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Assessment of Physical and Biocheimical Characteristics of Cotton (*Gossypium hirsutum* L.) Seeds Grown in Cote D'ivoire

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A B S T R A C T

During this study, different varieties of cotton seeds from various cotton growing areas in Côte d'Ivoire were physically and biochemically characterised. These are the varieties W471B, W448C, X442B and R405-2000 (Korhogo, North), BDL and BULK-SR (Bongouanou, East), W471A and W448C (Katiola, Centre). Physically, these varieties were characterised through 8 parameters: seed index, kernel rate, hull rate, seed moisture, linter rate and healthy, damaged and aborted seed rates. Biochemically, six parameters were measured: Total phenol activity, polyphenoloxidase activity (PPO), phenylalanine activity (PAL), peroxidase activity (POD), protein content and total sugar content were evaluated. Moisture (12.32%), aborted seeds (50%), spoiled seeds (41.63%), hull (44.87%) and linter (1.32%) were higher in the east (Bongouanou). The rates of seed index (09.10%), kernel (66.65%) and healthy seeds (53.66%) and linter (1.32%) are higher in the North (Korhogo). At the biochemical level, the results of our work revealed that for the same seed varieties, when total phenol and POD activity are high, PPO activity is low and vice versa.

Introduction

Cotton plant is of Indian origin. It was spread to North Africa by the Arabs. Its cultivation started in Egypt and Sudan in the 17th century (Hau, 1988). The cotton plant belongs to the genus Gossypium of which 4 species are currently cultivated. *Gossypiumhirsutum* L. is the most widely cultivated species; it provides almost 95% of the world's cotton production (Song *et al.*, 2012). African cotton producing countries account for only 8% of world production (Estur, 2005). Cotton is considered the

"white gold" of the African economy. West Africa is the world's 5th largest exporter of cotton with 15% of total world exports. Cotton is therefore of considerable economic and social importance to Africa.

Not only does it provide a substantial part of the population with a livelihood, but it is also an important source of foreign exchange earnings.

In Côte d'Ivoire, cotton is the third most important export product after coffee and cocoa and contributes 1.7% of the gross domestic product. It provides substantial income to the peasantry in the centre and north of the country, which are the main cotton-growing regions.

With approximately 340,000 tonnes of cotton expected this year, compared to 260,000 tonnes last year, Côte d'Ivoire is the third largest cotton producer in West Africa, after Burkina Faso and Mali. (Anonyme, 2013).

Cotton production has almost doubled in 3 years, partly due to the increase in the producer price. Cotton is grown mainly for its fibres, which are the main raw material in the textile industry; they account for just over 50% of the textile fibre market worldwide (Anonymous, 2005).

The seeds contain 18-20% oil. The cake contains 40% protein, which is used in human and animal feed and could satisfy 5-6% of the world's protein needs (Berti *et al.*, 2006). Unfortunately, the nutritional aspect of cotton seed is little known to the population.

Most of the work on cotton has focused on the fibres to the detriment of the seeds. This is why it seemed useful to study some physical and biochemical characteristics in order to better understand the nutritional properties of cotton seeds. Specifically, we will compare the seeds of 8 varieties of cotton grown in different areas by studying 8 physical characteristics, 4 soluble compounds and the metabolism of phenolic compounds.

Materials and Methods

Plant material

The plant material used consists of different varieties of cotton seeds (Gossypium hirsutum L.) from different cotton growing areas in Côte d'Ivoire. These are the varieties BDL and BULK-SR from the Bongouanou zone (East), the varieties W471A and W448B from the Katiola zone (Centre), the varieties W471B, W448C, X442B and R405-2000 from the Korhogo and Boundiali zones (North). All seeds were supplied by CIDT (Compagnie Ivoirienne pour le Développement du Textile).

Measurement of physical characteristics

Seed index

Approximately one hundred undelinted seeds of each cotton variety were collected and weighed with a precision balance. The mass of the 100 seeds expressed in g/100 seeds constitutes the seed index.

Kernel and shell content

The contents of the samples are emptied into basins and mixed so that they are homogeneous. One hundred seeds are taken at random, so that they are representative of the sample, these seeds are first cleaned of their fibres (delinting with sulphuric acid), then they are weighed (P1). The seeds of each variety are cut with a scalpel and the kernels are extracted from the shells with a lanceolate hollow needle. The extracted kernels are weighed (P2).

The kernel content is calculated using the following formula:

$$\text{Almond content in \%} = \frac{P_2}{P_1} \times 100$$

The determination of the cockle rate is complementary to the previous one. After weighing the hulls (p3), the hull count is determined as follows:

$$\text{Hull content in \%} = \frac{P_3}{P_1} \times 100$$

Moisture content of the seed

This is determined by drying the seeds. A Petridish, previouslydried in an oven (105°C) for 3 hours and thencooled for 15 minutes, is weighed (p1). A 10 g sample of disintegrated seeds of each variety was placed in the dish, weighed (p2) and placed in the oven (105°C) until a constant weight was obtained (p3). The moisture content of the seed is determined by:

$$\text{Moisture content n \%} = \frac{P_2}{P_3} \times 100$$

Linter content

A 10g sample of seeds with linter is weighedinto the taredcrucible (p1), then the whole is placed in the oven (105°C) for 24 hours. After cooling, the whole (crucible-sample) is weighed (p2). The sample (seeds with linter) was disintegrated with sulphuric acid in order to completely destroy the linter.

The seeds thus disintegrated were washed and then dried in an oven (105°C) for 24 hours. They were left to cool in a desiccator (15 min) before being weighed again (p3). The dry linter content is expressed by the following formula:

$$\text{Linter content in \%} = \frac{(P_2-P_3)}{(P_2-P_1)} \times 100$$

Content of healthy, spoiled, aborted seeds

A number N of 100 seeds are taken using a random counting device (the homogeneous and representative sample). The seeds thus taken are cut with a scalpel and divided by sorting into 3 groups according to the appearance of the kernel: healthy seeds, spoiled seeds and aborted seeds).

The results are expressed as a percentage:

$$\text{- healthy seeds content (\%)} = \frac{N_1}{N} \times 100$$

N_1 = the number of healthy seeds.

$$\text{-Content of spoiled seeds (\%)} = \frac{N_2}{N} \times 100$$

N_2 = = the number of spoiled seeds

$$\text{- borted seed content (\%)} = \frac{N_3}{N} \times 100$$

N_3 = the number of aborted seeds.

Measurement of biochemical characteristics

Extraction and determination of phenolic compounds

About 0.5 g of seed was ground in 5 ml of 80% ethanol. The grind was centrifuged at 5000 rpm for 5 min. The supernatant obtained is the crude extract.

The determination of phenolic compounds was done by the method of Singh *et al.,* (2000), modified and adapted to our plant material. The level of total phenols is determined using a calibration curve with different concentrations of gallic acid (100µg/ml) and is expressed in milligrams of seed.

Extraction and determination of proteins

Protein extraction was performed at 4°C by grinding 0.5 g of seed in the presence of 0.05 g of polyvinylpyrrolidone (PVP) in 5 ml of 0.1 M sodium phosphate buffer, pH 7.9. After centrifugation at 5000 rpm for 30 min at 4°C, the supernatant obtained is the crude extract. Protein determination is done by the method of Bradford (1976) where the optical density (OD) of the

coloured protein complex is measured with a spectrophotometer at 595 nm with Coomassieblue. A control is performed where the crude extract is replaced by 0.1 M sodium acetate buffer, pH = 5.

Extraction and determination of total sugars

Approximately 0.5 g of seeds are groundin 10 mL of 80% ethanol. The crushed material is centrifuged at 5000 rpm for 5 min. The pellet is taken up with 10 mL of 80% ethanol and centrifuged as before.

The supernatant obtained after these centrifugations was adjusted to 30 mL with 50% ethanol and constitutes the crude extract.

The determination of total sugars was carried out according to the method of Dubois *et al.,* (1956).

A glucose solution (200 µg/ml) was used as reference reducing sugars.

Enzyme extraction

All extraction steps were carried out at low temperature (4°C) to preserve the integrity of the enzymes. A sample of approximately 0.5g of cotton seed was ground in the extraction solution containing 5 mL of sodium phosphate buffer (0.1 M, pH 7.5), 5% PVP (Polyvinylpyrrolidone), 0.25% sodium thiosulphate, 2% ethylenediaminetetraacetic acid (EDTA), 1% mercaptoethanol and 15% glycerol. After centrifugation at 5,000 rpm for 20 min at 4°C, 5% Dowex-2 was added to the supernatant.

Peroxidase assay

Peroxidase (POD) activity was determined according to the technique described by Santimone (1973). The reaction mixture consisted of :

- 0.2 ml of enzyme extract;

- 1.4 ml of substrate consisting of 10-2 M guaiacol solution;

- 1.4 ml of sulphuric acid solution. After shaking, the reaction mixture was incubated for 10 min in the dark. The oxidation of guaiacol is monitored with a spectrophotometer at 470 nm.

The activity of the PODs is expressed in millimoles of product formed per minute per gram of seeds, considering that the molar extinction coefficient of the product formed is equal to 26.60 10-6 cm-1 mole-1

Extraction and determination of phenylalanine ammonia-lyase

The extraction of the enzymatic extract is carried out under the same conditions as for peroxidases. The determination of PAL activity was carried out using the method described by Zucker (1965) modified and adapted to our plant material. The base buffer used was sodium borate. The reaction mixture contains :

- 0.1 ml of enzyme extract;

- 1 ml of 0.1 M phenylalanine;

- 1.9 ml of sodium borate buffer.

After 10 min of incubation at room temperature, the activity of PAL, which is directly proportional to the amount of cinnamic acid formed, is monitored by spectrophotometer at 290 nm.

During the assay, a control test is performed for each extract in which the phenylalanine solution is replaced by the sodium borate buffer. PAL activity is expressed as millimoles of cinnamic acid formed per minute per gram of seeds, considering that the molar extinction coefficient of cinnamic acid is equal to 10000 cm. mole-1 (Zucker, 1965).

Extraction and determination of polyphenoloxidases (PPO)

The extraction of the enzymatic extract is done under the same conditions as for peroxidases and

PAL, except that here the phosphate buffer is replaced by citrate buffer.

The assay of PPO activity was carried out according to the method of Joslyn and Ponting (1951) modified and adapted to our plant material. The reaction mixture, incubated for 10 min at room temperature (25 °C), was composed of:

- 0.1 ml of enzymatic extract ;

- 1 ml of 130 mM pyrocatechol;

- 1.9 ml of citrate buffer;

The optical density reading is taken by spectrophotometer at 500 nm against a control assay in which pyrocatechol is replaced by 0.1 M citrate phosphate buffer, pH 6.5. The enzymatic activity of the PPOs will be expressed as the change in optical density (OD) per minute per gram of seed.

Statistical analysis of the data

The values of the different parameters studied represent the average of three separate experiments (each experiment consists of 3 trials). The statistical analysis of the results was performed with XLSTAT 7.5. The analysis of variance (ANOVA) with one classification criterion followed by the comparison of the means by the NEWMAN-KEULS method at a risk of 5% was carried out in order to compare the different parameters.

Results and Discussion

Physical characteristics

Evaluation of seed index and linter rate

The seed index or 100-seed weight was determined for each cotton variety (Figure 1). The results obtained show that the variety W471B has a seed index of 9.103g which is statistically identical to that of the variety W448C (8.7g). The seed index of varieties X442B and R405-2000 are not statistically different, however these values are statistically identical to the seed index of variety W448C but lower than that of variety W471B. The seed indexes of varieties W471A, W448B and BULK-SR are statistically identical to each other. These seed indices are not statistically different from those of varieties R405-2000 and W448B but are lower than the seed index of variety W448C. On the other hand, these seed indices are higher than those of the variety BDL (7.05g) which has the lowest seed index.

Evaluation of moisture content, protein and total sugar content

The moisture content was determined for each seed variety. The results obtained for moisture content showed that the variety BULK-SR has the highest moisture content (12.32%) but statistically identical to that of the variety BDL (12.24%). The varieties W471A, W448B, have statistically identical but lower moisture contents than the varieties BULK-SR and BDL. The varieties X442B, W448C, R405-2000 and W471B have statistically identical but lower moisture contents than W471A and W448B. These results are reported in Table 1.

The protein content was determined for each seed variety. The results obtained showed that the highest protein content was obtained with the variety W471B which was statistically identical to those of the varieties X442B (51.78 µg/g MF) and W471A (50.37 µg/g MF). The. BULK-SR (39.51 µg/g MF), W448B (37.43 µg/g MF) and W448C (51.78 µg/g MF) varieties on protein content show that W471B has the highest content (51.780%). The lowest content is recorded with the variety R405-2000 (0.690µg/g MF). The protein content of W471B is statistically different from the protein content of the other varieties. These results are reported in Table 3.

The total sugar content was determined for each seed variety. The statistical analysis of variance showed no significant differences between the seed varieties for the sugar content parameter. These results are reported in Table 3.

Evaluation of almond and hull content

The almond content was determined for each seed variety (Figure 2). The results obtained showed that variety W471B has a kernel content of 66.65% which is statistically identical to that of variety R405-2000 (65.11%). The kernel contents of varieties W471C, X442B, W471A and W448B are statically identical to that of variety R405-2000 but lower than that of variety W471B. The kernel rates of varieties W471A and W448B are statistically identical but lower than the previous values. These results are reported in Table 4. Table 4 also contains the results for the seed hull content of each cotton variety The results obtained showed that the variety BULK-SR has a rate of 44.87% which is statistically identical to those of the varieties BDL (41.16%), X442B (41.07%), W448B (40.31%), R405-2000 (39.52%), W471A (38.07%) and W448C (38.04%). W471B has the lowest rate (35.12%), statistically equal to BDL, X442B, W448B, R405-2000, W471A and W448C, but lower than BULK. These results are reported in Figure 2.

Evaluation of healthy, aborted and spoiled seed rate

The analysis of variance showed that in terms of healthy seed rate, variety W471B has a healthy seed rate of 53.66% statistically different from those of varieties R405-2000, W448C and X442B are identical to each other. W471A, with a rate of 31.67%, is statistically lower than the previous varieties, but higher than W448B and BULK-SR. The lowest rate is obtained with the variety BDL (13.00%). These results are shown in Figure 3.

Aborted seed rate

The aborted seed rate was determined for each seed variety. The results obtained on the aborted seed rate showed that the aborted seed rate values of the varieties BULK-SR and BDL are statistically identical. These values are different from that of the variety W471A. The aborted seed rate values of the varieties W471A. While those of varieties W471B and R405-200 are identical but lower than that of variety W448C. Variety X442B has the lowest rate (22.33%) but statistically identical to that of varieties W471B and R405-2000. These results are recorded in Figure 3.

Failed seed rate

The rate of spoiled seeds was determined for each seed variety. The results showed that the variety BDL had the highest spoilage rate (41.666%), while the lowest rate was recorded with the variety W448C (18.333%). The spoiled seed rate of the BDL variety is statistically different from the spoiled seed rate of the other varieties. These results are recorded in Figure 3.

Biochemical characteristics

Total phenol content

The total phenol activity was determined for each seed variety. The results showed that all varieties had statistically identical phenol values. These results are reported in Figure 4.

Polyphenoloxidase (PPO), Peroxidase (POD) activity

The PPO activity was determined for each seed variety. The results showed that the PPO activity of variety W471B (7.70 AU/ml), is statistically identical to that of variety W471A (6.87 AU/ml). The PPO activity of varieties W448B, X442B and R405-2000, are statistically identical, but lower than previous varieties. The varieties BULK-SR and W448C have identical, but significantly lower PPO activities than the varieties W448B, X442B and R405-2000. The lowest activity statistically is obtained with the variety BDL (2.12 AU/ml). These results are reported in Figure 5.

Peroxidase (POD) activity

The statistical analysis showed a significant difference between the seed varieties with regard to

POD activity. The results obtained on POD activity showed that the varieties BDL, W448C and BULK-SR had statistically identical values. The varieties R405-2000 and X442B also have statistically identical activities, but lower than BDL, W448C and BULK-SR. W448B and W471A have activities that are not significantly different, but lower than the previous varieties. The lowest activity statistically is obtained with the variety W471B (2.27 AU/ml). These results are shown in Figure 5.

Phenylalanine Ammonia Lyase (PAL) activity

PAL activity was determined for each seed variety. The results obtained on PAL activity showed that the varieties BDL, W448C and BULK-SR have statistically identical activities, these values are significantly higher than those of the varieties R405-2000 and X442. These results are reported in Figure 5.

Physical characteristics of the seed

Seed index, almond and hull content

The seed index is generally lower in the East than in the Centre and North. It is lower in areas with relatively poorkernel content or with a significant proportion of aborted seeds (Bongouanou). Kernel and hull content (complementary to each other) are closely linked to the seed index. A high seed index also indicates a high kernel content and conversely a low hull content.

The low kernel content and consequently low seed index in the East may be due to several factors at the same time. Indeed, cotton is known to be quite demanding in terms of solar radiation (Cai *et al.*, 2018). However, the East, with its denser vegetation compared to the Centre and the North, is frequently under cloudy, foggy skies all day long, thus attenuating the intensity of sunlight essential for the execution of the plant's photosynthesis and metabolism processes. On the other hand, the very high rainfall in these eastern regions can influence the physiology of the seed, since the cotton plant does not likewaterloggedsoils, as well as its sensitivity to water deficit, which reduces the size of the seeds (Zaman-Allah *et al.*, 2011) and increases the proportion of aborted seeds. The nature of the soil, apart from the influence of cultivation techniques and above all pathogens, could also intervene through a deficit or toxicity of certain mineral salts that would hinder the metabolism and development of the seed.

Moisture content and linter

The results of the moisture analysis vary according to an East-Central-North gradient. Despite the long storage time (5 to 10 months) of the samples in the laboratory, it can be seen that the seeds from the North are drier than those from the Centre and especially from the East, these results are in line with those obtained by Agali (2000) on cotton seeds. Thus, seeds produced in the East carry more linter than those produced in the Centre and East, in addition to their higher moisture content. In addition, abundant linter on the seed contributes to a higher moisture content of the seed in regions with a saturated atmosphere. In addition, abundant linter on the seed contributes to increasing the saturatedmoisture content of the seed. The irregularities recorded, resulting in an increase in the linter level slightly out of phase with the humidity level, are due to losses during washing of particles, shell fragments or tufts of fibre taken with the These clumps and particles are destroyed by sulphuric acid during delinting and contribute to the increase in linter. When these tufts and particles are destroyed by sulphuric acid during delinting, they contribute to raising the linter rate. On the other hand, the linter level would be linked to the variety. But it also seems to depend on the quality of the ginning and the condition of the seed at the time of delinting. Indeed, varieties that produce fibres with high resistance to tearing during ginning and those that produce seeds with a denser linter due to its distribution on the seed shell, are characterised by a high linter rate.

Table.1 Moisture, humidity, protein and total sugar contents of cotton seeds

Variétés	Taux d'humidité (%)	Teneur en protéines (µg /g de MF)	Teneur en sucres Totaux (µg/ml)
BULK-SR	12,32 ± 1,53a	39,51 ± 1,95bc	0,40 ± 0,10a
BDL	12,24 ± 0,11a	23,31 ± 0,66d	0,44 ± 0,33a
W471A	11,68 ± 1,43ab	50,37 ± 1,52a	0,42 ± 0,28a
W448B	11,42 ± 1,10ab	37,43 ± 1,12bc	0,66 ± 0,58a
X442B	09,38 ± 1,77c	51,75 ±1,62a	0,51 ± 0,15a
w448C	09,24 ± 2,12c	34,66 ± 1,52bc	0,58 ± 0,26a
R405-2000	06,12 ± 2,12c	21,69 ± 0,35d	0,63 ± 0,20a
w471B	06,05 ± 1,74c	51,78 ± 2,16a	0,41 ± 0,07a

Les valeurs suivies d'une même lettre sont statistiquement identiques à 5% (test de Newman-Keuls); ±S: erreur standard

Fig.1 Seed index and linter rate of different seed varieties

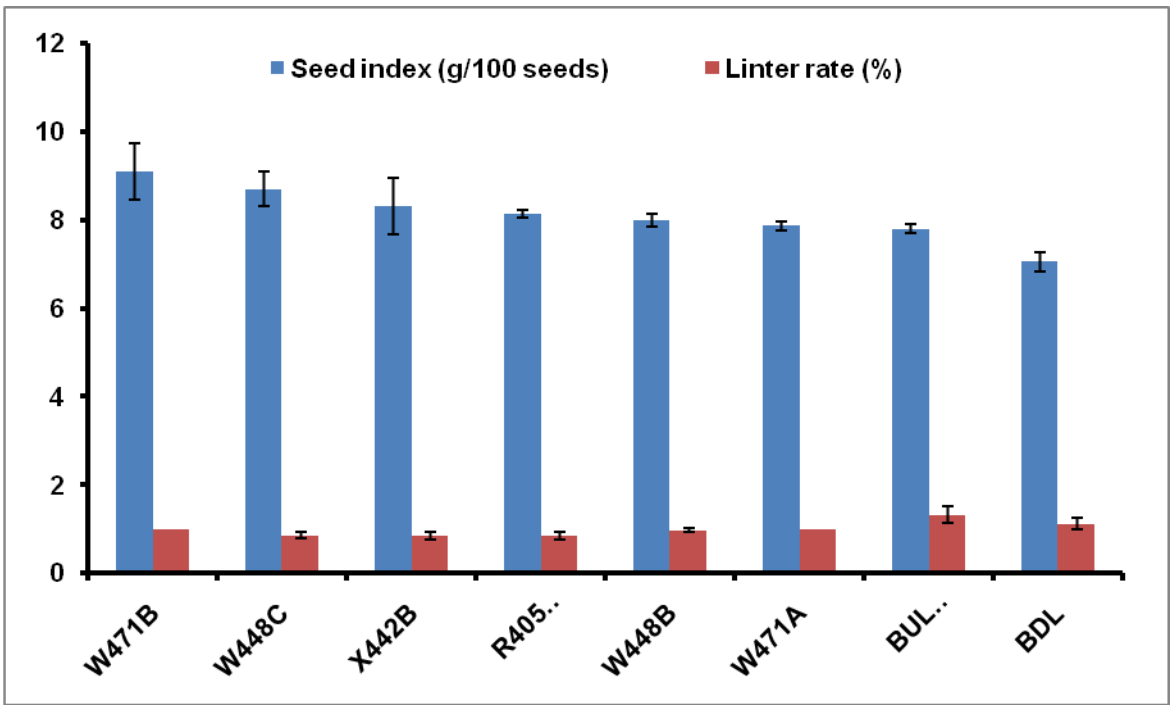


Fig.2 Almond and hull content of cottonseed

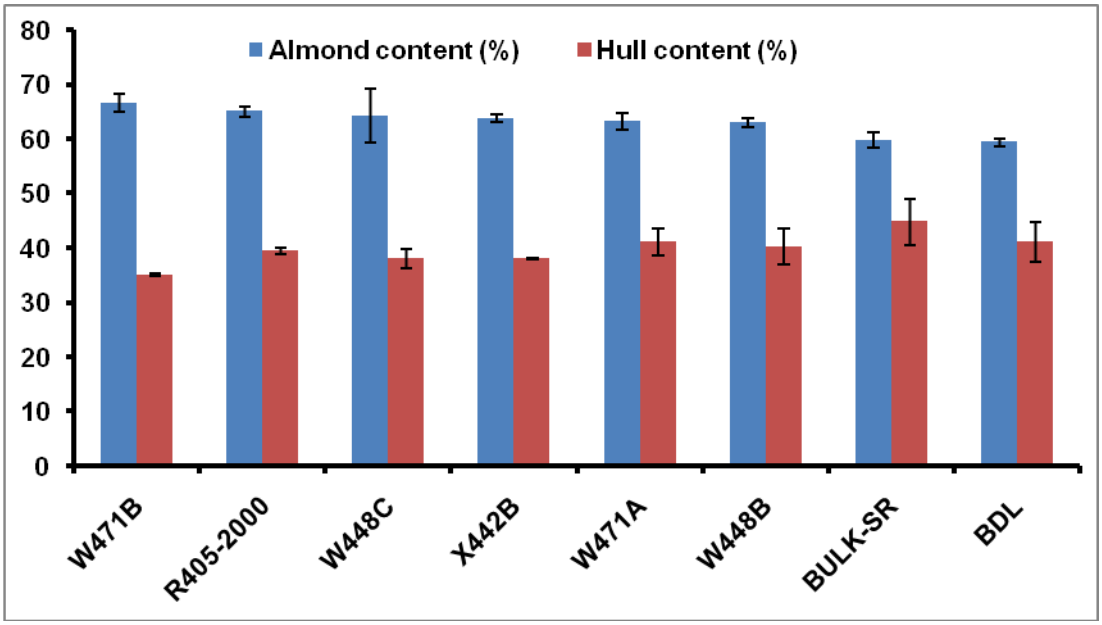


Fig.3 Rate of healthy, aborted and spoiled seeds

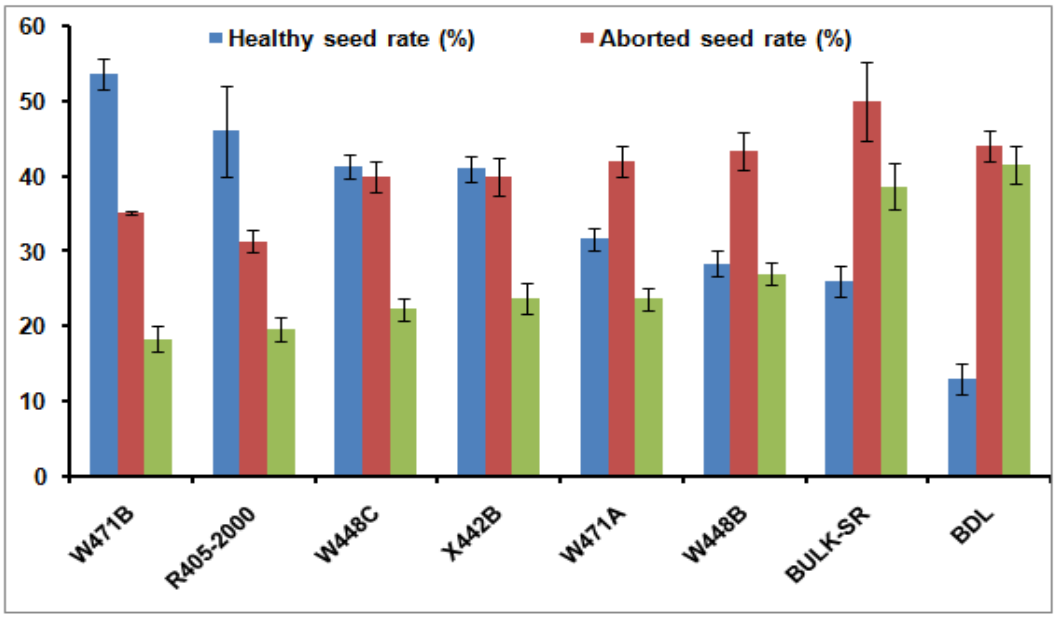


Fig.4 Total phenol content of seeds

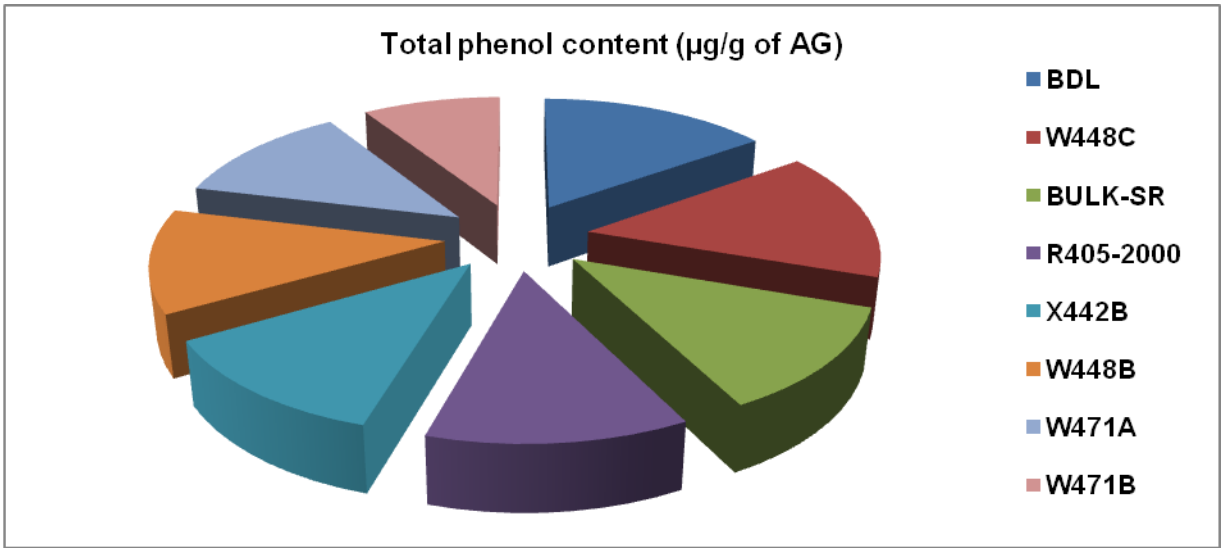
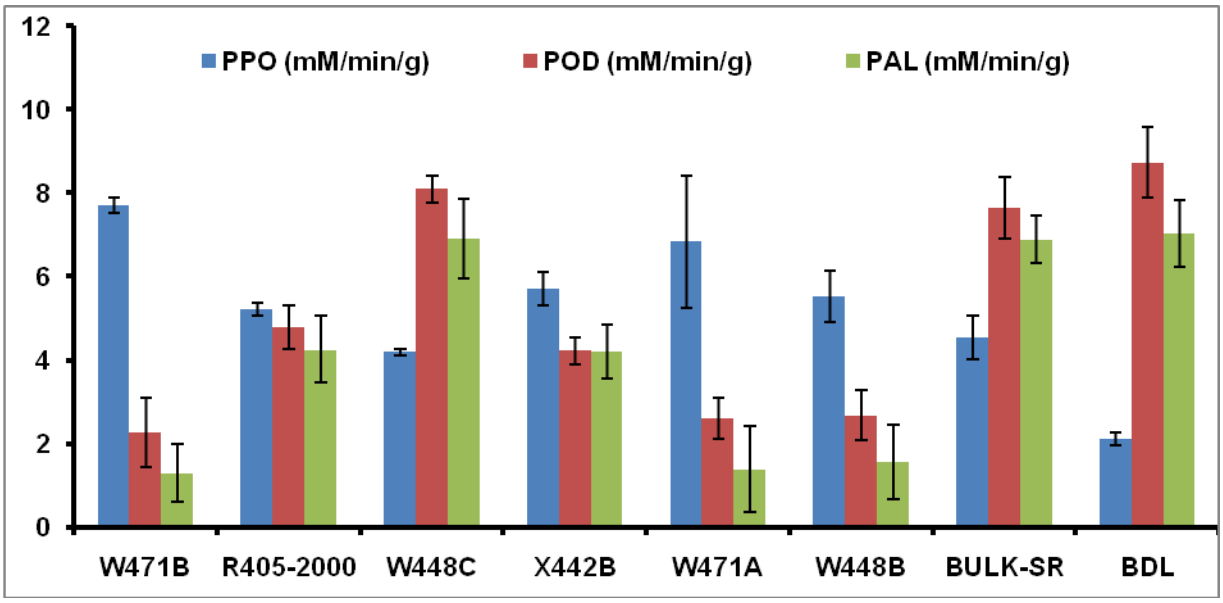


Fig.5 Enzyme activity of phenolic metabolism in seeds of eight cotton varieties



The importance of the linter on the seeds of the East, would make it possible to think of an effect of the moisture (higher in the East) of the seed cotton on the quality of the ginning. In addition, the openings made in the hull by shocks or insects constitute a privileged entry point for micro-organisms and caterpillars that attack the kernel; and also for sulphuric acid during delinting, which seeps through these openings and destroys the seed by reducing it to small fragments that are often lost during washing. This would stronglycontribute to the calculated linter rate. Sound, damaged and spoiled seed rates.

The rates of sound, damaged (deteriorated or rotted) and aborted kernels are complementary, in terms of percentage by mass. The determination of each of these rates allows the quality of the seeds in a

sampleto be assessed. The rate of spoiled or aborted seeds gives information on the quality of the seed by estimating the proportion of useless seeds, i.e. without kernels. Thus, a high rate of aborted seeds leads to a drop in the seed index of the corresponding sample. The eastern zone (Bongouanou) has the highest proportion of aborted seeds and consequently the lowest seed index. The variety W471A had the highest proportion of aborted and spoiled seeds, and therefore the lowest seed index (Bewley and Black, 2012).

All samples studied had high levels of damaged seeds (18.33-41.66%). The acceleration of seed spoilage is thought to be related to increased humidity due to previous rainfall, ambient climatic conditions in the production area, or the storage environment in the laboratory. The proportion of deteriorated seeds is the most worrying feature, since from a food point of view, a spoiled seed results in oil that is unfit for human consumption because of the high acidity. The ideal conditions for the protection and preservation of cotton seed are to avoid - the cottonseed is not exposed to rain during and after harvest or during transport; - anykind of shock, during transport or shelling, that would cause damage or breakage to the protective shell of the seed (Bellaloui *et al.*, 2015); the seed should be in contact with excessive relative humidity during storage; the rise in temperature in the environment where the seed is stored (Bakhtavar *et al.*,2019).

However, from a general point of view, these conditions are far from being satisfied given the nature of the climate in the central part of Côte d'Ivoire where the crushed seeds are stored (TRITURAF in Bouaké).

Biochemical characteristics of the seed

It should be noted that, generally speaking, the biochemical characteristics of the seed have no effect on the parameter measured. At the biochemical level, the results of our work have shown that for the same seed varieties, when the total phenol and POD activity are high, the PPO activity is low and vice versa. These observations suggest that these enzymes (POD, PPO) are involved in the degradation of phenolic compounds. According to Catillo *et al.*, (2002), monophenols are the preferred substrates for POD. This seems to indicate that 90% of the synthesised compounds are monophenols. It should also be mentioned that the limiting factor for PODs is the substrate (Dehon *et al.*, 2001). Moreover, the work of Shi *et al.*, (2008) showed that PPOs are incapable of oxidising monophenols. Thus, there is a total absence of monophenolic activity, which would explain their low activity in seeds. All these results constitute a first approach in the knowledge of phenolic metabolism in cotton seeds. The phenolic compound activity measured for each seed variety is a function of PAL activity. Indeed, the main biosynthetic pathway of phenolic compounds is that of phenylalanine (Kouakou, 2003). However, the analysis shows varieties with low PAL activity, but considerable total phenol activity. This would prove that phenylalanine is not the only biosynthetic pathway of phenolic compounds. In addition, TAL is also a phenolic biosynthetic enzyme, but in general, the participation rate of PAL is higher than that of TAL. These results are in agreement with those of Richter (1993) who reported that PAL functions as the key enzyme in the branching of phenolic synthesis pathways. The results also showed that cotton seeds have sugar contents ranging from 0.40 to 0.66% and protein contents ranging from 21.69 to 51.78%). Cotton seed is used for the production of meal for the preparation of food and feed, after removal of the gossypol. Cotton seed meal with gossypolcan be used in cattle feed and in general in the feed of polygastricanimals, which are much more tolerant of gossypoltoxicity than monogastric animals. Cotton seed kernel proteins are composed of 30% albumins and 60% globulins and have an amino acid composition that makes them extremely soluble in aqueous media. According to Sunilkumar *et al.*, (2006), by 2033, cotton seed will have taken its rightful place as the world's leading source of vegetable protein and will establish cotton as the queen of crops. Thus, the cotton plant, a textile plant par excellence, is on its

way to becoming a highly important food crop.

The production of a good and uniform quality cottonseed in all cotton growing areas in Côte d'Ivoire is the desire of the Development Companies and the Trituration Company for which it is the main raw material.

The evaluation of the physico-chemical characteristics of this seed is an important contribution to the research for its better valorisation. The results have enabled us to understand the characteristics of cottonseed and the great variability of its quality depending on a number of factors, the most important of which are the environmental conditions of its cultivation and storage. Seeds produced in favourable areas (North) are larger (Seed index, high kernel content and low linter content, low hull content). The main problem with the quality of this commodity is only in the east of Côte d'Ivoire. Thus, there is a basic lack of climatic adaptation of the cotton plants grown in this part of the country for the production of fat-rich seeds. Another major disadvantage of this area is that it is not conducive to the conservation of an oilseed such as cottonseed, because of the high relative humidity that prevails there. If the crushing plant had been installed in the North, which is more productive of cotton and has a drier atmosphere, this would help solve the problem of conservation. However, it is not beyond the scope of research to find alternative solutions by improving the industrial cotton sector by increasing the production of seeds that are resistant to deterioration and richer in kernel (oil) and protein.

This improvement in the productivity of good quality seeds should be achieved by selecting or creating varieties that are better adapted to the climatic hazards of the regions revealed, unfavourable on the one hand, and producing seeds that are less sensitive to deterioration during storage on the other.

However, a study could be carried out with a view to the creation of new varieties of cotton seeds which are both resistant to the climatic hazards of the zone, thus having a good organoleptic property and profitable in terms of fibre production.

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