FLOWER SEED PRODUCTION

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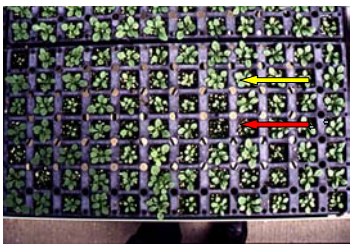

% Nonuseable Seedlings	Per Plug Wholesale Value ($) 0.03	0.04	0.05	0.06	0.07
5	0.77	1.02	1.28	1.54	1.79
10	1.54	2.05	2.56	3.07	3.58
15	2.30	3.07	3.84	4.61	5.38
20	3.07	4.10	5.12	6.14	7.17
25	3.84	5.12	6.40	7.68	8.96
30	4.61	6.14	7.68	9.22	10.75

FLOWER SEED PRODUCERS

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- Breeding Companies
  - Own production facilities
  - Full control of production details
  - Generally, high-valued bedding and cut flower seeds

FLOWER SEED PRODUCERS

- Breeding Companies
- Contract Seed Production Companies
  - Located in favorable areas
  - Greenhouse producers usually seed producers themselves
  - Provide on-site supervision of production

FLOWER SEED PRODUCERS

- Breeding Companies
- Contract Seed Production Companies
- Local Seed Growers
  - Produce seed under contract
  - Not full-time seed producers
  - Normally in ornamental business with expertise

FLOWER SEED PRODUCERS

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PRODUCTION AREAS

Useful Adage

"The ideal location for greenhouse seed production is in the tropical highlands and the best place for open field production is an irrigated desert."

PRODUCTION AREAS

Costa Rica	California
Guatemala	Mexico
Indonesia	France
Sri Lanka	China
Chile	Japan
Kenya	Zimbabwe
Holland	India

PRODUCTION AREAS

PRODUCTION AREAS

- Open-field Production
  - France
  - Holland
  - United States
  - Mexico

PRODUCTION AREAS

PRODUCTION AREAS

- Good climate
- Investments in land improvement, buildings, and specialized machines
- Training of workforce for hybrid production
- Low labor costs
- Satisfactory transportation infrastructure
- Ease of communication
- Social/economic stability

SEED PRODUCTION PROCEDURES

- Parental plant culture
- Genetic quality control
- Pollination management
- Seed harvest and extraction
- Seed cleaning and conditioning

SEED PRODUCTION PROCEDURES

F-1 Hybrid Crops	**Open-Pollinated Crops**
e.g. Impatiens	*e.g. Marigold*
Small scale (grams)	Large scale (kilograms)
Greenhouse	Open field
Labor intensive	Highly mechanized
Insect-proof facilities	Isolation requirement
Environment control	Site selection
Proprietary production	Grower contracts
Hands-on culture	Quality control

SEED PRODUCTION PROCEDURES - Hybrids

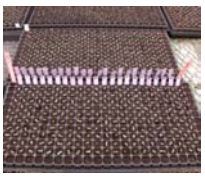
- Produced under greenhouse conditions

SEED PRODUCTION PROCEDURES - Hybrids

- Parental Plant Culture
  - Inexpensive
    - Coconut fibers
    - Rice hulls

SEED PRODUCTION PROCEDURES - Hybrids

- Parental Plant Culture
  - Inexpensive
  - Raised from seed
    - Plug trays
    - Transplanted into pots

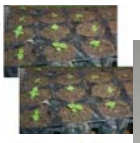


SEED PRODUCTION PROCEDURES - Hybrids

Matthiola plants in a greenhouse grown in pots.

SEED PRODUCTION PROCEDURES - Hybrids

- Parental Plant Culture
  - Inexpensive
  - Raised from seed
  - Pots
    - Plastic bags
    - Plastic pots
    - Styrofoam pots



SEED PRODUCTION PROCEDURES - Hybrids

- Soil Analysis and Plant Nutrition

SEED PRODUCTION PROCEDURES - Hybrids

- Integrated Pest Management
  - Crop scouting daily
  - Yellow-sticky boards
  - Fungicide applications
  - Bacteria/virus infected plants rogued

SEED PRODUCTION PROCEDURES - Hybrids

- Genetic Quality Control
  - Roguing of off-type plants
  - Presence of insect-proof screens

SEED PRODUCTION PROCEDURES - Hybrids

- Pollination Management
  - Defines seed yield and genetic purity
  - Three steps
    - Pollen collection
      - Shaken
      - Vacuumed

SEED PRODUCTION PROCEDURES - Hybrids

- Pollination Management
  - Defines seed yield and genetic purity
  - Three steps
    - Pollen collection
    - Emasculation

SEED PRODUCTION PROCEDURES - Hybrids

- Pollination Management
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    - Pollen collection
    - Emasculation
    - Pollination

SEED PRODUCTION PROCEDURES - Hybrids

- Seed Harvest
  - Correct stage of seed development important
    - Immature seeds
    - Deteriorated seeds
    - Dormancy
  - Harvested when pods dry and cracked
  - Hard seed pods cracked, loose seeds separated by sieves

SEED PRODUCTION PROCEDURES - Hybrids

- Seed Cleaning
  - Little debris
    - Hand screens
    - Air blower

SEED PRODUCTION PROCEDURES – Open-Pollinated

- Seed produced in blocks of one or more acres
- Less labor intensive
- More equipment required
- Generally open pollinated varieties, although hybrids with self-incompatible parents can be done
- Production is seasonal
- Must find a suitable climate
- Less precise controls in crop management

SEED PRODUCTION PROCEDURES – Open-Pollinated

- Site Selection
  - Most important factor in field production
  - Must have required temperature and moisture conditions for seeds to ripen fully
  - Must have a dry period at harvest to allow field drying
  - Soil type (heavy vs. light) must fit crop
  - Crop history in field (minimize disease and pest pressures) important

SEED PRODUCTION PROCEDURES – Open-Pollinated

- Isolation Distance
  - Pollination accomplished randomly by wind and insects
  - Varieties of the same species intercross
  - Isolation distance must be established to minimize undesirable crosses
  - Items considered in isolation distance
    - Topography of production site
    - Direction of prevailing winds
    - Flower structures that allow self pollination
    - Planting of similar varieties nearby

SEED PRODUCTION PROCEDURES – Open-Pollinated

- Crop Culture
  - Usually grown in beds to facilitate irrigation, fertilizer application, fungicide/insecticide sprays
  - Genetic uniformity of parents at flowering, off-types rogued
  - Weed control important (plastic mulches increasing)
    - Lowers seed yield
    - Complicates cleaning
    - Adds noxious weed seeds
  - High quality plants produce high quality seeds

SEED PRODUCTION PROCEDURES – Open-Pollinated

- Pollination
  - Climatic conditions influence flowering, pollen production, and stigma receptivity
  - Insect-pollinated plants placed in regions where natural pollinator populations are high (sometimes bee hives added)
  - Application of fungicides/insecticides during flowering should be avoided
    - Damage stigma
    - Interfere with pollen tube development
    - Kill pollinating insects, lower seed yield

SEED PRODUCTION PROCEDURES – Open-Pollinated

- Harvest
  - Many bedding plants have indeterminate flowering
  - Determining proper time to harvest critical: compromise between yield and seed quality
  - Often cut and dried in the field

SEED PRODUCTION PROCEDURES – Open-Pollinated

- Seed Drying
  - Threshed by combine, vacuum harvested for marigold and gazania
  - Rough cleaned by scalpers

Tunnel Dryer Commonly Used for Seed Drying

Rotary Dryer Used for Drying Plant Materials

SEED PRODUCTION PROCEDURES – Open-Pollinated

- Seed Cleaning
  - Field-grown seed has substantial debris
  - Air-screen cleaner most important
  - Finishing operations needed according to crop
    - Removal of hairy layers from gazania and anemone
    - Detailing marigolds to facilitate sowing
    - Scarify hard seed coats of Pelargonium

Gravity Table

Multi-cut Air Column

Review: Flower Seed Production – Crop Culture

F-1 Hybrids	***Open-Pollinated Crops***
• Greenhouses	• Open field
• Grown as potted plants	• Grown as field crops
• Structured routines in:	• Less structured cultural routines
– Irrigation	
– Fertilizer application	
– Pest/disease control	
• More flexible crop time	• Seasonal start/finish dates

Review: Flower Seed Production - Pollination

F-1 Hybrids	***Open-Pollinated Crops***
• Hand pollination:	• Insect/wind pollination
– Pollen collection	• +/- Beehives
• Pollen storage	
– Emasculation	
– Pollination	
• Timing	
• Tools	
• Mechanism	
• No isolation requirement	• Crop isolation critical

Review: Flower Seed Production – Seed Harvest

F-1 Hybrids

- Multiple harvests
- Picking the fruit/seed pod
  - Timing of harvest
  - Drying the seed pod
  - Seed extraction methods
- Harvesting the dispersed seeds
  - Mechanism/facilities
- Little debris

Open-Pollinated Crops

- Single harvest
  - Timing
  - Mechanism
- Multiple harvests
  - Mechanism
- Much debris

Review: Flower Seed Production – Drying/Storage

F-1 Hybrids

- Dry mostly seed/seed pods
- Dryers commonly used
- Controlled RH/T storage

Open-Pollinated Crops

- Dry much plant material
- Dry first in the field – sometimes dryers used
- Open bulk storage

Review: Flower Seed Production – Conditioning

F-1 Hybrids

- Clean out small amount of plant debris
- Light seeds routinely removed
- Extensive weight/size separations
- Some seeds need detailing, defuzzing, scarifying

Open-Pollinated Crops

- Clean out large amount of field dirt
- Light seeds routinely removed
- Some grading according to weight/size
- Some seeds require detailing, defuzzing, scarifying