



WESTERN HIGHLANDS AGRICULTURE AND FORESTRY
SCIENCE INSTITUTE (WASI)

INTEGRATED CROP MANAGEMENT (ICM) FOR PEPPER PLANTS



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Section 8: Management of harvesting and pre-processing, and storage

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8.3. Peppercorn storage

8.4 Strategies to avoid chemical/ biochemical and physical hazard



Full maturity of black pepper

8.1. HARVESTING PEPPER FRUITS

❖ Harvest time

- Take about 7-8 months after flowering to reach full maturity
- Harvest time: based on the kind of pepper product

Product	Stage of maturity at harvest
Canned pepper	4-5 months
Dehydrated green pepper	10-15 days before maturity
Oleoresin and essential oil	15-20 days before maturity
Black pepper	Fully mature and 1-2 berries start turning <u>from</u> yellow to red in each spike
Pepper powder	Fully mature
White pepper	Fully ripe



Prepare tools before picking

8.1. HARVESTING PEPPER FRUITS

❖ Harvest time

- In the Southeast, pepper is harvested around January - March
- Central Highlands February - April
- Central Coast (Quang Tri..) June - July.
- Kampot pepper (Cambodia): March-May

❖ Prepare

Before harvesting:

- Clean the grass and tidy everything in the garden one month before harvesting
- Labor
- Tools: tarpaulin, bag, ladder, threshing machine

8.1. HARVESTING PEPPER FRUITS

❖ Harvest technique

- Pepper is harvested by hand and is picked about 2-3 times/crop.
- When the fruit cluster turns green yellow.
- Spread the canvas in rows, around the pepper base to avoid spillage
- Use your hands to separate each bunch of fruit.
- Clean leaves, impurities, collect in bags, transport to drying yard
- **Advantages of handpicking**
 - **Can select only matured fruit,**
 - **Less damaged plant**
 - **Minimize bruising of fruits that could allow microbial invasion during drying and storage**



Steps of harvesting and processing

8.2 POSTHARVEST OF PEPPER

❖ Black pepper



Black pepper processing





8.2 POSTHARVEST OF PEPPER

❖ Black pepper

- **Harvesting:** Fully matured pepper (**Harvest starts when one or two berries start turning yellow or red in each spike.**)
 - Do not collect un-matured bunches except for the last harvest
 - **Pepper is harvested directly by hand** and is usually **divided into 2 to 3 batches** during the harvest
- **Threshing:**
 - The berries are separated from the spikes manually on a clean cement floor
 - Using a manually operated or motorized thresher

8.2 POSTHARVEST OF PEPPER



Blanching

Black pepper

Blanching:

- Immersing the berries in hot water (80-90°C), for 1-2 minutes before drying
- Reduce the microbial load, wash of dust
- >giving a hygienic product
- Reduce drying time
- Improve colour (glossy appearance, uniform color)

Drying:

- Moisture content of berries at harvest: 65-70% -> 10%
- **Sun drying: Spreading berries on bamboo mat, cement floor or PVC sheets.**
- **Thickness: 2-4 cm, stirring 4-5 times a day**
- It takes 4-6 sunny days for peppers turn from green or yellow to black and reach a moisture content of 11-12%



8.2 POSTHARVEST OF PEPPER

Black pepper

- Drying machine: electronic hot air dryer
- Temperature: $< 80^{\circ}\text{C}$ (recommended 55°C)
 - *Cleaning : removing lighter fractions: dust, dirt, immature beans, pin heads, spend spikes*
- Small scale: winnowing basket and sieves
- Larger scale: winnowing machine
 - **Grading:** using sieves and shifting black pepper into different grades based on size
 - **Packaging:** using packaging materials: gunny bags, gunny bags with polyethylene lining, laminated bags, paper bags
 - Storage: low temperature and humidity, free from pests or insects



Dryer



Grading machine



Winnowing basket



Winnowing machine

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Grading machine



Winnowing basket



Winnowing machine

8.2 POSTHARVEST OF PEPPER

Black pepper

Hygiene requirements

- Persons engaged in threshing, sifting, sun drying etc. should clean their hands and feet with soap and water before they begin work.
- Baskets and other containers used in processing and storage should always be kept clean.
- Premises should be dry and stores should be clean and hygienic.
- Borders of the drying yard should be protected to keep out birds, domestic animals, rodents etc.



Dryer



Grading machine



Winnowing basket

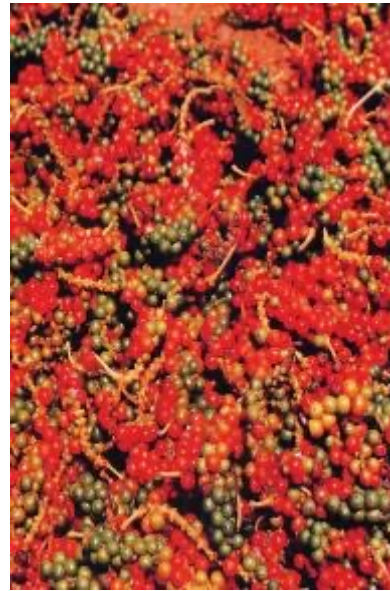


Winnowing machine

8.2. POST- HARVEST OF PEPPER

❖ White pepper

- From full ripe fruit
 - The value is 1.3 - 1.5 times higher than black pepper. Export 15% of output in 2015
 - Requirements: ripe pepper, pepper cluster with more than 50% ripe fruit.
 - Incubate 2-3 days, then peel off the shell, soak in a tank with water change for 7-10 days until the shell is mushy.
 - Rub well and treat until the shell is gone, dry in 1-2 sun when the seeds have a moisture content of 12-13%.
 - Packing, storage



Processing white pepper from fresh fruit

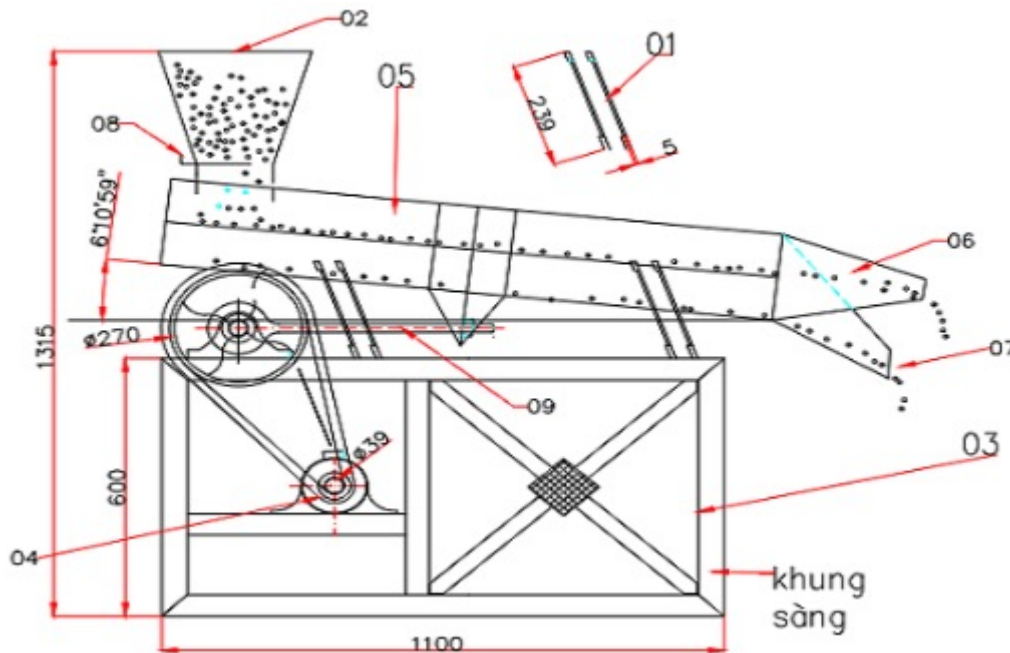
8.2. POSTHARVEST OF PEPPER



❖ White pepper

➤ From black pepper

- Take the grain with a weight of more than 550 g/liter
- Soak in a tank with water changes for 7-10 days, change the water once every 2-3 days until the shells crumble.
- Rub well and treat until the shell is gone, dry in 1-2 sun when the seeds have a moisture content of 12-13%.



Pepper Peeling Machine

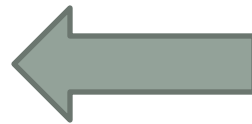
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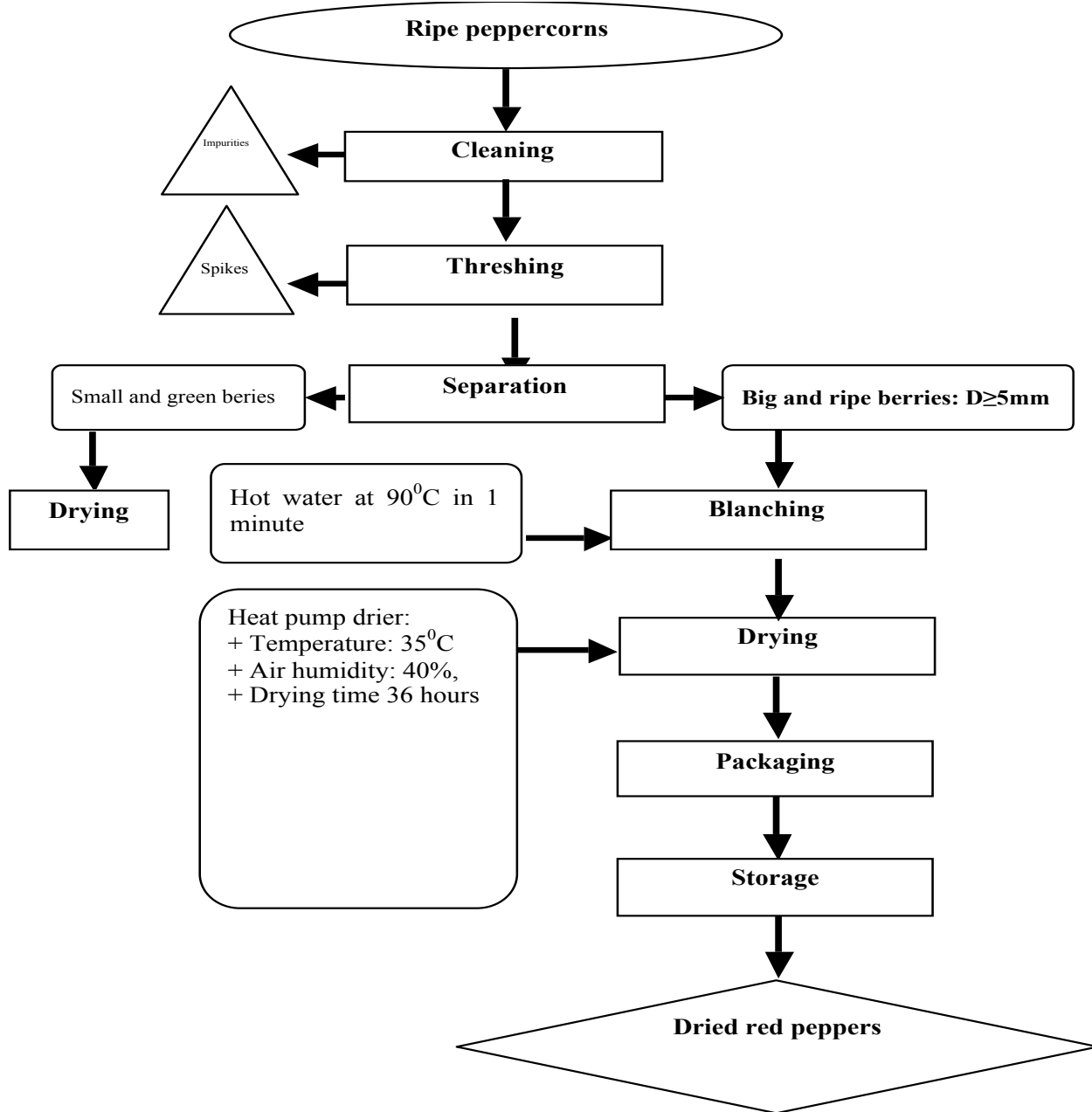
Black pepper production

8.2. POSTHARVEST OF PEPPER



❖ RED PEPPER PRODUCTION PROCESS

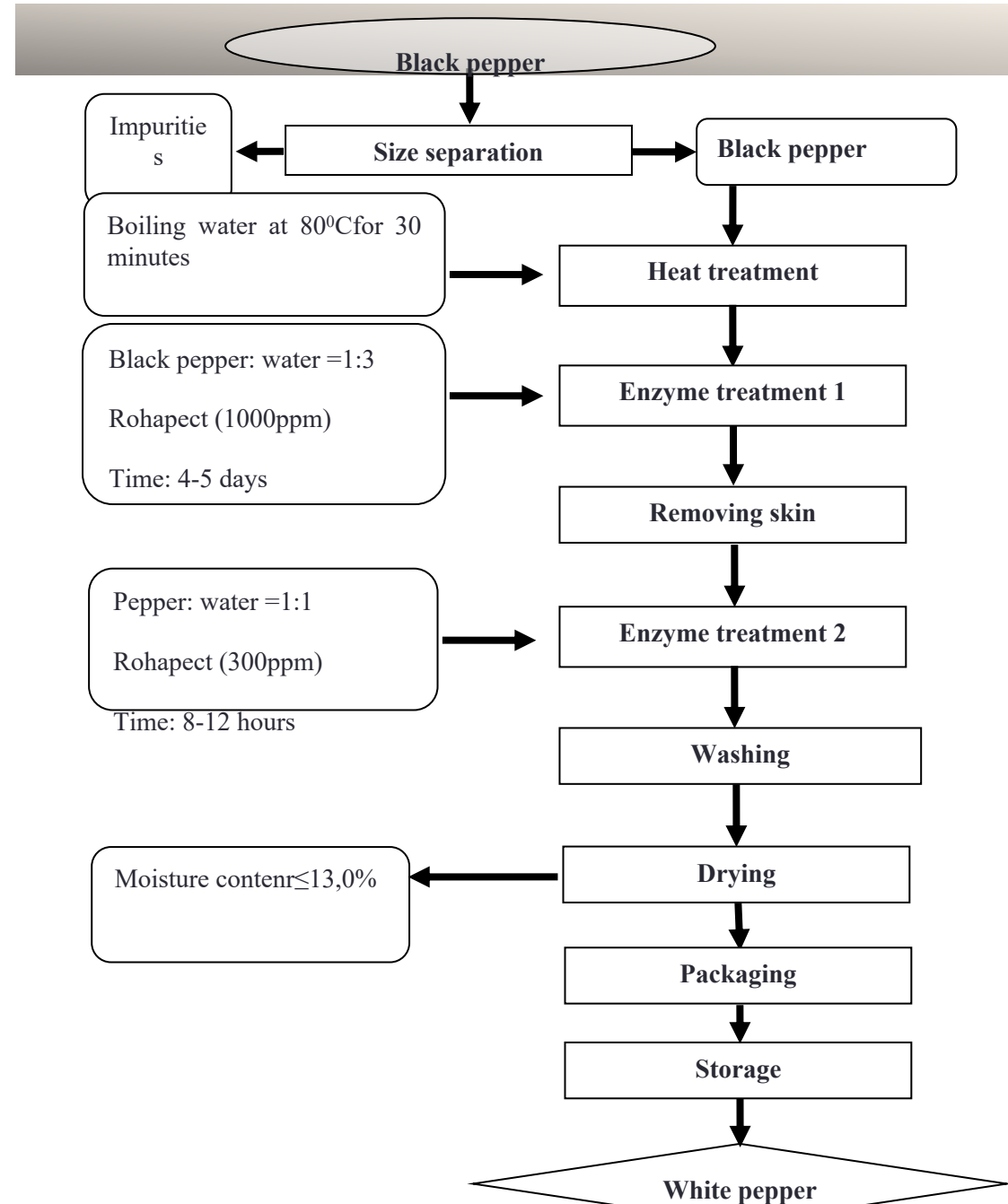
8.2 POSTHARVEST OF PEPPER



Section 8: Management of harvesting and pre-processing, and storage

8.2. POST-HARVEST OF PEPPER

❖ PRODUCTION PROCESS OF WHITE PEPPER FROM BLACK PEPPER



8.3. PEPPERCORN STORAGE



Preserving pepper

- ❖ Warehouses, places to store pepper after preliminary processing must be dry, cool, clean, have enough area, not be leaked by rain.
- ❖ Packed in 2 layers, each bag is about 50-70 kg, inner nylon layer and outer fiber bag to prevent moisture absorption and reduce the quality of black pepper.
- ❖ The pepper bags are stored in cool, airy and dry warehouses. Shelves are placed at least 10-20cm away from the floor and walls.
- ❖ Periodically check

Section 8: Management of harvesting and pre-processing, and storage



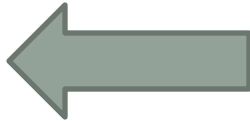
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8.4 Strategies to avoid chemical/ biochemical and physical hazard

A. Physical hazards

- **Rocks, metal and glass**
- **Prevent:** using metal detection, product screening and visual inspection

B. Chemical hazards

- Heavy metals, chemical agents and Pesticide residue
- **Prevent:**
- Chemical or pesticide residue testing
- Don't store pepper products along with others **materials that could cause cross-contamination**

C. Biological hazard

- - Presence of Pathogenic microbes: E. coli, Salmonella
- Presence of Mycotoxins produced by Fungi
- **Prevent:**
- Regular microbial final product testing
- Mycotoxin analysis of final product
- Drying: ensuring moisture content of product < 10%
- Control storage condition: low temperature (<20oC; relative humidity <60%)