LABORATORY 3

TITLE: Physical Properties of Agricultural Products III – Angle of Repose and Angle of Internal Friction

OBJECTIVES: At the end of this laboratory, you will be able to:

1. Determine the Dynamic angle of repose of an agricultural produce
2. Determine the station co-efficient of friction for agricultural produce

Note: frictional characteristic of agricultural crops play a big role in the design of handling and processing equipment. Angle of repose and static coefficient of friction are two indices that can be used to indicate frictional properties of crops and their definitions have been given in the class. Revise these definitions in order to get a clear distinction between these two properties.

PROCEDURE

A. DYNAMIC ANGLE OF REPOSE

a) You are supplied with two types of agricultural crops. Follow the instructions of the laboratory supervisor and use the funnel system to determine the angle of repose.

ii) You are also supplied with an emptying angle box. Use this method in obtaining the angle of repose.

iii) Compare your results. Which of these values for these crops?

B. STATIC COEFFICIENT OF FRICTION

(i) You are supplied with an inclined plane method apparatus. Following the instructions of the laboratory supervisor, determine the static coefficient of friction on

(a) plywood (along the grain)
(b) plywood (across the grain)
(c) galvanized iron sheet

C. ANSWER THE FOLLOWING QUESTIONS:

(i) Under what real-life situations would you think angle of repose and angle of internal friction are useful?

(ii) Under what situations do you think:

(a) a high angle of repose is an advantage?

(b) A high angle of repose is a disadvantage?

LABORATORY 4

TITLE: The Planimeter

OBJECTIVES: At the end of this laboratory, each student will be able to do the following:

a. Identify the various parts of planimeter

b. Test the planimeter for reliability

c. Use the planimeter to determine area of given shapes

APPARATUS: Planimeter, plain paper, pencil and ruler

NOTES: A planimeter is an instrument for measuring the area of

all shapes of plane figure. The area is obtained by tracing their

perimeters. Area of plans and maps to any scale, sectional areas of machine drawings as well as the mean heights of line diagrams can also be otained with the panimeter.

PROCEDURE

A. GETTING FAMILIAR WITH THE PLANIMETER

The laboratory instructor will explain to you how the panimeter isused

1. Sketch and label the various parts of the planimeter
2. Explain in your own words how the planimeter is set up and used.

B. TEST-RUNNING THE PLANIMETER

1. Attach the test rule as described to you. Set the planimeter as directed and

determine the area described inmm2

2. Find the percent difference between your measurement and the area of the square.

3. Draw a square of 1 x 1cm and use the planimeter to determine the area of the square. Repeat for a circle of 1cm diameter.

4 Find the percentage error.

A. ANSWER THE FOLLOWING QUESTIONS

1. What are the advantages and disadvantages of using a planimeter for area

determinations

2. In what disciplines do you think the planimeter can be very useful

LABORATORY 5

TITLE: Using the Planimeter for Area Measurements.
OBJECTIVES: At the end of this laboratory, you will be able to do the following:

1. Use the planimeter to measure the projected area of some crops
2. Use the planimeter to measure the surface area of leaves.
3. Compare the effectiveness of planimeter to graph sheet method

APPARATUS: Planimeter, graph paper, pencil, fruits and leaves.
NOTES: Roundness and surface area of crops and leaves are often needed. The planimeter is one instrument that can be used to quickly determine these characteristics especially where there are no other means of measurement. However, the use of the planimeter requires care because a small error of judgement can result in a large error of measurement.

PROCEDURES

A. AREAS OF LEAVES

You are supplied with three kinds of leaves with different surface areas

1. Trace the areas of the leaves on graph paper
2. Use the planimeter to determine the area of each leaf
3. Use the graph paper to determine the area of each leaf.
4. Compare your results.

ROUNDNESS

You are supplied with three fruits.

2. On a graph paper, draw the projection of each fruit in the natural rest position.
3. Draw the smallest circumscribing circle on the projection drawn in (1)
4. Use both planimeter and graph sheet method to determine the projected area Ap and the circumscribing circle A_2
5. Determine Roundness (Ap / Ac) with both methods
6. Compare your answers for the three products

B. SURFACE AREA OF FRUITS

Your are supplied with two kinds of fruits/seeds

1. Coat each fruit/seed with the ink supplied
2. Cover the entire fruit/seed with graph paper (You may fold the graph paper)
3. Use the graph paper squares to determine the surface area of each fruit/seed.
4. Use the planimeter to determine the surface area of the fruit/seed.
5. Compare your results.

D. Answer the following questions:

1. What specific advantages to do you think

(a) the planimeter has over the graph paper method?

(b) the graph paper method has over the planimeter?

2. Which method will you choose and why if:

(a) you are in the field

(b) you are in the office.

LABORATORY 6

TITLE: Determination of Fineness Modulus and Modulus of Uniformity for feed.

OBJECTIVES: At the end of this laboratory, students will be able to:

1. Identify a set of Tyler's sieve and a Ro-tap machine
2. Determine the Fineness modulus of a given ground feed
3. Determine the Modulus of Uniformity of ground feed.

NOTE: Screening is a method used for classifying small grains or granular materials. Tyler's sieve's which are commonly used originated in the United states in 1910, Sieve sizes (size of opening) vary from 3.75mm to 0.07mm with a pan at the bottom. However, a standard set of seven sleeves is used to classify ground feed.

Fineness modulus and modulus of uniformity are two indices that are used to classify ground feed. These indices have been explained to you in the classroom.

PROCEDURE:

A. SCREENING

You have been supplied with two samples

(i) Grains
(ii) Ground feed

(I) Weigh 250g of each sample

(II) Arrange the seven standard sieves (3/8" 4, 8, 14, 28, 48, 100) and the pan on the Ro-tap, pour the sample from the top and vibrate for 5 minutes.

(III) Find the percentage on each sieve

B. CALCULATIONS

(i) Using an appropriate table, calculate the fineness modulus (f_m)

(ii) Calculate the average size of grain (D) in inches.

$D = 0.0041 \times 2^{fm}$

(iiI) Determine the modulus of elasticity

iv) Draw a graph of screen opening versus percent finer than screen.

C. ANSWER THE FOLLOWING QUESTIONS

i) In what category will you place your two samples in terms of course, medium and finer in relation to;

(a) Fineness Modulus

(b) Modulus of uniformity

ii) What do you think about this statement?

“The bigger the animal, the coarser the feed should be”

Describe how a complete Tyler’s sieve set look like (with the aid of diagrams).