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RESPONSE OF TOMATO VARIETY (UC-82B) TO THREE DIFFERENT CONCENTRATIONS OF COLCHICINE ($C_{22}H_{25}NO_6$) AND SEASONAL VARIATIONS FOR IMPROVED GROWTH AND YIELD RELATED TRAITS

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ABSTRACT: *The Response of tomato variety (UC-82B) to colchicine and seasonal variations to improved growth and yield related traits was investigated with the aim of inducing variability that could be exploited in the improvement of some quality traits in Tomato. The seed of the tomato variety (UC-82B) was treated with three different concentrations of colchicine (1.0mM, 1.5 mM, 2.0 mM and 0.0 mM as control). The result indicated that, the interaction makes (UC-82B) variety of tomato to respond more to the mutagenic treatments during the rainy season than the dry season. The interaction showed that, seedlings height, height at maturity and pericarp thickness of the controls have the highest response during the dry season. However, the (UC-82B) mutant treated with 1.0mM concentration showed highest response in all the selected traits during rainy season except fruit diameter. Similarly, all the 1.5mM treated mutants showed highest response during rainy season except in leaf area where highest response was found in dry season. Similar result was found in 2.0 mM treated mutants.*

KEYWORDS: Colchicine, UC-82B, Rainy Season, Dry Season, Mutation.

INTRODUCTION

Tomato is one of the most highly praised vegetables consumed widely and it is a major source of vitamins and minerals. It is one of the most popular salad vegetables and is taken with great relish. Tomatoes and tomato products are rich in health-related food components as they are good source of carotenoids (lycopene and -carotene), ascorbic acid (vitamin C), vitamin A, vitamin E, folate, flavonoids, minerals, proteins and dietary fibre (Beecher, 2001). Regular consumption of tomatoes has been correlated with a reduce risk of various types of cancer and heart disease. These positive effects are believed to be attributable to the anti-oxidant particularly the carotenoid, flavonoids, ascorbic acid and phenolic compounds Giovanelli, G., V. Lavelli, C. Peri and S. Nobili, (2006).

In Nigeria, especially at the Southern or Western region, tomato production is highly seasonal and mostly weather dependent, which as lead to surfeit during the favorable season and scarcity during the unfavorable season. This scenario have caused unfriendly consumer price of this commodities during the off season. The demands for high quality, moderate sized, red

colored tomato with high firm fruit, pleasing appearance and good taste is increasing, while grower prefer high yielding, higher weight, indeterminate growth habit and resistance to pest and diseases. The solution to these is to find suitable varieties for growing that will meet the consumer's wants under a controlled environment. Growth, yield and fruit quality performance of tomatoes varieties under controlled environment conditions.

Colchicine is a chemical toxic that is often used to induce polyploidy in plants. It prevents the microtubules formation during cell division, thus the chromosome do not put apart like they normally do. Colchicine has been one of the most powerful mutagens in crop plants. The mutagen city is mediated through the production of an organic metabolite of azide compound. This metabolite enters into the nucleus, interacts to DNA and creates point mutation in the genome. (Kozgar & Mustafa, 2011). It has also proved its worth as chemical lmutagens to induce genetic variability. Thus, this chemical mutagen has become important tool to enhance agronomic traits of crop plants. (Khan, 2006).

Presently imported varieties and hybrid tomatoes are introduced into the market; greenhouse vegetable growers use this variety without full knowledge of the performance of these varieties under controlled environment. The main aim of this study was to investigate Response of tomato variety (UC-82B) to colchicine and seasonal variations for improved growth and yield related traits was investigated with the aim of inducing variability that could be exploited in the improvement of some quality traits in Tomato. Findings will help growers overcome the problem associated with varieties at the same time achieving increase in yield with high quality, typical to this agriculture system.

MATERIALS AND METHOD

Study Site

The research was conducted in the Green House of the Botanical Garden of the Department of Biological Sciences, Ahmadu Bello University Zaria (2014). (Lat 11^0 12^1N, Long 7^0,37^1E, Alt 550-700 m above sea level).

Sources of the Seeds

Seed of the cultivated tomato (*UC*-82B) was collected from the Institute for Agricultural Research (I.A.R), Ahmadu Bello University Zaria, Nigeria.

Treatment and Experimental Design

The treatments used in the research are mutation using various concentrations of colchicine, the seeds of the tomato variety was treated with four different concentrations of Colchicine (1.0mM, 1.5mM, 2.0mM and 0.0mM as control) respectively. The tomato variety used was UC-82B. It flourishes and grows successfully during the dry season. The treated plants were grown in 45 polythene bags arranged in a Completely Randomized Design (CRD) with three repetitions in each season as described in (McVoy, 2005) protocol.

Data Analysis

All the data collected were analyzed using Analysis of Variance, and the means were separated using Duncan's Multiple Range Test, (DMRT).

Effects for Interaction of Concentration, (UC-82B) Variety and Seasons on some Selected Tomato Traits

Concentration (mM)	Variety	Season	Germination % (2 WAP)	Seedlings Height (cm)	Survival Rate (%)	Height at Maturity (cm)	Number of Leaves	Leaf Area (cm^2)	Number of Fruits	Pericarp Thickness (mm)	Fruit Diameter (cm)	Root DW (g)
0.0	**UC**	**Dry**	40.51^a	22.83^a	44.29^a	37.73^a	15.11^a	9.83^a	2.77^a	0.40^a	0.39^a	1.66^a
	UC	**Rainy**	40.66^a	19.44^a	23.70^a	30.81^a	12.44^a	11.50^a	1.77^a	0.30^a	0.42^a	2.60^a
1.0	**UC**	**Dry**	83.11^a	33.07^b	83.11^a	55.50^a	20.33^a	31.83^a	9.33^a	0.28^b	0.15^a	3.04^a
	UC	**Rainy**	73.70^b	34.97^a	62.66^b	50.35^b	17.55^b	30.66^b	4.77^b	0.50^a	0.14^b	2.90^b
1.5	**UC**	**Dry**	75.77^a	29.07^b	73.66^a	47.31^a	18.77^a	25.94^a	6.22^a	0.25^b	0.28^b	2.77^a
	UC	**Rainy**	64.37^b	29.78^a	49.92^b	41.54^b	16.33^b	23.33^b	3.22^b	0.28^a	0.30^a	2.58^b
2.0	**UC**	**Dry**	64.48^a	27.54^a	58.88^a	43.46^a	17.77^a	17.72^a	4.55^a	0.21^b	0.36^b	2.47^a
	UC	**Rainy**	53.40^b	25.66^b	38.81^b	38.32^b	14.33^b	14.83^b	2.44^b	0.32^a	0.45^a	2.26^b

N.B: *[1] Means within the columns with the same letter(s) are not significantly different (P≤0.05)

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RESULT

The result of the interaction of concentration with variety and season is presented in the table above. The result indicated that, the interaction makes the (UC-82B) variety of tomato to respond more to the mutagenic treatments during the rainy season than the dry season. The interaction showed that, seedlings height, height at maturity and pericarp thickness of the controls have the highest response during the dry season. However, the (UC-82B) mutants treated with 1.0mM concentration showed highest response in all the selected traits during rainy season except fruit diameter. Similarly, all the 1.5mM treated mutants showed highest response during rainy season except in leaf area where highest response was found in dry season. Similar result was found in 2.0 mM treated mutants.

DISCUSSION

The distinct differences observed in most of the quantitative and qualitative traits among the colchicine induced mutants of tomato evaluated showed significant improvements in the selected traits. Although there were few traits with no significant differences in responses to the applied treatments; the ability of the mutants to germinate faster after one and two weeks of planting in respect to the controls showed that the mutagenic treatments induced increase enzymatic activities, which could be responsible for the early germination. This finding is in agreement with the findings of Mensah, J.K., Obadoni, B.O., Akomeah, P.A., Ikhajiagbe, B., & Ajibulu, J. (2007) who reported decreased in germination with increase in the dose of chemical mutagens. In the present investigation, germination, plant heights and leaf number and area decreased with increasing concentration of colchicine. This finding conformed to the earlier report by (Ahloowalia & Maluszynski, 2001) that, the viable mutants observed are mainly dependable measure of genetic effect in mutagen. The increased in the number of leaves, fruit number and plant heights due to colchicine treatments is also in conformity with the work of (Adamu & Aliyu, 2007) who reported increased in growth and yield parameters of tomato due to colchicine treatments. Reductions in germination percentages and diameter of the fruit due to the effects of mutagens on various crop plants have earlier been documented by (Mensah & Akomeah, 1997; & Mensah *et al*. 2007).

The increased in the leaf area and seedling height among the mutants signifies the ability of the mutagen (colchicine) to initiate more foliar buds. This finding agrees with the work of Maluszynski, M., Szarejko, I., Barriga, P., & Balcerzyk, A. (2001) who independently reported an increase in leaf number and leaf area among *Zeamays* mutants.

More so, the improvement in the growth and yield components of tomato due to colchicine treatments stressed the effect of mutation on the growth and yield of plants. This is in conformity to the work of Adamu, A. K., Oluranju, P. E., Bate, J. A., & Ogunlade, O. T. (2002) (2002) when groundnut was treated with gamma rays and Sheeba*et al*. (2005) when gamma rays and EMS were used to treat *Sesanum indicum* L. where seed germination, seedling, survival, plant height and pollen fertility were reduced significantly with an increase in dosage levels of both mutagens. However, in contrast, Sasi, A., Dhanavel, D.& Paradai, P. (2005) showed that all plant mutant types registered lower yields compared to their parents in the study of the effects of diethyl sulphate and EMS on Okra (*Abelmoschus esculentum* (L.) var. MDU-1).

The increased in fruit quality, such as pericarp thickness due to induced mutagenesis by colchicine signifies the vital role played by the mutagen in improving the quality traits of tomato. The increased in dry weights of the tomatovarieties due to sodium azide treatments is in contrast to the findings of Ikhajiagbe, B.,Mshembula, B.P.,and Mensah, J.K.(2012). Significant improvements were found among the mutant tomatoes in both the dry and wet seasons.

CONCLUSION

It was concluded that, there is significant difference in the effect of colchicine on the growth and yield components of the tomato variety under study. It was found that 1.0mM concentration of colchicine has the highest effect. Significant difference was found in the response of the variety (*UC-82B)* responding more significantly to colchicine treatment.

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