Allium Crops –
General Information

All classified in the Alliaceae (historically Amaryllidaceae) family and the Allium genus
Cultivated types mostly Asian in origin but found throughout the northern hemisphere
Center of origin in Afghanistan and Pakistan, secondary center in the Mediterranean

Species preference is often culturally influenced:
- Onion – worldwide acceptance and use
- Garlic – Asian, especially Korean
- Leek – western Europe
- Bunching onion – China and Japan
Source of flavoring, not a major contributor to calories or nutrition in most cultures
Allium Crops – Cultural Information

All are considered to be cool-season, hardy crops but grow in many climates
Most are frost tolerant during early growth, less so during vegetative growth and maturation
Most species are easy to produce
Most bulbing species can be stored without sophisticated facilities

Allium Crops – General Management

Climate – Best quality with abundant sun and dry weather in late development
Soil – grow in many types of soil, but best quality bulbs are produced on light soils
Fertility – considered heavy feeders, especially P
Often transplanted in market-garden and subsistence production
Extended storage feasible and common for bulbing species

Onion

Taxonomy

Monocotyledon
Family: Amaryllidaceae (Alliaceae)
Genus and species: Allium cepa
Related species: wild onion, garlic, leek, members of the lily family
**Domestication**

Originated around Iran and West Pakistan
Parental wild types unknown
Used by ancient Egyptians, 3200 BC
Spread to India in 600 BC
Written about by the Greeks and Romans
Brought to American by 1600 AD

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**Use and importance**

Greek historian Herodotus wrote that 9 tons of gold were used to purchase onions to feed the builders of the Egyptian pyramids
Widely used to flavor other foods
Historically considered important medicinally
(ward off evil spirits, remove warts, lower blood pressure, prevent infections, prevent acne, help kidney function)

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**Major producing countries**

- China: 3,800,000 mt
- Russia: 2,500,000
- India: 2,480,000
- United States: 2,168,000
- Turkey: 1,300,000
- Japan: 1,274,000
- Spain: 1,008,000
Onion

Genetics and breeding

Hybrid varieties dominate production in US, Europe, Japan
Hybrids using male-sterile cytoplasm are common (sterility genes that are not nuclear) created by planting a sterile parent next to a fertile parent

Onion

Varieties

Include bulb types, bulbing green types, and non-bulbing green types
Bulbing:
Spring-seeded types, fall-seeded types
Bulbing green types
Any bulbing variety harvested early
Non-bulbing types
A. fistulosum or hybrids, include related perennial species

Onion

Varieties

Classed by photoperiod needed for bulb growth (all are “long day” plants)

Short day – 12 to 13 hour  subtropical
Intermediate – 13.5 to 14 hour  warm temperate
Long day – 14.5 to 15 hour  temperate
Very long day - >16 hour  cold temperate
Daylength effect modified by temperature – complicated by flowering response

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Short days (11 hr)</th>
<th>Long days (15 hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High temperature: 21°C (60°F)</td>
<td>No bulbing: No floral initiation (prolonged)</td>
<td>Rapid bulbing: No floral initiation (promoted)</td>
</tr>
<tr>
<td>Low temperature: 10°C (50°F)</td>
<td>No bulbing: Floral initiation (slow)</td>
<td>No bulbing: Floral initiation (fast)</td>
</tr>
</tbody>
</table>

Source: Adapted from Brewster (1977).

FIG. 17.2 Soil temperature effect on onion (Allium cepa) bulb shape. From Yanivitch et al. (1979).
Onion

Bolting (going to seed)

Induced by vernalization
Modified by genetic background, stage of development
Caused by daytime temperatures below 50F
Greater incidence of cool days increases bolting
Modified by age and size of plant
Older plants more prone to bolting

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Onion

Production – Climate and soils

Benefits from a climate with dry fall weather – aids in curing and harvest preparation

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Onion

Propagation

Grown from seed (preferred), transplants, or bulbs
Bulbs are grown in nursery beds, harvested, stored dry
Vernalized bulbs are utilized for seed production
Onion Production – Diseases and Pests
Onions are prone many disease and pest problems
- Fungal leaf diseases
- Storage rots
- Onion maggots
- Leaf feeding insects
- Nematodes
- Weeds (lack competitive nature)
Heavy use of pesticidal compounds is common in modern-intensive production systems

Onion Harvest Preparation
Curing essential (3-4 weeks)
Best under dry conditions, ambient temps (field or ventilated storage)
Curing is complete when necks seal, scales dry
Topping is completed by hand or mechanically

<table>
<thead>
<tr>
<th>Table 11</th>
<th>Effects of Curing on Storage Losses of Onions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method</td>
<td>77 days</td>
</tr>
<tr>
<td></td>
<td>Weight loss (%)</td>
</tr>
<tr>
<td>No curing</td>
<td>11.8</td>
</tr>
<tr>
<td>Artificial curing</td>
<td>6.3</td>
</tr>
<tr>
<td>Field curing</td>
<td>6.1</td>
</tr>
<tr>
<td>LSD at p = 0.05</td>
<td>3.3</td>
</tr>
</tbody>
</table>

*All units after first month.
NS = Not significant.
Source: Ref. 19E.
Onion

**Storage of bulb onions**

Optimal at 32 degrees and 65-75% RH
Can be stored for 5-6 months (if free from rot problems)

Onion

**Aspects of Modern-Intensive Production**

Management tends to be chemically intensive
Herbicides for weed control
Soil and foliar insecticides
Fungicidal treatments for rot control
Maleic hydrazide for sprout inhibition

Onion

**Aspects of Modern-Intensive Production**

Mix of mechanized and hand operations
Mechanized seeding, cultivation, harvest
Hand labor for transplanting, topping
Aspects of Modern-Intensive Production
Storage
Maleic hydrazide used for sprout control
Fungicidal dips or powders often used for rot control

Aspects of Organic Market Garden Production
Green bunching onions are excellent subjects for organic production and farmer’s market sales.
Bulbing onions produced for sale from storage are much more difficult to manage under organic or minimum input market garden conditions.

Aspects of Organic Market Garden Production
Major issues in organic production include:
Weed control (season-long)
Insect control (especially onion maggot)
Storage rot diseases (pink root, neck rot)
Onion

Aspects of Organic Market Garden Production

Weed control
- Select fields free of perennial weeds
- Rotate with cover crops and green manures
- Soil solarization
- Eliminate early weeds before planting
- Hand weeding (careful to avoid damage)

Insect control (onion maggots)
- Fall plowing
- Long-term crop rotation
- Isolation (1 mile) from previous production fields
- Sanitation (eliminate all crop waste)

Disease Control (storage rots)
- Long-term rotation
- Resistant cultivars
- Furrow irrigation
- Sanitation (elimination of crop waste)
**Onion**

**Major Problems in Subsistence Production**
- Lack of suitable varieties
- Lack of high quality seed
- Premature bolting
- Need for high levels of fertilizer & irrigation
- Poor storage potential

**Garlic**

**Use and importance**
- Minor crop with respect to production
- Used primarily as a condiment and flavor additive
- Historically used to mask flavor and odor of aged and salted meats

**Garlic**

**Major producing countries**
- China: 3,012,000 mt
- South Korea: 647,000
- Spain: 400,000
- India: 229,000
- Egypt: 200,000
(31,000 acres in U.S., nearly all in California)
Garlic

Varieties
Many varieties. Adapted to localized conditions, regionalized preferences for size, color, flavor
Two types:
Hardneck or bolting: closely related to wild garlic, do not store as well, hot and spicy flavor
Softneck or non-bolting: store well, mild flavor, most U.S. production (California Late, California Early)

Garlic

Propagation
Vegetatively propagated from cloves Seed cloves stored over-winter at 45 degrees Seed clove size regulated using close spacing Usually planted in the fall (vernalization)
Garlic

Adaptation to Production and Marketing Systems

Garlic has few of the disease and insect problems of onions
Good subject for market garden and subsistence agriculture
Market base tends to be ethnic in nature

Leek

Botany

Differs from onion in 3 significant ways:
Limited ability to form bulbs
Has flattened rather than rounded leaves
Leaves are not hollow
Tops are much larger than those of onions
Leek Production
Planting practices depend on market preference for blanching
Blanched:
  Labor intensive (appropriate for market gardens)
  Transplant into trenches 10-15 in deep
  In-row spacing of 2-4 in
Non-blanched:
  Seed (1/4 in deep) or transplant in 15 in rows

Leek Production
Blanching
Used to lengthen and whiten the lower stem
Accomplished by filling planting trenches or hilling around plants when fully grown

Planting blanched leeks
Hilling of leek for blanching

Shallot

Taxonomy, Origin, and Botany

Species: Allium cepa var. ascalonicum
Same species as onion and thought to be a genetic variant of the cultivated onion
Also known as (or similar to) the multiplier onion
Originated in western Asia, known from antiquity
Produces clusters of bulblets, but no common membrane

Chive

Description

Perennial (not evergreen) relative of onion
Species: Allium schoenoprasum
Used by the ancient Greeks and Romans
Clump growth habit with numerous thin, hollow leaves 6-10 in long
Only leaves are used as food
Used as an herb for flavoring many foods
Chive

Production
Excellent market garden subject
Amenable to container and greenhouse production
Treated as a perennial
Planted in the fall for spring production
Continuous harvest essential to maintain vigor
Varieties:
  - Common – mild flavor
  - Garlic – stronger, garlic-type flavor

Other minor Alliums

Chinese chive
Species: Allium tuberosum
Has flat, gray leaves, the edible portion
  (which includes the flowers)
Used as a seasoning for meat, stir-fry
Grown as a perennial
Production systems similar to chives
Stores for only 2-4 days at 32-34 degrees

Other minor Alliums

Japanese bunching onion
Species: Allium fistulosum
Important in China, Japan and Korea
Perennial crop grown as an annual
Very similar to leek in growth, use, and
  production (round leafed)
Often produced with blanched stems
Other minor Alliums

**Rakkyo**
Species: Allium chinese
Important in China and Japan
Use for fresh consumption or making pickles
Similar to shallots in growth habit (clusters)
Usually produced on sand dunes for best quality (low fertility)

Other minor Alliums

**Egyptian onion** - Allium cepa
similar to multiplier onion

**Kurrat** - Allium ampeloprasum
similar to leek but smaller

**Elephant garlic** – Allium ampeloprasum
Leek-like plant produces bulb similar to garlic

**Pearl onion** – Allium ampeloprasum
leek-like plant that produces a small garlic type bulb