



Traditional Methods of Milk Processing and Preservation by Local Farmers in Kashongi Sub County Kiruhura District

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Abstract: This study was carried out to analyze traditional methods of milk processing and preservation by local farmers in Kashongi Sub County Kiruhura district. Milk producers in Kashongi Sub County own small and widely scattered farms, making access to markets a big challenge, given lack of well-developed infrastructure. Substantial amounts of milk remain at the farms, justifying preservation to avert total wastage. The study established the methods, equipment and materials used by the local farmers in milk processing, established the effectiveness of milk preservation methods used in the sub county and identified the possible areas of improvement on milk processing in the sub-county. The research design was descriptive in nature and therefore used qualitative methods to analyze the magnitude of the problem. It was partly quantitative because the findings were tallied, tabulated and calculated to percentages. A total of 160 respondents was targeted for this study. The category of the respondents that was selected are specifically cattle keepers, who have reared cattle for a long time. This category of people were selected because; they have reared cattle for a long time and know many aspects on the cow. Cattle keepers were specifically used because they directly deal with cattle products. The study findings revealed that quite number of local methods have been used to store, process and preserve milk. Some of these include; natural air cooling, boiling, traditional vessels like wooden churn and gravitational among others. These methods were used because they were favored these farmers. Focusing on Kashongi Sub County, these methods are widely used to preserve and store milk. However these local methods are not in line to preserve milk for long hours, and days, it is well known that these methods cannot go three to four days of preservation. Some strategies like provision of modern processing equipment, extension of agricultural services to train farmers on how to improve on handling milk should be provided by the government. Dairy products that can be manufactured by small scale dairies include fermented milk (Bongo - similar to yoghurt) and ghee. Some technologies for their improvement have been adapted to suit local conditions and some of the modified processing techniques have been tried successfully in Kashongi Sub-County areas to some farmers.

Keywords: Traditional Methods, Milk Processing and Preservation, Increase Shelf Life, 'Low Input-Low Output' Approach to Maximize Production and Minimize Losses

1. Introduction

1.1. Background

Milk is almost sterile when secreted from a healthy udder. The natural inhibitors in milk for example lactoferrin and lacto peroxidase prevent significant rises in bacterial numbers for the first three to four hours after milking, at ambient temperatures. Cooling to 4°C within this period maintains the original quality of the milk and is the method

of choice for ensuring good-quality milk for processing and consumption. Cooling can be achieved by mechanical refrigeration or cooling tanks. Cooling facilities are expensive for small-scale producers in developing countries and can usually be afforded by only large-scale dairy enterprises. However, in areas with high concentrations of small-scale dairy operations, milk cooling centres can

represent a valid solution for cooperatives of small-scale producers (Journal of dairyscience.org. Retrieved 2014-05-23).

According to the Journal of dairyscience.org. Retrieved 2014-05-23, in some parts of developing countries, refrigeration is not feasible because of the high initial investment and running costs and technical problems, including the lack or unreliability of an electricity supply. Options for lowering temperature and/or retarding the growth of spoilage organisms include boiling the milk immediately after milking, partially immersing the milk containers in cool water (for example streams), and using the lacto peroxidase system. This last option is a Codex Alimentarius-approved safe and natural system of raw milk preservation. Lacto peroxidase is an enzyme that is found naturally in milk and that acts as a natural antibacterial agent. It is recommended that only trained people at collection points use the lacto peroxidase system; it is not intended for use by milk producers and should not replace pasteurization. The lacto peroxidase system of milk preservation extends the shelf-life of raw milk by seven to eight hours at 30°C.

When the milk can be cooled to between 15 and 20°C, the lacto peroxidase system allows overnight preservation of the evening milk, and thus the collection of milk only once per day, which reduces milk losses related to collection logistics and collection costs.

1.2. Statement of the Problem

Milk production in Uganda is characterized by a 'low input–low output' approach. This is characterized by low levels of capital input and low yields there from. As we move to high input high output, we need to innovate along the dairy value chain to maximize production and minimize losses.

Western Uganda is characterized by cattle keeping as the main economic activity. Cattle keepers in Kashongi Sub County just like in many parts of Kiruhura District, own small and widely scattered farms, with poor road and power infrastructure. Access to markets is a big challenge and milk spoilage and wastage are real possibilities. For that matter, quite a number of local methods have been used to store, process and preserve milk including; natural air cooling, boiling, traditional vessels like wooden churn and gravitational among others. Kashongi Sub County dairy farmers use predominantly, these methods. However these local methods are not highly recommended to preserve milk for long hours, and days, it is well known that these methods cannot preserve milk for three to four days before it gets spoilt. It is therefore against this background that the researcher decided to establish the traditional methods of milk processing and preservation by local farmers in Kashongi sub county Kiruhura district.

1.3. Objectives of the Study

The research was guided by the following research objectives;

To establish the methods, equipment and materials used by

the local farmers in milk processing.

To establish the effectiveness of milk preservation methods in Kashongi sub-county.

To identify the possible areas of improvement on milk processing in Kashongi sub-county.

1.4. Justification of the Study

It is hoped that the findings of this study may be useful in the following ways among many others;

The findings may help the policy makers especially the local leadership, Ministry of Agriculture Animal Industry and Fisheries and Dairy Development Authority in ensuring that they apply the best mobilization methods for local farmers to ensure dairy value chain through preservation that ensures maximum gains.

The findings have brought to light the challenges local farmers face in getting profits out of dairy farming. This may be useful in proposing strategies to overcome such challenges.

The study findings may also contribute much to the existing body of knowledge about milk preservation and dairy production. This may be useful to the academicians who may wish to carry out further studies on dairy development, making profits out of dairy farming, doing dairy farming as a business or any related field.

2. Materials and Methods

Table 1. Showing milk preservation methods.

Methods used	Frequency	Percentage
Heating	72	45
Churning and separation	51	32
Fermentation	37	23
Total	160	100

Source: Field data (2014)

According to Table 5 above, the highest number of respondents 72 representing 45% used Heating process, 51 respondents representing 32% used churning and separation, while 37 respondents representing 23% used fermentation process. With heating, the milk is boiled by the local farmers in order to keep it safe for consumption. For churning the milk is kept in traditional vessels in local language called Ebyanzi (Gourds) which are well treated with smoke after removing the old milk. These vessels preserves milk for eight to ten hours under cool environment of around 40c, but for the local farmers they keep these vessels with milk under grass thatched huts.

Cooling here is where the farmers use natural air and create cool environment and paint white colour on the walls of small grass thatched houses. This helps in reflecting heat from the side hence creating a cooling environment for storing milk.

Fermentation of milk is where milk is allowed to ferment naturally without addition of starter culture. Milk is accumulated over a number of days in pot vessels of 2-4 litres volumetric capacity or a bottle gourd and allowed to

develop acidity up to 1% lactic acid. In cold weather, the container is kept near the fire to keep it warm. Soured milk (Bongo) is consumed as a side dish. If not consumed, sour milk is only 72 hours at ambient temperature. The

disadvantage of this type of milk is that since it is not boiled there is always danger of people contracting diseases like Tuberculosis (T. B)



Fig. 1. Showing how a wooden Guord is cleaned.

In Fig. 1 the researcher was shown how a milking gourd is cleaned and preserved. The farmer clearly explained how the guard is preserved with smoke from the smoking unit known as Ekyicunga using thatching grass stems. Here women collect thatching grass stems and leave them to dry.

After drying, they use them as fuel to produce smoke, they insert these grass stems in smoking unit called ekyicunga there after they invert wooden gourds on smoking unit. Then the farmer narrated the following steps when treating a milking gourd. The farmer got a dry milking gourd, the farmer turned the gourd upside down, and the farmer fixed the outlet of the milking gourd on the outlet part of the smoking unit, The farmer kept on removing the gourd slowly

from the smoking outlet to check whether the smoke had occupied the whole inside of the milking gourd, This smoke helped in killing germs and bacteria that could be available and it added a nice flavor in the gourd, The farmer then cleaned the milking gourd thoroughly and smeared it with a well-treated ghee, The farmer then kept a well-treated and cleaned Gourd on a raised rack unit called Orugyegye for the next use.

Separation is where by when the milk cools it forms cream which has to be removed in order to maintain clean milk; Respondents explained that Separation process is the removing of cream from the actual milk to keep it clean.



Fig. 2. Showing separation of cream from milk.

Whereas these processing methods were used by local farmers in Kashongi, they had the durations at which milk

can go bad as shown in Table 6 which illustrates each process and its duration.

Table 2. Showing milk processes.

Process	Duration time of each process	Reason for each duration
Heating	24-48 hours	99% of the bacteria and germs are destroyed.
Churning	6 Months	The outcome product which is ghee has a long shelf life.
Fermentation	72 hours	Here the farmer is interested in accumulation of bacteria in order to turn milk into the required product. Beyond this, the coagulation of milk will be at maximum which is not good for consumption.
Separation	12 hours	The farmer is interested in the formation of cream on fresh milk for collection later
Cooling	12 hours	There is no chance for multiplication of bacteria in milk.

Source: Field data (2014)

From Table 2 and how the respondents answered about the process used, the duration of each process and the reason advanced by these farmers for the duration

Various methods were revealed to be preferred most to others and the reason why they were preferred by the majority. Other respondent's preferred heating or boiling to other methods because heating kills 99% of the bacteria and germs. It also requires cheap materials and is very convenient to every farmer. In so doing many diseases such as Tuberculosis and whooping cough are prevented. Heating

also removes bad odor from milk and creates a good flavor while it is consumed. It was regarded as the cheapest method which is afforded by everyone. It was also noted that heating process allows milk to last for long hours when the process is repeated over and over again.

Nevertheless the respondents were able to tell that other processing methods also have advantages and disadvantages. In the Table 7 below the farmers were able to show each method used, its advantages and the disadvantages.

Table 3. Advantages and Disadvantages of milk processing methods used by farmers in Kashongi.

Method	Frequencies	(%)	Advantage	Disadvantage
Heating				
Churning, Separation	88	55	Milk is turned into a product which can stay longer. It can even give two products that is ghee and whey (Amachunda) Dirt is separated from clean milk	High risks of getting Tuberculosis Milk still Contain dirt Some cream can be contaminated most especially when it is in contaminated environment or un covered containers.
Fermentation, Cooling	72	45	Allows the accumulation of bacteria which is important for the formation of the product. Milk remain at normal temperatures and there is no multiplication of bacteria.	High risks of getting Tuberculosis The products need to be consumed in a short time. Some nutrients can be inactive like proteins if somebody consumes it.

Source: Field data (2014)

In relation to the above methods, the researcher found out that methods like heating and separation were far better than others because they have low risks of disease transmission compared to others. Findings also show that the heating process method is highly ranked compared to any other method of preservation because with heating it kills 99% of the germs that could make the milk go bad and it can allow milk to have long shelf life.

2.1. Magnitude of Milk Spoilage in Kashongi Sub County

On the quantity of milk each respondent produced many farmers did not have proper records of their milk production per day. However the findings from those who kept records are presented as in Table 8 as below;

Table 4. Average milk produced by each respondent per day.

Litres	Frequencies	Percentage
60 Litres of milk	40	25
45 Litres of milk	40	25
120 Litres of milk	32	20
25 Litres of milk	48	30
250 Litres of milk	160	100

Source: Field data (2014)

According to table 4 above, 250 liters were recorded to having been produced per day in the parishes of Kashongi sub county where by 25% of the respondents collected 60 liters a day each, 25% of the respondents produced 45 liters per day each, 20% of the respondents collected 120 liters of milk a day each and 30% of the respondents gathered 25 liters of milk per day each.

Farmers were asked the causes of milk spoilage and the details are shown in table 9 below;

Table 5. Showing causes of milk spoilage.

Causes of spoilage	Frequency	Percentage
Dirty Milking containers	58	36
Dirty transporting materials like cans	38	24
Poor collecting Centres	40	25
Diseases like Mastitis	24	15
Total	160	100%

Source: Field data (2014)

According to Table 9 above, the biggest percentage (36%) indicated dirty milking containers to be the major cause of milk spoilage, 24% indicated dirty transporting materials like

cans to be the major cause of milk spoilage, 25% indicated poor collection centres to be the major causes of milk spoilage while 15% indicated diseases like mastitis.

However, the respondents were able to explain some facts about milk spoilage. The analysis shows that all the 160 respondents (100%) indicated that they had experienced milk spoilage levels which were brought about by a number of mistakes in handling milk.

Signs of Milk Spoilage

Farmers indicated that they observed that milk went bad

and therefore was spoilt by observing the following;

The milk changes color from white to brownish or may contain blood spots (89%), The milk becomes watery (76%), It changes odor to an unpleasant smell (59%), The milk becomes more coagulated (61%), It changes taste from sweet to sour (41%).

On how much milk was lost per month, respondents revealed that they do not always keep these records since it normally came as an accident.



Fig. 3. Showing a local processing Centre where local processing materials are kept.

Fig 3, it shows the local processing materials placed on a locally made semicircular pavement locally known as Orujeje. This is where the processing materials are kept. The black materials which the researcher is holding are called milking gourds commonly known as Ebyanzi. These help in

storing milk. Then the medium brown calabashes are known as Churns (Ebirere) where whey (Amachunda) is stored after separating it from butter. Then the bigger brown churns at the corner are commonly known as (Ebishabo) which are used for churning milk.



Fig. 4. Showing how to churn milk.

Fig. 4 shows how one holds the churning calabash (Ekyishaabo) when churning milk. Here the researcher tried to churn the milk himself. In the local language churning

milk is called (Okuchunda). This kind of milk processing is done to get other products like ghee (Amajuuta) and whey (Amachunda).



Fig. 5. Showing a coke used to cover the milk churn.

Fig. 5 shows the researcher holding a coke commonly known as (Omuhaiha) which is used to cover the churning calabash during churning. This cover is made from wild finger millet flower stalks. The churning person keeps on

removing the coke to reduce the pressure from the churning calabash. The churning person removes the coke slowly such that milk does not spill over the churning calabash due to increased pressure.



Fig. 6. Showing how products are got after churning.

At this level in Fig. 6, the churned milk is ready to produce different products. After churning, products like whey (Amachunda) was the first product from churned milk. It can be consumed within 24 hours after its production. Then ghee is the next product to be got. In Fig. 6 foreground is a white bucket and a small brown calabash. The white bucket is where ghee product is extracted from. Ghee is a long lasting product which lasts for up to 6 months. The small brown

calabash commonly known as (Ekyirere) is where whey is extracted and stored. So at local level the above mentioned products are the ones which are commonly got out of milk. Other products made at local level are yoghurt and ghee.

On whether farmers were involved in local processing of milk, all the 160 respondents (100%) from all the parishes of Kabushwere, Mooya, Rwanyangwe and Rwenjuba specifically 40 respondents from each parish, indicated that

they are involved in local processing of milk and have benefited from the processing method mentioned. The respondents explained to the researcher what they benefited from the process as follows.

Products like ghee act as a source of income to the local farmers. So they were able to earn a living from milk products.

The products act as food stuffs: Products like, ghee, whey and yoghurt act as a source of food to the local farmers.

Products like Ghee were used as preservatives for their processing equipment like Ebirere, Ebyanzi, Ebishaabo and Ensimbo. Farmers smear these equipment with ghee to prevent them from depreciation some farmers even use ghee as body oils.

2.2. The Need for Farmers to Be Provided with Modern Processing Machines

All the respondents interviewed reiterated the need for improved technology in processing their milk and getting other products. The respondents noted that they are aware of the modern technologies in milk processing as indicated in Fig. 7 below showing milk processing machine which the farmers wish to be provided with by the government. The modern materials included the following; cooling plant, filter lactometers, buckets permanent house to accommodate all materials to use and skilled labour is shown in Fig. 7



Fig. 7. A milk processing machine.

Fig. 7 above shows a modern milk processing plant/machine in one of the trading centre in Rwenjuba parish which consisted of cooling machine, modern milk cans which they use in transporting milk to collecting centre

and stainless pails which each hold 20 litres. The skilled personnel were testing milk before putting it in the cooling machine and stainless funnel, this helped to hold milk when filling the cooling machine.

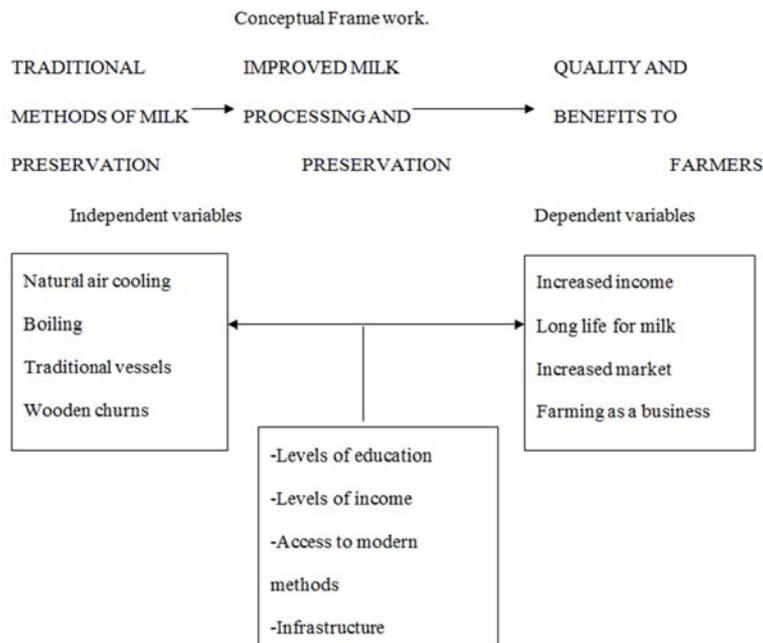


Fig. 8. Source: Formulated by the Researcher (2014).

Farmers in Kashongi sub county are using traditional methods of milk preservation like natural air cooling, boiling, traditional vessels like wooden churn and gravitational among others. However if these farmers were able to adopt improved technology and preservation methods like using power coolers, transporting milk in refrigerated cars and using pasteurize, they would be able to produce quality milk that can be stored for longer periods, give them increased income, be able to attract market and thereby making farming a business that can employ them. In reviewing literature, materials were drawn from secondary sources for the researcher believed that any relevant literature irrespective of the place or time could still be substantial to form a basis for this study. An attempt was however made to fill the research gap between the past writers and the present situation.

2.3. Data Analysis

For Quantitative data analysis, the responses of the subjects were categorized in frequency counts and score tables. A computer programme called SPSS was used to enter data on close ended questions out of which percentages were generated. Interpretations and drawing conclusions was made according to the results in these tables. In qualitative data analysis, field notes from the interviews were written down during the course of these interviews. Work would be edited at the end of each day to ensure accuracy in recording of this collected data. Themes were clearly identified and put in coding categories. A scheme of analysis was worked out following these coding categories using quotations on most occurring ideas.

Data presentation and Discussions

i. Bio-data of Respondents

The study made an attempt to be gender responsive and equal number of male and female respondents was used for all respondents who filled the questionnaires and were interviewed.

ii. Equipment and materials used by local farmers in milk processing

The majority of the farmers used milking buckets as the chief container while milking their cattle. This implies that it is very appropriate for them compared to others. The reason as to why many used this type of container was that it holds large volumes of milk and many cows give quite good quantities of milk which cannot fit in the small tins and gourds. Farmers also preferred this kind of container because it can hold milk for long hours before going bad.

Milk gourds are also used by a reasonable number of farmers although these hold small volumes of milk. It was indicated that gourds store milk for long hours and the milk stored in these gourds contain good flavors because of the way they are treated. These findings are in agreement with other scholars who noted that, in some parts of developing countries, refrigeration is not feasible because of the high initial investment and running costs and technical problems, including the lack or unreliability of an electricity supply.

Milk is almost sterile when secreted from a healthy udder.

The natural inhibitors in milk for example, lactoferrin and lacto peroxidase prevent significant rises in bacterial numbers for the first three to four hours after milking, at ambient temperatures. Cooling to 4°C within this period maintains the original quality of the milk and is the method of choice for ensuring good-quality milk for processing and consumption.

Cattle keepers in Kashongi Sub County are likely to produce significant amounts of milk but cannot sell the whole produce due to poor transport facilities and infrastructures such as the roads system leading to difficulties in milk marketing in towns where potential buyers are.

Although farmers have some traditional methods for processing milk, their effectiveness is still questionable. It was established that preservation of milk using boiling/heating, high sanitary and hygienic related issues in milk marketing and keeping milk in well cleaned milk utensils, storing the milk in cool place at ambient temperature of 200 C up to a minimum of 40 C was found to be quite effective to local farmers.

iii. Magnitude of Milk Spoilage

It was important for the researcher to know the causes of milk spoilage and also establish whether they

Exist in the area of study. Milk from Kashongi Sub County is very rich in nutrients. Because of this,

Bacteria that cause spoilage easily multiply very quickly in this milk. Other scholars have noted that

Bacteria cells grow by dividing into two. If milk is stored at high temperatures for a long time then

The bacteria will grow and divide multiple and soon the milk will have a very high number of

Bacteria and thus get spoilt quickly.

From the study, the majority of the respondents agreed that some of the local traditional methods of preserving milk could improve on the shelf life of the milk, such as heating or boiling enabled them to preserve their milk for a long period of time most especially in areas studied. Also farmers found it necessary to promote churning processing of milk as their second priority of preserving their milk since churned products especially ghee could be stored for a long time. These milk products are consumed and traded locally. The findings are in agreement with other scholars who have noted that internal consumption of milk products is often in the form of liquid milk, while the bulk of international trade is in processed dairy products such as milk powder.

Milk processing Technology

According to the research findings, it was agreed that there are problems encountered among the farmers when using their local technologies of milk processing. All the respondents interviewed reiterated the need for improved technology in processing their milk and getting other products.

The respondents noted that they are aware of the modern technologies in milk processing. Other scholars have noted that simple milk processing techniques can preserve milk safely for one full year. Hence it is the only way to go if

farmers have to do dairy farming as a business and it becomes a full time employment. The simple technologies that could be used in this study area is where fresh milk is heated to a temperature of 600 C, Sugar and other flavors are added before being transferred to milk bottles. The bottles have to be thoroughly cleaned with a detergent or sand and rinsed well in hot water. Milk should be filled leaving a gap of 5cms from the bottle top. The bottles are made air tight with crown corks using a manually operated machine. After checking for leakages they are placed in an autoclave or domestic pressure cooker. The autoclave or cooker is heated to 1100 C - 1150 C under 6.5 kg pressures for 4 - 5 minutes. The autoclave is then removed from the fire and kept on the floor for cooling. The bottles are removed and stored on a shelf in a cool place. These bottles should be checked after every 2 - 3 days. If any bottle shows signs of contamination it should be removed from the shelf (precipitation or change in color). The properly sterilized milk could remain preserved for about a year under ordinary conditions.

The farmers also agitate for improvement in road transport networks, extension of rural electrification, extension of agricultural advisory services and establishment of more milk processing centres with modern machines if they are to overcome the effects of milk spoilage.

3. Conclusions

From the research findings, it was concluded that, quite a number of local methods have been used to store, process and preserve milk. Some of these include; natural air cooling, boiling, traditional vessels like wooden churn and gravitational among others. However these local methods are not well suited to preserve milk for long hours and days. It is well known that these methods cannot guarantee three to four days of preservation. Some government strategies therefore need to be explored like provision of modern processing equipment and advisory services to farmers on how to improve on handling milk. (King Alan, 2002) 8.

Dairy products that are manufactured by farmers locally include fermented milk and ghee. Some technologies for their improvement have been adapted to suit local. Conditions and some of the modified processing techniques have been tried successfully like storing this milk in bottles (caribashes). The government needs to modify these with the aim of ensuring that farmers maximize out of their milk products.

Recommendations

In line of the findings of the study and discussion made, the researcher has the following recommendations to make in order to help farmers to use their local methods of processing milk in order to minimize spoilage.

At present only a small fraction of milk produced by farmers in Kashongi sub-county enter the commercial market owing to the lack of milk collecting centers, low prices for milk and scarcity of small scale processing techniques such

as churning, heating and others. The government therefore should attract investors to the area to do milk processing that will be able to benefit these local farmers.

The government needs to speed up the rural electrification initiative such that farmers are able to acquire coolers and set up collecting Centre's where this milk can be stored before it is finally transported to the market in urban Centre's.

Also, since raw milk is highly perishable, the government and local authorities should improve on the road network so that this fresh milk can easily and quickly be able to reach the cooling and collecting centres before it is finally transported to urban centres where the market is high.

It is suggested that sponsorship should be acquired to train the small holder farmers on milk processing techniques preferably at Bishop Stuart University where there are facilities and expertise so that farmers are able to get other product out of their milk instead of selling it in its raw form.

Milk treated with, lactoferrin and lacto- peroxidase could improve shelf life of raw milk by seven to eight hours without spoilage at room temperature therefore farmers need to be educated on this technology and also make these antibacterial agents available to farmers for use. (Shallo and et al, 1973) 17

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