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EFFECTS OF THE IRRADIATION IN SEEDS OF COTTON

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ABSTRACT

The experiment aimed to verify if seeds of cotton of variety FiberMax FM 993, irradiated with the doses of 0 (test); 25; 50; 75; 100 Gy can induce the production increase in cotton culture. For all treatments with irradiation, was used a source of cobalt-60, type Gammacell 220. After the irradiation, the seeds were planted in the experimental field of the Department of Plant Production ESALQ-USP, Piracicaba-SP. The experimental design was randomized blocks with four replications and 60 g of seed were used for each repetition, the rows were 5m and the spacing of 0.90m, using randomized blocks and rows of edging. After planting the final height and productivity were evaluated. The obtained data were statistically analyzed in the Tukey test at 5% level of probability. From the results obtained, it was concluded that the dose of 50Gy was the one that induced a greater production of cotton.

1. INTRODUCTION

The cotton plant (Gossypium hirsutum L.) is a plant of the Malvaceae family already cultivated in antiquity. It has been found in India, in the Americas there is evidence that Inca civilizations used it for textile handicrafts due to fragments of fabric made with In Brazil, at the time of the discovery of the Indians already cultivated by the cotton plant, use a fiber for a fabric preparation, the crushed and cooked lump in the food and the fulfillment of the leaves as [1, 2, 3]. Fiber is the main product of cotton and its feather is a plant fiber more cultivated by man, representing about 74% of natural fibers by the textile industry [1, 2, 3].

No Brazilian scenario or contributory cotton in conjunction with other agricultural raw materials for a generation of foreign exchange since a colonial era. At that time its importance was summed up to the in natura product. From the implantation of the industrial park of the decade of 30, the cotton passed a substantial expressive economic activity by the export of manufactured textile products as of other by-products [4].

Stated that the concept of seed quality involves an interaction of attributes of physical, physiological, genetic and sanitary nature. In addition, they are produced from cotton that are severely damaged during harvesting and processing, and suffer reductions in their physiological quality, which can be tested for germination and vigor [5].

According to [6] the route of cotton seed between field and plant consists of: harvesting, temporary storage for one month no field, transportation, temporary storage for three months in the plant in the form of bins, transport And Improvement in sawing or roller guns. In addition step, as seeds are still unlabeled and stored until a next sowing. Ministerial Ordinance No. 607, of December 14, 2001, the exclusive use of delineated seeds became mandatory.

When not turned to seed production, the seed is a by-product of processing and / or ginning, aiming at a separation of the fiber. A source of oil products, pie and bran, rich sources of good quality protein and widely used without feed preparation, Gossypol, toxic compound present in the seed should be eliminated [6].

During germination, the chemical composition changes and the rate of utilization of the reserves varies according to the species. Germination begins by the absorption of moisture by imbibitions, but the excess moisture causes a decrease in germination, since it prevents the penetration of oxygen and reduces the metabolic process. In order for germination to occur satisfactorily, living and non-dormant seed must have favorable environmental conditions. The environmental factors essential to seed germination are oxygen, water and temperature [7].

In a survey conducted for 14/15 harvest by Conab (National Supply Company), it was estimated a decline of 11.2% of the planted area of cotton in Brazil in relation to the previous harvest (1121.6 ha), reaching a total of 995,7 thousand hectares. Therefore, the reduction of 125.9 thousand hectares. The main factors are the low prices when compared to the previous year, the current market price levels of competing commodities (soybeans and corn) and above all, the sharp rise in production costs.

By virtue of the high cost of production, alternatives for raising productivity should be researched. The use of physical methods such as irradiation to increase production can significantly improve the economic return of the crop without side effects such as damage to man and the environment.

The use of ionizing radiations is an alternative method of increasing production. Depending on the dose level of ionizing radiation, the organisms have or do not have apparent modifications such as inhibition, death or stimulation. Lethal or inhibitory doses have been studied extensively and are generally high. In plants, high doses of ionizing radiation inhibit tuber sprouting, seed germination and induce mutations. The effects of radiation depend beyond dose, other factors such as: the genus, species and variety of plants, environmental conditions of cultivation, Type of soil, fertilization, etc.

Observed that gamma radiation at low doses induced an improvement in the emergence of urucum plants. The study of the effects of radiation on arugula (Eruca vesicaria subsp. Sativa) from radiated seeds at doses of 0, 20, 50, 100 and 200 Gy found that in addition to the final production, seed mass and essential oils, The total sugars, free amino acids, total soluble

phenols, kinetin (cytokinin), GA3, nitrate reeducates activity and total protein, also increased significantly in relation to the 20 Gy dose. The study also shows that nitrate content dropped significantly and that the content of macroelements such as nitrogen and potassium increased when phosphorus remained stable [8].

Studied with tomato seeds of the hybrid "Gladiator" exposed to 60Co gamma radiation at doses 0; 2.5; 5; 7.5; 10; 12.5; 15 and 20 Gy. It was observed an increase in the production in all the treatments in relation to the control, being that the greater stimulus occurred for the doses of 10; 12.5 and 15 Gy, among other results during the development stages of the plants, showing that the use of low doses of Co-60 gamma radiation applied in pre-seeding treatment in the seeds was efficient in stimulating the development of plants and increase tomato production [9].

Studied to verify in the field the hormonal effects of low doses of Co-60 gamma radiation on irrigated rice seeds, applied a dose rate of 0.70 rad in 90 sacks of seed rice at a dose of 6 krad. Min -1. The final production was 30% higher than the presumed harvest at the beginning of the harvest, and its neighbors had, due to the drought in the region of the municipality of São Gabriel in 2007, a 30% drop in production. The same author also reports that grass seed colonies were irradiated which led to a significant increase in the number of tillers and higher final yield [10]. Hormone is a dose response phenomenon that is characterized by low dose and high dose inhibition [11].

2. MATERIAL AND METHODS

The experiment was carried out in Piracicaba - SP, Brazil, where the seeds were irradiated in the Radiobiology and Environment Laboratory at the Center for Nuclear Energy in Agriculture - CENA / USP and the germination planting and testing were carried out in an area of the Department of Plant Production of the School of Agriculture "Luiz de Queiroz" - ESALQ / USP.

The soil of the area is classified as eutrophic Red Nitosol, characterized by being clayey, heavily developed block structure, originated from basic rocks with remarkable horizon differentiation and high fertility. Corresponds to what was formerly termed structured rock land. The climate in the planting region is considered Cwa (humid temperate climate) according to the Köppen-Geiger classification. The Cwa climate is characterized by dry winter and hot and humid summer.

For the preparation of the soil one week before the planting, three grading operations and one scarifier operation were used together with the fertilization, using 300 kg of 08-28-16 (Percentage of nitrogen, phosphorus and potassium consecutively) per hectare, totalizing 8 kg of 08-28-16 in the assay.

The main characteristics of the cultivar Fiber Max 993, produced by Bayer CropScience, used for the experiment are: Moderate medium / high plant, normal use of growth regulator, lodging resistant, pod weight from 5 to 6g, flowering from 48 to 62 DAE (days after emergence), harvest from 150 to 190 DAE, 4 to 6 vegetative branches, 16 to 20 reproductive branches, Resistant to Blue Disease, Resistant to Bacteriosis, excellent fiber yield, good pen retention in the capsule after opening And excellent fiber quality. Samples of cotton seeds from cultivar FM 993, duly separated in batches of 240 grams and characterized for

treatment, were irradiated with low doses of Cobalt-60 gamma radiation (0; 25; 50; 75 and 100 Gy). The irradiation was carried out on December 14, 2010 at the Center for Nuclear Energy in Agriculture, CENA / USP, Piracicaba, SP, in a Cobalto-60 irradiator, type Gammacell 220, from Atomic Energy of Canada Ltd, Otawa, Canada .

To carry out the germination test 24 hours after irradiation, on 12/15/10, 4 replicates were used, each with 50 seeds that were positioned on wet filter paper and placed in the germinator, the first evaluation being performed 7 days after , And the second and final, performed 12 days after.

Sowing occurred on 12/15/2010, 24 hours after irradiation. Being adopted the use of rows of 5m in length and spacing of 0.9 m between rows. Each treatment consisted of 3 replicates, each with 60 g of seeds, totaling 900 grams of seeds including control. Each of the repetitions consisted of 4 rows of 5 meters being the outer rows used as rows of border. Each row consisted of about 15 g of seed (equivalent to approximately 150 seeds). After 25 days of germination, thinning was performed, leaving 8 plants per linear meter. The management of weeds, pests, diseases and growth regulator application were performed according to the need. Eight height assessments were performed fortnightly at first and monthly the final stages of development. On January 20, 2011, cover fertilization was carried out in the growing line, using 300 kg of 20-00-20 per hectare, totaling 8 kg of 20-00-20 in the trial.

For the evaluation of productivity (kg / ha), the manual total harvest was carried out on 04/06/2011, the plot number being broken down during the process. After planting the final height and productivity were evaluated. The data obtained were statistically analyzed with the Tukey test at a 5% probability level.

3. RESULTS AND DISCUSSION

The results of the germination test are shown in Table 1 and we can observe that there was no significant difference between the treatments with irradiation when compared with the control. It was possible to verify that all the treatments obtained a high percentage of germination, superior to 96%, thus demonstrating a good quality of the seed lot used in the experiment.

Table 1: Germination test in percentage of seeds irradiated with increasing doses of Cobalt-60 gamma radiation.

Tratamento	Germinação (%)*
Testemunha	97,0 a
25 Gy	96,5 a
50 Gy	96,5 a
75 Gy	97,5 a
100 Gy	97,5 a

Means followed by the same letter do not differ by Tukey test at 5% of significance.

Table 2 shows the mean values of the heights of the treatments with the radiation and the control, it is possible to verify the difference between the treatments in the eight evaluation period, until the stoppage of the growth due to a higher dose of growth regulator (type - PIX HC of the Basf) purposefully used for this purpose.

Table 2: Mean plant height values of treatments with increasing doses of Cobalt gamma radiation in eight different periods.

Tratamento	19/01*	03/02*	16/02*	02/03*	18/03*	25/03*	30/04*	15/05*
Testemunha	27,03 a	49,78 a	67,67 a	92,00 a	110,28 a	110,61 a	117,73 a	119,67 a
25 Gy	31,15 ab	51,56 ab	70,17 ab	98,11 ab	116,50 ab	116,61 a	122,56 a	125,7 b
50 Gy	32,83 b	54,89 ab	73,56 ab	101,56 bc	118,50 b	126,17 b	129,73 b	131,00 c
75 Gy	32,50 b	56,5 b	79,13 b	107,06 c	126,68 c	132,67 c	135,11 bc	136,33 d
100 Gy	30,11 ab	50,15 a	69,61 a	99,44 b	122,28 bc	129,61 bc	140,00 c	143,33 e

* Averages followed by the same letter do not differ from each other by the Tukey test at 5% significance.

From the results obtained it is possible to verify that although in some periods the average height of many treatments did not present a statistically significant difference with the control, but afterwards all treatments differed statistically from the control and each other on 15/05. In the first period, treatments with doses of 25 and 100 Gy showed no significant difference with the control. In the course of the evaluation periods, the plants developed more rapidly until they passed the intermediate treatments. For the cotton crop, these results are not recommended, because there is a relationship between the ideal height of the plant with the spacing, due to that when perennial growth of the crop occurs, growth regulators are used. As the spacing used in the experiment was 0.9m, the ideal height of the stand would be 1.35m. Therefore, the best results were obtained with the treatments with doses of 50 and 75 Gy.
The average values of productivity in kg / 104m2 of treatments with increasing doses of Cobalt-60 gamma radiation are shown in Table 3.

Table 3: Mean values of productivity of treatments with increasing doses of Cobalt-60 gamma radiation.

Tratamento	Produtividade ($kg/10^4.m^2$)*
Testemunha	2244,67a
25 Gy	2691,33cd
50 Gy	2800,00d
75 Gy	2486,67bc
100 Gy	2388,67ab

- Averages followed by the same letter do not differ from each other by the Tukey test at 5% significance.

From the results obtained we can observe that there was a positive stimulus in the seeds increasing the productivity levels in kilogram per hectare, when they were irradiated with low doses of radiation in relation to the control. The doses with the best results were 25 Gy and 50 Gy, with a production of approximately 25% in relation to the control. It is important to note that, during the development of the experiment, doses of fertilizer, growth regulator and pesticide application were carried out in a cautious and as uniform as possible to avoid interferences of these products in the production results. All doses differed statistically from the control, except for the treatment with 100 Gy, which despite its higher height when compared to the other treatments, its production was lower.

4. CONCLUSIONS

From the results obtained can be concluded that the dose of 50Gy was the that induced a greater production of cotton.

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