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Effects of Nordox 75 WG on the Health Quality of Tomatoes

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ABSTRACT

Tomato fruit ripening is a purely natural process but it can also be influenced by several artificial means such as using Nordox 75 WG. In recent times, artificial tomato ripening has been an issue because of its health implications. To get a detailed understanding of the hazards, tomatoes treated with the chemical and those that did not undergo any chemical treatment were harvested and analyzed. On analysis, different compounds were found to be associated with tomatoes treated with Nordox 75 WG. The main objective of the paper was to identify the components of the chemical. Untreated Nordox 75 WG tomatoes recorded a 0g/L Cu²⁺ and K recorded the highest value of 0.23 mg/g. Tomatoes treated with Nordox 75 WG recorded 0.76 g/L Cu²⁺ and Ca²⁺ with a least value of 0.003 mg/g.

Keyword: Tomato, Nordox 75 WG, Ripening, lifespan

INTRODUCTION

Nordox 75 WG is a pinkish crystalline chemical used for the generation of copper and for making fungicide. The material is colourful in its pure form and constitutes about 83.9 % copper oxide. The rest is a cuprous oxide (Cu₂O) 86% (Gubler, 2013). Most vegetable farmers at Ligba, a community in northern Ghana have been applying Nordox 75 WG on their Tomatoes to enhanced ripening. Tomato

fruit ripening is still done largely in a conventional way in northern Ghana. The conventional way of ripening is not uniform and results mostly in a shorter lifespan. Artificial fruit ripening is on the ascending as it results in uniform ripening and makes farmers meet the demand at a particular quantity, quality and time. However, there are a lot of questions surrounding the use of artificial

ripening chemicals of fruits as many consider it not good enough for our health. ^{[1], [2]} Artificial ripening arises due principally to the high demand for fruits. Agricultural material transportation is a critical component in agriculture. Transportation is likely to take many days to reach the consumer or the customer. During the transportation, process fruit can ripe naturally and may overripe and may also undergo some form of physiological disorders. ^[3] Transporting agricultural products in its ripened stage to other distances may lead to bruises and may result in fungal attack thereby reducing the quality of the product. This leads to economic loss to farmers. Farmers upon experience now realized that it is better off to harvest and ripe the fruits uniformly to meet the demand of customers and also avoid post-harvest losses.

Materials and Methods

Study Area

The study was conducted at the Libga farming community in the Savelegu Municipal of Northern Ghana.

Sample Size

The sample size for the study was fifty tomato farmers.

Sampling Technique

The sampling technique used for the investigation was the convenience sampling method.

Materials and Uses

- i) Petri dish: Used to contain tomato for weighing on the scale
- ii) Tomatoes: Nine (9) pieces were used for the sampling analysis.

- iii) Weighing scale: Used to weigh the tomato at 1gram.
- iv) Distilled water 500 mL / 0.5 L: Used to mix with the tomato sample for the test.
- v) Measuring cylinder: Used to measure the tomato sample and distilled water.
- vi) Cell holder: Used to indicate sample record that is in mg/L.
- vii) Powder pillow: They are reagents that produce a chemical reaction in the mixed sample
- viii) Murioxide indicator powder and titre value: Are mixed with the tomato sample to read for calcium and magnesium hardness when the sample changes from pink to purple.
- ix) Blender: It was used in grinding the tomato sample making it smooth and soft.

Experimental Design

The treatments were tomatoes without application of Nordox 75 WG and tomatoes applied with Nordox 75 WG. The unapplied tomatoes were harvested on September 13, 2020, in the morning at a temperature of 100C – 150 C and analyzed in a laboratory on September 15, 2020. Tomatoes treated with Nordox 75 WG were harvested on September 22, 2020, in the afternoon at a temperature of 200C -250c and the analysis was done on September 24, 2020, at the Northern Regional Laboratory of the Ghana Water Company Limited. 1gram (g) each of the samples was taken to determine the level of calcium (Ca^{2+}), Magnesium (Mg^{2+}), copper (Cu) and potassium (K) milligram.

Methods and Procedure

The method and procedure for the Unapplied and Applied chemical (Nordox 75 WG) tomatoes were based on:

Magnesium (Mg^{2+})
Potassium (K)
Copper (Cu)
Calcium (Ca^{2+})

Table 1: Methods and Procedures for Potassium (K) Analysis

METHODS		PROCEDURES
Potassium (K) (0-7.0mg/1) Tetra phenyl Borate Method		Fill a clean sample cell with 25ml of the sample. Add the content of one potassium one reagent powder pillow. Add the content of one potassium two reagent solution pillow swirl to mix. Add the contents of one potassium three reagent powder pillow after the solution clears, shake for 30 seconds. Wait for 3 minutes reaction period. Fill another cell (the bank) with 25ml of the sample. Place the prepared sample into the cell holder and press read to record K in mg/L.
Reagents Required	Potassium 1, Potassium 2, Potassium 3, Powder pillow	
Apparatus Required	Spectrophotometer. Sample cell	

Table 2: Method and procedure for Magnesium (Mg²⁺) Analysis

Magnesium Hardness. Complex metric Method		Fill 500ml beaker with 100ml water sample. Add a little murexide indicator powder swirl to mix. Add 2ml of 1N NaOH solution swirl to mix and titrate against 0.02N EDTA. Read titer value from pink to purple magnesium hardness as mg/L CaCO ₃ .
Reagent Required	0.02N Ethylenediaminetetraacetic Acid (EDTA) solution, Murexide indicator powder (Ammonium purpurate)	
Apparatus Required	500ml beaker, Auto burette	

Table 3: Methods and Procedures for Calcium (Ca²⁺) Analysis

METHODS		PROCEDURES
Calcium hardness Complexometric Titration Method		Fill 500ml beaker with 100ml water sample. Add a little murexide indicator powder swirl to mix. Add 2ml of 1N NaOH solution swirl to mix and titrate against 0.02N EDTA. Read titer value from pink to purple magnesium hardness as mg/L CaCO ₃
Reagents Required	0.02N Ethylenediaminetetraacetic acid (EDTA) solution, Murexide indicator powder (ammonium purpurate)	
Apparatus Required	500ml beaker, Auto burette	

Table 4: Methods and Procedures for Copper (Cu²⁺) Analysis

METHODS		PROCEDURES
Copper (Cu) (0-500)mg/L, Bicuichoninate method		Fill cell with 10ml of the sample. Add the contents of one curver, 1copper reagents pillow powder to the sample cell (the prepared sample), swirl to mix. Wait 2 minutes reaction period. Fill another sample cell (the blank) with 10ml of the sample. Place the blank into the cell holder and press zero. Place the prepared sample into the cell holder and press read to record copper volume.
Reagents Required	Curver 1, Copper Reagent (Pillow powder)	
Apparatus Required	Curver 1, Copper Reagent (Pillow powder)	

Source of Data

Primary data was generated during the analysis of both the applied and unapplied tomatoes to acquire the relevant findings.

Data Analysis

Data collected were analyzed using the Statistical Package for Social Scientist. Results of the data were drawn in tables using excel.

RESULTS AND DISCUSSION**Laboratory Analysis of tomatoes (controlled)**

The sample picture below shows a tomato fruit that was cultivated without the application of Nordox 75 WG chemical (Figure 1). The following findings were recorded after the experiment was conducted. The analysis conducted was to determine the presence of potassium, calcium, magnesium and copper in the tomatoes.

Take 1 gram of tomatoes = 11.834g
Distilled water = 500ml/0.5L

Figure 1. Chemical unapplied Tomatoes

Weight of Petridis = 0.8
-1gram = 11834g - 0.8
= 11.034g
To get the concentration divide
11.034g
0.5L
= 22.068g/L as the concentration

Elements Analysis

Analysis for Potassium (K) (Tetraphenylborate Method)

Using the sample of 10mg:
 $10\text{mg} \times 0.5\text{L} = 5\text{mg/L}$
 $\frac{5\text{mg/L}}{22.068\text{mg/L}}$

Therefore Potassium = 0.23mg/g

Analysis for Calcium (Ca) Hardness
(Complexometric Method)
Using 100ml of sample = 4.1ml as total hardness
and
50ml of sample = 1.6ml
-4.1 - 1.6 = 2.5ml

Therefore calcium hardness

$$= \frac{TV \times EDTA \times 1000}{100}$$

$$= \frac{1.0 \times 0.02 \times 1000}{100}$$

= 32mg/L

Calcium hardness = 0.32mg/L

Then to calculate calcium ion (Ca^{2+}) in the tomatoes sample

Taken Calcium hardness = 0.32mg/L
Calcium molecular weight = 0.40mg
Calcium ion (Ca^{2+}) = 0.32mg/L $\times$ 0.40
= 0.128mg/L

$$\frac{0.128\text{mg/L}}{22.068\text{g/L}}$$

Therefore Calcium ion = 0.006mg/g

Analysis for Magnesium (Mg) Hardness

(Complexometrix Titration Method) by formula

$$\frac{TV \times EDTA \times 1000}{100}$$

$$\frac{2.5 \times 0.02 \times 1000}{100}$$

$$\frac{50\text{mg}}{100\text{L}}$$

= 0.5mg/L

Therefore magnesium hardness = 0.5mg/L

Then to calculate magnesium ion (Mg^{2+}) in the tomatoes sample

Taken magnesium hardness = 0.5mg/L

Molecular weight = 0.243mg

$$0.5 \times 0.243$$

$$\frac{0.1215\text{mg/L}}{22.068\text{mg/L}}$$

$$= 0.0068\text{mg/g}$$

Therefore magnesium ion = 0.0068mg/g

Analysis for Copper (Cu) Bicuichominate Method

Using 10mL of the tomatoes sample
Fill in the blank cell press read on the holder

Blank cell = 0.0

Sample = - 0.35

$$\frac{0.0}{-0.35} = 0$$

Therefore Copper (Cu) = 0g/L

Table 5: Unapplied Chemical Tomatoes (Nordox 75 WG) Analysis and Results

Element	Results
Potassium	0.23mg/g
Calcium	0.006mg/g
Magnesium	0.006mg/g
Copper	0g/L

The results as shown in the above table show unapplied chemicals of Nordox 75 WG in tomatoes. It shows that potassium, magnesium ion, calcium and other nutrients as vitamins retains their natural values for the function of regulating blood pressure, "good" HDL-Cholesterol significantly by 15.2percent, protect against inflammation, cause of cardiovascular diseases, reduction of obesity metabolic syndrome and reducing "bad" LDL-cholesterol by 13percent.

Generally, these results recommend the natural practice of cultivating and treating vegetables, especially tomatoes due to their high consumption preferable.

Applied Chemical Tomatoes (Nordox 75 WG) Analysis and Results

Figure 2. Chemical applied Tomatoes

Using tomatoes sample of 11.088g
Distilled water (solvent) of 500ml/0.5L
For concentration

$$\frac{11.088g}{0.5L} = 22.176g/L \text{ as the concentration}$$

To find calcium and magnesium hardness

Take 100ml = 4.1ml for magnesium

$$4.1 - 0.9 = 3.2ml/L$$

Analysis for Calcium (Ca) Hardness (Complexometric Method)

To calculate calcium hardness

By formula:

$$\frac{T.V \times EDTA \times 1000}{sample \ volume}$$

$$= \frac{00.9 \times 0.02 \times 1000}{100}$$

$$= \frac{18mg}{100L}$$

$$= 0.18mg/L$$

Therefore calcium hardness = 0.18 mg/L

To get calcium ion (Ca²⁺)

= 0.18mg/L as the hardness multiply by the
molecular weight = 0.40

$$= 0.18mg/L \times 0.4$$

$$= \frac{0.07mg/L}{22.176g/L}$$

Divided by the concentration

$$= 0.003mg/g$$

Therefore calcium ion = 0.003mg/g

Analysis for Magnesium Hardness (Complexometric Method)

To calculate magnesium

By formula

$$\frac{T.V \times EDTA \times 1000}{sample \ volume}$$

$$\frac{3.2 \times 0.02 \times 1000}{100} =$$

$$= 64mg$$

$$100L$$

$$= 0.64mg/L$$

Therefore, Magnesium hardness = 0.64mg/L

To get magnesium (Mg²⁺)

= 0.64mg/L as the hardness multiply by the
molecular weight = 0.243

$$= 0.64mg/L \times 0.243$$

$$= \frac{0.15552mg/L}{22.176g/L}$$

$$= 0.007mg/g$$

Therefore, magnesium ion = 0.007mg/g

Analysis for Potassium (K) (Tetraphenylborate
Method)

Using the sample of 10mg

Place the blank into the cell the holder and press
zero

Place the prepared sample into the cell holder and
press read to record k in mg/L

$$= 6.8mg/L$$

$$= 6.8mg/L \times 0.05L$$

$$= 3.4mg/L \text{ of potassium}$$

$$= \frac{3.4mg/L}{22.176g/L}$$

$$= 0.15mg/g$$

Therefore, potassium = 0.15mg/g

Analysis for Copper (Cu) (Bicuichominate
Method)

Using 10ml of the sample

Fill in the blank cell press read on the cell holder to
record copper content

$$= 1.52mg/L \times 0.5L$$

$$= 0.76mg/L$$

Therefore copper (Cu) = 0.76mg/L

Table 6: Applied Chemical Tomatoes (Nordox 75 WG) analysis and results.

Elements	Results
Calcium (Ca ²⁺)	0.003mg/g
Magnesium (Mg ²⁺)	0.007mg/g
Potassium (K)	0.15mg/g
Copper (Cu)	0.76mg/L

From the results of the applied analysis even though, farmers get a high yield of tomatoes through chemical treatment (Nordox 75 WG), it also contributes to the negative functions of potassium and other nutrients like vitamin C, A and K by increasing blood pressure, hypertension, obesity, cardiovascular diseases, "bad" cholesterol level and metabolic syndrome forming weak immune system by the high or low nutrients required to function properly.

Tomatoes applied with this kind of chemical also acquire a high rate of copper oxide of 86 % which does form toxin in the tomatoes fruit and to the consumer.

In these results the use of the chemical in general on agricultural produce for example, vegetable reduces its deficiency by causing the degree of diseases due to its raw consumption.

Sex Profile of Farmers in the Study Area

Table 7 frequency distribution shows that 74% of the respondents represent males while 26% represent females. The sex profile of the farmers shows that males formed the more noticeable group in the production of tomatoes. This may be due to the task nature activities involved. The dominant male percentage may also be attributed to the fact that in this farming community the most economical viable venture for the farmers, especially tomatoes.

Table 7: Sex Profile of Farmers in the Study Area.

Sex profile	Frequency	Percentage
Male	37	74
Female	15	26
Total	50	100

Age Distribution of Farmers in the Study Area

Table 8 is the respondent's level of age, 40% fall within 30-39 years, 34% fall within 40-49 years, 14% fall within 50-59 years and the rest of the 12% farmers are between 20-29 years.

Table 8: Age distribution of farmers in the study area.

Age	Frequency	Percentages respondent
20-40 years	35	70
41-60 years	9	18
61- years and above	6	12
Total	50	100

From the table, 9% of the respondents are below 40years and 60 % are below 50 years. These suggest that 20-45 years, especially the active youth are into this business to meet high productivity.

Educational Background of Farmers

Table 9 shows that 64% of the farmers were illiterate, 20% completed basic school 4% completed senior high school and 12% completed Arabic school (others)

The study, therefore, revealed that a greater number of the response was illiterates. These indicate that the high illiteracy may be a hindrance to technology transfer to the farmers.

Table 9. Educational background of farmers

Educational level	Frequency	Percentage
Illiterates	32	64
Basic school	10	20
Senior high school	2	4
Others	6	12
Total	50	100

From the results in table 9 tomatoes, farmers at Ligba community are mostly illiterates. Above the 50 frequency farmers, only two people had senior secondary school and six-person representing 12percent had had no English education apart f

Farmers Who Produce Tomatoes Distribution

Tomatoes production in Ligba respondents was asked whether they produce tomatoes. The responses are shown in the table below.

Table 10: Farmers Who Produce Tomatoes Distribution

Tomatoes farmers	Frequency	Percentage
Yes	50	100
No	0	0
Total	50	100

Stages of Tomatoes at the Harvest Period

Respondents were asked at what stage of the tomatoes harvest is recommended. The respondent said at the matured (partial ripped) due to transportation challenges 20% said at when the fruit is fully ripped and 30% indicates when the fruit is not fully ripped due to higher deterioration rate.

Table 11: Stages of Tomatoes at the Harvest Period

Stage of harvest	Frequency	Percentage
Matured (partial ripped)	25	50
Fully ripped	10	20
Not fully ripped	15	30
Others (specify)	0	0
Total	50	100

The above results indicate that tomatoes farmers harvest much at the matured (partial ripped) stage, but not to allow the fruit to be fully ripped. This is to have healthy fruits since they are

to be transported to different locations and to reduce wastage in a form of rot.

Losses Observed at the Time of Harvesting

Tomatoes farmers were asked if they observe any losses at the time of harvesting, the respondent's response is elaborated in Table 12. The 50 respondent said yes, they observed losses. On the losses recorded during harvesting the result is shown in table 5 of the 50 respondents, 22 representing 44% observed high rotting rate, 26 representing 52% observed bruises on the fruits and 2 representing 4% said other losses can be wounds on the fruits.

Table 12: Losses Observed at Time of Harvesting.

Harvest losses	Frequency	Percentage
Harvesting high rotting rate	22	44
Bruises	26	52
Others (specify)	2	4
Total	50	100

Chemicals Treatment Practice

In figure 1 below, the respondents were asked whether they carry out chemical treatment practice. The response was yes. Only 5 respondent representing 10% said no and that they do not use chemicals.

Fig.1: Treatment usage among farmers

Summary, Conclusion and Recommendations

The study was to determine the effects of agrochemicals (Nordox 75 WG) on tomatoes production and their effects on consumer health in the community by conducting a survey and scientific analysis.

The vegetables commonly grown in the community include tomatoes and pepper, with the majority of the farmers cropping tomatoes. The study also revealed that tomatoes cultivation is done all year round. Mostly; during the rainy season production is usually for consumption and sales.

The findings also revealed that respondents encounter losses during production and that, the losses range from weight loss, quality loss, to financial loss.

The major constraints to tomatoes production include inadequate extension service, poor practice (pre-harvest alike) and the use of uncertified seeds. The study indicates that tomatoes farmers have adopted modern methods of improving upon their vegetable losses by the use of chemicals (Nordox 75 WG).

However, the findings also revealed that the use of agrochemicals in general on vegetable production causes an enormous disease in the human body due to its row consumption.

The study also showed that other factors include education and processing of vegetables (tomatoes) affect production in the community.

Recommendations

Intensive education should be carried out by the Minister of Food and Agricultural (MOFA) and other agricultural agencies to educate farmer on the

improved method of tomatoes farming. This will enable them to acquire accurate and reliable information to ensure vegetable quality production. An effective and extreme reaching educational programme on chemicals in vegetable production is critically needed that it will not be essential in the future for users.

Tomatoes producers should be given training on natural practice techniques by trained post-harvest technologist on the field and outside the field.

Tomatoes producers also form and join vegetable growers association in their communities. This will help them generate funds and also invite resource persons from time to time to offer information that will improve their products without chemicals.

Researchers should do more analysis on agrochemicals and recommend the negative impacts on consumer health to reduce the high demand during production.

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