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Influence Of Harvest Splitting On Physical Characteristics Of Cotton Seed In Ivory Coast

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***Abstract*—The major stakes of the cotton culture in Ivory Coast are the improvement of the outputs to the field and the production of cotton of good quality. One of the methods suggested to guarantee this quality is the split harvest of cotton. In order to study the influence of this practice on the physical characteristics of cotton seed used as seed and for the trituration, a study was undertaken in the main production areas of cotton production in Ivory Coast. On the tests set up for this purpose, cotton had been harvested when the capsules were opened at 50 %, 75 % and 100%. After ginning, the seeds were analysed and their essential physical characteristics were evaluated. The results obtained show that whatever the area, the partitioning of harvest influences the studied parameters which are the seed index and the healthy, rotted, fallen through and germinated seed rates. These quality parameters are better when one passes from early harvests to late harvests.**

Keywords—harvest, splitting, cotton, seed, characteristic, quality

I. INTRODUCTION

Cotton is grown primarily for its fiber, which is the world's primary source of textile yarn, but also for its seed, which is used in trituration process [1]. Cotton is an important export crop [2]. In Ivory Coast, cotton plays an important role in the country's economy. It has contributed to industrial development [3] and ensured food security and sovereignty in the central and northern regions of the country, thanks to associated food crops [4]. Given this importance, ensuring the quality of marketed seed cotton and its two main by-products, seed and lint, is a major concern for both commercial and scientific research [5]. Indeed, cotton quality depends on a variety of factors [6] including harvest and post-harvest conditions [7, 8]. Splitting the harvest is often proposed as an average way to preserve cotton quality [9]. Hence the importance of knowing its impact on the technological characteristics of cotton, particularly the seed that is used as seed and greenhouse for crushing. The present study is a contribution to the determination of the technological parameters of the cotton seed influenced by the fractionation of the harvest.

II. MATERIAL AND METHODS

A. Material

Vegetal material used in this study is seed cotton of three cotton varieties (Y764B, Y616B and W766C), popularized in Ivory Coast.

Various technical materials were used in the laboratory to determine the technological characteristics of the seed.

B. METHODS

Experimentation and management of the trials

The trials were set up in the three (3) main cotton production areas of the Ivory Coast cotton basin. These areas cover respectively the Southern, Central and Northern parts of the cotton production area. Each one is represented by a locality housing an observation post (OP). Thus, the trials were set up in the OPs of Séguéla (southern area), Korhogo and Nambingué (northern area). At each experimental site, three (3) varieties, Y764B, Y616B and W766C, were evaluated in a Fisher block design with three treatments and three replications. Each variety was planted in a plot of 20 lines of 10 m where the spacing between plants was 80 m between lines and 30 cm between each line.

Plot maintenance was carried out according to the technical itinerary for cotton proposed by [9] and popularized in Ivory Coast. Thus, NPK fertilizer was applied between the 15th and 20th day after emergence (DAE) at a rate of 200 kg/ha and urea between the 30th and 45th DAE. During the experiment, six (06) insecticide treatments were carried out at the rate of one treatment every 15 days, from the 45th to the 115th DAE.

Seed cotton harvesting and sampling

On each elementary plot, three types of 5 kg samples of seed cotton were taken. They correspond to harvests carried out respectively at 50, 75 and 100 % of boll opening.

Post-harvest analyses

Determination of the seed index

The seed index is the weight of 100 cotton seeds. It was determined by weighing 100 cotton seeds taken at random.

Sanitary analysis

Seed health analysis was performed using the knife test, which consisted of cutting 100 cotton seeds transversely in order to examine their interior under natural light or white light. Seeds were then classified as healthy, rotted or spoiled. The rates of these types of seeds are calculated as the ratio of their number to the total number of seeds examined.

$$\text{Seed rate (healthy, rotten or aborted)} = \frac{\text{Number of seeds (healthy,rotten or aborted)}}{\text{Number of seeds examined}} \times 100 \quad \textbf{(1)}$$

Germination test

The germination test was used to assess the germinative quality of the seeds. It consisted in germinating 100 cotton seeds placed on a layer of blotting paper before being covered by another layer. The papers are previously wet with water to facilitate germination. The whole is then rolled up and kept in a dark and humid place. After 3 days, the seeds were unpacked in order to count those that had germinated or not and those that were rotten. The rates were determined according to the formula below.

(sprouted, unsprouted or rotten)

$$Rate\ of\ seeds\ (sprouted, unsprouted\ or\ rotten) = \frac{\text{Number of seeds (sprouted,unsprouted or rotten)}}{Number\ of\ seeds\ tested} \times 100 \quad \textbf{(2)}$$

Data Analysis

The collected data were analyzed using SPSS 22.0 software. An analysis of variance (ANOVA) was also performed on each given quality parameter. In case of significant difference between treatments, the Newman-Keuls test was used to compare the means at the 5 % threshold.

III. RESULTS

Effects of harvest splitting on seed index

Comparative analysis between harvest levels at 50%-75% and 100% boll opening showed a significant difference between seed indexes in the localities of Korhogo and Nambingué (Fig. 1). In these localities, the seed index is relatively low when harvesting is carried out at 100% boll opening (7.32 and 7.88 respectively). This difference was not observed in Séguéla.

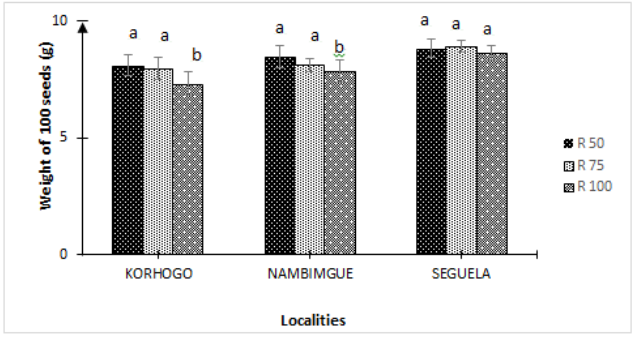

Fig. 1. Seed Index of seeds according to harvest level by locality

Effects of harvest splitting on healthy seed rate

Fig. 2 shows that healthy seed rates decrease when moving from harvesting at 50 % to harvesting at 100 % boll opening. In Korhogo and Nambingué, the respective values of the healthy seed rates obtained with the 100 % boll opening harvests (62.16 and 78.89 %) are significantly different from those found with the 50% boll opening harvests (83.41 and 88.04 %) and the 75 % boll opening harvests (81.37 and 85.81 %). At Séguéla, no significant differences were observed between harvest types.

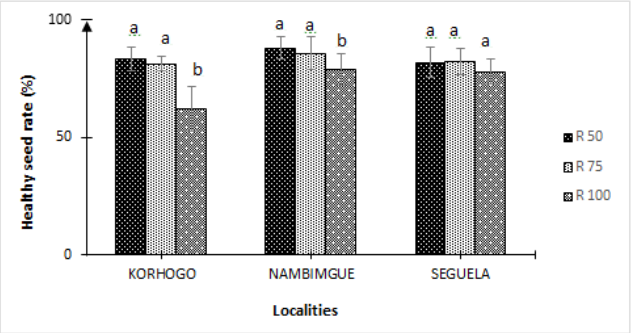

Fig. 2. Healthy seed rate by harvest level by locality

Effects of harvest splitting on rotten seed rate

The rate of rotten seeds is relatively higher when the harvest is done at full boll opening. In Korhogo, this rate is significantly higher when harvesting at 100 % boll opening (19.48 % compared to 9.56 % and 6.52 % respectively for the 75 % and 50 % harvests). In contrast, the values obtained in Nambingué and Séguéla are statistically identical (Fig. 3).

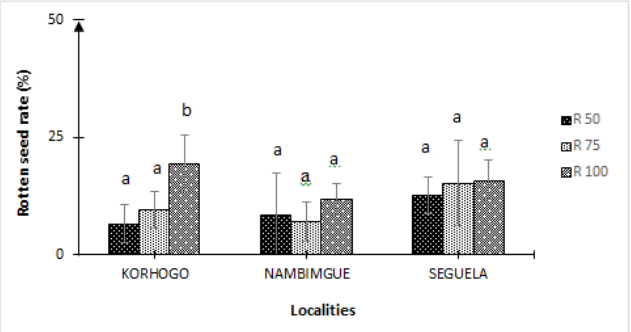

Fig. 3. Rotten seed rate by harvest level by locaty

Effects of crop splitting on aborted seed rate

The aborted seed rates according to harvest type are presented in Fig. 4. In Séguéla and Nambingué these rates are relatively low and statistically identical regardless of the type of harvest adopted. In Korhogo, it is higher when harvesting takes place after total opening of the bolls. Samples harvested at 100% opening contained twice as many aborted seeds (18.37%) as those harvested at 50% opening (9.96%) and 75% opening (9.33%).

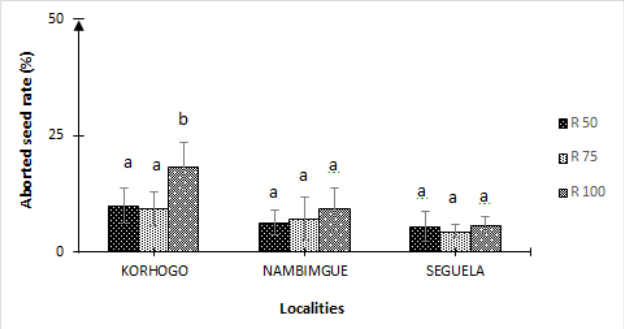

Fig. 4. Aborted seed rate by harvest level by locality

Effects of harvest splitting on seed germination rate

In all three locations studied, germination rates were relatively higher and statistically identical for harvests at 50 % and 75 % boll opening (Fig. 5). Seeds from harvests at 100 % boll opening had lower germination rates, especially in Korhogo where more than 50 % of the seeds did not germinate.

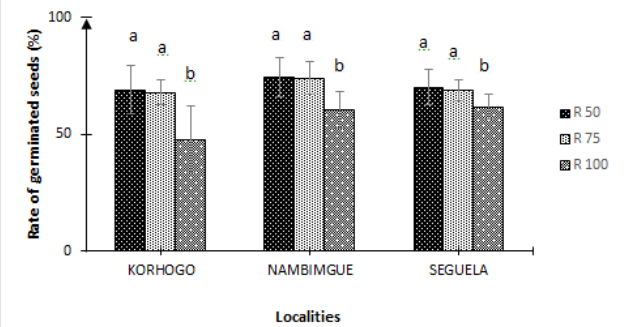

Fig. 5. Seed germination rate by harvest level by locality

IV. DISCUSSION

The physical characteristics of the seed represented through the seed index, the rate of healthy, rotted or aborted seeds and the germination rate varied according to the type of harvest. The seed index was relatively high for the first harvests (50 and 75 % opening) and low when the harvest is delayed (100 % opening). This is because the seed index is a function of seed size and weight. Large seeds full of kernels tend to weigh more and therefore have a higher seed index [7]. However, these types of seeds come from the first bolls formed and opened on the cotton plant [10]. These bolls constitute the bulk of the seed cotton in the first harvests, hence the better seed index obtained in harvests with 50 and 75 % opening. The healthy seed rate and germination rate were statistically higher in the 50 % and 75 % harvests than in those with 100 % opening. In reality, these parameters are related and evolve in the same way. Generally, seeds with good germination rates are those that are healthy. These results confirm those of [11], Indeed, these authors have shown that the success of germination depends strongly on the physical, physiological and sanitary quality of the seeds. Furthermore, the work of [7] showed that the good technological characteristics of the seeds from the first harvests are justified by the fact that the capsules in first position on the plant are those that are better nourished. As for rotten or aborted seeds, their rate was low in the first harvests and high in the last ones. According to [10], aborted seeds come from immature bolls that usually appear at the end of the cotton cycle. As for rotten seeds, they result from attacks by sucking bugs such as Dysdercus, as pointed out by [12].

V. CONCLUSION

The results obtained show that the type of harvest can have an influence on most of the technological parameters of the cotton seed. The parameters studied can be classified into two groups. On the one hand, the seed index which depends on the intrinsic characteristics of the variety and the position of the boll on the plant. On the other hand, the rates of healthy, rotten, aborted and germinated seeds are related to climatic conditions, insect attacks and weather conditions after the opening of the bolls. Cottons harvested at 50 % and 75 % opening yield better quality seeds. In addition, because they have similar seed characteristics, these harvests can be pooled and marketed together.

VI. ACKNOWLEDGMENT

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