CLEANING, SORTING, AND GRADING

CLEANING:
- Remove foreign objects or materials which are not similar from a product.

SORTING:
- Separate product into several quality fractions based on the shape, density, texture, and color.

GRADING:
- Classify materials based on the commercial value and usefulness of the determinants of more than sorting.
- Grading determined by various agencies or institutions which are interested in certain agricultural products that are used as standards in trading.

CLEANING PRODUCTS

OBJECTIVE:
- Provide customers with a product that is attractive and clean with minimal risk of microbial contamination.

WASHING:
- Ideally, washing, rinsing, and sanitizing provide the greatest reduction of potential microbial contamination.

HAVE TO CONSIDER:
- How dirty the product is coming from the field?
- Ability to remove excess moisture.
- Tenderness & perishability of the product.
# CLEANING PROCEDURES

## WASHING

- Fruits, vegetables, and legumes should be washed frequently to clean from soil/dust, pesticide residues, and other foreign material.
- Washing activities can begin with a pre wash or directly.
- Type of wash can be on washer tubs/bath or continuous. Washer tubs for small factory, whereas the continuous type for big factory.
- Washer can be one or combination of the following:
  - Soaking in water or other liquid materials
  - Sprinkler
  - Rotating drum
  - Rotating brush
  - Washer vibrates

- Soaking: soaking in flowing water or other liquid only effective to eliminate dust or other impurities that attached on the surface is easily separated. This method is often used as a precleaning which are forwarded to the other methods.
- Water sprayer: varies from low pressure to high or wide angle to straight to the product. Sprayer effective to remove soil or dirt that attaches firmly to the product. This method can be used for a variety of products but with the appropriate pressure settings. Appropriate pressure for potato may be damaging when it used for vegetables.
- Rotating drum: washers are commonly used this type for commercial scale because of simple, high capacity, immediate cleaning, and minor damage to the product. The level of cleanliness depends on the rotating speed, the roughness of surface drum, and the time of washing.

- Brush Washer: a brush that rotates and generally have higher effectiveness. This method is effective for removing sand, clay, or pesticide residues. The length of time is determined by the relative movement of washing between products and brushes. Brush can be made from fiber, rubber, or sponge or other materials that can be replaced after wear out.
- Vibrates Washer: This tool works by strong vibrations. Due to high vibration and repeated so needed a strong construction.
- Good washing procedure are using a combination of two or more procedures that described above, and the washing procedure can be integrated with the materials inside the factory.

- Whasing cases:
  - Pesticide residues can be cleaned by washing with a mixture of detergent and 0.5 - 1.0% solution of hydrochloric acid.
  - Power-spray for 3 minutes will eliminate almost all of the deposit.
  - Wax or oil can be washed with high temperature water or alkaline solution.
  - In leaching chemicals are also often added to fungi, insects, and bacteria control.
Sanitizing Agents

- Typical sanitizers include chlorine, iodine, hydrogen peroxide, quaternary ammonium compounds (Quats), and some organic acids.
- Be sure sanitizers are approved for food contact.
- Use correct concentrations for food contact.
- Test that correct concentrations are reached and maintained - test strips.

Sanitizing Agents for Fresh Produce

- Sodium hypochlorite * – aka Bleach (6%, @ 100 - 200 ppm)
- Hydrogen peroxide * (H2O2, 3%)
- Tsunami™ * (peroxy-acetic acid, 80 ppm)
- PRO-SAN® LC (1%)
- Acidified sodium chlorite (Sanova™)
- Ozone * (requires a generator)
- Acetic acid * (from an organic source)

Over-the-Counter Sanitizers

- Chlorine Bleach:
  1. Can be used for sanitizing Product and Food Contact Surfaces.
  2. Important to measure accurately to avoid toxicity.
  3. Effectiveness decreases with time and dirtiness of the water.
  4. Use test strips to ensure proper concentration.
    i. Time of testing and result.
    ii. When water & sanitizer was changed.
  Note: Don’t use scented/oxidized chlorine bleach.

Chlorine Bleach Use

- Sanitizing the Product:
  - Up to 200 PPM.
  - 2 Tablespoons per gallon in warm water (75 - 120°F)
  - Most effective if used after any soil is removed.
  - Change the solution as needed.
- Sanitizing Food Contact Surfaces:
  - 50 – 100 PPM (1/2 to 1 Tablespoon/gal.)
  - Packing table & other contact surfaces
  - Last step in cleaning; do not wipe off.
  - Harvest & other reusable containers.
  - Gloves (washable)
SORTING AND GRADING

• Benefits Sorting and Grading:
  1. Ensuring producers obtain price relative to its quality
  2. Easier handling grains in storage with similar quality
  3. Can be a simple method in pricing in relation with the quality in the trade
  4. Allowing buyers to obtain the same quality of grains consistently
  5. Can sorting grains into quality groups so that there is a choice of quality gradation from product quality groups.

FACTORS OF GRADING / SORTING

• Factors of grading / sorting are used for agricultural products can be classified as follows:
  – Physical properties:
    • Moisture content, size, weight, texture, color, foreign objects, shapes
  – Chemical properties:
    • Chemical composition, rancidity, free fatty acid index, smell, and flavor
  – Biological properties:
    • Germination rate, the type and number of damage due to insects, the type and number of damage by fungi, number of bacteria

• Sorting Objective:
• To remove product or portions of product that may detract or pose a risk for shortened shelf life and/or contamination by a microbial organism.
  – Contaminated product
  – Senescing product
  – Insect damaged product
  – Product with a broken skin
  – Product that is out of grade
SORTING OF FRUIT AND VEGETABLES

- Sorting of fruits and vegetables based on:
  - color, damage, and size.
- Sorting colors and the damage is generally done manually. Although recently developed electric method to separate by color.
- Some tools used for fruit and vegetable sorting based on size are: screen, diverging belt, roller sorter, and weight sorter.

Screen:
- Fruits and vegetables which are round or elliptical can be sorting with vibrating screen or screen rotater as long as the material does not react with steel products, stainless steel or other material screen maker.
- The smaller size of fruit or vegetable will pass through the filter and the larger size will through the end filter for further processing or packaging. Further products will be separated in some grade by size.

Diverging belts:
- Consists of two conveyor belts which gradually separate.
- When the tire separate automatically widen, smaller products will fall, while the larger product will be transported further.

Roller Sorters:
- More quickly, accurately, and little risk of damage.
- Each roller rotates counter-clockwise, and then fruit separate on the holes between the roll that progressively widened.

Rotary Cylinder Grader:
- Consists of hollow cylinder and rotates clockwise and is driven by an electric motor.
- Each cylinder has a hole that allows sorted fruit to fall through with the smallest in the first cylinder and getting bigger in the next cylinder.
- The fruits were separated and fell on collector containers.
- Fruits which were oversize will fall apart on the tip of the cylinder graders and separated with other sized fruit.
Sorting by based on weight product:
- Accurate, rather quickly, and minor damage to the product.
- Used to separate the large size products, such as apples and oranges. This tool to separate the fruits and vegetables that can not be separated based on texture and shape.
- Products will be entered automatically in a single container. Containers will be run on area that contains spring which the tension is gradually weakened.
- The heavy products pressing spring and will be removed earlier, while lighter products will go further so product separated.

Sorting Based on Fruit Color:
- The fruits can be quickly sorted automatically using: *microprocessor controled color sorting equipment*. 
- Fruit flowed through column and photos detector. Photos detector measure the reflected color of the fruit and compared with the standard.
- Reflected further light is processed by a microprocessor which operates reject system automatically.
- Furthermore, the fruit will be separated by fruit color.
CLEANING AND SORTING OF GRAINS, LEGUMES, AND SEEDS

- On the grains are not too different between the activities of cleaning, sorting, and grading. Cleaning, sorting and grading of grain based on: size, shape, density, and properties/texture of the surface
- Screen:
  - Mostly used
  - Consist of 2 or more screen and often combined with a blower.
  - The grains are separated by a determined hole. Product move down because of the screen slope and vibration, so that the holes are not blocked. The speed of moving products can be set based on screen slope. Size and shape mesh of the screen can be determined based on products.

- Examples of separation by sieve consists of 3 screen (see figure):
  - The first screen to filter out dirt which is larger than the product.
  - Second screen with appropriate holes with the desired size of filled grain.
  - The third screen will pass inferior small grains and weed seeds so fall to the pan (last pan).
- Screen often combined with a pneumatic separator (separator by using airflow so products separate based on weight). On the intake (place entry of grain) wind blown from the fan (blower) so filled grain fell early and empty seeds or dirt fall further. This system is called aspirating.

- Spiral separator:
  - Separates products based on shape
  - Products which have a round shape will roll faster and centrifugal force would cause the product thrown on the outer. Flat shape products that will run slower and get in on the inner. Thus both of the product will be separate.

- Disc and cylinder separator:
  - Cylinder which is installed horizontal with round or elliptical holes on inner surface that appropriate with the shape of separated grains. Appropriate grain will be drawn by the hole and will rotate through the angle of 180 degrees so it will be thrown to the other side, while smaller or larger seeds than the hole will be left behind or fall before 180 degrees so it does not cross the line. Thus the product will be separated.
• Specific Gravity Separators:
  – This tool separates the product because of two conditions:
    • Ability of grains to flow down on slope
    • Floating effect on grain caused by the upward air flow.
  – The separator consists of a triangular pervorated table and there is regulator of slope table. At the bottom of the table installed fan to flow the air up through table holes. Table is also driven by engine to vibrate during operation.
  – Grains put in the income box, further with vibrations and the upward air flow, the products which have a small density will float and move up, while heavier products will move down. Based on its density and float ability the products will separate in some grade.

• Separation based on skin texture:
  – To separate the products that have same size, shape, weight, and density but have different skin textures.
  – Consists of a drum which has a certain skin texture. It can separate grains that have rough skin. Grains that have rough skin texture thrown farther than the grains with smooth skin texture. Finally the grains with a rough skin texture will be thrown away over the edge and separated with smooth-textured skin.
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