SPINACH

Objectives: Spinach or English Spinach or Vilayati Palak is the most important potherb or leafy vegetable grown in winter season. The word spinach actually comes from Spanish word Hispania. The shape of the leaves is quiet different from that of Palak. The edible parts consist of the compact rosette of leaves prior to the elongation of central bud in flower stalk formation. It is purely a cool season plant and is dioecious in nature. It is having two types of varieties viz. prickly seeded and round seeded. The present chapter will make the students understand with its importance, production technology, seed production practices and plant protection measures.

SCIENTIFIC NAME : *(Spinacia oleracea L.)*
COMMON NAME : Vilayati palak, Angreji Palak
CHROMOSOME NUMBER : 2n=2x=12
FAMILY : Chenopodiaceae
CENTRE OF ORIGIN : Iran

USES:

- Traditionally spinach or vilayati palak is classified as a pot herb.
- The edible part of spinach is a compact rosette which is normally consumed as a cooked vegetable.
- Sometimes, it is also used as salad along with lettuce and other vegetables.
- Spinach is highly suitable for hydroponics.
- Spinach is also processed, primarily canned and fried.
- Leaves of spinach are rich in vitamin-A (9300 IU) and contain considerable amount of iron and calcium.
- Spinach produces a seed stalk easily in response to low day and night temperature.
- Spacing and environmental conditions influence leaf number and size.
- The margins are smooth or wavy, surface is also variable ranging from smooth to heavily of savoy.
- The blistered appearance of savoy tissue results from differential growth of parenchyma tissues between the leaf veins.
- Spinach is classified as a dioecious plant, however, rarely some monoecious plants may develop in certain cultivars.

There are 4 sex forms in spinach.

Extreme males:

- These produce only staminate flowers with minimum foliage.
- Small with very little vegetative development and tend to bolt quickly.
- This plant type flowers early and die soon after flowering.
- Eliminate the extreme males from commercial strains by selection.

Vegetative males:

- These produce only staminate flowers, more foliage and flower later than extreme males.

Female plants:

- These produce only pistillate flowers and have well developed foliage with very late tendency to flower.
- Gibberellic acid plays an important role in sex expression of spinach.
- Female and vegetative male plants are preferred because they are larger, slower bolting and higher yielding.
- Pollination is mostly by wind.
- Fruits usually an achene, the fertilized ovary form a one seeded fruit called utricle. Parthenocarpic fruits also occur in spinach.

Vegetative males and females are slower to flower and produce considerably more foliage, making them the preferred plants type for commercial cultivation.

Monoecious plant:

- These produce staminate and pistillate flowers, well developed foliage and are slow to flower.

There are two types of seeds:

1. Smooth round seeded types (considered as summer type)
2. Irregularly prickly shape (considered as winter type)

CULTIVARS AND HYBRIDS

Cultivars may be either smooth seeded or prickly seeded and smooth leaved or Savoy leaved.

Cultivars may be classified as:

A. Leaves heavily savoyed

i) Plants late seeding

a) Leaves blue-green
b) Leaves dark green

ii) Plants not late seeding

a) Plants very late seeding
b) Plants medium early seeding

B. Leaves not savoyed (or slightly savoyed in cool weather)

i) Plants early seeding

a) Seeds prickly
b) Seeds not prickly

ii) Plants not early seeding

a) Seeds prickly
b) Seeds not prickly

I. Leaves blue green

II. Leaves medium green

Cultivars may be classified into 3 groups as:

A. Round-seeded

1. Smooth-leaved (or slightly savoyed in cool weather)

i) Early bolting or not long-standing
ii) Slow bolting or long-standing

2. Savoy-leaved

i) Early bolting or not long-standing

(a) Mosaic resistant
(b) Not mosaic resistant

ii) Slow bolting or long-standing

B. Prickly seeded

1. Smooth-leaved (or slightly savoyed in cool weather)

i) Early bolting or not long-standing
(a) Mosaic resistant
(b) Not mosaic resistant
ii) Slow bolting or long-standing

2. Savoy-leaved

i) Early bolting or not long-standing
(a) Mosaic resistant
(b) Not mosaic resistant
ii) Slow bolting or long-standing

Cultivars may also be classified into 3 groups on the basis of leaf type as:

i) Savoy
ii) Semi-savoy
iii) Smooth

- Prickly seeded cultivars are suitable for winter autumn sowing in hills while smooth leaved are suited for spring summer cultivation in hills and autumn sowing in plains.
- Round leaved cultivars are seeded in hills in summers and autumn sowing is done in plains.
- Round seeded varieties perform well in the plains whereas, prickly seeded grow better in hills.

Spinach varieties commonly grown in India are:

Virginia Savoy

- Prickly seeded cultivar having blistered large dark green leaves with round tips.

- Plants are upright and vigorous in growth, average yield 100-125 q/ha

Early Smooth Leaf

- Smooth leaf type and smooth or round seeded.
- Leaves are small light green with a pointed apex.

Long Standing

- Dark green thick leaves triangular in shape with a pointed apex.
- Slow in growth, average yield 100-125 q/ha

CLIMATE

- Spinach is strictly a cool season vegetable.
- It does not grow well during hot weather.
- Spinach growth is best at temperature of about 18-20oC.
- Spinach is a short day plant and the growth is slow at 10oC.
- Acclimated plants can tolerate freezing temperature up to -10oC.

SOIL AND FIELD PREPARATION

- It can be grown on a wide range of soil types however soil having high moisture holding capacity and good drainage are preferred.
- Plants have some tolerance of salinity and favorable pH range is 6.5 to 7.0.
- Soil should be ploughed thoroughly two or three times followed by harrowing.
- Planting should be done to ensure uniform irrigation.

SOWING, SEED RATE AND SPACING

- Spinach can be sown round the year in different agro-climate conditions of the country.
- The different sowing times are as follows:
- In plains : September-October
- In low hills : July-November, February-March
- In high Hills : March-June and September
- In spinach, 50 per cent of the plants turn out to be male with poor growth and such plants cannot be removed till the time of blooming.
- Hence a higher seed rate of 37-45kg/ha is required.
- Seeds are either broadcasted or line sown.
- However, line sowing is preferred for the convenience in intercultural operations.
- Row to row spacing is maintained at 30 cm and plant to plant at 10-12cm.

NUTRIENT MANAGEMENT

- Apply 100q/ha well rottened Farm Yard Manure/compost during field preparation.
- An application of 75 kg N, 55 kg P and 30 kg K/ha gives best yield.
- Nitrogen should be applied in 2 splits, first half prior to sowing along with full quantity of Farm Yard Manure, P and K and other half 1 month after seed germination.

IRRIGATION

- Spinach is a quick growing shallow rooted crop that is not tolerant to water stress.
- Adequate moisture should be maintained by frequent irrigation when necessary.
- Irrigation practice that splash soil into the leaves is damaging and should be avoided.
- About 12-13 inch water may be sufficient during the entire crop season.
- Moisture requirement is not very high since rate of transpiration is low during cool season.
- Water logging of the field should be prevented.

WEED CONTROL

- Wed control is very important because spinach plant cannot compete well with the weeds.
- For weed control, one to two shallow hoeings are needed. Herbicides can also be used to control the weeds effectively.
- Asulam (6 or 8l/ha) has been reported to give good weed control in spring-summer and autumn crop without any harmful effects.

HARVESTING

- Harvesting should not be done early in the morning because leaves are crisp and break easily.
- The crop is ready for harvest 4-6 weeks after sowing.
- Cutting is done with a sharp knife/ sickle.
- About 3-4 cuttings may be obtained throughout the season.
- Product should be hydro or vacuum cooled immediately after harvest.

YIELD

- About 50-60 q/ha green leaves can be obtained from one hectare..

STORAGE

- Spinach can be stored at 0oC and at 95-100 per cent RH.
- It can be stored only for 10-14 days.
- Temperature should be as close to 0oC as possible because spinach deteriorates rapidly at higher temperature.

DISEASES AND PESTS

- Diseases and Pests of Spinach are same as that of spin

SEED PRODUCTION

SEED PRODUCTION

Climatic requirements

- Spinach is a cool season crop, but it has a much wider range of adaptability to climatic conditions.
- It produces seed freely in the north Indian plains.
- Long day plant with critical day length ranging from 12-15 hours

Land requirements

- Land to be used for seed production should be free of volunteer plants.
- The soil of selected field should be rich in organic matter.

Isolation distance

- Foundation seed : 1600 m
- Certified seed : 1000 m

Cultural Practices: Almost similar to that of leaf crop

Time of sowing

- For seed production purpose, seed sowing should be done in October- November

Methods of sowing

- Sow the seeds in rows 45 cm apart.
- Place the seeds close to each other at the depth of about 2cm. The seedlings after emergence can be thinned to provide a spacing of 15 cm within a line. .
- Sufficient soil moisture is required for good germination.

Nutrient management

- Well rotten Farm Yard Manure @ 350-400 q/ha should be applied at the time of preparation of land.
- Besides this, N, P and K @ 150:100:100kg/ha, respectively should also be applied.
- Nitrogen should be applied in 2 splits, first half prior to sowing along with full quantity of Farm Yard Manure, P and K and other half 1 month after first application.
- More nitrogen is required because high nitrogen increased the yield and dry matter content of the tops.

Irrigation

- Frequent irrigation according to season is required to obtain good yield.

Intercultural operation

- The field should be kept free of weeds especially in the early stages of crop growth..
- The field should be completely clean of pigweed plants after the crop has been left for seed.

Cutting

- Not more than 2-3 cuttings should be taken from the seed crops.

Rouging

- Careful rouging for off-types, early bolters and pigweed plants is necessary.
- The rouging may be done at pre-flowering stage to remove of-types on the basis of foliage characters.
- Subsequently early bolters, off-types plants and pigweed plants may be removed immediately as and when they are noticed.

Harvesting:

- Harvesting should be done when most of seeds are formed before shattering.
- The crop is cut by hand and allowed to dry in the field.
- After drying the seeds can be threshed by beating them with sticks.
- After cleaning, the seed must be dried to 9 per cent moisture before storage.

Seed Yield:

- Seed yield varies from 1000-1500 kg/ha.

SEED CERTIFICATION STANDARDS

Field Inspection

Minimum of two inspections shall be made first before flowering and second during flowering

stage.

A. Fields Standards

a. General requirements

Isolation

Seed fields should be isolated from the contaminants as shown in the table given below:

Contaminants	**Minimum distance (m)**	
	Foundation	**Certified**
Fields of the other varieties	1600	1000
Fields of the same variety not conforming to varietal purity	1600	1000
Field of swiss chard	1600	1000

b. Specific Requirements

Factor	**Maximum permitted (%)**	
	Foundation	**Certified**
Off-type	0.10	0.20

B. Seed Standards

Factor	**Standards fo**	
	Foundation	**Certified**
Pure seed (minimum) %	96.0	96.0
Inert matter (maximum) %	4.0	4.0
Other crop seeds (maximum) Number/ kg	5	10
Total weed seeds (maximum) Number/ kg	5	10
Objectionable weed seeds (maximum) Number/ kg	-	-
Germination (minimum) %	60	60
Moisture (maximum) %	9.0	9.0
For vapour proof containers (maximum) %	8	8