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Evaluation of Distintion, Homogeneity and Stability (DHS) Traits and Agronomic Value of Low Amylose Rice varieties under Growing Conditions in the Senegal River Valley

Ibrahima Mbodj[1*], Omar Ndaw Faye[2] and Aly Ndiaye[1]

[1]Alioune DIOP University of Bambey, Higher Institute of Agricultural and Rural Training, BP 54 Bambey-Senegal
[2]Senegalese Agricultural Research Institute, Center of Saint-Louis, BP 240 Saint-Louis, Senegal

[*]**Corresponding Author:** Ibrahima Mbodj, Alioune DIOP University of Bambey, Higher Institute of Agricultural and Rural Training, BP 54 Bambey-Senegal, Tel: 221 77 552 61 08, E-mail: ibrahima.mbodj@uadb.edu.sn

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Abstract

The choice of promising lines is one of the first results of a long process of varietal selection. These fixed and stable and judged agronomically efficient with the first tests, will be morphologically tested from a Distinction-homogeneity-Stability (DHS) character record harmonized by the Economic Community of West African States (ECOWAS) seed regulations. This test is the very last step to propose them for approval. Our study goes in this direction and consists of characterizing 10 new rice lines from the anther culture and evaluating the yield and its components in the conditions of the Senegal River Valley. The objective of this study is to contribute to the achievement of self-sufficiency in rice by offering producers varieties adapted to the conditions of the different zones with an appreciated quality and grain cleanliness.

The experimental setup is in randomized complete blocks with 3 repetitions. Four (4) samples of one (1) square meter seedlings were taken from each plot. Variety comparison is done by the Tukey test. Characterized lines are similar to controls by ligule shape, non-anthocyanin colouration, limb habit, length, shape and color of caryopsis. The analysis of variance showed a highly significant effect for the sowing-heading cycle, the sowing-to-maturity cycle, the height and the yield; a significant effect for the number of tillers and the weight thousand grains; a very significant effect for panicle weight per m2. Lines KF160064, KF160093 and KF160074 have higher yields than the best control (Sahel 108) with averages of 6.14 to 7.06 T / ha. The combined analysis of these results in the station and a series of multi-local trials will make it possible to validate the proposal or not for the approval of these lines.

Key points of the article

10 new rice lines from anther culture underwent distinctness, homogeneity and stability (DHS) tests for their approval. It is a question of determining their distinct morphological characters, of verifying the stability of these characters and their homogeneity.

These newly created varieties have good yield, good disease resistance, short cycles, good seed quality. This work also consisted of verifying the agronomic behavior of these varieties, their potential and their performance.

The TONGIL rice used, resulting from a cross between the indica subspecies (recognized by their good adaptation in Africa with very good yield) and japonica (remarkable grain quality characteristics). it enabled South Korea to achieve self-sufficiency in rice in a short time. The Agricultural Research Center of Saint Louis is in its third series of rice varieties TONGIL, resulting from the culture by anther allowing to shorten the cycle of selection by having fixed and stable lines in two or three years.

Keywords: Characters, lineages, Varieties, Anthers

Introduction

Rice cultivation is considered the main source of nutritional calories for humans and its use reached in 2021, 518.9 million tons worldwide [1]. Among the foodstuffs of food importance, rice is the third cereal in the world after maize and wheat [2]. According to the latest forecast from the International Grains Council (IGC), world rice production is expected to grow for the sixth consecutive year in 2021/22, to a new peak of 512 million tonnes, against an estimated 506 million tonnes for 2020/21. [3].

In Africa, rice occupies a prominent place in the diet of the population, it represents more than 25% of the total cereals consumed, ranking second behind maize [4]. It is in West Africa that rice has experienced the greatest growth over the past 20 years. It is grown in nearly 40 of the 54 countries on the African continent and rice cultivation is the main activity and source of income for more than 35 million smallholder rice farmers in Africa [4]. Local rice production covers only 60% of demand in Africa, giving rise to imports of 14-15 million tons per year (costing more than US$6 billion), which constitutes considerable losses in rice reserves. foreign currencies of the continent [4].

In Senegal, rice is a staple food and the main sector, supplying 73.8% of households, but the country's milled rice needs are estimated at around 1.5 million tonnes per year, contributing only 7.6% to the total. Country's GDP [5]. However, 742,348 tons of white rice are produced in 2020, resulting in a deficit of about 1,070,286 tons, which are imported [6,7]. The average annual consumption of rice is estimated at 100 kg/inhabitant, constituting the most consumed cereal in Senegal [8]. Unfortunately, Senegal is 51% dependent on imports to meet its domestic demand for rice [5]. In order to reduce this deficit, the Senegalese Government has set up the National Rice Self-sufficiency Plan (P-NAR), the objective of which is to double rice production between the years 2020 and 2030.

In 2017, the regional branch of the Senegalese Institute for Agricultural Research (ISRA) approved, through the National Committee for Seeds and Plants, fifteen new varieties of rice called “ISRIZ”. This range of rice varieties is tolerant to abiotic and biotic stresses and meets the requirements of Senegalese consumers and producers. These new varieties have potential yields that can reach 13 tonnes per hectare. Variety improvement approaches have experienced a boom in recent years in Senegal, in particular with the use of anther culture, which makes it possible to shorten selection cycles with crosses between indica and japonica subspecies. Indeed, the use of Tongil-type lines derived from intraspecific crosses between japonica and indica often improves the genetic potential of rice yield, quality and taste [9]. It is in this context that our work focuses on the evaluation of the agro morphological characters of 10 promising rice lines developed from anther culture in the culture conditions of the Senegal River valley.

The general objective of this study is to contribute to the achievement of self-sufficiency in rice by providing producers with new varieties with high yield potential with good grain quality and tolerant to different stresses. It is a question of (i) evaluating the agronomic performance of these new lines compared to the controls and (ii) determining the morphological characters which make it possible to identify the lines compared to the others registered in the national catalog.

Material and Methods

Plant Material

The plant material consists of ten (10) new varieties not yet approved from South Korea and two (2) varieties (Sahel 108 and Nerica S19) (Table 1).

Table 1: List of varieties used

Designation	Varietie **Code**	**origin**
V1	KF160069	South Korea
V2	KF160973	South Korea
V3	KF160448	South Korea
V4	KF161016	South Korea
V5	KF160093	South Korea
V6	KF160127	South Korea
V7	KF160074	South Korea
V8	KF160094	South Korea
V9	KF160064	South Korea
V10	KF160061	South Korea
V11	Sahel 108	IRRI Philippines
V12	Nerica S19	Africarice / Saint-Louis

Methods

Experimental Pparatus

A randomized complete block design is used with three (3) repetitions. Each repetition is in a block 65.5 m long and 14 m wide. These blocks are separated from each other by 1 m wide paths and a 0.5 m bund between the plots. Each block has 12 plots measuring 5 m by 4 m (representing the treatments) separated from each other by 1 m wide alleys (Figure 1). The factor studied was the variety with 12 treatments.

Conduct of the Trial

The test was conducted at the Fanaye station in the hot off-season from February to July 2018.

Soil Preparation

Soil work with two offset passes was carried out, followed by mud filling and leveling of the plots.

Sowing

A seed rate of 40 kg/ha is used for each variety, i.e. 80 g for an elementary plot. Sowing in the nursery is carried out after soaking the seeds in water for 24 hours, followed by an incubation phase which consists of providing the seeds with additional water, air and heat. The bags were first taken out of the water and left to drain for 5-10 minutes. Then they are placed in a ventilated place, in the shade and in the ambient heat. This operation lasted 48 hours coinciding with the appearance of stems and rootlets.

Transplanting

The nurseries were transplanted with spacings of 20 cm between rows and 20 cm between pockets. Each elementary plot has a density of (5*4)/(0.2*0.2)=500 plants.

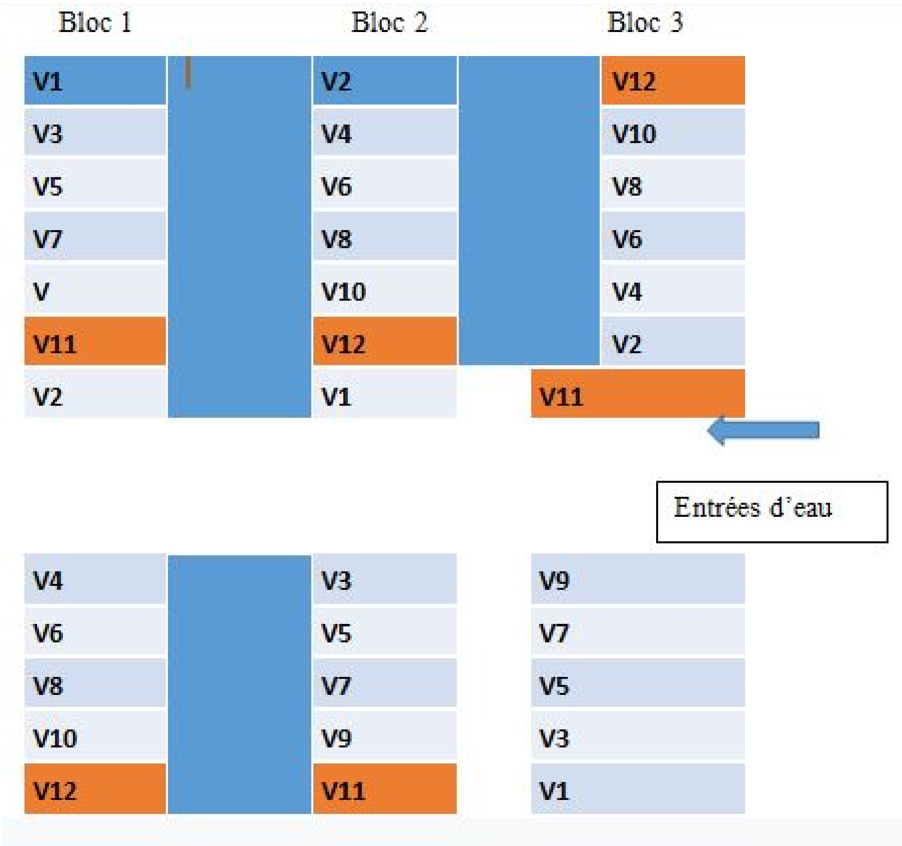

Figure 1 : Plan of the experimental device of the test

Fertilization

DAP was used as a basic fertilizer before sowing in the plot with a dose of 100 kg/ha, i.e. 200g per elementary plot. Urea is used as a cover fertilizer at the rate of 300 kg/ha in 3 inputs (10):

- 150 kg/ha in the tillering phase, i.e. 300 g per elementary plot;
- 100 kg/ha in the panicle initiation phase, i.e. 200 g per elementary plot;
- 50 kg/ha in the elongation phase, i.e. 100 g per elementary plot.

Water Management

Irrigation is done twice a week with a water slide between 5 and 10 cm by gravity with a motor pump connected to the Ngalanka River.

Cultivation Maintenance

During cultivation, different operations were applied in this test. It's about (10):

- Herbicide treatment with a mixture of propanil 8 l/ha i.e. 16 ml per elementary plot and weedone at a rate of 1 l/ha i.e. 2 ml per treatment;
- manual weeding if necessary with the support of workers;
- and guarding to fight against bird attacks or other damage, during the sowing-emergence periods and from the beginning of heading to maturity
- Harvest

The harvest took place when in a plot 80% of the plants are mature.

Observations and Measurement of Parameters

Average Height of Plants at Maturity

Ten (10) plants were randomly selected from the useful plot of each treatment and the average of these 10 measurements gave this height. This measurement (in cm) was taken from the base of the plant (soil) to the end of the last leaf of the plant at maturity. It was done using a graduated ruler.

Date 80% Maturity

The sowing-maturity cycle corresponds to the number of days separating the sowing date from the 80% maturity date.

Number of Tillers

Ten plants are randomly selected from each useful plot and the number of tillers counted for each plant. This operation was carried out at the end of the vegetative phase and at maturity; the average number of tillers per plant was then calculated by the average of the number of tillers counted in the ten selected plants.

Number of Panicles per m2

To assess this parameter, four (4) yield squares of one (1) m side were placed in each useful plot. The total number of panicles is counted and the average per square meter calculated.

Panicular Weight

The average panicle weight for each treatment was obtained by averaging the weights of panicles harvested from the four (4) yield plot samples. This weight was weighed using an electronic scale.

Weight 1000 Grains

Using a grain counter, 1000 filled and dried grains at 14% moisture content were counted from the threshed panicles of the yield bed sample and their weight determined with a precision scale.

Yield

The yield was determined according to the formula of Radeau (1998): Grain yield in T/ha = Number of panicles per m2 * Number of grains per panicle * Percentage of full grains * Weight of 1000 grains then extrapolated in tonnes per hectare.

Humidity

Each time grain is weighed, a sample is automatically taken to measure the moisture. This humidity is taken with a moisture meter.

Data Processing and Analysis

Microsoft Office 2007 (Word and Excel) enabled text processing and the design of tables and graphs. Breeding view 1.6 software was used for the analysis of variance.

DHS Morphological Parameters Monitored

During Vegetation

The DHS parameters observed during vegetation with their reading code are recorded in Table 2 below: in reproductive phase, the DHS parameters observed in the reproduction phase with their reading code are recorded in Table 3 below; at maturity, the DHS parameters observed in the maturity phase with their reading code are recorded in Table 4 below.

Table 2: DHS parameters observed during vegetation

Observations DHS	**JAS**	**CODES**
leaf green color intensity	40 JAS	3 = clear; 5 = average; 7 = dark
anthocyanin pigmentation of the collarette	40 JAS	1= absent9 = present
distribution of anthocyanin coloration on the leaf	40 JAS	1 = only at the top; 2 = only at the edge; 3 = only in spots; 4= uniform
anthocyanin pigmentation of the auricles	40 JAS	1= absent; 9 = present

Table 3: DHS parameters observed in the reproduction phase

Observations DHS	JAS	CODES
Limb habit	60 JAS	1 = upright; 3 = semi-erect; 5 = horizontal; 6 = curved
anthocyanin coloration of the carina of the lower lemma	65 JAS	1=absent or very low; 3 = low; 5 = average; 7 = strong
spikelet stigma color	65 JAS	1 = white; 2 = light green; 3 = yellow; 4 = light purple; 5 = purple
Pigmentation of nodes and internodes	70 JAS	1 = absent; 9 = present
Port of branches	Harvest	1 = upright; 3 = semi-erect; 5 = spread

Table 4: DHS parameters observed in the maturity phase

Observations DHS	CODES
Caryopsis length	3 = short; 5 = medium; 7 = wide
caryopsis profile shape	1 = rounded; 2 = semi-rounded; 3 = semi-fusiform; 4 = fusiform5 = very fusiform
pericarp color	1 = white; 2 = light brown; 3 = dark brown; 5 = light red; 6 = red 7 = variegated purple; 8 = purple; 9 = dark purple/black

Results

The results on the morphological parameters presented on the different lines concern the anthocyanin pigmentation of the collar and auricles, the habit of the limb, the shape of the ligule, the anthocyanin pigmentation of the apex, the curvature of the main axis, the branch habit, length and shape of caryopsis and color of pericarp.

Anthocyanin Pigmentation of the Collar and Auricles

The results of the observations on the leaf show that none of the lines showed anthocyanin coloration at the level of the collar and the auricles at the 40th DAS (Figure 2).

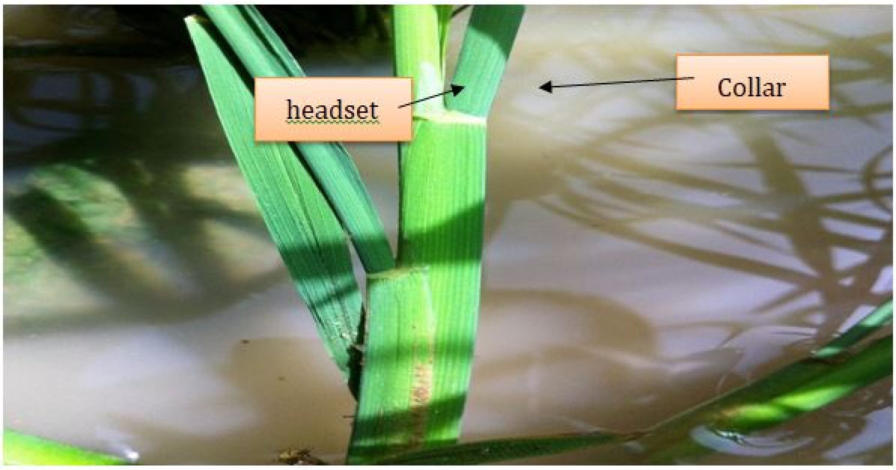

Figure 2: Absence of anthocyanin pigmentation at the level of the auricle and the collarette

Port of the Lamina

At the 60th DAS (early observation), the results of the observations show that all the lines have an erect habit. At the 90th JAS, six (6) lines (KF160069, KF160973, KF160093, KF160127, KF160064 and KF160061) have a semi-upright habit (Figure3) and the remaining four (4) KF160448, KF161019, KF160074 and KF160 094 have an upright habit (Figure 4).

Figure 3: semi-upright habit (KF160069)

Figure 4: upright habit (KF160448)

Shape of the ligule

Regarding the shape of the ligule, the results obtained show that all ten (10) new lines tested have a divided ligule (Figure 5).

Figure 5: split ligule of variety KF160069

Anthocyanin Pigmentation of the Apex

The results of the early observation carried out at the 90th JAS show that none of the lines showed anthocyanin coloration at the apex.

Anthocyanin Pigmentation of the Stem

Observations made at the 70th JAS on anthocyanin pigmentation show that none of the lines present anthocyanin coloration all along the stem (nodes and internodes). (Figure 6)

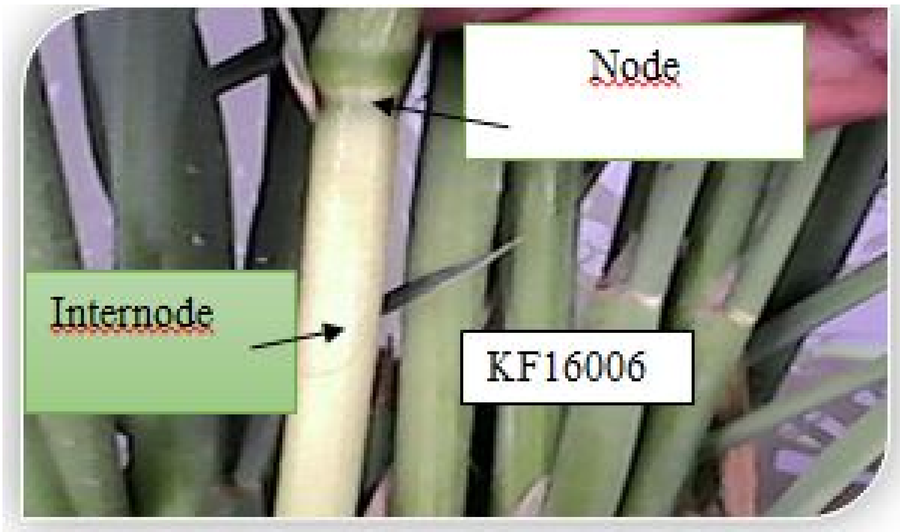

Figure 6: Absence of anthocyanin coloration on the stem

Curvature of the Main Axis

Regarding the curvature of the main axis, early observations made at the 90th JAS show us that only one of the lines tested (KF160448) has a straight axis and that all the other varieties are semi-straight (Figure 7).

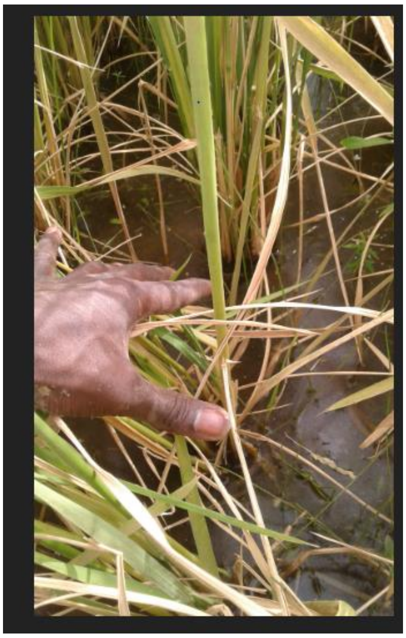

Figure 7: right main axis of variety KF160448

Port of Branches

Concerning the ramifications of the panicle, the results after early observation show us that nine (9) lines have a semi-erect port and only one (KF160448) has an erect port.

Caryopsis Length

For caryopsis length, our results show that lines KF160094, KF160127, KF160093, KF160064, KF160069, KF160074 and KF160061 each have a caryopsis of average length. Lines KF160448, KF161019 and KF160973 have a short caryopsis (Figure 8 and 9).

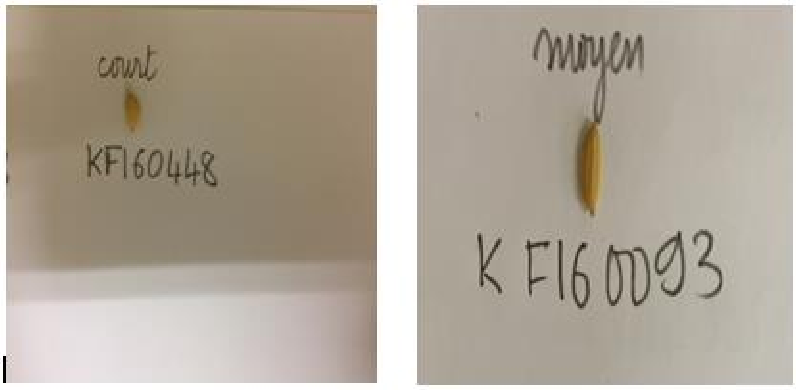

Figure 8: short length caryopsis, 9: medium length caryopsis

Caryopsis Shape

For the shape of the caryopsis, after an early observation, three lines (KF160093, KF160064 and KF160069) are semi-fusiform and the others, half-round (Semi-round). (Figure 10 & 11)

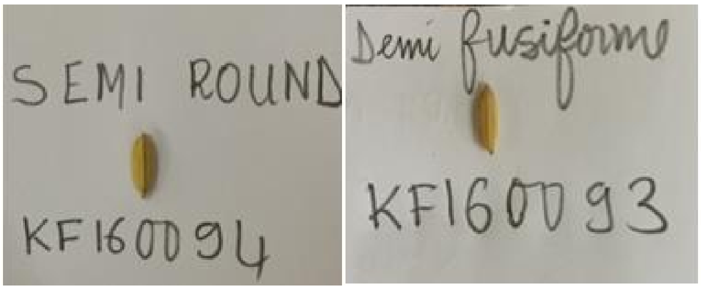

Figure 10: semi-round shape of the caryopsis, 11: spindle-shaped caryopsis

(KF160094) (KF160093)

Color of the Pericarp

Regarding the color of the pericarp, our results show that all ten (10) new lines have a light brown color of the pericarp. (Figure 12)

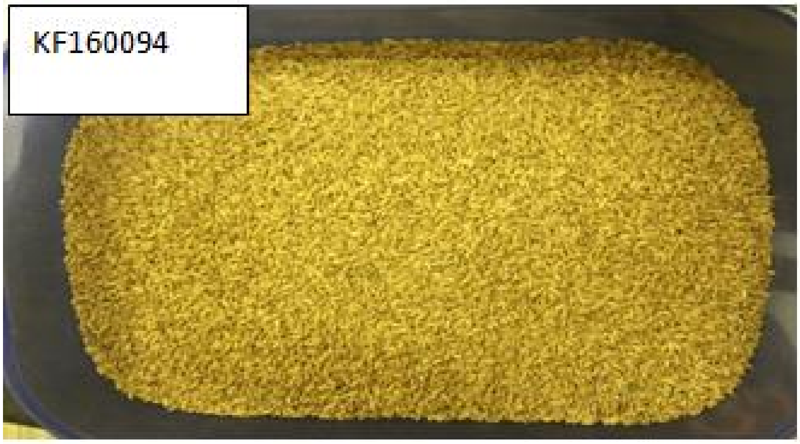

Figure 12: color of the pericarp of the KF160094 variety

Agronomic Parameters

The results on the agronomic parameters of the lines tested are given in Table 5. They concern the sowing--heading cycle, the sowing-maturity cycle, the height and the average number of tillers at maturity, the number of panicles/m2, the weight thousand grains and yield at 14% moisture content.

Table 5: Average values of agronomic parameters of the different varieties

agro parameter	Height at maturity (cm)	JRSEPI	JRSMAT	Nbre Tal/pied	Nbre Pan/m^2	PMG	Yield (kg/ha)
Varietiess							
KF160061	90,8	87	125.00	24	393,23	25,37	4187,83
KF160064	82,6	86,33	121	28	440,77	24,84	7064,12
KF160069	96,06	97,33	134	29	426,15	24,4	4731,83
KF160074	85,86	98	132	23	493,9	23,66	6140,87
KF160093	87,63	96	131,66	22	491,77	23,39	6777,07
KF160094	88,66	89	125	24	419,53	23,36	4913,01
KF160127	89,46	91	127,66	27	326,66	23,16	4526,09
KF160448	90,7	96	132	22	275,37	22,98	1598,85

KF160973	63,36	101	138	31	101,9	22,7	617,98
KF161019	88,46	95	127,33	25	398,94	21,68	1228,97
NERICA S19	92,8	99,33	139	23	376,82	21,38	1515,45
SAHEL 108	71,36	87	120,33	35	413,89	20,04	4364,89
Héritabilité	0,94	0,97	0,97	0,6	0,75	0,64	0,94
CV	9.83	5.23	6.05	5.1	100.81	2.11	2192
P-value	2,04E-08	6,49E-12	7,83E-12	0,032165311	0,002238514	0,029342579	1,76E-08

Sowing-Heading Cycle

The cycle varies between 87 and 101 days (Figure 13). The Turkey test allowed us to group the lines around the two controls (Sahel 108 with long cycle and NERICA S19 with short cycle).

In the first group, we have lines substantially similar to the control Sahel 108 with an average cycle of 87 days. Their cycles vary between 87 to 91 days. These lines are: KF160061, KF160064, KF160094 and KF160127.

The second group concerns lines with a cycle slightly longer than the Sahel 108 control and shorter than the NERICA S19 control, between 95 and 98 days. These lines are: KF161019, KF160093, KF160448, KF160069 and KF160074.

In the last group, we have a line (KF160973), almost similar to NERICA S19 with an average long cycle of 101 days.

The analysis of the variance of the sowing-heading cycle of the different varieties showed a highly significant effect at the 5% threshold (Pr<0.001).

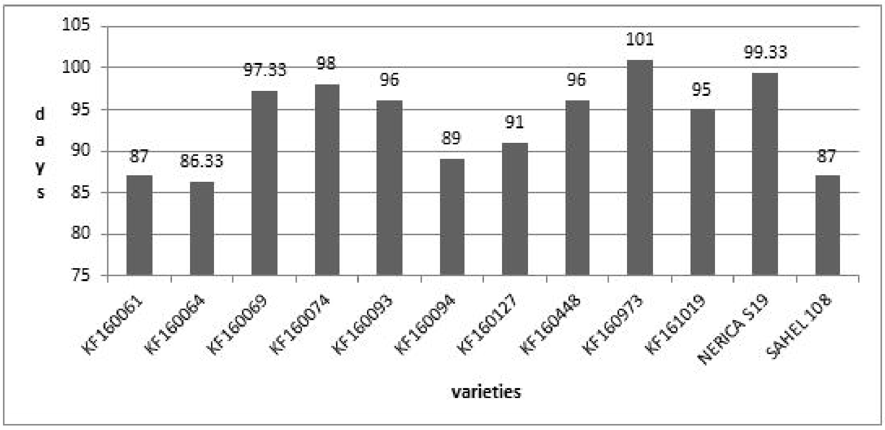

Figure 13: Number of days from sowing to heading depending on the variety

Sowing-Maturity Cycle

The cycle varies between 120 and 139 days (Figure 14). The KF160061, KF160094 and KF160064 lines are moderately similar to the Sahel 108 control with an average cycle of 120 days. The other lines KF160127, KF161019, KF160093, KF160074, KF160448 and KF160069 have a longer cycle than the control Sahel 108 and shorter than NERICA S19. The KF160973 line is somewhat similar to the NERICA S19 control with a long cycle of 138 days.

The analysis of variance shows a highly significant effect (Pr<0.001) between the lines at the 5% threshold.

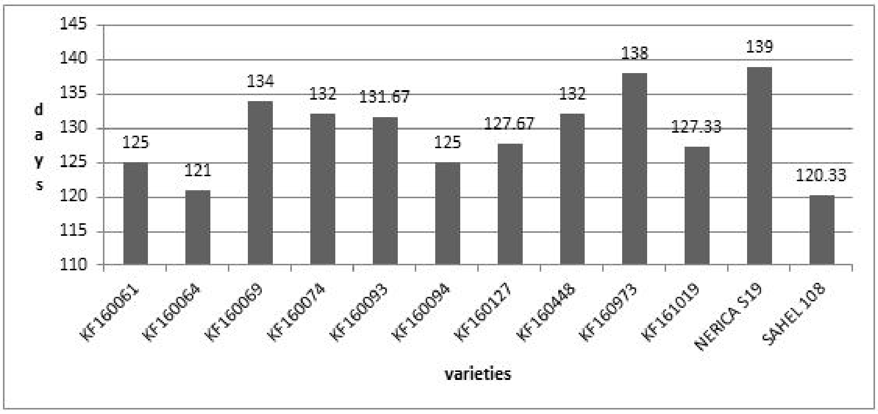

Figure 14: Number of sowing-maturity days depending on the variety

Height of Plants at Maturity

The average height of the varieties varies between 63.36 and 96.07 cm (Figure15). The two lines KF160064 and KF160973 are below the witness Sahel 108 which has a height of 71.37 cm. On the other hand, all the other lines have a height greater than the Sahel 108. The control NERICA S19, with a height of 92.80 cm, is identical to all the other lines with the exception of KF160973.

The analysis of variance showed a highly significant effect between the lines (Pr<0.001) at the 5% threshold.

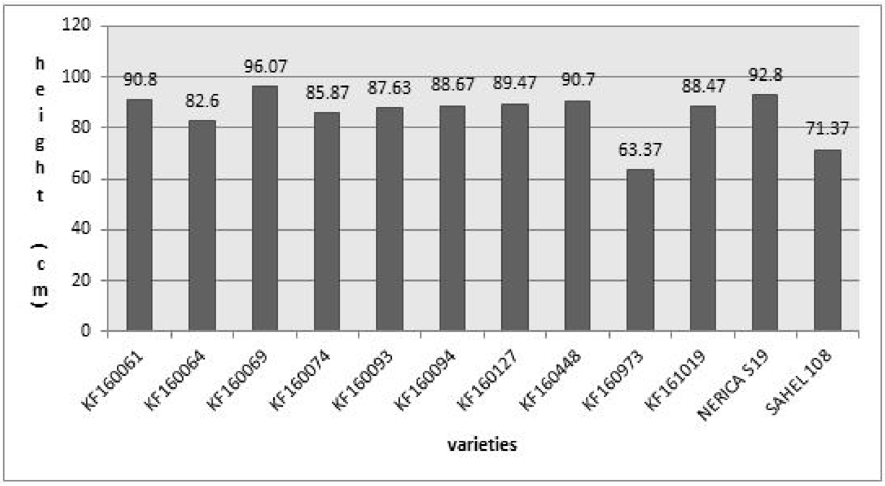

Figure 15: Average height by variety

The Number of Mature Tillers

The average number of tillers per variety varies between 22 and 34 (Figure 16). The control Sahel 108 is moderately similar to the 10 lines as well as the control NERICA S19; according to the Turkey test, KF161019, KF160973, KF160127, KF160094, KF160069, KF160064 and KF160061 developed greater tillering than the NERICA S19 control. Also, lines KF160448 and KF160093 have a lower number of tillers than NERICA S19. Finally, the NERICA S19 control is identical to the KF160074 line for this parameter.

The analysis of variance showed a significant effect between the varieties at the 5% threshold. (Pr<0.05).

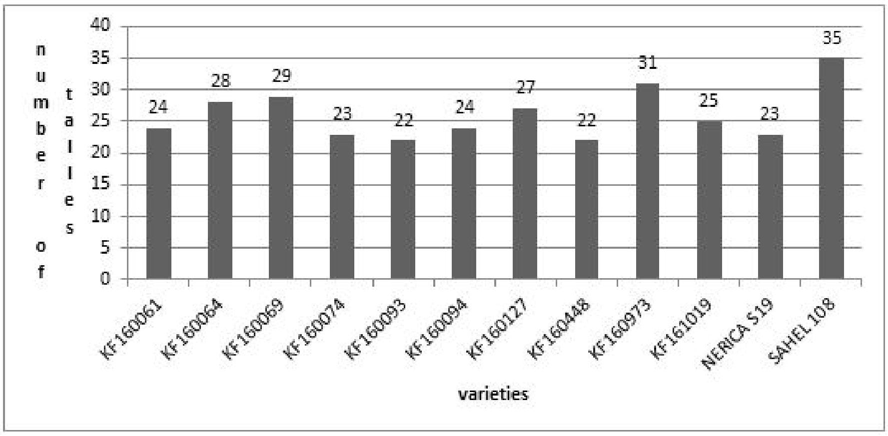

Figure 16: Average number of tillers by variety

Number of Panicles per m2

The number of panicles varies from 102 to 494 (figure 17). The Turkey test shows us that the control Sahel 108 with an average number of panicles of 414 is moderately identical to all ten (10) lines tested. The NERICA S19 control is also moderately similar to the lines with an average number of panicles of 377. The lines KF160094, KF160093, KF160069 and KF160064 are superior to the control Sahel 108. These lines, in addition to KF160061 and KF161019 are superior to the control NERICA S19.

The analysis of variance revealed a very significant effect between the different varieties at the 5% threshold (Pr<0.01).

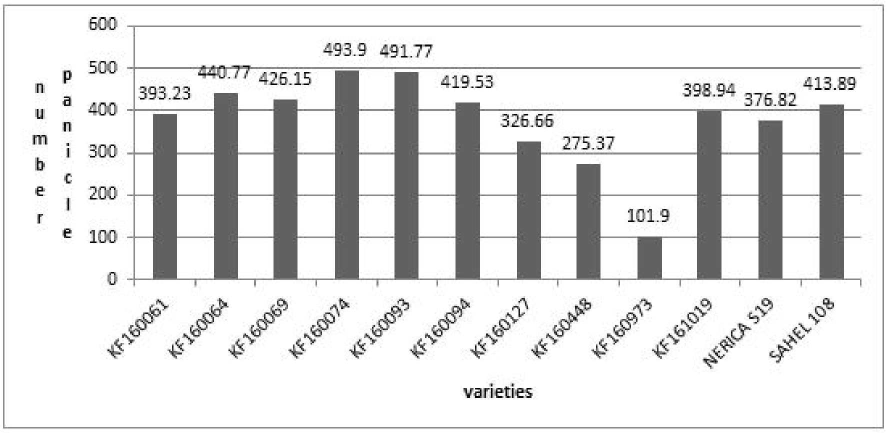

Figure 17: The number of panicles per m2 according to the varieties

The 1000 Grain Weight

This parameter varies from 20.04 to 25.37 g. The Turkey test shows the NERICA S19 control as being the best control with a PMG of 24.84 g. The KF160093 line is superior to the two controls with an average PMG of 25.37 g. Lines KF160973, KF160074 and KF160127 are identical to Sahel 108. KF160069 and KF160093 are superior to the Sahel 108 control. 0 average grains lower than Sahel 108.

The analysis of variance shows a significant effect between the different varieties at the 5% level. (Pr<0.05).

The Figure 18 illustrates our results.

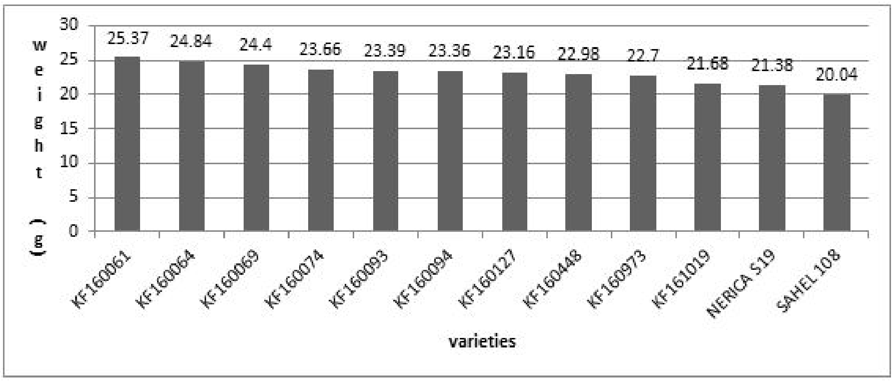

Figure 18: Average thousand-grain weight by variety

Yield at 14% Humidity

The average yield of the varieties oscillates between 0.62 and 7.06 t/ha (figure 19). According to the Tukey test, the lines KF160094, KF160069 and KF160061 are similar to the control Sahel 108. KF160064, KF160093 and KF160074 are superior to the control (Sahel 108) for this parameter. These lines have an average yield varying between 6.14 and 7.06 T/ha. The NERICA S19 control is moderately identical to the KF160448, KF161019 lines.

The analysis of variance showed a highly significant effect between the lines (Pr<0.001) at the 5% threshold.

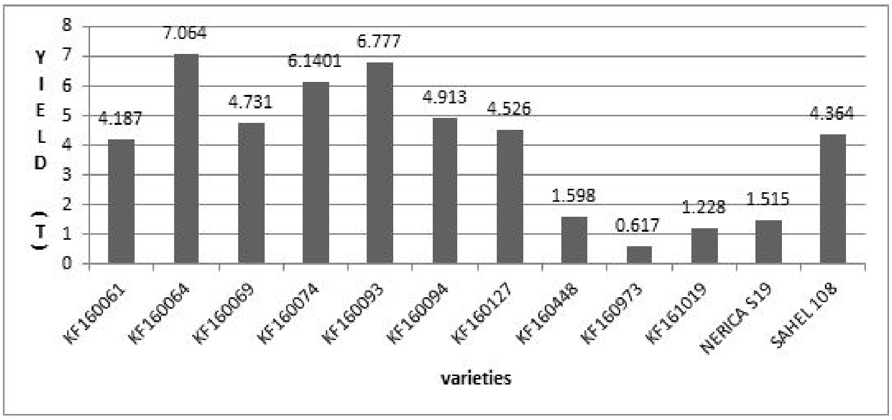

Figure 19: Average yields by variety

Discussion

Morphological Parameters

The anthocyanin coloration of the collar, the auricles, the nodes, the internodes and the apex of the lines are identical to the controls (Sahel 108 and NERICA S19). The results obtained in terms of absence of anthocyanin pigmentation at the level of the leaf, the collar and the auricle are in perfect correlation with those obtained by [11] on Korean varieties and by [12] on American varieties.

Concerning the ligule, it is divided for all the lines as well as for all the witnesses.

At the 60th DAS, all the varieties tested have an erect limb habit similar to Sahel 108 and NERICA S19. These results are in line with those of [13] who found that at 60 DAS, Sahel 134 and the Korean varieties had an upright habit. [12] had found that the limb habit of Jassmines varieties was semi-erect on the 60th day. At the 90th JAS, only 4 lines (KF160074, KF160094, KF160448 and KF161019) are similar to the two controls and the others keep their habit still upright. These results are not in line with those of [13] which revealed a semi-upright habit for the Chinese and Korean varieties.

The length of the caryopsis measured at maturity shows that 7 lines (KF160094, KF160127, KF160093, KF160064, KF160069, KF160074, and KF160061) resemble the control Sahel 108 which has an average length. The remaining 3 (KF160448, KF161019, KF160973) have a short caryopsis length. No variety tested resembles the control NERICA S19. These results are in line with those of [14] which shows at the 92nd JAS that generally Korean varieties have a short and medium grain.

Concerning the shape of the caryopsis, all the 7 lines have a "half-round" shape and do not resemble any of the two controls. Lines KF160093, KF160064, and KF160069 have the same "semi-fusiform" shape of the two controls.

All 10 new lines have a light brown color of the pericarp similar to that of the control.

Agronomic Parameters

The sowing-heading cycle shows that the lines tested such as KF160061, KF160064, KF160094 and KF160127 are similar to the best control Sahel 108 with an average duration of 87 days. Lines KF161019, KF160093, KF160448, KF160069 and KF160074 have a longer cycle than Sahel 108 and shorter than NERICA S19. Only KF160973 has a longer cycle than this last control. The sowing-heading cycle of the two controls is longer than their normal duration as described in the catalog and compared to the results obtained in the hot off-season [14]. This is due to the environmental factors that have slowed down this cycle. Indeed, during the test, the average monthly temperatures had become low (13.3° in February on average) during the hot dry season. Remember that too low a temperature in rice can cause the development of the plant to stop. If it is too cold (below 15°C), growth is slow and plants fail to flower. Normally, the optimum temperatures should be between 20 and 30°C. A certain number of degree-days are needed for the plant to reach flowering [15].

The sowing-maturity cycle indicates that the KF160061, KF160094 and KF160064 lines are moderately similar to the Sahel 108 control with an average cycle of 120 days. Sahel 108 is a short-cycle variety adapted to double cropping and this confirms the results obtained in the hot off-season with this control by [14]. This makes it possible to affirm that these three lines can adapt well to this double culture. The remaining lines (KF160127, KF161019, KF160093, KF160074, KF160448, KF160069) have a longer cycle than Sahel 108. They are identical to the NERICA S19 control which has an average cycle.

Regarding the variable height at maturity, we note a similarity between the lines (KF160064 and KF160973) and the control Sahel 108 with an average height of 71.37cm. All the other lines have a height, on average, greater than Sahel 108. Only one line is close to the control NERICA S19. The average of Sahel 108 and that of NERICA S19 are respectively lower and higher than the normal as described in the technical sheet of the catalog of rice varieties. This would be due to unfavorable climate-related conditions [14].

Sahel 108 has the highest number of tillers compared to the other lines. The 10 lines, except KF160448 and KF160093 are superior to the NERICA S19 control. Overall, the lines have good tillering. Tillering ability is a criterion much sought after by breeders because it directly influences yield and is positively correlated with cycle length. Indeed, the phases of tillering and bolting until flowering are crucial for obtaining good yields [16].

Regarding the number of panicles per m2, the KF160094, KF160093, KF160069 and KF160064 lines are higher than the Sahel 108 control with an average of 414 P/m2. This difference could be due to the shape of the caryopsis, the length of the grains and the number of ramifications containing grains. Only the last two lines (KF160061 and KF161019) are inferior to the NERICA S19 control for this parameter. This could be explained by the influence of certain climatic factors such as temperature, solar radiation and wind which influence rice yield through their effects on plant growth and on physiological processes related to grain formation [17].

Concerning the 1000 grain weight which is one of the important components of the yield and which develops during the filling and maturity phase, KF160093 is the only line superior to the best control NERICA S19. This shows that this line has large grains. Apart from this line, KF160069 and KF160093 are superior to the sahel 108 control with an average weight of 1000 grains. The remaining lines are inferior to the two controls.

Finally for the yield, the KF160094, KF160069 and KF160061 lines resemble the control Sahel 108 with an average yield of 4.36 T/ha. As for lines KF160064, KF160093 and KF160074, their yields are higher than the best control (Sahel 108). This shows that these lines from the anther culture give good yields. As expected, some of the progenies (lines) combine yield characteristics of the indica parent with local adaptation characteristics. The NERICA S19 control is the same as the two lines KF160448 and KF161019.

Conclusion

This study made it possible to first make a characterization of 10 new lines of Korean origin and then to evaluate the yield and its components.

Our results showed some variability compared to the two controls for all the traits studied. Lines KF160064, KF160093, KF160074 obtained the best yields. Concerning the sowing-maturity cycle, all the lines are included between the two controls, NERICA S19 which has the longest cycle and Sahel 108 which has the shortest. The sowing--heading cycle indicates that lines KF160061 and KF160064 are almost similar to the best control Sahel 108 which has the greatest number of tillers. However, all lines except KF160064, KF160973 have a higher 1000 grain weight than him.

This on-station work was coupled with a series of ongoing multi-location trials in three (3) villages. The combined analysis of these two series of experiments will make it possible to validate the proposal or not for the approval of these lines.

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