WHAT IS PROPAGATION?

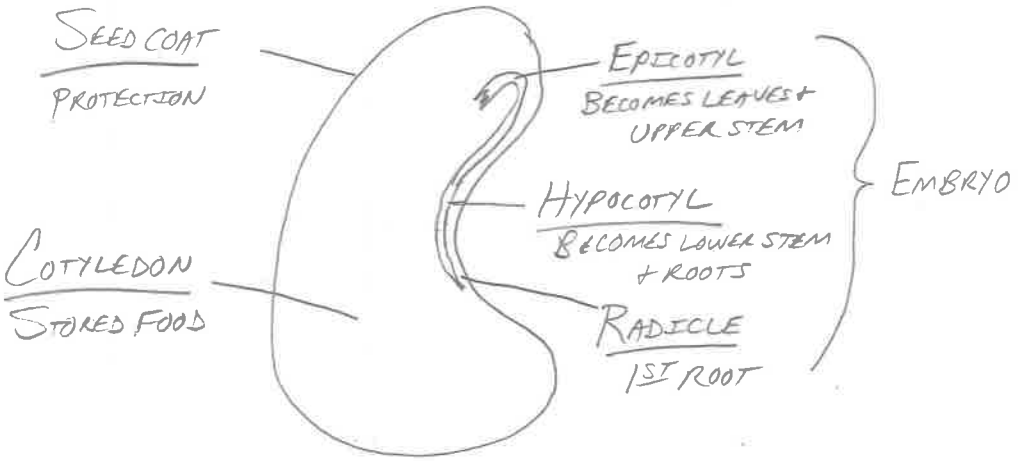
Reproduction is the production of __OFFSPRING__. When humans __CONTROL__ plant reproduction it is called __PROPAGATION__. In nature, plants reproduce both __SEXUALLY__ (using flowers & cones), and __ASEXUALLY__ using vegetative parts of the plant. **Vegetative propagation** is asexual reproduction, growing __NEW__ plants from __ROOTS__, __STEMS__, and __LEAVES__.

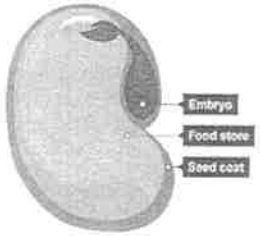
TYPE OF REPRODUCTION	ASEXUAL	SEXUAL
DESCRIPTION	The offspring is a __CLONE__ of its __ONE__ parent  Ex. RUNNERS These clones come from __STEMS__ that run along the ground, forming __NEW__ plants	The offspring is a __COMBINATION__ Of genes from its __TWO__ parents Ex. FLOWERS – When pollinated produce __SEEDS__ 
GENETICS	Offspring have the __SAME__ DNA as their one parent so they are genetically __IDENTICAL__. Plant propagators can produce __LARGE__ quantities of desirable plants __QUICKLY__	Offspring are a __UNIQUE__ new combination of genes. Produces genetic __VARIABILITY__, but the offspring can be missing desired __TRAITS__

SEED STRUCTURE

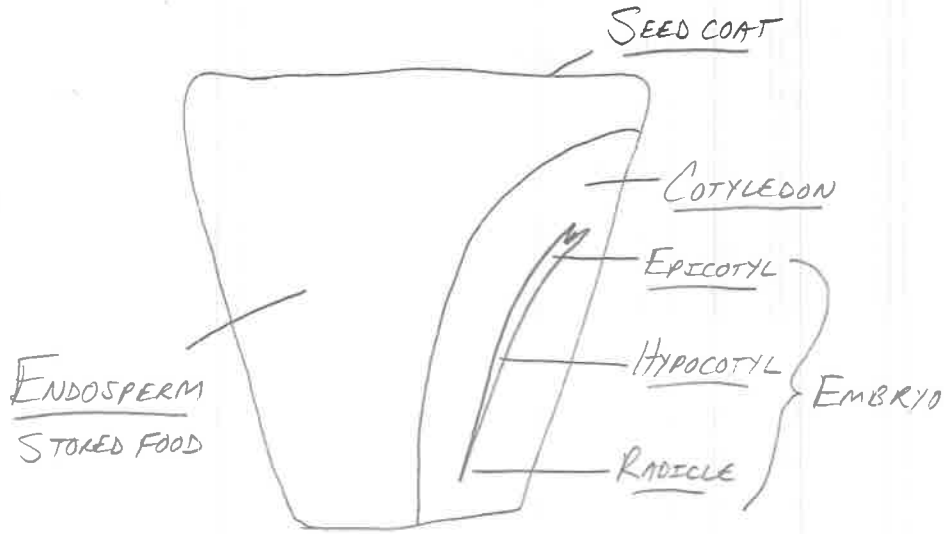
Seeds are the product of SEXUAL reproduction in ANGIOSPERMS (flowering plants) and GYMNOSPERMS (cone-bearing plants).

Seed cross-section (Dicot) Ex. BEAN



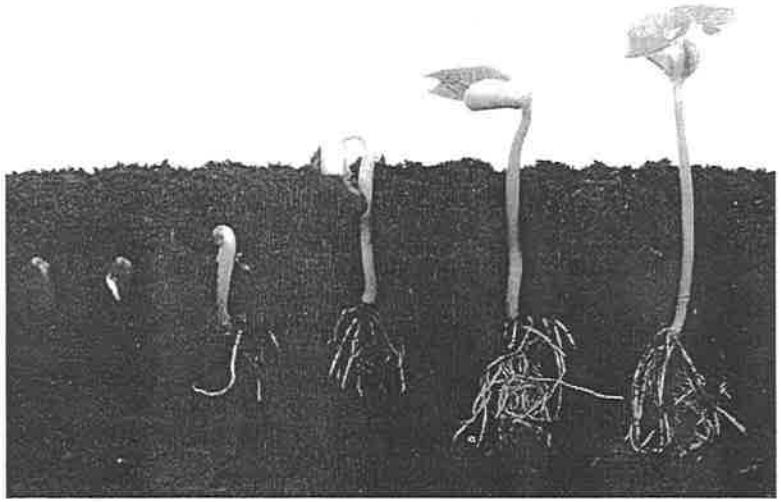


Seed cross-section (Monocot) Ex. CORN



"A seed is like a BABY plant, in a BOX, with it's LUNCH." (Dr. James Haynes 1993)

SEED DORMANCY



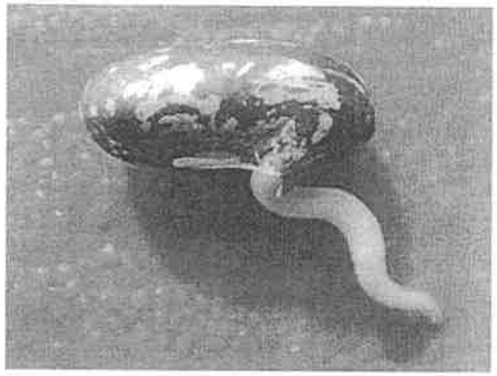
After formation, most seeds will NOT begin to GROW until they experience a time of DORMANCY (the seed is ALIVE but not actively growing). Seeds remain dormant during an "AFTER RIPENING" period. During this period the cold winter conditions PREPARE the seed for germination by inducing hormonal & enzymatic CHANGES within the seed. Also, the FREEZING and THAWING serve to damage the tough seed coat, allowing WATER into the embryo. In nature this would occur NATURALLY as seeds pass through the DIGESTIVE tracts of animals, and microbes in the SOIL help break down seed coats.

Plant propagators can SIMULATE after ripening by PRECONDITIONING the seeds.

STRATIFICATION - EXPOSING dormant seeds to COLD temperature to mimic winter

SCARIFICATION – Mechanically breaking down the seed COAT using:

A. ABRASION by rubbing with sand paper or TUMBLING in drums with SAND or gravel
B. SOAKING in hot water to SOFTEN the seed coat
C. SULFURIC ACID to DISSOLVE the seed coat



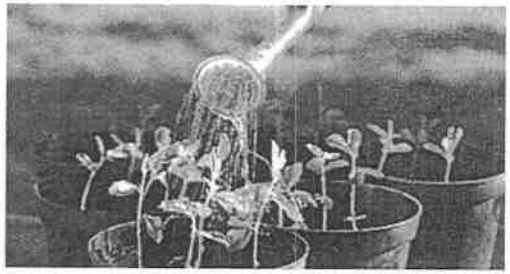
SEED GERMINATION

Seed germination is when the EMBRYO begins to grow and EMERGES from its seed coat.

Most seeds have 3 germination requirements:

1. WATER
2. OXYGEN (for cellular RESPIRATION)
3. Correct TEMPERATURE

PLANTING THE SEEDS:



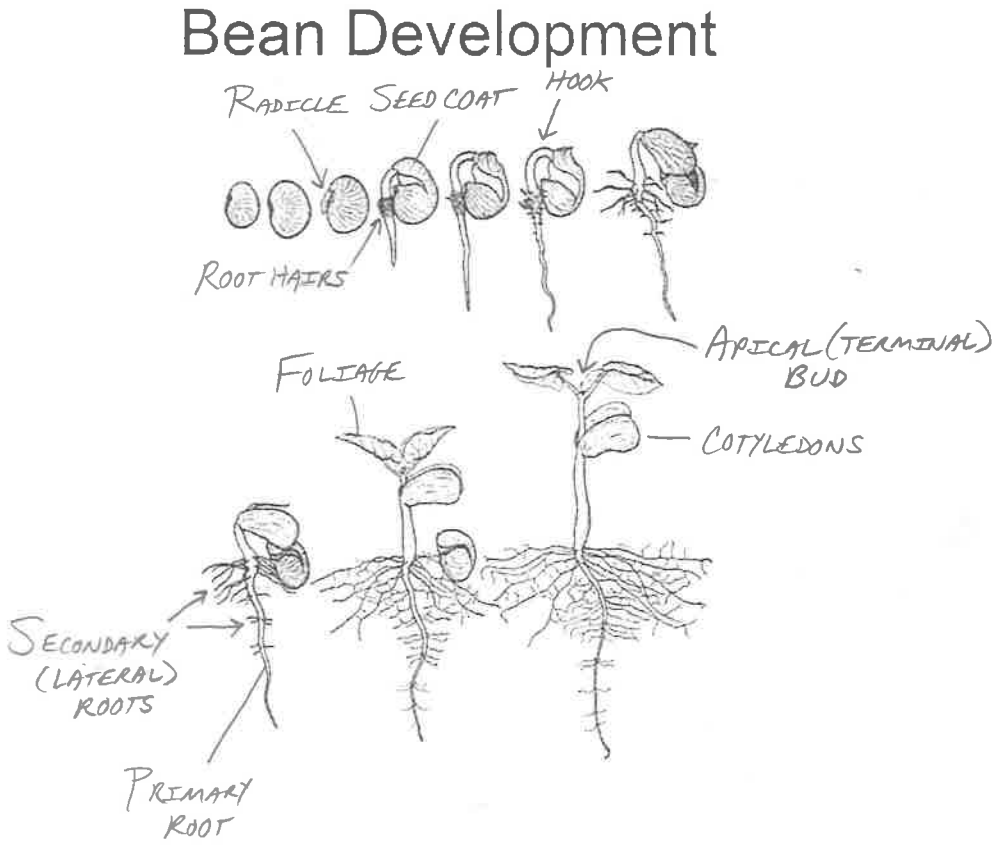
The factors of successful propagation are:

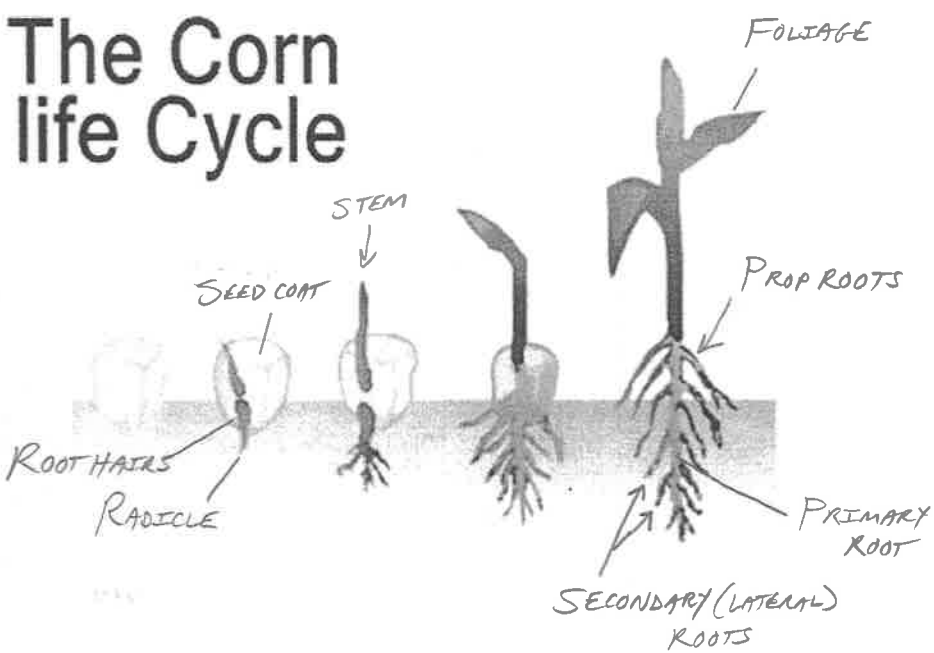
- ✓ Good quality SEED
- ✓ Correct MEDIA (soil components)
- ✓ Correct planting TECHNIQUE
- ✓ Appropriate LIGHTING, WATERING, TEMPERATURE, NUTRIENTS, & DRAINAGE

(FYI – Some plants, such as mango, dandelions, and grasses can produce seeds ASEXUALLY by APOMIXIS. The plants produced from these seeds are actually CLONES of the parent plant.)

EARLY GROWTH OF THE PLANT

After germination, the __FIRST__ structure to emerge from the seed is the embryonic root or __RADICLE__.
The radicle __ANCHORS__ the seed in the soil and allows the embryonic plant to __ABSORB__ water.

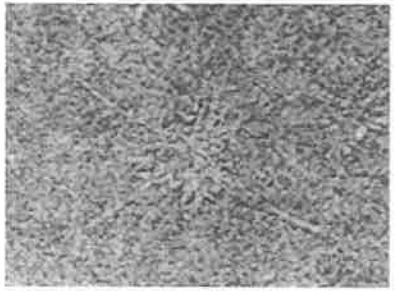




ASEXUAL PROPAGATION TECHNIQUES

(1) **RUNNERS & STOLONS** - __STEMS__ that grow along the __GROUND__ or from __AERIAL__ stem tissue, and form __NEW__ cloned plants at their nodes.

Strawberry



Crabgrass

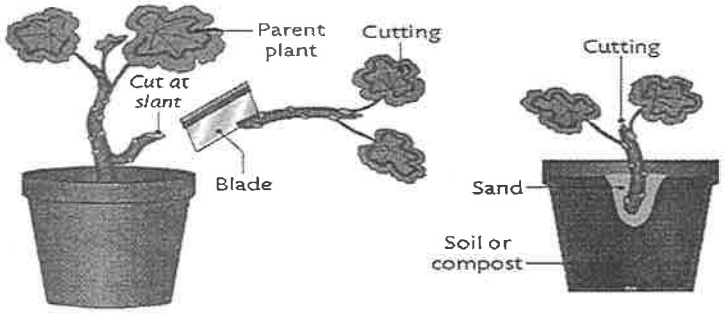
Spider plant

Black locust sucker removed

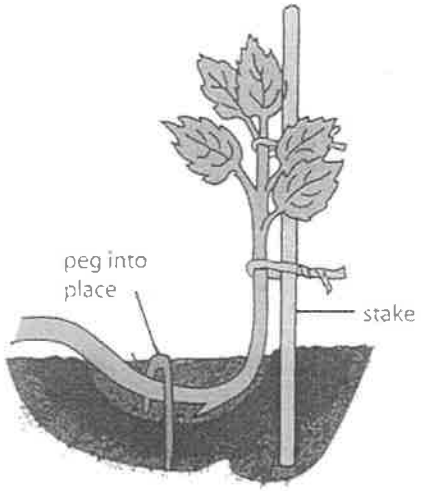
(2) **SUCKERS** – New __SHOOTS__ that grow from adventitious __BUDS__ on the roots or the base of the __STEM__ or trunk. The suckers can be __CUT__ from the parent and __TRANSPLANTED__.

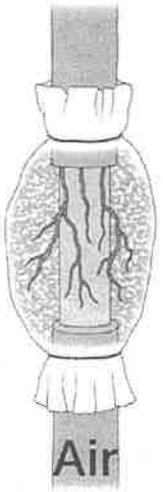
Rose sucker

(3) CUTTINGS - __SEGMENTS__ of leaves, stems, or roots are __CUT__ off the parent plant and __NEW__ roots and shoots develop. Propagation by stem cuttings is the __MOST__ common means of reproducing plants __ASEXUALLY__.

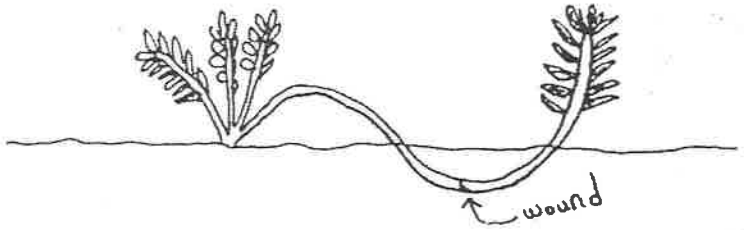


(4) LAYERING – Roots develop on a __STEM__ that is still __ATTACHED__ to the parent plant. The stem is __WOUNDED__, rooting __HORMONE__ is applied, and the stem is __BURIED__ or wrapped in a cool, moist medium that promotes root formation. The __SECTION__ of stem with roots can then be __REMOVED__ from the parent plant and transplanted.

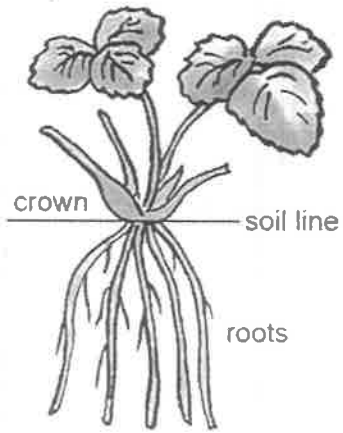


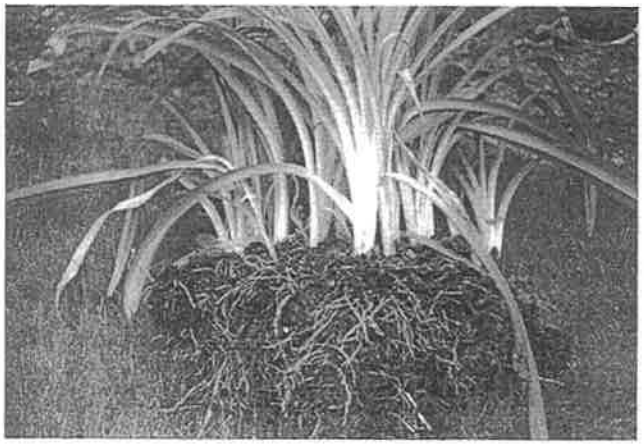


Layering

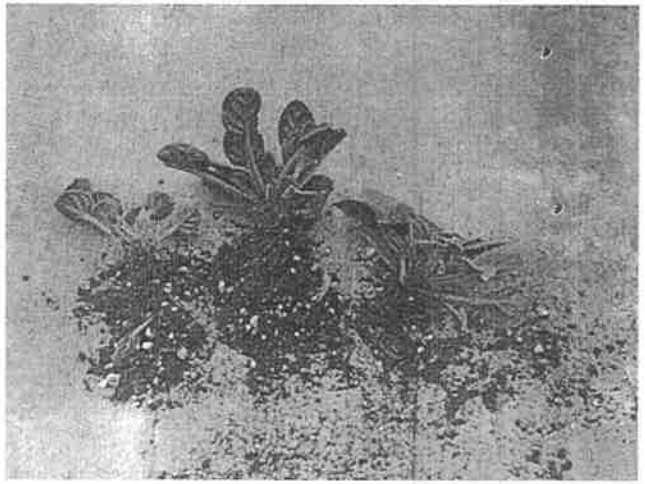


(5) **CROWN DIVISION** – The _CROWN_ of herbaceous perennials is the _JUNCTION_ of the roots and the shoots. Plants can be dug up and _DIVIDED_ into sections, that can be replanted individually.





Clump of daylilies that can be divided into smaller sections and replanted

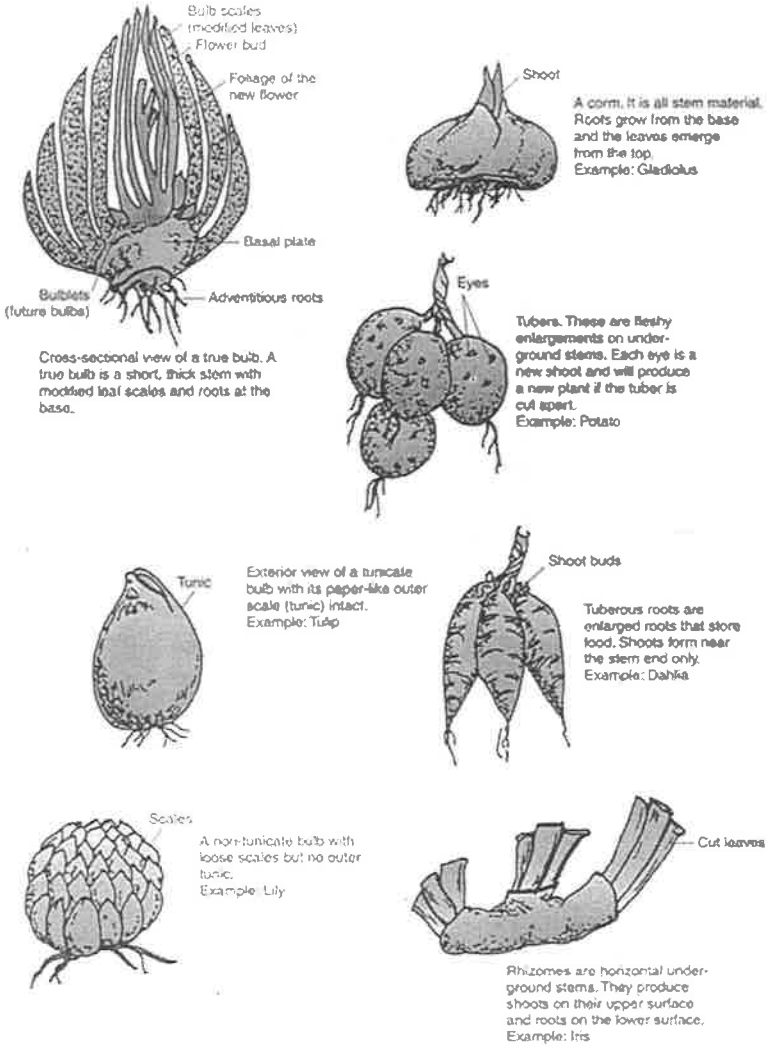


African violet sections

(6) GEOPHYTES (GEO = EARTH PHYTE = PLANT)

These are PERENNIAL plants with UNDERGROUND storage organs to store FOOD, NUTRIENTS, & WATER. At the end of the growing SEASON the stems DIEBACK and the plant SURVIVES in the ground as a dormant organ. In the spring, buds produce new SHOOTS. Propagation of geophytes can be done by SEPARATION of natural clones or by CUTTING the plant into sections.

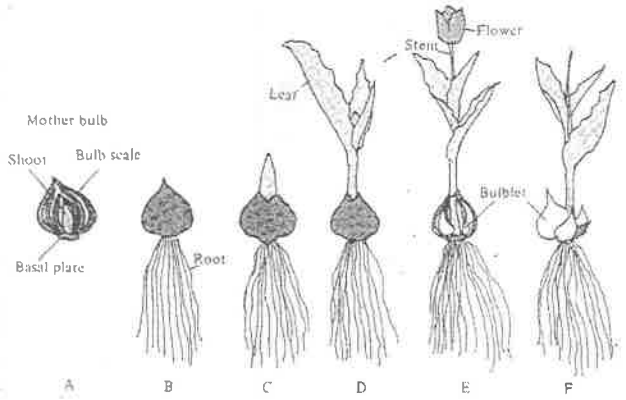
Tulip bulbs sending up new shoots



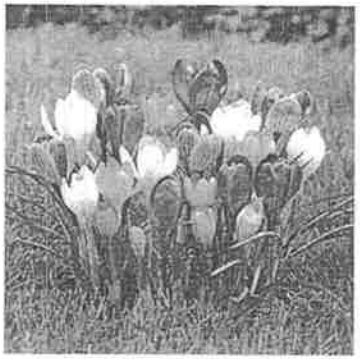
EXAMPLES OF GEOPHYTES

BULBS

Bulbs can branch underground producing __BULBLETS__ that are clones. Bublets take their energy from the parent bulb, but eventually produce their own stems and can be __SEPARATED__ from the parent.



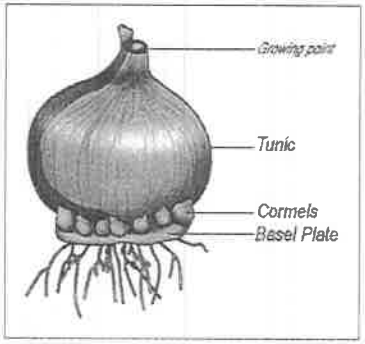
DAFFODIL



CROCUS

CORMS

Corms are similar to bulbs but are __SOLID__ inside (no scales). Ex. Gladiolus, crocus



GLADIOLUS

HARDY BULBS – Can be planted in the __FALL__ and bloom in the __SPRING__. Hardy bulbs are left in the __GROUND__ year-round. Ex. Tulips, __DAFFODILS__, & hyacinth

TENDER BULBS – Are planted in the __SPRING__ and bloom in the __SUMMER__. Tender bulbs must be __DUG__ up and stored indoors __BEFORE__ the ground freezes. Ex. Calla lilies, ranunculus

CALLA LILLY

RANUNCULUS

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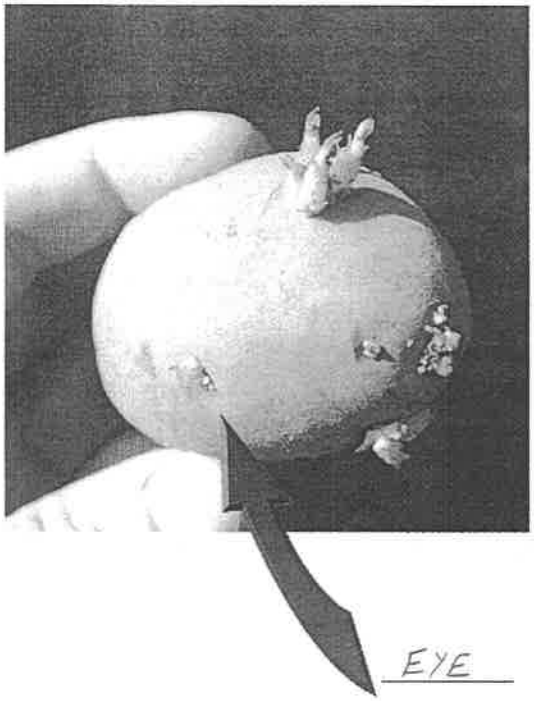
TUBERS

Tubers have several nodes, or growing points, called EYES. Each eye can DEVELOP into its own plant.

New potato plants growing from the eyes



EYE

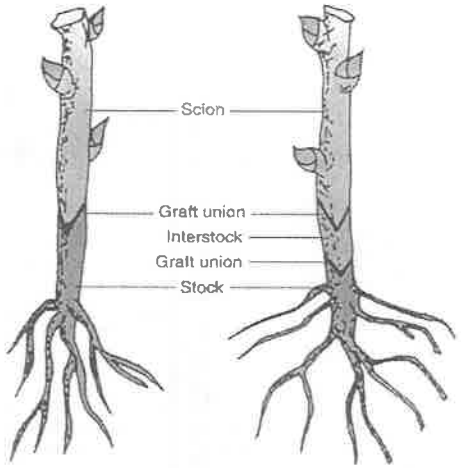
RHIZOMES

Rhizomes are STEMS that grow HORIZONTALLY along the surface of the SOIL or just BELOW it. Rhizomes BRANCH out with each portion growing ROOTS and SHOOTS of its own.

Iris flowers

Iris rhizomes can be cut into pieces and replanted

(7) GRAFTING – The union of parts from TWO (OR) of more plants into a SINGLE plant. Grafting is commonly used in WOODY plants to produce desired plants, UNUSUAL forms, or to repair DAMAGED plants. NOT all plants can be grafted.

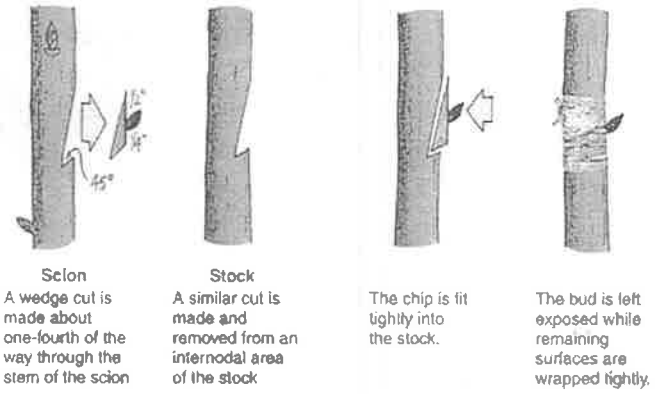


STOCK – The portion of the graft with the ROOT system

SCION – The portion of the graft that will develop BRANCHES, FOLIAGE (leaves) and FLOWERS

After the scion and stock have been CUT and JOINED, they are tied into place. Then the area of the wound is SEALED with WAX or TAPE to keep the moisture IN and disease OUT.

"TREE OF 40 FRUIT"
A tree designed by a professor who grafted in branches from 40 different types of fruit trees



Scion
A wedge cut is made about one-fourth of the way through the stem of the scion

Stock
A similar cut is made and removed from an internodal area of the stock

The chip is fit tightly into the stock.

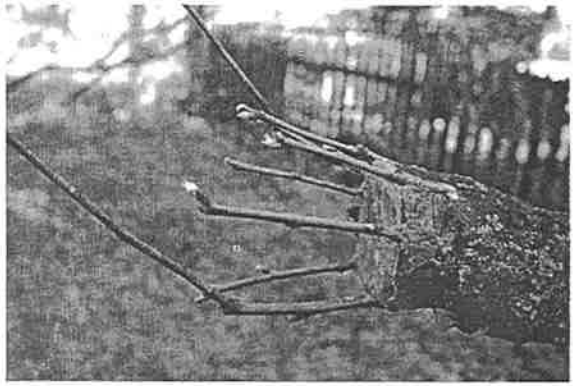
The bud is left exposed while remaining surfaces are wrapped tightly.

BUDDING is a type of grafting in which a BUD is inserted into the stock and develops a new SHOOT

Grafting by cuttings with _ROSES_ allows growers to display different _VARIETIES_ of roses on one plant. Beautiful and unusual rose bushes can be _DESIGNED_. Also, growers can _GRAFT_ roses onto the root stock of _HARDIER_ bushes to allow them to grow in colder _CLIMATES_

Various rose colors grafted onto one bush

Grafting a rose stem



Multiple grafts on an apple tree branch

Many _FRUIT_ trees are grafted to _MAINTAIN_ particular varieties or cultivars of fruit. For example, if _APPLE_ seeds are planted, the grower will _NOT_ get an identical copy of the _TREE_ that produced the apple. Grafting is the only way to get an _EXACT_ copy.

(8) TISSUE CULTURE – The propagation of plants from TINY pieces of plant TISSUE, usually MERISTEMATIC shoot tissue. The piece of tissue is REMOVED from the parent plant under STERILE conditions and grown in a NUTRIENT media in a carefully controlled environment. Through cell division, a new CLONED plant grows.

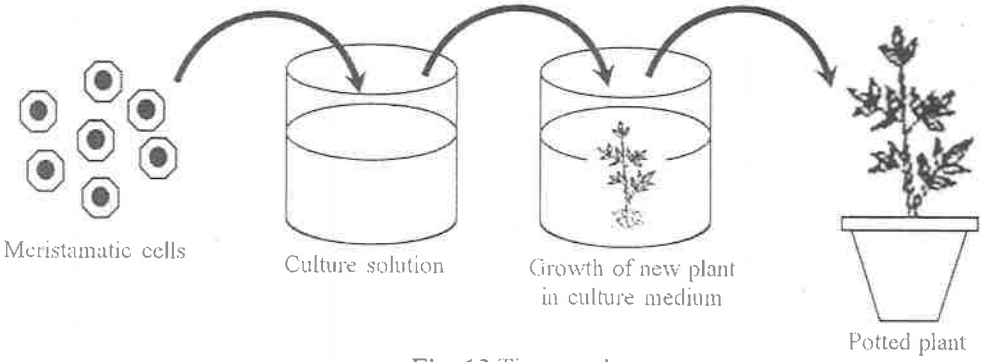
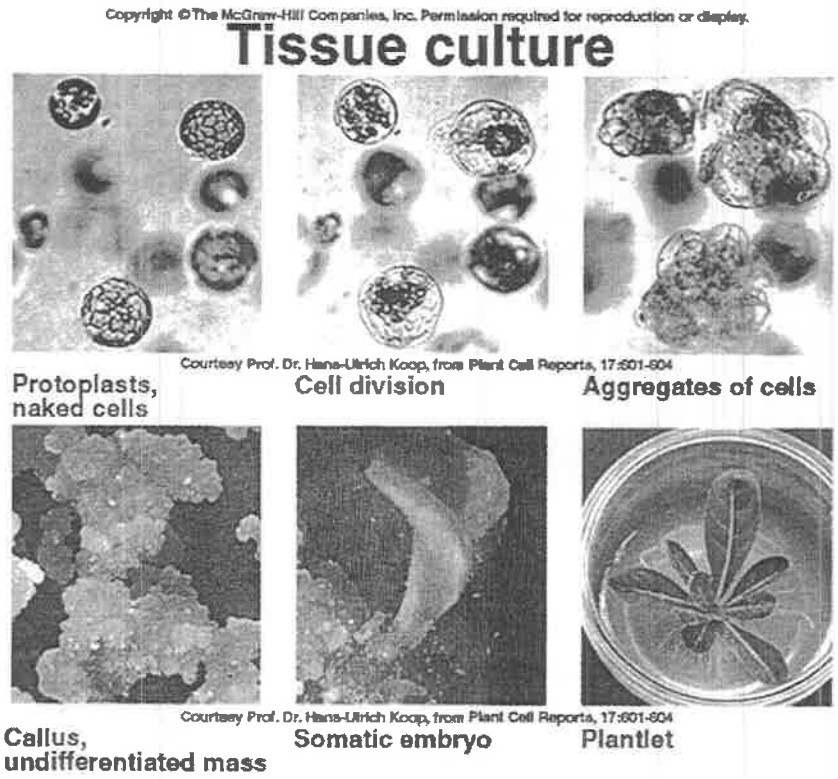
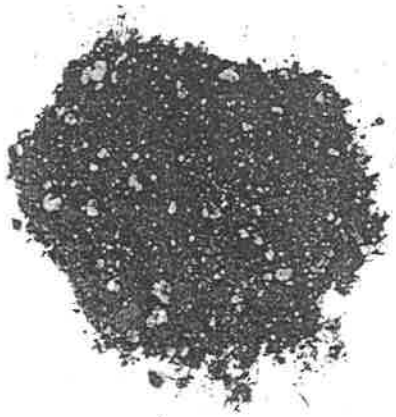


Fig. 13 Tissue culture



MEDIA = PLURAL
MEDIUM = SINGULAR

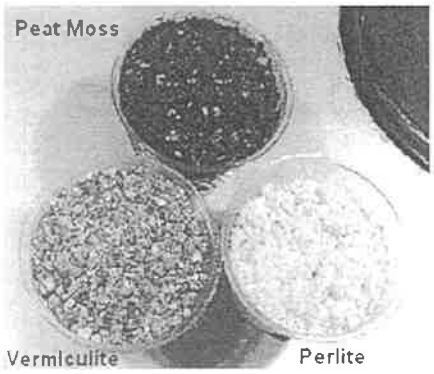
MEDIA FOR PROPAGATION



The growing medium is the ENVIRONMENT in which the plant is grown, and needs to SUPPORT the developing SEEDLINGS by providing:

NUTRIENTS WATER AERATION SUPPORT CORRECT pH

Natural (field) soil is NOT always used in propagation because it can be too HEAVY, contain weed SEEDS and PATHOGENS, and may not provide the AERATION, water holding capacity, and DRAINAGE needed. Several soilless or SYNTHETIC growing media have been designed and contain various combinations of:



SPHAGNUM (PEAT) MOSS - Dehydrated REMAINS of acid-bog plants. It is LIGHT in weight and can absorb 10 to 20 times its weight in WATER. Sphagnum moss also provides NUTRIENT retention, aeration, and DRAINAGE

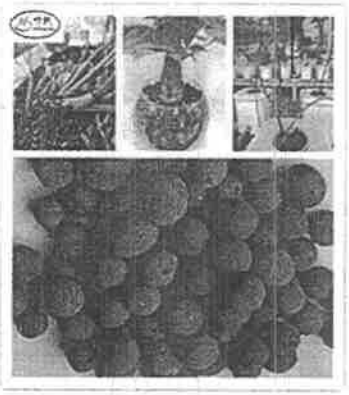
BARK - Small PARTICLES of pine bark obtained from the wood & paper industries. Bark provides excellent drainage and AERATION.

SAND - COARSE sand provides aeration and DRAINAGE

PERLITE - A LIGHT-WEIGHT mineral of volcanic origin PROVIDING aeration & drainage

VERMICULITE - A mineral with PLATE-LIKE particles that increase water holding capacity It is also a good source of POTASSIUM and magnesium.

FIRED CLAY - Clay pebbles that are __FIRED__ in a kiln causing them to __EXPAND__. Fired clay __PROVIDES__ excellent drainage and aeration.



All of the materials used as propagation media must be steam __PASTEURIZED__ before use to __ELIMINATE__ weed seeds, nematodes, fungi and other __PATHOGENS__.

1 cubic ft

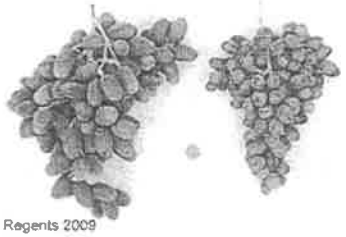
Product Details
Description
The Soil Sterilizer is an effective way to combat soil-borne weeds, pests, molds, and disease. With an adjustable temperature range of 140-200 degrees F, the Sterilizer pasteurizes the soil, creating a clean, pest-free soil that's ready for seeds, seedlings, or cuttings.

The artificial __MEDIA__ may also have __LOW__ nutrient content for the seedlings, and will need to be __SUPPLEMENTED__ with fertilizers and be adjusted for the correct __pH__.

PLANT GROWTH REGULATORS

Plant Growth Regulators (PGRs) are NATURALLY occurring or SYNTHETIC compounds that AFFECT plant growth and development.

Grapes treated with PGRs



Untreated grapes

UC Regents 2009

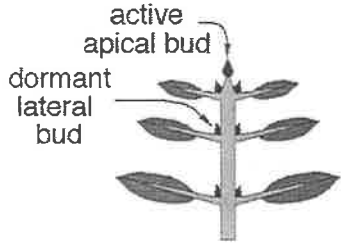
3 TYPES OF PGRs:

1. Growth- PROMOTING chemicals (Plant grows MORE)
2. Growth- INHIBITING chemicals (Plant grows LESS)
3. ROOT - promoting chemicals (Roots grow MORE)

NATURALLY OCCURING PLANT HORMONES (These may work INDIVIDUALLY or TOGETHER)

(1) AUXIN – BOTH promotes and inhibits growth

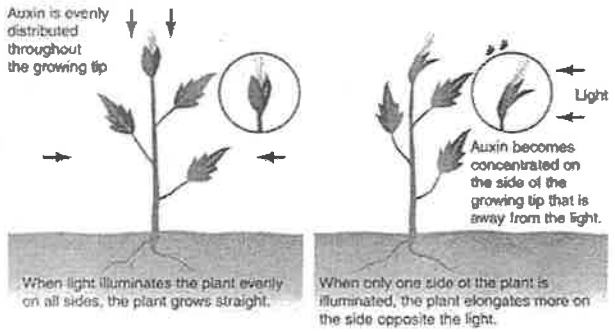
Ex. APICAL DOMINANCE



Promotes the growth of the APICAL (terminal) bud while Inhibiting the growth of LATERAL (axillary) buds. "Pinching" is a practice of REMOVING the apical bud to promote FULLER bushy growth.

Ex. PHOTOTROPISM – The ability of plants to BEND toward the LIGHT

Auxin causes cells away from the light to elongate



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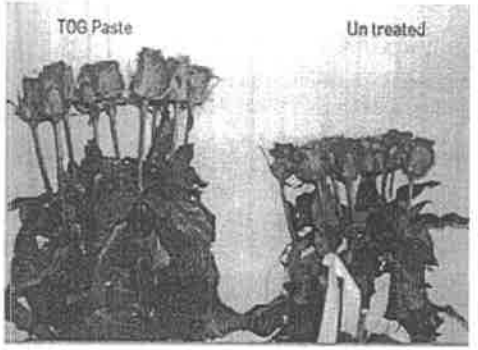
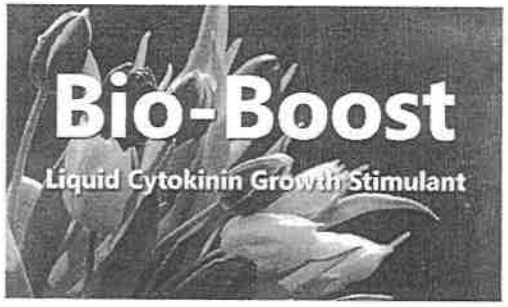
(2) GIBBERELLINS – Cause cell elongation often causing _INCREASES_ in plant height. Growers can apply gibberellic acid to make plants grow taller more _QUICKLY_ and to _STIMULATE_ the development of _FLOWERS_. Gibberellins also help with seed _GERMINATION_ and the production of seedless _FRUITS_ (parthenocarpic fruit) by applying gibberellins to the pistils of flowers.



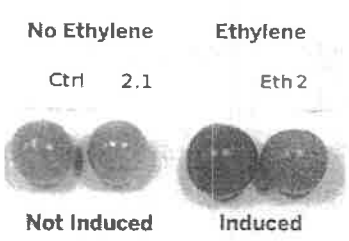
Synthetic gibberellic acid paste applied to roses

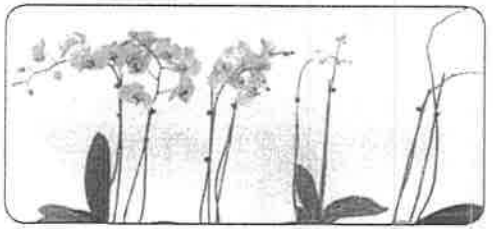
Fig 2: Effect of T.O.G. PASTE on stem length of rose flowers cv. 'Mitva' (Israel 2005)

(3) CYTOKININS – Used in tissue culture to promote cell _DIVISION_ and differentiation. Cytokinins also delay aging and are used in _FLOWER_ shops to keep leaves green and cut flowers _FRESH_.



(4) ETHYLENE GAS – Often called the "_RIPENING_" hormone, it causes fruits to _CHANGE_ in color & texture as they ripen. Ethylene gas is used commercially to ripen _TOMATOES_, _BANANAS_, and _PEARS_. Ethylene also affects flowers causing leaf _YELLOWING_, flower & petal _DROP_, and Leaf _ABSCISSION_ (falling off). Sensitivity to ethylene varies among plants. Many fresh cut _FLOWERS_ are sensitive to ethylene and can be _TREATED_ against its effects.





Treated with EthylBloc™ Technology Control (no EthylBloc™ Technology)

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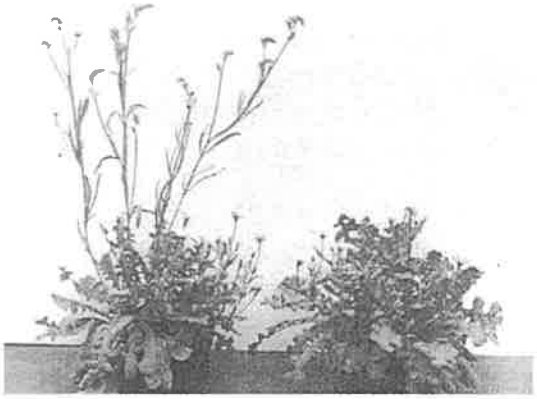
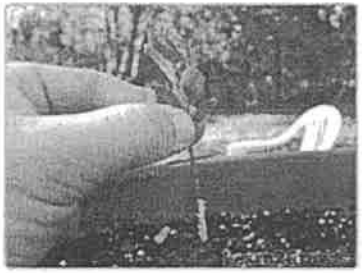
SYNTHETIC GROWTH REGULATORS



GROWTH RETARDANTS – Many synthetic products are growth INHIBITORS used to produce SHORTER, fuller plants. Some plants grow too TALL getting "LEGGY" and undesirable. Growth retardants can:

- Prevent BLOW-OVER of taller plants
- Prevent plants from growing OUT of the pots
- Provide ATTRACTIVE, compact plants
- Increase ease of TRANSPORT

ROOTING HORMONES - Vegetative CUTTINGS can be dipped in rooting hormones to promote & ACCELERATE root formation. The main component of commercial rooting hormones is AUXIN.



Some turf GRASSES are treated with growth retardants, particularly those on sloping DIFFICULT to mow areas. This REDUCES the cost of fuel and labor to mow.


GARFIELD
HI, HI, PUSSY-WUSSY. WOULD YOU WIKE SOME WA-WA?
OH, BOY! WOMEY
IF YOU SPEAK NICELY TO PLANTS, THEY GROW BETTER, GARFIELD
BOLOGNA
DIE!
LIVE AND LEARN