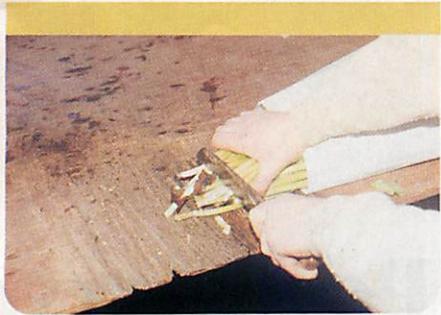


Armstrong 2001



After bunching, tulips should be trimmed and then placed in clean, cold water.

tulips with the bulb still attached, especially if they have to be stored over a weekend, so that the flower continues to be provided with food.

It is also possible to delay harvesting time by lowering the greenhouse temperature to 5°C for a maximum of 7-10 days at any stage in the plant development. It is then brought back to the original temperature. Lowering the temperature does, however, cause a large increase in the relative humidity in the greenhouse and thus must, at all costs be kept below 80%, for example, by ventilation.

Tulip plants should be dry when harvested to prevent the development of Botrytis (leaf spots). It is also recommended that harvesting is carried out 1-2 times every day to increase uniformity of



Tulips should be stored upright and there should be some slight air movement to prevent the development of Botrytis.

## STABY

the product. The temperature of the flowers should then quickly be lowered to 1-2°C in order to prevent or limit the effects of ethylene, bacteria, fungi and other contaminants on the cut surface of the stem. This limits the flower's rate of respiration and thus consumption of nutritional reserves, and its transpiration rate so that the flower does not become limp and the transport of nutritional reserves to the flower can continue unhindered. Dissiccation can be prevented by keeping the relative humidity high.

Once this temperature has been reached the tulips can be bunched and setting them upright will help prevent the crooked growth of the stems during storage.

### Grading

Grading according to quality and length increases the value of tulips so it is important to ensure that when bunching that the buds are at the same height and that the difference in overall length is no more than 3-5 cm. The rubber band should not be too high and the packaging must not damage the leaves. Also if the bulbs were still attached they should be removed before bunching with a bulb removing machine or clean, sharp knife.

After bunching trim the tulips and put them in clean, cold water (1-2°C) for 30-60 minutes. Then store the tulips, preferably upright at 1-2°C and provide a slight air movement to help prevent the development of Botrytis.

The storage period should be no longer than 1-2 days but if for some reason this must be longer, for example over a weekend then it is advisable to leave the bulb attached to the stem. The longer the tulip has to remain in storage the greater the chance of it suffering from desiccation, presence of ethylene and disease.

Finally the tulips should also be transported at 1-2°C and the tulip sellers should be advised to trim the flowers after their arrival in the shop and put them in water at 1-5°C for several hours and not to have any fruit or other ethylene producing products in the vicinity. ■

## Ethylene blocker

✦ By Helen Armstrong

High levels of ethylene created during the storage of tulips pose a significant problem for bulb quality. Affected bulbs fail to flower and stock bulbs split excessively leading to small daughter bulbs. Normally these bulbs will produce 2-3 daughter bulbs per bulb but ethylene can cause 5-6 daughter bulbs to be produced, all of which are smaller than normal.

The problem is that tulip bulbs are particularly sensitive to ethylene, even at 0.1ppm, and the combination of the bulb and the ubiquitous fusarium fungus found in the bulbs creates high levels of ethylene while they are being stored from July to November (northern hemisphere).

So far the only way to prevent the accumulation of ethylene is to ventilate the storage chambers usually at a

## Commerical

*For a northern hemisphere based company to additionally be able to produce bulbs in the Southern hemisphere brings both market and quality advantages.*

During the last few years many bulb producing companies, particularly Dutch companies have started operations in the Southern hemisphere in order to be able to supply fresh bulbs all over the world throughout the whole year. Being able to supply fresh bulbs in the Spring to growers in Holland gives them a much better quality product than bulbs which have been stored for several months.

New Zealand, South Africa and Chile are all being explored as new production sites although one Dutch company, van den Bos, after trials in



*Hypoaspis aculeifer*, a predatory mite which feeds on bulb mites. (Photo: Koppert BV/Groenten en Fruit).

### Interaction with fungi

Most bulb mite injury is on plant parts beneath the soil surface, but mites have sometimes been collected from lily stems and leaves. In severe infestations bulb mites may even work their way up into the stem. Bulb mite infestations can stunt, distort or even stop plant growth. Mites will injure apparently healthy plant tissue, but infestations develop faster when bulbs are also infected with *Fusarium* or other fungi. In fact, there may be a chemical attraction between bulb mites and bulbs infected by fungi. It is not yet known how important fungi are as food, but mites are definitely attracted to bulbs, corms and tubers infected with fungi. This relationship complicates trying to estimate how many bulb mites it takes to injure a plant. However, if there are over 100 bulb mites per bulb one can assume that there will be some injury visible on leaves and/or stems.

### Management

Management is difficult and the usual method with potted greenhouse crops is to apply an insecticide/miticide or combination of an insecticide/miticide and fungicide. But, bulb mites are resistant to pesticides in several chemical classes. Most products registered specifically for mite control are ineffective. Pyrethroid insecticides are not effective. Most of the effective pesticides are in pesticide classes now under scrutiny by the Environmental Protection Agency: the organophosphates and carbamates.

The best bulb mite control seems to be obtained with the organochlorine miticide dicofol (Kelthane) - generally by soaking bulbs in a suspension of the pesticide for 30 minutes before planting. Drenches of Kelthane after planting are

not as effective, but do help.

The relationship between bulb mites and fungi complicates control of plant pathogens as well. Research done at the University of Minnesota found that controlling plant pathogens with fungicides was only possible when bulb mite infestations are low. Therefore, the bottom line is that bulb mites and plant pathogens must be managed together. The question is, how?

Alternative controls include hot water treatments (soaks and vapor) and biological control. Hot water treatments have been successful at mite control, but unfortunately have also injured bulbs. Perhaps someone ought to try a drench of a pesticide in water that is just below the temperature for bulb injury.

Predatory mites in the genus *Hypoaspis* feed on all stages of bulb mites. *Hypoaspis* mites also are effective predators of fungus gnats and thrips transformation stages, so introducing these mites at the beginning of a crop, or as soon as pots are brought into the greenhouse from the cool storage facility could help keep bulb mites below damaging levels. Fungicide drench applications for plant pathogen control could still be applied. If further research shows that *Hypoaspis* mites can control bulb mites, this would be the preferred management method. ■

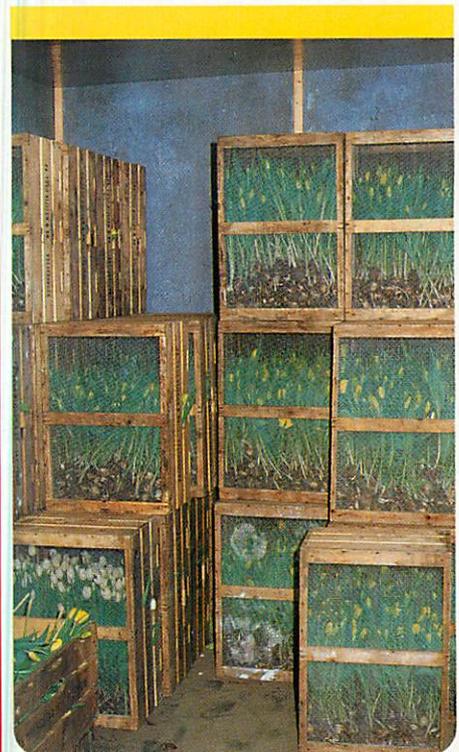
*Information in this article is from a number of sources, but it comes mostly from the most recent review of bulb mites entitled, "Biology, ecology, and management of the bulb mites of the genus Rhizoglyphus (Acari: Acaridae)" by Diaz et al. was published in 2000 in Experimental and Applied Acarology, Volume 24: 85-113.*

# Post harvest tulip care

*Cutting off tulips from their nutritional supply will cause them to rapidly deteriorate unless they are treated properly.*

*By the International Flower Bulb Centre, The Netherlands*

If flowers are harvested before they are sufficiently mature the plant will not have time to lay down nutritional reserves in the stem and it will be impossible to produce satisfactory flowering. Thus, in some cases it may be better to harvest



*If tulips have to be stored over a weekend it may be better to harvest them with the bulb still attached so that the flower continues to receive food.*

## eliminates need for ventilation during storage of tulip bulb

rate of 100m<sup>3</sup> /m<sup>3</sup> of bulbs/hour. No other crop requires such a large quantity of fresh air but because there are no cheap methods of measuring the amount of ethylene gas given off, maximum ventilation rates must be imposed as a precaution. Bearing in mind that a constant temperature must also be maintained the energy costs associated with tulip bulb storage are extremely high.

Now an alternative procedure has been developed although approval in many countries is still awaited. It is based on a gas which blocks the receptors to which ethylene binds. Dutch researchers at the Laboratory for Flower Bulb Research, in Lisse, have found the gas, code-named EB-01, to be harmless to people but especially effective in preventing damage to the bulbs.

"It is a chemical gas which has a similar molecular structure to ethylene. It binds to the ethylene receptors on the bulb preventing the attachment of ethylene.

"We have been working with it for several years and the results are very good," said Henk Gude, of the research laboratory.

"When we pre-treat bulbs for 12-24 hours with 1 ppm of CB01 the tulip bulbs are completely insensitive to high levels of ethylene (200ppm) for 10-12 days. Repeating the treatment can extend the insensitivity," he said,

### Registration

Although the gas appears to be effective it must still go through the long drawn out process of registration in Europe which is being implemented by the multinational company, Rohm & Haas. Also, it is

important that when the gas is available it is affordable so that the producer receives both economic and quality advantages.

It is already registered in the USA where it is used as a pre-treatment for cut flowers, especially carnations which are particularly susceptible to ethylene. The only other pre-treatment currently available is silver thio-sulphate.

Another application for the gas will be to use it when transporting bulbs by sea container where the ventilation possibilities are limited.

In addition to pretreating cut flowers the gas can also be used to enhance quality of pot plants during transportation. Often this involves several days in a dark truck which stresses the plants causing them to produce ethylene which leads to flower and leaf fall. ■

## advantages of setting up in Chile

many countries has found Chile to be the best for it. Production here is allowing the company to supply a year-round programme for growers, which means a better service for customers and due to the better quality, better margins for the company.

One of the major advantages of working with a company in Chile is the ability to supply high quality bulbs to Japan and the USA, the world's first and second largest consumer's of lilies in the world. Even the South American market is growing as more people are willing and/or able to buy flowers. Buyers in the USA appreciate the quality guarantee and are prepared to pay a premium price for it. Also, according to van den Bos, because more and more flowers are sold to supermarkets, growers have to supply good quality all year round or risk being squeezed out of the chain. Conversely quality guaranteed products should not only maintain sales but also cause them to rise.

### Adapting Dutch technology

Van den Bos, through Pacific Flowers has already set up supply programs to customers in the US with supply of Dutch, French and Chilean bulbs coming mostly from Chile. The company is hoping to extend the program to Japanese customers. The European market is not the first priority due to high transport costs and Chilean bulbs would need to be planted in greenhouses under lights which would mean higher production costs even though these bulbs are reliable and secure.

Pacific Flowers was founded in 1991 and now has operations in Olmue, Canete, Puyehue.

Olmue has 10 ha of greenhouses in which mainly lilies and tulips are grown as well as chrysanthemum, allium and nerin. With modern techniques for temperature and climate control the site produces over 6.4 million stems per year, virtually all of which is sold through Duamex Inc, of the USA, the

country's largest lily wholesaler.

Canete is the company's central site for the production for bulbs, with more than 152 hectares and advanced techniques and machinery. The company works with small growers, who are bonded together in a cooperation, to whom PF outsources a large part of the work. A small area of the land belongs to VDB which enables it to increase the delivery of bulbs and also to secure the plantation of new varieties planned for the coming years.

A 74 ha site in Puyehue produces flowers and bulbs, mainly tulips and peonies. Here a cooperation is also active in order to provide services to PF. The company has been active for four years adapting the bulbs to another hemisphere, by incorporating the technology of the Dutch market. ■

# Currency and competition depress Israel's growers

*Israel is still managing to maintain its supply of cut flowers for export despite a fall in the number of producers, adverse currency exchange rates and a sharp rise in production costs. However, the number of growers is expected to decline further and others are being forced to undertake new strategies.*

By Aaron Priel

Exports of Israel's cut flowers always peak in December to meet the Christmas and New Year demand and the year 2000 was no exception. Between 65 million and 70 million stems were flown out of the country during a two-

week period. This was the same quantity as in 1999, despite the sharp decline in the number of growers and the shortage of workers due to the outbreak of hostilities in the region. The flower sector remains Israel's largest agricul-



*Gypsophila is one of the most popular flower crops in Israel but many growers are moving to new cultivation areas to take advantage of climatic conditions which are suitable for new crops.*

## Israel's top export cut flowers

	Quantity 2000 (million stems)	1999/2000 (change in %)
Roses	450	-5
Solidago	130	-20
Greens	125	+3
Gypsophila	115	-27
Standard Carnation	80	-23
Wax Flower	75	-3
Ruscus	75	-9
Anemone	40	+8
Gerbera	40	-15
Limonium	35	-20
Asc. Tuberosa	32	-8
Leuca "Safari Sunset"	28	+10
Hypericum	25	-32
Helianthus	20	-40
Aster	15	-40
Lilium	15	-10
Anigozanthos	14	-20
Trachelium	14	-15
Ornith. "Dubium"	12	-10
Lisianthus	12	+15
Others	150	-10
Total	1,502	-8

Source: The Flower Board of Israel, December 2000

tural exporter and it is forecast to export 1.5 billion flowers during the 2000/2001 season, but this is a drop of 8% compared with the previous year.

According to the Flower Board of Israel, the number of active growers in 2000/2001 fell to 1,621, compared with 1,957 in 1999/2000 and 2,213 in 1998/99. This is largely attributed to an increase in the size of individual farms, an upgraded level of professionalism, the promotion of direct deals between growers and overseas

clients, the introduction of new crops and the move to new cultivation regions, specifically from the country's central region to its southern areas. This last point indicates a new approach to cultivation strategy, according to Yaakov Sitton, general manager of the Flower Board of Israel.

He said that the move from the central region to the southern region - the Negev and the Arava - "is a process by which the flower cultivators take full advantage of the climatic and topographical

## Export of Plants and Propagation Material

	Quantity 2000 ('000 pieces)	1999/2000 (change in %)
Pot Plants	2000	+1.5
Propagation material	170,000	+7.5
Flower bulbs	85,000	+4.5

Source: The Flower Board of Israel, December 2000