderate stress); T2: watering every 2 days at 1/4 of soil retention capacity (severe stress)

Number of plant branches: The impact of continuous water deficit on the number of branches per plant in sesame varieties is shown in Figure 4. Analysis of variance showed a highly significant difference ($P < 0.001$) between varieties. HB168 had more

branches than SN103. A highly significant difference ($P < 0.0001$) was found between treatments. Severe water deficit T2 caused a greater reduction in the number of branches than moderate water deficit T1.

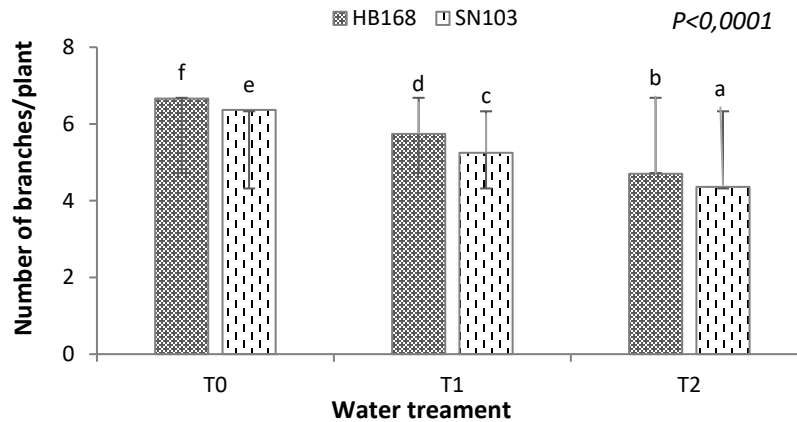


Figure 4: Average number of branches per plant under water stress

Legend: T0: control plants; T1: watering every 2 days at 3/4 of soil retention capacity (moderate stress); T2: watering every 2 days at 1/4 of soil retention capacity (severe stress)

Chlorophyll content of leaves at the vegetative stage: Figure 5 shows the effect of continuous water deficit on the chlorophyll content of leaves in the vegetative stage (18th day of stress). Analysis of variance showed a significant difference ($P < 0.05$) between varieties. HB168 (56.72 g/kg DM) had a

higher chlorophyll content than SN-103 (36.44 g/kg DM). However, the restrictive treatments T1 and T2 showed no significant difference ($P > 0.05$). These water restrictions caused a similar reduction in chlorophyll content in both varieties.

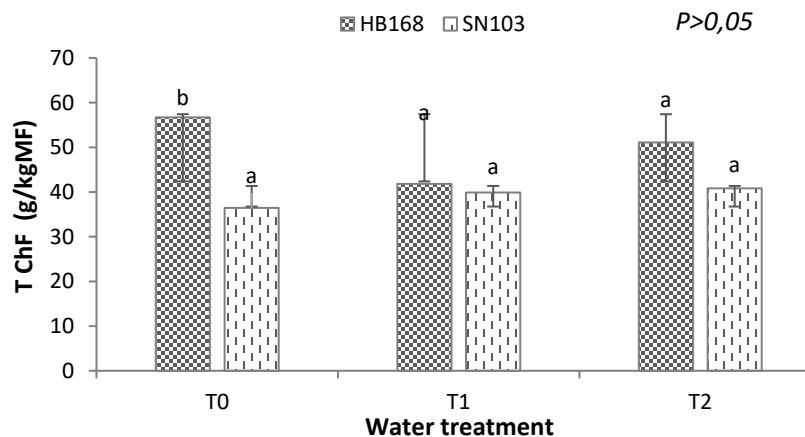


Figure 5: Average chlorophyll content of leaves at the vegetative stage under water stress

Legend: TChF: leaf chlorophyll content; T0: control plants; T1: watering every 2 days at 3/4 of soil retention capacity (moderate stress) T2: watering every 2 days at 1/4 of soil retention capacity (severe stress)

Leaf chlorophyll content at flowering stage:

Figure 6 shows that continuous water deficit had a significant effect on the chlorophyll content of leaves at the flowering stage (38th day of stress). Analysis of variance showed a significant difference ($P < 0.05$) between varieties. SN103 (45.11 g/kg DM) had a

higher chlorophyll content than HB168 (36.44 g/kg DM). Similarly, a highly significant difference ($P < 0.01$) was revealed between treatments. Moderate or severe water stress causes an increase in chlorophyll content, but to different degrees in the two varieties.

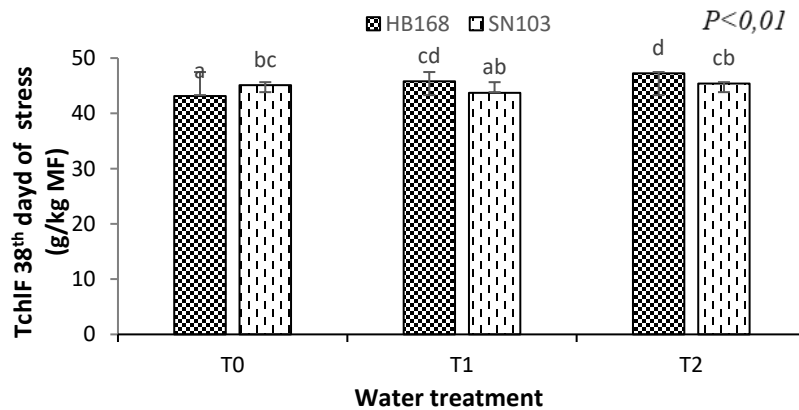


Figure 6: Average chlorophyll content of leaves under the effect of water stress

Legend: T0: control plants; T1: watering every 2 days at 3/4 of soil retention capacity (moderate stress); T2: watering every 2 days at 1/4 of soil retention capacity (severe stress)

Above-ground dry weight: Figure 7 shows the impact of continuous water deficit on above-ground dry weight in the SN103 and HB-168 varieties. Analysis of variance showed that there was no significant difference ($P > 0.05$) between the varieties, as the above-ground dry weight was almost the

same in both varieties. However, a highly significant difference was found between the treatments. Severe water restriction (T2) caused a greater decrease in above-ground dry weight than moderate water restriction (T1).

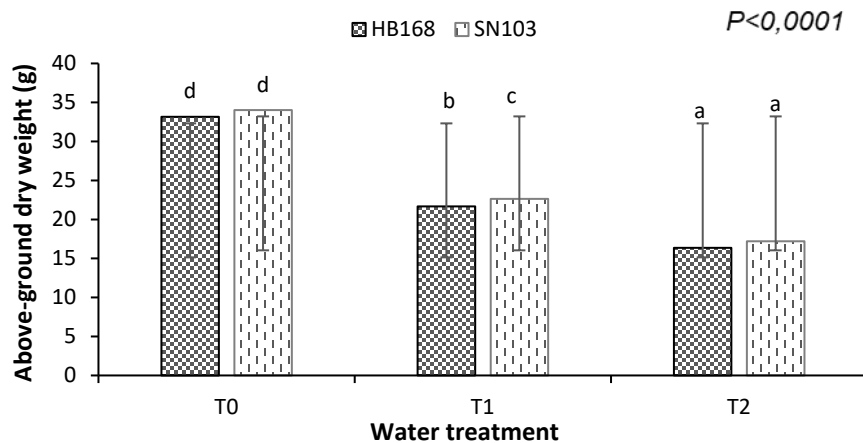


Figure 7: Above-ground dry weight of plants of both varieties under water stress

Legend: T0: control plants; T1: watering every 2 days at 3/4 of soil retention capacity (moderate stress); T2: watering every 2 days at 1/4 of soil retention capacity (severe stress)

Dry weight root: The impact of continuous water deficit on root dry weight in both SN103 and HB168 varieties is shown in Figure 8. Analysis of variance showed that there was no significant difference ($P>0.05$) between varieties, as root dry weight was essentially

the same in both varieties. However, a highly significant difference ($P=0.0001$) was found between treatments. Severe water restriction (T2) reduced weight more than moderate water restriction (T1). However, SN103 plants were less affected than HB168 plants.

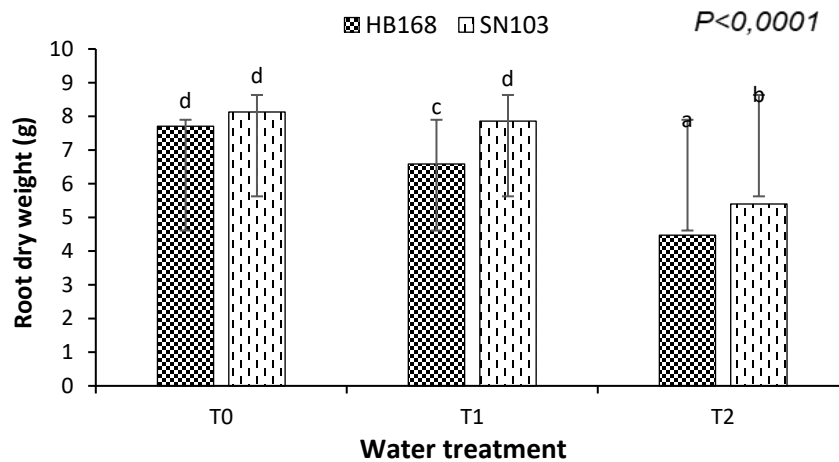


Figure 8: Dry root weight of plants of both varieties under water stress

Legend: T0: control plants; T1: watering every 2 days at 3/4 of soil retention capacity (moderate stress); T2: watering every 2 days at 1/4 of soil retention capacity (severe stress)

Total dry biomass :Figure 9 shows the impact of continuous water deficit on total dry biomass in the two sesame varieties SN103 and HB168. Analysis of variance revealed that there was no significant difference ($P>0.05$) between the varieties.

However, a very significant difference ($P<0.0001$) was revealed between the treatments. Severe water restriction (T2) caused a greater reduction in weight than moderate water restriction (T1).

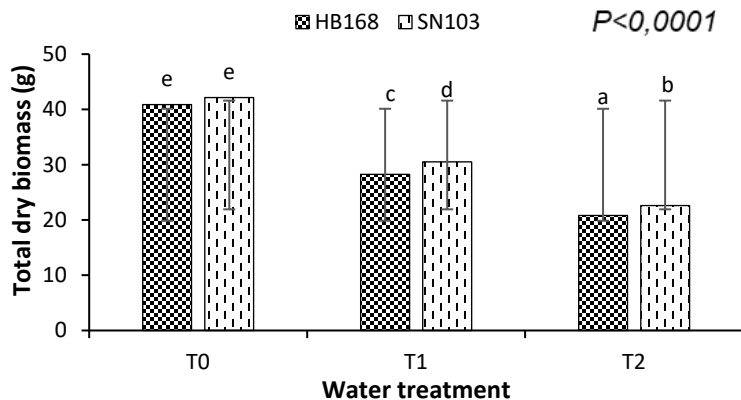


Figure 9: Total dry biomass of plants of both varieties under water stress

Legend: T0: control plants; T1: watering every 2 days at 3/4 of soil retention capacity (moderate stress); T2: watering every 2 days at 1/4 of soil retention capacity (severe stress)

Drought resistance index: Figure 10 shows the resistance to continuous water deficit of the SN103 and HB-168 sesame varieties. A very significant difference ($P < 0.0001$) was found between treatments and varieties. The

plants were more resistant to moderate water deficit (T1) than to severe water deficit (T2), with SN-103 showing greater resistance than HB168.

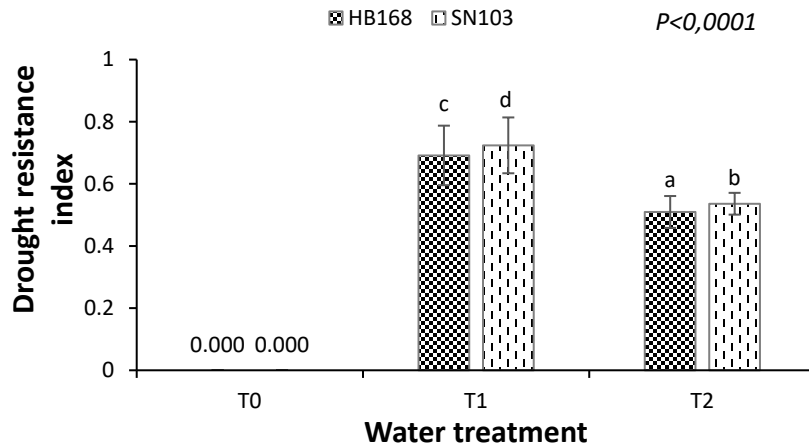


Figure 10: Average drought resistance index of plants of both varieties under water stress

Legend: T0: control plants; T1: watering every 2 days at 3/4 of soil retention capacity (moderate stress); T2: watering every 2 days at 1/4 of soil retention capacity (severe stress)

Number of capsules per plant: The impact of continuous water deficit on the number of capsules per plant can be seen in Figure 11. Analysis of variance showed a highly significant difference ($P < 0.0001$) between varieties. HB168 was more productive than

SN103. A highly significant difference ($P < 0.0001$) was found between treatments. Severe water deficit (T2) caused a greater reduction in the number of capsules than moderate water deficit (T1) in both varieties.

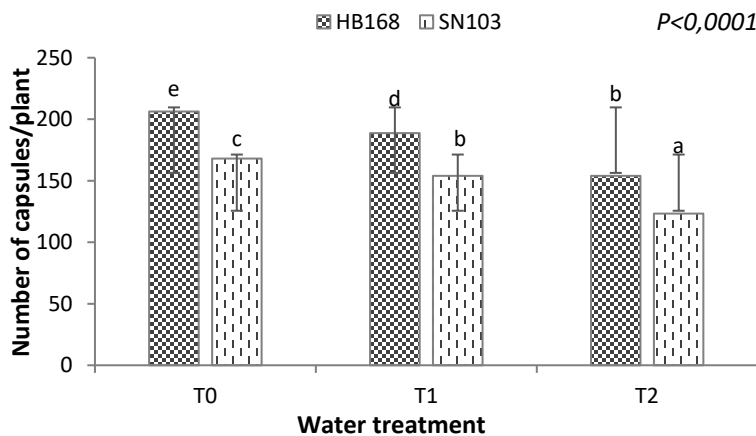


Figure 11: Average number of capsules per plant of the two varieties under water stress

Legend: T0: control plants; T1: watering every 2 days at 3/4 of soil retention capacity (moderate stress); T2: watering every 2 days at 1/4 of soil retention capacity (severe stress)

Number of seeds per capsule: Figure 12 shows the impact of continuous water deficit on the number of seeds per capsule in the SN103 and HB168 sesame varieties. Analysis of variance revealed a highly significant difference ($P < 0.0001$) between the varieties. The capsules of SN103 contain more seeds

than those of HB168. Similarly, a very significant difference ($P < 0.0001$) was revealed between treatments. Severe water restriction T2 reduced the number of seeds per capsule more than moderate water restriction T1 in both varieties.

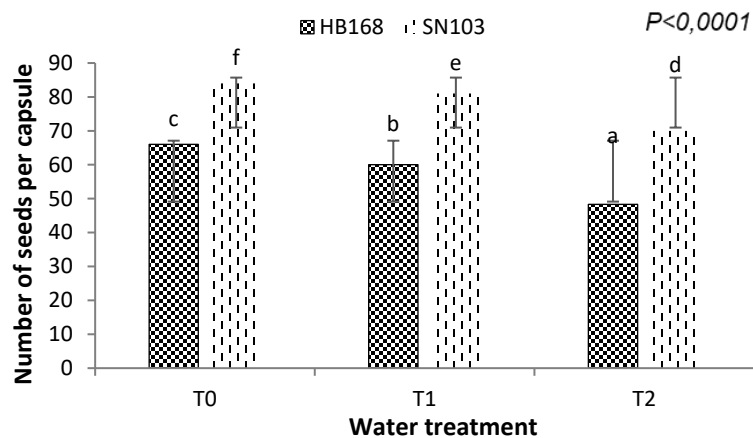


Figure 12: Average number of seeds per capsule of the two varieties under water stress
 Legend: T0: control plants; T1: watering every 2 days at 3/4 of soil retention capacity (moderate stress); T2: watering every 2 days at 1/4 of soil retention capacity (severe stress).

Weight of 1,000 seeds: For the weight of 1,000 seeds (Figure 13), analysis of variance revealed a significant difference ($P < 0.05$) between varieties. The weight of 1,000 seeds of HB168 was higher than that of SN103.

Similarly, a very significant difference ($P < 0.0001$) was revealed between treatments. Severe water restriction (T2) reduced seed weight more than moderate water restriction (T1).

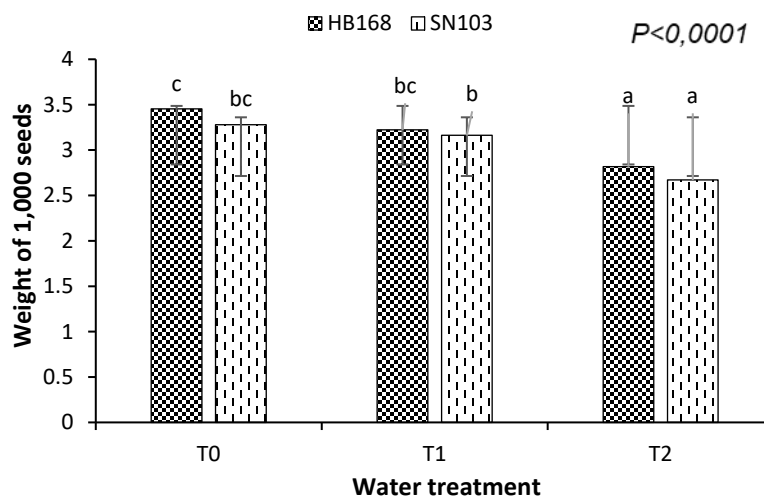


Figure 13 : Average weight of 1,000 seeds of the two varieties under water stress
 Legend: T0: control plants; T1: watering every 2 days at 3/4 of soil retention capacity (moderate stress); T2: watering every 2 days at 1/4 of soil retention capacity (severe stress)

Seed yield per plant: Figure 14 shows the impact of water deficit on seed yield in varieties SN103 and HB168. Statistical analysis showed that there was no significant difference ($P>0.05$) between the varieties.

However, a very significant difference ($P<0.0001$) was found between the treatments. Severe water restriction (T2) caused a marked reduction in yield compared to moderate restriction (T1).

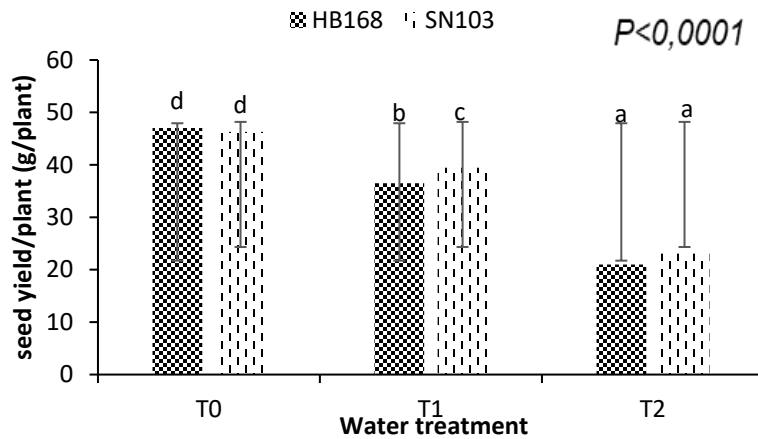


Figure 14: Average seed yield per plant of the two varieties under water stress

Legend: T0: control plants; T1: watering every 2 days at 3/4 of soil retention capacity (moderate stress); T2: watering every 2 days at 1/4 of soil retention capacity (severe stress)

DISCUSSION

The average temperatures and relative humidity measured during the study showed that the plants were subjected to high temperatures and low relative humidity. The atmospheric dryness recorded during the trial exacerbated the effect of the continuous water deficit applied. This type of plant stress (continuous stress) can occur in natural environments with low but regular rainfall throughout all or part of the crop cycle. This phenomenon is quite common in tropical areas. Regardless of the intensity of the water deficit, the start of flowering, the date of 50% flowering, and the duration of the cycle did not vary. This means that there is no phenological plasticity in the sesame varieties studied, as is the case in certain species such as cowpea (Kihindo, 2016). In the two sesame varieties studied, height, collar diameter, total dry biomass, and number of branches per plant decreased compared to the controls when water stress was applied with irrigation every 2 days at 3/4 of field capacity. This decrease

was more significant under the effect of water stress with irrigation every 2 days at 1/4 of field capacity. Our results are similar to those of Badiel (2018), Tantawy *et al.* (2007), Hassanzadeh *et al.* (2009), and Compaore (2011), who reported a significant reduction in plant height, stem diameter at the base, and total dry biomass of sesame under water-deficient conditions. Mouloudi (2019) reports that water stress negatively impacts the number of branches and panicles on *Chenopodium quinoa* Willd. Thus, the greater the water shortage, the lower the number of branches. This reduction could be explained both by the reduction in assimilating surfaces and by a slowdown in photosynthesis linked to water deficit (Scotti *et al.*, 1999). Similarly, Diallo (2009) demonstrated that a prolonged water deficit significantly reduces the growth and development of rice. In fact, imposing water stress throughout the plant's development cycle caused a permanent water shortage. This led to insufficient

hydromineral nutrition and caused a reduction in their radial and vertical growth as well as their development. Severe and prolonged water stress has more pronounced and detrimental effects on plant growth and development. In terms of parameters, collar diameter and total dry biomass, the HB168 variety was the most affected, and in terms of height, SN103 was the most affected by the effect of permanent water deficit, whether severe or moderate. The total chlorophyll content was higher in plants that underwent water stress compared to non-stressed plants (controls) on the 32th day of stress for HB168. These results are consistent with those of Badiel (2018) on sesame and those reported on okra by Nana (2010). This increase was even greater in plants stressed with watering every 2 days at 1/4 CAC (severe stress) than in those stressed with watering every 2 days at 3/4 CAC (moderate stress). Indeed, the increase in chlorophyll content observed in these varieties could be explained by an osmotic adjustment mechanism, which helped limit the decrease in cellular turgor pressure and protect the membranes and enzymatic systems (Belhassen *et al.*, 1995). Thus, maintaining cell turgidity, which is essential for preserving several physiological functions, prevented stomatal closure and therefore enhanced photosynthesis by increasing chlorophyll content (Bammoun, 1997). In addition, the photosynthetic apparatus is relatively tolerant to water deficit in a wide range of conditions encountered in cultivated

situations (Flexas *et al.*, 1998; Escalona *et al.*, 1999). In terms of resistance index, both varieties were more resistant to moderate water stress (plants watered every two days at 3/4 of field capacity) than to severe water stress (plants watered every two days at 1/4 of field capacity). In fact, subjecting plants to severe water stress throughout their entire life cycle has a more significant and negative impact on their growth and development (Badiel, 2018). Water stress, whether severe or moderate, had a negative impact on pod production, the number of seeds per pod, seed yield per plant, and seed weight. In fact, in both varieties, moderate or severe water stress caused a reduction in capsule yield, but the reduction was greater in the SN-103 variety than in the HB-168 variety. These findings are consistent with those of many other authors, notably those of Badiel (2018), Tantawy *et al.* (2007), Hassanzadeh *et al.* (2009), and Compaore (2011) on sesame, as well as those of Mawuli *et al.* (2014) on cowpea. Severe water stress affects factors related to seed formation, including photosynthesis and the translocation of assimilates, which can result in reduced growth, development, and yield. The impact of water stress depends on its severity, the phenological stage at which it occurs, and the plant's genotype (Sawadogo *et al.*, 2006). Furthermore, some researchers attribute the majority of yield losses under dry conditions solely to a decrease in photosynthesis (Moutinho-Pereira *et al.*, 2004).

CONCLUSION AND APPLICATION OF RESULTS

The results obtained from the morphological, physiological, and agronomic evaluation of the sesame varieties SN103 and HB168 show that flowering occurred when one-third of the development cycle was complete. The SN103 variety had a very high above-ground biomass due to its vigour compared to the HB168 variety, which was less vigorous. The HB168 variety had taller plants, more

branching, and more capsules. The capsules of the SN103 variety contained more seeds, but the seeds of the HB168 variety had the highest weight. Tolerance to moderate or severe continuous water deficit resulted in varied responses; height, collar diameter, and number of branches were reduced in both sesame varieties studied. However, HB168 was the tallest in terms of height; SN103 was

the most vigorous in terms of collar diameter; and HB168 had the most branches. The total chlorophyll content under moderate and severe water stress revealed better tolerance in HB168 on the 32th day of stress. Both moderate and severe prolonged water deficits caused a significant reduction in yield and its components in both varieties. However, severe water deficit had a more pronounced reducing effect, especially in the HB168 variety. The SN103 variety was the most tolerant to water deficit. It can therefore be used as a variety of interest for improving sesame productivity.

Looking ahead, it would be wise to extend the study to other sesame varieties grown in the Sahel in order to determine their responses to water stress with a view to selecting varieties in the face of climate change. These results suggest that SN103 should be the variety of choice in areas prone to water stress, due to its greater tolerance and overall productivity. They also suggest that cultivation practices and irrigation management should be adapted to optimize the yield of sensitive varieties such as HB168.

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