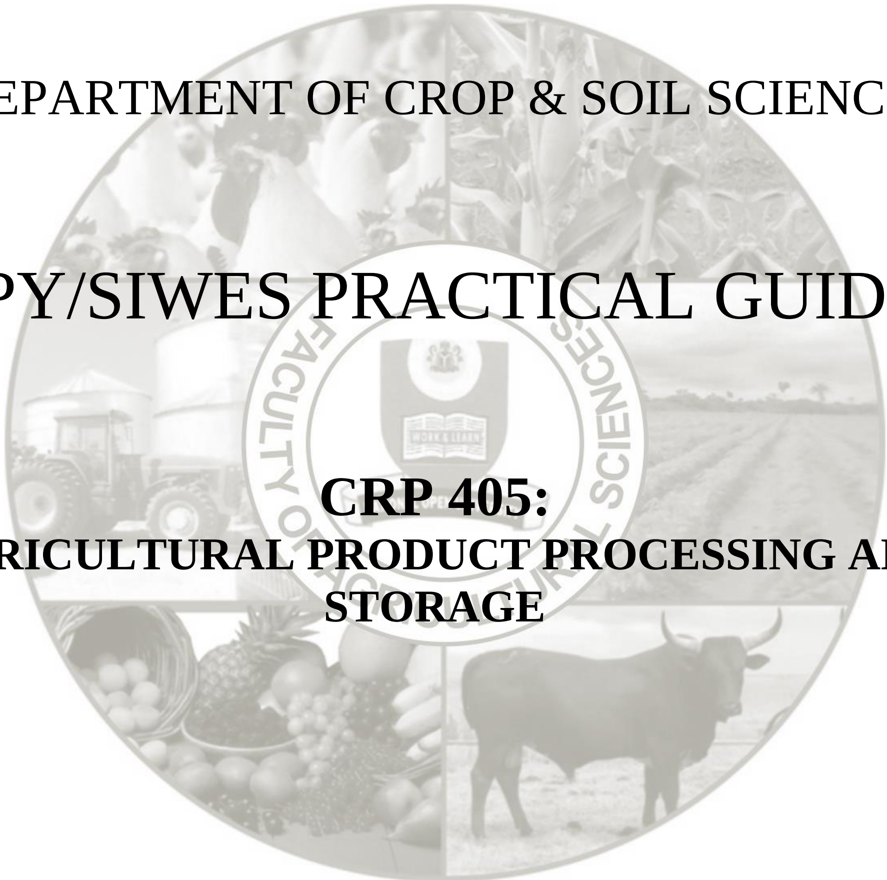
NATIONAL OPEN UNIVERSITY OF NIGERIA

FACULTY OF AGRICULTURAL SCIENCES

DEPARTMENT OF CROP & SOIL SCIENCE

FPY/SIWES PRACTICAL GUIDE



CRP 405:

AGRICULTURAL PRODUCT PROCESSING AND STORAGE

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400 LEVEL (FPY/SIWES) PRACTICAL GUIDE

CRP 405: AGRICULTURAL PRODUCT PROCESSING AND STORAGE

POST HARVEST PROCESSING

1.0 Introduction

Agricultural product processing and storage plays an important role in food and feed preservation for the continual survival of man. Through the development of modern storage facilities, food crop preservation becomes easy and simple to follow. The practical will be conducted with the aim to look into processing procedures and find possible solutions to the problems facing the students and agricultural machine operators in Agric business. Low level of mechanisation will be observed to be high in areas visited during the period of this research.

Considering the challenges of increase in human population, low yield due to pest and disease attack on cultivated crops and poor level of mechanized agricultural activities. Then product processing and storage in other to meet these necessities becomes of crucial importance. If we process and store our food crops we make it more durable, attractive and add value to it, this can go a long way in mitigating global food insecurity. Agricultural produce and by-products is an essential demand and means of survival for the world's agro-based industries, as it plays a greater role in almost all aspect of life.

Unprocessed raw materials are raw materials for the intermediate industries with processed food/consumables as the finished product. Energy use in Agriculture and food processing is high; hence, mechanization is essential to reduce the level of drudgery especially in the local processing factories and mills. Rice and oil palm processing will be discussed in details during the course of practical.
Agricultural Products processing and storage is the stage immediately following the harvest. It determines the final quality of product and it activities basically include:

- Drying
- Threshing
- Transportation
- Storage

Agricultural Processing

Agricultural Product

In Agriculture, product refers to processed agricultural produce (animal or crop) which has been turn into finish goods either for human/animal consumption or for industrial uses.

Processing

Processing in agriculture involves the biological, physical, mechanical, and biochemical manipulation of agricultural produce in other to preserve it for further use. It involves the series of operations taken to change agricultural products into a consumer-finish product.

Agricultural processing involves both scientific and traditional manipulation of agricultural produce so as to make it to be more useful and be able to store them for future uses.

Processing Techniques

These are some of the different processing techniques involved in processing of Agricultural produce. Here, different machines are used in the processing

Why We Process our Food Crops

- Processing helps to make food available even during the off-season.
- When food is processed it taste and look very attractive
- Processing helps in the durability of food crop products- when food crop is been processed like in dehydration of a food crop, micro-organisms becomes absent thereby preventing spoilage.
- Processing adds value to the agric produce.
- Processing helps in producing income to individual and foreign exchange to a country
- It creates room for commercial agriculture, thereby promoting agricultural activities.
- If we stand to process our food crop regularly, then more food will be in our food reserve which is an aid in adaptation and mitigation of climate change.
- Processing provides raw materials for further studies and for industrial uses.
- Through processing some materials are produced (by-products) which can be used for formulation of animal feed.
- The science of processing can aid in drugs and medicinal purposes
- Agric produce processing gives Income to a farmer and improve his standard of living
- When a country processes her food crops then exportation will be high, thereby improving her foreign exchange earning
- Processing provides employment for individual and the masses
- Through agricultural processing of crops like sugarcane bio-fuel and power is produce which is use for generation of farm or industrial power.
- If a processing factory is sited in a rural area, it creates development of that rural areas.

Prior to handling test materials, performing equipment setups, and/or conducting this method, testers are required to read "SAFETY AND HEALTH" in Section F of this method. It is the responsibility of whoever uses this method to consult and use departmental safety and health practices and determine the applicability of regulatory limitations before any testing is performed.

2.0 Objectives

The main objective therefore of acquiring Practical knowledge is to help in solving practical agricultural problems. Specific objectives of the Practical are:

1. Is an essential aspect of our educational set up
2. it educates youths on the impact and opportunity in the Practical and agro-business.
3. It also exposes them to vast store of knowledge available for anyone contemplating owing or managing a farm.

- This practical aim at promoting sustainable agricultural management for economic development.
- It seeks to support local food processing, in-other to improve local knowledge on agricultural mechanization.
- The practical seeks to aid food security, this is because food will betage and spoilage can be cut-down through processing.
- Looking at the amount of food produced yearly, this practical on processing will aid in conservation and re-organisation of any agricultural produce, while contributing in the development and promotion of agricultural activities.
- If greater percentage of our agricultural produce are processed then, importation of many other foreign processed food will be minimised.

- Since climate change is one of the greatest challenges to our food crop production, processing will aid in adaptation and mitigation, creating new ways in which our food crop can be properly managed.

3.0 PROCEDURE FOR CONDUCT OF PRACTICAL

Work Practice: Determination of Moisture Content

A. APPARATUS

1. Weighing device: A balance or scale sensitive to 0.1 % of the mass of the test sample, and having a capacity equal to, or greater than, the wet mass of the sample to be tested.
2. Drying device: An oven or other suitable thermostatically controlled heating chamber capable of maintaining a temperature of 110 ± 5°C.
3. Containers: Any pan or other container, that will not be affected by the drying temperature, and is suitable for retaining the test sample without loss while permitting the water to evaporate.

NOTE: A broad shallow pan is normally most suitable for promoting drying; however, containers with moisture-tight covers are required when the mass of the test samples are not determined immediately after preparation or after cooling following the drying period.

B. TEST PROCEDURE

1. Prepare a representative portion of the material to be tested.

a. Unless other amounts are specified, the following minimum test sample sizes are suggested.

Material	Minimum Sample Size
(1) Soil	100 g
(2) Fine Aggregate – nominal maximum size of 9.5 mm or smaller	500 g
(3) Coarse Aggregate – maximum particle size larger than 9.5 mm sieve.	1000 g

(4) Miscellaneous Materials (straw, chips, etc.) : Sufficient bulk to be representative

b. When testing lightweight, bulky materials, such as straw, hand pack a substantial amount of material into a suitable container having a capacity of approximately 3.8 L.

2. Determine the mass of the test sample and record this mass as the "wet mass".

a. The most convenient procedure for determining the mass of the sample before and after drying is to place it in a tared container where it will remain throughout the test. The mass of the container and sample are determined and the mass of the container subtracted.

b. If the mass of the test sample is not determined immediately after preparation, place the moisture-tight cover on the container to prevent evaporation.

3. Dry to constant mass at 110 ± 5°C.

a. The drying time required to achieve constant mass will vary depending on the type, quantity, and condition of the material. In most cases, an overnight (16 h) drying period is sufficient. Large clay lumps may require significantly longer drying periods.

b. To reduce the drying time, break lumps of material into small fragments and spread in a thin layer over the bottom of the containers. Position the containers in the drying device to allow the maximum air circulation and exhaust of the moisture laden air.

c. Constant mass has been achieved when less than 0.1 % of the test sample wet mass is lost during an additional exposure to the drying process. Subsequent drying periods to verify constant mass shall be of at least 1 h duration.

d. Verification of constant mass will not be necessary for each sample, provided the drying time exceeds the minimum time established for similar materials and conditions in the same drying device.

4. Remove the sample from the drying device and cool to room temperature. NOTE: If the mass of the test sample is not determined immediately after cooling, place the moisture-tight cover on the container to prevent absorption of moisture from the air.

5. Determine the mass of the test sample and record this weight as the “dry mass”.

D. CALIBRATION

Determine the moisture content of the test sample as follows:

1. Mass of water in sample = wet mass minus dry mass

2. Percent moisture = Mass of Water Dry Mass of Sample ´100

E. PRECAUTIONS

The drying rate of test samples will be affected by the moisture conditions and number of samples in the drying device. When wet samples are placed in the drying device with nearly dry samples, completion of the drying may be restarted.

F. SAFETY AND HEALTH

Soils and aggregates may contain bacteria and/or organisms which can be harmful to one's health. Wearing dust masks and protective gloves when handling materials is advised. The use of heat resistant gloves/mitts or pot holders to remove samples from the ovens is recommended.

4.0 CONCLUSION

By the end of this practical the students should be able to:

- The practical can help to enlighten or widen students scope on the knowledge of agricultural product, giving possible recommendations and practical advice to students, students and agricultural machine operators.
- Through this practical a student can get an ideal practical inside of different ways of preservation and their advantages and disadvantages as applied in real life.

This test is used to determine the water content of a materials by drying a sample to constant mass at a specified temperature. The water content of a given soil is defined as the ratio, expressed as a percentage, of the mass of the pore water to the mass of the solid material (or "solids").

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MILK PROCESSING AND HANDLING

1.0 Introduction

Dairy Technology is a vocational/professional course and therefore practical aspect of this course has been given greater emphasis. This practical guide is designed to supplement textbook on “Fluid Milk Processing” for XI students and is an integral part of the Dairy Technology curriculum. The exercises in this book to impart practical knowledge to the students. Practical covered in this book is the platform tests only and Schools may set up a small lab with pilot scale equipment and models. Educational visits to dairy processing plant may be arranged for the students.

2.0 Objective

Platform tests of milk are the commonly used tests carried out at collection and/or reception for rapid evaluation of quality of the incoming raw milk. These are carried out at the Milk Collection Centres and at Milk Processing Plants. This is important in dairy processing as single lot of milk of poor quality can spoil the whole mixed milk lot. Platform tests do not directly involve the laboratory analysis of raw milk samples. The suspected milk will be segregated and will not be mixed with bulk milk. The milk not fulfilling the compliance with previously set quality standards is subjected to rejection.

3.0 PROCEDURE FOR CONDUCT OF PRACTICAL

A. Organoleptic tests

Quality of milk judged by a person's senses view, smell, and taste is called organoleptic tests. The tests are the first screening of incoming raw milk at reception dock. No equipment is required for conducting the tests. Trained and experienced person yield the reliable results. The appearance of milk and lid of milk can is observed and inspected instantly after removal of lid. Judge smells the milk, observes the appearance, checks the can for cleanliness, looks for sediment, flies, etc. and tastes if necessary. For classifying the milk according to cleanliness, milk is filtered with a special milk filter. If there is any doubts the milk samples are subjected to other laboratory tests for confirming the quality.

Procedure

1. Open the can/ container of milk.

2. Immediately smell the milk.

3. Observe the appearance of the milk.

4. If still unable to make a clear judgement, taste the milk, but do not swallow it. Spit the milk sample into a bucket provided for that purpose or into a drain basin, flush with water.

5. Look at the can lid and the milk can to check cleanliness.

Observations/Judgement

- Condition of containers/cans: ____
- Appearance of milk: ____
- Colour of milk: ____
- Extraneous matter: ____
- Accept/reject milk: ____
- Comments: ____

Abnormal smell and taste may be caused by:

- Atmospheric taint (e.g. barny/ cowy odour).
- Physiological taints (hormonal imbalance, cows in late lactation spontaneous rancidity).
- Bacterial taints.

- Chemical taints or discolouring.
- Advanced acidification (pH < 6.4).

B. Indicator test

The acidity developed in milk due to bacterial activity is measured in terms of pH value as indicated by special indicator dyes, e.g. brom thymol blue and brom-cresol purple.

Observation

Acidity of milk: ________________________

Accept or reject milk: ________________________

C. Sediment test

Milk is passed through a funnel containing a filter disc and the amount of dirt and dust collected is compared visually or by weight. The test indicates the gross impurities and dirt in milk as a result of unhygienic conditions of production.

Sediment test

Presence of sediment: __________________________

Accept or reject milk: __________________________

D. Lactometer or density test

During the organoleptic inspection, if the milk appears to too thin and watery and its colour is "blue thin", it is suspected that the milk contains added water. Lactometer test serves as a quick method to determine adulteration of milk by adding water. The test is based on the fact that the specific gravity of whole milk, skim milk and water differ from each other.

The density or specific gravity of milk is determined by lactometer reading. At 15 ºC the normal specific gravity of the milk ranges from 1.028 to 1.033. Below the value indicate the possible addition of water to the milk. It is also possible the lactometer reading can be combined with the fat test to have the total solid levels in milk. Density of fat is lower than that of milk. Results of the low-fat test and higher specific gravity indicate the possible skimming of milk. Results of low fat test and low specific gravity indicate the possible addition of water in milk. Always read the temperature of the milk first; the lactometer reading varies according to temperature.

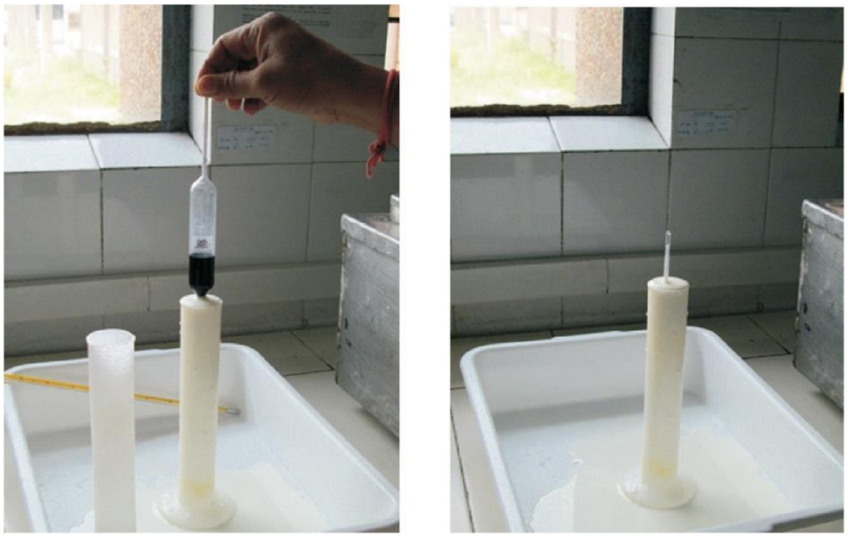

Fig. Measurement of density of milk using lactometer

Observations

1. Type of lactometer: ______________________________

2. Temp of milk: ______________________________

3. Lactometer reading: ______________________________

4. Specific gravity of milk: ______________________________

4.0 CONCLUSION

Quality of milk judged by a person's senses view, smell, and taste is called organoleptic tests. The tests are the first screening of incoming raw milk at reception dock. No equipment is required for conducting the tests. Trained and experienced person yield the reliable results. During the organoleptic inspection, if the milk appears to too thin and watery and its colour is "blue thin", it is suspected that the milk contains added water. Lactometer test serves as a quick method to determine adulteration of milk by adding water. The test is based on the fact that the specific gravity of whole milk, skim milk and water differ from each other.

5.0 REVIEW QUESTIONS

1. Define platform tests?

2. What is the need of platform tests in a milk reception doc?

3. How are water addition/ skimming of milk checked?

4. What is the importance of 10 min Resazurin test?

5. What is importance of alcohol test?

6. Define developed acidity of milk.

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AGRICULTURAL PRODUCT STORAGE

1.0 Introduction

"Storage" means the phase of the post-harvest system during which the products are kept in such a way as to guarantee food security other than during periods of agricultural production.

The main objectives of storage can be summed up as follows:

- at the food level, to permit deferred use (on an annual and multi-annual basis) of the agricultural products harvested;
- at the agricultural level, to ensure availability of seeds for the crop cycles to come;
- at the agro-industrial level, to guarantee regular and continuous supplies of raw materials for processing industries;
- at the marketing level, to balance the supply and demand of agricultural products, thereby stabilizing market prices.

In order to attain these general objectives, it is obviously necessary to adopt measures aimed at preserving the quality and quantity of the stored products over time.

Influences of environmental factors

To conserve the quality of products over long-term storage, degradation processes must be slowed down or even stopped.

Degradation of grains during storage depends principally on a combination of three factors:

- temperature,
- moisture,
- oxygen content.

During storage, as during other phases of the post-harvest system, the combined effects of these three factors can sometimes cause severe losses.

Temperature and moisture

Temperature and moisture are determining factors in accelerating or delaying the complex phenomena of the biochemical transformation (especially the "breathing" of the grain) that are at the origin of grain degradation.

Furthermore, they have a direct influence on the speed of development of insects and microorganisms (moulds, yeasts and bacteria), and on the premature and unseasonal germination of grain.

In the general diagram of conservation designed by Burges and Burrel, the relationship between temperature and moisture content is established in order to determine the area of influence of certain important degradation phenomena, such as: the development of insects and moulds, and the germination of grain.

Diagram of cereal conservation

It is easy to observe that the higher the temperature, the lower must be the moisture of the grain in order to ensure good conservation of the products.

In view of their influence on the speed of development of these degradation phenomena, the temperature and moisture content of the grain condition the maximal duration of storage.

DURATION OF WAREHOUSING (in days)

	TEMPERATURE					
MOISTURE	**5°C**	**10°C**	**15°C**	**20°C**	**25°C**	**30°C**
13%				180	115	90
14%			160	100	50	30
15%			100	50	30	15

16%		130	50	30	20	8
17%		65	35	22	12	5
18%	130	40	25	17	8	2
19%	70	30	17	12	5	0
20%	45	22	15	8		
21%	30	17	11	7		
22%	23	3	8	6		
23%	17	10	7	5		
24%	13	8	4	4		
25%	10	8	6	3		

As an example, the preceding table shows the recommended durations of warehousing, according to the temperature and moisture content of the grain.

The temperature depends not only on climatic conditions but also on the biochemical changes that are produced inside a grain mass, provoking undesirable natural heating of the stored products.

As for the moisture content of the stored grain, it depends on the relative humidity of the air, as shown in the air-grain equilibrium curves.

With a relative air humidity below 65-70 percent, many grain-degradation phenomena are slowed down, if not completely blocked.

In this sense, the "safeguard" moisture content is defined as that corresponding to an equilibrium with the air at 65-70 percent relative humidity.

The following table shows the moisture content recommended for long-term storage in hot regions of various sorts of grain.

GRAIN	**MOISTURE**	**GRAIN**	**MOISTURE**
Paddy	14.0%	Sunflower	9.0%

Rice	13.0%	Wheat	13.0%
Maize	13.0%	Millet	16.0%
Sorghum	12.5 %	Coffee	13.0%
Beans	15.0%	Cocoa	7.0%
Groundnut	7.0 %	Copra	7.0 %

Oxygen content

Like grain, micro-organisms and insects are living organisms that need oxygen.

Storage of grain in places that are low in oxygen causes the death of insects, cessation of development of micro-organisms, and blockage, or slowing down, of the biochemical phenomena of grain degradation. This favours the conservation of grain, but may affect its germinating power.

Agents causing deterioration of stored grain

The principal enemies of stored grain are micro-organisms, insects and rodents.

Micro-organisms

Micro-organisms (moulds, yeasts, bacteria) are biological agents present in the soil which, when transported by air or water, can contaminate products before, during and after the harvest.

Their presence and growth cause severe changes in the nutritive value and the organoleptic features of grain (taste, smell, aspect).

Furthermore, they are responsible for the alteration of important germinative properties of seeds (vigour and capacity to germinate) and, in the case of moulds, for the potential formation of dangerous poisons (mycotoxins).

Impurities, and cracked or broken grains, foster the development of micro-organisms.

Furthermore, temperature and humidity have a determining influence on the growth rate of these degradation agents.

It has been observed that micro-organisms develop at temperatures between -8°C and +80°C, when the relative humidity of the air is over 65 percent.

On the contrary, atmospheres that are low in oxygen help check the development of these degradation agents.

Insects

Insect infestations can occur either in the field, before the harvest, or in the places where products are stored.

In some cases, these infestations are difficult to discern with the naked eye, since the damage is provoked by the larvae developing inside the grain.

The insects most likely to infest stored products belong to the following families:

- Coleoptera (damage by larvae and adult insects);
- Lepidoptera (damage only by larvae).

Insects can be responsible for significant losses of product. Furthermore, their biological activity (waste production, respiration, etc.) compromises the quality and commercial value of the stored grain and fosters the development of micro-organisms.

Insects can live and reproduce at temperatures between +15°C and +35ºC.

On the contrary, low humidity slows or even stops their development, and a low supply of oxygen rapidly kills them.

Rodents

Rodents invade and multiply in or near storage places, where they can find an abundance of food.

They cause serious damage not only to stored products but also to packaging and even to storage buildings.

The principal rodents, those most common and likely to attack stored products, belong to the following species:

- black rat, also called roof rat (Rattus rattus),
- brown or Norway rat, also called sewer rat (Rattus norvegicus),
- mouse (Mus musculus).

Prolonged attacks by these pests inevitably results in serious quantitative losses of stored products.

To these losses must be added those arising from the decrease in quality of the foodstuffs, caused by the filth (excrement, secretions) rodents leave behind in the stored products.

This contamination is as important from the marketing standpoint as it is for hygiene and health. Indeed, rodents are often the vectors of serious diseases (rabies, leptospirosis).

Storage methods

There are basically two methods of storage: in bags and in bulk.

Bags can be stored either in the open air or in warehouses; bulk grain is stored in bins or silos of various capacities.

The choice between these methods and the degree of technological sophistication of the storage buildings depend on many technical, economic and socio-cultural considerations.

The traditional storage systems used by small farmers must also be mentioned. With their use of artisanal construction techniques and local materials, these are the systems that prevail in the rural communities of many developing countries.

As post-harvest losses are still a major issue for farmers, lack of electricity and poverty in Nigeria, processing of perishable agricultural produce becomes a very big problem. As population increases, there is need to increase food production without much effort on how what has been produced in excess are stored.

Locally constructed Evaporative coolers are not very expensive to produce and can be used for the preservation of vegetables. When water evaporates from the surface of a body, that surface becomes much cooler because it requires heat to change the liquid into vapour. Evaporative cooling, therefore, works by evaporating water into air-steam. The chilling effect that is felt when you come out of a swimming pool and a breeze blows across your body best illustrate this principle (evaporative cooling). The more moisture that is present in the air, the less the chilling effect because the less the evaporation of water. Also, the less moisture that is present in the air, the more the chilling effect because the more the evaporation of water from the surface of the body (Liberty et al., 2013)

Figure . Locally constructed Hygrometer

2.0 Objectives

The main objectives of storage can be summed up as follows:

- at the food level, to permit deferred use (on an annual and multi-annual basis) of the agricultural products harvested;
- at the agricultural level, to ensure availability of seeds for the crop cycles to come;
- at the agro-industrial level, to guarantee regular and continuous supplies of raw materials for processing industries;
- at the marketing level, to balance the supply and demand of agricultural products, thereby stabilizing market prices.
- Is an essential aspect of our educational set up
- it educates youths on the impact and opportunity in the Practical and agro-business.
- It also exposes them to vast store of knowledge available for anyone contemplating owing or managing a farm.
- This practical aim at promoting sustainable agricultural management for economic development.
- It seeks to support local food processing, in-other to improve local knowledge on agricultural mechanization.
- The practical seeks to aid food security, this is because food will betage and spoilage can be cut-down through processing.

- Looking at the amount of food produced yearly, this practical on processing will aid in conservation and re-organisation of any agricultural produce, while contributing in the development and promotion of agricultural activities.
- If greater percentage of our agricultural produce are processed then, importation of many other foreign processed food will be minimised.
- Since climate change is one of the greatest challenges to our food crop production, processing will aid in adaptation and mitigation, creating new ways in which our food crop can be properly managed.

3.0 PRACTICAL PROCEDURE FOR PRACTICAL

Work practice NO 1 : Construction of A Local Evaporative Coolers

Materials

- Two (2) thermometer for each hygrometer
- Plywood, hard wood, wick and bottle.

Procedure

- Cut the wood into 30 × 5cm
- Cut 2 plywood and cover one side
- Bore 2 holes on the upper and lower parts of the hygrometer
- The hole should be 1cm apart
- Nail 2 of the board on each side of the wood such that the wood having holes are located first and second followed lastly by the wood without holes.
- Insert 2 thermometers on the holes and make one of the thermometer wet bulb by fixing a wick on the bulb and inserting the wick in the bottle containing water.
- Put one of the hygrometer in the trolley and the other one outside the cooler for recording of ambient temperatures (both dry and wet bulbs).

Work practice No.2: CONSTRUCTION OF THE EVAPORATIVE COOLER

Materials: - jute bag, trolley, hygrometer and weighing balance.

Figure. Locally Constructed Evaporative Cooler For Agric Produce Storage

Procedures

- Soak the jute bag in clean water and wipe off excess water
- Wrap the jute bag round the trolley such that no part of it is exposed.
- Put freshly harvested and weighed vegetables (100g) into the second chamber of the cooler. The vegetables are fluted pumpkin, water leaf and garden egg (egg plant).
- Also, put one hygrometer into the second chamber of the cooler.
- Finally, place the entire arrangement in the greenhouse.
- The readings must be taken and recorded for 7 days and summary made in tables.
- The vegetables should be weighed 6am and 6pm daily while the both wet and dry bulb temperatures are to be taken every 2 hours from 6am to 6pm daily.

4.0 CONCLUSION

Agricultural product processing and storage plays an important role in food and feed preservation for the continual survival of man. Through the development of modern storage facilities, food crop preservation becomes easy and simple to follow. The practical was designed with the aim to look into processing procedures and find possible solutions to the problems facing the students and agricultural machine operators in Agric business. Low level of mechanisation will be observed to be high in areas visited during the period of this research.

Practical assignment on various agricultural processing and storage are to be conducted by the students at the end of the exercise which will amount to six work practice.

By the end of this practical the students should be able to:

- The practical can help to enlighten or widen students scope on the knowledge of agricultural product storage, giving possible recommendations and practical advice to students, students and agricultural machine operators.
- Through this practical a student can get an ideal practical inside of different ways of preservation and their advantages and disadvantages as applied in real life.

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MEAT PRESERVATION AND HANDLING

1.0 Introduction:

Meat can be defined as animal flesh used for human consumption. Usually, the skeletal muscle and the fat attached to it are referred to as meat, but some organs, like, lungs, liver; kidneys, brain, skin, bone marrow, etc. are also included in this term. It is a collective term, used to denote a wide range of meat, obtained from different animals and birds.

The most common sources of meat are domesticated animal species such as cattle, pigs and poultry and to a lesser extent buffaloes, sheep and goats. In some regions other animal species such as camels, yaks, horses, ostriches and game animals are also eaten as meat. To a limited extent, meat is also derived from exotic animals such as crocodiles, snakes and lizards.

For thousands of years, poultry supplied meat and eggs, cattle, sheep and goats provided meat and milk, and pigs provided a source of meat. These species are the main sources of animal protein for humans. The meat derived from cattle is known as beef, meat derived from pigs as pork and from chickens as poultry.

In physical terms, drying is the lowering of the water activity aw in meat and meat products. Water activity is the measure of free unbound water available for microbial growth. Microorganisms need certain amounts of free water for growth, and their growth is halted below defined minimum levels of moisture. Minimum levels vary from species to species of microorganisms.

Meat drying is not a clearly defined technology. Drying may be done for the single purpose of dehydrating fresh meat for extension of storage, but it may also be one of various processing steps during the manufacture of specific meat products.

The manufacture of fermented meat products, such as raw hams or dry sausages is an example, where drying is one processing component amongst several others. To have an extended shelf life, fermented products need to lose moisture during their fermentation, they are dehydrated or “dried” to a certain extend. Drying and fermentation must go hand in hand to achieve the desired flavor and shelf life. The drying of such products is mostly done in climatized chambers with exact temperature and humidity parameters. Drying under natural conditions is increasingly rare. Another example is the drying of meat preparations in ovens with temperatures in the range of 70-80°C, to become fast-dried products such as beef sticks formed of ground, salted and flavored meat. Furthermore, for a number of indigenous meat products, moderate drying is part of the manufacturing technique with the aim of lowering the water activity (a), thus curbing microbial growth.

2.0 OBJECTIVES

Objective of dry meat

- To make dry meat available in market
- To increase the product quality
- To increase shelf life

3.0 PROCEDURE FOR CONDUCT OF PRACTICAL

MATERIALS & METHODS

- Ingredients, Solvents, Chemicals & Equipment
- Meat
- Common salt
- Distilled water
- Knife
- Ring
- Desiccators
- Crucible
- Selling machine
- Digital weight machine
- Micro oven
- Three layer package

Procedures

1. **Preparation of meat for drying**

The meat is exposed to the open air and intermittent solar radiation and quickly loses substantial amounts of its tissue moisture. The drying process will be faster the shorter the distance from the centre of the meat piece to its surface. In order to accelerate the drying process in particular from the inner layers of the meat, it is therefore common practice to cut the meat in narrow strips or in flat pieces.

2. **Sun drying procedure**

The basic traditional drying method is called sun drying, characterized by direct solar radiation and natural air circulation on the product. Meat pieces are cut into strips or flat leaf-shaped pieces as described above. Then suspended in the open air or spread on drying trays made of fibre or wire mesh with a wooden or metallic frame. For sun drying, in particular for the suspension method, the meat is sometimes dipped in salt solution (approx. 14% common salt). This helps to limit microbial growth on the meat surfaces and protects to some extend against insects. The drying of such products is mostly done in climatized chambers with exact temperature and humidity parameters. Drying under natural conditions is increasingly rare. Another example is the drying of meat preparations in ovens with temperatures in the range of 70-80°C, to become fast-dried products such as beef sticks formed of ground, salted and flavored meat.

Simple methods of chemical analysis
(Protein, fat, water, ashes)

Chemical analyses to determine the content of protein, fat, water and minerals (ashes) of processed meat products are carried out to establish the nutritive and economic value of the products. Samples of the meat product are finely ground and weighed accurately for each respective chemical analysis.

The determination of the moisture content (or water content) is done by drying an appropriate amount of the sample. The difference in weight between the fresh and dried samples represents the water content. For rapid determination of moisture content a microwave oven is useful

Moisture analysis
(Microwave Drying)

General:

Samples are dried in a microwave oven and the loss of weight upon drying is expressed as percent moisture content.

Application:

This method may be used to determine the moisture content of fresh meat, semi-processed meat, meat mixes and processed meat products.

Equipment:

- Mincer with 6mm plates or heavy duty food processor
- Balance with at least 0.1g sensitivity.
- Desiccators with silica gel.
- Beaker
- Filter papers, 7cm diameter or open weave disposable kitchen cloth.

- Silicon carbide (carborandum) finely ground.

Approximate Drying Times for Sample Sizes of Meat

Weight of crucible = A

Weight of crucible + sample (before drying) in grams = B

Weight of crucible + sample (after drying) in grams = C

% Moisture = (B-C) / (B-A) = (weight of sample) x 100

Method

- Prepare the sample by mincing or chopping as described in sample preparation.
- Preheat the oven
- Determine the heating time necessary to completely dry the samples in the microwave oven.
- Weigh an empty crucible. Weigh about 10 grams of sample. For meat samples, spread the samples into a thin layer around the lower wall of the container with spatula or spoon. Place the samples in the preheated oven.
- Cool the samples in desiccators and accurately weigh the crucible & dried sample.
- Repeat drying until constant weight is obtained.
- Fat analysis
  Fat determination using samples dried from the microwave oven
- Get the weight of the dried sample.
- Put the dried sample.
- Place the dried sample inside the sox let extraction tube connected to the sox let flask.
- Pour enough ether into the extraction tube.
- Extract for 10 hours, at 3-4 drops per second.
- After extraction, take out the defatted sample from the extraction tube and air dry the sample for traces of ether. Dry further in an oven at 100°C and cool in a dessicator. Weigh the defatted cooled samples to constant weight.
- %Fat = Weight of dried sample – Weight of defatted sample / Original weight of the sample x 100
- Ash determination
- The defatted sample is placed in a constant weight porcelain crucible with cover.
- The crucible is then placed in a muffle furnace, and at a temperature of 600°C the sample is ignited for two hours.
- After ignition the crucible is placed in the oven to bring down the temperature for about 30 minutes, and then cool in a desecrator for another 30 minutes.

- The sample is then weighed to constant weight.
- % Ash = (Wt. of crucible with cover + ash) – wt. of crucible with cover / original wt. of sample x 100

Protein content

Calculation of the approximate protein content for pure meat and meat products

% Protein = 100% - (%water + % ash + % fat)

Microbiological sampling and testing

The purpose of microbiological testing is to determine the degree of bacterial contamination on surfaces of equipment, tools, and premises as well as in meat and meat products. This testing can be done qualitatively as microbiological screening, for example by contact such as using an impression plate or quantitatively by determining the exact number of microorganism per sample unit (in cm2 or grams) by using the swab or the destructive method. Quantitative testing can be either determination of the entire contaminating flora, also called “total plate count” or determination of a specific group of microorganisms out of the entire flora, also called “selective plate count”.

Microbiological Analysis

Total Plate Count (using nutrient agar)

For determination of the number of viable or living microorganisms in a sample

Meat sample (10 grams meat + 90 ml sterile distilled water or 0.1% peptone water). Homogenize in stomacher. First dilution.

Transfer 1 ml from first dilution (101) to second test tube (Test tube contains 9 ml. of sterile distilled water) (2nd dilution or 102) then from second test tube transfer 1ml to the third tube (3rd dilution or 103) and so on up to the 4th or 6th dilution.

Inoculate sample.

Pipette 1 ml from 3rd dilution and transfer to the sterile Petridis, also from the 4th dilution to another sterile Petri dish depends upon how many dilutions are
desired.

The inoculation is usually done according to the spread plate method. The diluted sample is released from the pipette onto the solidified agar and spread on the surface by means of a sterile bent glass stick. The alternative is the pour plate method, where the sample is first put into the Petri dish and 15 ml agar (liquefied in a water bath at 44-46°C) are poured into the plate afterwards. Agar and sample are thoroughly mixed by rotating the Petri dish.

Incubate for 12 to 24 hours at 35 to 37°C, alternatively 24-48 hours at 30°C.

Results

Count all colony forming units (CFU), including those of pinpoint size. Select spreader-free plate.

normal plates 25-250 counts

plates with more than 250 colonies for all dilution - too numerous to count

Plates with no CFU. Report as less than 1 times the corresponding dilution used.

4.0 CONCLUSION

Dry meat processing & preservation in food industries is the name of the project. Many materials, ingredient, methods & machineries are applied this project. Many methods are:

- Moisture Analysis, Result- Moisture Content 12%
- Fat Analysis Result- Fat Content 0.13%
- Ash Analysis Result- Ash Content 2.11%
- Protein Analysis Result- Protein Content 85.76%
- Also microbial analyses were applied such:
- Microorganisms
- The pH
- Relative humidity
- All kinds of tests & methods are carefully completed.

Acceptability of this type of products depends on sensory test report. If the products win by sensory test then it will be success in the market. According to this type of theory topic of study “dry meat” was won success. According to the raw materials these products are easy to manufacture in our country, because of that meat is the main raw materials of the products and this available in our around. Others raw materials of these items are available in our market. For this project needed to some light machineries. These types of machineries we will get in low cost, so we can manufacture the dry meat easily. After the products of good it will be tested by the quality control department. They will check appearance, color, odor & pH this product will pass or approved for sale and marketing. This product is beneficiary to us and the people of our country will benefited by the project.

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