

Assessment of Quality of Clove (*Eugenia caryophyllus*) Produce: A Case Study in Ukuwela Secretariat Division of Matale District

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ABSTRACT

The objectives of the study were to assess quality of clove produce at the producers' level and to suggest appropriate measures to improve quality.

A questionnaire survey was conducted to collect data on the practices contributing to the quality of clove. Sixty farmers were randomly selected, 20 from each Agrarian Services Center areas: Tenna, Elkaduwa and Ukuwela of the Ukuwela Divisional Secretariat Division. A clove sample of 300g was collected from each respondent to assess physical quality parameters against the specifications formulated by the Sri Lanka Standard Institution.

One third of the respondents have produced grade 1 produce while 53% have produced grade 2. The rest (14%) has produced grade 3 quality produce. The variables: method of drying, sieving of baby clove and extraneous matter and type of labor used for clove harvesting have a significant effect on the quality of clove produce. The clove produce examined are in conformity to the SLSI standards with respect to content of baby clove and khuker clove. However, the extraneous matter and moisture content were excessively high in grade 2 and 3. The color of all three grades was unsatisfactory. Use of artificial dryers and drying of clove produce on mats are possible options for improving drying and enhancing color. All clove grades have a considerably higher proportion of damaged buds ranging from 15-30% indicating an undesirable situation. Careful handling is needed to minimize this defect.

It is also important to revise the existing quality standards for clove produce by introducing additional parameters such as maximum permissible percentage of damaged buds by mass (preferably less than 10%) and mother clove percentage by mass.

KEYWORDS: Baby clove, Drying, Grading, Khuker clove, Quality

INTRODUCTION

Export Agriculture Crops (EAC) has emerged as a prominent sector in the economy of Sri Lanka. The EAC contributes 2% to the Gross Domestic Product (GDP). The important crops in this group are: cinnamon, black pepper, clove, nutmeg, cardamom, vanilla, coffee, cocoa and essential oil producing crops such as citronella and lemongrass.

Clove (*Eugenia caryophyllus*) is an evergreen tree belongs to family Myrtaceae and genus Eugenia. It is mainly grown in Kandy, Kegalle, Matale, Kurunegala, Ratnapura and Nuwara Eliya districts. The total clove extent in Sri Lanka is approximately 10700 hectares (Anon, 2003). The total quantity of clove produce, as clove buds, exported during 2003 was 1615.7 mt valued 539.7 million rupees (Anon, 2003).

Clove is grown to an elevation of about 1000m mean sea level. Well drained loamy soils rich in organic matter are more suitable for clove cultivation. Suitable temperature range is 20° C to 30° C and an annual rainfall of 1750 to 2500mm is also required. Dry periods alternate with moist ones are needed for successful flowering (Anon, 2002).

Main harvestable part of clove is unopened flower bud. It is used to extract clove bud oil, use as a spice in domestic culinary purposes and in the industrial manufacture of sauce and pickles. Clove bud oil is used for pharmaceuticals industry, flavoring and perfumery industries. Sri Lanka has exported

1.3mt of clove oil in 2003 and earned 4.6 million rupees by exporting the same (Anon, 2003).

Clove produce has good keeping quality in comparison to other EAC. Once produced properly, clove produce can be kept for long period even years. This healthy situation allows farmers to store their produce until clove prices become favorable.

It was found that cost of harvesting and processing has increased in the recent past which accounts for half of the cost of production (Narampanawe and Seneviratne, 1995). According to the same scholars, irregular bearing and difficulties in drying also have caused to decrease income of the clove producers. These unhealthy situations can be overcome by increasing quality of clove produce to fetch higher prices in the local and the international markets.

The objectives of the study were to assess quality of clove produce at the producers' level in Ukuwela Divisional Secretariat Division and to suggest appropriate measures to improve quality.

METHODOLOGY

Sampling

Among the clove growing areas of Sri Lanka Matale has the third largest cultivation extent (1132 ha). The main clove growing area in Matale is Ukuwela Divisional Secretariat Division having 355 ha of clove lands (Anon, 2003). Ukuwela division has three Agrarian Services Center areas: Tenna,

Elkaduwa and Ukuwela where clove is more or less equally distributed among these three divisions. Sixty clove growers, 20 from each Agrarian Services Center area was selected randomly for the study. Secondary data maintained at the district office of the Department of Export Agriculture and respective Agrarian Services Centers were used for the selection purpose.

Data Collection

A questionnaire survey was conducted to collect data with respect to processing practices of clove from March to September 2006. The questionnaire had both closed and open-ended questions. The questionnaire was aimed at collecting information on the practices directly contribute to quality of clove produce such as separation of small buds, removal of stalks and removal of extraneous matter (winnowing). It also looked at the quality related attributes such as type of labor used for clove harvesting and drying methods.

The questionnaire was pre-tested using 10 clove growers similar to survey group from the study area and made adjustments to the questionnaire in order to improve the clarity of questions.

Assessment of Quality

The specifications formulated by the Sri Lanka Standard Institution (SLSI) were used to determine quality of clove samples collected during the study. The SLSI standards have four main quality parameters: Khuker cloves maximum percentage by mass, clove below 10mm length (baby clove) maximum percentage by mass, extraneous matter maximum percentage by mass and moisture maximum percentage by mass (Table 1).

In addition to the specifications laid down in the SLSI standards, percentages of clove buds without petals due to damage and blossomed clove (mother clove) were also determined since the presence of these two forms of inferior produce lowers the quality of clove produce. It is generally accepted that the contents of damaged buds and stalks should be below 10% and 2% respectively.

Table 1 - Sri Lanka standard specifications for clove:

Parameter	Grade 1	Grade2	Grade 3
Khuker clove % by mass	3	5	10
Clove below 10mm % by mass	15	25	Not applicable
Extraneous matter % by mass	1	2	3
Moisture % by mass	12	12	14

Source: Sri Lanka Standard Institution

Insufficiently dried and fermented cloves are soft and pale brown with a whitish mealy appearance are called khuker clove. Extraneous matter includes dust, stones, pieces of stalks and stems, floral parts such as dried petals, stamens and anthers.

At the time of questionnaire survey, samples required for the determination of quality were also collected from each respondent. Initially 600g of representative clove sample was obtained from a respondent. The sample was reduced to 300g by 'corning and reducing' method. The 300 g sample was divided into three equal samples, 100g each and used in the determination of quality. The mean value of three samples was taken for each quality parameter.

No.6 sieve was used to separate small clove buds and dust particles. Khuker clove, damaged cloves (without petals) and blossomed cloves were hand picked. The weight of these forms of clove produce was taken and percentage by mass was calculated.

Hundred buds of clove was taken and bent to observe how they were broken (snap test). Those buds that were broken easily without bending were considered sufficiently dried. Their percentage was calculated against the sample weight.

One desirable characteristic given by the SLSI is color of clove produce. Light brown or golden color is said to be superior to dark brown or black color in determining clove prices. Color of clove grade was assessed against the chart on visual characteristics of EAC grade developed by the Department of Export Agriculture. Light brown clove produce was grouped as grade 1 while dark brown produce in grade 2. Black color produce were categorized in grade 3.

The Ordered Logistic Regression (OLR) model was used to determine the factors affecting quality of clove.

Determination of Clove Grades

When all four parameters in the SLSI were satisfied, the samples were included in grade 1. When the parameters: baby clove percentage, khuker clove percentage and moisture percentage were satisfied the samples were grouped as grade 2. It was assumed that the results of the snap test should be more than 50% for the inclusion of produce in the grade 2 clove. The rest was categorized as grade 3 clove.

RESULTS AND DISCUSSION

One-third of the respondents has produced grade 1 clove. The highest proportion of respondents (53%) have produced grade 2 clove whereas the rest (14%) has produced clove belongs to grade 3. Grading has been done by 64% if weather permitted.

However, their grading practices were confined to separation of baby clove and removing of dust and other extraneous matter. It is also interesting to note that grading was done by 20% of respondents during rainy seasons due to inability of carrying out drying operations.

Characteristics of Clove Grades

Grade 1 Produce

The baby clove percentage in the grade 1 was approximately 8% that was below the recommended value indicating a desirable situation (Figure 1). This situation can be attributed to harvesting of clove at appropriate maturity. The extraneous matter content was below 1% and was acceptable. Khuker clove was not present in the grade 1 sample possibly due to separation of this inferior produce or drying the produce without delay. The results of the snap test were 100% indicating produced were well dried.

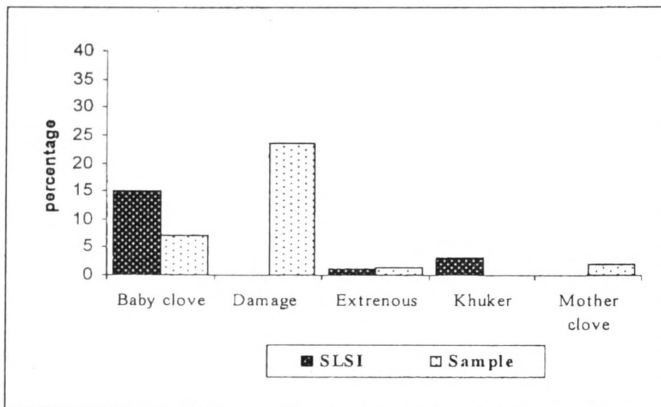


Figure 1 - Distribution of characteristics of grade 1 Clove produce:

Surprisingly a higher proportion of damaged buds without petals were observed in grade 1. Even though it was not mentioned in the SLSI standards, it is generally accepted that the damaged bud percentage should be below 10%. It was found that some traders did not concern about the damaged clove fraction whereas the others reduce clove prices according to the percentage of damaged clove. This behavior of traders seemed to be purely on their discretion. Inclusion of a higher proportion of damaged buds will result in the reduction of income gained by the clove producers. Excessively higher proportion of damaged buds restricts selling of clove produce as either special grade or grade 1 indicating an unsatisfactory situation.

Occurrence of higher amount of damaged buds may be attributed to way of separation of buds from the flower stalk. The usual way of separation is removal of buds with gentle hand pressure. This practice is usually done by experienced women-workers. Thereby chances of damaging to buds are reduced. However, it was found in the recent times that crushing of clove produce was done in order to speed up primary processing operations by some large farmers, who owned approximately five acres in major clove producing areas. Then sieving was done to remove twigs and large stalks. Applying of pressure during crushing caused to damage flower petals. Small portion of opened buds (mother cloves) was also included in grade 1 would not deteriorate its quality. It was worth mentioning that SLSI

specifications have not taken into account of the occurrence of mother cloves.

Grade 2 Produce

The baby clove content of grade 2 was also well below the recommended level reflecting the fact that crop has been harvested at correct maturity (Figure 2)

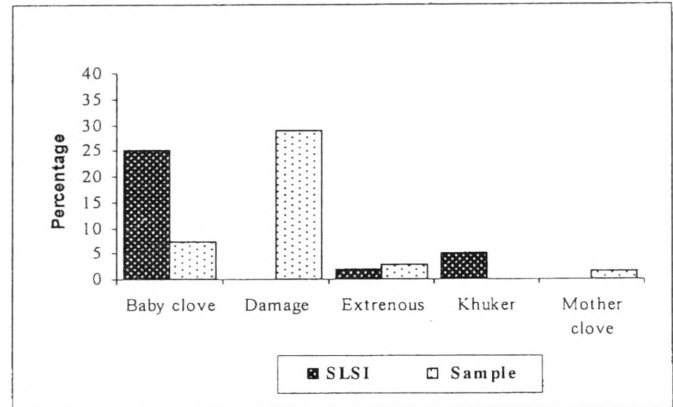


Figure 2 - Distribution of characteristics of grade 2 Clove produce:

However, the extraneous matter content has exceeded approximately by 1% of the recommended value (2%). The stalk content shares 1% of extraneous matter. The permitted stalk content is 2%. These stalks could have been hand picked to reduce extraneous matter content of the grade 2 produce to upgrade its grade. The result of snap test was 58%. This implies inadequate drying of the produce (42%). Prolonged drying, failure to mix the raw produce during drying and mixing of dried and partially dried products together may also have attributed to insufficiently dried products. In grade 2 the content of damaged clove was notably high (30%) and precautions have to be taken to minimize this inferior fraction of clove produce.

Grade 3 Produce

The production of grade 3 clove was comparatively low (14%). The defects found in grade 3 were: a large proportion of damaged buds and extraneous matter exceeding the recommended level (Figure 3).

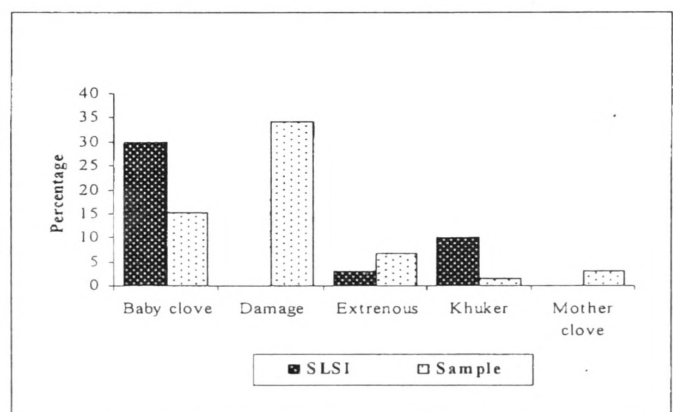


Figure 3 - Distribution of characteristics of grade 3 clove produce:

Extraneous matter content has exceeded nearly by 3% indicating an unsatisfactory situation. Among the extraneous matter dust, sand, petals, stamens, anthers, stalk and other spice produce such as black pepper seeds and cardamom capsules were visible.

This failure can be linked to way-side drying, non-use of raised platforms for drying purpose and mixing of other spice produce while drying or storing. By winnowing most of the extraneous matter could be removed. The stalks were predominant in the extraneous matter portion. The stalk content was high (2.53%) exceeding the acceptable level of 2%. This situation can be avoided by removing stalks at the time of grading. Hygienic drying can reduce the other substances in the extraneous matter.

The damaged bud content was comparatively higher than the grade 1 and 2. Careful handling can reduce this portion to an acceptable level. Approximately 3% of mother clove was found in grade 3. This situation may be averted by removing opened buds and adhering to the correct harvesting stage. The result of snap test was 38% indicating the proportion of inadequately dried clove was 62%. This defect can lead to infection of moulds and infestation of insects thus reducing storage period and quality of produce. However, mould growth was found only in three samples. This healthy situation can be linked to low storage periods. It was found that storage periods were fallen: below one week (35%), below one month (50%) and more than one month (15%).

Color of Clove Produce

The color of the different grades was determined according to the color chart and results presented in table 2.

Table 2 - Distribution of different color produce (percentage) in three grades of clove:

Grade	Light brown %	Dark brown %	Black %
Grade 1	30	70	Nil
Grade 2	20	80	Nil
Grade 3	38	50	12

Color is an important quality determinant of clove since sorting out of special grade from grade 1 is done according to the color of the buds. The special grade or fancy grade includes clove buds of bigger size, light brown in color without any damage. Special quality clove is also called hand-pick quality clove since sorting is done manually by experienced sorters. The special grade is marketed in the super markets of the developed countries and fetched the highest price.

Though the grade 1 produce identified in the study rich with the required quality attributes it is

deficient in the required color standards (table 2). Therefore, opportunity for grading as the special grade is lost. Similarly grade 2 and grade 3 produce also lack of desirable light brown color to be marketed as quality grades in sophisticated markets.

The results revealed that the color of clove produce has to be improved. The undesirable dark brown buds and black color buds are due to weakness in drying such as drying of raw materials directly on cement floors and on polythene sheets, prolonged and insufficient drying and fermentation of harvested crop before it is dried. It was found that nearly half of the respondents have used cement floors or polythene sheets for drying of their clove leading to the end products of black color. It was detected through snap test that produce in grade 2 and 3 have high moisture content (approximately 50%). This situation has a bearing with the dark brown and black color produce of clove. Therefore, adequate drying using mats is required to improve color.

Factors Affecting Quality of the Clove Produce

The statistical analysis revealed that the variables: method of drying, adoption of sieving for separation of baby clove and extraneous matter and labor used for clove harvesting have a significant effect on the quality of clove produce (table 3).

Table 3 - Factors affecting significantly on clove produce:

Factor	Estimate coefficient	Level of significance
Intercept	0.23	0.039*
Type of labor used for harvesting	0.83	0.022*
Mode of drying	0.84	0.019*
Adoption of sieving practices	1.17	0.049*

Likelihood ratio: <0.0001. * denotes statistically significance at 0.05 level.

Those who used mats (50%) for clove drying have got significantly higher quality produce. As previously described, the reason for quality improvement is enhancement of light brown color by using mats for drying.

Separation of small buds and extraneous matter (64%) also has significantly influenced the quality of clove produce. This is obvious since these practices directly improve quality attributes stipulated in the SLSI standards.

The labor used for clove harvesting belonged to hired labor (63%), the grower himself (25%) and school children as part-time harvesters (12%). It was found that the hired laborers contributed significantly to the quality of clove. The possible reason may be their skillfulness on the job.

CONCLUSIONS

The clove produce examined from Ukuwela Divisional Secretariat Division conform to the SLSI of all three grades was unsatisfactory. In order to improve quality of the produce, sieving and winnowing practices and drying operations have to be improved. Use of artificial dryers is a possible option for improving drying and enhancing color.

It was also revealed that all clove grades have a considerably higher proportion of damaged buds ranging from 15-30% indicating an undesirable situation. When the amount of damaged cloves is higher the attractiveness of the produce is diminished. Besides, the detached petals and floral parts contribute to the increase of extraneous matter fraction. More importantly the opportunity for the inclusion in the special grade and grade 1 is restricted. Therefore, careful handling is needed to minimize this defect. Crushing of raw materials to facilitate separation of buds from the stalks has to be stopped.

It is also important to revise the existing quality standards for clove produce by introducing additional parameters such as maximum permissible percentage of damaged buds by mass (preferably less than 10%) and mother clove percentage by mass. The revised quality standards would upgrade the existing quality of clove.

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