

DECLARATION

I hereby declare that I have personally, under supervision, undertaken this study herein submitted. References to other works as a source of information have been fully credited. This dissertation has never been presented in part or whole at any University for the award of a degree in any occasion.

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1.0 INTRODUCTION

Capsicum fruits, also known as peppers, are one of the major sources of red food colourant and of pungency for spice production. In addition; fruits can be used as fresh vegetables or ornamentals due to their pleasant taste, attractive appearance medicinal properties, and vitamin content (Sonago 2003). It belongs to the Solanaceae family. Several species of the genus *capsicum* are known to be cultivated with the rest growing in wild. Fruits of capsicum are harvested at two stages depending on use: fully mature green for fresh use, and coloured for fresh and other uses. Capsicums are important agricultural crop, not only because of its economic importance, but also due to nutritional and medicinal value of its fruits. These are the excellent source of natural colours and antioxidant compounds (Howard *et al.*, 2000).

The world demand for capsicums has been continuously increasing recently, and production increased by 40 % between 1990 and 2000 with about 1.4 million hectares cultivated (Food and Agricultural Organisation) (FAO, 2000).

In Ghana, Capsicum is one of the leading vegetable crops noted for export. Its production is a good source of income for small growers and is significantly one of the foreign exchange earning vegetable crops (Bonsu *et al.*, 2003). The four commercial pepper types grown from *Capsicum annum* and *Capsicum frutescens* in Ghana include the Elongated-type (e.g Legon 18 and Shito adope), Cherry-type (e.g Kpakpo Shito), Bonnet shaped (e.g Scotch bonnet) and the small elongated type (e.g African bird's eye). Both the Legon 18 and Shito adope belongs to the *Capsicum frutescens* (GST 2004.)

2.0 LITERATURE REVIEW

2.1 TAXONOMY, ORIGIN AND DISTRIBUTION

Pepper belongs to the Solanaceae family with its genus as *Capsicum* and is closely related to tomato, eggplant, potato and tobacco. The genus *Capsicum* represents a diverse plant group and includes twenty seven species; five cultivated and twenty two uncultivated (Bosland, 1993).

Cultivated *Capsicum* species are thought to have originated in tropical areas such as Mexico and South America and have spread to the rest of the world over several centuries. Exclusively, Chili and sweet pepper (*Capsicum annuum*) are from Mexico while aromatic hot Pepper (*Capsicum chinense*) is from the Amazonian region. Bird pepper (*Capsicum frutescens*), originated from the coastal regions of the southern part of the tropical South America.

It is believed that pepper may have been introduced into the West African region by the Portuguese some five centuries ago and thus the crop can be said to have been naturalized as an indigenous crop of the sub-region (Yanney -Wilson, 1960)

2.1.1 Cultivars of Pepper

The five main cultivated species in the *Capsicum* genus include: *Capsicum annuum*, *C. baccatum*, *C. chinense*, *C. frutescens* and *C. pubescens* but the most important species is *C. annuum* (Wien, 1997). There are many distinctive cultivars in *C. annuum* including most of the common commercial types such as sweet pepper (bell, large-fruited pepper), paprika (sweet, smaller -fruited pepper), and chilli (hot pepper) (Rajput and Paruleke,

pepper amounts to its Provitamin A content as carotene is converted to vitamin A in the liver. Maturation affects synthesis of these compounds which influence hot pepper quality e.g. differences in hot pepper colour, shape and capsaicin level changes continuously during maturation. Important nutrients like ascorbic acid and Provitamin A increased from green stage to the red stage (Howard *et al.*, 1994 and Sidonia *et al.*, 2005).

2.4.2 Total Soluble Solids (TSS).

Fruits of pepper contain many compounds which are soluble in water: e.g. sugars, amino acids, ascorbic acids, Provitamin A and some phenolic compounds. These soluble compounds form the soluble solids content of the fruits. In most ripe fruits sugars forms the main component of the soluble solids.

Total soluble solids are an important postharvest quality attribute in the screening of new hybrids of fruits. Since the amount of TSS or sugar in fruits usually increases as they mature and ripen, the soluble solids content of the fruit can be a useful index of maturity or stage of ripeness Chan *et al.* (1979). The **refractometer** is the instrument used to measure the total soluble solids contents of fruits.

2.4.3 pH and Total Titratable Acidity

pH value gives a measure of the acidity or alkalinity of a product, while titratable acidity give a measure of the amount of acid present. Assessment of pH and titratable acidity of fruits aroused primarily to estimate consumption quality and hidden attributes. Organic acids are important in giving a desired sugar-to-acid balance which results in pleasing fruit taste during ripening. Acidity measured as titratable acidity in the fruits

3.0 MATERIALS AND METHODS

3.1 LOCATION OF EXPERIMENT.

The laboratory work was conducted at the laboratory of the Department of Horticulture. Kwame Nkrumah University of Science and Technology (KNUST), Kumasi.

3.2 SOURCE OF PEPPER FRUITS

A mature green fruits of the Legon 18 and the Shito adofo variety of pepper were harvested from the horticultural farm of the Council for Scientific and Industrial Research (CSIR) horticulture Unit, Kwadaso. The harvested fruits were transported within 45 minutes to the laboratory under minimal temperatures and climatic conditions i.e. morning harvest.

3.3 PREPARATION OF FRUITS

Pepper fruits showing overall gain of green mature colour at the blossom end and has undergone a complete physiological stage of maturity was selected for the laboratory work. Mature fruits uniform in shape and size without any deformity and apparently showing no sign of disease was favoured.

The fruits were boxed in a clean paper box and the relative humidity and temperature of the box was determined and recorded using the digital thermometer and the hygrometer upon arrival.

$$\% \text{ acid} = \frac{N \times V_1 \times \text{Eq. wt.}}{V_2 \times 10}$$

$$V_2 \times 10$$

N= normality of the titrant

V₁ = volume of the titrant.

Eq. wt. = equivalent weight of the predominant acid

V₂= volume of sample

3.5.6 Shelf-life Studies

Shelf life studies were conducted on the pepper varieties from the period of harvest till the period of senescence. During this period, moisture loss and fruit quality was monitored. A shelf life study was terminated when the fruits start to show some signs of rot (senescence).

3.6 DATA ANALYSIS

The data collected was subjected to analysis of variance ANOVA using Genstat 12.0 statistical software. The differences between treatments means was subjected at 1% (P=0.01) least significant difference

4.4 pH OF PEPPER FRUITS

Figure 4.3 shows the effect of ripening on the pH of both the Legon 18 pepper and the Shito ado pepper at each stage of colour change. A linear pH pattern was observed for both peppers with each pepper having an up rise increase at stage 1 to stage 7. The highest pH value of 6.33 and 6.52 was recorded at both last stages (stage 7) of the Legon 18 and the Shito ado pepper respectively.

However, significant differences were observed among the Legon 18 pepper at colour stage 2, 3, 4, 5 and 6 ($P < 0.01$). However, no significant differences were observed among the pepper fruit at colour stages 1 and 7 ($P < 0.01$).

Significant differences were also observed among the Shito ado pepper at colour stage 1, 2, 3, 6 and 7 ($P < 0.01$). However, no significant differences were observed among the pepper fruit at colour stages 4 and 5 ($P < 0.01$).

It was observed that the quality of both peppers showed signs of loss of quality at colour stage 5 to the colour stage 7. At colour stage 7, the fruits were not marketable as there was structural collapse of the pulp. According to Felipe *et al.* (2009), Colour stages 5 coincides with maximum respiration rate and ethylene production hence the observed poor quality. The loss in quality also reduces the market value and makes the fruit unmarketable.

Reid (2002) reported that colour changes are the widely used visual maturity index in many fruits and vegetables. Aked (2000) indicated that fruit colour intensity and uniformity greatly affect fruit quality since in many fruits these involve loss of chlorophyll, synthesis of new pigments such as carotenoids and unmasking of other pigments previously formed during development

The loss of green colour is due to the degradation of the chlorophyll structure (Merodio and De la Plazza 1997). Maturity stage of the fruit at harvest greatly influences the Postharvest fruit behaviour during marketing and storage. Colour of the skin can therefore be considered as good maturity stage indicators and reliable quality standards of the *Capsicum frutescens*. Based on the ripening response of the fruits in storage, stages 2 and 3 are the proper times to harvest for long distance shipment (export), whilst fruit can be harvested at colour stage 4 for the local markets. The colour chart developed during the study would help producers and consumers predict the stages of ripening and quality of both the Legon 18 and the Shito adope pepper.

5.6 SHELF-LIFE STUDIES

Shelf-life studies conducted on the Legon 18 variety depicts from Figure 4.1 that Legon 18 pepper loosed moisture at a minimal rate throughout the various stages of maturity.

Residual	14	0.00040000	0.00002857
Total	20	0.04018095	

Grand mean 0.2090 Cv 2.6%

1. ANOVA FOR SHITO ADOPE PEPPER

(1) Variate: **weight**

Source of variation	D.F	S.S	M.S	F	P
trt	6	5.30156	0.88359	24.73	<.001
Residual	14	0.50013	0.0357		
Total	20	5.80169			

Grand mean 1.570

Cv 13.8%

(2) Variate: **pH**

Source of variation	D.F	S.S	M.S	F	P
trt	6	0.7467238	0.1244540	687.77	<.001
Residual	14	0.0025333	0.0001810		
Total	20	0.7492571			

Grand mean 6.2714

Cv 0.2%

APPENDIX 3: Colour coding

Figure 4.8 sRGB COLOUR CODINGS OF THE LEGON 18 pepper (COLOUR STRENGTH)

