

SPINACH BEET OR INDIAN PALAK

TYPES OF SPINACH: There are two types of spinach.

1. Desi or common palak (Spinach beet or beet leaf or beet leaf spinach or Indian Palak or Desi Palak).
2. Vilayati palak or English Spinach (spinach)

DIFFERENCE BETWEEN SPINACH BEET AND SPINACH

Sr.No.	Spinach Beet	Spinach
1	Botanical name is <i>Beta vulgaris var. bengalensis</i> Hort	Botanical name is <i>Spinacea oleracea</i> L
2	Chromosome number $2n=18$	Chromosome number $2n=12$
3	Leaves with margins	Leaves with lobed leaf margin
4	Produce hermaphrodite flowers	Produce staminate, pistilate and hermaphrodite flowers
5	Tolerates high temperature and grow well in hot weather	Purely a cool season crop and can not tolerate high temperature. In warm weather and long days it quickly tend to flower

SPINACH BEET

BOTANICAL NAME : *Beta vulgaris L. var. bengalensis Roxb*
CHROMOSOME NUMBER : $2n=2x=18$
FAMILY : Chenopodiaceae
COMMON NAME : Palak, Saag, Indian Spinach, Indian Palak, Desi Palak

USES

- Rich source of vitamin A as compared to spinach and carrot
- Also contains high quantity of ascorbic acid and iron
- 100g of leaves supply as much essential amino acids as 100g of any non vegetarian food like meat and fish
- Its succulent leaves and stems forms a nutritious dish after cooking
- The herbaceous parts are mildly laxative besides other medicinal values.

ORIGIN AND HISTORY

- The spinach is probably native of Indo-Chinese region.
- Spinach is a nutritive leafy vegetable.
- It is rich in vitamins and minerals.
- The Romans used it as feed for animal and man.
- In Germany, it was first described in 1557, where it is referred as Roman beet.
- The crop was introduced in USA in 1800.
- It has some medicinal properties also, the herbaceous parts of palak are mildly laxative, beside other medicinal values and it is a leafy vegetable which is highly suitable for hydroponics.

CLIMATIC REQUIREMENTS

- Spinach beet is a cool season crop.
- It can withstand frost better than other vegetable crops.

- High temperature, especially long day cause bolting, thus reduces its market value.
- Higher yields are obtained under short day and mild temperature.
- Succulence and tenderness of leaves are increased under high atmospheric humidity.
- Can be grown throughout the year under mild temperature conditions.

SOIL CONDITIONS

- Spinach beet can be grown on a wide range of soils.
- It thrives best in well drained loamy soil.
- pH should be in the range of 6-6.5.
- Low soil pH is harmful for growth and development of crop.

VARIETIES / HYBRIDS

On the basis of pigmentation of midrib and leaf veins, palak cultivars can be divided into two groups:

1. Reddish midrib and leaf veins.
2. Green midrib and leaf veins.

All Green:

- This is an early variety suitable for growing in September.
- Leaves are green, uniform, tender with entire leaf margins.
- Plant produces seed stalks in 75days after sowing.
- Average yield is 125q/ha of green leaves.

Arka Anupama:

- It has been developed through hybridization of IIHR-10 and IIHR-8 followed by pedigree method of selection and released from IIHR, Bangalore.
- Leaves are medium large, dark green, wrinkled and attractive.
- It is late bolting variety and regenerates at fast rate.
- Leaves are ready for first harvesting in 30 days after sowing.
- It gives about 410 q/ha fresh green leaves in four cuttings.

Banerjee Gaint:

- It is very popular variety developed in West Bengal through hybridization between Local Palak x Sugar beet.
- It produces large thick and succulent leaves with very succulent stem and fleshy roots.
- It yields 150-200q/ha of green leaves.

Jobner Green:

- Evolved through spontaneous mutation and selection made from a local collection (5-5).
- Leaves are long, thick, and succulent with strong flavour.
- Can be successfully grown on alkaline soils having pH of 7.0-10.5.
- It produces tender leaves and strong flavour having entire margin.
- Taste is comparable to cultivar All Green.

- Prolific yielder with average yield of 300q/ha.

HS-23:

- It is quick growing and heavy yielding cultivar, gives first cutting in 30 days after sowing and a total of 6-8 cuttings at 15 days intervals.
- Evolved through mass selection
- Leaves are long, dark, thick and succulent

Pusa Jyoti:

- It gives 6-8 cuttings and yields 290q/ha.
- It is a polyploid, evolved through selection among colchicine treated progenies of All Green.
- It is a giant leaved type with succulent and crisp leaves.
- It yields 490q/ha with 6-7 cuttings.
- It is rich in K, Ca, Na, Fe, and ascorbic acid and can be grown throughout the year.

Palak No. 51-16:

- It produces green leaves, gives several cuttings and yields about 160q/ha.
- Released by the Maharashtra State Department Of Agriculture.
- It is a late bolting cultivar.

Pusa Palak:

- It produces uniform green leaves without any purple pigmentation.
- Developed by hybridization between Swiss Chard x Local Palak
- It is a late bolting cultivar.

Ooty-1:

- It is tasty green leafy vegetable.
- It yields 150q/ha of leaves.
- Leaves are rich in vitamins.
- It also contains higher carotene content.
- It can be grown throughout the year and can withstand frost.

Pusa Harit:

- Suitable for cultivation in the hills throughout the year,
- Plants are upright, vigorous growing with uniformly thick green, slightly crinkled and giant sized leaves,
- Heavy yielder with remarkable ability for rejuvenation.
- It has late bolting habit and wide range of adaptability to varying climates,
- Average yield 150-200q/ha.

Punjab Green:

- Foliage is shining dark green, thick, long, sweet, succulent and free from sourness.
- There is light purple pigment on the stem.
- Slow bolter and has low oxalic acid content which is a desirable character in greens.
- Average yield is 315q/ha.

Punjab Selection:

- Leaves are light green, long, thin, narrow and smooth with slightly sour taste.
- Stem is covered with purple pigment.
- It yields 275 q/ha green leaves.

Pant Composite-1:

- It is released from GBPUAT, Pantnagar.
- It is a heavy yielder and tolerant to *Cercospora* leaf spot.

Pusa Bharati:

- Leaves are long, succulent and flavoured.
- It yields 500q of green leaves per hectare.

SOWING TIME

- In plains of India, it can be grown 3 times in a year i.e. early spring, in the beginning of rainy season and as main crop during Sept. - Nov.
- It can be grown throughout the year in places where mild climate exist.
- In hills, it is generally sown in March-May

SEED RATE

- Summer crop : 25-30 kg/ha
- Winter crop : 10-15kg/ha
- Seeds are soaked in water overnight before sowing to improve germination

SPACING

- Keep planting distance of 25-30cm between rows and plants should be spaced at 5-10cm after thinning.

NUTRIENT MANAGEMENT

- For good crop, add 250-300q/ha of Farm Yard Manure per hectare and mix it well during field preparation.
- Besides Farm Yard Manure, 80-100kg nitrogen, 60 kg phosphorus and 60kg potash should be applied per hectare in the form of inorganic fertilizers.
- The entire quantities of P and K along with one fourth quantity of nitrogen are applied at the time of planting.
- The remaining amount of nitrogen is top dressed into three split doses each @ 20-25kg/ha after each cutting.

USE OF PLANT GROWTH REGULATORS

- In Spinach beet, application of GA at 10ml/L in combination with 1 per cent urea has been reported to give higher yield.

IRRIGATION

- There should be sufficient soil moisture for proper seed germination and growth.
- If soil moisture is not sufficient at the time of sowing, pre sowing irrigation is advisable.
- Irrigation should be done after sowing.

- In summers, water is applied at 4-5 days interval and in winters at 8-10 days interval.
- However, the rainy season crop does not require any irrigation except during the long dry spell.

INTERCULTURAL PRACTICES

- Thinning is essential which should be done to provide proper space for accommodation and development of large uniform plants.
- Shallow hoeing is essential because the spinach beet plant cannot compete well with the weeds.
- To keep away the weeds from the field and to loosen the soil for proper aeration, 2-3 hoeings cum weedings are required.
- Application of Pyrazone @ 2.4-2.8 kg/ha as pre-emergence application is also found effective.
- Harvesting is made more difficult where weeds are present.
- Avoid weedicides for controlling weeds in palak.

HARVESTING

- Spinach beet leaves become ready for harvesting in 25-30 days after sowing, the leaves are cut with the help of a sharp knife/sickle.
- The successive cuttings may be done at 15-20 days interval. In 4-6 cuttings, the crop is over.
- Winter crop gives more cutting than spring-summer crop.
- Varieties of broad leaves are usually high yielding than those of a short leaved.
- The yield and quality of leaves are affected adversely, if harvesting is not done at regular intervals.
- Palak is highly perishable vegetable, so immediately after harvesting, it should be sent to the market.
- The attractive appearance of leaves and their turgidity is lost within 24 hours of harvesting along with rotting of leaves.
- Palak cannot be stored at room temperature, but at low temperature (0°C) with high relative humidity (90-95 per cent) leaves can be stored for about 10 to 14 days.

YIELD

- On an average, green leaves yield varies from 100-150 q/ha (winter) and 80-100 q/ha (Spring-summer).

DISEASES : Fungal Diseases

Damping off : (*Pythium spp.*)

- Seedlings are attacked by the fungus before or after germination and killed.

Control measures

- Avoid thick sowing of seeds.
- Treat seeds before sowing with any one of the fungicides like carbendazim or captan @2.5g/kg of seed.
- This disease can be controlled by drenching the infected seedlings with a mixture of mancozeb (0.25%) and carbendazim (0.05%).

Downy mildew : (*Peronospora spinaciae*)

- Affected plants show similar symptoms as that of downy mildew of peas.
- The causal organism can survive in soil as oospores, in seed as dormant mycelium, on the seed as contaminating oospores, or on perennial spinach beet.

Control measures

- Use clean seed.
- Remove crop debris and destroy it.
- Follow a three year crop rotation and spray zineb at 0.2 per cent.

Leaf spot : (*Cladosporium variabile* and *Stemphylium botryosum*)

- It is a seed borne disease.
- Older leaves show dirty white, water soaked circular spots.

Control measures

- Seed treatment with hot water or with fungicides like carbendazim. (0.05%) is recommended to check the disease.
- The pathogen can be eradicated by 1.2 per cent chlorine treatment for 10 minutes.

Anthracnose : (*Colletotrichum dematium*)

- Affected leaves show water-soaked spots, which later on coalesce and cause drying of the leaves.
- On seed stalk, elongated spots are formed.
- Black dots are also seen on seed.

Control measures

- Reduce leaf moisture by avoiding sprinkler irrigation, if possible.
- Spinach fields should be adequately fertilized.
- Use resistant varieties.
- Apply copper oxychloride (0.3%) as a protectant spray at 10–14 day interval.

Bacterial Diseases

Bacterial soft rot: (*Erwinia carotovora*)

- It is a post harvest diseases, the disease appears on leaves in transit.
- Water soaked areas develops and rotting occurs in the packed leaves due to lack of aeration and cleanliness.

Control measures

- Follow rotation with maize, beans, small grains and grasses.
- Care should be taken at harvesting and handling to avoid bruising.
- A storage temperature just above freezing (0°C) and a relative humidity below 90 per cent does much to reduce soft rot losses.

- Storage rooms dump tanks and boxes should be disinfected each season with copper sulfate.

Viral Diseases

Spinach mosaic

- This disease is characterized by light to dark green patches and mosaic symptoms on infected leaves.
- The leaves are reduced in size, distorted and invariably show chlorotic sectors which are almost white.
- This infected disease is caused by a strain of cucumber mosaic virus (CMV).
- This virus is easily transmitted by sap inoculation.
- The virus is also transmitted by insect vector *Myzus persicae* in a non-persistent manner.

Control measures

- Removal and destruction of affected plants, control of aphids with malathion @ 0.05 per cent, and growing of improved varieties are recommended.

Pests

Aphids

- These are small in size.
- Both adults and nymphs suck sap from plant tissues due to which, the plant becomes weak.

Control measures:

- Spray malathion (0.05 %) or oxy-demeton methyl (0.025 %).

Leaf eating caterpillar: (*Laphygma exiqua*)

- Caterpillars feed on leaves and make holes.

Control measures

- Spray malathion (0.05%) for effective control.

SEED PRODUCTION

Land Requirements

- Land to be used for seed production should be free of volunteer plants.

Climatic Requirement

- Palak is a cool season crop, but has a much wider range of adaptability to climatic conditions.

Isolation

- Palak is cross-pollinated by wind.
- Air current may carry the pollen to considerable distances.

- Seed fields must be isolated from fields of other varieties of palak and fields of same variety not conforming to varietal purity requirement for certification and from swiss chard, sugar-beet and garden beet, at least by 1600 meters for foundation seed production and 1000 meters for certified seed production.

Roguing

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

Time of Sowing

- For seed crop, sowing should be done in October and November.

Preparation of Field

- Prepare the field to fine tilth by ploughing.
- Three to four harrowing, followed by leveling are necessary.

Method of Sowing

- Sow the seed in rows 45 cm apart. Place the seeds close to each other at the depth of about 2 cm.
- Later on the plants can be thinned to 15 cm.
- Sufficient soil moisture is required for good germination.

Harvesting

- Harvesting should be done when most of the seeds are firm before they shatter and the crop is cut by hand and allowed to dry in the field.
- Crop bolts after 75 days of sowing and harvesting is done after 150-180 days.
- The seeds do not shed, so harvesting is done after full ripening.
- After drying the seed can be threshed by beating them with sticks.
- After cleaning, the seeds must be dried to 9 per cent moisture before storage.

Yield:

- Seed yield-vary from 10-15q/ha.

SEED PRODUCTION

SEED CERTIFICATION STANDARDS

Field Inspection

- A minimum of two inspections shall be made, the first before flowering and the second during flowering stage

A. Field standards

a. General Requirements

Isolation

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

Contaminants	Minimum Distance (meters)	
	Foundation	Certified
Fields of other Varieties	1600	1000
Fields of same variety not conforming to varietals purity requirements for certification	1600	1000
Fields of the swiss chard (chard, sea kale beet, silver beet), sugar beet and garden beet	1600	1000

b. Specific Requirements

Factor	Maximum permitted (per cent) *	
	Foundation	Certified
Off types	0.10	0.20

*** Maximum permitted limit at and after flowering.**

B. Seed Standards

Factor	Standards for each class	
	Foundation	Certified
Pure seed (minimum) %	96	96
Inert matter (maximum) %	4	4
Other crop seeds (maximum) Number/ kg	5	10
Weed seeds (maximum) Number/ kg	5	10
Germination (minimum) %	60	60
Moisture (maximum) %	9	9
For vapour proof containers (maximum)%	8	8