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Agro-morphological Evaluation and Genetic Variability Analysis of 11 Sesame Lines Under Sudano-Sahelian Conditions

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ABSTRACT: Sesame (Sesamum indicum L.) is a vital oilseed crop extensively cultivated in tropical and subtropical regions. This study aimed to assess the agro-morphological performance and genetic variability of 11 sesame lines under the Sudano-Sahelian conditions of Burkina Faso. Conducted over three years at the INERA/Saria's experimental station, 12 phenological and agronomic traits were evaluated using a randomized block design with three replicates. Results revealed significant differences among lines for most traits, including flowering time (DFLS), capsule length (HFCI), and yield components. Heritability values were high for parameters such as plant height at maturity (62.24%) and height of the first capsule insertion (79.31%), indicating their strong genetic influence. Yield variability was substantial, with the Wollega line achieving the highest mean yield of 1612.82 kg/ha. This analysis provides critical insights into the genetic potential and adaptation of sesame lines, laying the groundwork for future breeding programs to enhance productivity and resilience in semi-arid regions.

KEYWORDS: sesame; lines; performance; yield; Burkina Faso; diversity; heritability.

1 INTRODUCTION

Sesame (Sesamum indicum L.) is the most widely used oilseed plant by humans, according to [1]. It belongs to the order Lamiales, the family Pedaliaceae, and the genus Sesamum [2]. Sesame is primarily cultivated in the tropical and subtropical regions of Asia, Africa, and South America [3]. Global production of sesame seeds has gradually increased from 2 million tons per year in the 1970s to 3.7 million tons per year in 2010, and by 2014, it reached 6.3 million tons. Burkina Faso, like other countries, is not lagging behind. The area planted with sesame increased from 120,750 hectares in 2011 to 400,255 hectares in 2015, and production rose from 84,759 tons to 235,079 tons [4]. In Burkina Faso, as elsewhere, sesame is cultivated for its seeds, which have high nutritional value and multiple uses. In fact, sesame seeds contain large amounts of oil (46 to 52%), protein (25%), vitamins (B, E), and minerals (Ca, P, Mg) [5]. It is also an excellent rotation crop and a good soil improver due to its roots, and its cake constitutes an excellent fertilizer. Despite the very important role of sesame in creating added value and sources of income for rural and urban populations in Burkina Faso, yields are decreasing each year in various production systems. It has become more necessary than ever to explore ways and means to improve the available local lines. This study, conducted over three consecutive years in the Central-West region of Burkina Faso, aimed to evaluate the agronomic morpho-physiological performance of 11 sesame lines of diverse origins and to determine the heritability of each studied parameter for each line.

2 MATERIAL AND METHODS

2.1 STUDY AREA

The trials were conducted at the INERA/Saria experimental station during the 2021, 2022, and 2023 agricultural campaigns. It is located between latitude 12° 16’ North and longitude 2° 9’ West, at an altitude of 300 m. The climate of Saria is Sudano-Sahelian type, and the soils are primarily ferruginous tropical soils, either leached or non-leached, derived from granite bedrock.

2.2 PLANT MATERIAL

Eleven sesame lines of diverse origins were selected for this study. The selected lines were chosen based on their varying characteristics, including yield potential, growth habits, and adaptability to local conditions. The origin and cycle of the lines are presented in Table 1.

Table 1. Origins and cycles of sesames lines

Lines	Origin	Cycles(days)
Banamba-2	MALI	110
Namsubani	MALI	100
GMP-3	BURKINA FASO	95
KDG-3	BURKINA FASO	91
SMK -2	BURKINA FASO	90
SMK-3	BURKINA FASO	90
SMK-8	BURKINA FASO	90
SMK-9	BURKINA FASO	90
SMK-12	BURKINA FASO	90
S-42	INDIA	88 to 90
Wollega	ETHIOPIA	115

2.3 EXPERIMENTAL DESIGN

The experimental design used was a completely randomized Fisher block with three (03) replications. The planting was done in four (04) rows spaced 4 m apart, with a distance of 60 cm between the rows and 30 cm between the plant clusters. Two (02) weeks after sowing, 2 plants were removed from each cluster.

2.4 DATA COLLECTION

A total of twelve (12) agro-morphological parameters were measured. The phenological parameters measured were: the date of the first leaf stage (DFLS), the date of 50% flowering (FLO50), the number of nodes before the first capsule (NN), the average internode length (Len), the height of the first capsule insertion (HFCI), and the plants height at maturity (HPM). The agronomic parameters measured were the number of branches per plant (BN), the average capsules length (CL), the number of capsules per plant (NCP), the number of seeds per capsule (NSC), the weight of 1000 seeds (SW1000), and the average yield per line (YIELD).

2.5 STATISTICAL ANALYSIS

The collected data were analysed using R software [6]. Lines were characterized through one-way analysis of variance (ANOVA), with pairwise comparisons conducted using Student–Newman–Keuls (SNK) mean structuring tests. A significance level of 5% was applied to compare the parameters across groups. To visually assess similarities and differences between lines based on agronomic parameters, a cluster heatmap was generated. Furthermore, genotypic and phenotypic variances (GV and PV), genotypic and phenotypic coefficients of variation (GCV and PCV), broad-sense heritability (H^2), and expected genetic gain (GA) were calculated according to the formulas provided by [7], [8] and [9] as summarized in Table 2.

Table 2. Formulas and meaning of Genetic Parameters for Estimating Variability and Selection Potential

Parameters	Formulas	Meaning of terms
Genotypic Variance (VG) **Phenotypic Variance (VP)** **Broad-sense heritability (H^2)**	VG = (MSG – MSE) /r VP= VG + (MSE/r) = MSG/r H^2 (%) = (VG/VP) *100	MSG: Mean square of genotypes MSE: Mean square error r: number of replications
Genotypic coefficient of variation (GCV)	GCV (%) = (√VG/X) *100	√VG : Standard deviation of genotypic variance
Phenotypic coefficient of variation (PCV)	PCV (%) = (√VP/X) *100	√VP : Standard deviation of phenotypic variance
Expected genetic gain (GA)	GA = H^2*√VP*I	I : constant. With Selection coefficient of 5%, I est 2.06
Expected genetic gain relative to the mean of the trait [GAx (%)]	GAx (% mean trait) = (GA/X)*100	X : mean of the trait

3 RESULTS

3.1 ANOVA RESULTS

The ANOVA results of phenological and agronomic parameters are shown on Table 3 and Table 4 respectively. A highly significant difference (P<0.0001) was noted between the lines for all the phenological parameters observed. The date of first leaf stage DFLS varied from 35 to 40 Day after sowing (DAS). The earlier line for DFLS and Flo50 was SMK-8 line with 35,11±2,09 DAS and 47,78±4,09 DAS respectively. For the number of nodes before the first capsule (NN), the Banamba-2 and Wollega lines recorded the highest mean values, with 6.36±0.38 nodes and 6.73±0.57 nodes respectively. In addition, the Banamba-2 and GMP-3 lines had the best performances for the length of the internodes (Len) with 5.60±0.43cm and 5.99±0.66cm respectively. With regard to the HFCI parameter, Banamba-2 line recorded the highest average value (45.98±2.34cm), while Namsubani and Wollega lines performed best for the height of mature plants (HPM), with an average of at least 100 cm.

Table 3. Variation in mean values of phenological parameters

Lines	DFLS	Flo50	NN	Len	HFCI	HPM
Banamba2	37.89±2.8	51.22±4.89	6.36±1.14	5.59±1.29	45.98±7.02	97.13±8.78
GMP3	36.22±1.48	49.56±3.28	5.51±1.07	5.99±1.99	43.84±7.94	99.29±12.95
KDG3	35.33±2.18	48.44±4.72	5.68±0.88	4.82±1.25	35.77±5.86	91.4±11.09
Namsubani	35.89±2.37	49±4.82	5.67±1.1	5.18±1.83	42.51±8.13	101.96±15.11
S42	36±2.06	49.44±4.48	5.98±0.98	4.94±1.69	39.56±10.07	95.24±14.85
SMK12	35.67±2.4	48.67±5.43	5.69±1.2	4.17±1.28	34.93±8.21	93.77±13.86
SMK2	35.89±1.96	49.11±4.78	5.13±1.17	4.02±1.18	29.19±6.07	89.03±11.88
SMK3	35.89±2.57	49.89±5.25	5.43±1.08	4.41±1.3	30.81±7.12	81.39±12.73
SMK8	35.11±2.09	47.78±4.09	5.4±1.11	4.62±1.63	32.44±9.04	85.67±12.15
SMK9	36±1.94	48.67±3.57	5.35±1.09	4.77±1.26	32.17±6.82	87.56±10.79
Wollega	39.56±2.79	52.44±1.81	6.73±1.71	4.41±1.24	42.44±10.21	100.88±8.54

DFLS: date of the beginning of floral bud formation; FLO50: date of 50% flowering; NN: number of nodes before the first capsule; Len: average internode length; HFCI: height of insertion of the first capsule; HPM: height of plants at maturity

Table 4 shows the analysis of variance at the 5% threshold of the mean values of the yield components. A significant difference (P=0.012) was observed for the number of seeds per capsule (NSC); a highly significant difference (P=0.003) for the number of capsules per plant (NCP) and a very highly significant difference (P<0.0001) for the number of branches per plant (BN) and the length of capsules (CL). In addition, very highly significant difference was recorded for 1000 seeds weight and the average seeds yield. The Banamba-2 line recorded the highest mean value (4.20±1.31) for the number of branches per plant (BN); the KDG-3 line performed best for the number of capsules per plant (NCP) with 83.62±35.70 capsules; for the number of seeds per capsule (NSC), lines KDG-3 and Wollega recorded the highest average values with at least 60 seeds; however, a minimum average value of 2 cm was observed for the length of the capsules (CL), depending on the line. ANOVA results showed that yield components were significant across lines. The results of the analysis of variance (at the 5% threshold) on 1000-seed weight showed a significant difference (P=0.000) between the lines. The Namsubani line had the highest mean value at 3.12±0.30g. With regard to seed yield, a highly significant difference (P<0.0001) was observed between the lines. The Wollega line recorded the best performance with an average value of 1612.82±721.43Kg/ha.

Table 4. Variation in average values of yield components

Lines	BN	NCP	NSC	CL	SW1000	YIELD
Banamba2	4.2±1.31	50.93±30.52	57.7±10.94	2.68±0.29	3.04±0.67	527.38±214.28
GMP3	3.2±1.26	48.69±16.74	59.26±4.44	2.72±0.26	2.97±0.49	461.44±199.76
KDG3	3.4±0.92	83.62±107.11	60.8±4.2	2.56±0.23	2.58±0.35	1310.4±1438.58
Namsubani	3.04±1.26	45.24±25.58	58.93±5.17	2.86±0.39	3.12±0.9	416.29±299.61
S42	3.07±1.06	39.13±13.34	57.09±15.64	2.65±0.39	2.52±0.37	344.74±174.32
SMK12	2.98±1.16	35.71±9.32	56.11±11.95	2.43±0.27	2.91±0.9	322.29±254.07
SMK2	2.42±0.88	37.42±18.32	52.7±11.07	2.5±0.26	2.46±0.39	494.82±323.19
SMK3	2.53±0.98	37.64±28.41	56.61±5.3	2.32±0.27	2.74±0.33	278.72±154.06
SMK8	2.78±1.18	42.04±26.49	53.62±8	2.44±0.29	2.62±0.59	706.37±851.51
SMK9	2.64±0.68	37.46±10.3	53.9±4.63	2.42±0.29	2.93±0.67	278.17±210.14
Wollega	3.24±1.32	61.36±44.93	66.79±3.65	2.59±0.24	2.44±0.68	1612.82±2164.28

BN: number of branches per plant; CL: length of the capsules; NCP: number of capsules per plant; NSC: number of seeds per capsule; SW1000: weight of 1000 seeds; YIELD: average yield per line.

The variations in average value of the agromorphological parameters measured for all sesames line over the years 2021, 2022, and 2023 are shown on Figure 1. Each panel shows the evolution of a specific parameter over the years. The values for DFLS remain relatively stable for most lines over the three years. Some variations are present, but the differences between lines are consistent. The trend is relatively stable for Flo50 values year by year for each line. The variations between lines are minimal, suggesting homogeneity in this parameter. Greater variations are observed between lines, especially for Namsubani (in dark green), which shows a marked increase in 2022 for BN parameter. However, most other lines have lower and more stable values over the years. NCP parameter shows high variability, particularly for GMP-3 (in yellow) in 2021, which has a significantly higher value. Aside from this peak for GMP-3, the other lines show lower and more stable values. Len and CL parameters show a similar trend for most lines, with a slight increase in length over the years. Namsubani seems to have a higher Len value in 2023. Variations are visible for SW1000 parameter between lines and years. SMK-12 (in light blue) shows a notable increase in 2023. Yield values show significant variations between years and lines. Some lines like GMP-3 and Namsubani have high yields value in 2021, while others have lower yields value.

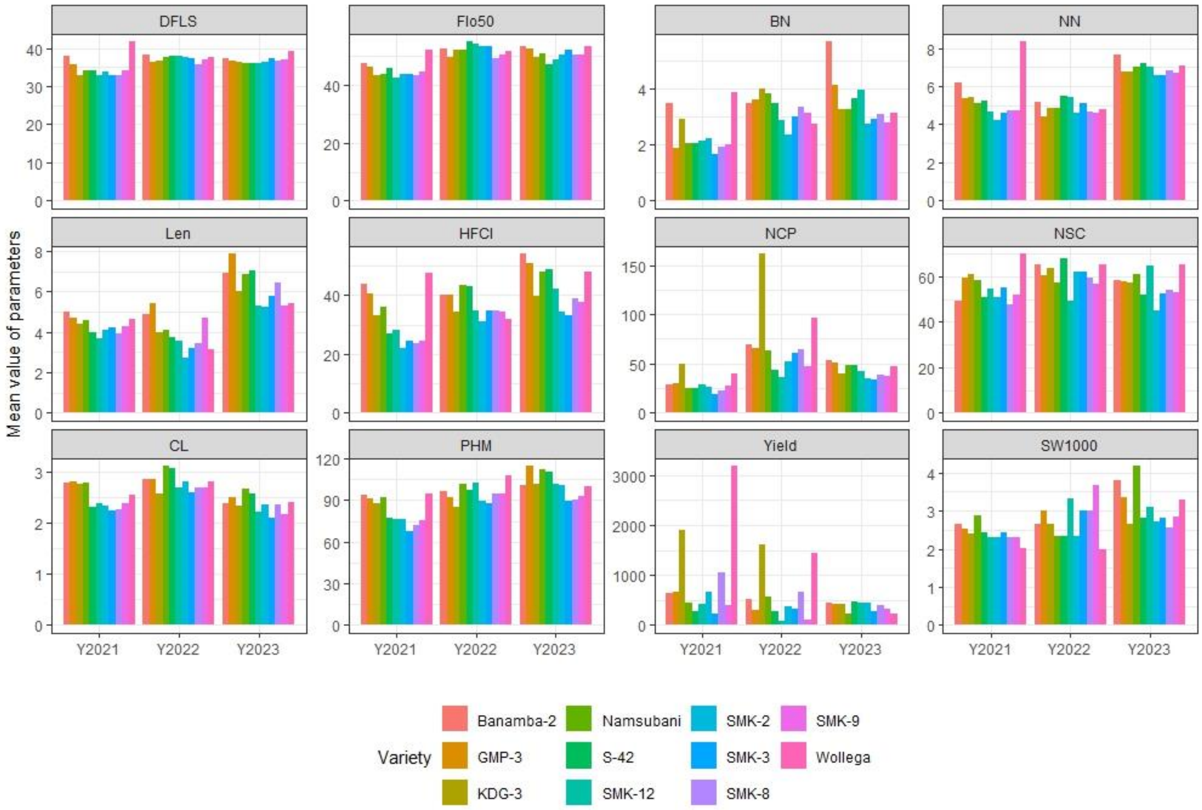

Fig. 1. Multi-Year Trends in Average Phenotypic Parameters Across lines

3.2 HEATMAP'S ANALYSIS

The heatmap presented on Figure 2 compares sesame lines based on different agronomic parameters. The heatmap allows for a visual comparison of differences and similarities between lines based on their agronomic performance. The colours represent the relative values of each parameter, with colour gradients enabling the quick identification of high or low values. The dendrogram on the left helps group lines into clusters based on their similarity, making it easier to identify lines with similar agronomic characteristics. It also allows us to see how different parameters influence the performance of each line by observing areas with similar or contrasting colours. The colour variations range from light (yellow, light orange) to dark (dark red). These colours indicate the intensity or value of each parameter for each line. Visualization of dark red areas indicate higher values for certain parameters in specific lines. Namsubani shows high values for some parameters, such as BN and HCl, represented by dark red zones. KDG-3 exhibits high values for the DFLS parameter. Light zones (light yellow, light orange) indicate lower values for certain parameters in specific lines. The lines SMK-8 and Wollega show lower values for many parameters. The light-yellow zones in the center indicate lines that have moderate values for several parameters. Dendrogram on the left shows four clusters. First cluster is composed by lines Nansubani, Banamba-2 SMK-2 and GMP-3. The second one contains S-42, SMK-12, SMK-9 and SMK-3. KDG-3 and Wollega appear to be more distinct from the other lines

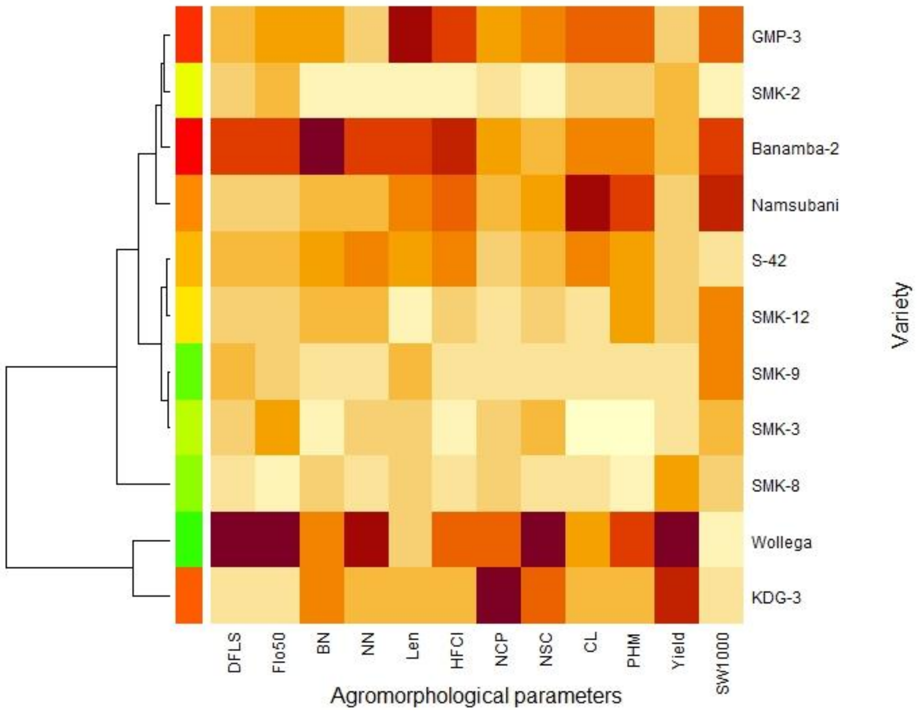

Fig. 2. Heatmap showing Correlation Matrix of Agromorphological Parameters by lines

3.3 GENETICS PARAMETERS ANALYSIS

The results of genetics parameters' estimation for each parameter are available on Table 5. The Higher values of PCV (309.32 %) and GVC (95.99) were observed for YIELD parameter. High H^2 value (79.31) was recorded for HFCI, followed by DFLS (65.37), HPM (62.24) and Len (61.61). GA value ranged from -103.53 to 93362.62 respectively for Flo50 and YIELD.

Table 5. Genetic Parameters' estimation of Agromorphological Traits in sesame lines

	Mean	Mean Square	PCV (%)	GCV (%)	H² (%)	GA
DFLS	36.31	5.162**	3.70	4.83	65.37	300.20
Flo50	49.47	19.36	3.27	-	-21.84	-103.53
Nram	3.05	1.22	4.87	18.38	43.4	76.02
NN	5.72	1.34	3.41	8.19	33.00	55.44
Len	4.81	2.17	4.71	12.16	32.11	68.30
HFCI	37.24	63.8***	16.61	24.24	79.31	1656.21
NCP	47.21	1598	36.12	19.33	13.52	690.97
NSC	57.59	74.6	9.02	8.14	46.93	661.69
Cl	2.56	0.09***	1.71	8.39	61.61	34.73
HPM	93.03	149.9**	11.93	9.75	62.24	1474.76
Yield	613.95	720139*	309.32	95.99	59.13	93362.92
P1000	2.76	0.3711	2.57	8.80	32.28	28.42

Mean: Average of the observed value for each trait; Mean Square: Measure of variability among the observed values; PCV (Phenotypic Coefficient of Variation): Phenotypic variability expressed as a percentage, reflecting observable variation in the traits; GCV (Genotypic Coefficient of Variation): Genetic variability expressed as a percentage, representing variation attributable to genetics; H^2 (Heritability): Broad-sense heritability expressed as a percentage, indicating the proportion of phenotypic variation due to genetic variation; GA (Genetic Advance): Expected genetic gain through selection.

4 DISCUSSION

Agro-morphological parameters between lines have varied during the study (Table 3). The expression of the trait between lines could be explain by the variation observed. Analysis of variance showed that date of 50% flowering (Flo50) ranges from 47.78±1.36 to 52.44±0.60 days before flowering could be explained by the genotypic effect of the lines [10]. In a previous study [11] have found between 38 and 65 days before flowering. Photoperiodism in certain sesame lines could be at the origin of the difference in the Flo50 parameter. Environmental factors may also have contributed to affecting the lines, as confirmed by studies of [12]. These writers have found that growth and flowering of sesame can be accelerates by temperature from 25 to 27 °C. The Flo50 parameter is therefore a determining factor in the plant's cycle. Thus plants with early flower have a short cycle and those with late have a long cycle.

Yield components variations were significant across lines (Table 4). The average values of parameter number of branches per plant (BN) varied from 2.42±0.29 to 4.20±0.44, which explains the phenotypic variation of the lines evaluated. These results are similar to those of [13]. These authors carried out an agro-morpho-physiological evaluation of four lines and six lines of Sesame grown under natural field conditions. They counted an average of 3.63 branches for the S-42 line and an average of 3 to 4 branches for six mutant lines. For the parameter, number of capsules per plant (NCP), the average values varied from 35.71±3.11 to 83.62±35.70 capsules. The adaptability of these lines to climatic conditions may justify these results since, according to [12], low temperatures below 18°C retard growth and cause flower abscission and pollen sterility, while high temperatures of 40°C affect fecundity and reduce the number of capsules. This could also be explained by the distance between reproductive nodes and the number of capsules per axil [10].

With regard to seed yield, a highly significant difference (P<0.0001) was observed between the lines. The Wollega line recorded the best performance with an average value of 1612.82±721.43Kg/ha. Mean values for 1000-seed weight (SW1000) ranged from 2.46±0.13 to 3.12±0.29 g. This confirms the range of variation in SW1000 defined by [12] and [14], which is 2 to 5 g. This variation could be explained by hydric stress, which can be favourable or unfavourable to sesame production. According to Son (2010), hydric stress influences yields and the biochemical composition of the seeds. Number of seeds per capsule varied from 52.70±3.69 to 66.79±1.22 seeds, which could be linked to climatic variations during the three (03) years of experimentation; this is explained by [15], who showed that hydric stress and limited availability of assimilates are the main factors that cause poor seed filling. hydric stress during seed filling affects seed composition. [16] explained that depending on the position in the development cycle and the intensity of the hydric stress, hydric stress influences yields and the biochemical composition of the seeds.

The evolution in the average values of different parameters for sesame lines over three years (2021, 2022 and 2023) were reported on Figure 1. The graph analysis showed that DFLS and Flo50 parameters across years for most lines remains stable, suggesting these lines may have stable responses to environmental triggers for flowering. Lines SMK-8 et KDG-3, with consistently earlier flowering, may have advantages in environments with limited growing seasons, as early flowering can allow for early seed setting. While BN and NN parameters show some variation, they are generally stable across years for most lines. These parameters are indicators of plant architecture, which can influence light capture, resource allocation, and, ultimately, yield [17]. Spikes or reductions in BN and NN observed for some lines might indicate differences in how those lines respond to environmental stressors like drought or nutrient deficiency. Lines with more branches (Banamba-2) or nodes (Banamba-2 and Wollega) may potentially produce more flowers and seeds but might also require more resources. Len, HFCI, and CL parameters measure aspects of the plant's reproductive structure [17]. Higher values for Len and CL suggest larger pods and capsules, which can translate to a greater potential for seed production. The variations observed here could reflect genetic differences among lines, as well as the effect of environmental conditions on reproductive growth [18]. HFCI indicates the plant's structural height, which could affect exposure to sunlight and plant competition; this parameter's variation might indicate certain lines like Banamba2, are better suited for specific planting densities or farming systems.

NCP and Yield are directly linked to productivity. Lines with consistently high yields or NCP across years could be valuable for farmers seeking stable production. NSC reflects the reproductive efficiency, as more seeds per capsule mean higher potential yield. SW1000, which measures seed size, is important for market preferences and crop value [19]. Lines with higher SW1000 values may produce larger seeds, which are often preferred in markets and may have better germination potential. The relatively stable values for NSC and SW1000 suggest that seed production and size are less affected by annual variations, making them reliable traits in these lines.

Parameters like NSC and SW1000 can be prioritized for seed quality, whereas parameters like NCP and yield are key for overall productivity. The stable performance of certain lines in DFLS and Flo50 could be leveraged to breed lines with predictable flowering times, essential for planning harvests and managing crop rotations.

The lines are organized in clusters based on similarities in agromorphological parameters, as indicated by the dendrogram on the left side (Figure 2). This grouping suggests that certain lines share similar traits, which could be valuable in selecting lines for specific breeding goals or agricultural conditions. GMP-3 and SMK-2 appear closely related in their parameter profiles, likely showing high values in similar traits. Conversely, KDG-3 and Wollega are in different clusters, indicating distinct agromorphological characteristics from the others lines. Parameters are also clustered, indicating which traits tend to vary together across the lines. Traits like Yield and SW1000 are clustered together, suggesting they may be related. This can inform breeding strategies, as improving one trait could impact the other. DFLS and Flo50 are also grouped, as they both measure flowering time. The clustering highlights that lines with early flowering may also reach 50% flowering faster.

According to Figure 2, some lines exhibit high values for key productivity parameters like Yield and NCP. Lines with dark shading in the Yield column, like SMK-12 and Banamba-2, may have high yield potential and could be promising candidates for regions where yield is a priority. SW1000 values are also notable, with lines showing darker colours in this column indicating larger seed weights, a desirable trait for market appeal and planting potential. Lines like SMK-9 appear to excel in this trait. Flowering and Maturity-related traits (DFLS and Flo50) exhibit variability among lines. Some lines flower earlier (lighter colours in DFLS and Flo50), which can be advantageous in environments with shorter growing seasons. For instance, Banamba-2 appears to have relatively early flowering based on the lighter colour in DFLS and Flo50, making it a potential candidate for areas prone to drought or early-season climate risks.

Structural and Growth Traits (Branch Number and Node Number) show variation across lines, which can impact plant architecture and resilience [20]. Lines with higher values in these traits, such as SMK-3 and SMK-8, may have denser structures, potentially enhancing light capture and yield but possibly increasing competition for resources if planting density is high. Lines grouped in the same cluster with desirable traits could be crossed to produce offspring with improved productivity. Conversely, lines from different clusters may be crossed to introduce new traits and enhance diversity. The clustering of parameters like Yield and SW1000 suggests potential correlations. Breeders could focus on these traits together to achieve lines that are both high-yielding and have larger seed sizes, improving both productivity and market value.

The table 5 provides essential information to identify traits with high improvement potential and to understand the factors influencing each trait. The Phenotypic Coefficient of Variation (PCV) and the Genotypic Coefficient of Variation (GCV) show different degrees of variability for each trait. High variability in some traits, such as NCP, Yield, and HFCI, indicates that these traits are influenced by multiple genetic and environmental factors. Generally, when PCV is higher than GCV, it means that the environment has a significant impact on the trait. This is observed in traits like Flo50 and NCP, where variability appears largely due to environmental factors, which limits direct selection.

Heritability (H^2) values vary from low to high for different traits. High heritability (>50%) indicates that variation is primarily due to genetic effects, which makes selection for these traits easier. HFCI (79.31%), CL (61.61%), and DFLS (65.37%) have high heritability, suggesting that selection gains for these traits will be reliable and less affected by the environment. In contrast, traits with low heritability, such as Flo50 (-21.84%) and NCP (13.52%), are largely influenced by the environment, making direct genetic selection less effective.

Genetic Advance (GA) represents the potential gain that could be achieved through selection for each trait. Traits with high GA, such as YIELD (93362.92), HFCI (1656.21), and HPM (Height of the Plant) (1474.76), offer significant improvement potential. This means that rigorous selection of these traits could lead to considerable improvement in future generations. On the other hand, traits with low GA, such as NN (55.44) and SW1000 (28.42), show limited genetic improvement potential, suggesting they may require finer environmental management or crop practices to maximize their performance. Traits with high heritability and GA values, such as HFCI, YIELD, and HPM, are ideal candidates for a selection program. Improvement of these traits is not only feasible but is also likely to yield quick results due to their strong genetic basis. Traits influenced by the environment, such as Flo50 and NCP, would require a combined approach involving both genetic selection and adapted crop management practices, or further research to understand genotype-environment interactions for optimal performance. DFLS (Days to Beginning of Flowering) and Len (Length) show moderate genetic variability but good selection potential, with relatively high heritability. Selecting for early-flowering lines could enhance adaptation to environments with shorter growing seasons. Yield shows very high variability, with extremely high PCV and GCV values, indicating significant improvement potential. However, yield is also influenced by the environment, so improving this trait may require efforts to stabilize its expression across different environments.

5 CONCLUSION

The results of this study highlight key traits that can be prioritized for rapid genetic improvement, including the height of the first capsule insertion (HFCI), plant height at maturity (HPM) and yield. These parameters, with high heritability and significant genetic gain potential, offer solid opportunities to reliably enhance the overall performance of sesame lines. Conversely, other traits, such as the date of 50% flowering (Flo50) and the number of capsules per plant (NCP), show strong environmental influence, suggesting they require tailored agronomic management in addition to genetic selection. Thus, an integrated approach could optimize line productivity across various environments. These insights could guide breeding strategies and contribute to the development of more resilient and productive sesame lines, meeting the needs of Burkinabe farmers and strengthening sustainable agriculture in the region.

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