

# Technology and engineering in urban environment

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# MACHINERY AND TOOLS FOR RELIGIATION AND SOIL BONIFICATION

- By land religiation and benification we mean the opening of new lands, protected from erosion and with regulated water regime.
- Sloping lands are arranged in belts (terraces) for raising trees and vineyards.
- For orchards drainage is a very important factor, for the reason that some species of tree roots die without oxygen when planted in poorly drained soils.
- Especially nuclear trees (peaches, cherries and plums) are very sensitive in soils with poor drainage.
- Apples are moderately stable and pears can survive even in poorly drained soils.
- It is recommended to research the soil profile through excavation.
- Poorly drained soils usually have light-colored horizontal layers.
- The best soil is well-drained soil to a minimum depth of 1 meter

# Machines for opening and cleaning canals

- Jaruzhar Plows - serve for opening and cleaning of canals with small dimensions.
- The working organ is of the type with ears that cut the soil, scatter and compress the soil on both sides of the canal forming an embankment (feather).
- This plug opens channels with dimensions 40 - 50cm wide at the bottom of the channel and 155 - 170 cm at the top of the channel.
- They work at a depth of 65 - 85cm, while for traction a tractor with a power of 70-100 kW is needed.
- Channel cutters - the working body is the rotor with knives, usually placed obliquely at an angle of 45°.
- During the rotation of the rotor the knives cut the ground and throw it sideways.
- The speed of movement of the milling tractor (aggregate) during work ranges from 0.5 - 1.5 km / h and the working effect is 600-2,000 m / h depending on the type of soil and the width and depth of the channel.
- Excavators - used to open wide canals as well as to level and compact the soil.
- The main parts of the excavator are: the lower base with chains or tires and the upper base with the cabin

# Drainage machines

- Drainage through the system of closed canals and with drainage pipes has obvious advantages compared to open canals as there are no obstacles during mechanized works in orchards and vineyards.
- For the application of drainage with pipes are used milling cutters and drainage opener with knives placed in endless chains.
- The drainage opener with knives in endless chains - are connected to the three-point system of the tractor and through the hydraulic system is determined the working depth which can be up to 1.4m.
- Knives in the endless chain that are put to work through the rotating shaft of the tractor, make the cut of the ground and throw the soil to the surface.
- The ground is then surrounded by screw rotors placed on either side of the chain.
- A sloping gutter is reinforced in the frame of the machine through which the drainage pipes are lowered.
- The channel can have a width of 20 - 46cm and a depth of up to 1.4m.
- The working effect of the machine is from 40 - 250 m / h, which depends on the depth of work, condition and type of soil.

# Machines for laying drainage pipes

- They are used to open drainage channels with a passage, they install synthetic pipes, and some of them place the filter material as needed, but these machines can also cover the channels.
- All work is mechanized, and the workforce is only about 2-3% of total work.



# “Mole” drainage equipment

- These devices open circular or oval underground channels through soil compaction.
- When working at a depth of 45 - 90cm, a hole or channel with a diameter of about 8cm is made.
- The working organ is a knife at the lower end of which is placed a wedge, behind which is attached a shell (mole) with a diameter of 10cm that gives the channel its final shape.
- "Mole" drainage can be used only in those terrains where the groundwater level is not high. This system is almost impossible to implement in rocky terrains.
- The working effect of this machine is about 100m / h.





# Rotary tiller

- Rototiller should be used for the base of the soil, for filling the soil - pre-preparing the soil for planting while after planting for mining between rows.
- With one pass, the milling cutters mix the ground animals with what they chop and scatter the manure and debris into another thing that has been worked on, thus creating other skins written in the protection of the soil environment and the eradication of weeds.
- Mills are also needed for the minimum tillage where with one pass the tillage, planting and leveling is done.
- In milling machines for working between rows, the distance of the working bodies is adjusted according to the conditions of the plants in the row.



# Field cultivators - tillers

- Field cultivators - tillers are tools that work the soil without overturning its top layers, cutting down the root system of the grass and doing the work between rows of plants.
- In the cultivators can be placed the equipment for the distribution of the manure and we call the nutrient cultivators where in one passage the mining and the dumping of the manure takes place.
- Cultivation and mixing of soil in the horizontal plane with cultivators many authors call surface tillage.
- This work affects the increase of capacity for water absorption in the ground and the reduction of water evaporation from the ground surface





# Machinery and equipment for seedlings of plants production

- Production through seedling shortens the growth time of plants in the open field.
- The seedling is produced in protected environments or in open permits, planted in pots, feeding cubes, containers, styrofoam modules and plastic bags.
- Soil sterilization is one of the most important phytosanitary measures during long-term cultivation of seedlings in the same area.
- Sterilization kills parasites, microorganisms, insects, nematodes and weed seeds.
- Sterilization can be chemical and thermal.
- Contemporary trends in vegetable production give preference to heat treatment in order to avoid the use of harmful chemicals.

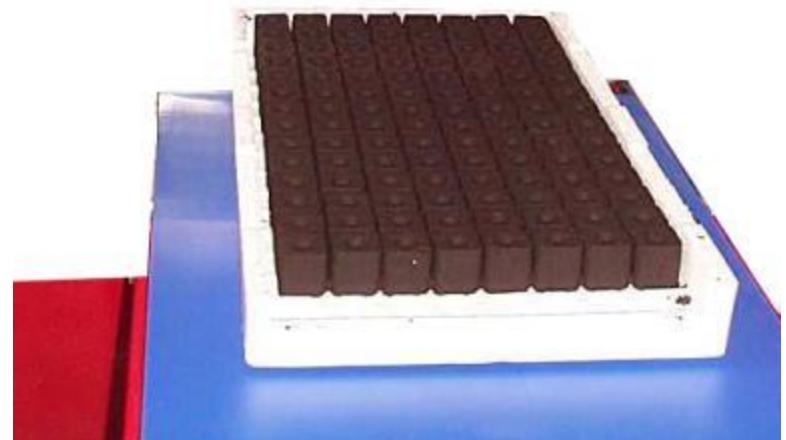


Tractor-dependent equipment for steam sterilization of soil water in the open field produces 100 kg / h of steam and enables disinfection of 20-30 m<sup>2</sup> / h of soil at a depth of 7-15 cm. Seedling production can be done on natural soil or on prepared substrate.



# Machines for the production of feed cubes where the substrate is placed

- With the help of the conveyor belt and limiters, a layer of a certain thickness is formed which is sent to the press, where the substrate is compressed through a matrix where cubes with dimensions of 2.5x2.5 cm to 10x10 cm are formed.
- The working effect of the machine is from 3,000 - 70,000 pieces / h depending on the speed of the conveyor belt and the size of the cubes.



# Machines for preparing of row-after-row of raised beds

- In order to intensify the production of some types of fruits and vegetables, in addition to flat surfaces, they can also be cultivated in raised beds, where uniform growth and ripening of vegetables is achieved.
- In the raised beds cultivation system, the wheels of the tractor, attachment machines and combine harvesters pass through the lines, in which case the damage and violation of the plants is avoided.
- These one-way cars form brothers.
- The rototurn blades located on the front of the machine crush the soil, while the toothed roller with the fingers does the further working of the particles, at the same time flattening and compacting the top layer of soil.

# Production of the raised beds

- The final shape of the raised beds, in some cases, is formed by the plates that stabilize the upper surface of the braces.
- Depending on the car model, the width of the brothers is 1.25-1.70 m, while the height is 15-20 cm.
- There is the possibility of forming two or three small brothers by placing additional sheets.
- The required power of the tractor motor for the formation of a brother is 25-40 kW.
- For the production of strawberries, the formation of tall branches 40-50 cm is needed, the width at the base should be 110-140 cm, while at the top 45-75 cm.
- The machine consists of two rotofressors and the stabilizing sheet metal of the upper part of the brother.
- The required power of the tractor for work with these machines is 65kW.







# Seedling Planting

- It should be done with special machines which achieve greater effect for workers compared to manual planting.
- With mechanized planting, accurate arrangement of plants in a row and between rows and uniform planting depth is achieved, which is a prerequisite for performing various operations during the care and harvesting of plants.
- For planting the seedling on mulched surfaces, a special construction should be used to open the holes, which most often has the shape of a peg.





- For the purpose of producing early vegetables, mechanized covering of plants with foil and that with or without supporting structure is used.
- Coverage of plants with the use of supporting structure means the use of foil and arches (metal, plastic or wood) where low and medium tunnels of different dimensions are formed.
- Placement of tunnels on planted plants
- The tunnel forming machine forms tunnels with a width of 60 - 200 cm and a height of 40 - 100 cm.
- The mechanism of covering vegetables without a supporting structure is realized together with the planting of the seedling or after planting the seed and the seedling.



# Hail protection

- Global climate change manifests itself in two ways: the hail is falling more and more and the size of the ice particles is getting bigger every time.
- Hail is often accompanied by strong winds and storms, which combined causes severe damage and injury to the aboveground part of the plant.
- The protection of perennial plants from hail is done:
  - - Anti-hail missile system,
  - - Establishment of anti-hail nets.
- In some places, planes that drop and scatter silver iodine in the clouds are used to destroy hail-carrying clouds.
- The most effective plant protection system, which also ensures a continuum of production over time, is of course the installation of anti-hail nets.





Hail protection  
net in open  
position - active



Hail protection  
net in closed  
position - passive

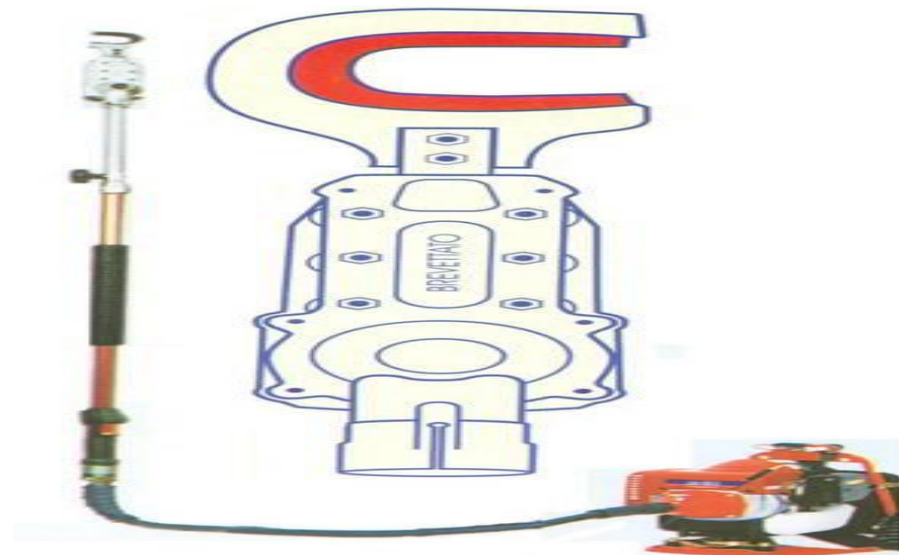
# Mechanical shaker of trees

- Shaking machines can be hand-held, suspended or towed by the tractor.
- Hand shakers are suitable for small plots, and can be mechanical, hydraulic and pneumatic and serve to shake the branches.
- Fruits are collected on platforms that are opened and harvested by hand or mechanically.
- Hand shakers receive motion from hydropumps or compressors that have their own engine.
- The hand shaker consists of the body, the hydraulic or pneumatic cylinder, the clamp and the branch clamp.
- Pressing the liquid or air creates a movement of up to 30 mm with about 12 shakes per second.



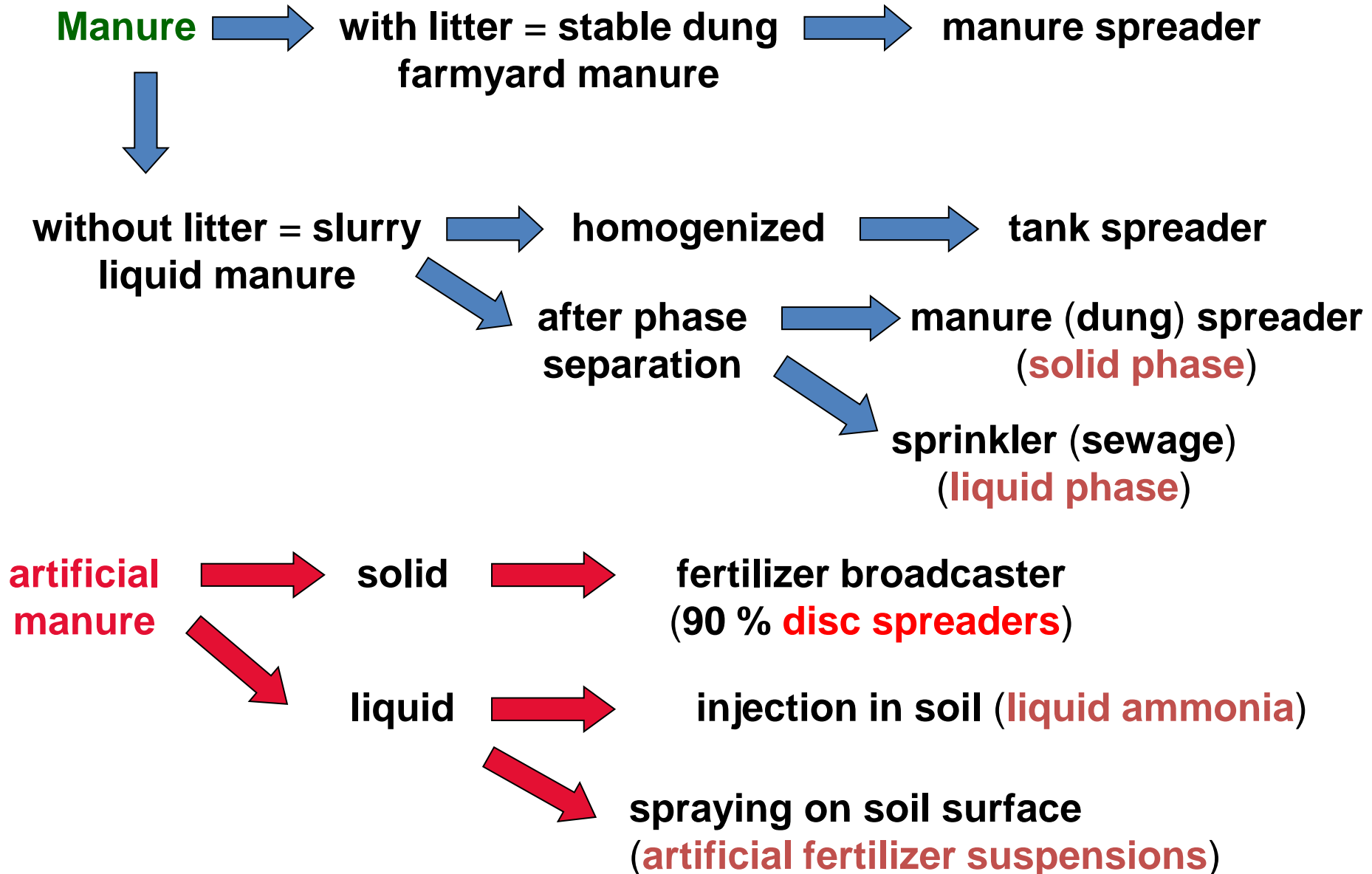
## Shakers hanging or pulled by the tractor

- They are more complex cars that need to:
- shake the fruits,
- acceptance of shaken fruits,
- their collection,
- removal of leaves and other unnecessary parts,
- and transport of packaged packaging.



# **Machines of Manure and Fertilizer Application**

# FERTILIZATION TECHNOLOGIES









# Manure spreaders

with vertical-axis  
shredding rotors



with horizontal-axis  
shredding rotors



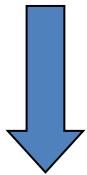
# Setting the manure spreader by an actual spreading rate (t/ha)

hydrostatic drive of bed (scraper) chain



varying the chain speed continuously

bed chain driven by the trailer wheel

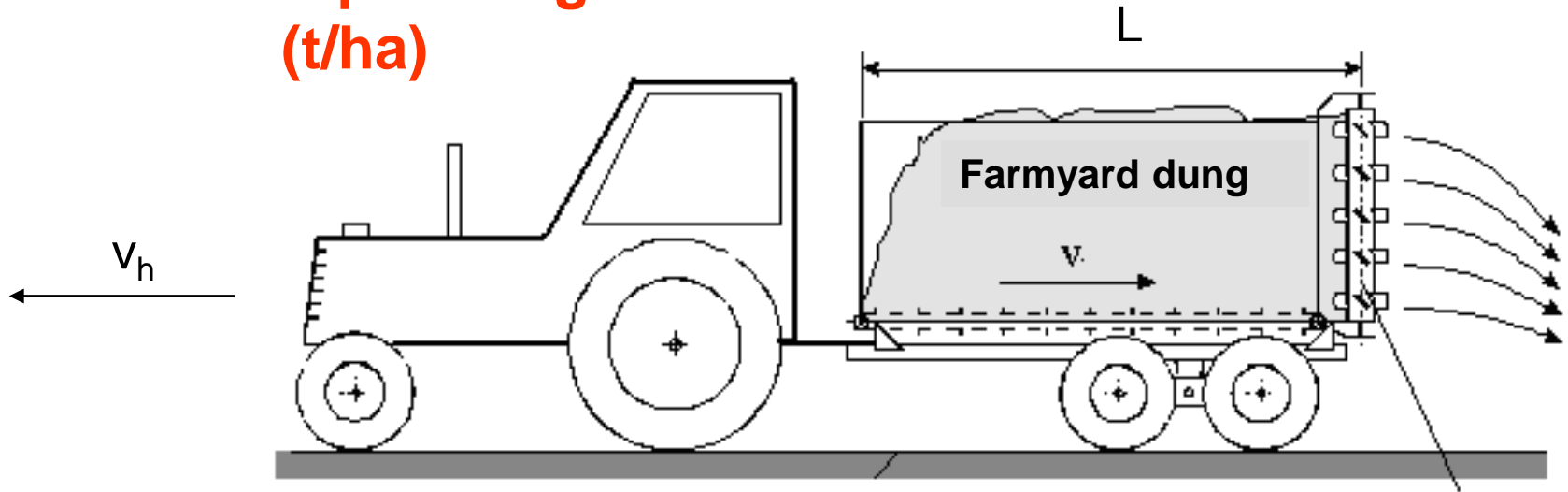


changing gears

(chain or ratchet drive)



# Setting the manure spreader by an actual spreading rate (t/ha)



## Data:

travel speed:

$$v_h = 7,2 \text{ km/h}$$

manure mass to be spread:  $Q = 35 \text{ t/ha}$

spreading width:

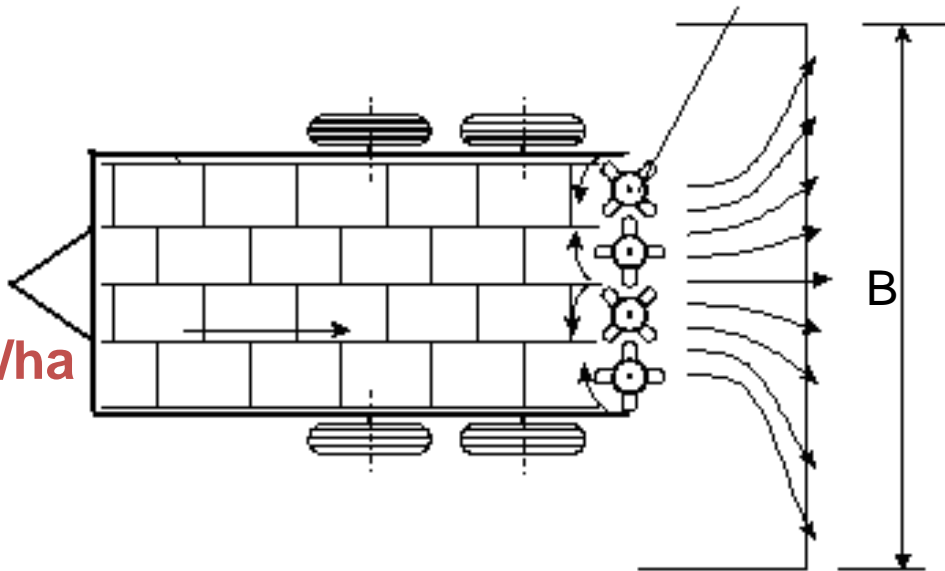
$$B = 6 \text{ m}$$

length of trailer:

$$L = 4 \text{ m}$$

mass of load:

$$M = 7 \text{ t}$$



# Setting the manure spreader by an actual spreading rate (t/ha)

Area spread by one manure load:  $A = \frac{M}{Q}$

$$A = B \cdot v_h \cdot t_{sz}$$

Spreading time:  $t_{sz} = \frac{L}{v_1}$

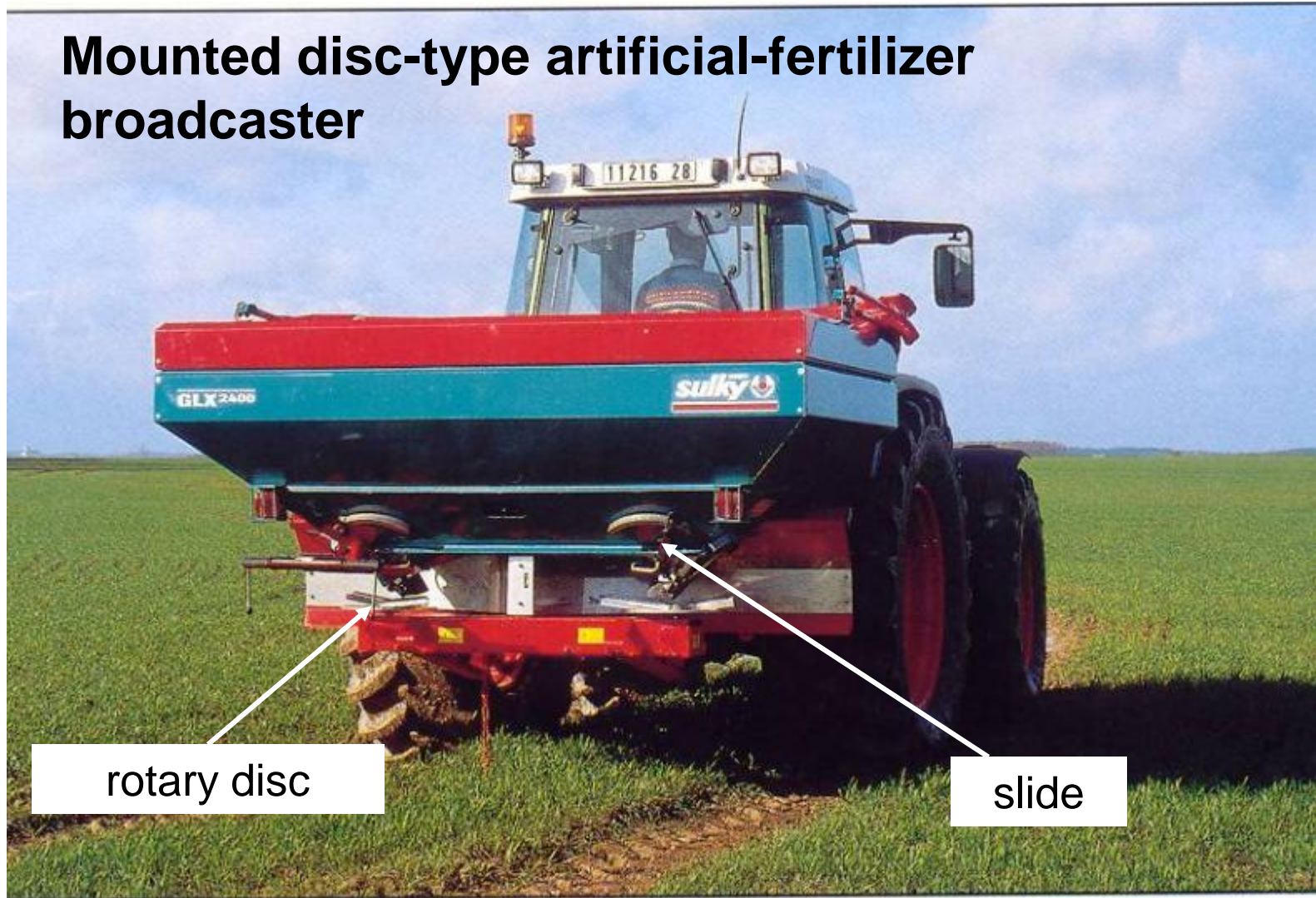
Accordingly:  $\frac{M}{Q} = B \cdot v_h \cdot \frac{L}{v_1}$

From which the chain speed:

$$v_1 = \frac{Q \cdot B \cdot v_h \cdot L}{M} = \frac{3,5 \frac{\text{kg}}{\text{m}^2} \cdot 6\text{m} \cdot 2 \frac{\text{m}}{\text{s}} \cdot 4\text{m}}{7000\text{kg}} = 0,025 \frac{\text{m}}{\text{s}} = 1,44 \frac{\text{m}}{\text{min}}$$

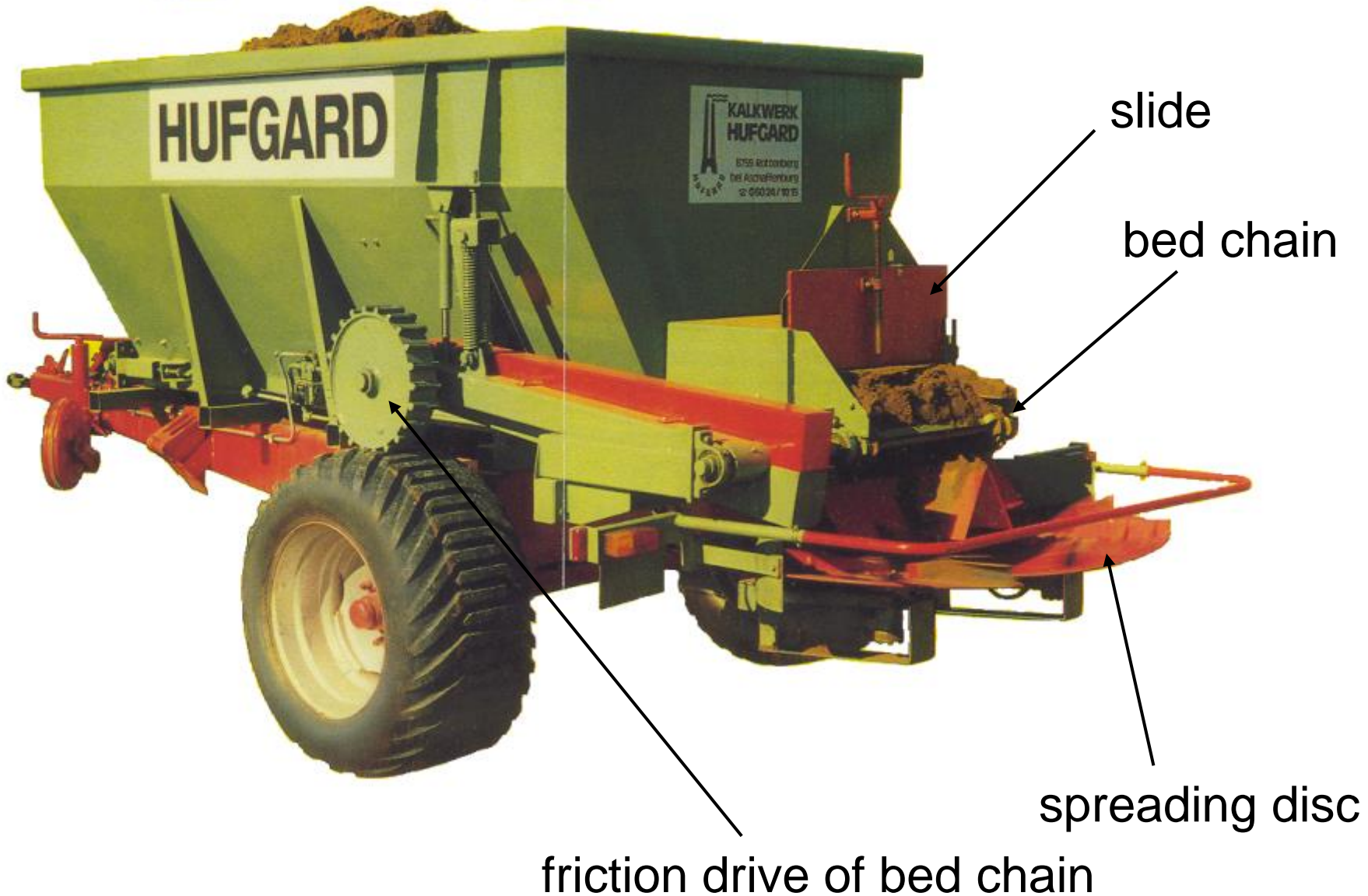
# Fertilizer broadcasters

## Mounted disc-type artificial-fertilizer broadcaster

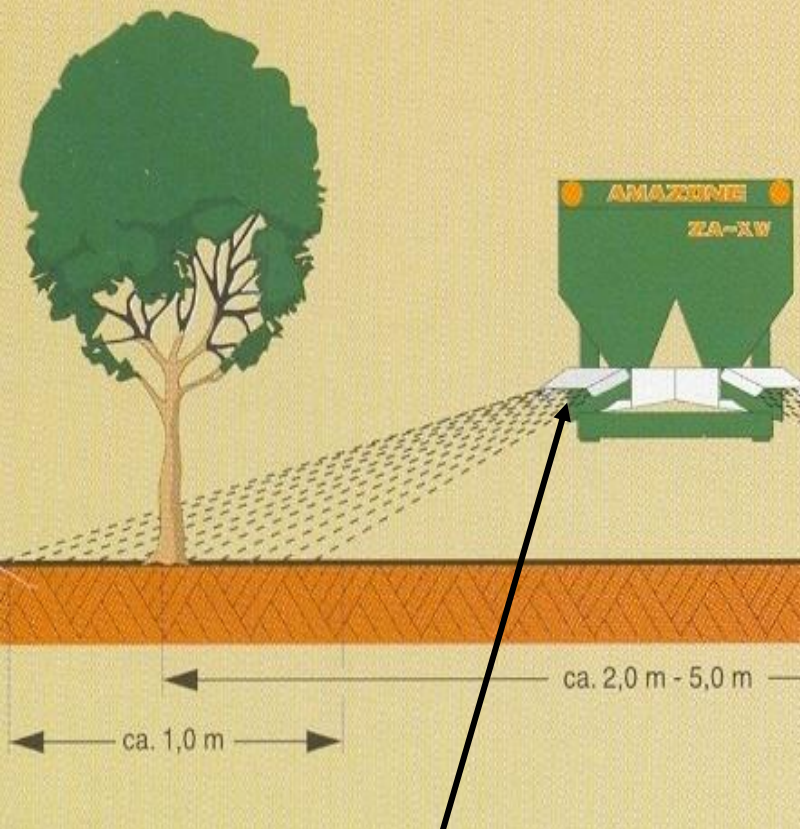




# Fertilizer broadcaster trailer



# Row fertilizing by disc broadcaster

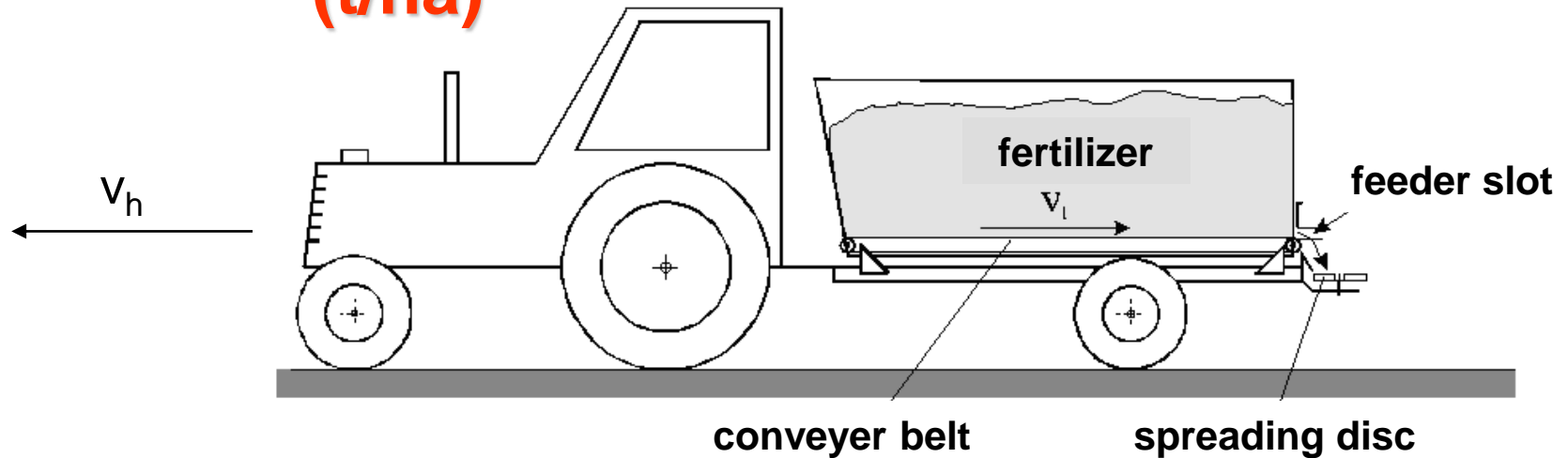


Baffle plates

Distributor tubes

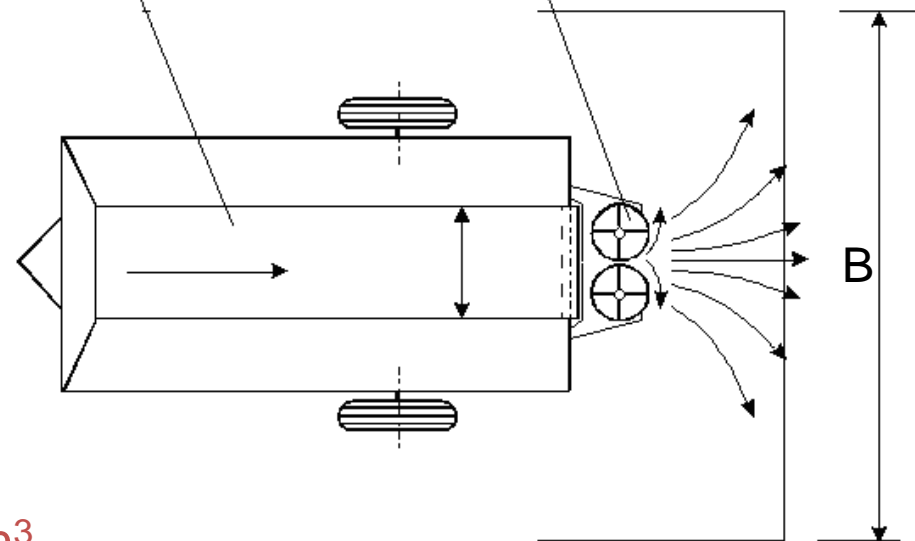


# Setting the fertilizer broadcaster by an actual spreading rate (t/ha)



## Data:

fertilizer to be spread:  $Q = 300 \text{ kg/ha}$   
 feeder slot width:  $b = 1 \text{ m}$   
 spreading with:  $B = 12 \text{ m}$   
 travel speed:  $v_h = 4 \text{ m/s}$   
 bed-belt speed:  $v_l = 2,5 \text{ m/min}$   
 mass of load:  $M = 3 \text{ t}$   
 bulk density of fertilizer:  $\rho = 1800 \text{ kg/m}^3$ .





# Setting the fertilizer broadcaster by an actual spreading rate (t/ha)

Spreading time:

$$t_{sz} = \frac{A}{\dot{A}} = \frac{M}{B \cdot v_h}; \quad t_{sz} = \frac{V}{\dot{V}} = \frac{M}{h \cdot b \cdot v_1},$$

$$\frac{M}{Q \cdot B \cdot v_h} = \frac{M}{\rho \cdot h \cdot b \cdot v_1},$$

Height of feeder orifice  
(slide position):

$$h = \frac{Q \cdot B \cdot v_h}{\rho \cdot b \cdot v_1} = \frac{0,03 \cdot 12 \cdot 4}{1800 \cdot 1 \cdot 0,04} = 0,02[\text{m}] = 20[\text{mm}].$$





# Loading fertilizer spreaders

Loading  
adapter

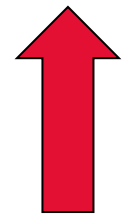
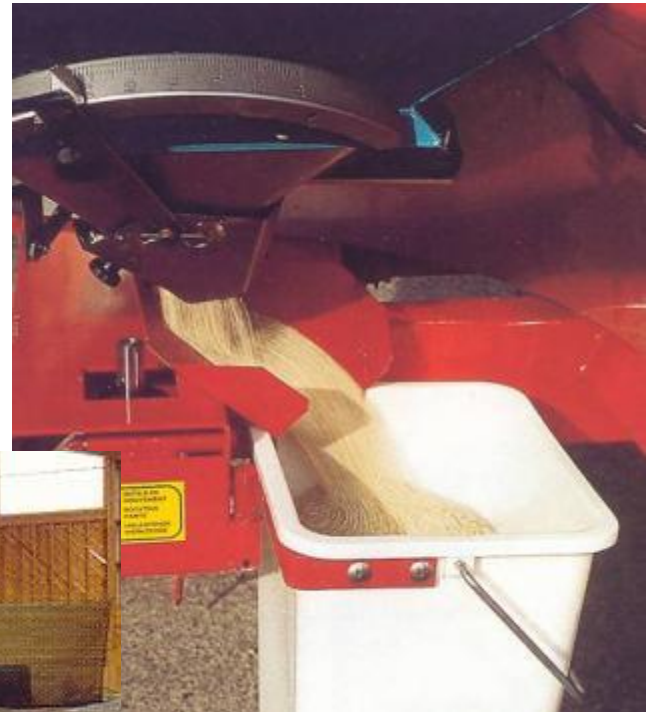


Self-loading from  
flex big-bag  
container

By loader

# Checking the setting of the fertilizer spreader

Scatterplot examination

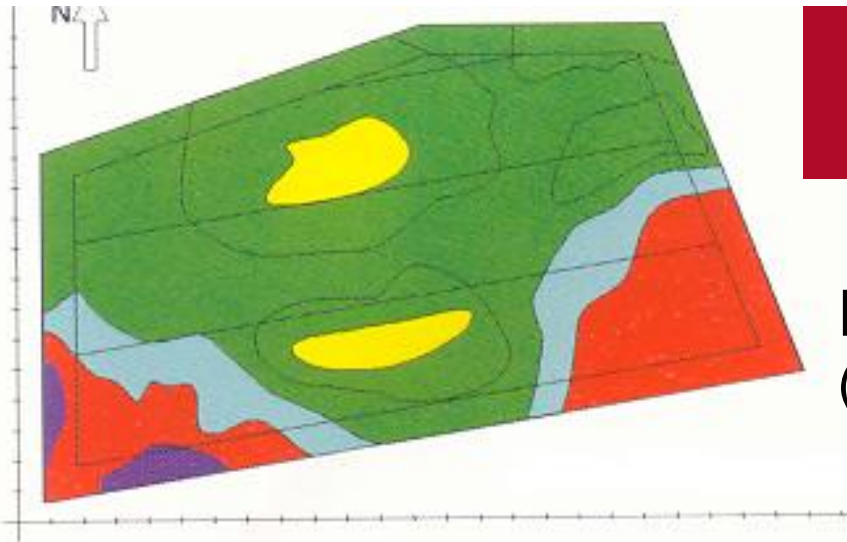


Rotation test

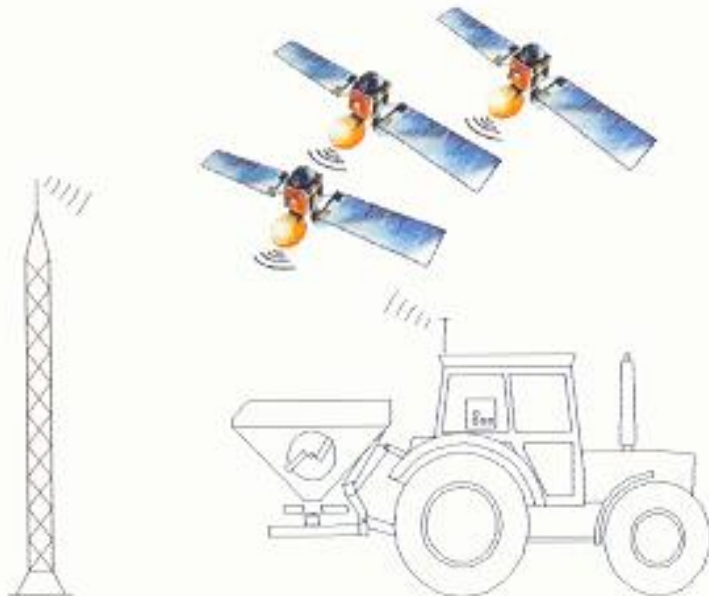


# Environment saving fertilizer broadcasting

Electronic field map  
(colours indicate nutrient demand)



GPS  
(Global Positioning System)



On-board computer

**Pneumatic**

**fertilizer broadcasters**



distributor cone

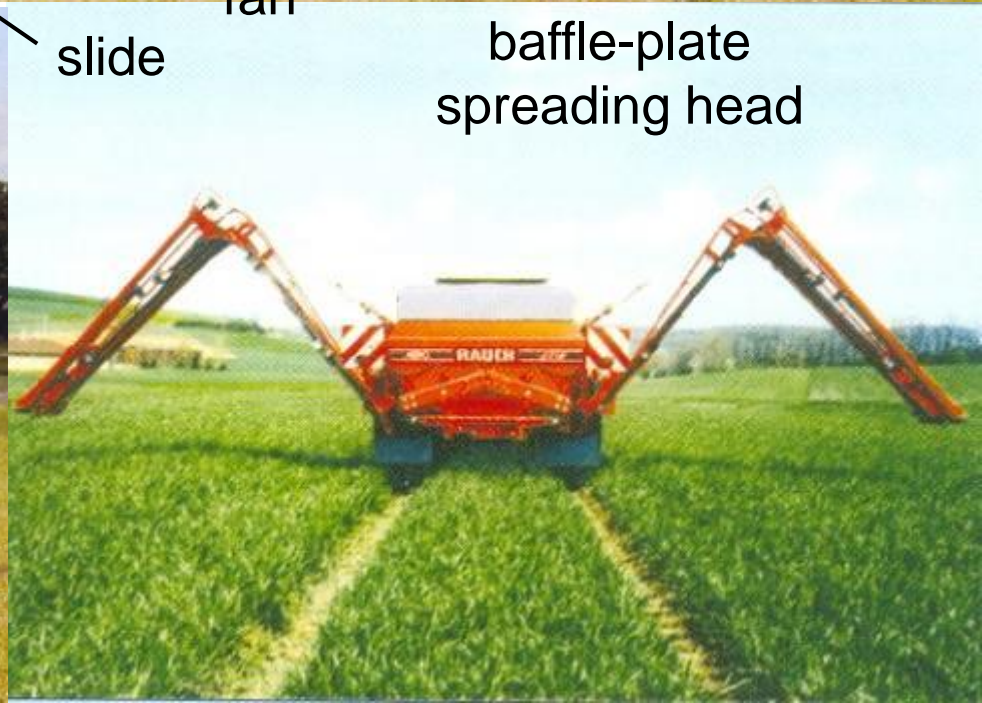
fan

slide

baffle-plate  
spreading head



foam track marker





# USE OF PLANT PROTECTION PRODUCTS

- Pneumatic sprayers
- The principle of treatment is the combination of fluid flow with air pressure and optimal treatment with strong air current in all parts of the plant.
- Atomizers used to be mainly used in orchards and vineyards but now they are also quite successfully used for the treatment of arable crops.
- Atomizers are characterized by large amounts of air (about 50,000 m<sup>3</sup> / hour) obtained from the fan, and air sprinklers that produce air velocities of 40-50 m / sec.
- Here are obtained fine particles of pesticide that cover the whole plant, without transport by wind or hot air currents.

# Advantages of pneumatic sprayer

- Water consumption per unit area is very small, where instead of spraying 1,000 liters of water by atomization for 1ha of vineyard, 200-300 liters of water are consumed.
- While for the treatment of 1ha orchards with this method 200 - 300 l of water are consumed, so the soil compaction is smaller.
- The air current which carries the droplets enables their penetration in the inner and upper parts of the crown as well as on the opposite side of the crown.
- In addition, the air current conditions the twisting of the leaf and thus enables treatment on the leaf surface as well.
- Because the droplets are smaller compared to spraying, the leakage losses from the object being treated on the ground are smaller.

# Deficiency of pneumatic sprayer

- Dependence on the wind that weakens the quality of work,
- Transfer losses (drift) are large and in special cases may completely prevent treatment with this method.
- Used only in the protection of grape trees and vines
- They are not suitable for winter spraying as well as for the application of herbicides.

## Backpack atomizers

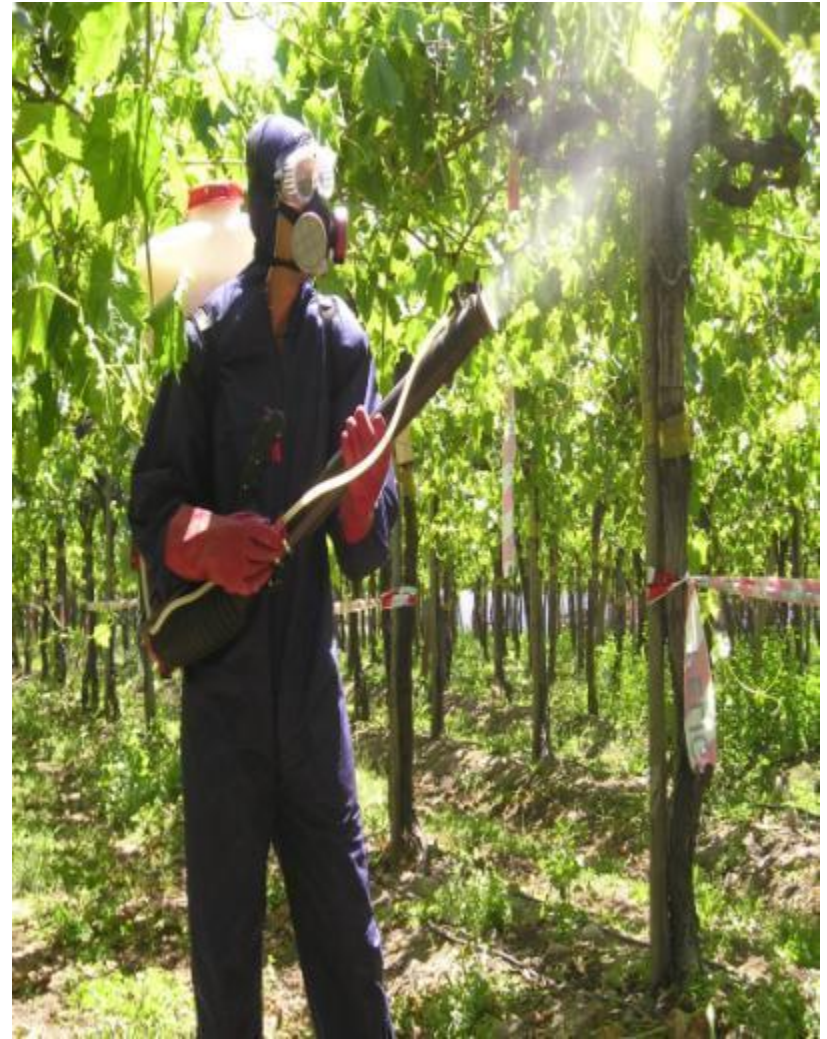


Used for treating small areas, and in those places where there is no water.

They are equipped with a radial fan with a capacity of 5-10 m<sup>3</sup> of air per minute, while the air stream comes out through the "ball" with a speed of up to 100 m / s.



# Backpack atomizers





Atomizer with tangential fan  
and air stream conductors



Flexible pipe  
atomizer



# Electrostatic sprayers



Apply an identical electric charge to the emitted micro-dots, which dots are attracted by the plants.

This innovative technology reduces the amount of water used for operations by 90%,

Lower working time and manpower by 70% and manage to reduce drift by 95%,

Reduce the amount of product applied to plants by 45-50%.

# Drip irrigation

- Here the water passes through plastic pipes placed quite densely across the surface and coming out through special holes, dripping wet the soil and each plant that is cultivated.
- The drip irrigation equipment consists of a motor hose, a water flow regulator and a water pressure gauge, a water purifier and a fertilizer dumping device.







Low volume irrigation systems provide water in or near plant root areas, with greater efficiency for healthy plants and exceptional water savings.



For trees, in addition to the drip irrigation system located in the ground, a drip sprinkler irrigation system is installed which is more suitable as it provides a better environment.



# Materiel Handling in Agricultural Production

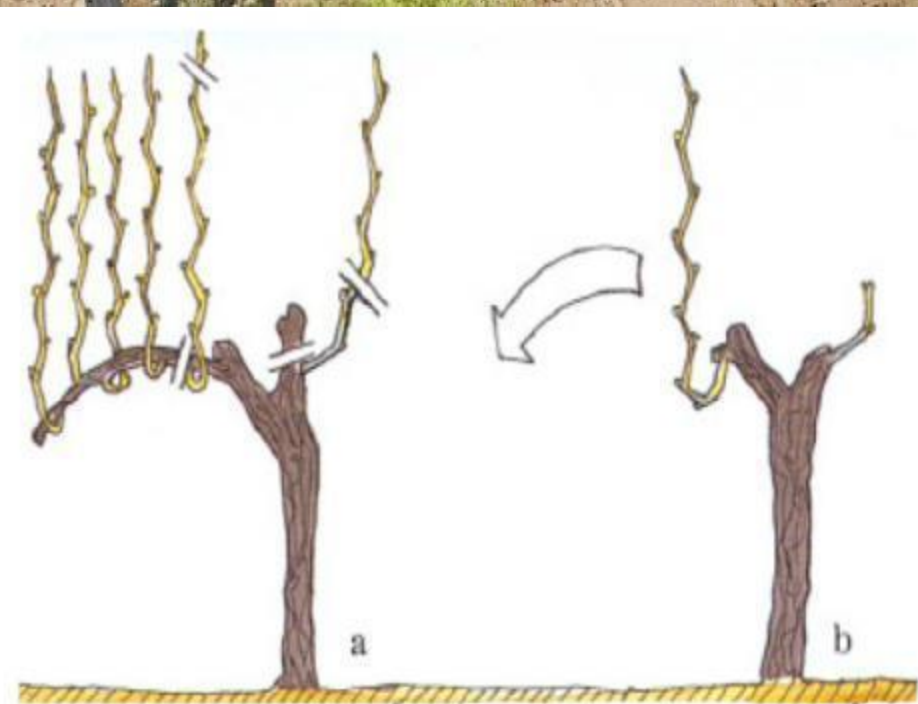
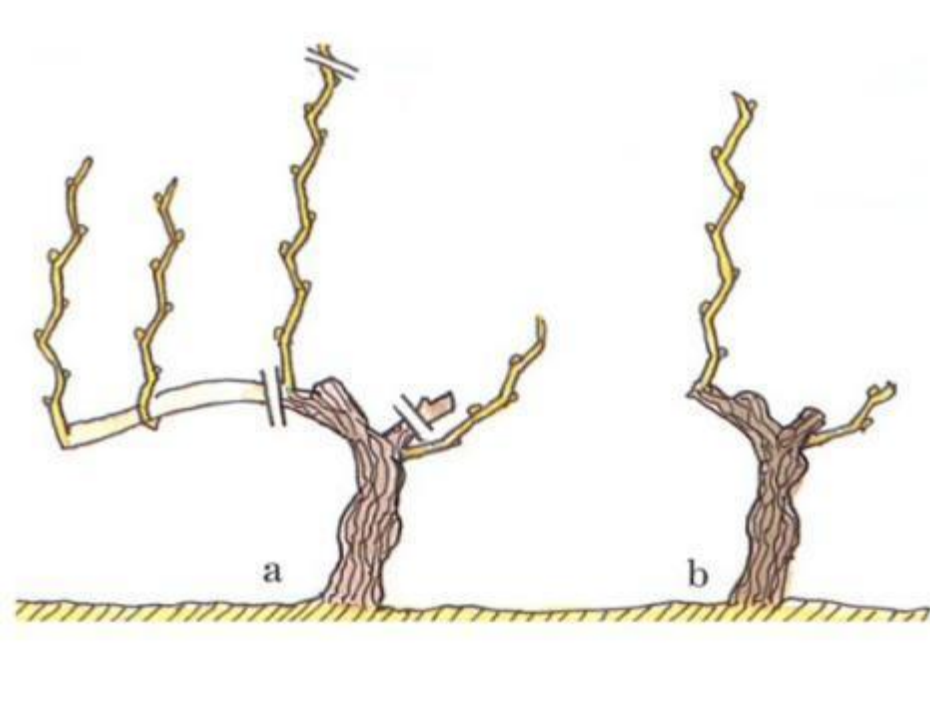
# Pruning of plants

- In general, trees are pruned to get the shape they want,
- to achieve the desired size,
- to facilitate spraying,
- to improve fruit quality,
- improve strength and promote branching and improve air circulation inside the tree, which would reduce the development of the disease.

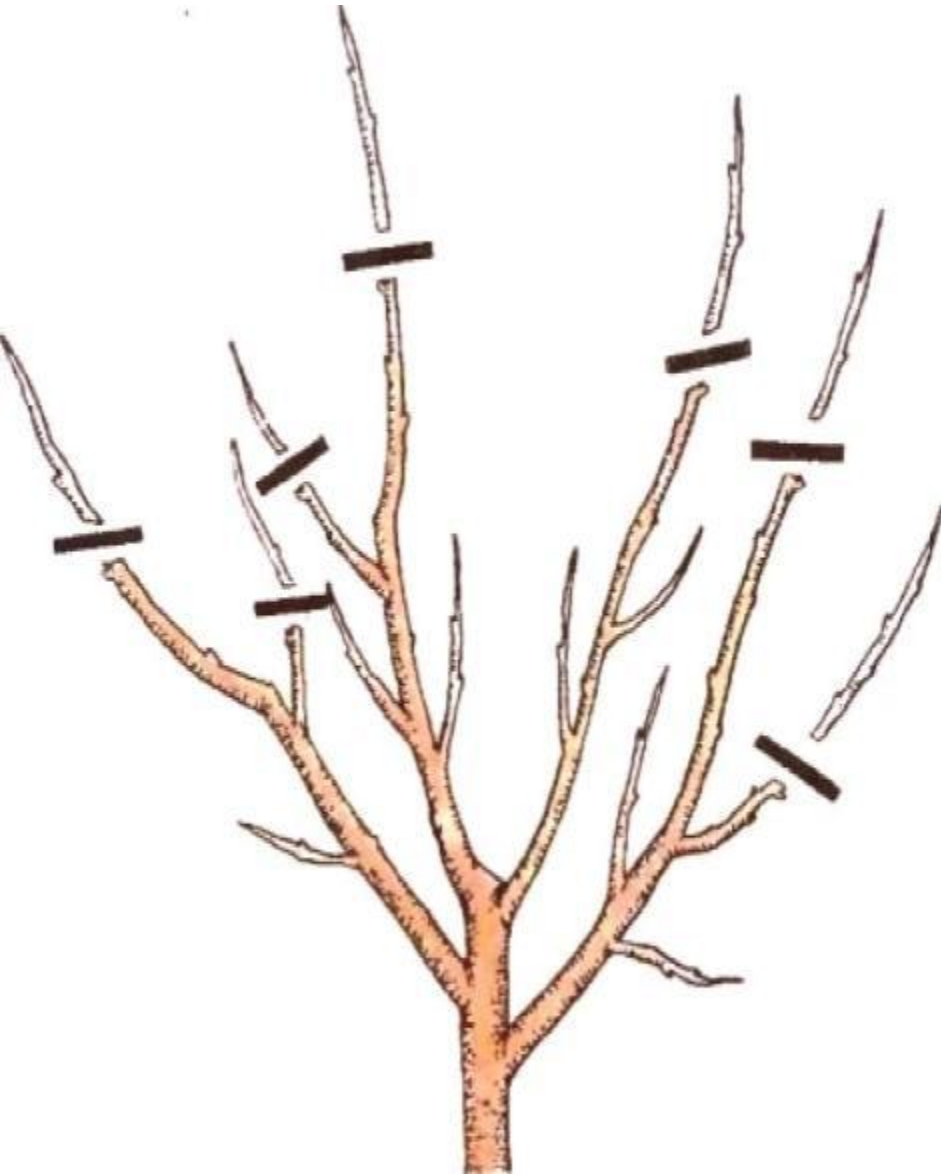




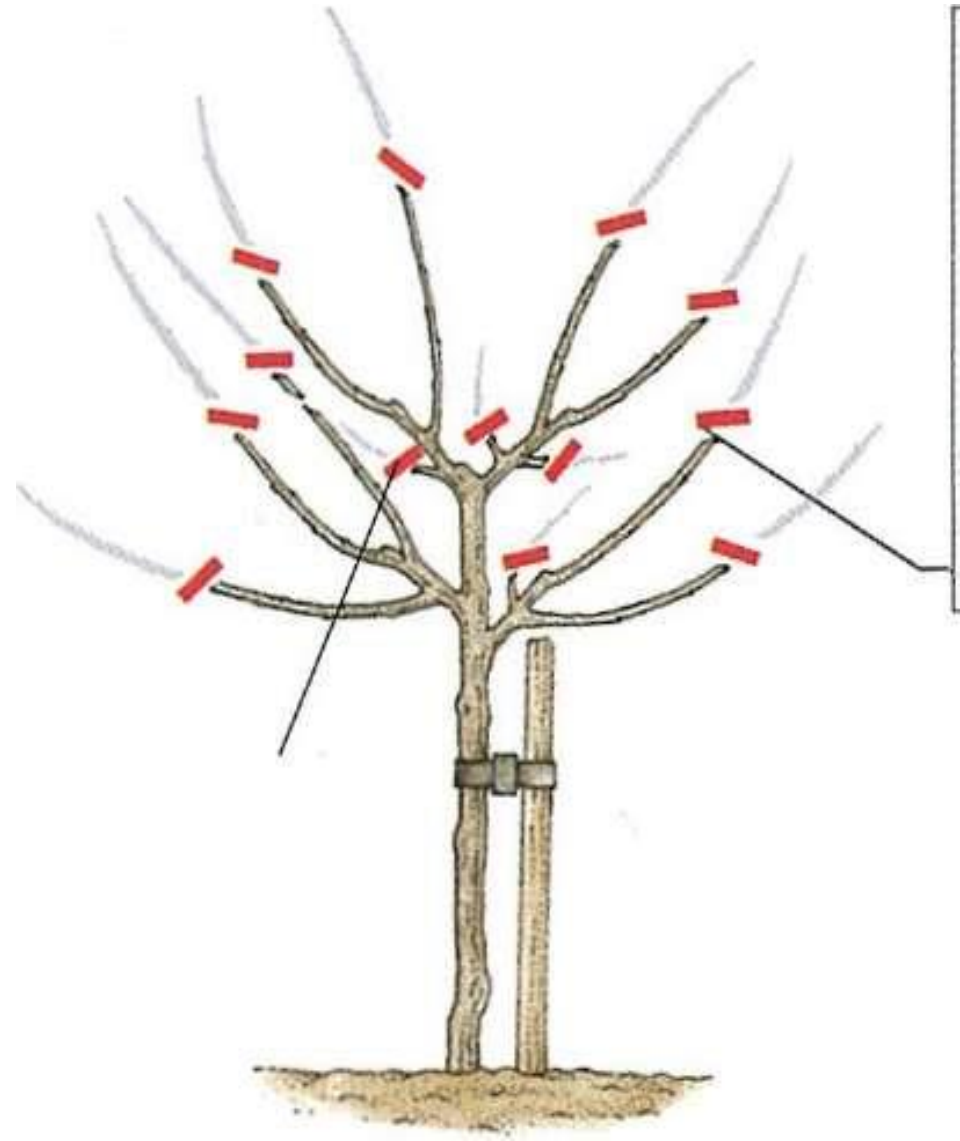




Pruning of peach tree

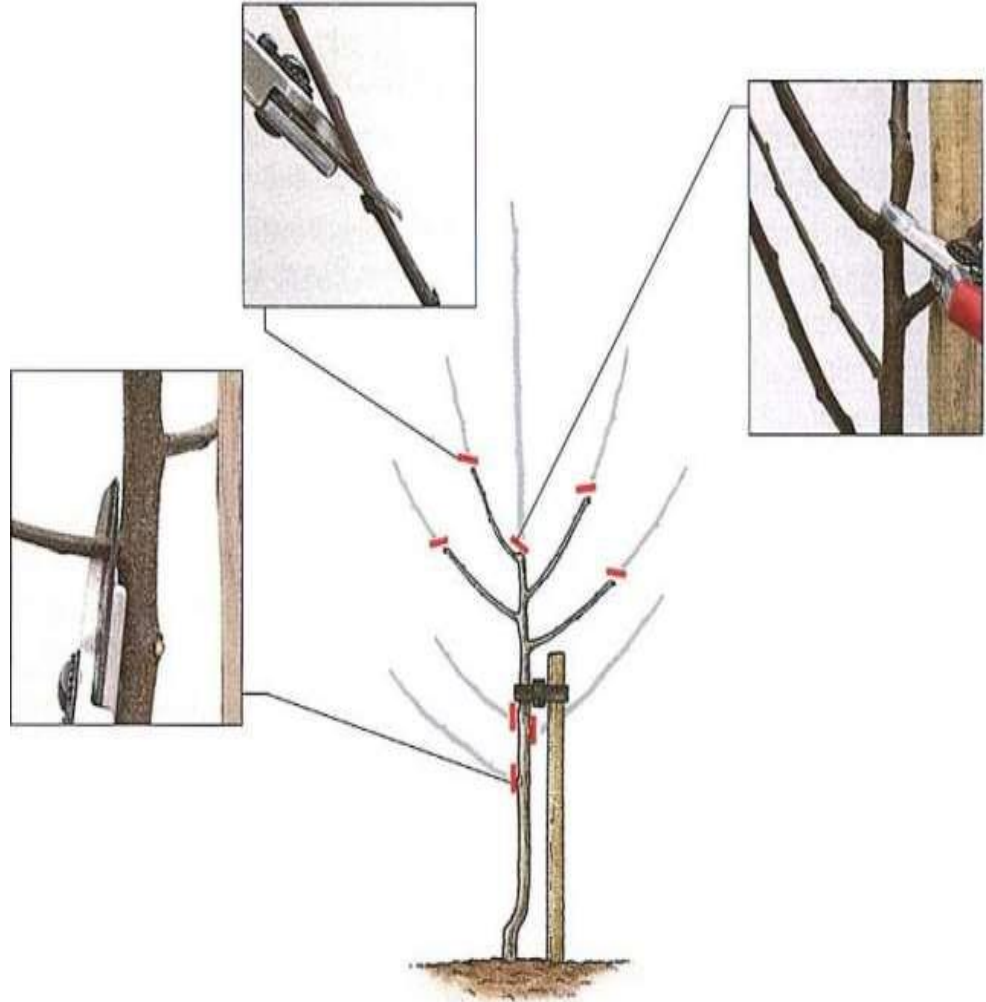
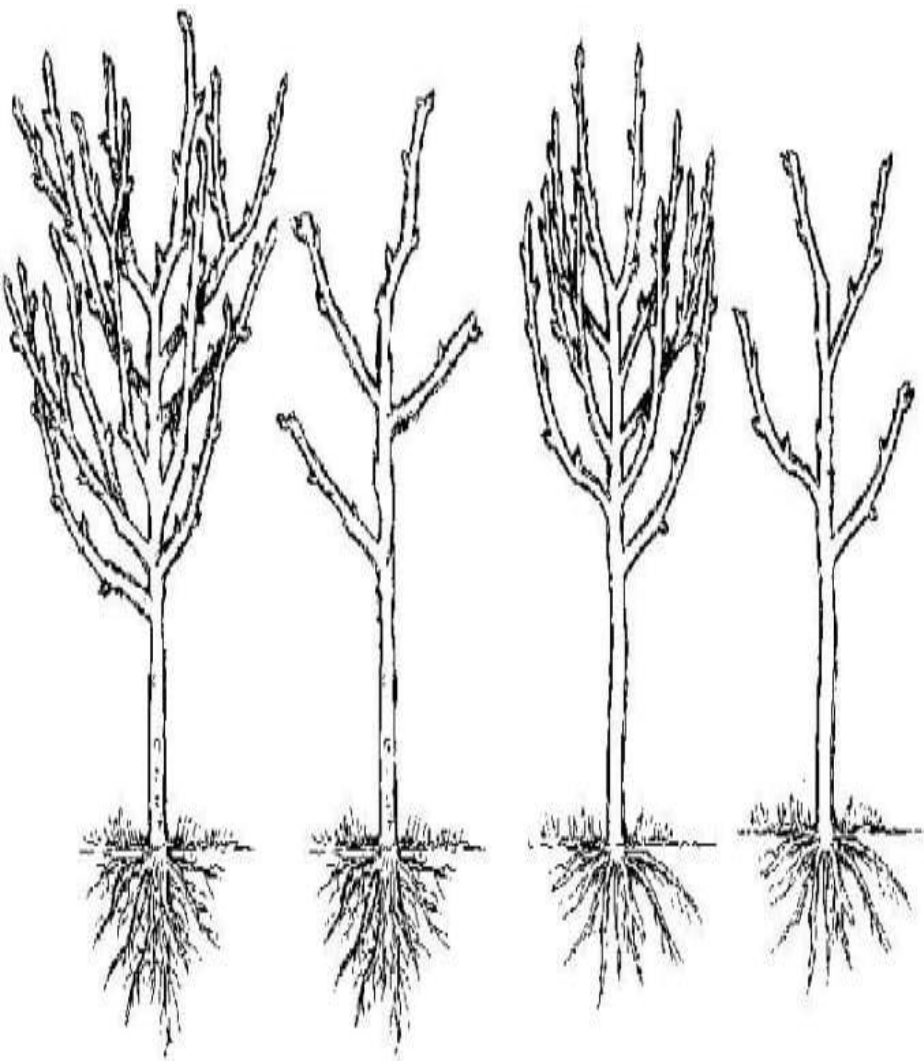


Pruning of nectarine tree

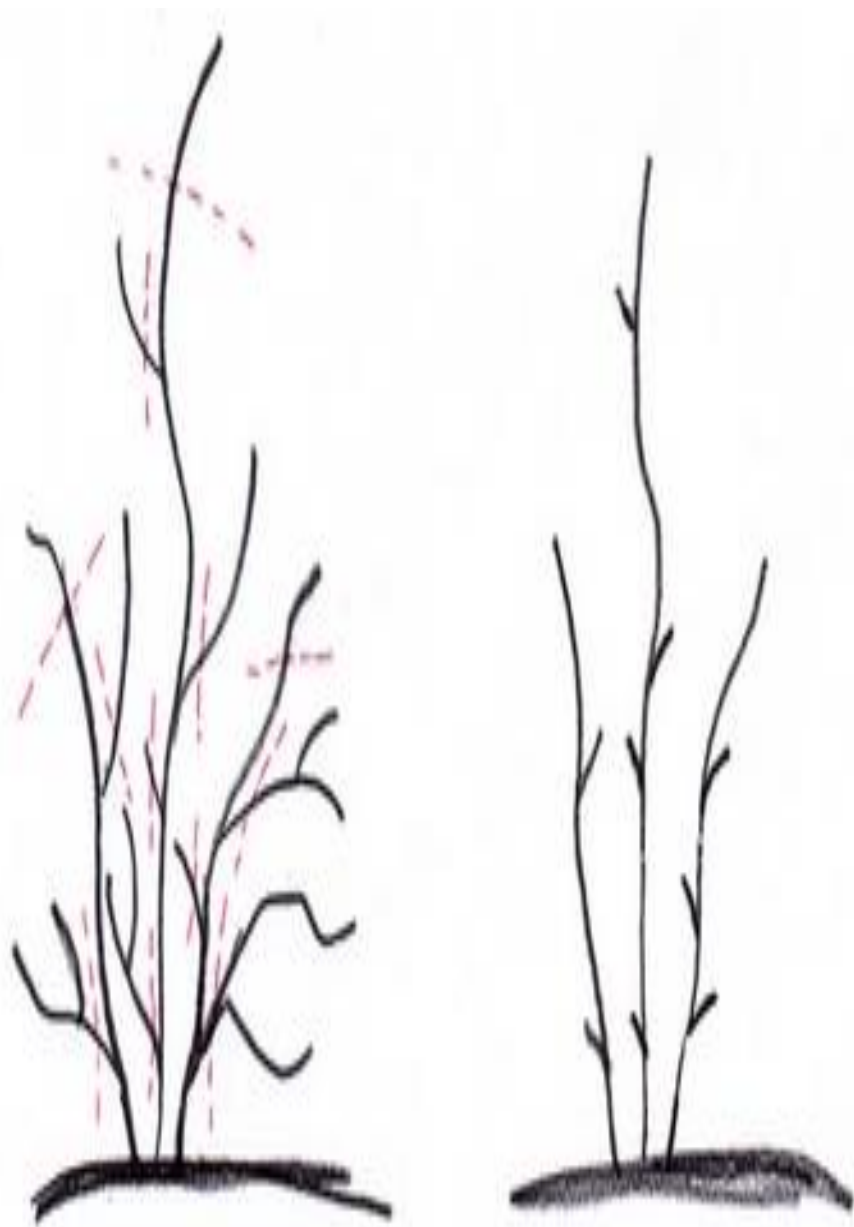


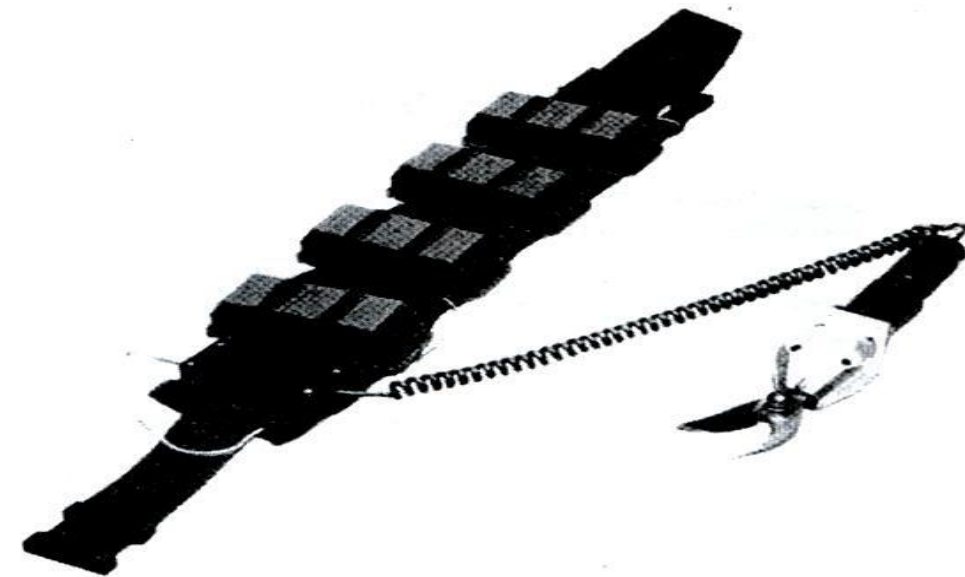


## Pruning of plum tree



## Pruning of blueberry bushes





## ELECTRICAL SCISSORS

To combat the risk of injury due to repetitive movement patterns and to support muscles, many people now use motorized shears.

The new electric models are particularly lightweight and low-power devices that work with a micromotor to offer higher efficiency with lower grinder weight



# Harvest and postharvest of fruit and vegetables

- Adequate harvesting practices, careful harvesting, adequate packaging, storage, and transportation contribute to maintaining the quality of the product after harvest.
- The quality can not be improved after harvest, only maintained.
- Therefore, it is important to harvest the trees at the appropriate stages and at the highest quality stage.
- Unripe or overripe products can not stay long in storage like those harvested at the time of optimal ripeness.

# The importance of cleanliness and care during harvesting

- PURITY
  - Use of adequate packaging for the product
  - Surfaces that contact the product
  - Protocol to ensure consistent cleanliness
- 
- CARE
  - Minimize product damage
  - Minimize time by touching the product
  - The consequences of the injury are shown later





Production, harvesting and storage are equally important for a high production and quality of vegetables.



The storage of vegetables starts from the moment of harvest until the end of the food to the consumer



Maturity stage for quality and longevity: harvest at the right stage for the target market





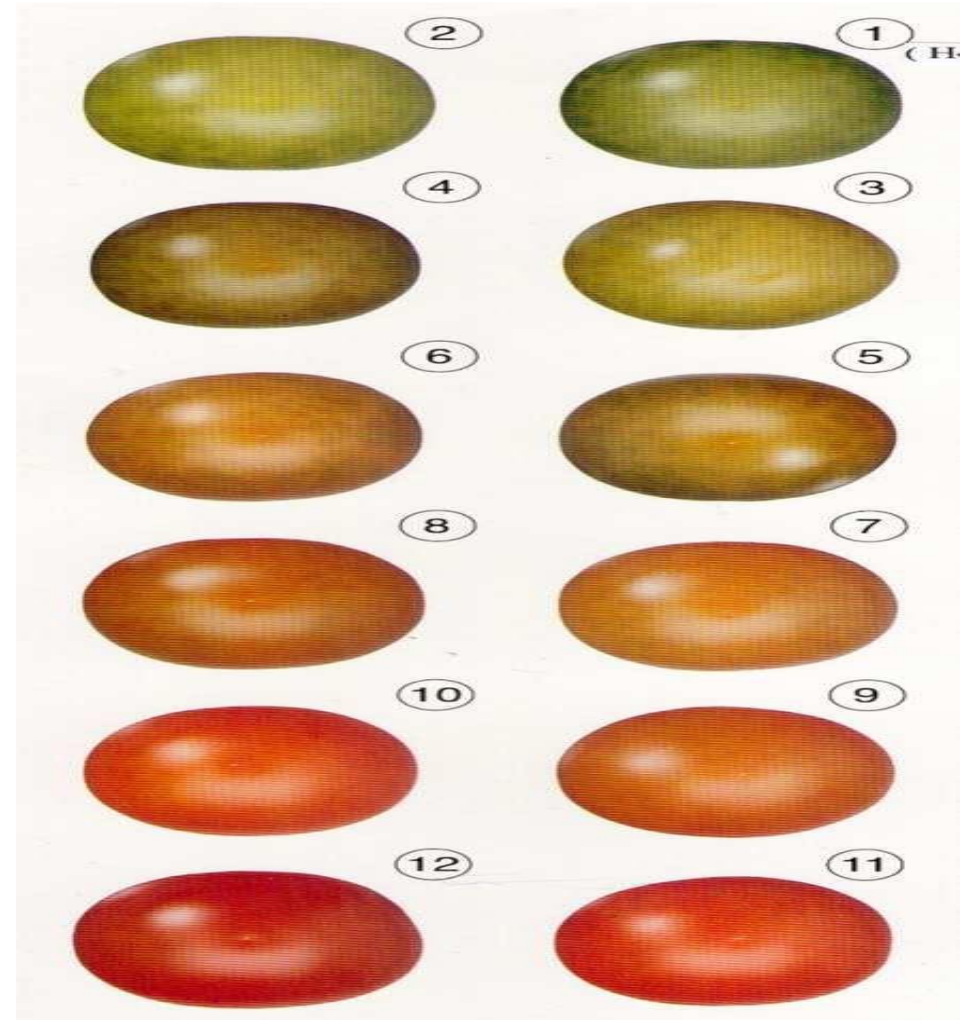
# Basic Principles of Post-Harvest Fruit and Vegetable Treatment

- Harvest to the right maturity
- Reduction of physical treatment
- Product protection from the sun
- Simple and fast packaging
- Ensuring workers' hygiene
- Careful classification and packaging
- Cool as soon as it is possible
- Familiarity with market demands and product





Harvest time depends on the type and cultivar,  
ripening, market distance - length of transport



# Analytical evaluation of fruit ripening

- Tomato hardness -  
Durometer



Color change Minolta colorimeter





# Harvesting



**Potato harvesting**



**Lettuce harvesting**



**Harvesting products in hydroponic greenhouses**



**Transport of tomatoes in the greenhouse**



# Other harvesting practices

Asparagus harvesting



Garlic harvesting



Celery harvesting



Pumpkin harvest



# Principles of harvesting

- Harvesting should be done during the coldest time of the day, which is usually early in the morning, and the product should be kept in the shade in the field.
- The product must be handled sensitively.
- Plants intended for storage should be protected from peeling, cracks, bites, sprains and other damage.
- Compressions and other mechanical damage not only affect the physical appearance of the product, but also its rapid deterioration.



Keep  
containers off  
the ground



Pallets to  
collect crates

Lower box on  
the ground



Simple treatment, very clean and careful for high quality product  
Post-harvest treatment that allow growers to compete effectively

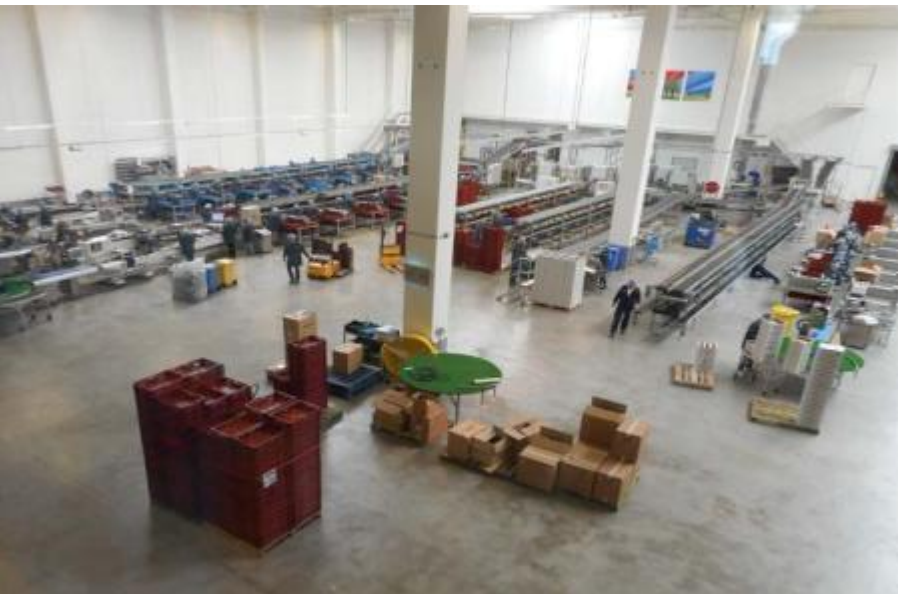


# Packaging of vegetables after harvest



Harvesting and packaging in the field / greenhouse

The packaging must be designed to protect against physical damage to the product and to be easily handled.

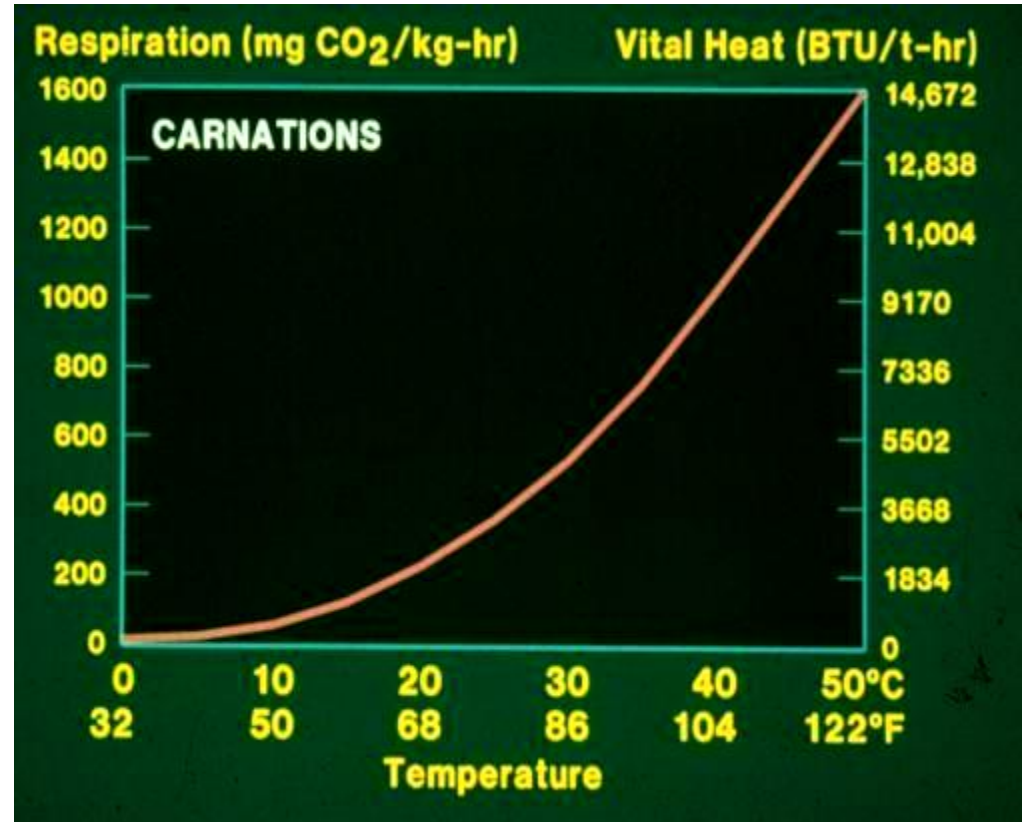
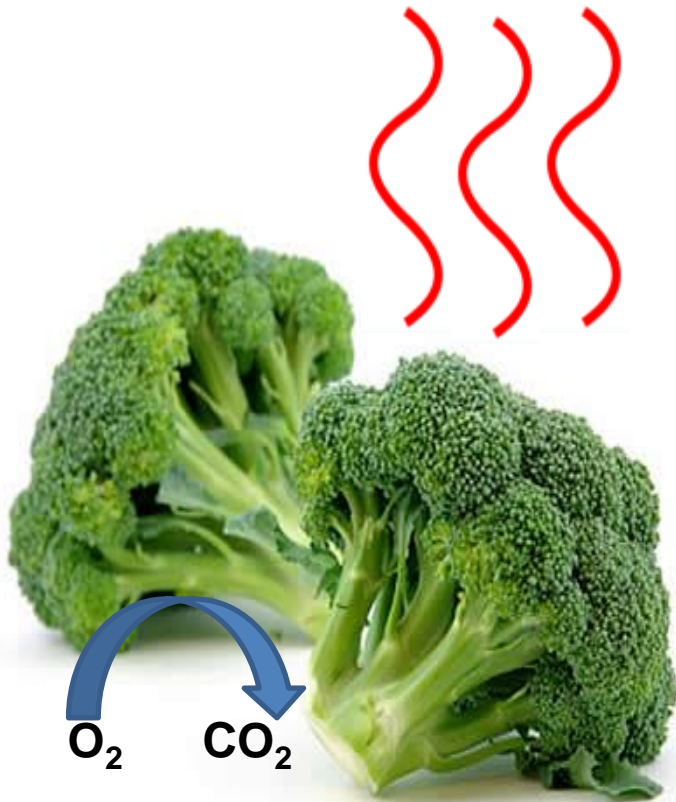


Packaging in packing houses



# Why temperature is important

- The rate of deterioration a rate of respiration
- Breathing:
- Sugar + O<sub>2</sub> → CO<sub>2</sub> + H<sub>2</sub>O + Energy (Heat)
- Respiration increases exponentially with T

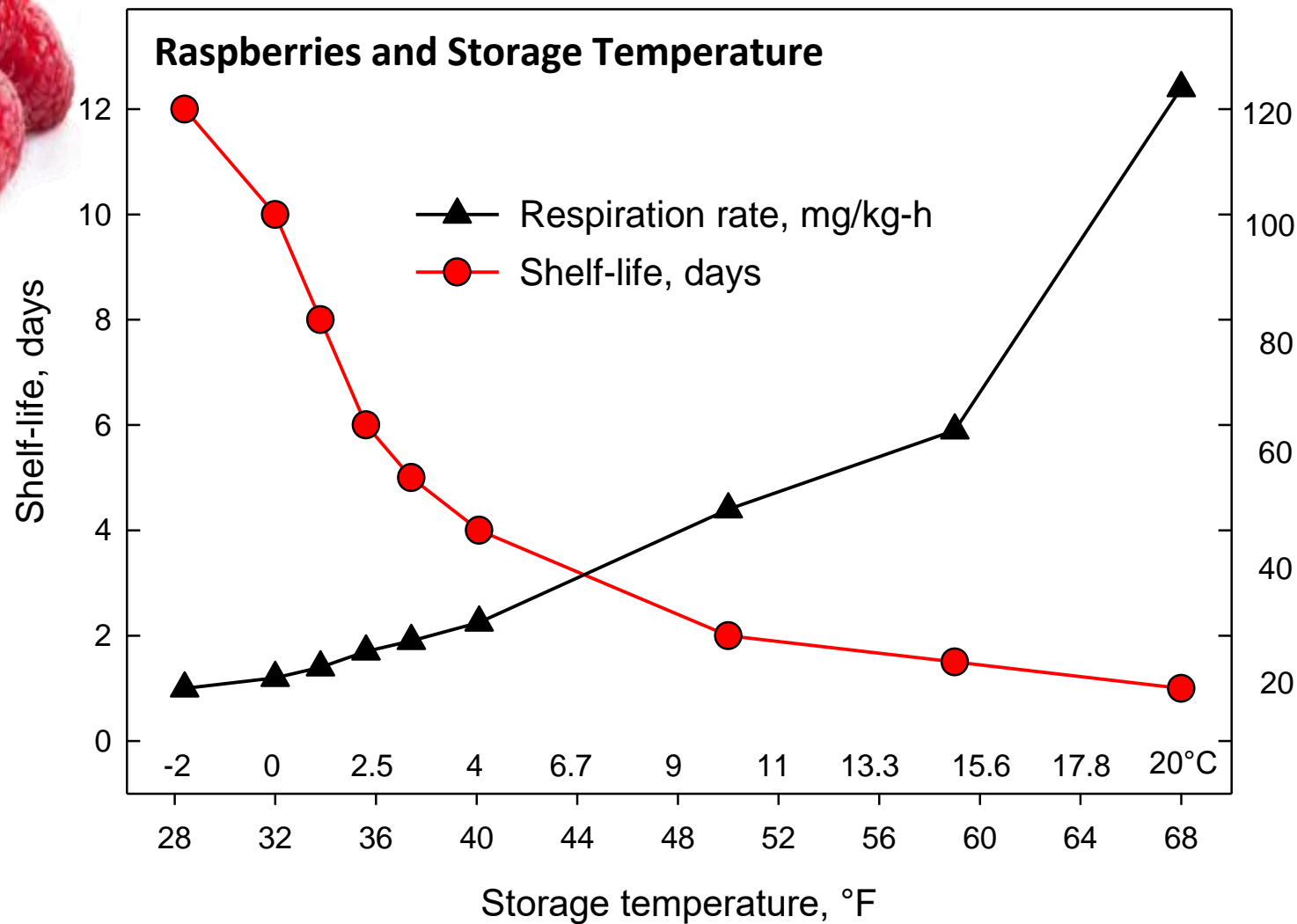






Raspberries

Temperature affects longevity by controlling metabolism and decay

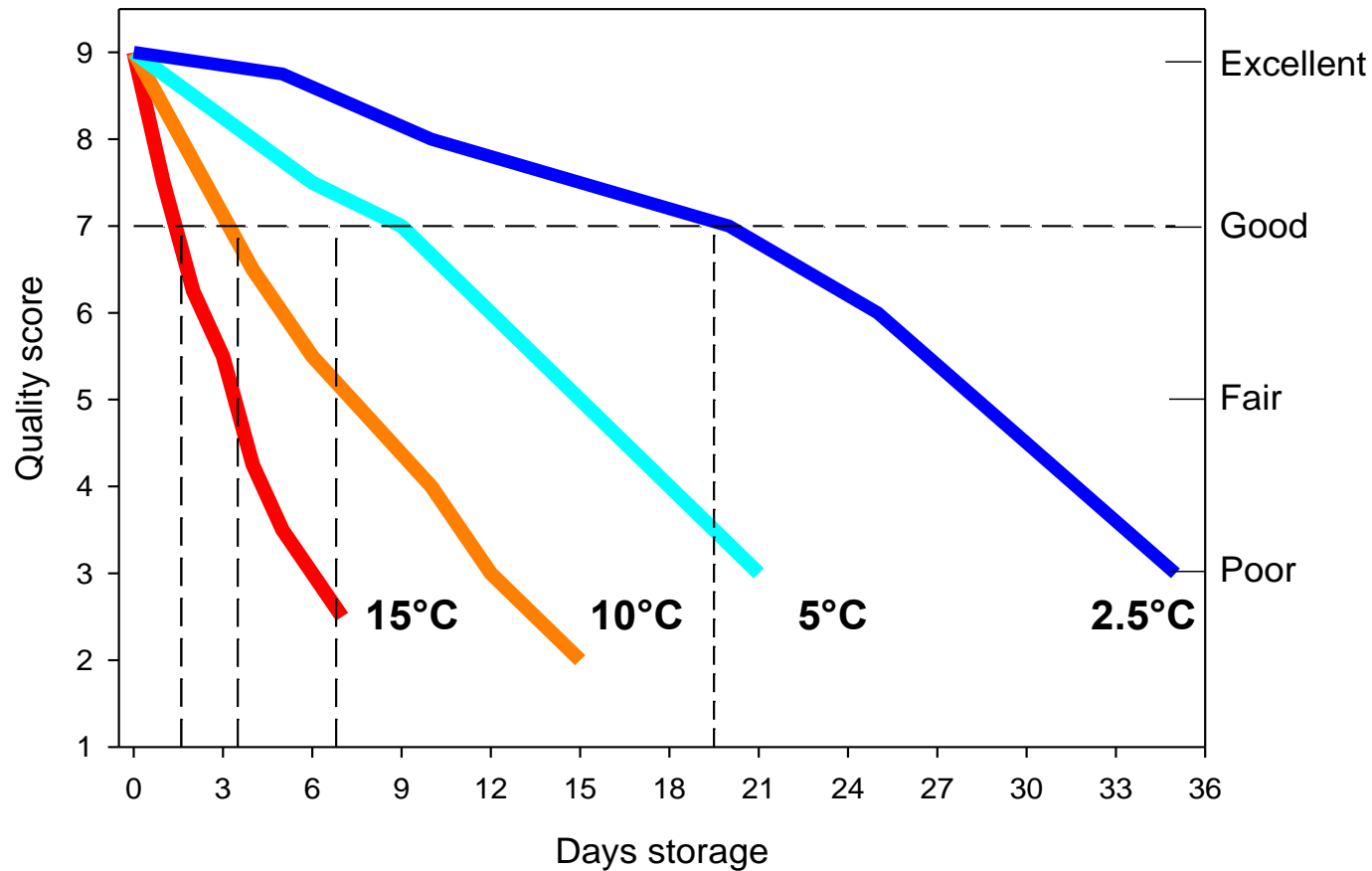


## Asparagus

- 1-2.5 °C
- High humidity
- 1-2 weeks;
- 3 weeks MA (10% O<sub>2</sub> + 10% CO<sub>2</sub>)



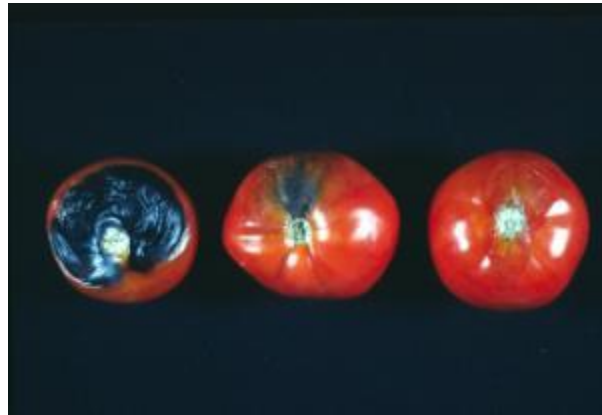
### Asparagus: Deterioration and Temperature



Decomposition during storage (bacterial)

# Symptoms of cold damage

- Surface hole
- Water soaking
- Coffee
- decay
- necrosis
- Poor aroma



Usually cold symptoms do not appear until the product is transferred from the cold room to a warmer temperature.







Recommendation for strawberries: Cool within 2 hours

General rule: for every hour of delay in cooling, you lose 1 day of shelf life





11 a.m. Cranberry temperature reaches around 35 C





# Vegetable sorting

1. Classification by weight
2. Classification according to mechanical size
3. Classification according to electronic image





# SORTING

Different classes and sizes  
Classification by size



Classification by color



# Quality control



Selection of fruits by hand or through mechanical equipment



# Packaging can be done in the field or in specialized places





# Packaging material and methods





# Micro packaging





# Packing line



Packing can be done by hand or machine





# Materials handling in agriculture

- Materials handling is concerned with the movement and handling of materials and products in a systematic manner from point of origin to destination.
- Movement may be in any direction-horizontal, vertical or any combination of the two
- Handling of agricultural materials and products is important, not only because of the work involved, but because of its effect on costs, product quality and management.

# How important is material handling

- Materials handling costs account for as much as 25 percent or more of the total production cost for certain agricultural crops.
- These costs can be lowered with efficient materials handling systems in which the components are integrated to provide a smooth flow of materials.
- A thorough analysis of materials handling can have a great opportunities for reducing costs

# Example of material handling influence on production

- Consider a 10 hectares production orchard operation.
- Product handling alone involves almost 500 tons and in many cases this tonnage is handled many times before it reaches market destination so that a total of 2,000 tons or more will be handled.
- In addition, production materials and supplies such as fertilizers and chemicals involve considerable handling



# Goals of material handling

- Reduce unit costs of production
- Maintain product quality, reduce damages, and provide protection of materials
- Promote safety and improve working conditions
- Promote productivity
- Promote increased use of facilities
- Control inventory

# DEGREE OF MACHANIZATION IN MH

- A MH System can be completely manual or fully automated
- Different degrees of mechanization also exist between these two extremes
- Level of Mechanization in MH System is classified with respect of:
- Source of power for handling,
- Degree of human involvement in operating the equipment

# Types of handling equipment

- Material handling equipment is mechanical equipment used for the movement, storage, control and protection of materials, goods and products throughout the process of manufacturing, distribution, consumption and disposal.
- The different types of handling equipment can be classified into four major categories:
  - transport equipment,
  - positioning equipment,
  - unit load formation equipment, and
  - storage equipment



# Material handling equipment

- A diverse range of tools, vehicles, storage units, appliances and accessories involved in transporting, storing, controlling, enumerating and protecting products at any stage of manufacturing, distribution consumption or disposal.
- Storage equipment is used to hold or buffer materials during “downtimes,” or times when they are not being transported.
- These periods could refer to temporary pauses during long-term transportation or long-term storage designed to allow the buildup of stock.
- The majority of storage equipment refers to pallets, shelves or racks onto which materials may be stacked in an orderly manner to await transportation or consumption.

# Bulk material handling equipment

- Refers to the storing, transportation and control of materials in loose bulk form.
- These materials can include food, liquid, or minerals, among others.
- Generally, these pieces of equipment deal with the items in loose form, such as conveyor belts or elevators designed to move large quantities of material, or in packaged form, through the use of drums and hoppers.
- Conveyor belts
- Bucket elevators
- Grain elevators
- Hoppers
- Silos

# Transport equipment

- Is used to move material from one location to another (e.g., between workplaces),
- Positioning equipment is used to manipulate material at a single location.
- The major subcategories of transport equipment are conveyors.
- Material can also be transported manually using no equipment



- The design and fabrication of bulk material handling equipment—which includes drag conveyors, belt conveyors, bucket elevators, and valves and fittings—is another segment of Agri-Products Inc.



# Conveyors - Advantage

- Permits high capacity for moving large number of items
- Their speed is adjustable
- Handling combined with other activities such as processing & inspection is possible
- Load transfer is automatic & does not require the assistance of many operators
- Straight line paths are not required
- Utilization of the cube is feasible through the use of overhead conveyors

# The material handling stage

- Considerable emphasis has been placed on updating growers on savings and lower the cost of production.
- Many growers who have adopted these ideas have realized significant savings.
- But still the largest cost item in plant production is labor.
- Equal or greater savings can be obtained by incorporating materials handling techniques and mechanization into the growing operation.
- Labor efficiency is something to strive for whether you operate a production by yourself or hire many employees.



# Evaluating labor efficiency and need for MH

- A good starting point for evaluating labor efficiency is to collect data on which operations require the greatest amount of time.
- Transplanting, potting, hand watering, spacing and plant selection for shipping are some of the greatest labor users.
- These tasks are the ones that should be evaluated first to see if improvements can be made.
- Equipment is available for almost all the tasks that take place in the agriculture production but not all tasks should be mechanized, especially for the grower with only a small amount of growing area.
- Some of this equipment is very expensive.
- Many machines have been used only a few days out of the year.
- Purchasing decisions need to be made only after considering many factors

# Selecting the right equipment

An understanding of how a piece of equipment works is important.

Low-tech equipment generally requires less adjustment, less maintenance and uses standard parts.

It is easier to upgrade a basic system than to replace a complex one that doesn't do the job.

Frequently there is an expensive equipment sitting in a corner because it didn't perform the way the grower had hoped

# What type of material handling machinery have to be installed

- Mechanize or automate jobs that are repetitive and time consuming.
- These are usually the easiest tasks to mechanize and result in a significant labor savings.
- Considerable equipment has been developed for most of these jobs.
- Container filling, plant spacing, moving plants and watering are good examples.
- Install equipment that reduces peak period labor requirements.



# Functions of Materials Handling Systems

- A materials handling system should have several functions,
- none of which will add anything to the value of the product, but which, if not properly planned, can reduce the value of the product, particularly perishable agricultural products.

# Reduce Production Costs

- A properly designed materials handling system can reduce costs by integration of components of the system and by substitution of mechanical power for manpower.
- A man serving as a power source is not very efficient.
- Materials can be handled less expensively with machines if volume is sufficient to spread high fixed costs.
- Small operations will be limited in the degree of mechanization feasible for handling materials

## Effect on Other Inputs

- Materials handling is a part of the total cost of production and can have a direct effect on other production costs.
- Improvements and better efficiency in other operations are possible with good materials handling methods and equipment



# Productive Capacity of Labor

- Volume of business can be increased without additional labor if materials handling is improved and mechanized to the fullest.
- Mechanizing materials handling to expand productive capacity rather than adding workers, even if they were available, avoids adding labor management to the business, a problem which many operators cannot cope with successfully.
- It also lessens the chance of subjecting the operation to a lower management level because of a changing labor force.
- Systems which embody a relatively high degree of mechanization perform some functions the results of which are difficult to measure.
- Working conditions may be improved and disagreeable tasks may be eliminated making it easier to employ and keep competent workers.
- More young people may choose to stay in agricultural work rather than seek other occupations.

# Principles in Analyzing Materials Handling Systems Questions

- Can the number of times the material is handled be reduced?
- Can the speed of handling be increased?
- Can the material be handled in larger containers or in greater volume?
- Can distances the material is handled be reduced?
- Are workers kept waiting for material to be moved?
- Are there times when the equipment is not used to full capacity?
- Can hand operations be done mechanically at the same or less cost?

# Planning Materials Handling Systems

- Use of Mechanical Equipment - Mechanize handling wherever feasible to reduce labor costs, increase capacity, reduce worker tiredness, improve safety and speed up handling of fresh products.
- Utilize Equipment Fully.
- Materials handling equipment costs money and should therefore be utilized to the fullest capacity.
- If present equipment is inadequate, additional equipment should be added, or a new system planned.



# Equipment Selection

- Improvements in material handling will depend on proper selection of equipment and methods.
- Economics is the controlling factor.
- The main objectives, namely reducing costs, increasing capacity and improving working conditions, should be kept in mind.
- Decisions should be based on facts about methods and equipment, and selection made with care and without prejudice.

# Handling systems classification

- Mechanized
- Semi-automated
- Automated
- Information-directed

For rough, uneven terrain, a compact track loader gives maximum capability and stability.





Available in a range of sizes, wheel loaders offer impressive material lifting and handling characteristics thanks to their rugged design and available features.



If you often have materials and loads that you need to pick and place, a telehandler is a convenient and useful piece of equipment that gives great flexibility.



Their small size and nimble controls make skid steer loaders indispensable in agricultural and construction applications.

With its many work tool options, delivers outstanding performance to help you get more done and increase your bottom line.

Spacious, ergonomic operator station and easy-to-use pilot operated joystick controls keep you comfortable throughout the workday.





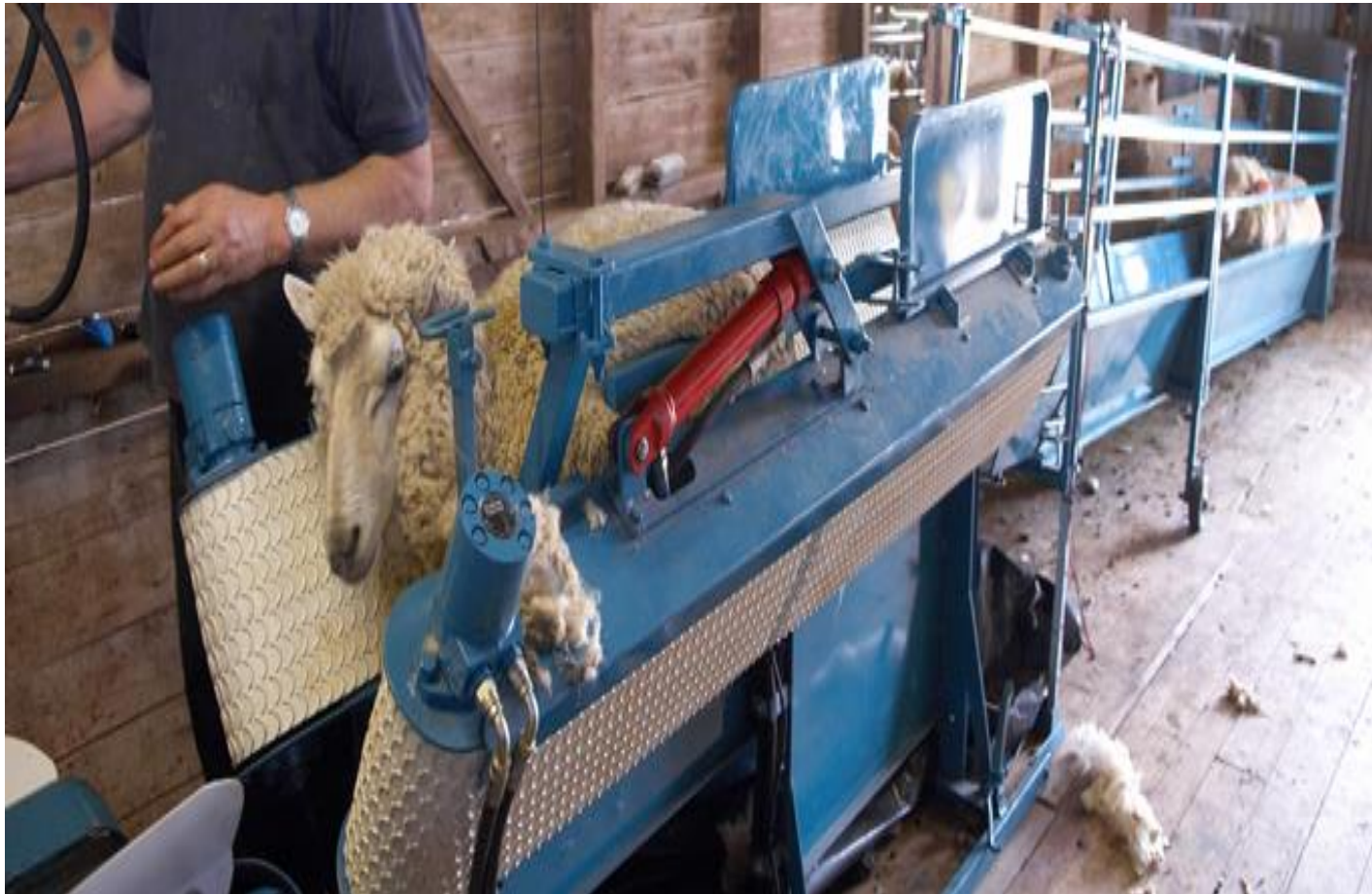
# Advantages of Implementing Automated Material Handling Systems

- Save money.
- Automated systems speed up productivity.
- The work can get done faster and with less people than with manual equipment.
- Automated material handling systems are an economical investment.
- Improve efficiency.
- Workers are better able to do their tasks using automated equipment, meaning they can work much more efficiently.
- It takes less time to do a job and it is more likely to be done correctly, which means each employee is able to accomplish more.
- Reduce accidents.
- One of the biggest advantages to automated equipment is that fewer accidents occur.

# Disadvantages of Implementing Automated Material Handling Systems

- Initial cost of equipment - Automated equipment is more expensive up front than manual equipment.
- However, what you save in man power and what you gain in increased productivity, means the equipment will eventually pay for itself.
- Reduced flexibility for change - Once automated systems are in place, it is likely not as easy to make changes in your workspace.
- Possible down time due to malfunction.
- With automatic machines there is always the chance of a problem or breakdown, which can lead to considerable downtime while it is repaired.
- Maintenance costs - Some automated equipment needs maintenance. Routine maintenance may be performed regularly by onsite workers, but periodic professional maintenance should be handled by specialists who are trained to inspect and tune-up machinery so that it runs smoothly and efficiently.

- In response to labour shortages, woolgrowers are adopting new ways to handle sheep with less labour.





Automatic feeding systems - from storing different feed components separately, to mixing and distribution onto the feeding table.



Belt harvesting system - requires the manpower needed to detach the fruit from the plant and place it on the belt, but it completely automates the successive phases of transport and storage in containers



Handling bales by trailer, quicker and easier to simply spike and carry them from field to store





Automatic system that uses artificial intelligence to identify the fruits and their quality

Automatic machine able to detect and collect strawberries.

The machine has attached a number of mobile arms that can identify and pick up the ripe strawberries.

The machine analyzes the strawberries one by one and gently harvests them to prevent damage to the fruit.

