Ornithogalum STAR™

Cultivation guide

Imagine more

DANZIGER

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Botanical Background

- Belonging to the Asparagacea family
- A perennial geophyte with seasonal flowering
- About 250 wild species around the globe
- O. saundersiae and O. arabicum are grown extensively as open varieties
- The two primary Species for protected varieties are O. dubium (orange) and O. thyrsoides (white and yellow)
- Native to the Cape of South Africa (Similar in environmental conditions to the Mediterranean)

Propagation

- Ornithogalum bulbs are commonly produced from plants that originate from seed
- Danziger offers bulbs produced from Tissue Culture plants only, with the following advantages:
  - Uniformity in growth, allows for better control in the field
  - Uniformity of the end product, appeals to the market
  - Easier in handling: harvest, sorting, packaging
  - A positive affect on the breeding process, allowing for better varieties

Propagation

O. Arabicum propagated from Seeds

Propagation

Ornithogalum **STAR™** propagated by TC

Propagation

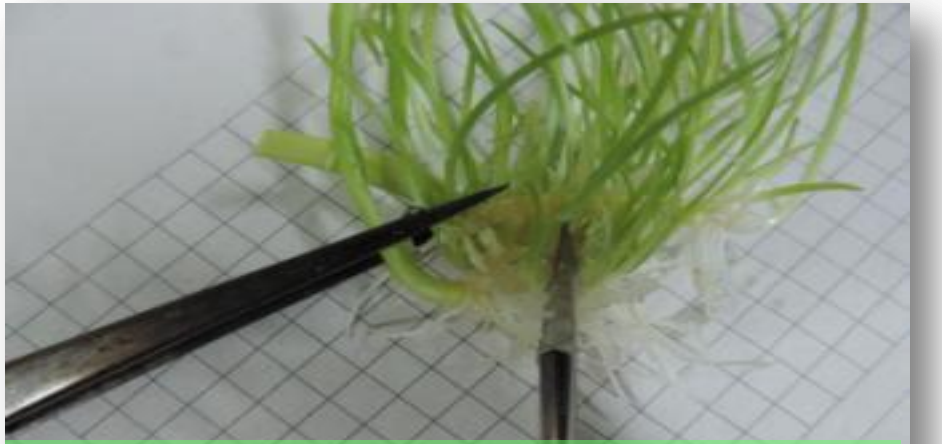
The process:

1. Plantlets production using tissue culture propagation
2. Plantlet planting, hardening and growing
3. Bulb cycle termination & dehydration
4. Bulb separation, sorting by size and counting
5. Bulb storage

Propagation - in the lab

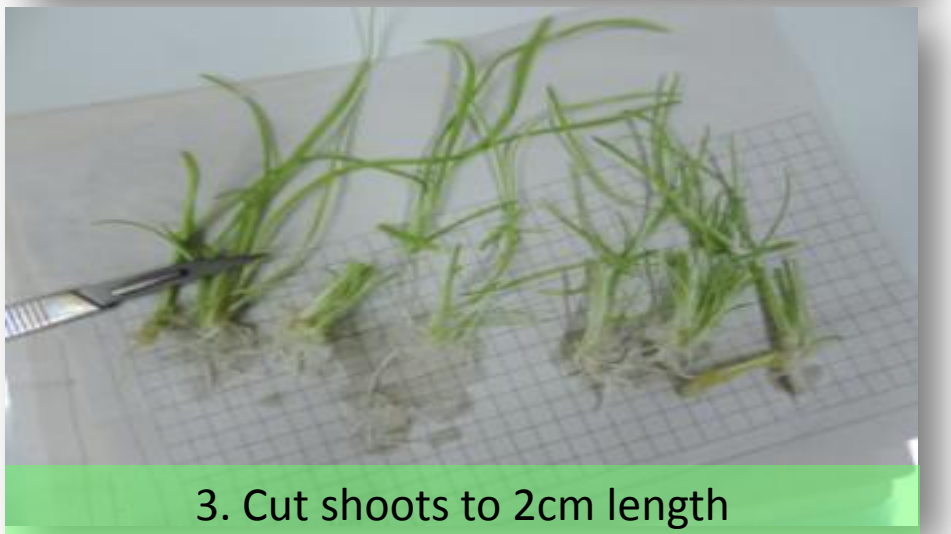
Source Box containing ~ 40 mother clumps

Propagation - in the lab



1. Cut and split between shoots

2. Shorten Roots



3. Cut shoots to 2cm length

4. Clumps ready to be transferred

Propagation - in the lab

Clumps transferred to growing media at a density of 1 clump/1.5cm radius

Propagation - in the lab

New clumps ready for the hardening stage

Propagation - planting clumps

Clumps are separated into 5 plantlets and planted in Coco-peat, 200 per tray

Propagation

Trays are placed in the hardening greenhouse

Propagation

The hardening stage:

- Growing conditions: 10°-25°C
- Humidity: misting for 30 seconds every10 min. until roots develop
- Irrigation: 50 cubic meter per hectare every 2-3 depending on temperatures and humidity levels
- Fertilize through drip at N:P:K 17:10:27 (0.1Kg/1L, 2 liters/ m^3)
- Recommended soil acidity of pH 5.5-6
- Maximum conductivity level of 2 milimos (E.C)

Propagation

After 140 days - dehydrating the bulbs

Propagation

Collecting the bulbs

Propagation

Storing bulbs by size

Propagation

Storing the bulbs at 25^{0}C and 60% humidity

Forcing bulbs

- This process can be used before planting, to encourage bulbs to flower earlier
- This can be done by cooling bulbs to 13°C for approximately 3 weeks
- It is also possible to force bulbs by dipping in **Gibberellic Acid** solution at 250ppm

Forcing bulbs

- In order to check if the bulbs have indeed been “awaken”, cut a sample of a few bulbs open through the center. If there is green color, this is a good indication that bulb germination has begun

The growth cycle

Autumn - Planting/ Germination

Winter - Vegetative growth/Bolting

Spring - Flowering /Harvest

Summer - Drying Out/ Hibernation

This cycle is relevant to geographical areas with **four distinctive seasons**

The growth cycle

Development stage	SUPER STAR™ (Dubium)	Other STAR™ varieties (Thyrsoides)
Planting / Germination	September	October-beginning of November
Vegetative Growth	Winter	Winter
Flowering	From January	From March
Hibernation / Drying out	June	June

- Approximately 16-18 weeks from planting to beginning of harvest (**SUPER STAR™** fastest, **WHITE STAR™** slowest)
- Around 8 to 12 weeks of harvest

The growth cycle

- In high altitude **equatorial areas**, where temperatures are mild year-round, it is possible to plant anytime during the year
- The length of time from planting to start of harvest is longer, around18 to 24 weeks, depending on climatic conditions
- The harvest stage is considerably longer as well, in Kanya even up to 6 months as secondary bulbs develop and produce an additional stem. Hibernation is delayed

Plot Preparation

- Growing is done in Polyethylene covered , well ventilated tunnels
- 40%-50% shading net is placed above or inside the structure
- Soil should be well drained, and built into 1 meter wide and 30 cm high beds
- One support net of 20cm ✕ 20cm squares
- Irrigation system:
  - Drip System with three lines per one meter-wide bed, drippers every 20 cm. along the line).
  - Overhead System with sprinklers positioned at 3X3 meters intervals.

Plot Preparation -

- Shading has an important effect on the different growth stages:
  - Sprouting of the bulbs: high shade insures uniform sprouting by reducing radiation and heat
  - Vegetative growth: excess shade may cause inhibited growth and thin and etiolated foliage
  - Elongation: excess of light reduces stem length excess of shade reduces yield
- In equatorial areas, growers plant under two 40%-45% shade nets, and then remove one once bulbs have sprouted

Planting Density

Bulb Size (diamater in cm)	Year (of cultivation)	Per Meter	Per 1,000 m^2
2-4	1st	100	66,000
4-6	1st	72	47,000
4-8	2nd	72	47,000
8+	2nd	48	32,000

Planting

- Avoid planting during hot days (>30°C) to prevent distortion and early flowering*
- Plant in moist soil
- Plant close to the drip lines
- Plant at 2-3 cm. deep, with top of bulb just below soil level, and covered
- After planting apply 10 cubic meters of water per 1,000 m^2 with overhead irrigation

* See more information on flower distortion in ‘Plant Protection’ section

Irrigation

- It is important **not to overwater** in order to prevent Erwinia
- The optimal situation is when only the deeper soil is wet
- Cold season: 2 m^3/1,000m^2 every alternate day
- Hot season: 5 m^3/1,000m^2 per day
- As many intervals between irrigations as possible are recommended

Fertilization & Acidification

- Fertilizers should be applied regularly via drip system
- Recommended NPK concentrations are 80ppm N (50ppm NH_4 + 30ppm NO_3), 30 ppm P, 80 ppm K
- pH levels should be maintained at 5.5-6.0. Sulfuric or phosphoric acid can be used at a final concentration 0.016%
- In the event of Erwinia spreading in foliage, acidification is done also via sprinklers

GA treatments

- It is possible to achieve earlier flowering by applying Gibberellic Acid
- GA is applied by spraying the plant from above, 4-6 weeks after planting when foliar rosette has developed.
- Recommended GA concentration - 250ppm.
- GA treatments should be applied **very carefully** as they may reduce stem quality

Harvest

- Harvest is performed when 2-3 flowers have opened on each flowering stem.
- If the field is contaminated with Erwinia, it is advisable to disinfest the shears after harvesting each row.
- Post Harvest:
  - Sort.
  - Place in water with 50ppm Chlorine.
  - Store overnight in 4°C
  - Pack & ship to market

Post Harvest

- Post harvest is a rather simple process:
  - Sort
  - Place in water with 50ppm Chlorine
  - Store overnight in 4°C
  - Pack & ship

Treating bulbs for re-use

- Bulbs can be collected from the field after harvest, about one month after foliage of the plants begins drying out and yellowing
- An 'under-cutter' may be used to disconnect the bulbs from their roots
- This procedure enhances the drying out of the bulbs and lessens the chance of an Erwinia infection
- At this stage the bulbs in the soil are still kept under shade

De-hydration of plants

Treating bulbs for re-use

- Bulbs are collected when remaining foliage disconnects easily
- The bulbs are then treated with a powder containing 1 Kg of **Captan 50%** and 1 Kg of **Chlorpyrifus 5%**
- Bulbs are stored in well aerated containers and kept in a storage at 25^0C and of 60% relative humidity
- A de-humidifier may be used

Treating bulbs for re-use

- In Kenya, bulbs are kept at 26^0C for two months to induce hibernation
- They are then “forced” at 13^0C for 3 weeks
- Once bulbs begin to sprout, they are taken to the field for planting
- Soil temperature should be below 15°C

Pest and diseases

Erwinia Soft Rot

- A bacteria that spreads easily, both mechanically and via the water.
- Several types of the bacteria attack ornithugalum: E. Carotovora, E. Herbcola and E. Ananas

- Penetrates the plant through injuries and develops in gaps in between the cells (intracellular space)
- Causes plant rot, mainly in the plant's storing organs

Soft rot caused by *Erwinia Cartovora*

Pest and diseases

Erwinia Soft Rot

- Sometimes symptoms appear only after harvest.
- Can contaminate the soil, the greenhouse environment and the tools and is active also during storage.
- How to battle the bacteria:
  - Drying and sterilizing the soil before planting.
  - Proper irrigation (intervals).
  - Acidifying through irrigation.
  - The future: Genetic Engineering (the Tachyplesin gene)

Pest and diseases

O.M.V (Ornithogalum mosaic virus)

- The disease is characterized by dark and bright green spots and causes dwarfing and plant distortion.
- The disease is transmitted to the following generations mainly via vegetative propagation of the plant.
- It is crucial to create virus free plant material via seeds and tissue culture.
- Recently a method has been developed to gain tolerance against the virus by “silencing” it on the RNA level.

Pest and diseases

- Pests:
  - Aphids
  - Spodoptera littoralis (Prodenia)
  - Spider Mites
  - Nematodes
  - Rhizoglyphus (in bulb storage)
- Diseases caused by fungi:
  - Phytium
  - Rizoctenia
  - Fusarium
  - Powdery Mildew
  - Hetrosporium
  - Aspergillus (in bulb storage)

Physiological challenges

- Temperatures of over 28°C during the germination stage may cause distorted inflorescence
- A "Bull Head" inflorescence may occur in all varieties
- In PRINCE STAR™ and Yellow STAR™ distortions may also include an “empty” inflorescence and split and curved stems
- Correct use of shade nets and germinations stage will reduce this phenomenon

Physiological

Foliage distortion in **YELLOW STAR™**

Commercial Varieties

YELLOW STAR™

- Previously code 608
- Intense Yellow colored flowers
- Average stem length 55cm
- Inflorescence ~ 20-40cm
- Medium-low sensitivity to Erwinia
- Approx. 160 days till flowering
- Yield above 2 stems per bulb

Commercial Varieties

WHITE STAR™

- White colored flowers
- Solid and upright stems
- Average stem length ~ 50 cm
- Long inflorescence ~ 30 cm
- Relatively tolerant to Erwinia
- About 150 days until flowering
- Yield ~ 1.5 stems per bulb

Commercial Varieties

PRINCE STAR™

- Previously code 701
- Light Orange colored flowers
- Average stem length 60cm, remains long all flush
- Inflorescence ~ 20-40cm
- Medium-low sensitivity to Erwinia
- Approx. 160 days till flowering
- Yield above 2 stems per bulb

Thank you :)