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EFFECT OF COLCHICINE ON QUALITY AND MORPHOLOGY ON ZEA MAYS PROPERTIES

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Abstract

At Omar Mukhtar University, an experiment was carried out to investigate the effects of treating Zea Mays with varying concentrations of colchicine. The experiment was designed using random sectors in three replications at concentrations of 0.0%, 0.15%, 0.20%, and 0.10% (control). The obtained results demonstrated a substantial change in the characteristic of plant height and, at concentration, a superior characteristic of average height of 0.20 percent. Significant variations were also observed in the leaf area, with the best outcome occurring at 0.20% concentration. Additionally, the variation in the average sort of the plant's properties, which was significant at 0.20% concentration, accounts for the average length of the cob as well as the average diameter, chlorophyll A and B, and chlorophyll B averages. There were notable variations in the average characteristics of each of the following: average weight of cobs/ha, average weight of cobs/plant, average number of grains per row/cob, average number of cobs per plant, and average weight of cobs/ha, according to the study of the quantitative characters and their effect on colchicine treatment. The average sort of plant for each attribute showed significant differences, with the average Colchicine treatment at a concentration of 0.20% being preferable. However, the average weight of 100 grains showed no significant changes between the average treatments.

Keywords

Colchicine, Zea Mays, Chlorophyll

Introduction

One of the most significant grains grown in Libya is zea mays, which is ranked first in terms of overall production and third among the major grains farmed worldwide. Zea Mays cover 158 million hectares worldwide, yielding 791.8 million tons in 2007 at an average of five tons per hectare. For the above stated reasons, this study was conducted. The improvement of genetic and environmental factors is the cause of the growth in Zea Mays output (Nafziger, 2008).

Zea mays also have significant agronomic, medical, and nutritional qualities. Zea mays has a high nutritional content, with 72% of its weight being made up of carbs, 8.5% fiber, 10% protein, 4.8% fat, 1.7% minerals, modest levels of vitamins A and C, and a higher amount of vitamin E. Zea mays is utilized in animal feed in the form of grains and fresh green plants, as well as in human nutrition and food preparation (Chaudhary, 1983). (Shinners et al 2007).

In addition to environmental influences such soil composition and water requirements, genetics has a significant impact on the quantitative and quality attributes. The purpose of this research is to examine how genetic factors affect crop quality and how those changes affect yields of high-quality crops. In addition to the effects on the crop's growth characteristics and constituent parts, the types were also employed in this experiment (S.C.132).

Materials and methods

One of the major crops that provides food and animal feed is the Zea mays crop. Cross-pollination occurs at a 100% rate. Additionally, genetic alterations take place, with an impact shown in crop development and traits. In order to provide a broad range for selection and to enhance crop and quantity features, this study attempts to produce mutations and genetic classifications. The 2011 growing season, in which the variety sowed 100 grams of S.C.132 grains, was studied. Colchicine solutions 0.10%, 0.15%, and 0.20% were applied for 48 hours, along with control, according to Wright (1976). Following that, it was planted in three replications, with an experimental unit of 1.5 by 3 m2. Three rows made up the experimental unit; each row was three meters long and separated from the other by fifty centimeters. To produce the first generation (M1), seeds were placed 30 cm apart inside the row, and rainfed agriculture was used. In order to quantify the vegetative and crop characteristics, a sample of five plants was taken from each treatment in each experimental unit that contained a replica of the first generation plants (M1) cultivated in the same season.

Vegetative characteristics:

1- Plant height (cm), 2- Leaf area index, 3- Rate ofChlorophyll A and ChlorophyllB

Crop characteristics:

1- Number of cobs/plants, 2- Number of rows/cobs

3- Number of grains/rows, 4-Cob weight/gram

5-Grain weight/plant, 6-Grain weight/ha

7-Weight of 100 grains, 8-Chemical content:

A/DNAratio, B/Protein ratio. A.O.A.C(1980)

C/Fat percentage and lipid properties, Kock and McKen (1924)

Statistical analysis of the studied characteristics

Following statistical analysis of the study data drawn from the sample (Gomez and Cochran, 1984), the least significant difference between the averages was computed. L.S.D., as stated by Snedecor and Cochran (1967)

L. S. D= [where t0.05 denotes the tabular value of t at 0.05, M.S.E. stands for mean square deviations of experimental error, and r is the number of units from which the average of each treatment was obtained (repeats).

The grains were treated with a Colchicine solution at various doses to induce genetic changes and chromosomal doubling, which led to improved growth and yield characteristics. Since Zea Mays has a 100% cross-pollination rate, it is also important to investigate the extent of their influence on the vegetative and yield characteristics, as well as the components and division of these characteristics. Larry, year of 1971.

Results and Discussion

Due to the high degree of cross-pollination across Zea Mays, the study intends to accomplish broad genetic applications through the induction of chemical mutations and their effects on the crop and its constituent parts. Table 1 presents an analysis of the effects of applying various Colchicine concentrations: 0.10%, 0.15%, 0.20%, and 0 (control) on the characteristics of Zea mays. The average plant height was measured when the male inflorescence appeared as follows: 127.89 – 117.013 – 106.67 – 89.7 cm, so for concentrations 0.20%, 0.15%, 0.10%, and control, respectively. In this case, the average concentration of 0.20% was higher than the other averages. The effects of utilizing Colchicine and the cells it affects are the first area where the variations have been noticeable.

Table (1) showed that when a concentration of 0.20% was used, the average leaf area index outperformed the other averages and the differences became statistically significant. Since the time of taking averages was after vegetative growth was finished, the average of 5.48 cm2/cm2 was based on the influence of Colchicine on cells and increasing the leaf area, which reveals the effect of Colchicine on cell division.

Regarding the characteristic of cob length, Table (1) reveals that the concentration at which the average cob length was highest, at 0.20%, was 17.8 cm, while the control had the lowest average of 12.9 cm. This shows how much the formation of cobs responds to treatment with Colchicine, as it affected the cells of stems, leaves, and consequently the morphological properties of the cobs, with significant differences.

Table (1) shows that, although the difference in averages suggested that the average treatment was 0.20% higher than the averages utilizing other concentrations, the ratio of chlorophyll A to chlorophyll B did not achieve a significant effect. Chlorophyll (A) values for treatments at 0.20%, 0.10%, 0.15%, and control concentrations, respectively, were 4.97, 4.56, 4.38, and 4.13.

In contrast, the average concentrations of chlorophyll (B) were 3.8, 2.58, 2.41, and 2.36 for 0.20%, control, 0.10%, and 0.15%, respectively. Additionally, note that Table (1)'s average diameter of the cob did not exhibit statistically significant differences between the averages; the highest average, 4.08 cm, was for the treatment with a 20% concentration of colchicine, while the lowest average, 3.8 cm,

was for the control group. These findings are in line with reports from the studies of Lorry (1971), Ngoc et al. (2012), Barnabas (1999), and Singh et al. (2001).

Table (1) Effect of Colchicine treatments on the average vegetative properties of Zea Mays

Concentration %	properties	average plant height (cm)	Average leaf area index (cm^2/cm)	average cob length (cm)	average chlorophyll A	average chlorophyll B	
0.10		106.67	3.88	16.23	4.56	2.41	
0.15		117.43	4.0	16.46	4.38	2.36	
0.20		127.89	5.48	17.8	4.97	3.08	
Control		89.7	3.10	12.91	4.13	2.58	
L.S. D		11.43	0.68	0.91	NS	NS	NS

Table (2) Effect of Colchicine Treatment on the yield of Zea Maysand its Components

Concentration %	properties	Average number of grains per row/cob	Average number of cobs/plants	Average weight of the cobs, ton/ha	Average grain weight (g/plant)	Average grain weight/ha. ton/ha	Average weight of 100 grain/gram
0.10		30.6	2	2.57	121.7	2.38	29.22
0.15		29.19	1.6	3.4	120.4	3.24	29.22
0.20		33	4.3	5.12	129.5	4.3	29.34
Control		29.1	2.3	1	116.4	1.75	29.06
L.S. D		1.13	1.18	3.16	3.74	1.09	N.g

The impact of applying varying Colchicine concentrations on the average number of grains in the row/cobs is displayed in Table (2). Notably, there are notable variations in the average number of grains between the treatments with 0.10%, 0.15%, and 0.20% and the control, which were, respectively, 30.6, 29.19, 33, and 29.1.

Table (2) presents the variations in the average number of cobs per plant. Using a 0.20% concentration resulted in the highest average of 4.3 cobs per plant, whereas the control group had 2.3 cobs per plant, indicating a significant difference. The fact that using Colchicine doubled chromosomes and thus the amount of DNA, explaining the effect of plant yield, explains why the differences between the concentrations of 0.10% and 0.15% did not reach a significant effect, as they were 2 and 1.6 cobs/plant, respectively.

Explain the variation in the average attribute of the average weight of cobs weight/ha, which was 2.57, 3.4, 5.12, and 1 ton/ha for 0.10%, 0.15%, 0.20%, and control, respectively, with a significant difference. This indicates the difference in the average weight of cobs/plant.

Average grain weight (gram/plant): This difference indicates a variation in the number of grains in the row or cobs. In the treatment group, the average grain weight/plant was 33 cm, whereas in the control group, it was 29.1. The differences reached a significant level and indicate the impact of Colchicine and DNA on the doubling of quantity due to chromosome doubling.

The average grain weight (ton/ha) is shown in Table (2); in the treatment group treated with Colchicine at a concentration of 0.20%, the averages were 4.3 tons/ha, whereas in the control group, it was 1.75 weight/ha. The difference between the averages was considerable, with the increase being around 1.6.

Regarding the mean weight of 100 grains per gram, the variations in the averages did not yield a statistically significant effect; the averages were 29.22, 29.22, 29.34, and 29.06. This can be attributed to the treatment of 0.10% - 0.15% - 0.20% of colchicine and control, respectively, possibly because genetic factors are more prevalent. Smigh et al. (2002) and Semechenks et al. (2002) have both researched the impact of Colchicine therapy on grain yields.

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