

LECTURE 10: BULB VEGETABLES

Included in this group are:

- ✚ Onion - *Allium cepa* var. *cepa*
- ✚ Shallots/Multiplier onion - *Allium cepa* /*Allium ascalonicum*/ *A. aggregatum*
- ✚ Leeks - *Allium ampeloprasum/porrum* or var. *porrum*
- ✚ Garlic - *allium sativum* (313)
- ✚ Japanese bunching onion *Allium fistulosum*
- ✚ Rakkyo - *Allium chinense* (china)

Alliums-Genus

- ✚ **Characteristic onion smell/odour**
- ✚ **Biennials grown as annuals**
- ✚ **Bulbs are the storage organs**
- ✚ **Leaves arise from underground stems with long sheathing bases-give stem appearance-pseudostem**
- ✚ **Weakly competitive**

Onions (*Allium cepa* var *cepa*)

Classification, origin and History

- ✚ Belongs to *Alliaceae* family (formerly *amaryllidaceae* and *liliaceae* families)
- ✚ There are about 300 widely scattered species in the genus *Allium* and many of them have the characteristic onion flavour and odour
- ✚ Onion has been used by man as far back as history records (3500 BC)
- ✚ The cultivated species are probably native to the general area of S/E Asia
- ✚ The ancient Egyptians thought highly of them and were used as offerings to their gods
- ✚ Large quantities were eaten, used as medicine and mummification
- ✚ The Romas gave the name onion deried from the Latin word unionem or unio meaning single-referring to the single bulb

Botanical description

- ✚ A half hardy biennial herb, normally grown for its bulb as an annual and only carried forward into a second year when seeds are required
- ✚ Bulb-truncate formed from thickened leaf bases (sheaths) outer layers are thin and fibrous
- ✚ Leaves alternate, and are produced from a flattened conical basal stem, they are cylindrical and and leaf blades are hollow
- ✚ Flowers are greenish white
- ✚ Seeds are smooth black, wrinkled when dry
- ✚ Stem- cone shaped from where leaves arise

Climatic/Environmental requirements

- ✚ Cool season crop that will grow well over a wide range of temperatures optimal temperatures are 13-29°C
- ✚ Onion plant performs well(quantity and quality) when temperatures are cool during the early stages and warm temperatures towards the end of the growth period.
- ✚ Adry atmosphere at harvest is desirable to obtain satisfactory curing of the bulbs

- ✚ Requires high moisture during the vegetative growth, does well under irrigation
- ✚ Altitudes above 300 m asl
- ✚ Temperature and photoperiod affects flowering and bulbing
- ✚ Bulbing is the process of swelling of leaf bases, cessation of leaf primordial initiation
- ✚ Bulbing mainly affected by daylength, the required daylengths depends on varieties/cultivars
- ✚ Onion is a LDP with respect to bulbing, premature bulbing can occur at longer daylengths
- ✚ Tropical cultivars (9-12 hrs), temperate cultivars 15-16 hrs
- ✚ Temperature is vital in flowering-vernalization-initiate and daylength affects development of flowerstalk.
- ✚ When selecting cultivars consider daylength requirement
- ✚ **Soils:** onions can grow in practically all types of soil but prefer sandy loam, alluvial clay soils, friable, fertile, well supplied with humus and well drained, Ph 5.8-6.8

Cultivars

- ✚ Classified according to: daylength requirement, bulb colour and maturity period
- ✚ Cultivars grown in Kenya
 - Red bulbing varieties -red creole, Bombay red, red Tropicana
 - White bulbing varieties-white creole, Texas Grano and Tropicana F1 Hybrid
 - Yellow cultivars: yellow BERMUDA-does not store well, has mild flavour ideal for salads
 - Green bunching onion-non bulbing spring onion

Propagation:

- ✚ Onion is normally transplanted but can also be directly sown. Ensure proper seedbed preparation into pulverized and smooth
- ✚ Do not sow seed deep
- ✚ Planting can also be done from sets
- ✚ Spacing 30x10 cm
- ✚ If direct seeding, the thinnings are used as spring onion

Cultural practices

- ✚ **Weeding and Earthing up**-sensitive to weeds since it has very small amount of foliage and sensitive to weed competition and has shallow roots
- ✚ **Moisture:** moisture supply at bulbing stage is very critical. It needs plenty of water for retranslocation of assimilates to the leaf sheaths
- ✚ **Fertilizers:** The onion responds well to fertilizers, 200kg/ha of TSP when planting or transplanting; 6 weeks after transplanting top-dress with N fertilizer 100kg CAN/ha; manure 10-20 tons/ha. N promotes leaf growth and may delay the bulbing process and cause thick necks or bull necks which lowers the quality of the bulbs

Harvesting:

- ✚ Can harvest during green stage when the seedlings are about to bulb as spring onions

- ✚ It can be done at maturity stage when the tops fall over(maturity index)
- ✚ Harvest a crop stand when 25-50% of the tops have fallen over-curing
- ✚ In cool weather wait till >75% of the plants have their tops fallen
- ✚ Pull the plants and leave them to dry in the field in windrows for about 14-20 days when there is no rain to avoid sprouting
- ✚ Yields of 15-20 tons/ha, USA 40 tons/ha have been reported

Application of sprout suppressant:

- ✚ Chemicals applied to prevent sprouting. Maleic hydrazide can be applied when 50% of the tops have fallen over before harvesting and this will prevent sprouting in storage

Grading and packing

- ✚ Remove the tops, clean and grade according to size

Storing:

- ✚ Cultivars vary considerably in their storage characteristics
- ✚ Onion bulbs can be stored at 0°C and low R/H 65-75% and with adequate ventilation, can store for 6.5 months

Pests and Diseases

Pests:

- ✚ **Onion thrips (*Thrips tabaci*)**
 - The most important onion pest
 - Feeds at the base of the plant within the leaf sheaths
 - Infested leaves have sunken, silvery patches
 - When severe the entire plant appears silvery and later the leaves wither, dry up and die.
 - Hot dry weather favours a rapid increase in thrips numbers
 - Control- spray with Dimethoate, cabaryl etc

Diseases

- ✚ **Downey mildew-*Peronospora destructor***
 - Lesions are formed near tips of older leaves and can be seen as elongated yellowish patches covered in a purplish-grey web of fungus
 - The leaf tip shrinks and death of the leaf proceeds towards the base and extends to younger leaves
 - Dithiocarbamate fungicides such as zineb and Dithan M45, use resistant red varieties
- ✚ **Purple blotch (*Alternaria porri*)**
 - Initially small white spots on the foliage, which under moist conditions rapidly increase to produce large purplish blotches often surrounded by a yellow to orange border. The lesions then become covered with a sooty deposit of spores. The infection may spread to the bulb. **Control:** crop rotation, field hygiene use fungicides like benomyl

Neck rot: *Botrytis allii*

- ✚ A seed borne disease of bulb onions during storage
- ✚ Infection occurs at the neck or in the wounds on the bulbs during harvest
- ✚ Greyish mold on the surface of the infected area.
- ✚ Bulbs often decay while in storage or in transit

- ✚ Proper curing and storing, bulbs should be well dried especially at the neck
- ✚ Plant health sets

Onion smut (*Urocystis cepulae*)

- ✚ The disease is caused by soil borne fungus
- ✚ Infection occurs only in seedlings before the first leaf has made full growth
- ✚ Onion sets are resistant
- ✚ Seed pelleting with a fungicide like thiram

Onion rust: (*Puccinia porii*)

- ✚ Rust occurs on leaves as brown spots, control y using Triadimefon

Uses and composition

- ✚ Bulbs are usually boiled in soups and stews, fried or eaten raw.
- ✚ Leaves are also used in salads particularly of the spring or bunching onion
- ✚ In some tropical areas, onions have been selected for their dry matter yield and used for dehydration.
- ✚ Protein (1.5%), Ca (30mg/100g, iron 0.5mg/100g, Ascorbic acid 10mg/100g
- ✚ Alliums are characterized by the remarkable sulphur containing cpds that give them their distinctive smell and pungency
- ✚ Volatile flavour compounds
 - Occur in the form of various protein amino acids which include the precursors of the volatile flavour compounds
 - These precursors are odourless, non-volatile amino acids (cystein sulphoxides)
 - When the tissue is ruptured, flavour precursors react under the control of the enzyme allinase to give sulfenic acids +ammonia+pyruvate
 - The highly reactive sulfenic acids once released, proceed to undergo spontaneous rearrangement and inter-reactions to produce a wide range of volatile strongly smelling products
 - Propenyl sulfenic acid produced in onions spontaneously rearranges its chemical structure to form tear inducing thiopropanal S-oxide
 - In garlic allinase catalyses the formation of allcin which gives fresh garlic its characteristic smell
 - Medicinal properties attributed to flavour inducing sulphur compounds

Shallots (*Allium cepa*) \ var. aggregatum/ascolonicum

History

- ✚ The shallot is an ancient universally distributed onion like plant
- ✚ Native of W. Asia

Characteristics:

- ✚ The plant is a perennial that seldom produces seeds
- ✚ Must be propagated by division of its compound bulbs which are made up of several bulblets or cloves held together at the base.
- ✚ The bulbs are not encased by a sheath as is garlic

Uses:

- ✚ The flavour of shallots is somewhat milder than that of onions.
- ✚ The chief use is for flavouring both leaves and cloves being used.
- ✚ Most of the crop is produced for sale in the green state but some dry bulbs are used.

Cultural Practices:

- ✚ Loose sand soils with a high level of organic matter.
- ✚ Plants are very tolerant to high temperatures
- ✚ Spacing 25-30 by 12 – 15cm
- ✚ Excessive N may lead to delayed bulb formation.

Harvesting , grading and packaging (same as onion)

Leeks: (*Allium porrum*\ *empeloprasum*) (GROUP PRESENTATION)

- ✚ Resembles the onion in its adaptability and cultural requirements. Instead of forming a bulb it produces a thick fleshy cylinder like (pseudostem). Leeks are propagated from seeds like onions.
- ✚ Leeks are ready for use any time after they reach the right size, depending on the market demand.
- ✚ Native of Mediterranean region

Botanical Description:

- ✚ A biennial, no bulb formation
- ✚ Leaves flattened, variable in length.

Environmental response:

- ✚ Deeply cultivated soils, well drained, high in organic matter
- ✚ Cool conditions favour optimum growth
- ✚ Day temperatures above 24°C reduce the yield of some cultivars.
- ✚ Spacing 20 x 20 cm
- ✚ Earthing up to 1 – 2 weeks ensure blanching of the leaf basis
- ✚ 200kg \ ha double superphosphate 100kg CAN

Harvesting:

- ✚ Mature plants may be harvested 120 – 150 days from transplanting (25 – 30cm length) Diameter 4-5cm

- ✚ The base of the stalks should be white and the upper part of the leaves should be turgid and green.
- ✚ The upper portion of the leaves should be trimmed with a knife and the outer skin may be removed.
- ✚ Plants are tied in bunches for sale
- ✚ Storage 0°C RH 90-95% store for 28-80 days.
- ✚ Wrapping in perforated film will delay wilting.

Nutritional composition:

- ✚ The swollen, overlapping bases of the leaves are cooked, the upper portions of the leaves are rarely used.
- ✚ Ca mg 70 mg, Fe mg (7.5mg), P 53mg B- carotene (1827)µg, Thiamine mg- 0.07 Riboflavin mg 0.11mg, Niacin (mg) 0.87, Ascorbic acid 29mg

Japanese bunching onion, Welsh, Green Bunching onion, spacing onion (*Allium. fistulosum*)

Introduction

- ✚ Origin: Tropical Asia
- ✚ Grown as an annual herb rarely producing bulbs, basal lateral buds develop to form many offshoots.
- ✚ Leaves are hollow circular in cross section 15-30cm in length.

Environmental and Cultural Response:

- ✚ Well drained loams with high level of organic material
- ✚ Cool season >25°C not conducive
- ✚ Altitude 1000 – 2000 m asl ideal
- ✚ Seeds are sown in containers or in a seedbed and the seedlings transplanted
- ✚ Spacing 30 x 20 or 20 x 20
- ✚ Propagation by division of the basal shoots possible

Harvesting:

- ✚ Harvesting may be spread over a long period by detaching the outer leafy shoots from the main cluster
- ✚ Mature 60 – 120 days from planting

Packing:

- ✚ The leaves should be turgid crisp, clean and free from discoloration.
- ✚ The roots should be trimmed, without damaging the condensed stem base before the plants are tied into bunches.

Use and Nutritional Composition

- ✚ The leaves are used as flavouring in soups or eaten raw as salad.
- ✚ Composition: Protein (1.8%), Ca(40mg/100g fw), Fe(3.0 mg/100g), B- carotene(328µg/100g, Vit C(50mg/100g)