

**ADOPTION OF POSTHARVEST HANDLING TECHNOLOGIES OF PASSION
FRUITS (*PASSIFLORA EDULIS SIMS VAR.*) BY FARMERS IN
UASIN GISHU COUNTY**

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Abstract

In Kenya, Passion fruit is becoming part of solution in staving- off hunger and malnourishment. Most of the underutilized fruits passion fruits included are often among those which have the greatest potential in terms of nutrition and income generation for small holders. Passion fruit is underutilized because of the significant amounts that go into waste during peak production. The objective of this study was to evaluate how farmers harvest their produce, their postharvest handling technologies as well as establish their mode of storage of passion fruit (*Passiflora edulis Sims var*) in Uasin -Gishu County. A total of 77 farmers were interviewed in Soy and Kapsaret sub-counties in Uasin Gishu County. The survey was conducted using a semi structured questionnaire administered through snow ball sampling technique .The data collected was subjected to descriptive IBM SPSS statistics 21. The study has showed that Most of the farmers in Uasin County have entered into passion fruit production enterprise without proper passion fruit postharvest handling knowledge. Farmers are encouraged to embrace new harvest and postharvest handling technologies if they are to reduce Passion fruit postharvest losses.

Key Words: Postharvest, Postharvest handling, Underutilization, Technologies, Adoption.

Introduction

Passion fruit (*Passiflora edulis*) a native of tropical America, belongs to Passifloraceae family which comprises of about 530 species. Among the species, yellow passion fruit (*Passiflora edulis flavicarpa*), purple passion fruit (*Passiflora edulis*) and giant variety

(*Passiflora quadrangular is*) are the widely cultivated (Joy, 2010).

The purple passion fruit is considered to have originated from southern Brazil through Paraguay to northern Argentina (Acland, 1971; Morton, 1987). In Kenya, purple passion fruit farming was introduced around 1920's and was expanded in the mid 20th century. The fruit is mainly grown in the Rift

valley region (Elgeyo- Marakwet and Uasin-gishu counties), Eastern (Meru and Embu counties), Central (Murang' and Kiambu counties), Western (Bungoma county) and Nyanza (Kisii county) regions (Amata et al., 2009).

Passiflora edulis variety is purple and grows and produces well at altitude of 1200 m above sea level and temperature range from 8-20⁰c. The plant remains productive all year round in more tropical areas (Gaturuku and Isutsa, 2011).

There are several harvest maturity indices of passion fruit; they include the time after transplanting and external skin colour. Chen and Robert (2014) postulated that fruits that are harvested when they are $\geq 75\%$ turning yellow or purple, continue to stay that Purple. Important quality considerations in passion fruits include a consistent and fresh appearance, acceptable texture, characteristic flavour, and sufficient shelf-life to survive the distribution system (Watada, 1996). This therefore means that harvesting has to be done at a stage that gives a ripened flavour or rather an appealing organoleptic taste with a compromise stage that allows for long distance transport.

Film-bagging and various coatings helps reduce water loss in yellow and purple passion fruit during storage although it is said that response to coatings and film bagging may be associated with control of water loss, rather than modified atmosphere effects (Chen and Robert, 2014). Elsewhere it is said that plastic films and waxes increase post-harvest life because fruit respiration occurs inside the coating and consequently there is a reduction in the concentration of O₂ and an increase in CO₂, and an atmosphere with high

relative humidity is formed, thus reducing water loss by transpiration (Fonseca *et al.*, 2000).

Wounding is said to induce signals that elicit physiological and biochemical responses in both adjacent and distant tissues that not only directly affects appearance attributes (skin and flesh skin lesions and browning) but also creates sites for pathogen infection and water loss (Wu, 2010).

Passion fruit utilization faces several setbacks such as huge postharvest losses estimated at 10-60% of the harvested fruits (Mitra, 2008). Minimizing postharvest losses of already produced fruit is more sustainable than increasing production to compensate for these losses; unfortunately this is usually complicated by the nature of mechanical, physiological and pathological factors and weak post-harvest technologies causing deterioration (Food Agricultural Organization, 2004)

Uasin-gishu county is said to be a major 'bread basket' as is associated with maize, wheat and dairy farming but the trend is now shifting towards horticulture particularly passion fruits farming, which is known to have more returns compared to other enterprises (Horticultural News, 2012; Sambu, 2012).

This study was aimed at establishing harvest and Postharvest handling technologies of passion fruit adopted by farmers in Uasin Gishu County. The finding from the study was used to recommend to farmers the need to embrace the best harvest and postharvest handling practices that enhance quality of passion fruits hence its maximum utilization.

Materials And Methods

Survey area

The study was conducted in Kapsaret and Soy sub counties, which are among the major passion fruit producing areas in Uasin-gishu County (HCDA, 2012). The areas are suitable for passion growing due to

favourable climatic conditions. Farmers in the selected sub counties differ in the postharvest management of produce which made them suitable for assessing the postharvest handling techniques employed by the farmers along with other management practices. The various parameters of the two sub counties are described in Table One.

Table One: Description of the study area

Population	Kapsaret	Soy
Area(km ²)	451.00	702.9
Population	121178	171941
Population Density/km ²	268.7	244.6
Altitude (ma.s.l.)	2043	2116
Rainfall(mm)	900-1200mm	600-1200
Temperature ranges(⁰ c)	7 ⁰ c-29 ⁰ c	7 ⁰ c-29 ⁰ c
Soils	Red clay soils	Red clay soils

Source: Uasin Gishu County, 2015.

Sampling design

Since the population of the farmers undertaking purple passion fruit farming in respective sub counties was unknown, the study determined the desired sample size for the sub counties together that reflect a normal distribution, and then a proportionate sample for each sub county based on its population was determined from the total sample size. The sampling frame comprised of purple passion fruit farmers. A total sample of 77 farmers was selected by snow ball sampling technique.

Research instruments

The study made use of primary data. The data was collected through personal interviews with an aid of semi structured questionnaire administered to the farmers.

Statistical analysis

Data collected was analyzed by use of descriptive statistical IBM SPSS statistic version 21. Postharvest handling techniques, management practices scores, socioeconomic and institutional characteristics of the purple passion fruit farmers was examined.

Results

Colour maturity index at which farmers harvest their passion fruit

The survey showed that 15.6% of the farmers harvested their produce at mature green stage or at 25% purpling, while 59.7% of the farmers harvested their produce when it is fully ripe or at 75% purpling and another 24.7% of the farmers harvested their produce at any of the above colour maturity stages (Table Two).

Table Two: Percentage analysis of colour maturity index employed by farmers in Soy and Kapsaret Sub counties in Uasin Gishu County

		Colour maturity Index				
		25% Purpling	75% Purpling	Other	Total	
Sub county	Soy	Count	7	23	8	38
		% within Sub county	18.4%	60.5%	21.1%	100.0%
		% within Colour maturity Index	58.3%	50.0%	42.1%	49.4%
		% of Total	9.1%	29.9%	10.4%	49.4%
	Kapsaret	Count	5	23	11	39
		% within Sub county	12.8%	59.0%	28.2%	100.0%
		% within Colour maturity Index	41.7%	50.0%	57.9%	50.6%
		% of Total	6.5%	29.9%	14.3%	50.6%
Total		Count	12	46	19	77
		% within Sub county	15.6%	59.7%	24.7%	100.0%

% of Total	15.6%	59.7%	24.7%	100.0%
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Point of detachment from the mother plant

The farmers interviewed showed parity in their understanding of where to detach their produce with 27.3% of the respondents detaching their produce at the fruit shoulder, 50.6% at a five centimetre stricture from the fruit shoulder and the rest at 22.1% when the fruit has dropped to the ground (Table Three).

Table Three: Farmers detachment of produce from the mother plant during harvesting in Soy and Kapsaret sub counties in Uasin- Gishu counties

Sub county	Soy	Count	Fruit Shoulder	5 cm Stricture Attached	When the Fruit has dropped	Total
		7		20	11	38
		% within Sub county	18.4%	52.6%	28.9%	100.0%
		% within Detachment Point	33.3%	51.3%	64.7%	49.4%
		% of Total	9.1%	26.0%	14.3%	49.4%
	Kapsaret	Count	14	19	6	39
		% within Sub county	35.9%	48.7%	15.4%	100.0%
		% within Detachment Point	66.7%	48.7%	35.3%	50.6%
		% of Total	18.2%	24.7%	7.8%	50.6%
Total		Count	21	39	17	77
		% within Sub county	27.3%	50.6%	22.1%	100.0%
		% of Total	27.3%	50.6%	22.1%	100.0%

Mode of storage used by farmers

The survey found that 74 % of the respondents store their produce under the prevailing room conditions while only 20.8 % stored them on polythene films and another 5.2% did not use a specific mechanism for storage of their produce (Table Four).

Table Four: Mode of storage of passion fruit used by farmers in the Soy and Kapsaret Sub counties in Uasin Gishu County

		Ambient condition	Modified atmosphere	Others	Total	
Sub county	Soy	Count	25	11	2	38
		% within Sub county	65.8%	28.9%	5.3%	100.0%
		% within Mode of storage	43.9%	68.8%	50.0%	49.4%
		% of Total	32.5%	14.3%	2.6%	49.4%
Kapsaret		Count	32	5	2	39
		% within Sub county	82.1%	12.8%	5.1%	100.0%
		% within Mode of storage	56.1%	31.3%	50.0%	50.6%
		% of Total	41.6%	6.5%	2.6%	50.6%
Total		Count	57	16	4	77
		% within Sub county	74.0%	20.8%	5.2%	100.0%
		% of Total	74.0%	20.8%	5.2%	100.0%

Time of the day in which harvesting is done

Only 44.2% of the respondents harvest their produce in the morning when the fruit is dry, 29.9 % do it in the morning when the fruit is wet, 23.4 % harvest their produce in the afternoon when the fruit is dry and another 2.6% do it in the afternoon when the fruit is wet (Table Five).

Table Five: Time of the day in which passion fruit harvesting is done by the farmers in Soy and Kapsaret Sub counties in Uasin Gishu County

			Morning when fruit dry	Morn is fruit wet	Afternoon when fruit dry	Afternoon when the fruit is wet	Total
Sub county	Soy	Count %	21	7	9	1	38
		within Sub county	55.3%	18.4%	23.7%	2.6%	100.0%
		% of Total	27.3%	9.1%	11.7%	1.3%	49.4%
	Kapsaret	Count %	13	16	9	1	39
		within Sub county	33.3%	41.0%	23.1%	2.6%	100.0%
		% of Total	16.9%	20.8%	11.7%	1.3%	50.6%
Total		Count %	34	23	18	2	77
		within Sub county	44.2%	29.9%	23.4%	2.6%	100.0%

Discussion

Evaluation of farmers knowledge on Passion fruit harvesting, postharvest handling and storage principles

The survey on the two sub-counties indicated that farmers harvested their fruits on a diverse range of colour maturity indices which could

compromise the quality and shelf life of harvested produce. Some fruits and vegetables are best harvested when fully matured and still in the green stage, matured fruits stay longer as they ripen gradually while those that are already ripe will have a short storage life (Harvey, 1978). Very often it has been stated that fruits that are harvested earlier will have an unripe flavour (Campbell and Knight, 1983).

Studies have shown that harvesting of fruits should be done as carefully as possible to minimize mechanical damage such as bruises, scratches and punctures to the produce (Muhammad *et al.*, 2012). That half of interviewed farmers during harvest detach their produce leaving attached a stalk of about 5cm long is good. However, the fact that another half of farmers does it otherwise with detachment at the fruit shoulder and when the fruit has fallen to the ground suggests that a good amount of the produce loss is due to fruit bruises when they fall to the ground. When fruits are also detached close to the fruit shoulder, it may result to wounding and bruises on the skin which may accelerate transpiration loss of water and could also create openings for entry of disease causing pathogens (Tingbani, 2012). The survey exhibited a mixed reaction on mode of storage; most farmers stored their produce under prevailing weather conditions while a few of them stored them under some kind of modified environment and / or both. It has been said that modified atmosphere packaging (MAP) and coatings such as use of wax is desirable for yellow and purple passion fruit. The observed response is a good indicator that most farmers are not aware of modern storage technologies that are there to enhance shelf life of produce. There was varied responses as to the time of the day when harvesting should be done. It is recommended that fruit harvesting be done in early part of the morning when the fruit is dry or late hours of the day when it is cool. At that time, the temperatures are normally low and the rate of respiration and transpiration of the produce is low (Muhammad *et al.*, 2012). The surface of the produce should be dry or

be dried immediately as passion fruit should not be harvested when wet as this will encourage development and spread of disease (Ministry of Fisheries, 2004).

Conclusions

Most of the farmers in Uasin County have entered into passion fruit production enterprise without proper passion fruit postharvest handling knowledge. Slightly above half of the interviewed farmers harvested their produce at the recommended colour maturity stage. In addition half of the interviewed farmers harvested their produce leaving attached a 5 cm long stricture. Almost half (44%) of the farmers harvested their produce in the early part of the morning when it is dry while about 20% stored their produce under modified atmosphere conditions.

Recommendation

Farmers are encouraged to embrace new harvest and postharvest handling technologies if they are to reduce Passion fruit postharvest losses.

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