Genetic Engineering, Biotechnology, Floriculture and its Future in Pakistan

By Mrs. Farzana Panhwar, May 2005

Author:	**Farzana Panhwar (Mrs)**
Address:	**157-C, Unit No.2, Latifabad, Hyderabad (Sindh), Pakistan**
E-mail:	**farzanapanhwar@hotmail.com** **farzanapanhwar@yahoo.com**
Fax:	**92-21-5830826 and 92-221-860410**

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General.

In Pakistan the floriculture is not very well developed. We mostly have fresh flower market, which is all most flooded with roses, because roses are used in all types of ceremonies, as well as in perfume industry and in many Auravedic and Greek medicine preparations. While other flowers which are entering in fresh flower business are orchids, tulip, lily, Jasmine and gladioli, while others are less important.

Pakistan has successfully involved in biotechnology, tissue culture, cutting of floriculture as a result we are now in a position to export these flowers to the developed world. But in order to compete the world we have to study economic trend of shortage and over supply of some flower species in particular season as a result of this the prices of commodities become too low to grow them economically. In order to enter in the world floriculture business, we must consider these points.

The flowers in the world market may be rejected on the followings ground:

- Slight malformation.
- Slight bruising.
- Slight damage caused by diseases or animal parasites.
- Weaker, less rigid stem.
- Small marks caused by treatment with pesticide.

Floriculture which dominate the world market.

Cut flower.

- Roses.
- Carnations.
- Chrysanthemums.
- Orchids.
- Gladioli.
- Tulips.
- Freesias.
- Gerberas.
- Narcissus.
- Cypsophila.
- Iris.
- Lilies.
- Alstroemeria.
- Amaryllis.

- Anthurium.
- Lilac.
- Dendrobium.
- Protea.
- Birds of paradise.
- Heliconia.
- Gypsophila.
- Gerbera.
- Antirrhinum (snapdragon).

Future of exotic flowers.

- Heliconia.
- Porcelaine rose.
- Strelitizia.
- Protea.
- Red-ginger.

Dracacnas species and varieties are:

- Dracaena marginata.
- Dracaena Sanderane.
- Dracaena deremensis.
- Dracaena Massangeana.
- Dracaena Compacta.
- Dracaena S. florida beauty.
- Dracaena Rededge.

The micro-propagation is common in Rededge.

Alstroemeria - varieties.

- Jacqueline.
- Rosario.
- Lilac Glory.
- King cardinal.
- Carmen.
- Jubilee.
- Pink Triumph.
- Rio.

- Apple blossom.
- Red Sunset.
- Rosita.
- Yellow King.
- Red Valley and Cana.
- Pink perfection.
- Advendo.

Fresia - leading varieties.

- Ballerina.
- Blue heaven.
- Miranda.
- Aurora.
- Athene.
- Wintergold.
- Escapade.
- Cote d'Azur.
- Clazina.
- Fantasy.

Lillies - leading varieties.

- Connecticut King.
- Enchantment.
- Sunray.
- Prominence.
- Harmony.
- Uchida.
- Sterling Star.
- Mont Blac.
- Star gazer.
- Yellow blaze.

Foliage plants.

- Ficos.
- Elastica.
- Dracaena.

Consumer preference according to colour.

50% red, 10% Sonia pink, 10% other softer pink (bridal pink), 5% creams and whites.

- Croton (Codiaeum variegatum - pictum). The more important commercially grown species are:

    - Aucubifolium.
    - Van Ostenzee.
    - Gold star.
    - Gold sun.
    - Gold finger.
    - Gemengo.
    - Phillip Gedulding.
    - Sun beam.
    - Juiletta.
    - Norma.
    - Petra.
    - Europa.
    - Excellent.
    - Bravo.
    - Mrs. Iceton.
    - Nervia.

Rooted and unrooted cutting have great potential of import. But micro-propagation in future effect the import of following species from developing countries:

- Aglaonema spp.
- Codiaeum spp (crotons).
- Dracaena spp.
- Ficus robusta.
- Maranta Kerchoviana.
- Philodendron Scandens.
- Pleomele Spp.
- Polyscias Spp.
- Pseuderanthemum Spp.
- Schefflera actino phylla.
- Scindapsus aureus.
- Syngonium Spp.

Bromeliaceae species and varieties are.

- Acechmea chantinii.
- Aechmea fasciata.
- Ananas comosus-Aureovariegatus.
- Cryptanthus bivittatus.

- Cryptanttus fosteranus.
- Cryptanthus Rubescens.
- Cryptanthus zonatus.
- Guzymania - Amaranths.
- Guzmania - Claudine.
- Guzymania - Grand Prix.
- Guzmania - Marlebeca.
- Guzmana - Mini Exodus.
- Guzmania-Minor.
- Guzmania-Musaica.
- Guzmania-Remembrance.
- Neoregella-Carolinu Flandria.
- Neoregella Carolnae-myenderffii.
- Neoregella Cardinae-Perfecta Tricolor.
- Tillandsia spp.
- Vriesea poelmanii-hybriden.
- Vrlesea splendens-favourite.
- Vriese Vulkana.

All are produce exclusively by micro propagation.

Foliage pot plant.

- Bromelinds.
- Chamaedorea-c. erumpens.
- Croton-croton variegatum, Norma, peter, codiaeum spp.
- Cordyline.
- Dieffenbachia - camilla, compacta, Tropic snow, Diexotica.
- Dracaena - Janet craig, D. marginata (colrma, Tricolor), D-Fielastra.
- Ficus-Filyrata - Fragrants, Massangeans, Pleomele Reflexa. D - deremensis, war neckii.
- Maranta - Red and green varieties.
- Nephrolepsis - P. erubescens, P. wendiandii.
- Philodendron - cardatum pluto, P. selloum, spider, Swiss chese is a speices of Monstera delicosa.
- Schefflera - Brassais actinophylla, Barbaricola.
- Scindapsus - S. aureus, Marbie queen and golden varieties
- Yucca.
- A glaonema - silver queen, A. robellni Romana, Simplex, Emerold beauty, A. modestum, A. crispum.
- Cissus - Cissus rhombifolia, Ellen Danica and Ellanflonia.
- Gynura G. Sarmentosa.

- Ivy - English ivy of the Hedera genus, there are more than 100 varieties.
- Syngonium - Many varieties - Most of them are propagate through tissue meristem culture.
- Pothos (Scindapsus aureum).

For import all flowers must qualify following criteria.

- Flower not perfect/damaged.
- Supply phase incorrect.
- Sorting-unequal lengths.
- Stalk-limp, curved.
- Foliage deviation.
- Pest-aphids, red spider, thrips etc.
- Fungi - botrytis, mildew etc.
- Growth deviation.

The role of genetic engineering and biotechnology in Floriculture.

- Biotechnology is used to study photo-period, carbon dioxide concentration, growth regulators and water management.

- Modified atmospheric pressure. Integrated pest management cultural practice in floriculture. Floral preservation depends upon the water salinity, fluoride level, stem submersion time and length. Silver nitrate solution in non-metallic container, increases the shelf life of flowers.

- Application of cold storage and transportation methods to cut flowers cuttings, seedling, potted plants, bulbs, corns and ornamental plants help to increases their life while. The factors which affects on the quality of storage material are: stage of plant development, temperature, relative humidity, ethylene, and packaging and transport. Many pre-harvest and post-harvest factors like genetic, climatic a environmental (light, temperature, relative humidity, air quality and pressure) and management (soil conditions, nutrient, fertilisation, irrigation, plant protection) affect on post-harvest quality and longevity of cut flowers.

- Flowers and foliage plants are vulnerable to large post-harvest losses due to more susceptible to mechanical and physical damage, infection of pest and diseases because having moisture, during and after harvest. Biotechnology is used in harvesting, grading, packing, pre-shipping treatments, long distance transportation, long term storage facilities, use of floral preservatives and bud opening solutions development.

- Tissue culture produce consistently graded plants, which are pathogenic free. Due to restriction of phytosanitary regulation for peatmoss and styrofoam. Biotechnology is used to develop potted media that is light in weight having more water retention ability, which help the flowers to improve its shelf-life.

- Biotechnology is used to study the floral preservative solution, which act as substrate for providing continuous respiration, removing vascular blockage in the steam, so water should easily supply to the plant, prevents any bacterial infection and control proper petal colour.

- Biotechnology is need to study the role of ancymidol and ethephon. They act as a growth retardants. More study is needed to find out their role in delaying flowering, so they can be used as post-harvest of flower and to control senescence.

- Biotechnoloyg is needed to study the role of ion-leakage in the petals and its effect on keeping quality of flowers. It is confirmed by the research that ultraviolet radiation at 280 - 320 nm (UV-B) induce petal tip blackening of cut red roses and detached petal.

- At the same time other research on biotechnology used to study the role of ethylene and find that ethylene as low as 30-60 ppb retard the quality of floral crop and its effect in-rolling of carnation petals, fading and wilting of sepal tips, induction of anthocyanin formation. The findings said the most common preservative solution should contain 1-4% sucrose, 50-200 ppm 8-hydroxy-quinoline sulphate (8-HQS) along with other constituents.

- These findings in floriculture are the backbone of future of floriculture industry.

- Biotechnology should be used to study senescence of cult flowers, that shows 40% low level of esterified to phospholipids, which results into loss of phospholipids (consist of Palmitic, Stearic, Oleic, Linoleic and Linolenic acid).

- Biotechnology is used to control changes in carotenoids and anthocyanin during senescing process we must study catecholase activity causing white colour of flowers on senescing.

- Biotechnology is needed to study the effects of pH on senescing. If lower the pH of the media, then the content of organic acid like aspirate, malate, and tartarte increase the flower colour on senescing.

- Biotechnology is used to study to control of oxidative-hydrolytic enzymes, hormonal changes, biochemical reaction take place in the membrane and cell wall structure during senescene of flowers.

- More research is needed to improve the pre-harvest treatment chemicals like silver thiosulfate, N-benzyladenine, Kinetin; Cytokinins, citrates, solution containing sucrose and salts.

- Biotechnology is used to study the bud opening solution based on 10-12% sucrose +200 ppm 8-hydroxy-quinoline-sulfate + 25 ppm sliver nitrate + 75 ppm aluminium-sulphate + 75 ppm citric acid.

- Genetic engineering work already in progress on orchids, chrysanthemum and Dianthus. Although herbaceous ornamental work is easy but woody plant species work need more attention. The genetic engineering have a great large number of identical plants and production of new varieties and genotypes faches prime values in the world market.

Genetic engineering works on floriculture under process in the world.

- Genetic engineering of ethylene insensitivity in Petunia.

- Genetic engineering of Petunia for delayed leaf senescence.

- Genetic engineering of Petunia for growth regulator (dwarfism).

- Fundamental research tool for floriculture biotechnology Petunia Genomics.
- Cloning and engineering genes for better post-harvest life.
- Genetic engineering is used to study role of ethylene in floral senescence, adventiouxs root formation, seed germination and scent formation.
- Chrysan themum but stem is 15-20% shooter than original cultivar - Genetically growth plant have more 10-15% more chlorophyll so it show better growth. These plants are grown under commercial greenhouse conditions.
- Genetic engineering is used to modify the colour of carnation, roses, daisies flowers.
- The luminous bouquet glows florescent green (Green fluorescent protein GFP gene) under ultraviolet light.
- Genetic engineering in floriculture increase production, enhance resistance to insect, diseases and virus, reduce use of pesticide and herbicide.
- Genetic engineering used to extending vase life, minimise post-harvest losses, creating novel product.
- In rose delphinidins (blue-green) gene is response for colour - scientist identify pH genes and modifying vascular pH - so in future we see blue colour colours.
- Orchid - flower colour, prolong shelf life gene chalcone syntheses (CHS) and flavone 3-hydroxylase (F_3H), phytoenne and Antisense-Construct they block the enzyme and prevent the process of pigmentation and ethylene synthesis in flower.

Future of genetic engineering.

In Future the Biotechnology will play a role to develop flowers free from following infections and diseases.

A) Live organisms of the animal kingdom, at all stages of their development.

1. Anarsis lineatella Zell.
2. Diarthoronomya chrysanthemi Ahib.
3. Ditylenchus destructor Thorne.
4. Ditylenchus dipsacl (kuhn) Filipjev.
5. Gracilaria azalella Brants.
6. Lampetia equestris F.
7. Laspeyresia molesta.
8. Lirlomyza trifoll (Burgess).
9. Phthorimaea operculella (Zell).
10. Radopholus citrophilus (Huettel, Dickson en Kaplan).
11. Radopholus similis (Cobb) Thorne (Sensu stricto).
12. Rhagoletis cerasi L.
13. Scolytidae (of conifers).
14. Dactulosphaira vitifoliae (Fitch).

B) Bacteria.

1. Corynebacterium insidiosum (McCull) Jensen.
2. Corynebacterium michiganense (E.F. Sm.) Jensen.
3. Erwinia chrysantheml Burikh, et al. (syn. Pectobacterium) parthenii var. dianthicola Hellmers).
4. Pseudomonas caryophylli (Burkh.) Starr et Burkh.
5. Pseudomonas gladioli Severini (syn. P. marginata [McCull]. Stapp)
6. Pseudomonas pisi Sackett.
7. Pseudomonas solanacearum (E.F. Sm.) E.F. Sm.
8. Pseudomonas woodsiii (E.F. Sm.).
9. Xanthomonas vesicatoria (Doldge) Dows.
10. Xanthomones campestris (Doldge) Dows.
11. Xanthomonas compestris pv pruni (E.F. Smith) Dye.
12. Xanthomonas fragariae

C) Fungi.

1. Atropellis spp.
2. Didymella chrysanthemi (Tassi) Garibaldi et. Gulllino (syn.) Mycosphaerella ligulicola Baker et al.)
3. Fusarium oxysporum Schiecht. F. sp. Gladioli (Massey) Snyd. et Hans.
4. Gulgnaridia baccae (Cav.) Jacz.
5. Ovulinia azaleae Weiss.
6. Phlalophora cinerescens (Wr.) van Beyma.
7. Phytophthora fragarlae Hickman.
8. Puccinia horiana P. Henn.
9. Puccinia pelargonii-zonalis Doidge.
10. Sclerotinia bulborum (Wakk.) Rehm.
11. Sclerotinia convoluta Drayt.
12. Septoria gladioli Pass.
13. Stromathia gladioli (Drat.) Whet.
14. Uromyces spp.
15. Verticillium albo-atrum Reinke et Berth.

D) Viruses and virus-like pathogens.

1. Arabis mosaic virus.
2. Beet curly top virus.
3. Beet leaf curl virus.
4. Black raspberry latent virus.
5. Cherry leaf roll virus.
6. Cherry necrotic rusty mottie virus.
7. Chrysanthemum stunt viroid.
8. Little cherry pathogen.
9. Prunus necrotic ringspot virus.
10. Respberry ringspot virus.
11. Stolbur pathogen.
12. Strawberry crinkle virus.
13. Strawberry latent ringspot virus.
14. Strawberry yellow edge virus.
15. Tomato black ring virus.
16. Tomato spotted wilit virus.

Conclusion.

Role of genetic engineering in all fields of life is an important subject. Future of floriculture lies on genetic engineering and biotechnology, which will produce the future flowers free from pathogen, having better colour, better shapes of petals, better pre and post-harvest life with keeping them fresh for long time, short time of growth with desired feature, characteristics and smell. We are sure that future floriculture will bring revolution in perfume business since it is confirmed that now a days many people are allergic to special smell of some flowers. But genetic engineering will over come this problem in future.

Pakistan can easily get into floriculture market of the world. As we have better soil, suitable temperatures and good sun-shine which are the primary needs of any agrobusiness. Although Pakistan is far-behind in advance technologies but we are sure in future we will also come forward in learning and application of genetic engineering and biotechnology and compete the floriculture market in the world and bring revolution in agribusiness and earn foreign exchange.

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