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Quality of Pineapple Fruits as Influenced by Floral Induction in Ghana

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Abstract: A study was conducted to assess the influence of floral induction on the quality of pineapple (*Ananas comosus*) fruits. Freshly harvested pineapple fruits from farmers' managed fields that were induced by calcium carbide and non-induced (control) from Ayensudo, a major pineapple producing center in the Central Region of Ghana. The fruits were chemically analysed in the laboratory. The results revealed that moisture content of chemically induced pineapple is lower (84.3%) than the non-induced fruits (86.8%). Total sugars, sucrose and reducing sugars were all higher in induced fruits than the non-induced fruits. Organoleptic analysis showed 88.9% of the consumer preference for chemically induced fruits. Chemical induced fruits have shorter shelf-life than non-induced fruits.

Key words: *Ananas comosus*, organoleptic, preference, proximate analysis, shelf life

Introduction

Pineapple, *Ananas comosus*, Merr, is one of the most important crops grown in Ghana. The fruit is consumed fresh by many people and hence, source of essential mineral elements, nutrients and vitamins. It could easily be processed into jams, alcoholic and nonalcoholic drinks and other confectionaries. It is an important source of income to farmers and end uses and it is a foreign exchange earner for the country. Production of pineapple for export is one of the leading sectors of the non-traditional export in Ghana (Franzoi, 1996). Recently there had been increased demand for fresh pineapple from Ghana by foreign markets. Pineapple export increased from 45145 metric tones in year 2003 to 71805 metric tones in 2004 (MOFA, 2005; FAO, 2005).

Increase in pineapple production for both local and foreign industries involves flower induction, which is necessary for uniform fruiting and maturity. This is achieved through treating the pineapple with chemicals such as ethephon, acetylene and calcium carbide (Addo-Quaye *et al*., 1995; Soper *et al*., 1997; Chang, 2000). Unfortunately people have been complaining that the use of calcium carbide for induction, which is a common practice in Ghana, affects the quality of the fruits and reduces their shelf lives (Aboles, 1992; Dzogbefia *et al*., 2001). However, there is dearth of documented literature on the use of calcium carbide for pineapple production. It is therefore expedient to assess the effect of calcium carbide on the quality of pineapple fruits.

This study is therefore aimed at assessing the quality of calcium carbide induced pineapple fruits, organoleptic quality and their storability.

Materials and Methods

The study consisted of proximate analysis of the pineapple fruits conducted at Food Research Institute of the Center for Scientific and Industrial Research in Accra. Shelf life and organoleptic tests were conducted at University of Cape Coast, Ghana in 2006.

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Six pineapple fruits, each chemically induced with Calcium carbide and another six not chemically induced were randomly selected from the various pineapple farms under farmers managed trial in the Ayensudo, a major pineapple-producing center in the Central Region of Ghana between, 2005 and 2006. The chemically and non-chemically induced pineapple fruits were analyzed in the laboratory for proximate analyses to determine; moisture content (%) air-oven method, ash content (%) dry ash method, calcium (%), crude fiber, crude fat, pH, phosphorus, iron and sucrose (%) using the method suggested by AOAC (1990). A set of 10 pineapple fruits, each chemically induced and another 10 pineapple fruits not chemically induced were also randomly selected and stored under laboratory condition to assess daily the shelf life. Organoleptic analysis was done using a set of 10 chemically induced pineapple fruits and 10 non-chemically induced pineapple fruits, served among 36 students of School of Agriculture, University of Cape Coast, Ghana. Their responses were recorded and expressed in percent preference.

Results

Table 1 shows proximate analysis and mineral salt content of chemically induced and non-induced pineapple fruits. Pineapple fruits grown naturally have less sugar, less fiber but higher moisture contents than the chemically induced fruits. Also from Table 1, flower induction slightly increases the ash content and acidity of the pineapple fruits.

Floral induction influenced the mineral content of pineapple fruits (Table 1). Calcium content increased sharply from 162 mg/100 g in the non-induced to 224 mg/100 g in the chemically induced fruits. Iron content decreased slightly from 3.5 mg/100 g of the non-induced fruits to 3.0 mg/100 g in the chemically induced fruits. Phosphorus contents, was not affected by chemically inducing pineapple flower for fruit production.

Table 1: Proximate analysis and mineral salts of pineapple fruits

Quality parameter	Induced fruits (g/100 g)	Non-induced fruits (g/100 g)
Moisture	84.3	86.8
Ash	0.5	0.4
Crude fat	0.4	0.4
Crude fiber	1.2	.9
Sugars	2.9	2.5
Sucrose	2.3	1.8
Total sugars	5.2	4.3
pH	3.4	3.7
Calcium	224.0	162.0
Phosphorous	31.0	31.0
Iron	3.3	3.5

Table 2: Consumers' preference for chemically induced and non-induced pineapple fruits

Type of fruit	Consumers	Percentage
Chemically induced	32	88.8
Non-induced	4	11.1
Total	36	100.0
Induced more than once	2	5.6
Non-induced	34	94.4
Total	36	100.0

Table 3: Shelf life of pineapple fruits

	Induced fruit			Non-induced fruit		
Days	Rotten	Good	Total	Rotten	Good	Total
6-8	8 (40)*	12 (60)	20	1 (5.0)	19 (95)	20
> 8	12 (60)	8 (40)	20	1 (5.0)	19 (95)	20

*Figures in parenthesis are percent induced and non-induced frequency

Approximately 90% of the test consumers indicated preference for chemically induced. Less than 10% of the sampled consumers preferred pineapple fruits that were chemically induced more than once (Table 2).

Table 3 shows the shelf life of the pineapple fruits that were stored for various days. Non-induced fruits had higher shelf life than the induced fruits; within 2 days of storage under ambient temperature, 40% of the induced pineapple fruits had gone bad (rottened), while 60% are still good. Meanwhile, at over a week 60% of the fruits had gone bad. Over 95% of the non- induced fruits stored for more than 8 days.

Discussion

Crude fiber content was higher in the chemically induced fruits than in the non-induced fruits. This was due to induction by calcium carbide that enhanced excess ethylene production than those produced naturally by the plant organs. Consequently, this also increases the stem thickening and horizontal growth habit that enhance radial expansion of cells, thus, promoting fibrous growth in fruits. This finding agrees with those of Salisbury and Clean (1992) and Soper *et al*. (1997). There was direct relation between percentage crude fiber and percentage moisture content; as the fiber content increases, the moisture content decreases and vice versa. Awuku *et al.* (1991) stated that moisture absorbed from the soil plays an important role in the amount of moisture retained in the fruit. Therefore, if the period required for crop growth is shortened as the case in this study, the amount of moisture will decrease in the fruit.

Chemically induced pineapple fruits have higher sugar contents than non-induced fruits, as a result of low moisture content and high sucrose. These also explain their shorter shelf life compared to non-induced fruits. This finding was consistent with the report of Collins (1960).

The pH values show that the induced fruit is more acidic than the non-induced fruit. This confirms the report of Chang (2000), which asserts that treatment of pineapples with chemicals for floral induction affect the acidity of the fruit. However, the pH values of both induced and non-induced fruits fall within the range of 3.2-4.0 as specified by Morton (1987). This implies that the use of calcium carbide for floral induction does not seriously affect the acidity of the pineapple fruit beyond the acceptable limit.

The high level of calcium in the induced pineapple fruit was due to the absorption of calcium hydroxide formed from application of calcium carbide with water, thus, leading to bioaccumulation of calcium in the fruit. According to Awuku *et al*. (1991), this absorption has direct contribution to increased calcium level in pineapple fruits.

The high consumers' preference for chemically induced fruits could be attributed to the sucrose and total sugar contents which makes it tasty. Meanwhile, pineapple fruit are consumed fresh by many people because long storage (especially under bad conditions) affects the taste and denature the sugar content and essential mineral elements. This finding is in agreement with that of Mwale (1985) who reported that application of calcium carbide change the taste of the pineapple.

Conclusion

The study concluded that the use of carbide for floral induction affected the quality of pineapple fruits. High carbide dosage increased fruit acidity (though, not beyond permissible limit), it also increased calcium and crude fiber content with a decrease in moisture content, thus, making the fruit fibrous. Fruits from chemically induced pineapples were preferred due to high accumulated sugar content, however, poor or long storage denature the sugar content and makes the fruit unaccepted.

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