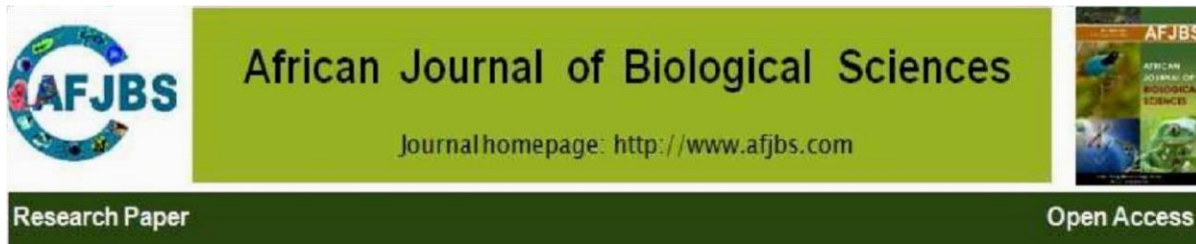


<https://doi.org/10.48047/AFJBS.7.6.2025.434-454>



Agromorphological Characterization of Twelve Dolic bean (*Lablab purpureus* (L) Sweet) Genotypes Introduced in Burkina Faso

*Célestin Thiombiano¹, Abdoul Fatao Moyenga^{1,2}, T Benoit Joseph Batiemo¹

Affiliation :

- 1- Department of Plant Production, *Institut de l'Environnement et de Recherches Agricoles* (INERA), Ouagadougou, Burkina Faso
- 2- Univerté Aube-Nouvelle, Ouagadougou, Burkina Faso

Corresponding author contact information (**address:** *Institut de l'Environnement et de Recherches Agricoles, Ouagadougou, Burkina Faso*; **Telephone:** +22679368685; **E-mail:** celest.thiom21@gmail.com)

Volume 7, Issue 6, Jun 2025

Received : 15 April 2025

Accepted : 05 May 2025

Published : 09 Jun 2025

[doi :10.48047/AFJBS.7.6.2025.434-454](https://doi.org/10.48047/AFJBS.7.6.2025.434-454)

ABSTRACT

Lablab purpureus (L) Sweet, also known as dolic bean is an unexploited pulse legume grown in tropical and subtropical regions of the world. Its productivity and agronomic characteristics can vary considerably depending on the agroecological conditions. This study was conducted with the aim of an agromorphological characterization of 12 lablab genotypes introduced into Burkina Faso from India. The trial was carried out using an incomplete block design (Alpha lattice), with three replications. Each replicate included 12 subblocks, each containing a genotype. Qualitative and quantitative data were collected and subjected to an analysis of variance, a Principal Component Analysis (PCA) and to a Hierarchical Ascending Classification (HAC) of genotypes using XLSTAT software. The results showed the existence of a genetic variability between the different genotypes for all the parameters ($P < 0.05$), except the type of bearing and the "stay green" character observed for all the genotypes at harvest. The seed color was black or brown. Agronomic performance varied from a genotype to another. The highest grain and fodder yields were registered from the genotype IC-0623096 (2222.33 kg ha⁻¹ and 43777.66 kg ha⁻¹), representing class 4, followed by HA-10-2 (1387 kg ha⁻¹ and 29427.33 kg ha⁻¹), and constituting class 3. Positive and strong correlations were observed between the number of days to 50% flowering and the number of days to 95% maturity ($r=0.794$), plant height and harvest index ($r=0.866$) and the leaflet length and width ($r=0.992$). Strong and negative correlations were observed between the number of days to 50% flowering and plant height ($r=-0.868$) and the harvest index ($r=-0.875$), as well as between the leaflet length and harvest index ($r=-0.74$). These results could serve as a basis to better guide the selection and improvement work of lablab bean for a wide promotion of its cultivation in Burkina Faso.

Key words: *Lablab purpureus*, genotype, genetic variability, Burkina Faso.

INTRODUCTION

Agriculture is the backbone of the economy for most of the african countries (Paul 2022). In Burkina Faso, 86% of the population are active in agriculture, which provide about 45% of households' incomes and contributing approximately at 18.5% to the gross domestic product (GDP) (The World Bank 2020). However, the country's remains in a chronic food insecurity. The fast growing of the population, the drastic effects of the global climate change on agriculture and the use of inappropriate agricultural practices in crop production lead to food insufficiency. To meet the food security, resilient crops such as pulses should be promoted. Indeed, growing pulse contributes to ensuring sustainable and resilient agriculture worldwide, providing a solution to the current environmental degradation in terms of greenhouse gases mitigation, soil health and fertility improvement, biodiversity, and energy costs (Amalfitano *et al.*, 2018; Courty *et al.*, 2015; Peix *et al.*, 2014; Stagnari *et al.*, 2017). Their richness in protein and their ability to fixing atmospheric nitrogen in the soil thanks to rhizobium bacteria are of great importance for consumers and the production lands (Gomez *et al.*, 2017). In addition to cowpea (*Vigna unguiculata*), the main cultivated legume in Burkina Faso, and vouandzou, an unexplored nugget among legumes has gained in popularity in a recent past by proving its versatility as a multifunctional crop (Davari *et al.* 2018). That is *Lablab purpureus* (L.) Sweet syn. *Dolichos lablab* (L.), *Lablab niger* medik, commonly known as lablab, hyacinth bean or dolic. It is extremely diverse and remarkably adaptable to a wide range of agro ecosystems thanks to its various genotypes thriving in different areas and conditions including arid, semi-arid and humid regions (Duke *et al.* 1981; NAS 1979). Underutilized but versatile, this crop is used as human food and fodder for animals. It is a highly valuable crop, with great potentials to contributing to quality nutrition (Ranaivoson *et al.* 2019). The average protein content in lablab grain is estimated at 23.5% (Ananth and Kumar 2018), which proportion is comparable with protein concentration in common grain legume dry seeds. Likewise, immature pods and seeds of this legume are rich in dietary fiber (47%), and content low carbohydrates and lipids (Habib *et al.* 2017; Pramila *et al.* 2023). Its growing also contributes in soil protection, fertility improvement, and weed control (Shivashankar *et al.* 1993; Yamaguchi 1983). Lablab has the potential to fix and suply atmospheric nitrogen in its cropping land (Ewansiha and Falodun, 2016). Besides, *Lablab purpureus* is endowed of therapeutic and medicinal properties. Its grain contains kievitone, a essential flavonoid in the fight against breast cancer and tyrosinase having an immense potential in alleviating hypertension in human beings

(Ewansiha *et al.*, 2016; Naeem *et al.*, 2009). In spite of its nutritional, agronomical and therapeutic values, *Lablab purperus* is an unknown legume in many African regions, especially in Burkina Faso. The genotypes encountered in the country result from introductions by researchers. In the current context of food insufficiency and climate change, the recourse to efficient and resilient introduced crops for agricultural productions are necessary. The adoption of such crops by producers could compensate nutritional deficits and insufficient pastures that are very often source of conflicts between farmers and herders. They could also contribute in climate change mitigation. However, the promotion of a newly introduced crop in a given region for production at wide scale by farmers, requires a preliminary understanding of its agronomic performance. Hence this study aiming at knowing the agro-morphological diversity of 12 introduced lablab genotypes in Burkina Faso.

MATERIALS AND METHODS

Site of the study

The study was carried out at the Centre of Environmental and Agricultural Research and Training at Kamboinse during the rainy season 2024. This centre is one of the Institute of Environment and Agricultural Research Centres located at Northern Ouagadougou, the capital city of Burkina Faso. The coordinates of the experimental site are 1°32 West longitude and 12°28 North latitude at 296 m above sea level. It is characterized by soils of sandy-loam type at the surface and loamy at the depth (Kaloga, 1969).

Vegetal material

The vegetal material is compound of 12 genotypes of *Lablab purpureus* of India origin (table 1).

Table 1 : List of the studied lablab genotypes

Genotypes	Color of the grain	Origin
IC-06230100	Jaune	India
IC-0623092	Jaune	India
IC-0623099	Jaune	India

IC-0623096	Jaune	India
IC-0623094	Jaune	India
HA-17-1	Jaune	India
HA-17-2	Jaune	India
HA-17-3	Jaune	India
HA-17-4	Jaune	India
HA-10-2	Jaune	India
HA-4	Jaune	India
D167	Noire	India

Experimental design

The experimental design was an Incomplete Randomized Bloc Design (alpha lattice), comprising three replicates. A spacing of 2 m was left between two consecutive replicates as alley, whilst that between two consecutive sub-blocs was of 1 m. The inter-row and inter-hill were of 0.6 m and 0.3 m respectively.

Plant maintenance

Plant maintenance consisted of a ploughing, a harrowing, a fertilization using NPK (14-23-14) fertilizer and a pesticide application. The application of the fertilizer was done two weeks after sowing at the dose of 100 kg per hectare. Plants protection against insects and fungal attacks was done using the Delcal insecticide two weeks after sowing and during the flowering stage. Two weeding were performed, especially at two weeks and five weeks after sowing. Harvest was carried out at pods physiological maturity for each genotypes.

Data collection

Qualitative and quantitative data were collected.

- The qualitative variables were : color of the flower, color of the grain, stay green and type of the port.
- The quantitative collected parameters were : number of days to first flowering, number of days to 50 % flowering, number of days to 95 % maturity, plant height, leaflet length, leaflet width, pod length, pod width, grain length, grain width, number of pod per plant, number of grain per pod, pod weight per plant, grain weight per plant, hundred seed weight, grain yield, fodder yield and harvest index.

The grain yield, the fodder yield and the harvest index were determined using the following formula :

$$\text{Grain Yield ha}^{-1} = \frac{\text{Grain yield of net plot (kg)}}{\text{Harvested area per net plot (m}^2\text{)}} * 10000 \text{ m}^2$$

$$\text{Fodder Yield ha}^{-1} = \frac{\text{Fodder yield per net plot (kg)}}{\text{Harvested area per net plot (m}^2\text{)}} * 10000 \text{ m}^2$$

$$\text{HI} = \frac{\text{Grain yield (kg ha}^{-1}\text{)}}{(\text{Biomasse} + \text{Pod yield}) (\text{kg ha}^{-1}\text{)}}$$

Data analysis

The quantitative collected data were analysed using the XLSTAT software. An analysis of the variance (ANOVA) was performed for an in-depth understanding of the variables variation within the genotypes. The Student Newman Keuls test was performed to separate the means. A Principal Component Analysis (PCA) and an Hierarchical Ascending Classification (HAC) were as well performed for a grouping of the studied genotypes depending on their characteristics.

RESULTS

Variation of the qualitative variables

The results on the qualitative characters were presented in table 2. The color of the flower and the grain (figure 1) of all the genotypes were respectively white and brunette, except the genotype D167, for which, violet flower and black grain were observed. The character « stay green » was observed at harvest for all the genotypes. Without exception, all the genotypes showed an erected port.

Tableau 2 : Variation of the qualitative variables

GENOTYPE	Color of the flower	Color of the grain	Stay green	Type of the port
----------	---------------------	--------------------	------------	------------------

HA-17-4	W	Br	Yes	Erected
HA-17-1	W	Br	Yes	Erected
D167	V	BL	Yes	Erected
HA-10-2	W	Br	Yes	Erected
IC-0623096	W	Br	Yes	Erected
HA-17-3	W	Br	Yes	Erected
IC-06230100	W	Br	Yes	Erected
HA-17-2	W	Br	Yes	Erected
IC-0623099	W	Br	Yes	Erected
IC-0623094	W	Br	Yes	Erected
HA-4	W	Br	Yes	Erected
IC-0623092	W	Br	Yes	Erected

W ; white ; V : violet ; Br : Brunette ; BL : black.



Figure 1 : Grains of *Lablab purpureus* (L.) Sweet (A : brunette ; B : black)

Variation of the agronomic and morphological traits

Table 3 shows the results of the analysis of the variance of the agro morphological traits. Very highly significant differences were revealed between the studied genotypes for all the phenological traits, namely, the number of days to first flowering, number of days to 50% flowering and number of days to 95% maturity ($P < 0.0001$). The genotype D167 was the first to flower and to reach the stage 50% flowering (32.66 and 40 days), whilst IC-0623092 was the late (50.66 and 55.66 days).

The average number of days to first flowering and number of days to 50% flowering was 45.86 and 50.38 respectively. The greatest number of days to 95% maturity was consistently registered from D167 genotype (70 days), whilst the smallest was recorded from IC06230100 (84.66 days). The average number of days to 95% maturity was of 82.47 days.

For the morphological characters, very highly significant differences was observed between the genotypes for plant height, leaflet length and leaflet width as well. The shortest plant was observed from the genotype IC-0623092 (39 cm), followed by IC-0623096 (41.50 cm) and HA-17-2 (40.40 cm). The early flowering genotype D167 presented the tallest plant (118.20 cm). However, for the variables leaflet length and width, D167 showed the lowest dimensions (15.20 and 10.12 cm). The highest leaflet length and width were registered from the late flowering genotype IC-0623092 (20.71 and 13.92 cm). The average leaflet length and leaflet width were of 18.35 and 12.37 cm, respectively.

The genotypes did not significantly differ for pod length ($P=0.130$), pod width (0.417) and grain width ($P=0.11$). Pod length and width ranged from 7.30 to 13.92 cm and from 7.32 to 8.03 cm, respectively. The grain width varied from 6.64 to 7.31 mm with a mean of 7.01 mm. In opposite to the grain width, significant difference was observed between the genotypes for the grain length ($P=0.04$). The longest grain was registered from D167 genotype (9.19 mm), whilst the shortest was obtained from HA-17-2 genotype (7.88 mm).

Variation of yield and yield attributes

The results of the analysis of the variance of the yield and yield attributes are presented in table 4. Statistically significant differences were observed between the genotypes for most of the studied yield attributes, especially, the number of pod per plant ($P=0.005$), pod weight per plant ($P=0.001$), grain weight per plant ($P=0.010$) and hundred seeds weight ($P=0.000$). The minimum and the maximum number of pod per plant were of 14.55 and 102.2 and were registered from the genotypes D167 and HA-4, respectively. The average number of pod per plant was of 46.28. The highest pod weight per plant was registered from IC-0623096 genotype (53.33 g), whilst the lowest was recorded from HA-4 genotype (14.59 g). Similarly, IC-0623096 and HA-4 genotypes consistently exhibited the highest and the lowest grain weight per plant, respectively. The average grain weight per plant was of 20.92 g. The highest hundred seeds weight was registered from D167

genotype (17.81 g), whilst IC-0623092 genotype showed the lowest (13.02 g). The average hundred seed weight was of 15.68 g. In opposite to the other yield components, a non-significant difference was observed between the genotypes for the number of grains per pod ($P=0.154$). The number of grain per pod ranged from 2.66 to 3.66, with an average value of 3.28.

At yields scale, the statistical analysis revealed highly significant differences between the genotypes for the grain yield ($P=0.000$), fodder yield ($P<0.0001$) as well as for the harvest index ($P<0.0001$). The grain yield ranged from a minimum of 555.00 kg ha⁻¹ to a maximum of 2667.00 kg ha⁻¹, with an average value of 1324.93 kg ha⁻¹. The best grain yielding genotypes were IC0623096 (2667.00 kg ha⁻¹), followed by HA-17-4 (2221.60 kg ha⁻¹) and HA-17-1 (2083.00 kg ha⁻¹). The genotypes HA-4 presented the lowest grain yield (555.00 kg ha⁻¹). The lowest fodder yield was recorded from the genotype D167 (3210 kg ha⁻¹) and the maximum from IC-0623096 (44000 kg ha⁻¹), followed by HA-10-2 (43810 kg ha⁻¹). An average fodder yield of 18495.02 kg ha⁻¹ was registered. The average harvest index was of 8.90. The highest harvest index was recorded from D167 (13.17), whilst IC-0623092 genotype showed the least (4.32) (10.35).

Correlations between the studied quantitative variables

The correlations study provides information on the nature and the thoroughness of the association between two quantitative characters. The Pearson correlation matrix presented in the table 5 expresses the coupling between the studied quantitative parameters. Strong positive and negative correlations were revealed between some of the variables. On one hand, positive and highly significant correlations were observed between the number of days to 50% flowering and the the number of days to 95% maturity ($r=0.794$) and on the other hand, between plant height and harvest index ($r=0.866$) and the leaflet length and width ($r=0.992$). Strong and negative correlations were revealed between the number of days to 50% flowering and plant height ($r=-0.868$), the number of dyas to 50% flowering and the harvest index ($r=-0.875$), ans well as between the lealet length and harvest index ($r=-0.74$).

Tableau 3 : Results of the analysis of the variance of the agronomic characters

GENOTYPE	DFF	50%F	95%M	PH	leL	leWi	PL	PWi	GL	GWi
HA-17-4	46.00cde	50.66cde	84.00ab	72.40b	17.53a	11.63b	7.48abcd	1.77ab	8.24b	6.92abc
HA-17-1	44.33e	48.33e	82.00b	66.20bc	17.30cd	11.74b	7.90ab	1.59b	8.27b	7.02abc
D167	32.66f	40.00f	70.00c	106.06a	15.20e	10.12c	7.44bcd	1.96a	9.19a	6.93abc
HA-10-2	46.66bcde	50.66cde	84.00ab	63.86bcd	18.26cd	12.17b	7.88ab	1.69ab	8.52ab	6.64c
IC-0623096	48.66abc	52.33abcd	83.33ab	47.50de	20.24ab	13.62a	8.03a	1.75ab	8.20b	7.05abc
HA-17-3	48.33abcd	54.66ab	84.00ab	65.66bc	18.63bcd	12.76ab	7.30d	1.69ab	8.14b	6.87bc
IC-06230100	50.00ab	54.33abc	84.66a	45.40e	20.36ab	13.90a	7.51abcd	1.63b	7.88b	7.18ab
HA-17-2	48.00abcd	51.00bcde	84.00ab	54.26cde	17.69cd	11.74b	7.32cd	1.67b	7.82b	7.08ab
IC-0623099	45.00de	48.00e	84.00ab	68.20bc	17.12cd	11.68b	7.87abc	1.60b	8.45b	7.16ab
IC-0623094	43.66e	48.66de	84.00ab	58.60bcde	18.07cd	12.14b	7.61abcd	1.66b	8.23b	7.31a
HA-4	46.33cde	50.33de	83.00ab	58.33bcde	19.08abc	13.06ab	7.82abcd	1.71ab	8.17b	7.21ab
IC-0623092	50.66a	55.66a	82.66ab	42.33e	20.71cd	13.92a	7.51abcd	1.63b	7.93b	6.83bc
Mean	45.86	50.38	82.47	62.40	18.35	12.37	7.64	1.69	8.25	7.01
CV	10.60	8.77	4.89	29.26	9.70	10.49	4.78	10.01	5.95	3.87
Probability	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.000	0.130	0.417	0.047	0.111

DFF : number of days to first flowering ; *50%F* : number of days to 50% flowering ; *95%M* : number of days to 95% maturity ; *PH* : plant height ; *leL* : foliole length ; *leWi* : foliole width ; *PL* : pod length ; *PWi* : pod width ; *GL* : grain length ; *GWi* : grain width ; *CV* : coefficient of variation. Means followed by the same letters are statistically non-different.

Tableau 4 : Results of the analysis of the variance of the yield and yield attributes

GENOTYPE	NPP	NGP	PWP	GWP	100GW	GY	FY	HI
HA-17-4	53.70abcd	3.33ab	34.79bc	23.40bc	15.53b-f	1559.86bc	21684.66bc	6.65de
HA-17-1	47.62bcd	3.53ab	36.52b	25.41b	16.82abc	1694.33ab	14917.00cde	10.05b
D167	75.80a	3.46ab	37.46b	25.16b	17.26a	1677.53ab	3370.66f	13.17a
HA-10-2	44.50cde	3.46ab	33.95bc	20.80bc	15.44cdef	1387.00bcd	29427.33b	4.93de
IC-0623096	71.60ab	2.93bc	53.33a	44.50a	14.94ef	2222.33a	43777.66a	4.83de
HA-17-3	31.63cde	2.66c	26.37bcd	17.81bc	16.38abcd	1187.70bcd	17207.66cde	6.59de
IC-06230100	43.36abc	3.13abc	25.48bcd	15.02bc	14.45fg	1112.66cde	19034.00cd	5.64de
HA-17-2	56.59de	3.20abc	34.04bc	21.59bc	15.33def	1439.33bcd	19205.00cd	6.98cd
IC-0623099	31.03cde	3.66a	22.51cd	15.76bc	15.95a-e	1051.16cde	11513.66de	8.39bc
IC-0623094	35.57e	3.40ab	23.94bcd	16.58bc	16.89ab	1056.03cde	9316.66ef	10.35b
HA-4	20.55e	3.46ab	14.59d	8.89c	15.93a-e	592.50e	11703.33de	4.92de
IC-0623092	43.43cde	3.13abc	25.20bcd	16.07bc	13.26g	918.76de	20782.66c	4.32e
Mean	46.28	3.28	30.68	20.92	15.68	1324.93	18495.02	8.90
CV	43.40	12.80	38.48	53.50	8.28	37.92	58.88	87.17
Probability	0.005	0.154	0.001	0.010	0.000	0.000	< 0.0001	< 0.0001

NPP : number of pods per plant ; *NGP* : number of grains per pod ; *PWP* : pod weight per plant ; *GWP* : grain weight per plant ; *100GW* : hundred grains weight ; *GY* : Grain yield per hectare ; *FY* : haulm yield per hectare, *HI* : Harvest index ; *CV* : coefficient of variation. Means followed by the same letters are statistically non-different.

Tableau 5 : Pearson correlation matrix of the quantitative variables

Variables	DFF	50%F	PH	GrL	leL	leWi	NPP	PWP	GWP	100GW	GY	FY	95%M	HI
DFF	1													
50%F	0.966**	1												
PH	-0.923**	-0.868**	1											
GrL	-0.899**	-0.862**	0.893**	1										
leL	0.849**	0.877**	-0.901**	-0.734*	1									
leW	0.840**	0.869**	-0.887**	-0.726*	0.992**	1								
NPP	-0.400 ^{ns}	-0.386 ^{ns}	0.340 ^{ns}	0.377 ^{ns}	-0.258 ^{ns}	-0.330 ^{ns}	1							
PWP	-0.135 ^{ns}	-0.156 ^{ns}	0.125 ^{ns}	0.222 ^{ns}	-0.087 ^{ns}	-0.151 ^{ns}	0.871**	1						
GWP	-0.092 ^{ns}	-0.120 ^{ns}	0.057 ^{ns}	0.191 ^{ns}	-0.009 ^{ns}	-0.061 ^{ns}	0.799**	0.973**	1					
100GW	-0.747*	-0.742**	0.738*	0.622*	-0.799**	-0.751**	0.011 ^{ns}	0.004 ^{ns}	0.011 ^{ns}	1				
GY	-0.227 ^{ns}	-0.252 ^{ns}	0.235 ^{ns}	0.287 ^{ns}	-0.216 ^{ns}	-0.267 ^{ns}	0.855**	0.982**	0.953**	0.149 ^{ns}	1			
FY	0.594*	0.549*	-0.545*	-0.344 ^{ns}	0.592*	0.534*	0.316 ^{ns}	0.632*	0.661*	-0.554 ^{ns}	0.525*	1		
95%M	0.882**	0.794**	-0.802**	-0.808**	0.610*	0.611*	-0.566*	-0.234 ^{ns}	-0.179 ^{ns}	-0.439 ^{ns}	-0.271 ^{ns}	0.450 ^{ns}	1	
HI	-0.950**	-0.875**	0.866**	0.824**	-0.747*	-0.741*	0.520*	0.187*	0.128 ^{ns}	0.600*	0.263 ^{ns}	-0.571*	-0.954**	1

DFF : number of days to first flowering ; **50%F** : number of days to 50% flowering ; **95%M** : number of days to 95% maturity ; **PH** : plant height ; **GrL** : grainn ; **leL** : leaflet length ; **leW** : leaflet width ; ; **NPP** : number of pod per plant ; **PWP** : pod weight per plant ; **GWP** : grain weight per plant ; **100GW** : hundred grains weight ; **GY** : Grain yield per hectare ; **FY** : haulm yield per hectare, **HI** : Harvest index ; * : significant ; ** : highly significant ; **ns** : non-significant.

Principal Components Analysis

Figure 2 (A and B) shows the results on the Principal Components Analysis (PCA) of the studied parameters. The two first axis (F1 and F2) express 74.17% of the genetic variability, with respectively 49.27% for F1 and 19.96% for F2. The analysis showed that the variables number of days to first flowering, 50% flowering, 95% maturity and fodder yield are strongly correlated to F1, whilst the variables harvest index, pod weight per plant and hundred seed weight, are negatively correlated to the same axis. Elsewhere, the parameters grain yield and number of pod per plant are strongly correlated to F2 axis, explaining 24.91% of the observed genetic variability.

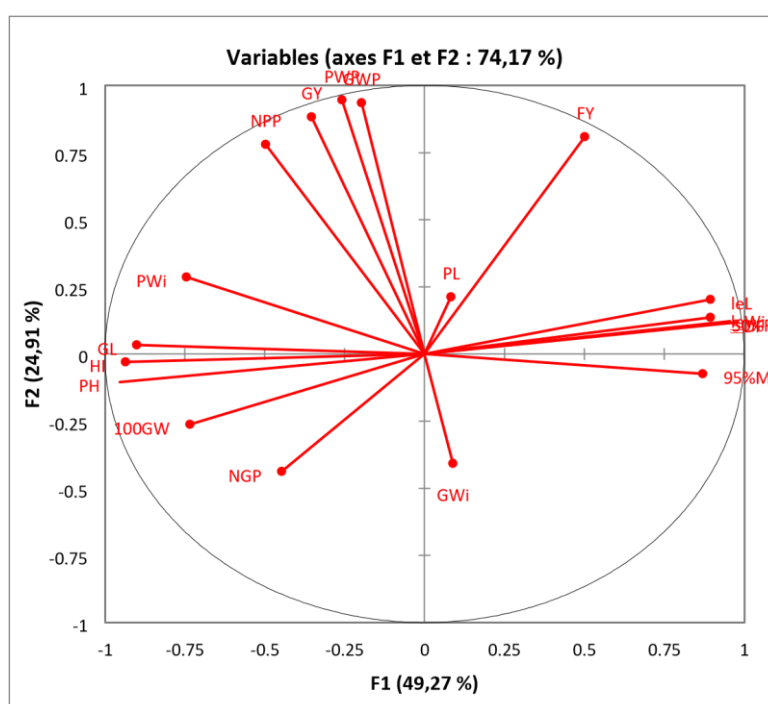


Figure 2 : Representation of the variables in axis F1 and F2.

Hierarchical Ascending Classification (HAC)

The Hierarchical Ascending Classification (HAC) carried out from the quantitative variables made it possible to group the studied lablab genotypes into four classes (Figure 3), with distinct characteristics (Table 6). Class 1 is composed of five (05) genotypes, characterized by a long developmental cycle, short tall, low hundred seeds weight, harvest index and grain yield. Class 2

is also made up of five (05) genotypes characterized by an early flowering and maturity, large plant, higher hundred seeds weight and harvest index and lower grain and fodder yield. The only accession (HA-10-2) representing class 3 is distinguished by a late pod maturity (84 days), intermediate hundred seeds weight, lower harvest index. Class 4 (IC-0623096) is build up of a single genotype, characterized by shorter height, higher grain and fodder yields and a low harvest index.

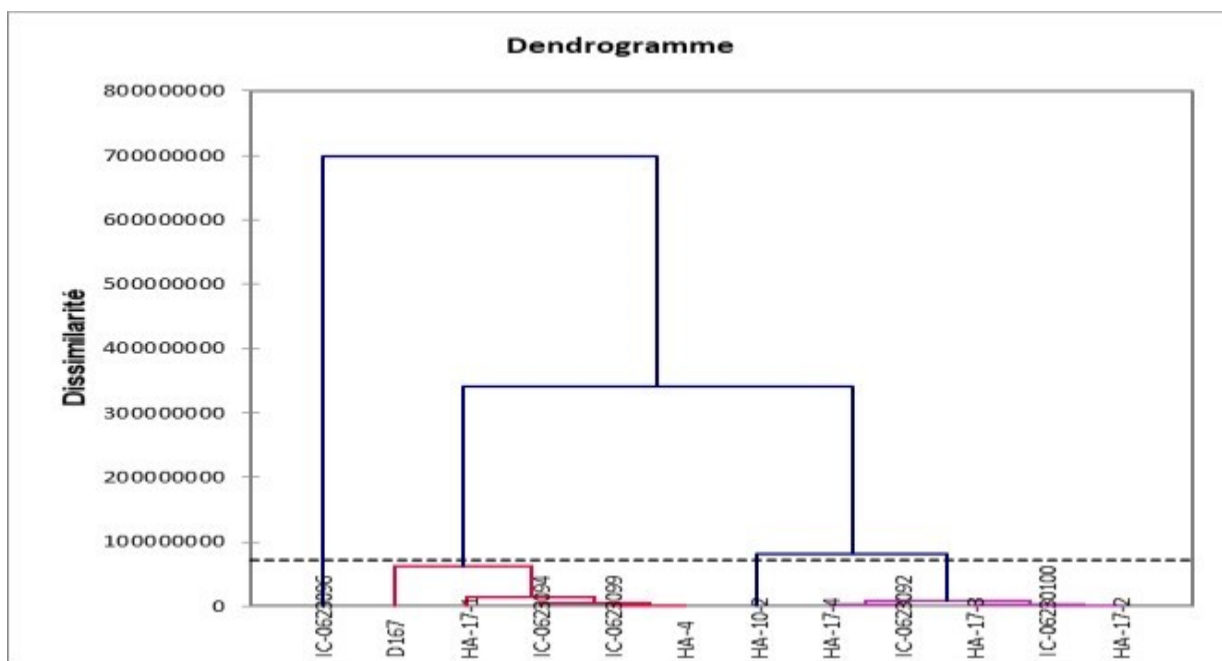


Figure 3 : Dendrogram showing the grouping of the studied lablab genotypes

Tableau 6 : Composition and characteristics of the different groups of the genotypes

Group	Composition of the group	Characteristics of the individuals of the group
1	HA-17-4, HA-17-3, IC-06230100, HA-17-2, IC-06230100, HA-17-2,	- plant height (56.01 cm) - developmental cycle (83.36 days) - hundred seeds weight and harvest index (14.99 g and 6.04) - grain and fodder yield (1243.66 and 19582.80 kg ha ⁻¹)
2	HA-17-1, D167, IC-0623099, IC-0623094, HA-4	- plant height (71.48 cm) - short developmental cycle (80.60 days) - hundred seed weight and harvest index (16.57 g and 13.37) - grain and fodder yield (1214.31 and 10164.26 kg ha ⁻¹)

3	HA-10-2	<ul style="list-style-type: none"> - plant height (63.86 cm) - developmental cycle (84 days) - average hundred seed weight (15.44 g and 4.93) - grain and fodder yields (1387 and 29427.33 kg ha⁻¹)
<hr/>		
4	IC-0623096	<ul style="list-style-type: none"> - plant height (47.50 cm) - developmental cycle (83.33 days) - hundred seed weight and harvest index (14.94 g and 4.83) - grain and fodder yield (2222.33 and 43777.66 kg ha⁻¹)

DISCUSSION

For each of the qualitative parameters stem habit and “stay green”, all the studied lablab genotypes presented the same modalities. This shows that the studied genotypes cannot be discriminated by these two characters. This lack of variability could be explained by low genetic diversity in the study dolic sample. The “stay green” character observed on all the genotypes at harvest could reflect a good adaptation of the genotypes to environmental conditions and particularly water deficits during the production season. Indeed, according to Chakoma *et al.* (2016) and the (USDA 2012), the “stay green” character is positively and strongly correlated with high tolerance to drought. *Lablab purpureus* would therefore be endowed of an ability to developing morphological mechanisms, such as leaves chlorophyll rate increase, an extension of the photosynthesis period, a deep penetration of the roots into the soil allowing a better withstanding of plants during drought stress periods. The uniformity of the studied genotypes for these parameters stem habit (erect) and the “stay green” could also be explained by the limitation of the number of samples or by their origin, as all the genotypes are of India origin. According to (Adewale *et al.* 2012) and KImani *et al.* (2012), the stem habit within a group of crop cultivars can vary depending on the geographical or the agro-ecological zone.

Genotypes also differed in color of the flower and color of the grain. These variations in flower and seed color suggest the existence of a genetic heterogeneity of the studied lablab genotypes. The low proportions of purple flower and black seed could be the results of selection pressure. Indeed, producers have high preferences for white seeds over black ones. This particular interest for white seed varieties is favorable to their large-scale promotion, making them more

available and accessible for dolic (lablab) users, which could explain the reduced proportion of black seeds genotypes compared to the white seeds genotypes in this study.

The analysis of the variance of quantitative traits showed highly significant differences between the studied lablab genotypes for the variables number of days to 50% flowering and 95% maturity. The differences between the genotypes for phenological parameters suggest that the flowering and pod maturity periods vary from a genotype to another. Some genotypes are early while others are late. These results corroborate with those of (Adebisi et al. 2013), who also observed significant genetic variability in flowering of cowpea. According to these authors, the precocity or the lateness of flowering of a crop variety depends mainly on its genes; the environment playing a secondary role. The early flowering and maturing genotypes (Genotypes of group 2) could be recommended for production in areas with short rainy season. Late flowering and maturing genotypes represented in this study by the genotype of group 3 (HA-10-2) would be suited in agro-ecological zones characterized by long rainy season.

Similarly, significant differences was revealed between the genotypes for the morphological parameters, especially, plant height, leaflet length, leaflet width and number of pods per plant. This significant differences show the existence of a genetic diversity between the studied dolic genotypes for the indicated traits. This variability within the genotypes could be attributed to factors such as the difference in the ability to adapt to given agro-ecological conditions (temperature, soil, water). (Henshaw, Adebisi, and Olabanji 2021), in a similar study depicted that in addition to the agro-climatic conditions, the genetic properties of the crop had a strong influence on pod production.

Genotypes did not differ in pod and grain dimensions as well as in number of grain per pod. This indifference of the studied genotypes shows that the genotypes are genetically homogeneous for these characters. Similar conclusion was reached by (Pengelly and Maass 2001), who observed a stability of the reproductive traits, even when changing environments. The results are in line with the findings of (Mwatuni, Nguluu, and Karanja 2017) in Kenyan, who concluded that variation for some reproductive traits, such as number of seed per pod was low compared to other traits.

However, significant differences were revealed between the studied genotypes for yield attributes such as number of pods per plant, pod weigh per plant, grain weight per plant, hundred seeds weight as well as for grain yield and fodder yield. This shows the existence of a genetic variability between the lablab genotypes for the yield components and yields. Some genotypes showed a higher potential for biomass and grain production. These variations could be explain by the difference of the level of adaptability of the genotypes to the cropping environment or the level of drought spells tolerance (Maass *et al.* 2010). Indeed, some genotypes would use more efficiently resources (water, light, nutrients) for an adequate vegetative development compared to others. According to (Singh *et al.* 2003), some crop accessions are high grain productive thanks to their adaptation to drought and their ability to channel resources towards seed production. The only genotype forming the group 4 (IC-0623096), regarding its both fodder and grain yields, the most recommendable to producers. Its production at broad scale could remarkably contribute in mitigating food insecurity and increasing forage availability for feeding animals.

The correlation study showed the existence of strong positive and negative correlations between several studied variables. The existence of the correlations mean that one of the correlated variables can be predicted from the knowledge of the other. Thus, the strong positive correlations observed between the parameters number of days to 50% flowering and 95% maturity ($r = 0.794$), plant height and harvest index ($r = 0.868$), number of pods per plant and grain yield, seed weight per plant and grain yield, suggest on one hand that the earlier the flowering, the earlier the pods maturity, or the later the flowering, the later the maturity. On the other hand, the strong positive correlations revealed between plant height and the harvest index show that the taller the plant, the more grain productive is the plant. The plant height would be a determining criterion in the selection or improvement processes for grain yield of *Lablab purpureus*. The strong positive correlations between the number of days to first flowering and the parameters leaflet length ($r = 0.849$) and fodder yield ($r = 0.594$) show that late flowering genotypes have significant vegetative development and are therefore more fodder productive. Late flowering genotypes should be favored in forage production compared to early flowering genotypes. Negative and significant correlations were observed between the number of days to 50% flowering and plant height, grain length, hundred seeds weight, number of pods per plant and harvest index, between harvest index and fodder yield, leaf length, leaflet width and harvest index and hundred seeds weight, as well as between the number of days to 95% maturity and plant height, grain length and number of pods

per plant. From these strong and negative correlations, it could be deduced that the earlier the flowering, the taller the plant and the better the plants are grain productive. Moreover, the later the pod maturity, the lower the number of pods per plant. The negative correlations between the plant height and haulm yield, plant height and leaflet length and width show that significant growth in height induces a limitation of leaves dimensions and then a reduction in forage yield.

The Hierarchical Ascending Classification (HAC) allowed the grouping of the 12 accessions into four (04) classes. The genotypes of class 4 characterized by shorter height, longer pods, larger leaves and a higher number of pods per plant seemed to be the best performing class of genotypes. The highest biomass and grain yields were recorded from this group. These results corroborate with those of (Makinde 2020), who showed that small-sized genotypes are the most fodder and grain productive. The genotype of this class (IC-0623096) is the most recommendable for potential producers and for breeding programs. Given its higher fodder yield and their “stay green” character showed at the end of the season, this group of genotypes can serve as a staple crop for fodder production for feeding animals. Indeed, the forage yield of this genotype is relatively higher compared to other legumes such as cowpea. In addition, the nutritional value of lablab seeds is remarkable. Its integration into the list of usual crops by producers could therefore serve as an alternative or supplement for nutritional deficits, especially in the current context of climate change and growing food insecurity. Class 2, comprising early flowering and maturing genotypes, taller plants, had the lowest haulm yield, higher hundred seeds weight and harvest index. These results suggest that this group of genotypes is more productive in grain than in fodder. Their production could therefore be advised when the production objective does not include fodder production. The results obtained are in line with those of (Adebisi *et al.* 2013) on *Vigna unguiculata*, who showed that short cycle varieties generally have higher grain yield.

Conclusion

A great morphological and agronomic diversity exists between the *Lablab purpureus* genotypes introduced in Burkina Faso. The agronomic performance varies from one genotype to another. The length of the development cycle is a function of the genotype. Through the existence of this genetic variability and the associations between the traits, the studied lablab accessions could be considered as a potential source for setting improvement and selection programs for this important

legume. Dolikos bean could be advised to farmers as main and resilient fodder crop for livestock thanks to its “stay-green” character observed at harvest for all the genotypes used in this study. The high grain and fodder yield genotypes identified could already be selected for performance tests on-farm in order to consider their large-scale production. However, further research on technical cultivation routes (optimal sowing date, sowing density, fertilization, irrigation) is necessary for a deep investigation of the genetic diversity of *Lablab purpureus*. An adapted valorization of *Lablab purpureus* in Burkina Faso could contribute to meet food security and agricultural sustainability.

References

- Adebisi, M. A., O. B. Kehinde, A. W. Salau, L. A. Okesola, and J. B. O. Porbeni. 2013.** “Genetic Variability and Stability of Seed Yield and Yield Components in Cowpea (*Vigna Unguiculata* L. Walp.).” *Plant Breeding and Biotechnology*, 1 (4): 396–406.
- Adewale, B. D., D. J. Dumet, I. Vroh-Bi, O. B. Kehinde, D. K. Ojo, A. E. Adegbite, and J. Franco. 2012.** “Morphological Diversity Analysis of African Yam Bean (*Sphenostylis Stenocarpa* Hochst. Ex A. Rich.) Harms and Prospects for Utilization in Germplasm Conservation and Breeding.” *Genet Resour Crop Evol* 59:927–36. <https://doi.org/10.1007/s10722-011-9734-1>.
- Amalfitano, Carmine, Diana Agrelli, Carlo Borrelli, and Gianluca Caruso. 2018.** “Production System Effects on Growth, Pod Yield and Seed Quality of Organic Faba Bean in Southern Italy.” *Folia Horticulturae* 30 (2): 375–85. <https://doi.org/10.2478/fhort-2018-0033>.
- Ananth, R., and S. Kumar. 2018.** “Screening of Dolichos Bean [*Lablab Purpureus* (L.) Sweet] Genotypes for Growth and Yield in Coastal Region of Tamil Nadu.” *Plant Archive* 18 (2): 1258–62.
- Courty P. E., P. Smith, S. Koegel, D. Redecker, and D. Wipf. 2015.** “Inorganic Nitrogen up

Take and Transport in Beneficial Plant Root-Microbe Interactions.” *Crit Rev. Plant Sci.* 34:4–16.

Davari, S. A., N. B. Gokhale, V. N. Palsande, and M. C. Kasture. 2018. “Wal (Lablab Purpureus L.) : An Unexploited Potential Food Legumes.” *Int. J. Chem. Stud.* 6:946-949.

Duke, J.A., A. E. Jr Kretschmer, C. F. Reed, and J. K. P. Weder. 1981. “Lablab Purpureus (L.) Sweet. In: Handbook of Legumes of World Economic Importance.” *Plenum Press, New York.*, 102–6.

Ewansiha, S. U., S. A. Ogedegbe, and E. J. Falodun. 2016. “Utilization Potentials of Lablab (Lablab Purpureus (L.) Sweet) and the Constraints of Field Pests and Diseases in Nigeria.” *Journal of Tropical Agriculture, Food, Environment and Extension* 15 (1): 11–16.

Gomez, L. D., C. Amalfitano, A. Andolfi, R. Simister, S. Somma, M. R. Ercolano, C. Borrelli, et al. 2017. “Valorising Faba Bean Residual Biomass: Effect of Farming System and Planting Time on the Potential for Biofuel Production.” *Biomass Bioenerg.* 107:227–32.

Habib, H. M., S. W. Theuri, E. E. Kheadr, and F. E. Mohamed. 2017. “Functional, Bioactive, Biochemical and Physicochemical Properties of the Dolichos Lablab Bean.” *Food and Function* 8

(2): 872–80.

Henshaw, F. O., M. A. Adebisi, and O. G. Olabanji. 2021. “Pod Yield Variability in Lablab Purpureus: Implications for Breeding under Drought-Prone Environments.” *Legume Research* 44

(2): 189–95.

Maass, B., M. R. Knox, S. C. Venkatesha, and et al. 2010. “Lablab Purpureus—A Crop Lost for Africa?” *Tropical Plant Biol.* 3:123–35.

Makinde, O. O. 2020. “The Effects of Physical and Social Characteristics on Residents’

Perception on Neighbourhood Quality in the Urban Environment.” *Journal of Human, Earth, and Future*. <https://doi.org/10.28991/HEF-2020-01-03-03>.

Mwatuni, F. M., S. N. Nguluu, and J. Karanja. 2017. “Stability of Reproductive Traits in Lablab Purpureus Accessions across Kenyan Agro-Ecologies.” *Tropical Agriculture* 94 (3): 245–54.

Naeem, M., M.M.A. Khan, and M. H. Siddiqui. 2009. “Triacontanol Stimulates Nitrogen-Fixation, Enzyme Activities, Photosynthesis, Crop Productivity and Quality of Hyacinth Bean (Lablab Purpureus L.)” *Scientia Horticulturae* 12 (4): 389–96.

NAS. 1979. *Lablab Bean. In: Tropical Legumes: Resources for the Future. National Academy of Sciences (NAS), Washington DC, Pp. 59-67.* Washington DC: National Academy of Sciences (NAS).

Paul, B. 2022. “Agriculture: The Backbone of the African Economy.” *International Journal of Advanced Research in Social Sciences Environmental Studies & Technology* 7 (1): 62–74. <https://doi.org/10.48028/iiprds/ijarssest.v7.i1.06>.

Peix, A., M. H. Ramírez-Bahena, E. Velázquez, and E. J. Bedmar. 2014. “Bacterial Associations with Legumes.” *Crit. Rev. Plant Sci.* 34:17–542.

Pengelly, B. C., and B. L. Maass. 2001. “Lablab Purpureus (L.) Sweet - Diversity, Potential Use and Determination of a Core Collection of This Multi-Purpose Tropical Legume.” *Genet Resour Crop Evol* 48:261–72.

Pramila, Udit Kumar, R.K. Tiwari, K. Prasad, S. Ghosh, B.M. Sinha, L. M. Yadav, and K. P. Vivek. 2023. “Character Association in Dolichos Bean [Lablab Purpureus (L.) Sweet] in Agro-Climatic Zone of North Bihar.” *Legume Research* 46 (3): 301–6.

Ranaivoson, L., K. Naudin, A. Ripoche, L. Rabeharisoa, and M. Corbeels. 2019.

“Effectiveness of Conservation Agriculture in Increasing Crop Productivity in Low-Input Rainfed Rice Cropping Systems under Humid Subtropical Climate.” *Field Crops Research* 239:104–13.

Shivashankar, G., R. S. Kulkarni, H. E. Shashidhar, and D. M. Mahishi. 1993. “Improvement of Field Bean.” In *Chadha, K.L. and Kallo, G. (Eds.) Advances in Horticulture*, 5:277–86. New Delhi, India.

Singh, B. B., H. A. Ajeigbe, S. A. Tarawali, and S. Fernandez-Rivera. 2003. “Improving the Production and Utilization of Cowpea as Food and Fodder.” *Field Crop. Res.*, 84 (1-2): 84 (1–2): 169-177.

Stagnari, F., A. Maggio, A. Galieni, and M. Pisante. 2017. “Multiple Benefits of Legumes for Agriculture Sustainability: An Overview.” *Chem. Biol. Technol. Agric.* 4:2. <https://doi.org/10.1186/s40538-016-0085-1>.

The World Bank. 2020. *Agricultural Productivity and Food Security Project (P114236)*.

USDA. 2012. *Collection of Materials from the USDA National Agricultural Library. The Materials Are Available in Digital Format, Whether Those Materials Originated in That Format or Were Converted to It Later.* United States Department of Agriculture: National Agricultural Library Digital Collections.

Yamaguchi, M. 1983. *World Vegetables: Principles, Production and Nutritive Values. Molecular Nutrition.* Vol. 28. <https://doi.org/10.1007/978-94-011-7907-2>.