The Nurseries

Theoretical part

Prepared by

Salah. Th. Younis Al-dabbage

Asst. professor

Northern Technical Univesity

Technical institute of Mosul

Dept. plant production Techniques

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1st week Lecture

The Nurseries

Definition:- It is a part of land specialized for propagation different types of plant and managed well until transferred to the permanent place for planting or to a customer .

Type of nurseries

A- According to the type of products:-

1- **Fruit tree nurseries**:- It is specialized for production evergreen and deciduous fruit trees production.
2- **Floriculture nurseries**:- It is specialized for propagation wide range of ornamental species.
3- **Forestry nurseries**:- It is specialized for production forestry seedling.
4- **Mixed nurseries**:- It is specialized for production wide range of plants. such as Fruit seedling, Ornamental plant, Forestry seedling, Vegetables seedling (Shrubs Roses, Trees, Indoor and outdoor plant, and Rootstocks).

B- According to the ownerships:-

1- **Private nurseries**:- These belong to the private sector they supply more than (60)% of the local demand from different type of plant and this nursery are distributed all over the country.
2- **Governmental nurseries**:- Those belong to the government for example. Al - Zafarania, Hawija and Mosul horticulture station.

Economic importance of nurseries

These can be summarized as follows:-

1- Profitable.
2- Provide working all over the year.
3- Supply orchards, parks, public and private gardens with different plants such as trees, shrubs, bedding plants, and others.
4- Improving the nursery stock continuously by using new techniques of plant propagation and sometimes needed breeding programes.

Selection of the nursery site

It is important to take the following factors when select the proper site of nursery establishment.

1- **Location**:- It should be established near the cities, roads and marketing areas.
2- **Climate**:- The nursery site should be establishment in suitable climate.
3- **Soil**:- The sites should be fertile and free from large stones and harmful chemicals.
4- **Water supply**:- It is very important and the amount of water required daily will depend on:-

A- Area of nursery. B- Method of irrigation.
C- Porosity of the soil. D- The temperature of wither.

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5- **Fencing**:- Fences are important to provide protection from humans and animals.

6- **Mother plant stocks**:- These represent the main source of propagation nursery plants because the mother plant stock provide nursery – men with the following:-

1- Seed. 2- Cuttings. 3- Scion. 4- Rootstock.

7- **Topography**;- The nursery site should be leveling to prevent water accumulation in some areas.

Nursery Planning

To establishment ideal nursery, the following steps should be done.

1- Establishment of fences:-

Types of fences

A- Artificial fences:- These are made by wire bored, brick and woods fences. Figure -1-.

B- **Natural fences**:- some of plants can be used for natural fences such as plarsconia plant and myrtas communis.

2- Ground plane:- The ideal geometric plan for a nursery is a square or rectangular. The entire area should be divided into working compartment to facilitate planning management.

3- Leveling the ground with heavy machinery, such as landplanes.

4- Dividing the site to the plots, furrows and border.

5- Building fixture : - These include many type of propagation structures such as:-

A-Glasshouses or Greenhouses. B- Lath house.

C- Plastic houses. D- Hot beds and cold beds, figure -2-.

6- Fixing the irrigation net:- By fixing surface or underground pipes.

7- Allocation of suitable place for the following:-

A- Pots, fertilizer, holders, pesticides.

B- Mother plant, seedbeds , it is place for drying fruit and place for extracting seeds.

8- Implementation of nursery rotation:- These can be three , four or five years nursery rotation.

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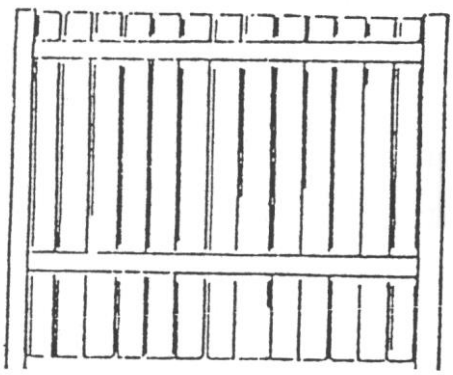
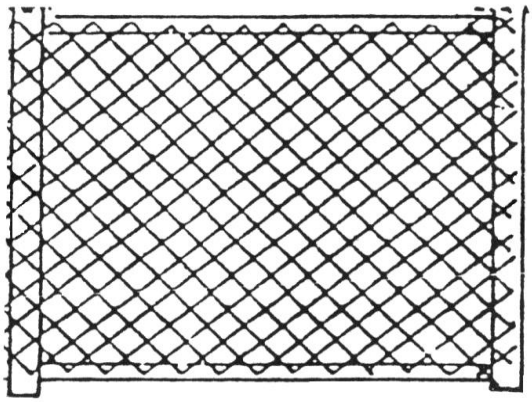


(Wood bored)



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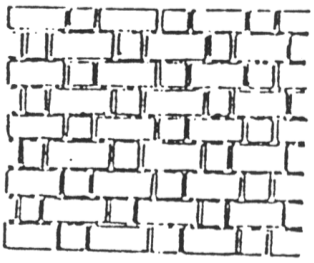
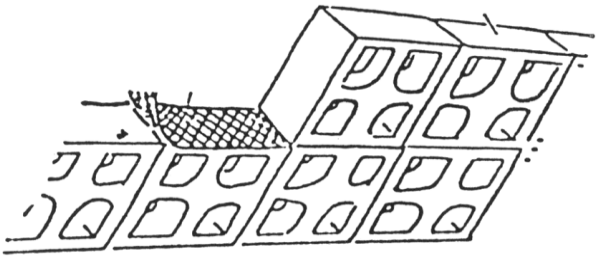
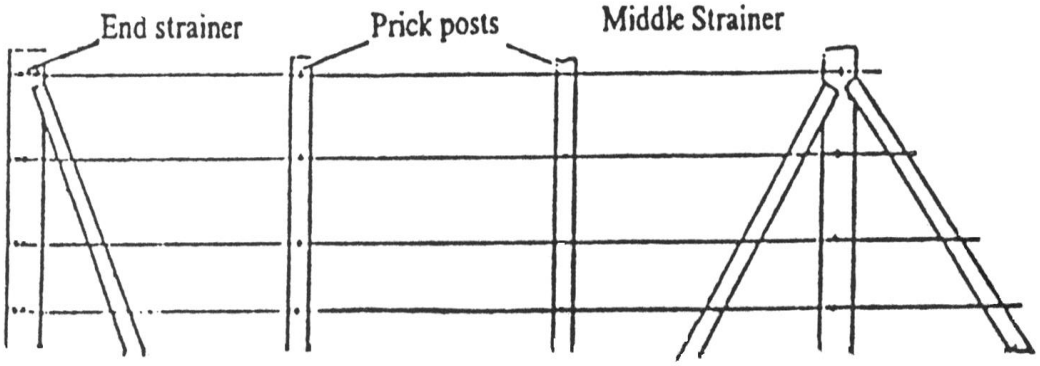




(Brick bored)



(Wire bored)

Figure -1- Different type of fences used in nurseries

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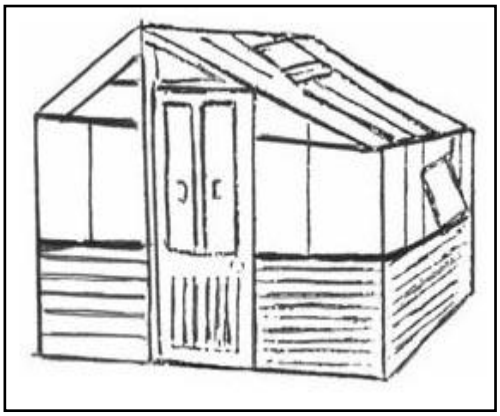
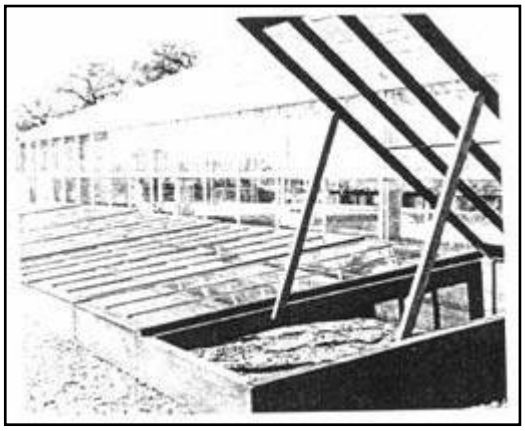
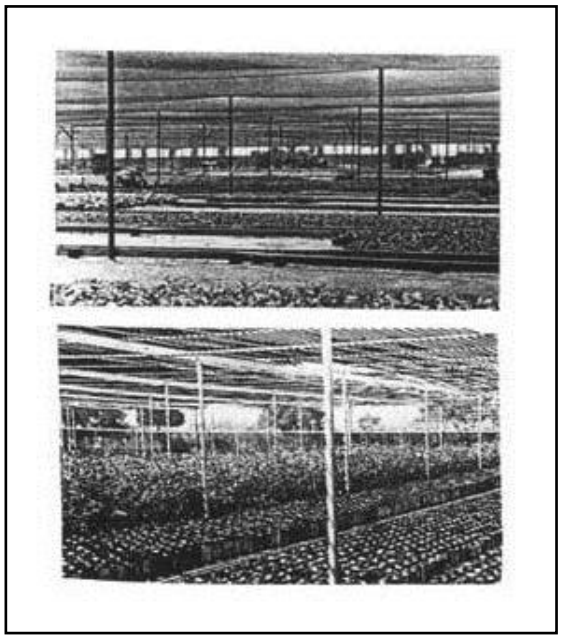


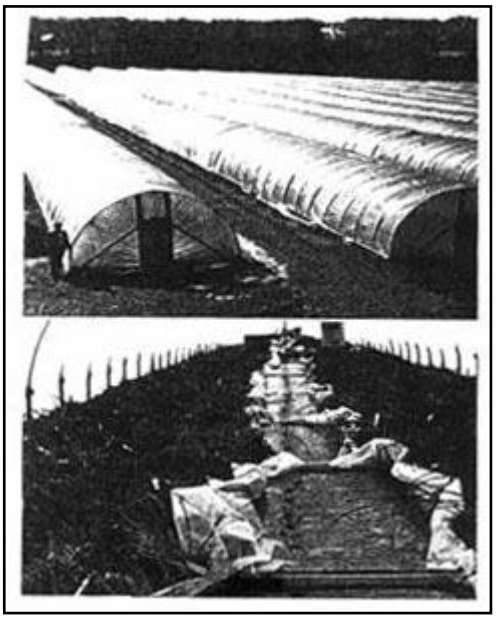
(Glasshouse)



(Cold bed)



(Lath house)



(Plastic houses)

Figure -2- Propagation structures

Nursery Accessories

This is involves the following:-

1- Stores.
2- Cold Room.
3- Office and W. C.
4- Garage or Park.
5- Marketing Area.
6- Working area
7- Room for labor.

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Meanings of nursery words

Accessories	موجودات	Permanent	المكان دائم
According	تبعا لـ	Pesticides	مبيدات
Artificial	صناعي	Place	مكان
Available	متوفر	Planning	خطة
Brick	طابوق	Plarisconia	شوك الشام
Building	بنايات	Plastic houses	بيوت بلاستيكية
Chosen	اختيار	Plots	أحواض
Cities	المدن	Posts	عمود / سارية
Climate	المناخ	Pots	سنادين
Cold room	غرفة باردة	Private	خاصة
Continuously	باستمرار	Product	المنتج
Customer	البائع	Profitable	مربح
Cuttings	عقل ، أقلام	Propagated	يتكاثر
Deciduous	أشجار متساقطة الأوراق	Proper	مناسب
Economic	اقتصادي	Provide	يجهز ، يوفر
Established	يؤسس ، ينشأ	Public	عمومي
Evergreen trees	أشجار دائمة الخضرة	Represent	موجودات
Extracting	استخراج	Respire	تمثل
Fencing	الاسيجة	Roads	طرق
Fertile	خصب	Rootstock	أصل جذري
Fixing	تثبيت	Rotation	دورة زراعية
Floriculture nurseries	مشاتل الزينة	Sand	رمل
Forestry nurseries	مشاتل الغابات	Scion	طعم
Furrows	خطوط	Seedling	شتلات
Holders	مرشاة	Selection	اختيار
Implementation	تنفيذ	Site	موقع
Importance	أهمية	Soil	تربة
Improving	تحسين ، تطوير	Specialized	متخصص
Lathhouses	ظلة خشبية	Stock	أصل
Managed well	يدار بشكل جيد	Stores	مخازن

1st week Lecture

Marketing area	منطقة التسويق	Strainer	شدْ
Mother plant	نباتات الأمهات	Suitable	مناسب
Natural	طبيعي	Supply	يجهز
Near	قرب	Transfer	نقل
All over the year	على مدار السنة	Until	حتى

The Nurseries questions

Q1 / List the following:-

1- Type of nurseries according to the type of products.
2- Types of nurseries according to the ownerships.
3- Advantage of mother plant stocks.
4- Types of fences.
5- Propagation structures.
6- What are the economic important of nursery.

Q2 / Put true or false about the following statements.

1- The nursery soil should be free from large stones and harmful chemicals.
2- The leveling of nursery ground should be done by tractors.
3- Mixed nurseries are specialized to produce ornamental species.
4- Forestry nurseries specialized for production fruit seedling.
5- Private nurseries such as Mosul horticulture station.
6- Fruit tree nurseries are specialized for propagation evergreen seedlings.

Q3 / Complete the following sentences:-

1- The importance of nurseries are : -
   a- b- c-
2- The importance factors should be take when select the nursery site : -
   a- b- c-
3- The water required daily depend on : -
   a- b- c-
4- Mother plant stock provide the nursery with : -
   a- b- c-

References

1- Ibrahim , K.M., S.H. Mageed . (2001) . The Nurseries . A textbook for Agricultural Insititutes . Book and document . Baghdad (910) .

2nd week Lecture

Propagation media

Media for propagation nursery plants :-

Several mixtures and materials are available for germination seeds and cuttings rooting. For better results the following properties of media :-

1- The media should be sufficiently firm and dense to hold the cutting until rooting or planting the seeds in a good place until germination .
2- The volume of the media must be stay constant when wet or dry.
3- It should be sufficiently porous to leaching the excess water and rains to permitting adequate aeration.
4- The media must be sufficiently retain with water.
5- It should be capable to sterilized with steam without deleterious effects.
6- It should be free from weed seeds, nematodes and various noxious organisms.
7- It must have a low salinity level.

Soil and media mixture for container growing :

In propagation the procedures of young seedling or cuttings rooted are sometimes planted in the field, but frequently they are started in a soil mixture in some type of the container . The loam soils a lone is un satisfactory for this purpose they are often heavy and tend to become stick after watering and upon drying they may shrink and become a hard and cracked surface . To provide the potting mixtures with better textures, sand and some organic material such as peat moss or saw dust are usually added when preparing these media mixtures.

Traditional potting mixture that have been used such as:-

1- Media for potting rooted cutting and young seedlings:-
   * 1 or 2 part sand.
   ** 1 part loam soil.
   *** 1 a part peat moss or shredded bark or leaf mold.
2- Media for general container.
   * 1 part sand.
   ** 2 part loam soil**.**
   *** 1 part peat moss or shredded bark or leaf mold.

Numerous artificial soil have been developed and used by nurserymen for example mixture for small seedlings and for cuttings rooting consists of equal part of shredded bark, peat moss, perlite and sand. To this added , super phosphate , potash and nitrogen withe the irrigation water.

2nd week Lecture

Meanings of nursery words

Adequate	كافي	Poorly	فقيرة
Away	بعيداً / جانباً / باتجاه آخر	Porous	مسامات
Capable	قادرة	Portion	جزء
Constant	ثابت	Proper	مناسب / لائق
Cracked	يحطم/يتكسر/يتشقق	Reason	اسباب
Deleterious	مؤذي	Retentive	محتفظ
Dense	كثيف / مزدحم	Salinity	ملوحة
Permitting	تسمح	Shrink	متجعد
Excess	الزائد / الفائض	Steam	نجار
Firm	متماسك	Stick	عصا / قضيب
Frequently	في أحيان كثيرة	Subsequent	التالي / اللاحق
Material	مواد	Sufficiently	بكفاية
Mixtures	خليط	Tend	تميل
Noxious	ضار	Textures	نسجة
Numerous	العديد	Traditional	تجاري
Organisms	كائنات دقيقة	Upon	على / فوق / حوالي

Propagation media questions

Q_1 / List the properties of good media?

Q_2 / Give the traditional potting mixture for the following?

A- Potting rooted cutting and young seedling.

B- Media for general Container .

C- Artificial soil used by nurserymen for small seedling and cutting rooting .

References

1- Bryant , G. 1995 . Propagation handbook . stackpole book : Mechaicsburg. Bennsylvania .

2- Ibrahim , K.M., S.H. Mageed . (2001) . The Nurseries . A textbook for Agricultural Insititutes . Book and document . Baghdad (910) .

3rd week Lecture

Sanitation and sterilization of propagation media

Sanitation is very important during propagation and growing seedlings . There are many losses of young seedlings , rooted cuttings, during propagation steps because of various pathogens and insect pests, especially under the warm, humid conditions which found in glasshouses . To control of these dangers sterilization the soil mixtures is very necessary also sterilization the containers and tools when propagation the plants. If the soil include weed seeds, nematodes, Funji and bacteria, which are deleterious to propagated the plants especially damping off disease which effect on the small seedling in the seeds beds for to control of these dangers .

Methods of sterilization:-

There are two way for sterilization the soil :-

A- Heat treatment (steam):-

Steam is used for soil sterilization by passing the steam inside a net of pipes with many apertures or holes through the soil at (82)C^{o} for about (30) minutes or by putting the soil inside a covered barrels and passing the steam inside. The heat can kill most of the harmful bacteria, Fungi, nematodes, insects and weed seeds.

B- Chemical treatment (fumigation):-

The chemical sterilization kill the micro – organism without effects on the physical and chemical characteristics of the soil. The soil should be wet (40–80)% of the field capacity when treated and temperature about (18–24)C^{o}.

The differences between the two ways are:-

No	Heat treatment (steam)	Chemical treatment
1	After treatment with steam the medium can be used so early.	It can be used early after several days .
2	Nonselective for pests.	It is highly selective.
3	Less dangerous for plants and operators.	It is very dangerous especially fumigant chemicals.
4	Steam pasteurization can be used for cold, wet media.	Do not vaporize well at low temperature.

Example a bout some chemicals used for media sterilization:-

1- Formaldehyde. 2- Chloropicrin. 3- Methyl bromide.
4- Vapam. 5- D- D mixture. 6- Benomyl.
7- Captan. 8- Truban. 9- Diazoben.

3rd week Lecture

Glossary

Apertures	فتحة / ثقب / منفذ	Micro organism	الكائنات الدقيقة
Bacteria	البكتريا	Mixtures	خليط
Barrels	برميل	Necessary	ضروري
seed beds	مراقد انبات البذور	Nematodes	النيماتودا
Characteristics	خواص ، مميزات	Operators	عامل ميكانيكي
Control	سيطرة	Passing	عابر
Damping off	مرض ذبول الشتلات	Pathogens	مسببات الامراض
Dangers	مخاطر	Pipes	أنابيب
Deleterious	ضار / مؤذي	Procedures	الاجراءات
Essential	اساسي	So early	كذلك / هكذا مبكراً
Field capacity	السعة الحقلية	Steam	بخار
Fumigated	يدخن / يبخر	Sterilization	تعقيم
Fungi	فطريات	Through	خلال / عبر
Harmful bacteria	البكتريا الضارة	Treated	علاج / معاملة

Sanitation and sterilization question

Q_1 / Complete the following sentences?

1- The important chemical used for sterilization soil are :-
   a- b- c-
2- The important methods of soil sterilization are
   a- b-

Q_2 / List the differences between heat treatment and fumigation chemicals treatment .

References

2- Ibrahim , K.M., S.H. Mageed . (2001) . The Nurseries . A textbook for Agricultural Insititutes . Book and document . Baghdad (910) .

4th and 5th week Lecture

Plant propagation

Introduction:

The most plant are propagated by seeds which produced seedling, and often used as rootstocks or for selected some varieties or strains and used for budded and grafting
It is the process of multiplying the number of species to maintaining the plants . Most of plants reproduce naturally by seeds . Seeds are growing to produce the seedling , Cultivars and rootstocks .
Also seeds are used in plant breeding . Finally we can say that the plant propagation of (trees shrubs , Ornamental plants , Forestry and Vegetables) starts with seed , and other vegetative propagation .

Methods of plant propagation

In general there are two methods of plant propagation:-

1- Sexual propagation, by using seeds . seed can be used for reproduction seeds are typically produced from sexual propagation . For this the seed may have different characteristics to its parent , some seeds requires special conditions to germinate , K cold treatment and some plant species do not produce until they reach maturity , propagation by seed also called (seedage) .
2- Asexual or vegetative propagation, using all mean except seed . Asexual propagation uses vegetative plants parts (roots , stems , leaves and tissue culture) . This methods produce plants similar to the parent .

The flower

It is reproductive organ of the plant when the flower have both sexes (male and female) is called Perfect flower complete flower see , figure -3-. But incomplete flower are those if one of the sexes is absent, there are two type of flower according to the present of both sexes .

Types of plants according to present of both sexes :

1- Monoecious plants:- This plants means the flower which have male and female flower on the same plant (tree) example filbert and walnut trees .
2- Dioecious plants:- This means the flower have one sex and each sex on plant or tree for example pistachio and date palm trees .

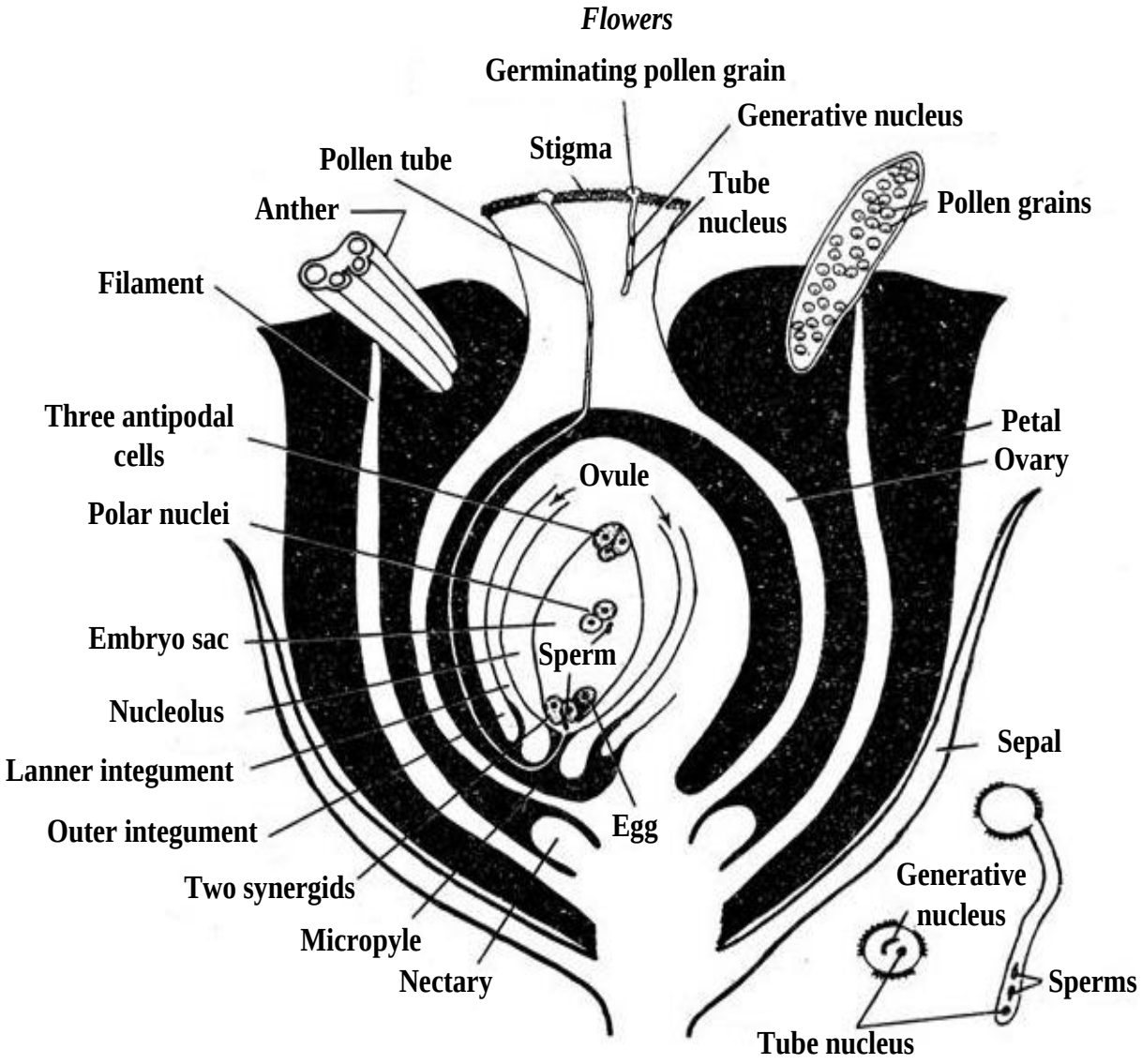

Figure -3- Diagram of basic flower structure of (Perfect flower)

Pollination

It is transfer the pollen from the anther to the stigma. Transfer the pollen within the same flower or any flower on the same plant known (self– pollination) while when is being transfer the flower pollen on plant to different genetic of plant they called (cross – pollination).

Fertilization

After the pollen grain reached the stigma surface of the pistil it absorbs water and sugars and forms (a pollen tube) which grow down throw the style to the embryo sac. The pollen tube penetrates the embryo sac. If the one male gamete unties with the egg will be formed the (zygote) and the second formed the endosperm see . Figure -4-.

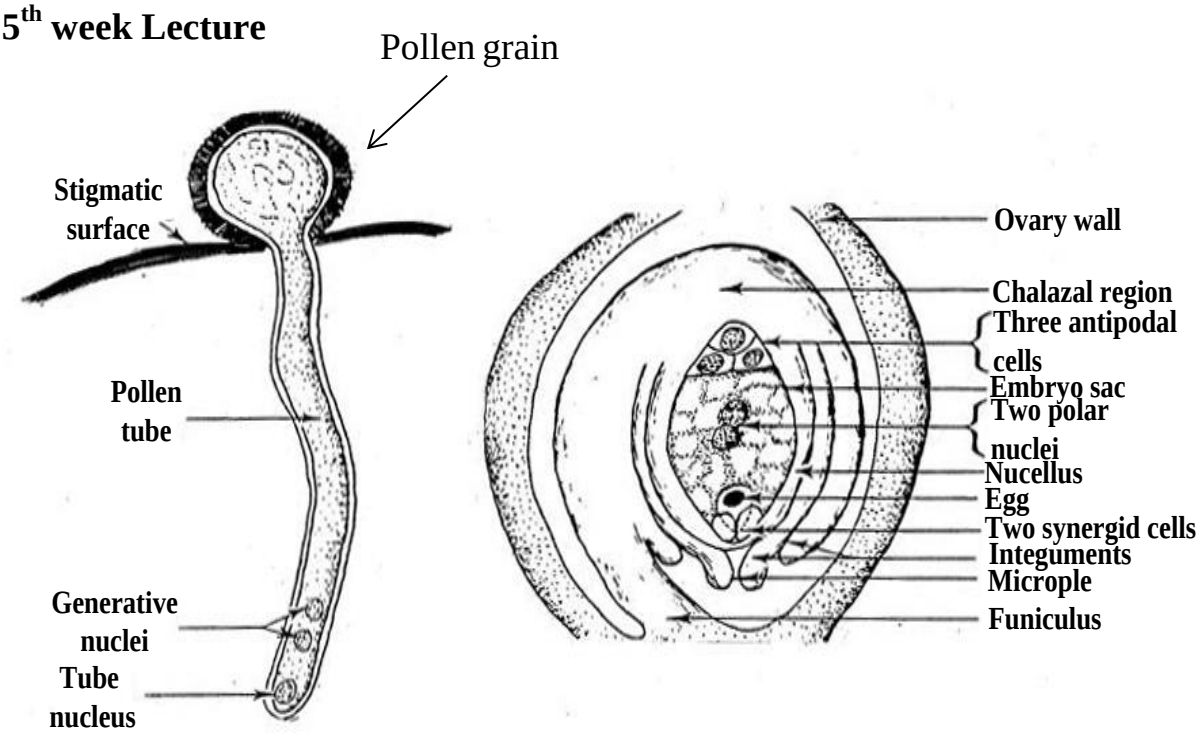

Figure -4- pollen tube and the embryo sac

The seed is an embryonic plant enclosed in a protective outer covering . seeds are the product of the ripened ovule after fertilization by pollen and some growth within the mother plant . the embryo is developed from the zygote and the seed coat from the integuments of the ovule . The term of seed also meaning anything that can be sown , e.g. vegetables seeds , ornamental seeds , fruit seeds .

Seed Storage

Seeds are usually stored for varying lengths of time after harvest. There fore seeds are divided according to the following.

1- **Short Lived Seeds:-**

2- **Medium Lived Seeds:-**

3- **Long Lived Seeds:-**

Seeds viability

seed viability means the seed is viable and capable to germination . under favorable conditions . There are many factors influenced on seed germination such as:-

1- Vigor of parent plant: seed from weak plants are apt to be deficient in stored foods and have small embryos.
2- Age of seed: seed viability refer to the percentage of seed that will complete germination.

4th and 5th week Lecture

Seeds collecting

Harvesting seed requires more than ordinary knowledge regarding the characteristics of each kind many studies has been given it seed collecting bec- ause of its great importance to germination, longevity, and vigor of resulting seedling.

Seeds Dormancy

The failure of seed means the seeds are unable to germinate under favorable condition. Some seeds that germinate over many month or year , and some seed can remain in the soil for more than 50 year before germination .

Reason of Dormancy In general the reason of dormancy are :-

1- **Drying:-**
2- **Photo dormancy**:-
3- **Thermo dormancy**:-

Dormancy in seed may be due because the following reasons

1- Seed coat inhibits growth of embryo.
2- Immature embryo.
3- Rest period of seed.
4- Internal inhibitors.
5- Combination of one or more of these factors.

Method of breaking dormancy

1- Leaching:- By exposing the seed to excess of water.
2- Scarification:- This process of seed means breaking, scratching, softing the seed covering and removed the inhibitors materials.
3- Stratification:- It is exposure of dormant seeds to a periods of chilling to enhance ripening of embryo.
4- Light - Light means the following:-

A- Light intensity. B- Wave length. C- Photoperiod.

Types of Dormancy

Primary Dormancy:-

It is the most common form of dormancy and takes two forms:-

A- Exogenous Dormancy:-

This type of dormancy is generally related to physical properties of the seed coat.

B- Endogenous Dormancy:-

This type of dormancy is the most prevalent dormancy found in seeds and due to inherent properties of the seed such as inhibitor that must be remov- ed perior to germination.

Forms of dormancy

The form of endogenous dormancy are:-

1- Rudimentary embryo dormancy:-
2- Physiological Dormancy:-
3- Double dormancy:-
4- Secondary dormancy:-

4th and 5th week Lecture

Methods of breaking exogenous dormancy

A. **Mechanical scarification**:- By grinding the seed with abrasives or by using the sand this techniques are used to scarification seed coat.
B. **Chemical scarification**:- The seed treated with chemicals degradation of the seed coat by using sulfuric acid. See Figure -5-.

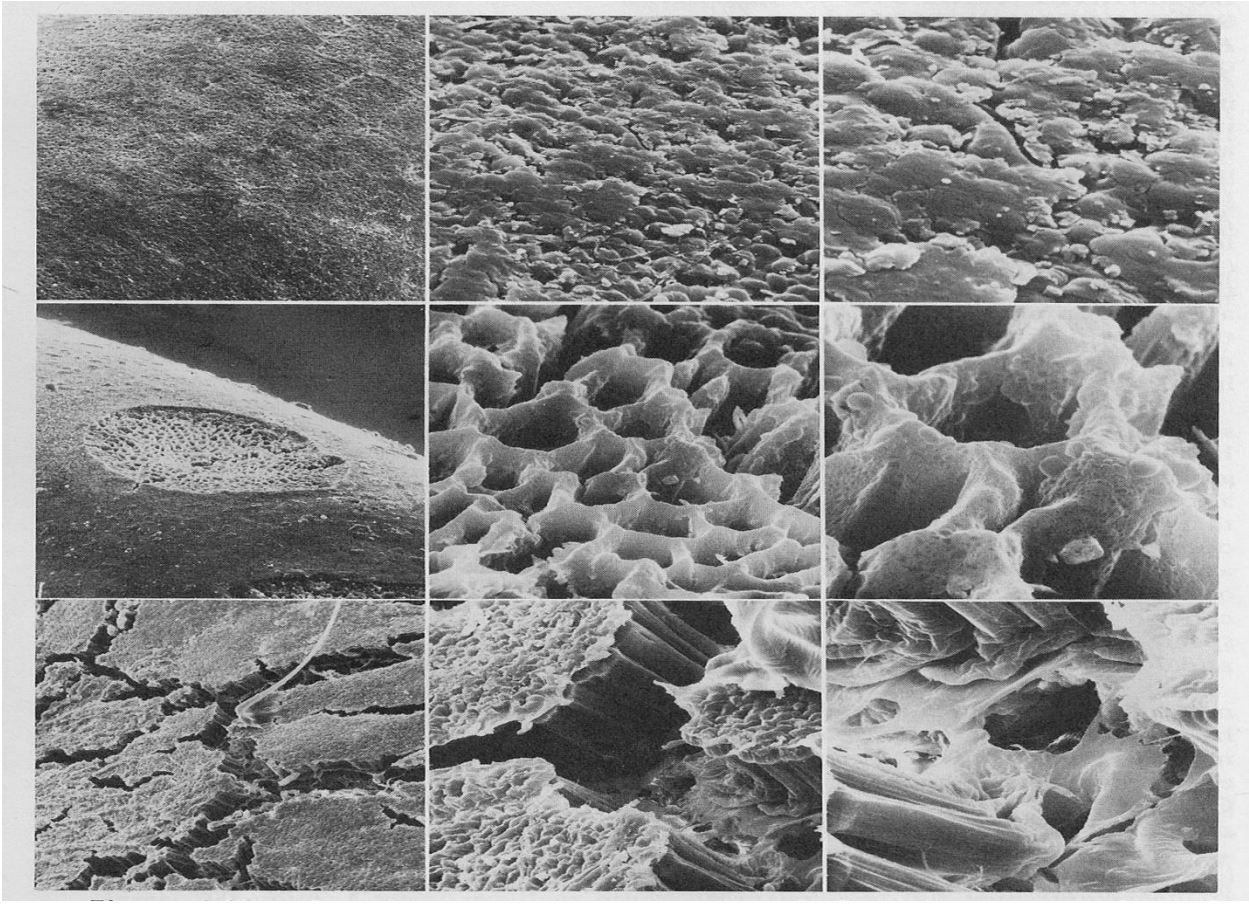

Figure -5- Scarification effects on seed coat.
Top row: **Un scarified seed.**
Center row: **Seed after (30) min. acid scarification.**
Bottom row: **Seed immersion in boiling water for (30) second**

Leaching or Seeds soaking in water

Several seeds are soaking in water before sowing to improve the seed germination percentage and lead too several advantage such as:-

1- Modify hard seed coat.
2- Remove inhibitors materials.
3- Soften the seeds.
4- Reduce the time of germination.
5- Stimulate the germination in some cases.
6- Overcome seed coat dormancy.

4th and 5th week Lecture

Stratification

It is the exposure of dormant seeds to a period of chilling to enhance ripening and breaking the rest periods of embryo. Table -1- explain the seeds stratification period and low temperature required for some fruit trees seeds. Stratification also called moist chilling the physiological dormancy and involves the addition of moisture to the seed so they imbibe water and then the seeds are subject to a period of moist chilling after ripen the embryo. Sowing outside in late fall and winter outside under cool conditions or put it in the refrigerators at suitable temperature.

Table -1- Stratification period of fruit trees seeds

Name of fruit trees seeds	Stratification period (day)	Temperature C°
1 – Almond	21 – 30	5
2 – Apricot	21 – 28	5
3 – Peach	90 – 120	4
4 – Plum	90 – 120	4
5 – Cherry	Seed sown directly after removal from fruit	
6 – Avocado	Seed sown directly after removal from fruit	
7 – caco	Seed sown directly after removal from fruit	
8 – Citrus	Seed sown directly after removal from fruit	
9 – Fig	Seed sown directly after removal from fruit	
10 – Olive	Non need stratification	
11 – Apple	60 – 90	2 - 7
12 – Pear	60 – 90	4
13 – Persimmon	60 – 90	10
14 – Pistachio	42 – 50	5 - 10
15 - Grape	84 – 90	0.4 - 4
16 - Pecan	84 – 120	1 - 5
17 - Walnut	90 – 120	1 - 5
18 - Chestnut	60	0 - 2

Stratification Requirement

Good stratification needed the following requirement:-

1- provide low suitable temperature about (2-5)C.
2- provide good moisture.
3- provide good ventilation.
4- provide suitable media.
5- provide sterile containers with excellent drainage.
6- provide sterile media.
7- provide enough period about (1-4) months for each species.

4th and 5th week Lecture

Scarification of Seeds

The coat of certain seed is extremely tough or (very strong) and must be penetrated by special means particularly hard seed may be scarified. Scarification involves breaking, scratching or soften the seed coat to allow moisture penetration.

Two methods of scarification commonly used by the home gardener are mechanical and hot water. Mechanical scarification involves breaking or weakening the seed coat with a file, sandpaper or hammer. Hot water scarification involves placing seeds in water that is (75 to 105) degrees Cº. after the water cools, seed should continue to soak for (12 to 24) hours. Then they are planted. Specific instruction for scarification are usually mentioned on the seed packet or in the seed catalog.

Methods of Scarification

1- Mechanical scarification by using file, sandpaper or hammer .
2- Acid scarification by using H_2So_4 or HCL.
3- Hot water scarification.
4- Warm moist scarification.

Seed germination requirement

1- **Moisture (water)**
2- **Temperature**
3- **Light**
4- **Oxygen**.

Meanings of plant propagation words

Absent	مفقود	Ovary	المبيض
Addition	اضافة / زيادة	Ovules	البويضات
Absorbs	تمتص	Perfect flower	زهرة كاملة
Accessory	ملحق	Perform	ينجز / يجري / يقوم بـ
Alternation	تناوب / تعاقب	Period	فترة
Abrasives	مزيلات / قشط	Absorbs	تمتص
Anther	المتك	Pistil	المدقة
Arid	جاف / قاحل	Excellent	ممتاز / فاخر
Being	وجود / في الوقت الحاضر	Planting	زراعة
Externally	كثيراً / جدا	Plasma	بلازما
Select	تحديد	Pollen	حبوب اللقاح
Strains	سلالات	Style	قلم المدقة
Sexes	الجنسين	Subject	موضوع / تخضع / معرض لـ
Stratification	تخديش	Male	الذكر
Cross	تلقيح خلطي	Present	موجود
Deciduous	نباتات متساقطة الأوراق	Protection	حماية
Favorable	مناسب	Monoecious plant	نباتات احادية المسكن
Female	إناثاً / الانثى	Reproctuctive	اعادة الاثمار
Funiculus	الحبل المنوي	Related	متصل بـ / قريب
Filament	الخيوط	Degradion	انحلال

4th and 5th week Lecture

Strong	قوي / شديد	Petals	الاوراق التويجية (بتلات)
Dioecious plants	نباتات ثنائية المسكن	Drainage	تصريف / تفريغ
Except	ماعدا	Respond	استجابة
Exposure	تعريض	Scarification	تخديش
Extremely	بإفراط / إلى حد بعيد	Dormancy	السكون
Failure	تفشل	Selected	يختار
Favorable	مناسب	Sexual	جنسي
Fertilization	تسميد	Specific	محدد / دقيق / معين
Prevallent	شائع / منتشر	Spelas	الاوراق الكاسية (سبتلات)
Present	موجود	Sperm	المني / السائل المنوي
Filament	الخويط	Sprout	ينبت ورقاً جديداً / ينبت
Formed	تكون	Stalk	مسحوق حبوب اللقاح
Pollen gran	حبوب اللقاح	Stamen	الاسدية
Protection	حماية	Stigma	الميسم
Genetic	جيني	Strains	سلالات
Outside	خارج / خارجي	Stratification	تنضيد
Over	فوق خلال / على طول	Organ	عضو
Grinding	طحن	Style	القلم
Nucleus	نواة	Subject	تخضع / معرض لـ
Hermaphroditic	خنثى	Surface	سطح
Imbibe	تشرب / يمتص	Gamete	المشيج / خلية جرثومية
Incomplete	غير كامل	Genetic	وراثي
Characteristics	مميزات	Tough	متين / قوي
Collecting	جمع	Toward	نحو / قرب / حولي / من أجل
Vigor	قوة	Transfer	تنتقل
Walnut	حرز	Generative nuclei	نوى مولدة
Maturity	النضج	Trigger	يطلق / يحدث
Melt	يذوب / ينصهر ينحل	Understood	مفهوم جيد / متفق عليه
Metabolic	أيض / متعلق بالأيض	Usually	عادة
Might	قوة / قدرة	Varieties	أصناف
Monocious	نباتات أحادية المسكن	Varying	مختلفة
Reason	سبب	Ventilation	تهوية
Regarding	بخصوص	Longevity	طول العمر
Nectary	الغدة الرحيقية / غدة تفرز الرحيق	Tough	قوي / متين / صلب

4th and 5th week Lecture

Sexual propagation questions

Q_1 / Put True or False?

1- The pistil consist stigma and ovary.
2- The stamen consist the anther and filament.
3- The petals and sepals are considered accessory parts.
4- Perfect flower contain the pistil and stamen.
5- Incomplete flower are those which one of the sexes is absent.
6- The anther contain the pollen grain.
7- Monoecious plant are those which have male and female flower on the same trees.
8- Dioecious plant are those flower which have two sex on one plant.
9- The pollen tube penetrate the embryo sac.
10- Pollination is transfer the pollen from the anther to the stigma surface.

Q_2 / List the following?

1- Type of pollination.
2- Type of plants according to the present of both sexes.
3- Reason of dormancy.
4- Dividing the seed according to lengths of lived after harvest.
5- Type of seed storage.
6- Germination requirements.
7- Methods of breaking dormancy.
8- Methods of breeking exogenous dormancy.

Q_3 / Draw the following?

1- Draw the perfect flower. 2-Draw the female flower. 3-Draw the male flower.

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6th Week Lecture

Seeds

Definition of Seed

(A seed in) . is a small embryonic plant enclosed in a covering called the seed coat. Also the seed is (a mature ovule-egg). Seed usually contain some stored food. It is the product of the ripened ***Ovule*** of gymnosperm and angiosperm plants which occurs after fertilization and some growth within the mother plant

Seed structure:-

Angiosperm seed includes three basic parts:

1- The embryo formed from the zygote.
2- Endosperm supply of nutrient for the embryo.
3- Seed coat which develops from the tissue of the ovule . see (figure – 6).

Seed coat surrounds the seed , Also the seed coat in the mature seed canbe appear as the following types :-

A- Thin layer , e.g. (peanut and loquat).
B- Thick and hard e.g. (coconut).
C- Fleshy e.g. (pomegranate and orange).

The seed coat helps and protect the embryo from mechanical injury , protect the embryo from mechanical layer may prevent water penetration and germination.
The seed after germination usually have two points of growth (one of which froms the stem and the other from the roots (Root system).

Seed development

Angiosperm (flowering plants) , Seed consist the following parts :

1- The embryo which formed from the zygote.
2- The endosperm which supply the embryo with nutrient . And the endosperm also provide the young plant with food until the root have developed after germination.
3-The seed coat which formed from tissue of the ovule . see (figure – 6 –)

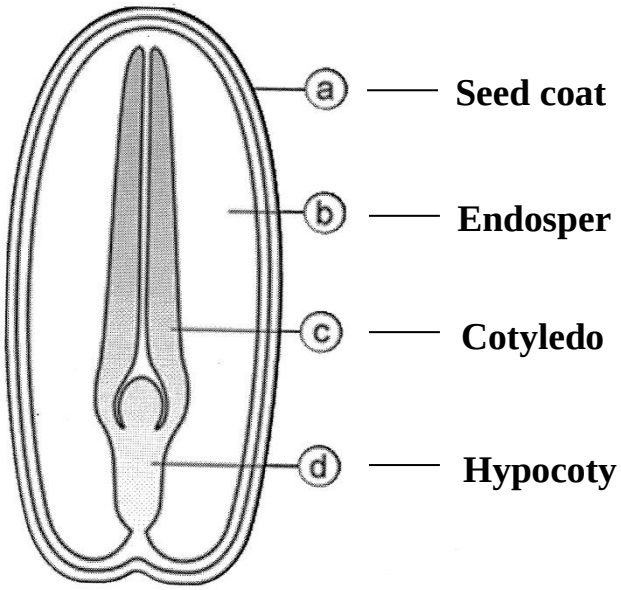

Figure -6- Diagram of a dicotyledonous seed very in size and shape.

6th Week Lecture

Seed size

Seeds are very differ in size, some seeds as the dust-like orchid seeds which containe bout million seeds per gram and other seeds are slightly larger such as (bottile bresh) and (Gum tree). Other seeds. The largest seed is the coco de me which weight (20)Kg see .figure -7-.

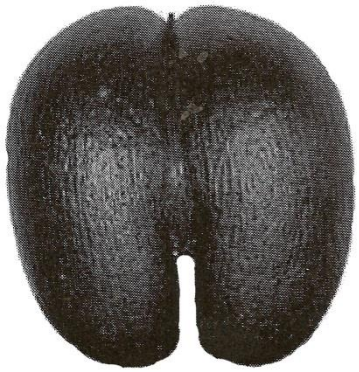

Figure -7- The massive fruit of the coco de mer

Seed dispersal

many ways to dispersal there seeds . A seed when arrive to the location at a suitable time then it stars with the germination and growth. The seed are dispersal to for distances . Some species can dispersal for several environmental condition and adapted to especially environments . The dispersal of seeds are affected by weight , size and shape of seed.

Many of seeds are specialized in good dispersal capacity and adaptation to long-range dispersal see (figure – 8 –) and other seed have little long-distances dispersal capacity . The weight of seed is different for example some is small and light and other are large and heavy and other seeds can be carried and dispersal for long distances by wind like dandelion seed see figure -8-.

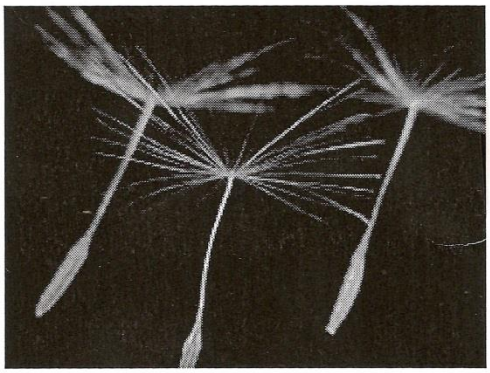

Figure -8- Dandelion seed (achens can be carried long distances by the wind

Methods of seeds dispersal

1- **By wind (anemochory)**:-
2- **By water (hydrochory)**:-
3- **By animals (zoochory)**:-
4- **By human** :-
5- **By agricultural machinery**:-

6th Week Lecture

Seeds Production

Seeds are produced in several groups of plants, and their manner of production distinguishes the angiosperms plants (enclosed seeds) from the gymnosperms plant which called(naked seeds). Angiosperm seeds are produced in a hard or fleshy. structure called a fruit that cover the seeds, In gymnosperms no special structure develops to enclose the seeds, This types of seeds cove- red by the cones such as some species of conifer. see Figure -9-.

Figure -9- Seed production

Meanings of seeds word

Achenes	الثمرة الفقيرة / ثمرة وحيدة البذرة	Hence	إذن / بعيدا / من الآن
Act	عمل/ فعل	Imbibition	تشرب/ امتصاص
Aid	يعاون / يساعد	Nutrient	العناصر الغذائية
Massive fruit	الثمرة الهائلة	Indent	يمزق طرف
Mature	ناضج	Inherent	ملازم / متأصل
Appendages	ملحق / ذيل	Initiation	نشؤ / بدء العمل
Arid	جاف / قاحل	Orchid seeds	بذور الاوركيد
Arrive	يصل/ يقدم / يجيء	Inverted	معكوس / شيء مقلوب
Assist	يساعد/يعين	Kernel	لب / النواة / حبة
Being	وجود / في الوقت الحاضر	Key	بيان المصطلحات في خريطة/مفتاح
Buried	يطمر / يدفن	Lined – up	المخطط – فوق
Carried	حمل / نقل	Long – term	طويل الأجل
Caryopsis	ثمرة جافة غير متفتحة	Mammals	الثدييات
Characterized	يصف / يصور / ميزة	Metabolic	أيضي
Penetration	اختراق	Milk weeds	حشائش اللبن
Predators	حيوانات مفترسة	Nourish	يغذي / يربي / يطعم
Constantly	دائماً / باستمرار	Nourishment	غداء / تغذية
Constituents	جزء أساسي	Obviously	بوضوح / بجلاء / على نحو بين
Consume	يستهلك / يتلف	Offspring	نتاج / ذرية نسل / نتيجة
Gymnosperm	مغطاة البذور	Values	قيمة / أهمية
Angiosperms	كاسيات او مغطاة البذور	Basic	اساسية / اساسيات
Conifer	صنوبرية	Cones	مخاريط
Dandelion	الهندباء	Draying out	الجفاف
Distance	مسافة / بعد	Dicotyledons	ثنائية الفلقة

6th Week Lecture

Embryonic	الخلايا الجنينية	Gymenosperm	عاريات البذور
Prevent	تمنع	Protect	يحمي
Slightly larger	اكبر قليلاً	Achenes	الثمرة الفقيرة / ثمرة وحيدة البذرة
Microhylid	فتحة صغيرة / فويهة / النقير	Act	عمل/ فعل
Grinding	يسن / يصقل / يجرش / يطحن	Aid	يعاون / يساعد
Saturate	مشبع	Being	وجود / في الوقت الحاضر
Metabolic	أيضي	Initiation	نشوء / بدء العمل
Degradation	انحلال / تفسخ / تعرية / تجريف	Funiculus	الحبل السري / الحبل المنوي / الحبل الذي يصل البويضة بمشيمة المبيض
Antipodal	متقابلة / متساقطة	Polar nucleons	البويضة القطبية
Imbibition	تشرب / امتصاص	Generative nuclei	أنوية مولدة او منتجة
Prevalent	مسيطر / غالب / سائد	Inherent	ملازم / متاصل
Characterized	يصف / يصور/ ميزة	Encounter	يقابل / يواجه

Seed questions

Q1 / Put true or false about the following statements :

1- Seed is a mature ovule egg .
2- Endosperm supply of nutrient for the embryo .
3- Angosperm seed includes five basic parts .
4- The embryo formed from the ovule .
5- Seeds are not differ in the size .
6- In gymenosperm the seed cover by covered tissue .
7- The dispersal of seeds are not affected by weight , size and shape of seed .
8- Pomegranate has a thick coat .
9- Coconut have a fleshy coat .
10- The seed after germination usually have three points of growth .
11- Seed coat don't protect the embryo .
12- The seed coat surround the embryo .

Q2 / List the following :-

1- The main basic parts of the seed .
2- Methods of seeds dispersal .
3- Types of seed coat .

6th Week Lecture

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7th Week Lecture

The application of rootstocks in plant propagation

It is necessary to explain what is the rootstocks. It is the lower part of budding seedling. In general there are two type of rootstock.

A- **Seedling rootstocks**: -

These seedling develop grow and from seed germination. It have certain advantages they are:-

1- Cheep.
2- Virus free.
3- Deeper grow.
4- Different in shape and size.

B- **Clonal (vegetative) rootstocks**: -

These are developed from vegetative propagation methods.

Effects of rootstock and scion:

The rootstock has an effect on the scion and vesa versa the scion has an effects on the rootstock as follows:-

1- Effects of rootstock on scion:

These can be summarized as follows:-

1- Effect on tree shape and vigor, e.g. East Malling apple cultivars.
2- Effect on resistance the trees to the cooler, e.g. Budding of sweet orange on poncirus trifoliate rootstock .
3- Utilized to studying the disease transmission, e.g. European pear varieties are susceptible to fungel and bacterial diseases such as black end. when grafted on ***pyrus pyrifolia*** (Japanese).Pear but black end will not develop when grafted on ***pyrus communis*** (French pear) and resistance to phytophthora cactorum.
4- Effect on the timing of bud burst, e.g. The rootstock effects on opens date of flower bud.
5- Effect on the time of bearing, e.g. grafting on vigor rootstock delays bearing in contrast with weak rootstocks.
6- Effect on productivity and fruit quality, e.g. skins thickness, carbohydrate contents, sweetness and bitter.
7- Rootstock effect on fruit storage.
8- Rootstock effect on tree physiological parameters.
9- Rootstock effect on nutrition.
10- Rootstock effect on dry matter accumulation.
11- Rootstock effect on genetic engineering for example budding apple and pear on Cydonia oblong rootstock.
12- Rootstock response to irrigation.

2- Effects of scion on rootstocks

The scion is also have some effects on rootstocks. These can be summarized as following.

1- Effect on rootstock vigor, e.g. Increases the number of root and therefore better growth.
2- Increasing the rootstock cold resistance.

3- Effect on the angle between top roots and secondary roots.

Incompatibility

It means incompatibility between scion and rootstock. See Figure -10-.

The reason of incompatibility are:-

1- Genetic reasons.
2- Physiological reasons.
3- Anatomical reasons.
4- plant injury with diseases.

Figure -10- Incompatibility phenomenon between the stock and the scion

Types of incompatibility

There are two types of incompatibility.

A- Localized incompatibility.
B- Translocated incompatibility.

The application of rootstocks in plant propagation

Rootstock:- It is the lower portion of the tree which develops in to the root-system of the budded or grafted plant.

Scion:- It is a short piece containing one or several dormant buds, which when united with the stock comprises the upper portion of the budding or grafting and they formed the top part (cultivars).

Inters tock or (Intermediate stock):- It is a piece of shoot inserted between the scion and the rootstock this piece is usually compatible with both scion and inters tock.

The major use of this part is to avoidance the incompatibility state between the scion and rootstock.

The rootstock of some fruit trees

1- Apple:- there are many rootstock of apple such as:-
   1- Seedling rootstock.
   2- Suckers.
   3- Clonal stocks, e.g. East Malling, Malling Merton.

7th Week Lecture

East Malling and series are classified according to their effects on the scion to the following:-

1- Dwarfing stocks e.g. M 27, M 13, M 9.
2- Semi - dwarfing stocks e.g. M 7, MM 106.
3- Vigorous stocks e.g. M 2, MM 104, MM 111.
4- Very vigorous stocks e.g. M 16, MM 109, M 25. Figure -11-.

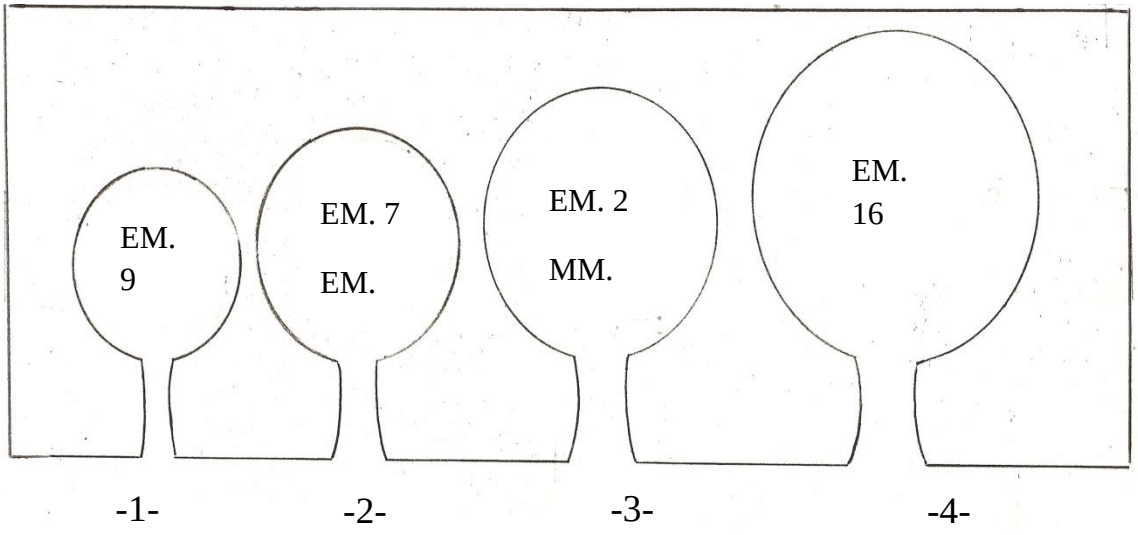

Figure -11- Group of East Malling and Malling Merton series

2- Pear:- The rootstock of pear are:-
   1- Seedling rootstock such as:-
      A- French pear (***P. communis***). B- Pyrus calleryana.
   2- Clonal rootstock such as
      Quince (***Cydonia oblanga***). This can be propagated by cuttings.
3- Plum:- The rootstock of plum are:-
   A- Myroblan plum seeds.
   B- Mariana plum this rootstock can be propagated by cuttings.
   C- Peach seeds.
   D- Apricot seeds.
   E- Almond seeds.
4- Peach:- The rootstock of peach are:-
   A- peach seeds. B- Apricot seeds. C- Almond seeds.
5- Citrus spp:- The rootstock of citrus are:-
   A- Sour orange seeds. B- Sweet orange seeds.
   C- Rough lemon seeds. D- Trifoliate orange seeds.
   E- Mandarin seeds. F- Citranges (Trifoliate orange X sweet orange).
6- Roses:- The rootstocks of roses are
   A- Rosa canina seeds.
   B- Rosa chinenses seeds.
   C- Rosa multiflora seeds.

7th Week Lecture

STRATIFICATION OF ROOTSTOCKS SEEDS

After removal from harvested fruit, seeds of most deciduous fruit trees ordinarily do not germinate, even under ideal conditions of moisture and temperature.

This delay in germination is partly due to the fact that the seed embryos are in a state of physiological rest, which must be broken by exposing the moist seeds to cold. In addition, the seeds of many plants have a hard, impervious, outer layer that must be softened before germination can begin.

A common process used to break the rest and to soften the hard seed coat is called stratification. Stratification can be accomplished by putting the seed between layers of moist sand or other materials, such as vermiculite, or in a mixture of sand and peat moss and then storing in a cool place. Figure -12-.

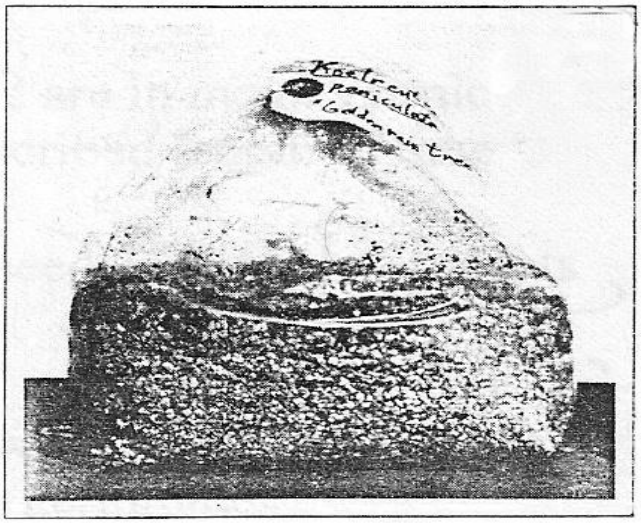

Figure -12- A small lot of seed ready for stratification. The seeds are in moist vermiculite in a polyethylene bag and will be held in cold storage for the prescribed length of time before planting.

If necessary, cover the container with wire screen to protect the seed from bird or rodents. Seed in cold storage at about (2-5Cº).

Plant seeds immediately after stratification. If germination temperatures are too warm, however, the seeds may develop secondary dormancy and fail to germinate.

7th Week Lecture

Words Meanings of the application of rootstock

Angle	زاوية	Increasing	زيادة
Anatomical	تشريحي	Localized	موقعي
Avoidance	تجنب	Major	رئيسي
Better	أفضل	Partly	جزئياً
Bitter	مرارة	Prescribed	يقضي
Burst	انبثاق	Resistance	مقاومة
Butter	مربة	Shape	شكل
Colonel	سلالة	Skins	القشرة (قشرة الثمرة)
Compatible	توافق	Storing	تخزن
Concern	يخص / يتعلق بـ	Suckers	السرطانات
Contrast	بالمقارنة	Summarized	تلخص
East Malling	محطة أبحاث ايست مالخ	Terming	موعد
Explain	يوضح	Translocation	انتقال
Fact	حادثة/واقعة/حقيقة	Vigor	قوة
Incompatibility	عدم التوافق		

Rootstocks questions

Q1: Put true or false about the following sentences.

1- Seedling rootstocks are very expensive.
2- Seedling rootstocks are virus free.
3- Rootstocks don’t effect on fruit quality.
4- Rootstocks don’t effect on shape and size of graft.
5- Vigor rootstocks delays bearing.
6- The scion effect on the angle between top roots and secondary roots.
7- The rootstock is the upper portion of the graft.
8- EM27 belong to vigorous stocks.
9- Myroblan plan can be propagated by cuttings.
10- The quince can be propagated by cuttings.

7th Week Lecture

Q2: List the following:-

1- Types of rootstocks.
2- Types of East Malling and Malling Merton according to their effects on the scion.
3- Advantage of seedling rootstocks.
4- Reason of incompatibility.
5- Type of incompatibility.

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8th Week Lecture

Asexual ((Vegetative)) propagation

Definition:- It is propagation the plant by all means except the sexual Propagation.

Reason of using vegetative propagation

1- Production of plants similar to mother plant stocks.
2- Propagation of seedless plants e.g. Banana, figs, and some varieties of oranges and grapes.
3- Propagation of sterile plants.
4- Enhancing the bearing time of fruit trees.
5- Overcoming the problem of variation occur in plants when propageted by seeds.
6- Production of some rootstock via vegetative propagation.
7- Overcoming some environmental factors via budding and grafting or resistant rootstock.
8- Controlling the size and shape of some plant such as budding and grafting on EM and MM apple rootstock.
9- Economics through the elimination of juvenile phase than mature cutting to give mature plant.

Classification the Cuttings

Cutting can be classified according to the following:-

1- According to type of plant part which taken from it.
   a- Stem cuttings. b- Root cuttings. c- Leaf cuttings.
2- According to growth site.
   a- Terminal cutting (containing a terminal bud).
   b- Non terminal (not containing a terminal bud).
3- According to type of wood mature used for propagation.
   a- Hard wood cutting. b- Semi-hard wood cutting. c- Softwood cutting.
4- According to cutting age .
   a- One year old cuttings. b- Two year old cuttings. c-Three year old cuttings.

Preparation of the cutting

Every stem cutting should be cut into pieces $(10\text{-}30)_{cm}$ length, a horizontal cut is made just below the node at the based end and slanting cut at the upper end, Leaving $(2\text{-}3)_{cm}$ above the upper bud, It is common to prepare the cuttings with the heal which have root primordial on the hard wood (mature wood). But it is very difficult to prepares a large number of cutting with heal.

Slanting cut benefits:-

1- The slant cut may help to detect right direction of the cuttings.
2- Protect the terminal bud from drought by evaporation.
3- Water will not accumulate on the slant cut.
4- To hold the cutting during planting to avoid bud damage.

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Horizontal cut benefits:-

1- The horizontal cut beneath the node have no pith in this region and easily infected by microorganisms and diseases the pith also permeable to water thus which causes rooting.
2- The roots emerge from the nodes more than any other region of the cutting.

Cutting storage

After preparation the cuttings during the dormant season the bases of cutting dipped into a root promoting materials such as (Indole butyric acid) (IBA), and tied into bundles (50-100) ones together, and stored under (0-5)C° Temperature with moist conditions until the spring early. It is a preferable to store the cutting upside down, the horizontal cut are near the soil surface while the slant cut are down inside the soil, the cutting are stored in the soil or peatmoss or saw-dust by putting it in the field or boxes in the refrigerators, and checking occasionally to examine the bud growth if the growth is occurred it is necessary to decrease the storage temperature.

Not:-

Sometime it is preferable to store the cuttings with inverted shape inside the soil and check the cutting from time to time . see Figure -13-.

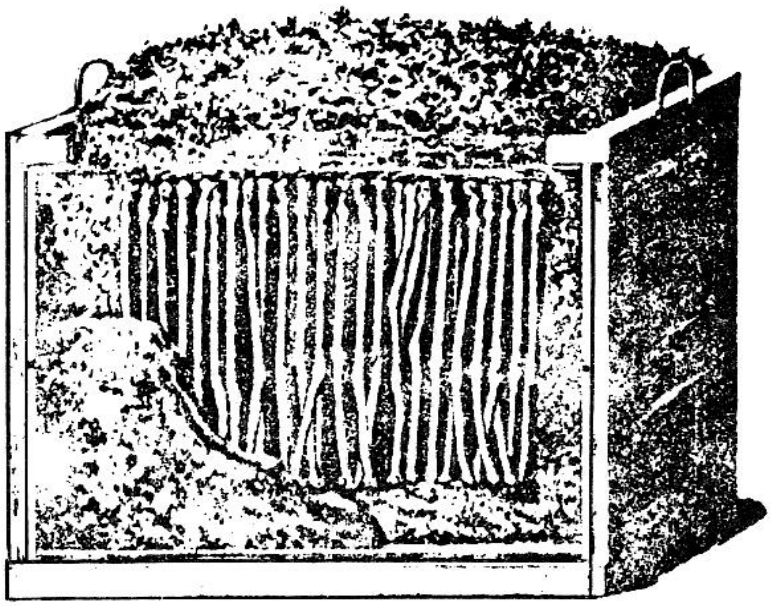
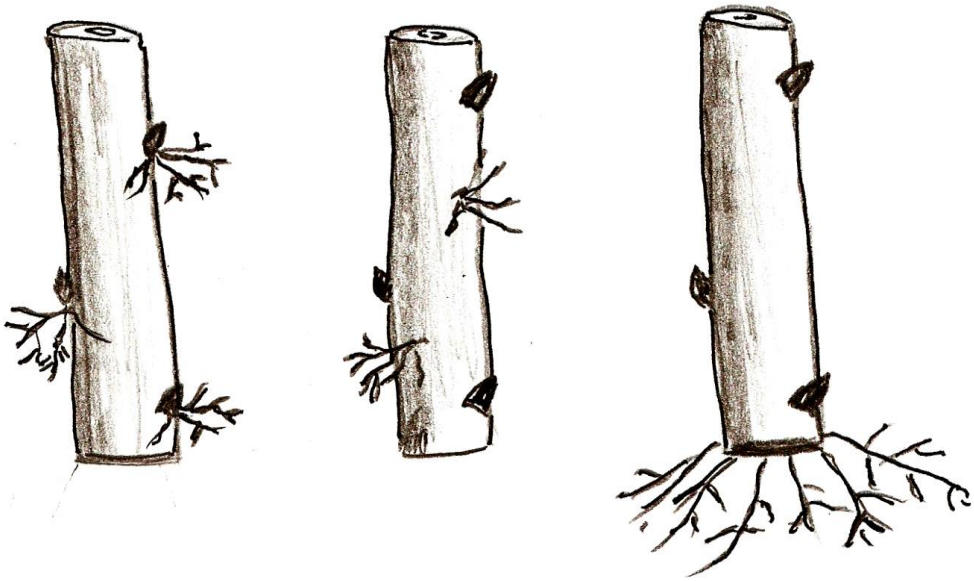


Figure -13- Cuttings Storage

Sites of roots appear on stem cuttings

Roots appear on stem cuttings at three sites.

A- The bases of buds.
B- The internodes.
C- The basal cut of the cutting . See Figure -14 -.



A- The basses of buds B- The internodes C- The basal cut of the cutting

Figure -14- Sites of roots appear on stem cuttings

Juvenility

It means taken the cutting from young seedling plants this rooted much more readily than cuttings taken from mature plants of same species. The phenomenon which is associated with the physiological age of plant.

Factors affecting root formation

There are many factors effects on root formation of cutting. These are can be summarized as following:-

1- Cutting stored food:- Hardwood cutting are rich with (CHO) therefore you expect better rooting.
2- Time of taking cuttings:- Such as spring, summer, fall, winter.
3- Juvenility:- Cutting from Juvenile plant root better than old ones.
4- Plant nature and physiology state Some plants are unable to form roots because of genetic or physiological reasons.
5- Anatomy of the cutting:- The anatomy of softwood cutting is different than the anatomy of hardwood cutting.
6- The presence of buds and leaves:- Buds are a source for auxins, leaves are a source for (CHO).
7- Callus formation:- In general callus formation enhances root initiation although in some plants it prevents root initiation. See Figure -15-.
8- Inhibitors:- Some plants secrete substances inhibit root initiation.
9- Wounding:- Wounding enhances root formation. See Figure -16-.
10- Rooting media:- Cutting inserted in sandy soil rooted more better than cutting inserted in heavy soils.

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11- Etiolation:- Cutting taken from etiolation plants usually the formation of roots more root better than un etiolated ones because etiolation increases the level of auxins in cuttings.

12- Humidity:- High relative humidity slows desiccation and there provides better chance for rooting.

13- Temperature:- Certain suitable temperature is required in ambient air around the cutting and root zone is necessary for better rooting.

14- The healthy condition of stock plant.

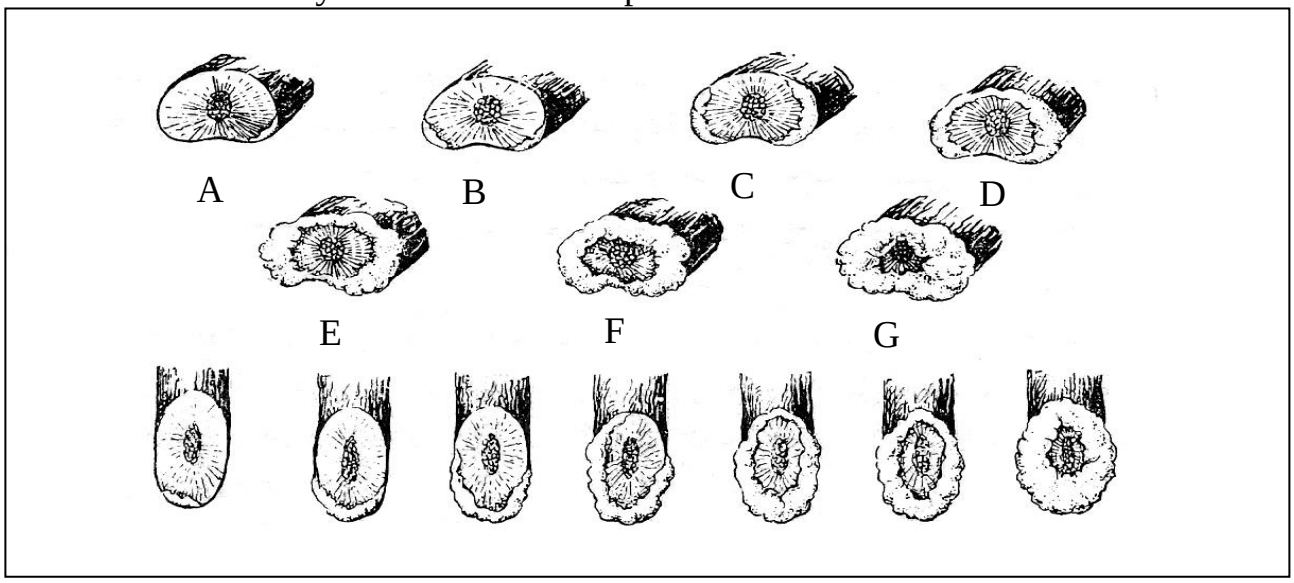
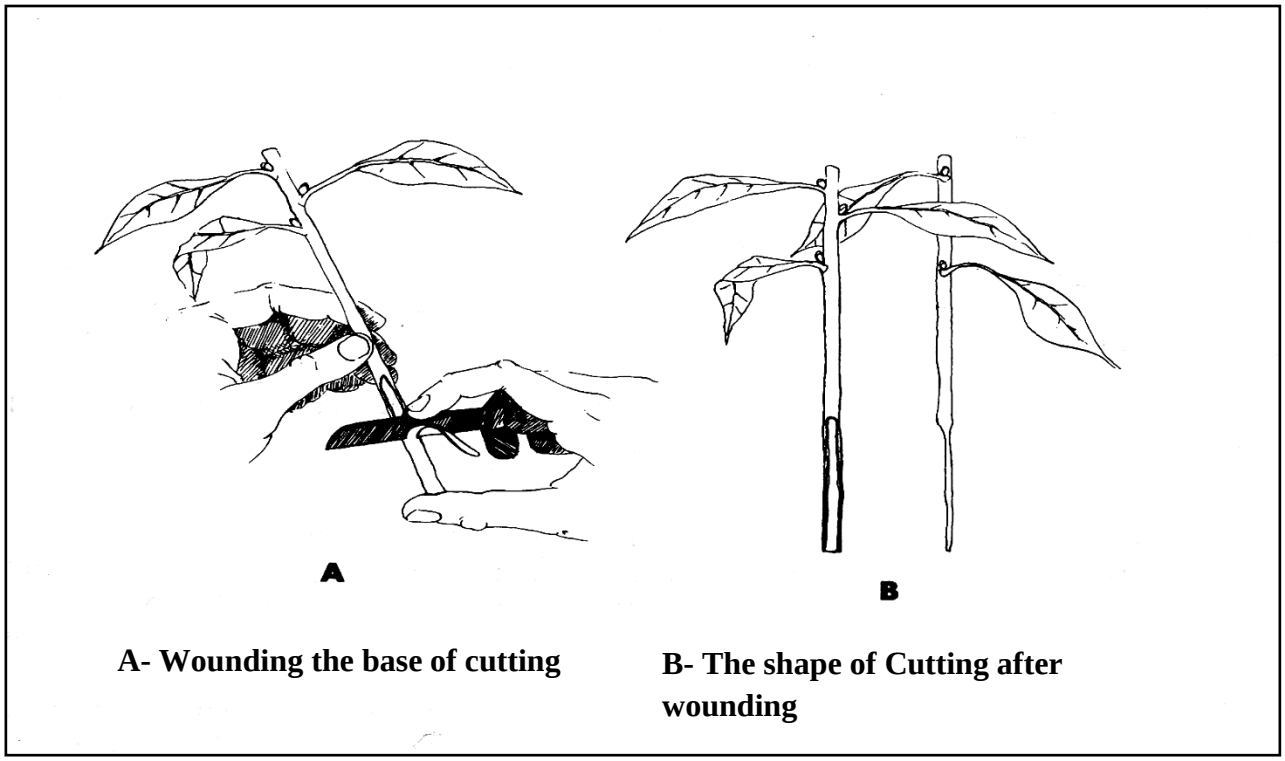


Figure -15- Development of callus formation in grape cutting.



A- Wounding the base of cutting

B- The shape of Cutting after wounding

Figure -16 - Cutting wounding

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Mist irrigation

This system is widely used in the world especially for propagation. Softwood cutting and leaf - bud cuttings this need special conditions like high moisture during propagation to prevent drought until rooting because the chief problem of plant by leafy cutting is to maintain the cutting without wilting until root formation see figure -17-.

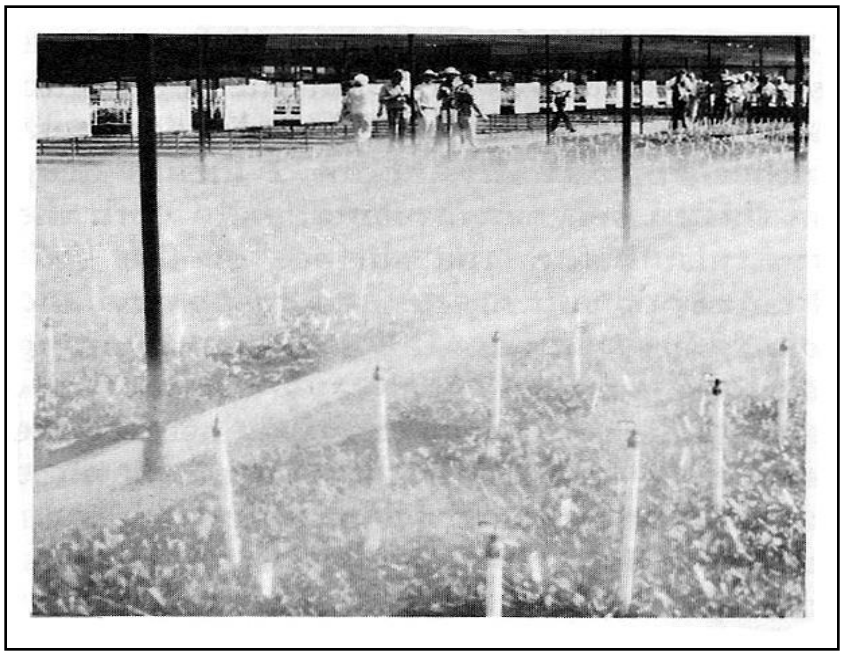

Figure -17- Mist propagation

Meanings of asexual propagation words

Asexual	الاكثار اللا جنسي	Juvenile	إحداثي / حدث
Auxins	الاوكسينات	Late	أواخر/متأخر
Percontra	بالمقارنة / على العكس من ناحية أخرى	Leaf	ورقة
Pieces	قطعة/جزء	Leaves	أوراق
Plate	شريحة / صفيحة	Leaving	ترك
Pore	يحدق / يتفكر	Means	وسائل
Presence	وجود	Mist propagation	الاكثار الرذاذي
Prevent	يمنع	Occur	يحدث
Primordial	بدائي	Old ones	مثيلاتها القديمة
Buds	البراعم	Because	بسبب

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Callus	الكالوس	Better	أفضل
Carbohydrates (CHO)	الكاربوهيدرات	Blade	نصل
Cell	خلية	Purpose	غرض
Contain	يحتوي	Rather	على الأصح / بالأحرى
Shape	شكل	Ratio	نسبة
Cuttings	عقل ، أقلام	Reasons	أسباب
Deep	عمق	Relative	نسبة/نسبية
Division	انقسام	Resistant	مقاوم
During	خلال	Rich	غني
East Malling	محطــة أبحــاث إيســت مالنج	Root	جذر
Elimination	تحديد	Shoots	نموات/افرخ
Enhancing	الإسراع	Similar	مشابهة
Entire	تام/كامل/سالم/صحيح	Size	حجم
Environmental contentions	الظروف البيئية	Softwood	خشب غض او طري
Except	ما عدا	Source	مصدر
Exhausted	مستنزف / مستنفذ	Starting	بدأ
Exhibit	يظهر / يبدي	Stem	ساق
Factors	عوامل	Sterile	معقم
Terminal	طرفي	Substances	مواد
Food	غذاء	Vegetative	خضري
Till	حتى	Versus	ضدْ/مقابل/أزاء
Tissues	أنسجة	Vicinity	قرب
Touch	يصل	Grafting	تركيب
Under	تحت	Grapes	العنب
Using	استعمال		
Usually	عادة	Greatest	أعظم

8th Week Lecture

Utilized	يستخدم	Hardwood	خشب ناضج
Inserted	ادخال	Horizontally	افقيا
In general	بشكل عام	Humidity	رطوبة
Tendency	ميل / هدف / غرض	Incorporate	مندمج / متحد / يدمج
Conductive	يساعد على احداث كذا	Out word	نحو الخارج / خارجي/ ظاهري

Asexual propagation question

Q_1\ Answer these question?

1. Cutting can be classified according to the type of plant part taken from:-
   A-
   B-
   C-
2. The stem cutting are divided to:-
   A-
   B-
   C-

Q_2 \ list the following?

A- Advantage of slanting cut of cutting.
B- Advantage of horizontal cut of cutting.

Q_3 \ Put True or False about the following statements.

1- Cutting should be prepared into small part a bout $(10\text{-}30)_{cm}$.
2- The slanting cut should be make at the upper end and leaving $(2\text{-}3)_{cm}$ above the upper bud.
3- Heal cutting is very difficult to formation the roots.
4- A horizontal cut is make just below the internodes.
5- Cutting are stored into the refrigerator at (0-5)C° until the planting time.
6- When storage the cuttings should be checking the cuttings from time to time to examine the bud growth.
7- The length of semi-hardwood cuttings are about $(10\text{-}20)_{cm}$.
8- Softwood cutting are generally rooting easier and quicker than other type of cuttings.
9- One year old cuttings is more better rooting than three year old cutting.
10- Leaf-bud cuttings are used when there is no enough wood for making cuttings.

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9th Week Lecture

Plant Growth Regulatores

What is Plant growth regulators

Plant growth regulators are either synthetic compounds or plant hormones that modify plant physiological process.

They regulate the growth by influencing hormone on action sites. For examples auxins, cytokinins, gibberellins, inhibitors (e.g., abscisic acid) and ethylen.

Introduction:-

Plant hormones are chemicals that regulate plant growth in the plant . These are termed plant growth substances . Hormone regulate cellular processes in targeted cells locally and moved to other location in other parts of the plant :

Plant hormones also known as phytohormones which are found not only in higher plants . but in algae , fungi and bacteria . they are naturally produced and effect on plant growth .

Also plant hormones are not nutrient , These hormones produced in small amount in plant hormones are organic compounds produced by plant but when produced in factories it called plant growth regulators and produced in large quantities , and used in low concentration . Some growth regulators preventing seed germination such as abscisic acid (ABA). For this should be removal by water before germination also (ABA) plays a role in closing the stomata under water stress , But gibberellic acid promotes seed germination and elongation of vegetative growth. (GA3) stimulate pollen tube growth and worker reverse the action of (ABA).

Finally it can be said that all hormones are growth regulators but not all growth regulators are hormones .

Techniques of improve rootings cuttings

Some methods are used to increase the rooting percentage in the cuttings

These methods are:-

1- Mechanical methods:- Such as wounding the cuttings.
2- Chemical methods:- Includes the using of hormones solution such as (IBA, IAA, NAA) or hormonal powders such as rooton and seradix. This material encourage rooting by dipping the bases of cutting in a diluted solution or hormonal powder before planting the cuttings in the soil.

Benefits of treatment the cuttings with (Growth requlatores)

1- Increase the rooting percentage in the cuttings.
2- Promotion of the root primordial roots emergence.
3- Increase the number of roots formed. See Figure -18-.

9th Week Lecture

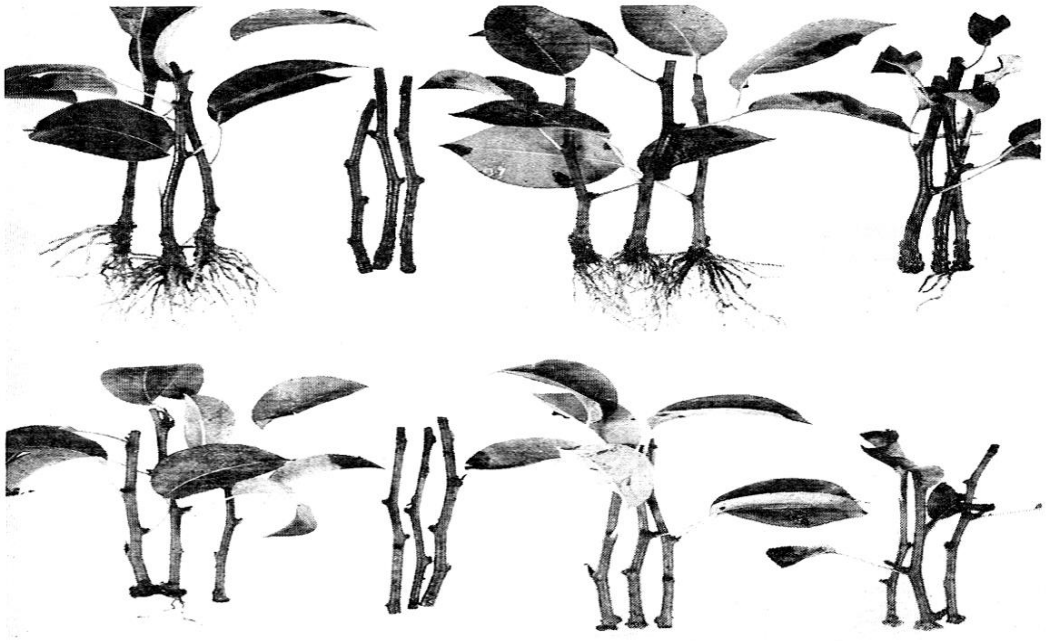

Figure -18- Effect of Indole buytric acid at (4000)ppm on root formation in Leafy Old Hom pear cutting.

1- Top:- Treated cutting. 2- Bottom:- Untreated cutting.

Auxins and Rooting

Auxins are widely used as a rooting substances in nurseries, they are organic compounds increase cell division and there fore enhance rooting. Auxins are produced commercially under some trade names such as:-

1- Rooton. 2- Rhizopon 3- Seradix:- there are used as a powders.

The most common a uxins used for this purpose are:-

1- Indole butyric acid (IBA).
2- Indole acetic acid (IAA).
3- Nephthalen acetic acid (NAA).

} These are used as a solution

Methods of used rooting hormones

There are several methods used when using hormones :-

1- Dry dip method

Dip the basal end of cutting into the (Rooton, Rhizopon, Seradixs) powder dry rooting hormone. One by one or in small bundles. Make sure that the powder is evenly distributed in a thin even layer over the base of the cutting. Too much powder on the cutting might result in excessive rooting where there the surplus powder. Root formation can be expected all over the part of the cutting covered with the powder . Avoid contact between the powder and foliage and other over ground parts of the stem since it excess powder. insertion the cuttings immediately in moist media.

2- Total immerse method

After prepare the hormone solution usually immerse the base of cutting for a few seconds. You can use large containers to dip the cutting and allow suitable time for the solution to dry after immerse. The temperat- ure of the solution should be at least equal to the cutting temperature. A cold solution

temperature causes close the stomata of the cutting and the amount of active material absorbed is reduced.

Not:-

There is a major benefit to use this method. The bud eyes keep dormant until the root is developed thereby get a stronger plant. Figure -19-, -20-.

Figure -19- Dry dip method

Figure -20- Total immerse method

Method of application auxins

There are several methods of application auxins they

1- As a powder:- By dipping the basal end of the cutting in the auxin powder.
2- As a solution:- By dipping the basil end of the cutting in prepared solution of auxins with some concentration.
3- As a past:- In this method mixing the auxins with lanolin paste to treat the bases of cuttings.

Meanings of plant growt requlatores words

Benefit	فائدة	Get	ينال / يكسب / يخرج
Bindles	حزم	Immerse	أغمس
Commercially	تجارياً	Might	قدرة / قوة / مقدار كبير
Compound	مركب	Modify	يحور
Contact	تلامس	Occurring	تحدث
Dipping	غمر	Organic	عضوي
Division	انقسام	Application	تطبيق
Emergence	بزوغ / ظهور	Regulator	منظم
Encourage	تشجع	Stomata	ثغور
Enhance	تسرع	Substances	مواد
Equal	مساوي	Sure	ثابت

9th Week Lecture

Growth regulators questions

Q_1\ Answer these question cuttings.

1- Methods of increasing the rooting percentage in cuttings.
2- Advantage of cuttings treatment by hormones.
3- The most common auxins used as a solution.
4- Methods of application auxins.

Q_2\ Put true or false about the following statements.

1- All hormones are growth regulators but not all growth regulators are hormones.
2- Plant growth regulators are plant hormones that modify plant physiological process in the plant.
3- Hormones decreases the number of root formation.
4- Rooton, Rhizopon and Seradix are auxins used as a solution.
5- When application hormone should be avoid contact between the powder and foliage and other ground parts of the stem.
6- Cold solution temperature causes close the stomata of the cutting and the amount of active material absorbed is reduced.
7- The major benefit of total immerse method is keep the bud eyes in dormant until the root is developed thereby we get a stronger plant.

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10th and 11th Week Lecture

Budding and Gafing

Budding definition

It is mean the connecting two pieces of living plant tissue together in such a manner that they will unite and subsequently grow and develop as one plant. The upper piece (one eye or more) develops in to the top of the seedling is called the scion. The lower part which becomes the root system is called the rootstock.

The budding is performed by taken a bud with a part of the bark tissue with a part of the leaf petiole and inserted on another plant stem from the same family or variety. The bud is called scion and the other plant is the root stock. It is generally used on dicotyledonous Plants.

Reason for budding and grafting

1- Maintenance of colons that can not maintained by other methods.
2- Obtaining the benefits of certain rootstocks.
3- Changing the cultivators.
4- Speeding maturity and re productivity.
5- Controlling plant size and shape.
6- Repairing damaged parts of trees.
7- Studying virus diseases.
8- Ornamental purposes e.g. Assembling of different colors of flower on one part of plant of roses also budding many types of citrus on sour orange.
9- Many species require cross-pollination by a different cultivar, grafting a pollinator scion wood on already established tree is faster than planting new trees.
10- Benefit from interstock to overcome the phenomenon between the scion ant the stock of some cases of budding and grafting.
11- Increase the growth rate of seedling.
12- Many species require cross-pollination by a different cultivar –Thus can be using grafting as pollinator scion wood to an already established tree is faster than planting new trees.

Factors influencing the success of budding and grafting

1- Incompatibility between stock and scion:- It is necessary that plants from the same family are compatible. For example apple and pear both belong to the same family are compatible, plum are compatible. But when budding the apple on the fig those not belong to the same family thus are not compatible also sometime the incompatibility occur in the same family such as budding apricot on almond seedling rootstock. But apple and apricot don't belong to the same family thus they are not compatible between them, also sometime the incompatibility occur in the same family such as budding apricot on the almond seedlings rootstock. See Figure -21-.

Sometimes it a break occurs in the cambium region such as budding apricot on peach and budding the apricot on plum combinations.

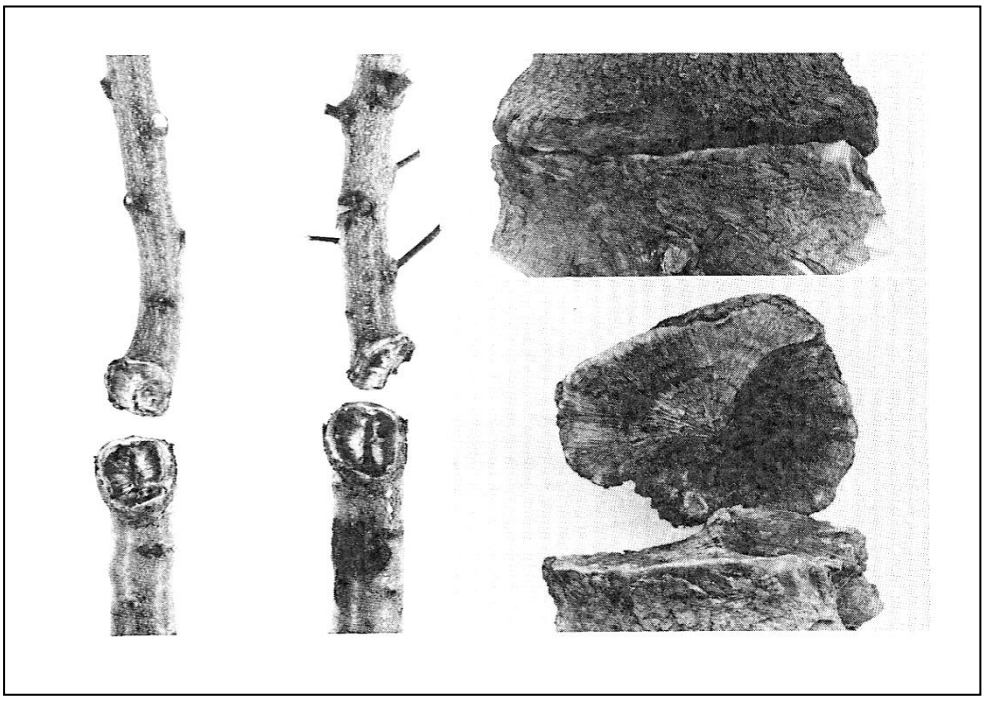

Figure -21- Right:- Breaking at the graft union due to incompatibility.
Left:- One year – old nursery trees of apricot on almond seedling rootstock.

2- Type of plant:- Not all plant species respond to budding and grafting.
3- Vigor of rootstocks:- Juvenile plants respond to budding more than old ones.
4- Skill and experience of the worker:- Because this technique requires very well trained people.
5- Health conditions of rootstock and scions.
6- Temperature :- Grafting usually completed during the dormant season when temperature are cool , Graft union formation is slow at (4 C°) or lower and should not exceed than (15 C°) for (2-3) weeks following grafting unless , scion bud opening in their rest periods . And the budding temperature around r (21 C°) for callus formation . but temper temperature (32 C°) slow or stop callus formation.
7- Age of plants . Bud sticks should be (1) year or less , scion 1 to 2 year old , and rootstocks (2) years or less .
8- The direction of the scion on the stock should be in the right direction.
9- Care of grafted plants . The surfaces of the stock and scion at the union must be protected from drying and from drying and for that cover with grafting wax or other.
10- Soil moisture . Adequate soil moisture is particularly important during budding.
11- The contact between the stock and scion must be very good and for that clean the smooth cut on the stock and scion , good tying promote proper contact.
12- Keep the union wet or (100%) relative humidity .
13- Disbudding the rootstock is necessary after growing buds.

10th and 11th Week Lecture

Time of budding

1- **Spring budding**:- The important notes about spring budding are.
   A. Usually done at early growth season in this season the buds growth is very faster burst.
   B. The growth season is very shorter thus it needed collecting and prepare a numbers of (bud stick) and storage the bud stick in suitable media and preserved in refrigerators until used.
   C. The seedling after budding exposure to higher at late summer temperatures and should be shaded or putting in the lath houses.

2- **Jun budding**:- Sometimes the seed when planted in fall or early spring the seedlings trunk are reached to suitable diameter then budded in May or June month by using current season buds directly. This methods is widely used for pudding citrus in Iraq.

3- **Fall budding**:- It's done often and preferred than spring budding because the budded seedling exposure to low temperature in winter season and this cases destroy the new growth and die. It's very necessary in fall budding to stay the budded seedling (bud or scion) in dormant at winter season until the next season (spring).

Properties of used buds

1- They should be taken from a vigorous and good varieties tree
2- Free from diseases and insects.
3- They should be chosen from one year age shoots with medium thickness, taking the middle buds and leaving the terminal ones.
4- The bud sticks should be rounded to facilitate the attachment of the scion around the rootstock.
5- The branches should be free from spines.
6- They must have a complete compatibility between the scions and rootstock.

Storage of bud wood

It is desirable to use bud wood as soon after collection, but it can be stored for several months under proper conditions. The bundled bud sticks should be sealed in a plastic bag and stored in refrigerator. The optimum storage temperature is (0 – 5)C° degree for (3-5) months. Also the stored bud wood should be checked every week for the presence of mold or excess moisture in the bag . The moldy or darkened bud wood should be discarded at the dead buds.

Preparing of the rootstocks:-

A very sharp knife is used to make a vertical cut in a smooth area of the rootstock about $(2 – 2.5)_{cm}$ long through the bark, deeply enough into the wood to be certain the bark has been completely cut. A horizontal cut about $(1)_{cm}$ long is made through the bark at the top (T) or bottom (inverted T) of the vertical cut, again cutting completely through the bark. At the finish of this cross cut, the knife blade is turned slightly up word and given a slight twist to open the bark at the T. The point of the knife can be used to lift the bark of the knife can be used to lift the bark along the vertical cut if necessary.

10th and 11th Week Lecture

Preparation of the bud

Cut a bud from the bud stick by holding the apical end of the bud stick. Start the cut about $(1)_{cm}$ above the bud end and finish a line less distance below the bud. The knife should be held almost paralleled to the axis's of the bud stick, cutting towards the thumb. Cut only deep enough to take a thin layer of wood under the bark.

Insertion the bud

Insert the bud shield under the bark flaps of the stock so that surface is flat against the wood. The bud shield should be completely enclosed in the -T- shape.

Wrapping the bud

Wrap the bud with budding tape about $(1)_{cm}$ wide and $(10\text{-}15)_{cm}$ long. Make the wrap below the bud with (3-4) turns and finishing with several turns above the bud. The end cut secured beneath the last circular turn of the wrap. Wrapping should be firm without being excessively tight. See Figure -22-, -23-.

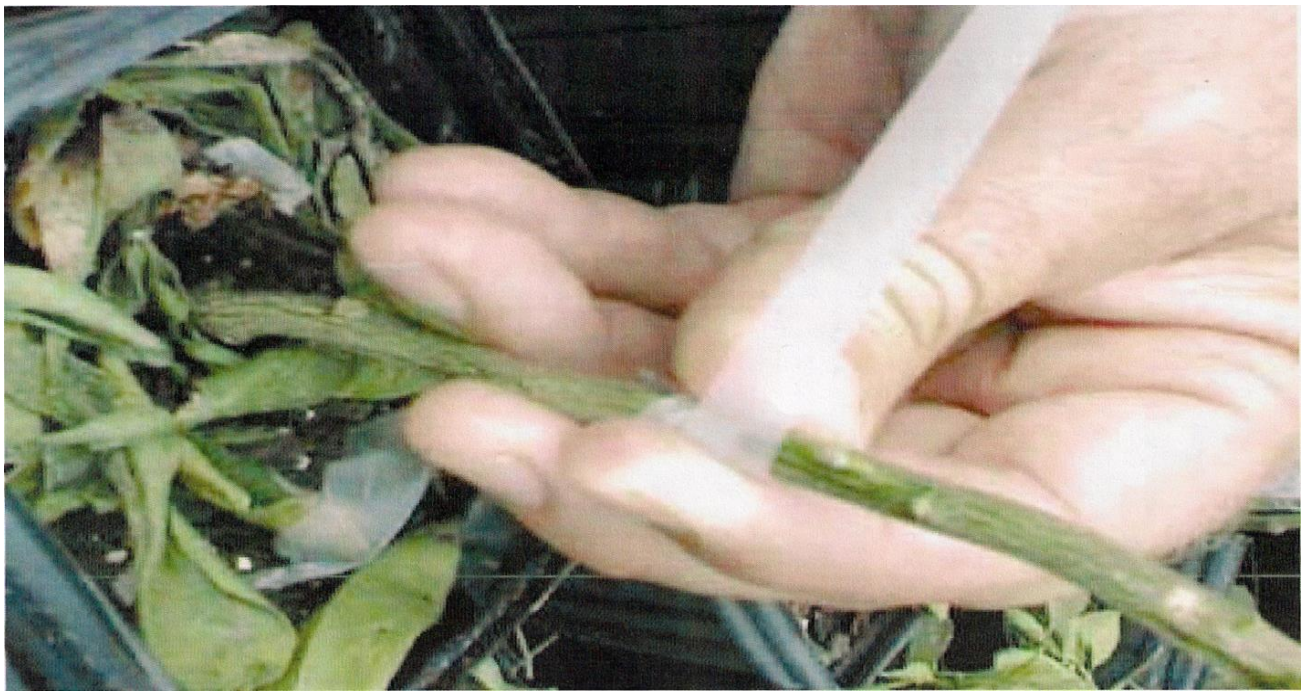

Figure -22- Wrapping the bud

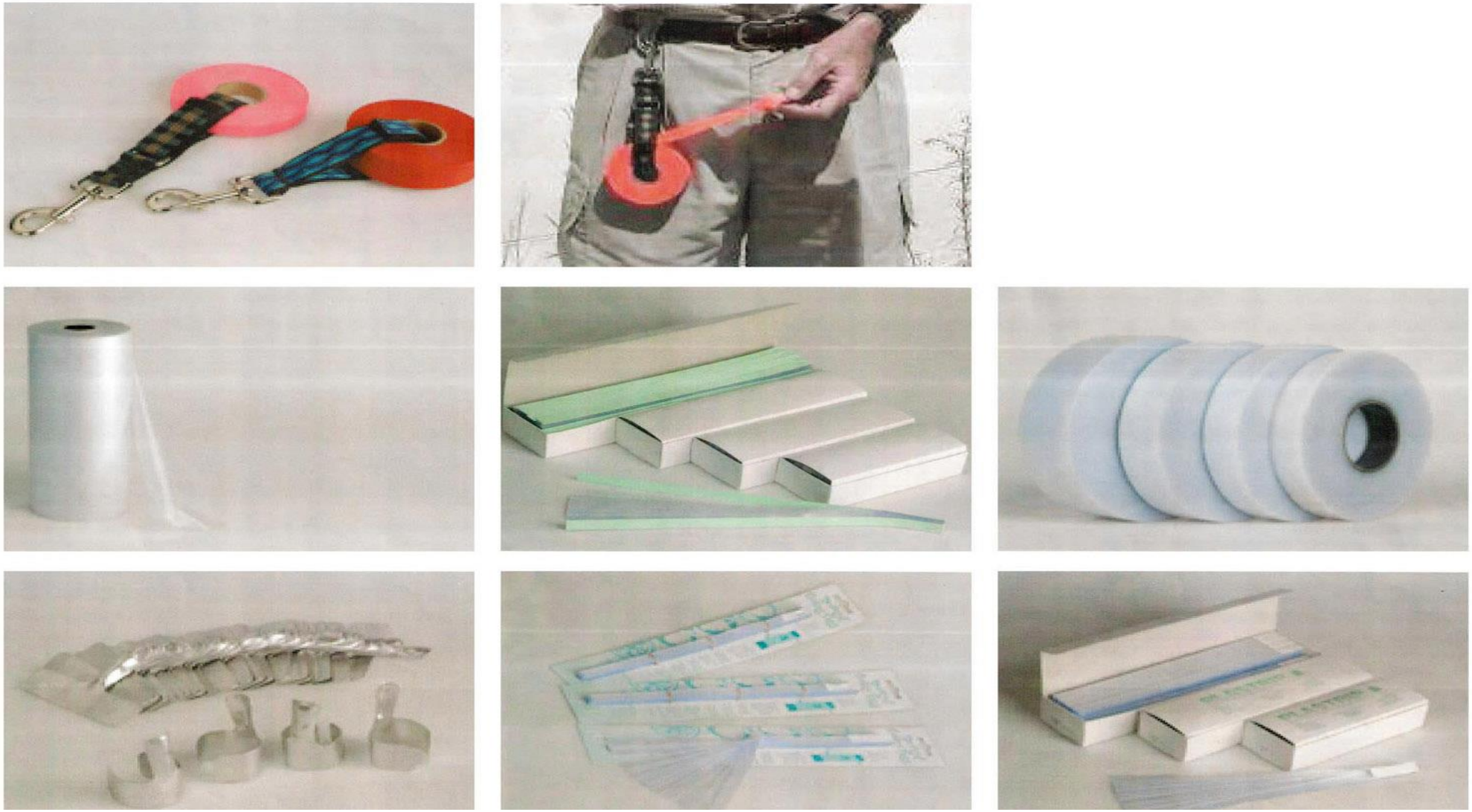

Figure -23- Different types of budding tapes

Remove the budding tape :

Usually cut the seedling above the budding area by about (10) cm to encourage the scion growth quickly and to link the growth of the scion after the elongation . Also all buds should be placed to face of the wind and at high (25-30) cm on the rootstock to allow for deeper planting when transplanting to the permanent place.

Usually remove all other buds and suckers from the rootstock stem.

Tools and materia required for budding and grafing

1- Budding Knife

The knife is the key of successful budding it should be a very sharp and can be pulled slowly and passes through the wood. Sharpen your knife as show last week. The knife should already be sharp and ready to. See Figure -24-.

2- Pruning shears
3- Saw
4- Mallet
5- Grafting wax
6- Electrical tape
7- Nails
8- Grafting clips
9- Budding strips
10- Gleft qrafting tools
11- Sharping stone

Figure -24- Different types of budding knifes

10th and 11th Week Lecture

Important points which noticed when choosing bud stick for budding

1- Avoid the outer growth of the tree because most of them are flower buds.
2- The basal and middle portion are the better buds while the terminals are not suitable.
3- The flower buds are large in size, while the leafs buds are small and pointed in shape. See Figure -25-.

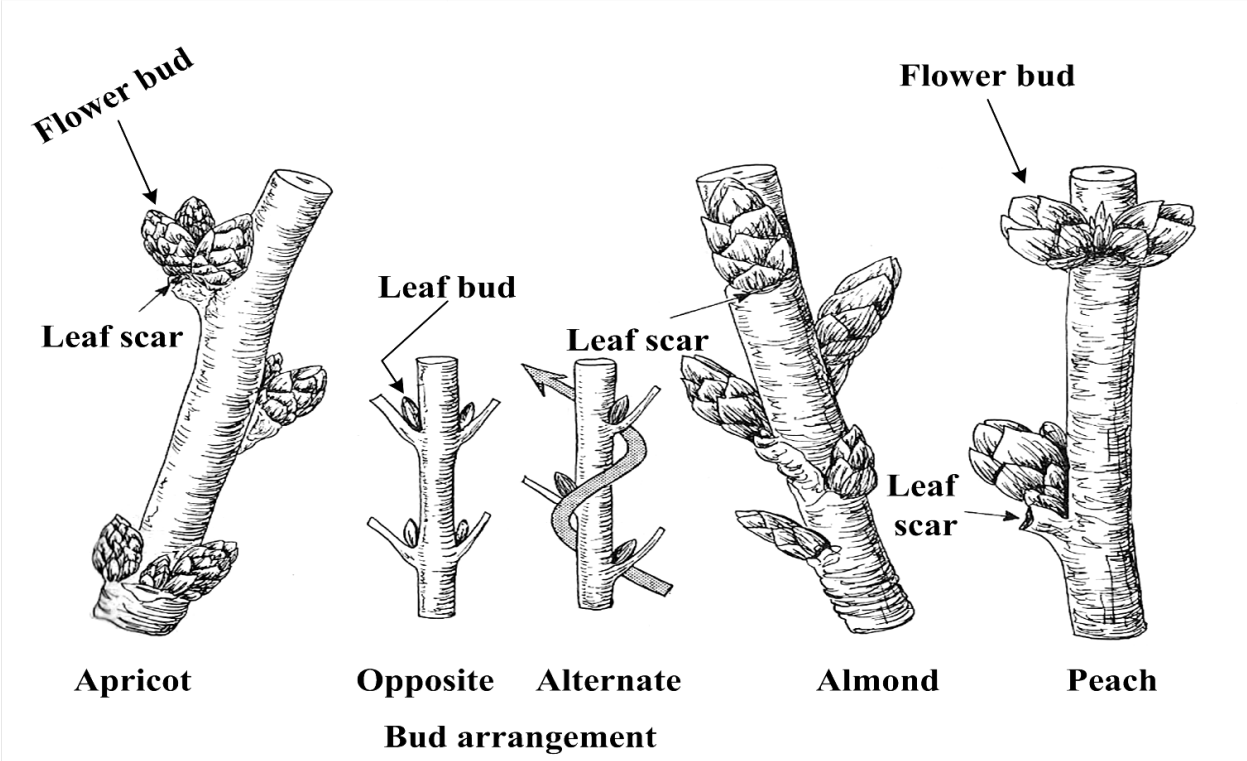

Figure -25- Dormant flower buds and leaf bud of apricot, almond and peach

4- Elimination of the leaves and only leaving the basel part of the petioles.
5- The buds are remaining dormant until the later spring, we can cut the tops of the bud stick and used the middle and bottom buds.

Factors that limiting the budding success

The following factors are limiting the budding success:-

1- The capability to make this operation.
2- The number of seedling prepared for budding.
3- Viability of buds used.
4- The wither conditions during and after budding.
5- Rootstocks size and strength of its growth.
6- Free from disease and insects.

How to differentiate between the fail budding and successful

1- When pressing on the petiole attached of the bud by thumb it is easily separated.
2- Bud color change from green to dark with shrinkage.

10th and 11th Week Lecture

Important notes about budding

1- The stock bark and the bud should be easily separated from the bud stick.
2- It is not advisable to promote the bud growth during the fall season to avoid the danger of the low temperature at winter.
3- Elimination of all the shoots and water sprouts under the budding region.
4- Budding should be done in the north direction to avoid the sun effects.
5- Don'ts use growing buds for budding seedling.
6- Irrigation and fertilization should be done regularly after budding.
7- Protect the growing scion from attacking birds.
8- protect the growing scion from disease and insects.

Meanings of budding words

Advisable	يفضل	Partly	جزئياً/إلى حد ما
Assembling	تجميع	Performed	تجرى/تتكون
Avoid	تجنب	Petiole	عتق/حامل الورقة
Bark	لحاء	Pieces	أجزاء
Beneath	تحت	Pink	يشذب الأغصان
Connecting	الارتباط	Plane	يسوي / مستوياً
Controlling	سيطرة	Plump	منتفخة
Bud stick	قلم الطعوم	Pointed	مدببة
Budding	تطعيم	Preserved	تحفظ
Cambium	طبقة من نسيج خلوي لين يقع بين اللحاء والخشب	Properties	صفات
Colors	ألوان	Purposes	اغراض
Changing	تغيير	Recognized	يتعرف/يدرك/يميز
Cleft	شق	Regularly	بانتظام
Colons	سلالات	Remaining	تبقى
Twinges	الأغصان	Repairing	اصلاح
Unite	اتحاد	Reproductively	إعادة الإنتاج والتكاثر
Vigorous	قوية/قوي	Respond	تستجيب
Wood shaving	نشارة الخشب	Root stock	الاصل
Obtaining	حصول	Root system	المجموع الجذري
Cultivars	الأصناف	Rounded	مدورة
Current	الحالي	Scion	الطعم

10th and 11th Week Lecture

Damaged	ضرر، أذى	Separated	فصل
Desired	متوق أليه/مطلوب	Shrinkage	تجعد
Manner	طريقة، صيغة، نمط	Shriveled	يذبل
Differentiate	تميز	Smooth	أملس / ناعم
Juvenile	الحداثة	Soon	عاجلاً/سريعاً
Extensive	واسع/شامل/انتشاري	Speeding	إسراع
Facilitate	سهلة	Spines	اشواك
Function	مهمة/عمل/وظيفة	Steadily	بثبات
Grafting	تركيب	Incompatibility	عدم التوافق
Insertion	إدخال	Terminal	طرفي
Subsequently	بالتالي، لاحقا	Together	سويا
Intensive	شديد/كتيف/مقو	Turned	تثنى / تنعطف
Maintenance	المحافظة		

(Budding Questions)

Q_1\ Put true or false about the following statements?

1- All plant species respond equally to budding.
2- Juvenile plants respond to budding better than ones.
3- The upper piece (eye or bud) of budding called the stock.
4- The lower part which becomes the root system called the scion.
5- Environmental factors affect the success of budding.
6- Budding should be done in the south direction.
7- For budding should be use growing buds.
8- Elimination all shoots and water sprouts under budding region.
9- It is advisable to prevent the bud growth during the fall season.

Q_2\ Answer the following questions?

1- Three reasons for budding and grafting.
2- Five factors influencing the success of budding and grafting.
3- Three properties of used buds.
4- Three important noted when choosing bud sticks.
5- Three factors limiting the budding period.

12th Week Lecture

Grafting

Grafting means inserting a scion (a short a piece of shoot contain (2 – 3) buds of the desired cultivar) into a rootstock plant. Most of grafting done in winter season this need collect scion wood during the winter when the buds are dormant. Such as cleft grafting and bark grafting and it is necessary to store the scion wood by putting the scion wood in the peat moss and preserved in boxes in the refrigeratores.

The best store of the scion wood at a temperature (0)C° to prevents the buds from growing at least (3 – 5) months.

Why grafting is more expensive and difficult than budding

1- The scion is a cutting containing many buds.
2- Grafting needs longer time, more effort and higher skill than budding.
3- The percentage of success is less than that in budding.

Why grafting is necessary in some special cases

1- When it is difficult to separate the bark from the wood.
2- When changing the old varieties by new ones.
3- For grafting on root at dormancy period of the trees in winter .
4- Sometimes fruit trees require cross pollination by a different cultivar. Grafting a pollinator scion wood to an already established tree is faster than planting new trees.

Grafting waxes

Grafting waxes have the following purposes:-

1- To seals over the graft union and prevent loss of moisture.
2- To prevent entrance of disease and decay the tissue and causing infection by organisms.

Grafting Waxes

Good grafting waxes have these charatresities:-

1- Adhere to plant surfaces and not washed off by rain.
2- Do not get brittle and crack.
3- Do not melt in hot weather.
4- Remain pliable to allow for swelling of the scion and enlargement of the stock.

12th Week Lecture

Meanings of grafting words

		Serve	يؤدي
Adhere	يلتصق/يلتحم	Enlargement	اتساع / تكبير
Closely	باحكام/بدقة	Pliable	مرن/طوي/سمح
Collect	يتجمع	require	يتطلب
Compacted	يتنافس مع	Pollination	تلقيح
Contact	يتصل يلامس	Cambium layer	طبقة الكامبيوم
Crack	يتحطم/يتصدع/ينشق	Possible	ممكن/مستطاع/متيسر
Desired	مرغوب	Changing	متغير
Disbudding	عملية فرك البرعم بالابهام	Sure	ثابت/راسخ/قوي
Dormant	في سبات عميق	Satisfactory	مرضٍ/مقنع
Entrance	دخول	Separate	يفصل/يميز بين
Matched	انتباه	Seals	ختم/سداة
Necessary	ضروري	Straight	مستقيم/قويم
Operation	عمل/عملية/فعالية/قوة	Inserting	ادخال
Swelling	تورم / انتفاخ	Tightly	بشدة/شديد/ضيق

(grafting questions)

Q_1\ Put true or false about the following statements.

1- Most of grafting usually done in winter season.
2- The scion in grafting is a short piece of shoot contain (2 – 3) buds.
3- Budding needed longer time more than grafting.
4- The percentage of success of grafting is more than budding.
5- It is possible to implementation the budding on the roots while grafting can done on roots at the dormancy period.
6- The best store of the scion wood at a temperature (0)C° to prevent the buds from growing at least (3 – 5) months.
7- The temperature degree around the budding zone about (12 – 25)C° to encourage callus formation for (10 – 20) days.
8- The suitable relative humidity around the grafting union should be near (100%).
9- The grafting wax should be adhere to plant surface and not washed off by rain
10- The grafting waxes should be melt.

Q2\ Answer these question.

1- Why grafting is more expensive and difficult than budding.
2- Why grafting is necessary in some special cases.
3- Characteristics of good grafting waxes.
4- Types of waxes.

12th Week Lecture

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13th Week Lecture

Layering

Layering or Layerage is the process used to forming roots on a stem when it is still attached with the mother plant , this method noted in the a nature with some types of plant. Thus the shoot or root still attached with the parent plant partially and stay covered with soil until the rooting take place then separated from the parent plant.

Layering requirement :

Layering process required some attention.

1- Layering is process requires skilled workers.
2- Layering is used for propagation some plant don't rooting easily by cutting or grafting.
3- Layering is not require special environmental conditions as propagation by cuttings.
4- Layering is not needed or require some tools or equipment and worker as the budding and grafting.
5- Layering is ideal method for propagation garden plant to produce a limited number of new plants.

Factors affecting on root formation during the layering period

1- Bending.
2- Girdling the shoot .
3- Wounding or broken the shoot
4- Utilization root promoting substances such as (IBA) indole butyric acid during layering is sometime beneficial. It is added as a solution or lanolin or powder to girding cuts.
5- Soil moisture.
6- Soil aeration.
7- Soil temperatures.
8- Cold wether kills the plants around the apple and quince stock plants, the sunlight in mild climates may damage uncovered stool beds. Figure -26-.

Methods of Layering

Layering can be divided to the following:-

A- Ground Layering.
B- Air Layering.

Type of ground Layering

1- Tip Layering.
2 - Simple Layering.
3 - Compound or serpentine Layering.
4 - Trench Layering.
5 - Mound or stool Layering.

13th Week Lecture

To explain the methods of stimulate rooting during layering see figure -26-

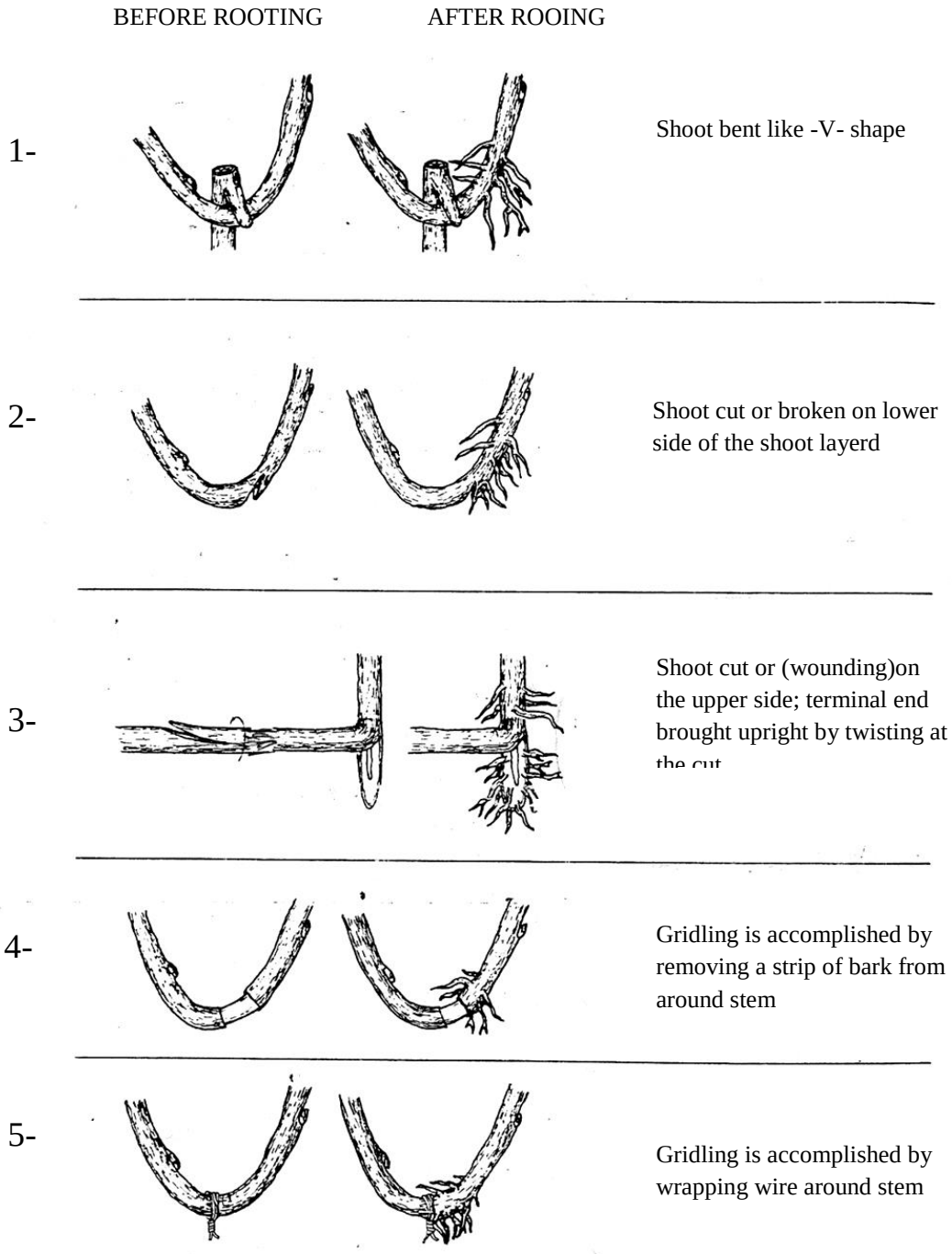


Figure -26- Method of stimulate rooting during layering

13th Week Lecture

1- Tip Layering:-

Tip layering is used for propagation plants which forms many current season's shoots near the ground surface by bending and buried the shoot to the ground at $(10)_{cm}$ depth the cover portion produces roots and shoots are still connected with the mother plant and separated in following spring season as a new plant for example propagated blackerrie and arabain jasmine see figure -27-.

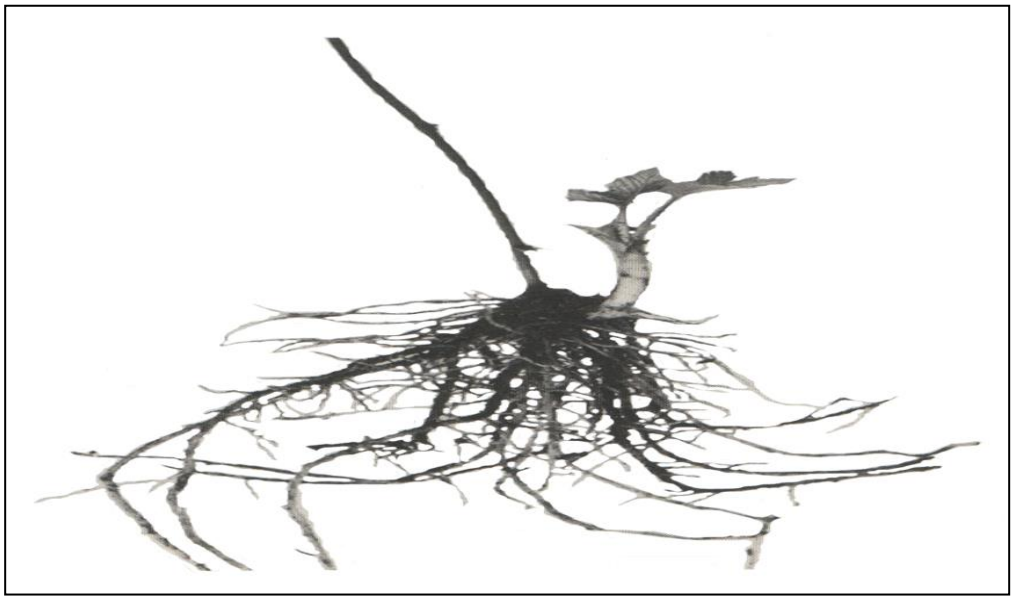


Figure -27- Tip layering of blackberries

2- Simple layering:-

Simple layering is a method of propagation some plant such as shrubs and grapes which have long shoots or canes, and when propagation this type by layering buried the shoot or canes toward down in the soil and covering with soil except leaving the part of shoot uncovered. Sometimes wounding the buried the shoot before covered this way encourage the root formation early. Sometimes used wire and bind with a wooden peg or small stone to hold the layer shoot in place. Spring season is suitable time for layering. Also one-year old shoots are used. This layering has been used commercially to propagate certain shrubs ornamental plants like philodendron, wisteria, clematis, vines and sour lemon, lime ….. etc. see figure -28-, -29-.

13th Week Lecture

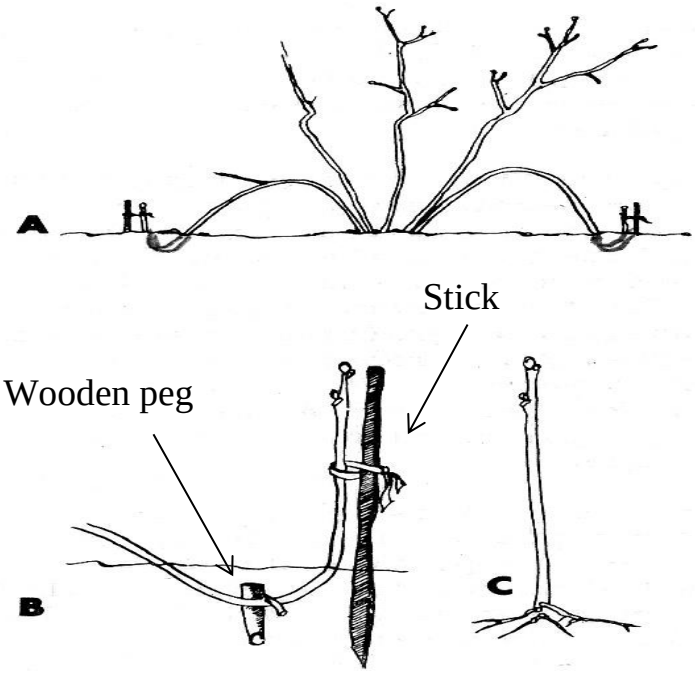


Figure -28- Steps of Simple Layering

A- The shoots are bended and bury in the soil about $(10)_{cm}$ deep except small part of shoot should be appearance over the soil and hold with stacks.

B- It is necessary to fixed the burent shoot with wooden peg and tied with the rope or wire.

C- A new seedling after separation from mother plant as (a new plant).

Figure -29- Fixed the shoot by bended wire

3- Compound or serpentine layering

This layering is essentially the same as simple layering except the shoots alternately a long growth, the shoot before covered injured or girdled of the lower part of the shoot. Roots develop at each of these buried shoot and the exposed part and develop to a new plant, after rooting take place cut it and separated as new plant

and transfer to containers or pots . This method is used for propagation plants which have long shoots or cans such as some ornamental plant , (philodendron) ,khanmaily, Jasmine ,magnolia ,quince and grapes . See figure-30-

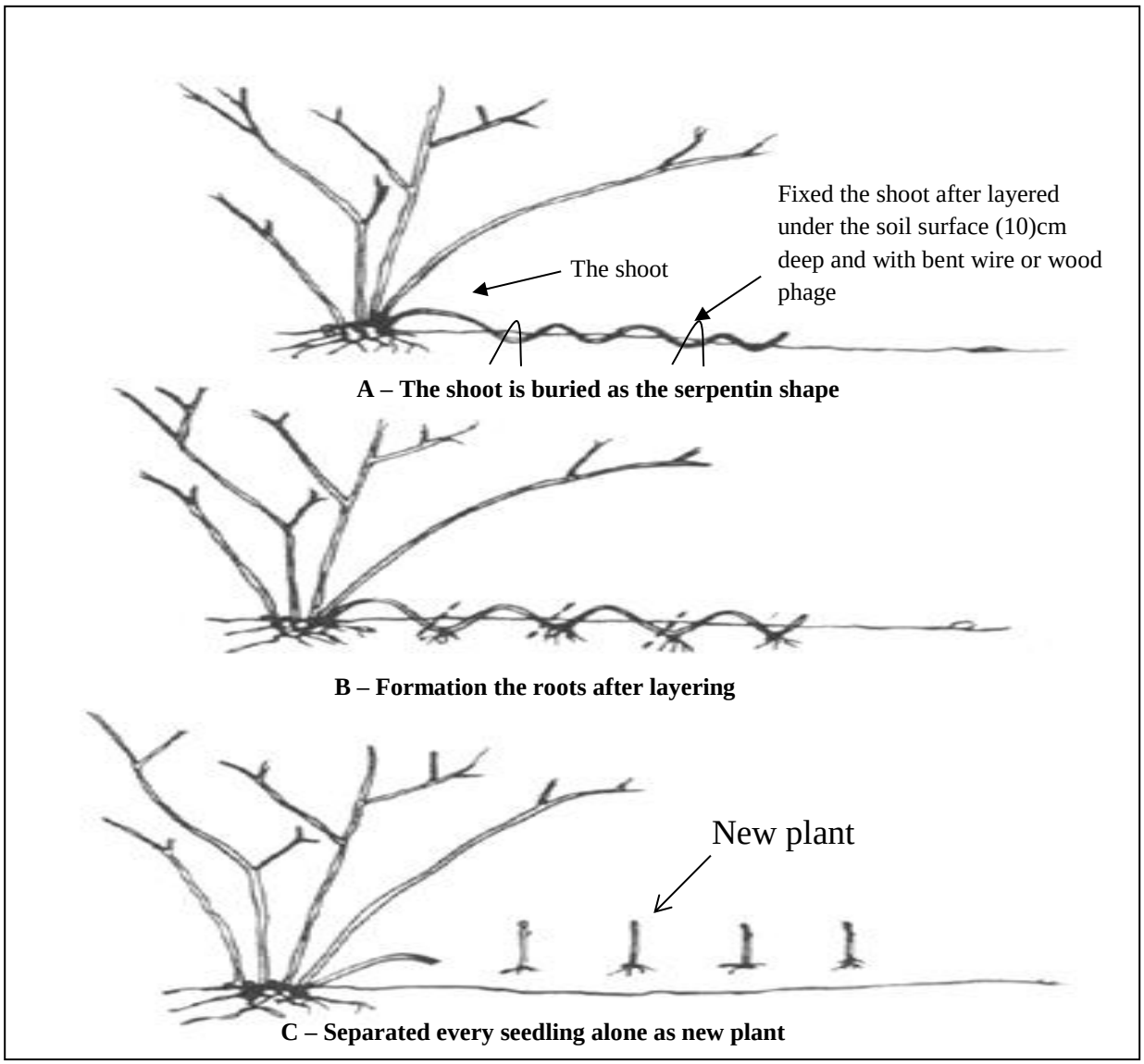


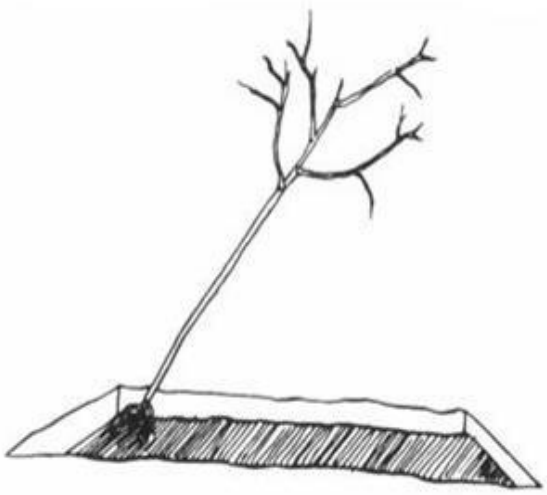
Figure -30- Compound or Serpentine Layering

4- Trench layering or continuous layering

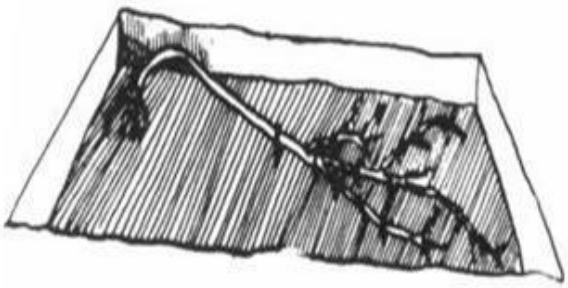
In trench layering the shoot is horizontally buried in the soil of the mother bed. the soil add around the shoot and covered a long its entire length, but the tip of shoot is left exposed about $(5\text{-}10)_{cm}$. When root formation the layering shoot is cut and separated .The rooted growth as a (new plant). Example for some plant propagated by this methods such as Shrubs , trees (grapes , apple , quince). See figure-31-

13th Week Lecture

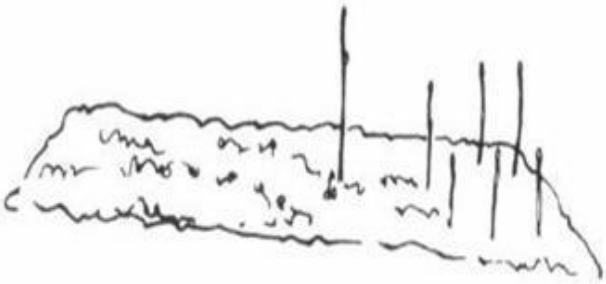
A- Mother plant before l year growth in nursery



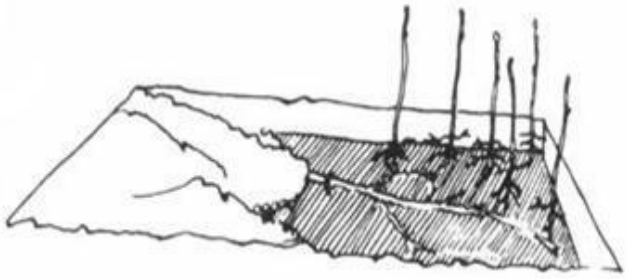
B- Mother plant after establishment the trench teuyering



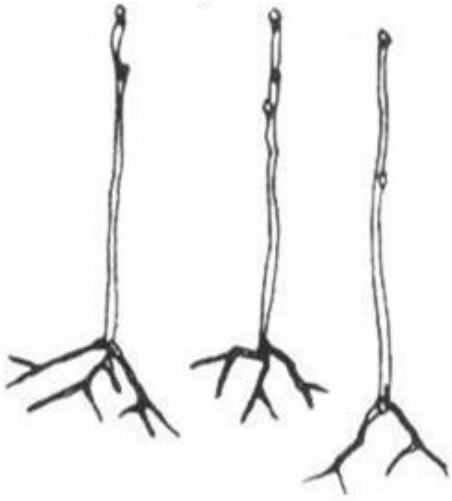
C- The shoot is horizontally buried in the trench and fixed with bent



D- The shoot covered a long its entire shoot length



E- Separated the new plant after rooting



F- Seedling after rooting as new plant

Figure -31- Steps of Trench layering .

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5- Mound or stool layering

This layering is commonly used to propagate apple clonal and plum rootstock by growing the root stock in at the bottom of ridges during the dormant season and mounding soil around the root stock (mother plant) during the one season. In this season encourage root formation, and through the second dormant season the top is removed to $(10\text{-}15)_{cm}$ above the ground (crown zone) and in the next spring a new shoots are formation $(10\text{-}15)_{cm}$ the soil is then added at intervals around the root formation, at the end of season the mound layering have root formed at the base of covered shoots. Then removed the soil and cut off the rooted shoots in late winter or early spring, and using as anew seedling as a rootstock . See figure-32-

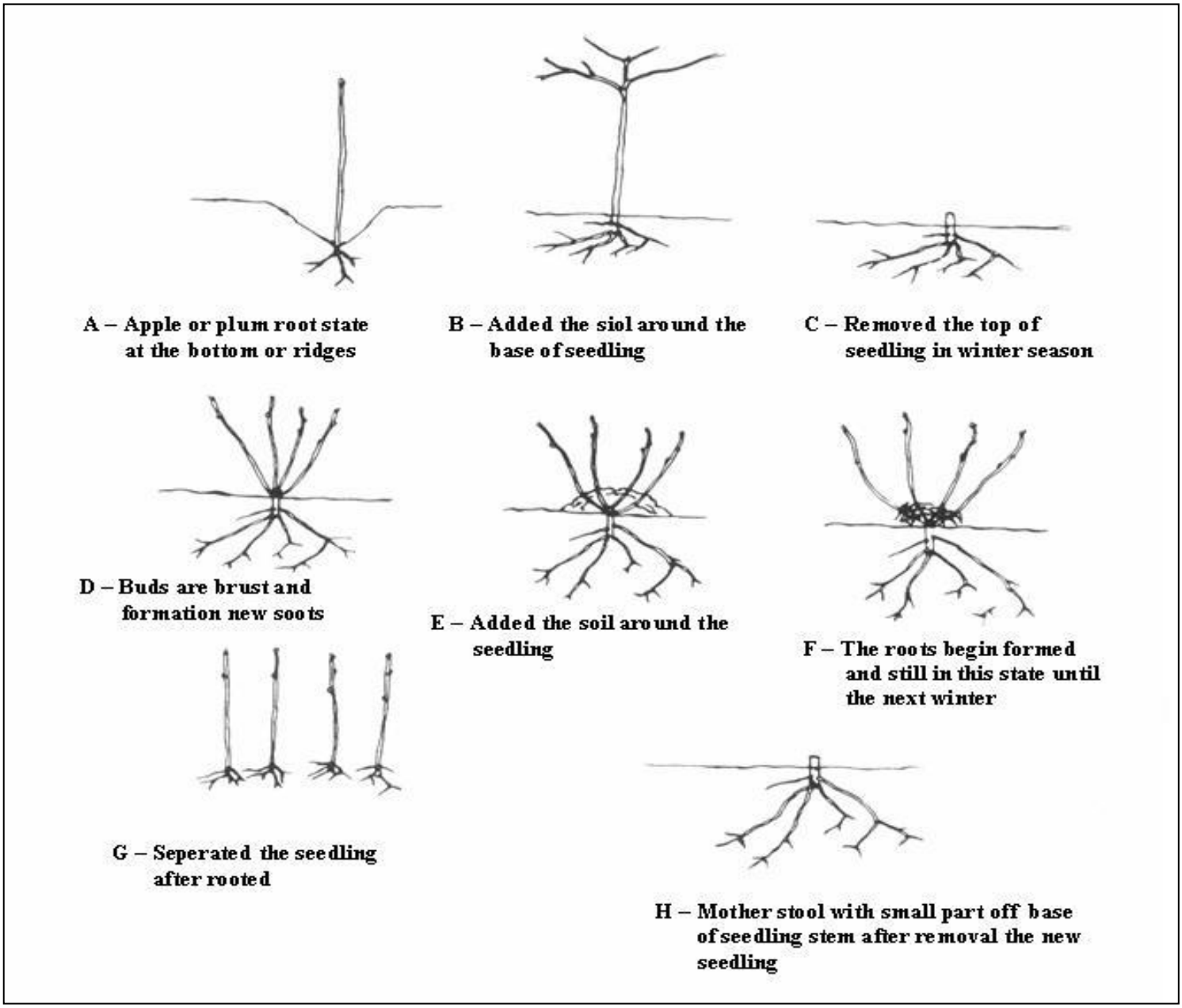

Figure -32- Steps of Mound or stool layering.

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6- Air layering (Chine, Pot Layering or Marcottage)

Air layering-sometimes called chins layering or pot layering, this metho- ds used to propagate plants that are difficult to start as cutting. The modern procedure of air layering is make girdle on the layering shoot and put it in ball or pot with some moisture-holding material such as sphagnum moss, peatmoss ...etc. Around this girdle part of the shoot to stimulate root formation and sometimes used a root-promoting powder or lanolin past and tied the ball tightly. The roots initiate begin at this point and grow into the peatmoss. Air layering is used to propagate a number of tropical and sub-tropical trees and shrubs, including the litchi and lime (*citrus aurantifolia*), rubber plant, croton, dieffenbachia woody ornamental such as azalea, camellia, magnolia, fig, persimmon, crab apple and plum. See figure-33-

Notes:-

1. Some plant formed roots during the first year, others do not develop a good root system until the end of the second year.
2. It is not necessary to add water when using polyethylene bag or Aluminum foil because it prevents water loss or you cars added the water by the Niddle.
3. After root system has developed, cut off the branch just below the ball of layering.
4. After cut the layering branch should be removed some of leaves and put it the new plant under cool, humid conditions until becomes in good state.

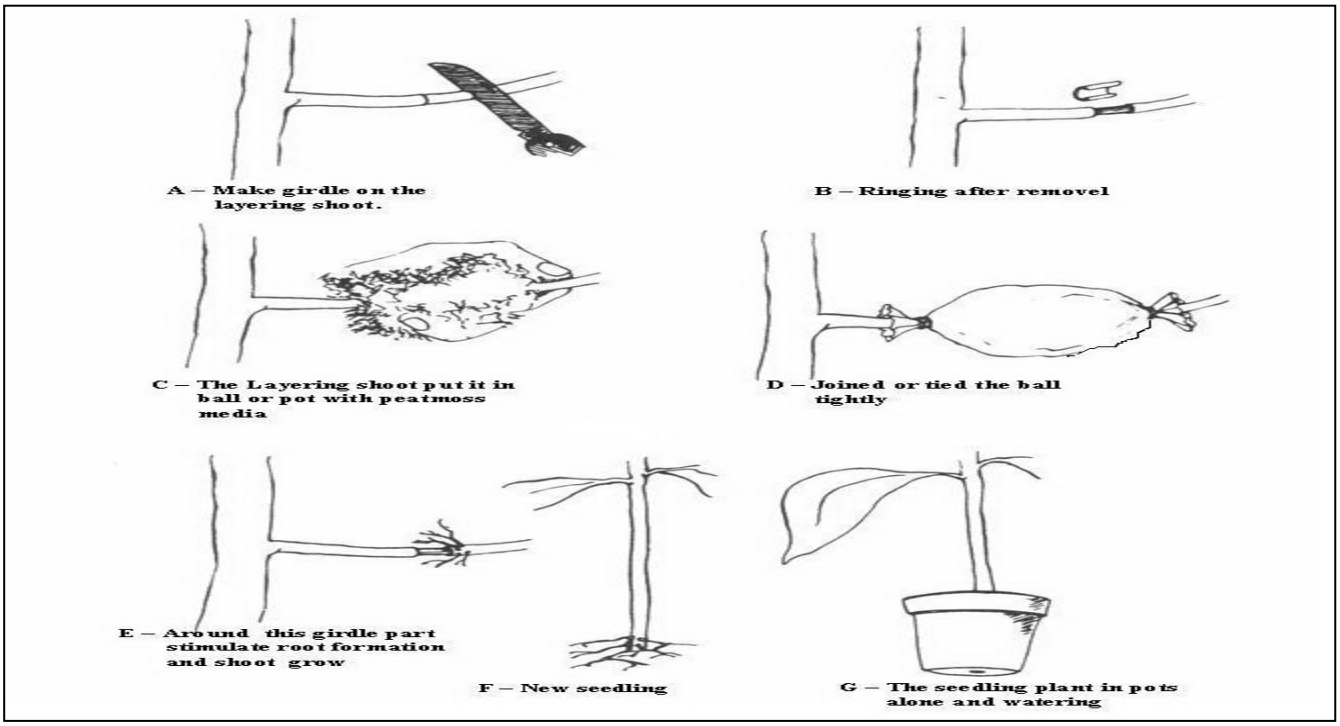

Figure -33- Step of Air layering.

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Natural form of Layering

Sometimes layering occurs naturally without the assistance of a propagator. Runner and offsets are specialized plant structures that propagation by layering, runner produce new shoots when it touch the growing medium, plants that produce or runners are propagated by separated the new plants from their parent plant. for example strawberry and spider plant.

Meaning of layering words

Injured	يجرح	Partial	جزئي
Horizontally	أفقياً	Separate	يفصل
Formation	تكوين	Serpentine	ثعبان
Except	ما عدا	Serve	يؤدي/يلائم/يفيد/يؤيد
Encourage	تحفيز/تشجيع	Stool	تل/بارز
Economically	اقتصادياً/باقتصاد	Stimulate	يحفز
Detached	متصل	Severing	صارم / متهجم / قاس
Crown zone	منطقة التاج	Renewal	يجدد/يكرر/بعيد
Compact	يدمج/يركب/محكم	Ready	جاهز
Canes	قصبات	Trailing	نبات ينتشر فوق سطح الأرض
Bury	يدفن/يطمر	Portion	جزء
Buried	يثنى/يحنى	Peg	وتد/اسفين
Bent wire	سلك منحني	Litch	ثمرة شجرة صينية ذات لب هلالي حلو
Beneficial	مفيد/نافع/مستفيد	Layer plant	ترقيد النباتات
Bend	يلوي/يثني/يحني	Layer	غصن يدفن تحت سطح التربة ليصبه له جذر مع بقائه متصلاً بالنبات الأم
Attention	اهتمام/عناية/انتباه	Lanolin past	عجينة اللالنولين
Assistance	المساعدة / عون / معاونة	Trench	خندق
Alternately	بالتناوب/بالتعاقب		

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Layering questions

Q_1 List the following?

1- Factors affecting on root formation.
2- Methods of stimulation of the root formation.
3- Methods of layering.
4- Method of ground layering.

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14th Week Lecture

Methods of vegetative proagation

Many of plant can propagated by other methods such as:-

1- Suckers: It is plants or seedling grow from dormant buds near soil surface at transmission zone (Crown) or from the roots. It can be separated at winter and used as rootstocks for example sucker of Apple, Pomegranates, Grapes, Olives, …..etc.

2- Runners: it is stems appear from the leaf axil which grow on soil surface. and formed new plants from the nodes. for example strawberry, spider plant see figure -35-

3- Rhizomes: It is a stems grow under the soil surface and formed a new plants. Rhizomes can divided and formed new plants .e.g. Reed plant, Iris Jerminica Arhizomes is a horizontal stem that often grows underground , usually sending out roots and shoots from its nodes . Rhizomes have short internods . which send out roots from the bottom of the nodes and shoots from the top of the nodes. Example Irises , Lily , Eannas and Dried ginger.

4- Bulbs: It is stems grow under the soil surface. the base of the bulb these produce a new bulbles which are used for propagation The bulb is a storage organs parts (Storage Leaves) are produced from the top of the basal plater help it during adverce condikion such as summer drought , heat and winter cold.

Flower season of ornamental bulbs

The flowering season are:

1- Spring fowering bulbs Spring is the most typical season for bulbs to flower for example. Freesias Cyclamen , Iris , Nurcissus and Crocus ...etc.

2- Summer flowing bulbs. For example Dahlia Gladiouls , Lilium , Oxaliso Begonia, Anemon, and Amaryllis

3- Autumm (Fall) flowering buds. For example. Crocus and Cyclamen.

4- Winter flowering bulbs Some species from the following genera , For example Galanthus Crocus and Cyclamen

And finally the bulbs can propagation by seeds or by vegetative propagation.

Many bulls increase naturally by production of bulblets (small bulbs). The new bulblet develop alongside near by. Usually separating these bulblet and planting them in favorable Location. Bulblets should not be removed untill they Completed at least one full growing season. and planted more shallowly and closer together than mature bulbs in sandy , Light soil. e.g. Onions, Tulip.

5- Corms: A corm is a short modified stem appear underground the soil surface , which produce a new corms from the base of mother corm . this can used for propagation. Corms are internally structure with soild tissues which distinguishes them from bulb. For example . Gladules , freesia and Anemon.

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6- Offsets: They are new plantlets appear from the leaf axil at the soil surface.

For example Date palm and Bannana.

7- Tubers: Tubers are either a root tuber is swollen lateral or advections root or a stem tuber swollen tips of underground stems . The top of tuber produce shoot which grown and formed stems and Leaves and the undersides part of tubers are produce roots.

Types of tubers:-

There are two types of tubers:

a- Tuberous roots: It is swollen roots under soil surface for example. Sweet potato, Dalia and Begonia.

b- Tuberous stems: It is swollen stems under soil surface.
for example. Potato Jerusalem and Artichoke.

8- Stock division: This method is used when the plant produces of rooted stems. In the late growing season and at beginning of the dormant stage we can divide the plant for several new plant according to the number of rooted stems. During this process the old part of the plant should be removed. See figure - 35-

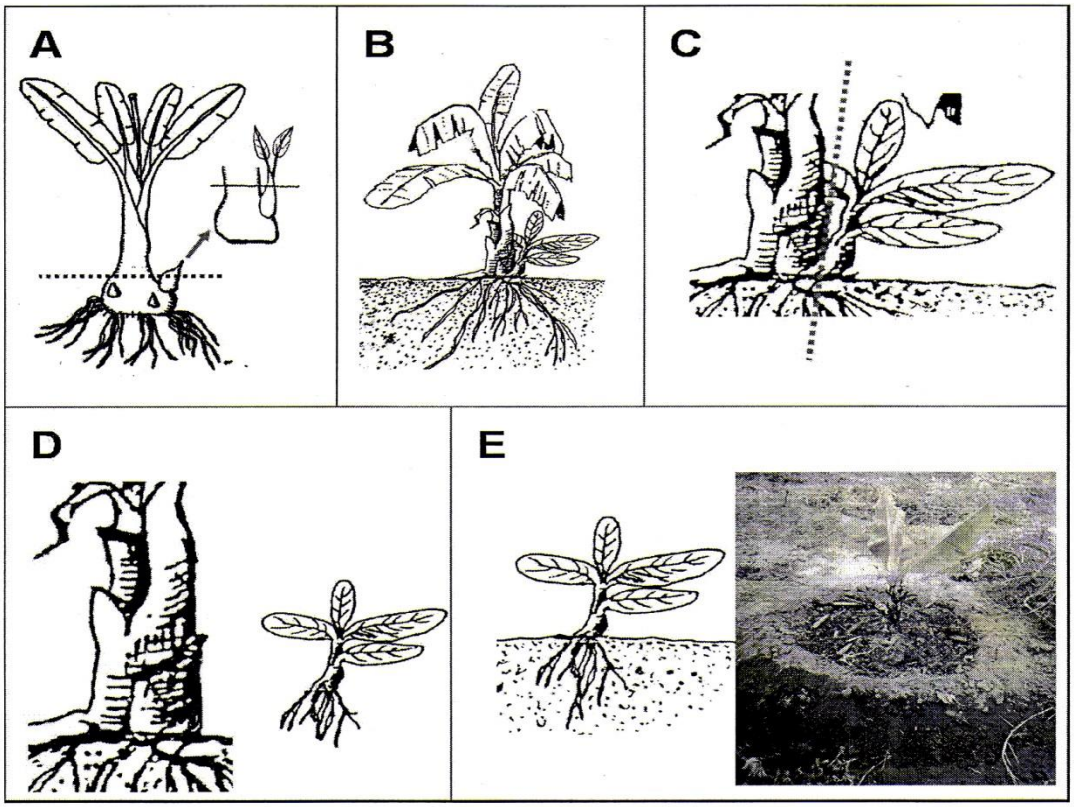

Figure -34- Propagation by sucker

14th Week Lecture

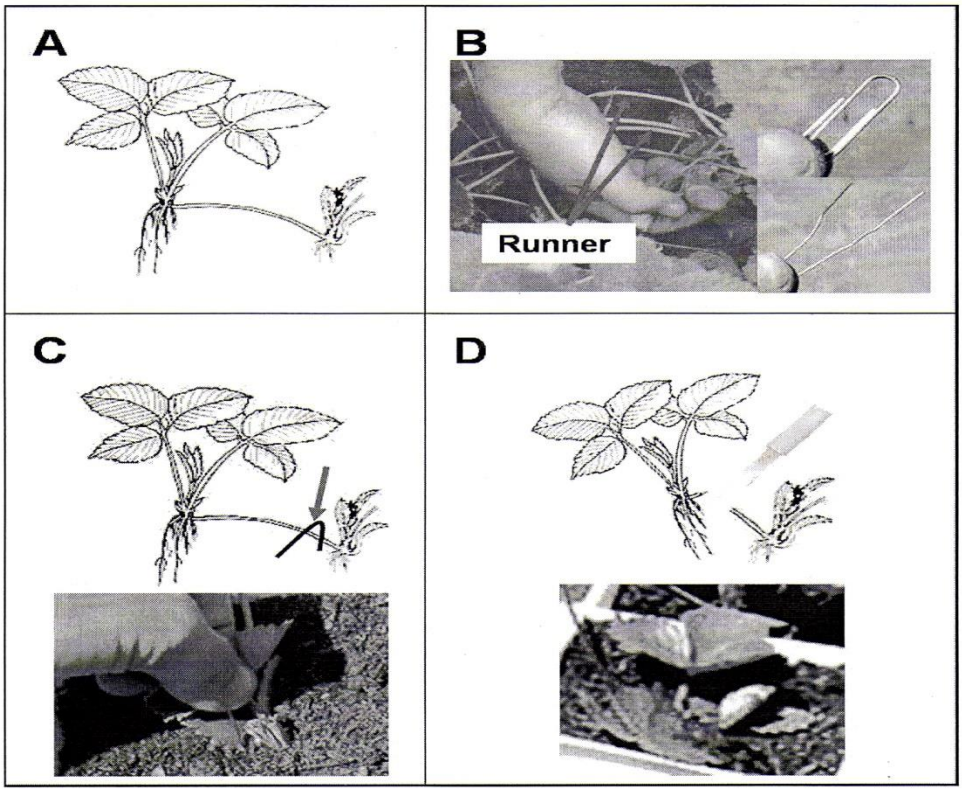

Figure -35- Propagation by runner

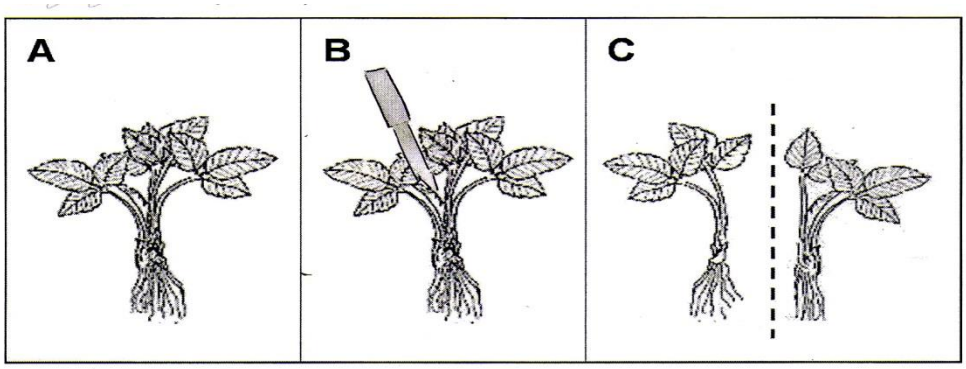

Figure -36- propagation by division

The word meaning of method of vegetative propagation

Appear	تظهر	Runner	امدادات
Basically	في الاساس	Sending	ارسال
Base	قاعدة	Several	العديد من
Beginning	بداية	Spider	عنكبوت
Dormant	ساكن / في سبات عميق	Strawbery	شليك / فرولة
Drought	جفاف	Structured	تركيب / بناء
Flowering	إزهار	Suckers	سرطانات

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Formed	تكون	Surface	سطح
Modified	معدلة / محورة	Swellen	تورم / انتفاخ
Ornamental plant	نباتات الزينة	Transmission	أنتقال
Pomegranets	الرمان	Underside	السفلي
Rhizomes	رايزومات	Vegetative	خضري
Removed	إزالة	Underground	تحت الارض

Vegetative Propagation method questions

Q_1: Put true or false about the following statements

1- Strawberry propagation by rhizomes .
2- Bulbs it is a roots grow under the soil surface.
3- Date palm propagation by suckers.
4- Gladules propagation by bulbs.
5- Potato propagation by tuberous roots.
6- Banana propagation by runners.
7- Apple propagation by offsets.
8- Reed plant propagation by suckers.
9- Spider plant propagation by rhizomes.
10- Canna propagation by rhizomes.

Q_2: List the following :

1- Method of vegetative propagation.
2- Seasons of flower ornamental bulbs.
3- Types of tubers.

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Propagation via plant tissue culture

Micropropagation or plant tissue culture: - The production of plants from very small plants parts, tissues or cells grown under aseptic and controlled conditions: -

Useful applications of plant tissue culture

1- Mass propagation To production of millions of plants within limited period of time.
2- Plant Breeding Improving plants through invitro techniques via the production of haploids and somatic fusion and hybridization.
3- Production of virus free plant via apical merits cells.
4- Production of plant which are resistant to environmental stress e.g. salt tolerance, disease resistance. etc.
5- Certain techniques such as meristem aglio tip culture can be used to produce clean plant material from stock
6- Micro propagation using meristem and shoot Culture to produce Large numbers of indentical individuals
7- For production of doubled monoploid (dihaploid) plants from Chaploid) Culture to achieve homozygous Lines more rapidly in. breeding programes of messer

Main contents of plant tissue culture laboratory

1- Preparation Room:- A room where media are prepared and sterilized.
2- Transfer Room:- A room where plant parts are inoculated (transferred) on the propagate- on media.
3- Culture or growth Room:- A room where cultured plant material left under right environ- meant for callus and plantlet regeneration.

Components of culture medium

1- Sucrose. 2- Vitamins. 3- Amino acids.
4- Inorganic salts. 4- Inorganic salts. 5- plant growth regulators.
6- Water. 7- Agar if a solid medium is required.

Basic Laboratory equipment

The following items are commonly found in laboratry

for in vitro propagation of plant materials.

1- Hot plate or small stove
2- Laminar air flow cabinet (Hood).
3- Glass or stainles steel containers for heating and dissolving media
4- Pressuré steam stove (Autoclave or Pressur cooker).
5- PH meter
6- Centigram blance
7- Culture tubes, boottels and other glassware with suitable closures.
8- Graduated measuring cylinders.

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9- Dispensing devices

10- Small transfer instruments (eg, spatulas 6 Scapelso and forceps.

11- Refrigerator.

12- Double distilled water unit.

13- Disinfectants.

14- Chemicals for culture media or commercially prepared culture media.

15- Steromicroscope.

Preparation culture medium

The following steps are followed:-

1- Dissolve sucrose to a double distilled water.
2- Dissolve the already prepared inorganic salts and hormones.
3- Adjust the pH to (5.7) using in HCL.
4- Add Agar to solidify the medium.
5- Autoclave (heat) at (121)C for (5) min.
6- Dispense to vials or jars and leave to cool.

Note:- Aseptic conditions are required to avoid any possible contamination.

Successful micro propagation must be using

1- Aseptic conditions.
2- Well trained and skilled people do the job.
3- Using the right combinations of plant growth regulators substances (PGRS).
4- Preparation of the right concentrations of any compound.
5- Any possible contamination must be avoided.

Stages followed in micro propagation

Stage -1- Establishment of sterile explants.

Stage -2- Multiplication

The function of the multiplication stage is to increase The number of prop gules .

Stage -3- Pre transplant.

The function of the pre transplant stage is to prepare The plantlet for transplanting and establishment outside The artificial environment I. e encourage shoot elongation and root formation.

Stage -4- Transplant

The transfer of plantlets to the environment I. e Acclimation the seedling.

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Nursery calendar

Nurseries require working force year round, therefore a time table or schedule for each month should be planned.

January:-
1- Preparation of nursery soil.
2- Taking cutting from deciduous trees.
3- Sowing of stone fruit seeds or (stratification).

February:- 1, 2, 3 as in January.
4- Marketing of deciduous plants.
5- Budding of some deciduous seedling.
6- Insertion of deciduous cuttings.
7- Sowing of citrus seeds.
8- Grafting of some deciduous trees and shrubs.

March:- The important working are:-
1- Irrigation is required.
2- Marketing of evergreen plants.

April:- The important working are:-
1- Marketing of indoor and outdoor shrubs.
2- Marketing of ornamentals plants.
3- Spring budding.
4- Asexual propagation.
5- Asexual propagation.

May:- As in April.

June:- Because of high temperature the important working are:-
1- Irrigation regularly is important.
2- Weeding is very important.

July:- As in June

August:- The important working are:-
1- Autumn or fall budding for deciduous trees shrubs.

September:- The important working are :-
1- Asexual propagation of some evergreens.

November:- The important working are:-
1- Maintenance of nursery structures such as:
A- Broking glass.
B- Installation of plastic tunnels.

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December:- The important working are:-

1- Preparation of nursery soil.

2- Stratification of deciduous seeds.