

Vegetable Crops–PLSC 451/551
Lesson 15, Onion & other Allium

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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

Allium Crops –
General Information

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




Onion



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

Onion



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)

Onion

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

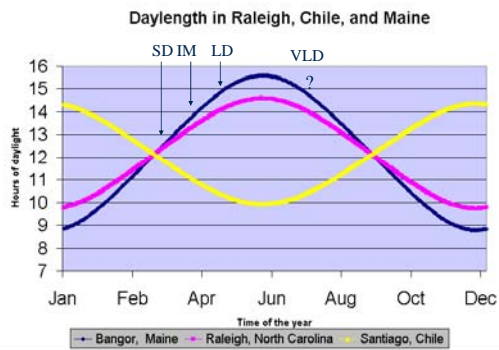
Varieties

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



Bulbing time for daylength onion classes in Maine



Daylength effect modified by temperature – complicated by flowering response

TABLE 17.1. PHOTOPERIOD AND TEMPERATURE EFFECT ON ONION BULBING AND FLOWERING

Temperature	Photoperiod	
	Short days (11 hr)	Long days (15 hr)
High temperature: 21°C (70°F)	No bulbing: No floral initiation (no emergence of previously formed initials)	Rapid bulbing: No floral initiation (previously formed initials - destroyed)
Low temperature: 10°C (50°F)	No bulbing: Floral initiation (slow bolting)	Bulbing: (Floral initials formed can emerge) No bulbing: Floral initiation (rapid bolting)

Source: Adapted from Brewster (1977).

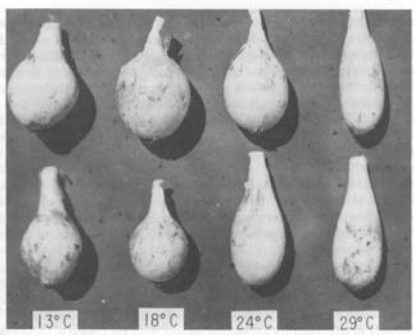



FIG. 17.2. Soil temperature effect on onion (*Allium cepa*) bulb shape. From Yamaguchi et al. (1975).

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



Onion

Production – Climate and soils


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



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 11 Effects of Curing on Storage Losses of Onions

Method	31 days		63 days		87 days	
	Weight loss	Rot (%)	Weight loss	Rot (%)	Weight loss	Rot (%)
No curing	11.8	76.7	a	a	a	a
Artificial curing	6.3	12.3	10.8	16.3	13.2	24.8
Field curing	6.1	20.0	11.2	23.3	14.5	36.5
LSD at $p = 0.05$	3.3	14.9	NS	NS	NS	NS

^aAll rotted after first month.

NS = Not significant.

Source: Ref. 10B.

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



Onion

Aspects of Modern-Intensive Production

Storage

Maleic hydrazide used for sprout control
Fungicidal dips or powders often used for rot control



Onion



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.

Onion



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)

Onion

Aspects of Organic Market Garden Production

Insect control (onion maggots)




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

Onion

Aspects of Organic Market Garden Production

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



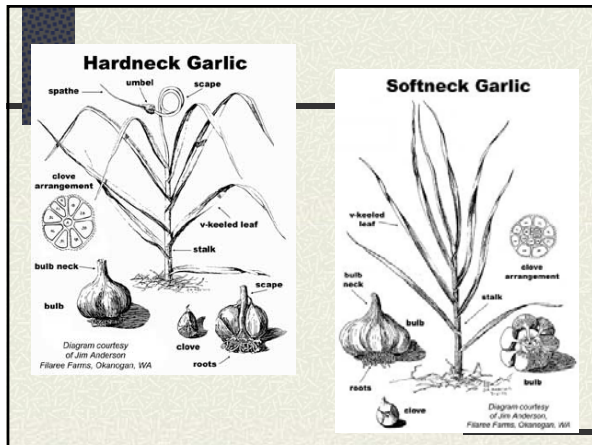
Varieties

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



Onion



Leek

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 leaved)
Often produced with blanched stems

Other minor Alliums

Rakkyo

Species: *Allium chinense*

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
