

Penang Sangam High School
P.O. Box 44, Rakiraki
Year 13 Agriculture Lesson Notes Week 15

Strand	AS 13.3 Agronomy
Sub-Strand	AS 13.3.2: Horticulture
Content Learning Outcome	AS 13.3.2.1 Demonstrate the skills of plant breeding and discuss its importance in plants.

Lesson 1: Introduction

Lesson Outcome: At the end of this lesson student will discuss the history of plant breeding and importance of plant breeding.

Plant breeding - is the art and science of changing the traits of plants in order to produce desired characteristics.

Importance of Plant Breeding

1. Food Security - developing varieties with higher productivity and better yield stability.
2. Social Benefits - developing more profitable varieties for poverty alleviation.
3. Economic benefits - developing drought resistant varieties that help reduce production costs and improve viability resulting in more revenue and higher gross domestic product.
4. Environmental benefits - developing varieties less dependent on pesticides or more efficient in water and nutrient use.

2018 – State one importance of plant breeding. (1 mark)

Lesson 2: Types of Plant Breeding

Lesson Outcome: At the end of this lesson student will be able to:

1. **identify the different types of plant breeding**
2. **explain the advantages and disadvantages of each type of plant breeding**

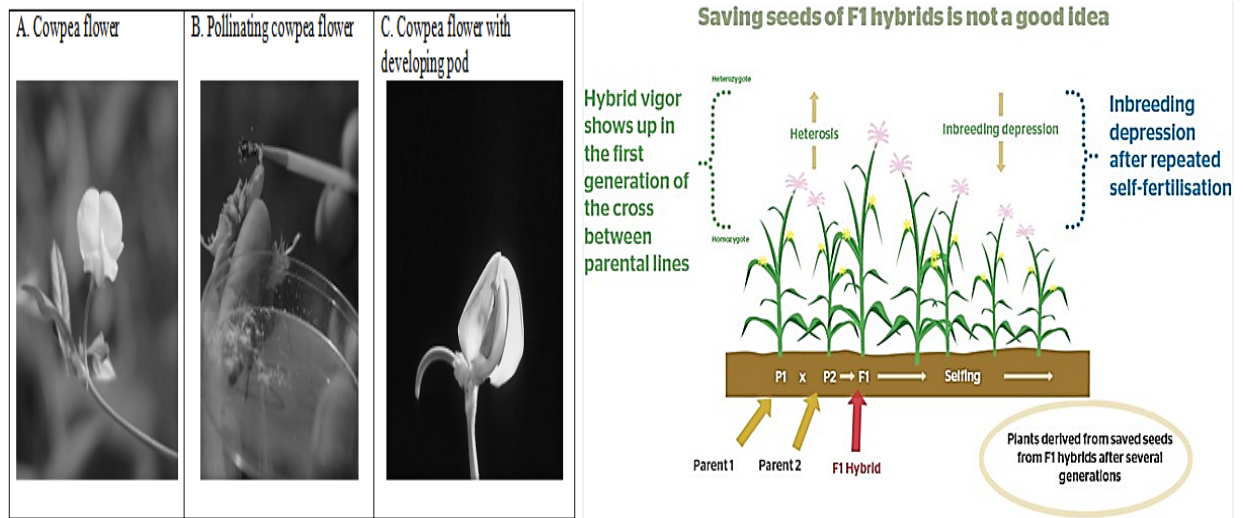
1. Inbreeding - the production of offspring via the mating between close relatives.
2. Line breeding - mating of selected members of successive generations among themselves in an effort to maintain or fix desirable characteristics.
3. Out breeding - introducing unrelated genetic material into a breeding line.
4. Crossbreeding - pollinating or breeding of plants that belong to different species, races, breeds, varieties to produce a hybrid.
5. Ephemeral - lasting for a short period

Plant breeding – combining parental plants to obtain the next generation with the best characteristics
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Plants are improved for food, feed, fibre, fuel, shelter, landscaping, eco-systems services and a variety of other human activities.

The breeder has to first remove the male organs of the flower to make sure the plant cannot fertilize itself (this process is called emasculation). This removes the source of pollen grains and prepares the female parent of the cross. The plant breeder will then deposit, usually with the help of a brush, pollen from the selected male parent into the female part of the emasculated flower. Crosses are then often bagged to prevent other pollen grains reaching the flower and contaminating the cross. If the cross is successful, the fruit develops and seeds are formed.

Crossing in plant



Advantages and Disadvantages of Plant Breeding

Types of plant breeding	Advantages	Disadvantages
Inbreeding	-increased uniformity (homozygosity) -increased pre-potency (ability to pass on traits to offspring)	-lower fertility and “vigor” -birth defects and smaller size -higher offspring mortality -reduced “genetic potential” (ability to improve a trait)
Line breeding	-increases particular trait in a population -less likely to cause problems in the first generation	-reduces genetic diversity -increased chance of genetic disorders -increased chance of inbreeding depression
Outbreeding	-produces hybrids with desirable characters like high yielding, resistance to diseases etc. -adaptable to environmental changes	-pure lines are created -hybrid plant is not always fertile -can destroy well adapted genotype because use genotypes may not be viable
Cross breeding	-hybrid vigor or heterosis is maintained -chances of acquiring broad genetic base -process of evolution continues	-seed formation always depends on availability of pollinator -lots of variability leads to heterozygosity and inconsistency in phenotypes

Lesson 1: Introduction

Lesson Outcome: Describe appropriate sustainable farming methods and how it benefits the community socially, economically and environmentally.

<u>Sustainable farming</u> - farming ecologically by promoting methods and practices that are economically viable, environmentally sound and protect public health <u>Sustainable farming methods</u> -use of crop waste or animal manure to help enrich the soil -crop rotation helps the soil maintain its nutrients and keeps the soil rich -collection of rainwater and then use it for irrigation	<u>Benefits of sustainable farming</u> 1. Environment Preservation - helps farmers innovate and employ recycling methods 2. Economic Profitability - brings up the standard of living of the farmer 3. Most efficient use of non-renewable resources 4. Protection of Public Health - growth of nutritious and healthy food
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Lesson 2: Urban Agriculture

Lesson Outcome: At the end of this lesson student should be able to:

1. define urban agriculture and identify different types of urban agriculture
2. state the advantages and disadvantages of agriculture

Urban Agriculture - growing, processing, and distribution of food through plant cultivation and raising livestock in and around cities for feeding local populations. Eg. community gardens, small urban farms, home gardens

Greenhouse gas emissions - is a gas in an atmosphere that absorbs and emits radiation within the thermal infrared range

<u>Advantages of Urban Agriculture</u> 1. Contributes to food security, nutrition and livelihoods 2. Provides for family self-consumption, healthy diet and saving on food expenditures 3. Provides a source of income 4. Improves supply of local markets with fresh and rich foods at competitive prices	<u>Disadvantages of Urban Agriculture</u> 1. Use of waste water for irrigation without treatment can spread diseases among population. 2. Cultivation on contaminated land can be a health hazard for consumers. 3. Cultivation along roadsides is risky since it exposes food to car pollution. 4. Lack of security of tenure acts as a drawback due to uncertainty in the use length of land.
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Lesson 3: Permaculture

Lesson Outcome: At the end of this lesson student should be able to:

1. define and describe permaculture
2. state the advantages of permaculture

<u>Permaculture</u> - the development of agricultural ecosystems intended to be sustainable and self-sufficient. We can be more productive for less effort, reaping benefits for our environment and ourselves, for now and for generations to come. Permaculture encourages us to be resourceful and self-reliant.	<u>Advantages of Permaculture</u> 1. <u>Reduced cost</u> - composting the waste into useful organic matter and manure, farmers save up a lot of money. 2. <u>Less waste</u> - waste products are recycled and manure back to the earth in the form of compost. 3. <u>Less pollution</u> – with the natural way of agricultural cultivation, pollution is reduced. 4. <u>Promotes green living</u> - uses natural fertilizers, natural pesticides, and freshwater reserves. It undoubtedly promotes green living of the backyard style.
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Lesson 4: Roof Gardening

Lesson Outcome: At the end of this lesson student should be able to:

1. define roof gardening
2. state the advantages and disadvantages of roof gardening

Roof garden - is a garden on the roof of a building. Roof gardening is the practice of cultivating food on rooftop of buildings. Examples are balcony, terrace, house roof tops etc.

<u>Advantages of Rooftop Garden</u> 1. Increase access to private outdoor green space-at home 2. Support urban food production 3. Improve air quality and reduce CO ₂ emissions 4. Increase the value of buildings for owners and tenants alike	<u>Disadvantages of Rooftop Garden</u> 1. Needs regular maintenance 2. Establishment cost is high 3. Attracts pests which can be harmful to human 4. Suitable for only certain type of crops and vegetables.
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Lesson 5: Bio Intensity Gardening

Lesson Outcome: At the end of this lesson student should be able to:

1. define bio intensity gardening
2. state the advantages and disadvantages of bio intensity

<u>Bio intensity gardening</u> - is a sustainable method for growing food organically with low-inputs and high-yields from a minimum area of land, increasing biodiversity and sustaining soil fertility.	<u>Advantages of bio intensity gardening</u> 1. Health and vigor of soil are maintained through use of compost 2. Close plant spacing protects soil organisms, reduces water loss and maximizes yield <u>Disadvantages of bio intensity gardening</u> 1. Composting is important, but it produces a lot of greenhouse gases
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Student Activity

2019 – State one advantage of urban agriculture. (1 mark)

2018 – Explain one advantage of permaculture. (2 marks)

2019 – State one way in which bio intensity gardening focuses on achieving maximum yields from a minimum area of land. (1 mark)

2018 - Give one reason why outbreeding results in an increase in the number of heterozygous offspring produced. (2 marks)

2019 – Describe the process of obtaining heterosis in plants (2 marks)

2019 – State one advantage of line breeding. (1 mark)