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COMBINED EFFECTS OF SODIUM AZIDE (NaN_3) AND COLCHICINE ON SURVIVAL RATE AND GROWTH ON THREE VARIETIES OF TOMATO (*Solanum lycopersicum* Mill.) IN DRY SEASON

***Aminu, Y[1]., Badaru, I.K[2]., Fa`iza, A.M.[1] and Maryam, M.G[2].**
1.Biology Department, College of Education and Preliminary studies, Kano State
2. Chemistry Department, College of Education and Preliminary studies, Kano State
*Corresponding Author: aminuyahayafagge@gmail.com GSM: +2347035347997

ABSTRACT
The Effect of Sodium Azide and Colchicine Induced Mutation on Survival and Growth on Three Varieties of Tomato in Dry Season, was investigated with the aim of inducing variability that could be exploited in the improvement of some quality traits in Tomato plants. Three different treatments (chemical mutagenesis via sodium azide, and colchicines. and a combination of sodium azide with Colchicine) were applied on to the three varieties of tomato seeds. The seed of the tomato: (Roma, UC82B and Local varieties) were treated at four different concentrations of colchicine (0.1mM, 1.0 mM, 2.0 mM and 0.0 mM as control). The result obtained revealed highly significant difference (P≤0.01) in the effects of sodium azide on survival rates, leaf area, number of fruits, and pH. Significant improvement (P≤0.05) was also recorded on fruit diameter. Similarly, highly significant differences (P≤0.01) were found between the treatments in all the selected traits except on number of fruits, where no significant differences exist. The result showed that sodium azide and colchicine improve important quality traits of tomato. It was deduced that variety UC82B responds significantly to colchicine. It was concluded that, the sodiuim azide and colchicines improve some quality traits on tomato that could be grown in dry seasons. It was concluded that 0.1 mM concentration of colchicine and sodium azide improve some important quality traits of tomato that could be utilized for further improvement of tomato crop.
Key Words: Sodium azide, Roma, Local variety, UC8, Mutation, Colchicine, Dry season

INTRODUCTION

The prime strategy in mutation breeding has been to upgrade the well-adapted plant varieties by altering one or two major traits which limit their productivity or enhance their quality. Tomato is an important crop of the world, one way of creating variability in such a self pollinated crop is attempting crosses between two genotypes complementing the characters of each other but due to autogamous nature of the crop, hybridization at appropriate time is a difficult process. The only alternative left for breeders to create variability is mutation breeding. This method can be used as a potential source of creating variability Novak and Brunner (1992). Mutations have played a great role increasing world food security, since new food crop varieties embedded with various induced mutations have contributed to the significant increase of crop production (Kharkwal and Shu (2009).

Mutation induction offers the possibility of inducing desired attributes that either cannot be found in nature or have been lost during evaluation. Treatment with mutagens alters genes or breaks chromosomes. Gene mutations occur naturally as errors in DNA replication. Most of these errors are repaired but some may pass to the next cell division to become established in the plant offspring as spontaneous mutations. Gene mutations without phenotypic expressions are usually not recognized. Consequently, genetic variation appears rather limited and breeders have to resort to mutation induction (Novak and Brunner, 1992).

Chemical mutagenesis is regarded as an effective and important tool in improving the yield and quality characters of crop plants. In general alkyl ting agents are very effective mutagens in higher plants. However, colchicine has also proved its worth as chemical mutagens to induce genetic variability. Thus, this chemical mutagen has become important tool to enhance agronomic traits of crop plants. The role of mutation breeding in increasing the genetic variability for quantitative traits in various crop plants have been proved beyond doubt by a number of scientists Kumar and Mishra, (2004); Erdem and Oldacay, Khan and Wani, (2006); Singh *et al.,(*2006); Tah, (2006); Addai and Kantanka, 2006; Bhat *et al., (*2007); Seneviratne and Wijesundara, (2007); Adamu and Aliyu (2007); Khan and Goyal, (2009); Kozgar *et al., (*2011).

Colchicine is a chemical mutagen and has been one of the most powerful mutagens in crop plants. The mutagen 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. Several factors such as properties of mutagens, duration of treatment, pH, pre and post treatment, temperature and oxygen concentrations etc. influence the effect of mutagens. The dose of a mutagen applied is an important consideration in any mutagenesis program. Generally, it was observed that the higher the concentrations of the mutagen, greater the biological damage. To enhance the mutagenic effectiveness and efficiency of colchicine and especially the metabolite, more knowledge about the effect of time, pH value, temperature, seed soaking and various concentrations are required (Khan *et al.,* 2009). The present studies have provided evidence on the induction of genetic variability connected with yield and component in Tomato crop.

Mutation is a root to study the nature and function of genes that constitute basic building of plant growth and development, which can lead to genetic improvement in economically important crops (Adamu and Aliyu, 2007). Another example of chemical mutagen is sodium azide (NaN_3) which is known to be highly mutagenic in several organisms including plants and cause genetic diversity that affect plant growth and productivity (Lunn *et al.,* 2012). A chemical mutagen generally produces an induced mutations leading to the substitution for sodium azide substitutions occurs especially resulting in amino acid changes that alter protein function. This chemomutagen induces a wide variation in morphology and agronomic characters when compared to normal plants (Al – Qurainy and Anwar, 2009). The main objective of this research is to discover the mutagenic effects of cholchicine and sodium azide in some selected traits on three varieties in Tomato (*Solanum lycopersicum* Mill) in dry season farming.

MATERIALS AND METHODS

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 Seeds of three varieties of cultivated tomato (*Roma*, *UC*82B and a *local variety*) were collected from the Institute for Agricultural Research (I.A.R), Ahmadu Bello University Zaria, Nigeria.

Experimental Design

The seeds of the three varieties of tomato were soaked into three different concentrations of sodium azide and colchicines i.e.(0.1Mm 1.0mM and 2.0mM) respectively for four hours (4hrs) after which they were removed and washed with distil water and left to dry before planting.

Roma was said to flourish successfully during the rainy season while UC flourishes and grows successfully during the dry season. The plants were grown during the dry season. The treated plants were grown in 45 polythene bags arranged in a Completely Randomized Design (CRD) with three repetitions.

DATA COLLECTION

Data were obtained for number of fruits/plant, and diameter of the fruits, survival rate and pH values.

Data Analysis

All the data obtained were analyzed using Analysis of Variance. The means were separated using Duncan's Multiple Range Test (Duncan, 1955).

RESULTS

The results for the analysis of variance (ANOVA) following the treatments of three varieties of tomato with colchicine and sodium azide during the dry season in (Table 1) revealed the presence of highly significant difference (P≤0.01) in the effects of different concentrations of colchicine on almost all the selected traits except on the on fruit diameter where the effect of colchicine is non-significant. More so, the result indicated highly significant difference (P≤0.01) among the varieties on almost all the selected traits except also on fruits diameters where no significant difference exists among the varieties.

The effect of sodium azide and colchicines on the leaf area and pH was highly significant (P≤0.01), similarly, there was significant difference on the fruit diameter (P≤0.05). However, no significant difference was found on the effects of the treatments on the survival rate and number of fruits, More so, no significant differences were found in the interactions of varieties and tin the treatments on all the selected traits.

Table 1: Mean Squares for the Effects of Sodium Azide and Colchicine on Some Varieties of Tomato in Dry Season

Sources of Variation	DF	Survival Rate (%)	Leaf Area (cm^2)	Number of Fruits/ plant	Fruit Diameter (cm)	pH
Replication	2	314.84^{ns}	165.08*	7.68^{ns}	0.04^{ns}	0.001^{ns}
Sodium Azide	3	7119.60**	1663.79**	90.14**	0.11^{ns}	0.01**
Variety	2	5840.46**	769.52**	99.70**	0.11^{ns}	0.53**
Colchicine	2	226.04^{ns}	55.26**	9.79^{ns}	0.34*	0.28**
Sodium Azide x Variety	6	19.72^{ns}	49.92^{ns}	7.02^{ns}	0.04^{ns}	0.60^{ns}
Sodium Azide x Colchicine	6	59.30^{ns}	13.96^{ns}	1.48^{ns}	0.08^{ns}	0.01^{ns}
Variety x Colchicine	4	260.85^{ns}	75.66^{ns}	7.13^{ns}	0.08^{ns}	0.04^{ns}
Sodium Azide x Variety x Colchicine	12	161.69^{ns}	16.54^{ns}	2.99^{ns}	0.27^{ns}	0.24^{ns}
Error	142	126.32	18.57	2.60	0.04	0.03

Keys: ns= No significant difference * = Significant difference (P≤0.05) **= highly significant difference (P≤0.01)

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. In the present investigation, germination, survival percentage, and leaf number area decreased with increasing concentration of colchicine. This finding conformed to the earlier report by Ahloowalia and Maluszynski (2001) that, the viable mutants observed are mainly dependable measure of genetic effect in mutagen. The increased in the number of fruits per plant due to colchicines treatments is also in conformity with the work of Adamu and Aliyu (2007) who reported increased in growth and yield parameters of tomato due to colchicine treatments.

The increased in the number of leaves and leaf area among the mutants signifies the ability of the mutagen (colchicine) to initiate more foliar buds. This finding agrees with the work of Maluszynski *et al.* (2001) who singly reported an increase in leaf area among *Zea mays* mutants.

The increased in fruit quality such as juice pH and fruit weight) and number of fruits 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 tomato varieties due to colchicine treatments is in contrast to the findings of Ikhajiagbe *et al*. (2012).

The distinct differences observed in most of the quantitative and qualitative traits among the mutagens on tomato plants evaluated showed, though there were few characteristics with no significant differences in responses to the applied treatments.

The increased survival rates of the tomato treated with sodium azide recorded showed excellent percentage of sodium azide success after 12 days in the incubation. This is similar to the earlier report by Anonymous (2011) that the percentage of survival ratios of all types of treatment with sodium azide was 97, 98 and 99% for splicing, top and tongue respectively.

The results of the study showed that the mutant treated with sodium azide on suitable rootstocks had positive effects on the yield. In combinations of the mutagens, the total fruit yield per plant increased significantly in comparison with that of the control plants.

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