PEA

BOTANICAL NAME : *Pisum sativum L.*
COMMON NAME : Matar
CHROMOSOME NUMBER : 2n=14
FAMILY : Leguminoseae

USES

- Pea is highly nutritive vegetable containing high percentage of digestible proteins (very valuable for the vegetarians) along with carbohydrates and vitamins A and C, also very rich in minerals like Ca and P.
- Excellent food for human consumption taken either as vegetable or in soup.
- Large proportion is processed (canned, frozen or dehydrated) for consumption in the offseason.
- Being N fixing legume, recognized as a soil building crop.
- Seeds contain trypsin and chymotrypsin which could be used for contraceptive, ecbolic, fungistatic and spermicidal. Pea stem is a nutritive fodder.
- Pea is being used in a growing snack market.

ORIGIN AND HISTORY

- The geographical origin of "*Pisum sativum L.*" is yet uncertain. However, *Pisum* is considered to have been originated in "Ethiopia" from where it spread during pre historic times to the Mediterranean region, central Europe, the near East and subsequently to rest of the world.
- Pea has been assigned to Mediterranean and the African center of diversity.
- *Pisum elatius* a wild species is considered as its ancestor.

AREA AND PRODUCTION

- The area under this crop in India was 370 thousand ha having a production 3517 thousand tonnes with a productivity of 9.5MT/ha (NHB, 2011).

CLASSIFICATION

- On the basis of species, the cultivated pea is divided into two types.
- The field pea with coloured flowers (*Pisum sativum var. arvense L.*) and garden pea with white flowers (*Pisum sativum var. hortense L.*). From practical stand point, Pisum sativum can be divided into following groups.

A. According to seed

- Round or smooth-seeded cultivars
- Wrinkled seeded cultivars

B. According to height of plant

- Bush or dwarf types.
- Medium tall types.
- Tall types.

C. According to maturity period

- Early season : 65-80days
- Medium season :90-100days
- Main season : 110-120days.

D. According to use of pods

- Fresh market types
- Freezing types
- Canning types
- Dehydration types.

E. According to pod walls

a. Types with thin pod walls

- Types with smooth seeds
- Type with wrinkled seeds.

b. Types with thick pod walls

- Type with smooth seeds
- Type with wrinkled seeds.

CLIMATIC REQUIREMENTS

- Pea seed can be germinated up to the minimum temperature of 5°C.
- The optimum temperature for germination is about 22°C.
- Pea can tolerate cold, but severe frost causes considerable injury to the freshly opened flowers.
- The optimum temperature for better growth and yield is 13-19°C.
- High temperature reduces the pod quality as sugars in the seeds changes to hemicelluloses and starch.
- Temperature above 27°C shortened the growing period and adversely affects pollination.
- Germination at high temperature results in tall plants whereas low temperatures at early growth stages promote branching and dwarf growth habit.

SOIL CONDITION

- Pea can be grown on many types of soil from light sandy to clay soil.
- Light soils are good for early crop whereas heavy soils are found suitable for main crop and produce high yield.
- It is very sensitive to saline and alkaline conditions.
- Most favourable range of pH is from 5.5 - 6.0.

VARIETIES

a) Early Smooth Seeded

Meteor:

- Plants are 35-40 cm tall, dark green, flowers borne generally singly; pods dark green, 8.7 cm long, well filled with 7 seeds, having shelling percentage of 45.
- Pods mature in 58-60 days, suitable for early October sowing.

Alaska:

- This is an early smooth seeded canning cultivar with bluish green seeds.
- Plants are about 45cm tall.
- Pods are borne singly, light green in colour 7 x 1.25cm.

b) Early Wrinkled Seeded

Arkel:

- It is an early, wrinkled seeded and most popular exotic variety.
- Plants are dwarf.
- Pods are green and sickle shaped.
- Yield potential of this variety is 100q/ha and shelling percentage is approximately 40.

Early December:

- It a selection from the cross T.19 × Early Badger.
- It is dwarf, producing light green pods, 7 cm long.
- It has higher number of pods per plant than Early Badger but is somewhat late in flowering.

Matter Ageta 6:

- It is a dwarf, dark green and early maturing Indian cultivar and is ready for first picking after 40-50 days from sowing, producing 6-7 seeds per pod.
- It produces 50 per cent of its total yield in the first picking.

Palam Triloki:

- Early maturing, about 10 days earlier in maturity than recommended variety "Arkel" besides having higher yield potential with an average of 70-75 q/ha.
- It has long, bright green, round, well filled pods containing 8-10 seeds with 48-50 % shellimg.

VL Ageti Matar 7:

- It is developed at Vivekananda Parvatiya Krishi Anusandhanhala, Almora by crossing Pant Uphar and Arkel.
- It is an early maturing variety with a green pod yield potential of 100-125q/ha.
- It matures 5 days earlier than Arkel, which helps to control damage caused by powdery mildew disease and frost.

c) Wrinkled-Seeded Main Season and Late

Bonneville:

- A medium tall, double podded cultivar, flowers in 50-60 days and first blossom appears at 13-15th node.
- Pods are light green, straight, about 9 cm long and 6-8 seeded with shelling percentage of 45.

Lincoln:

- It is a dwarf to medium tall, single podded cultivar, flowering in 55-60 days and first blossom appears at 11-12th node.
- Pods are dark green, 9.5-10 cm long, 6-7 seeded with shelling percentage of 45 and it is suitable for late sowing.
- Pods retain good colour after harvest and good for canning.

Azad P-1:

- Plants are 80-90 cm tall having dark green foliage.
- Pods are smooth, dark green and 8-10cm long.
- Shelling percentage is 50-55.
- Pods are slightly curved at the distal end.
- This variety can tolerate powdery mildew and rust.

P-88:

- It is developed from a cross between Single Pusa-2 and Morrasis-55.
- The plants are 75-85 cm tall.
- The numbers of seeds per pod range from 7-8.
- The matured seeds are wrinkled and bold.
- It is highly susceptible to the powdery mildew disease.

VL-3:

- Medium tall, pods medium long (7-7.5cm) containing 7-8 seeds/pod, green in colour.
- Gets ready in 100-110 days, slightly curved towards suture at distal end, wrinkle seeded.
- Average yield 140-150q/ha

Solan Nirog (Sel. 8-1):

- It is developed from UHF, Solan.
- Pods are 8-10 cm long, dark green with 8-9 seeds/pod.
- It matures in 90-95 days and resistant to powdery mildew disease.

Palam Priya (DPP-68):

- It is developed from HPKV Palampur. Medium tall, flowers borne in double almost throughout the plant.
- Profuse bearer, pods are attractive, light green, straight, 8-9cm long, 7-9 seeds/pod.
- Shelling is 45-50 %, wrinkle seeded, sweet, ready in 90-100days.
- Average yield 120-130q/ha, slow mildewing.

Punjab-89:

- Medium maturity, bright green, very long pods (9-10 cm) with more number of seeds/pod (9-10) and high shelling percentage (45-50%).
- More pods/plant (20-25) borne in doubles almost in every node, medium growth habit and sweet in taste (17.2o Brix TSS).

- Average yield 135 q/ha

Palam Sumool:

- Medium in maturity having very long (12-15cm), dark green and flattish round pods containing 8-10bold seeds.
- High yield potential (100-120 q/ha), 45-48% shelling, sweet in taste (TSS 180^{o} brix), and resistant to powdery mildew disease

d) Round Seeded Main Season and Late

Kanwari:

- This is a tall-growing, double podded cultivar, flowering in 65-75 days and first blossom appears at 15-17th node.
- Pods are about 8.5cm long, yellowish green, and 5.6 seed with a shelling percentage of about 40.
- A muciliage excertion on the pods is a characteristic of this variety.
- It is largely grown in hills and the plains around Ambala, as a non irrigated crop It is also suitable for growing as a grain type although the presence of black colour lowers the market value of the grain.

e) Edible Podded Type

Sylvia:

- It is a tall growing cultivar flowering in 60 days and first blossom appears at 14-16th node.
- Pods are borne singly, yellowish, 12 cm long and sickle shaped.
- Pods have general appearance of a medium sized French bean pod.
- Staking is desirable and it is suitable for late sowing.

Oregone 523:

- A commercial freezing variety of USA with field resistance to pea enation mosaic virus, red clover vein mosaic virus and race 1 of *Fusarium oxysporum* f. sp. *pisi.*

Others varieties are

1. Early Smooth- Seeded

a. Asauji
b. Lucknow Boniya
c. Early Superb

2. Early Wrinkle-Seeded

a. Early Badger
b. Little marvel
v. Kelvedon wonder

3. Wrinkled-Seeded Main Season and Late

a. T.19
b. Delwiche commando
c. Khaper Kheda
d. N29
e. Perfection New Line
f. Thomas Laxton
g. GC-14

4. Edible-Podded Cultivar

a. Punjab Meethiphali
b. Aparna
c. Pershotsuit
d. Khar Kovskii Usatyi
e. Vica
f. Alaska 81
g. Taichung 13
h. Pervenets
i. Trounce

j. Apex

SOWING TIME

- For Rabi crop, seeds are sown in October to middle of November in plains.
- Pea is cultivated in hills from middle of March to end of May.
- In North India, three sowings are done, during August, November–December and during March-April

SEED RATE

- Early varieties :100-120 kg/ha.
- Mid season and late varieties: 80-90kg/ha.

METHODS OF SOWING

- Seeds can be sown on flat or slightly raised beds either by broadcasting or behind desi plough in furrows, which are covered by usual planting.

SPACING

- Early Varieties - 30cm × 5-10cm
- Main season - 60cm × 10cm

SEED INOCULATION

- Inoculation of seed with *Rhizobium* culture can be used.
- The culture material is emulsified in 10% sugar or jaggery solution sufficient to moist the seed.
- It is to be mixed thoroughly with seed and dried in shade before sowing.
- This seed inoculation helps in quick nodulation on the roots which in turn fix atmospheric nitrogen.

SEED TREATMENT

- The seeds may be treated with fungicides like thiram or captan (3g/kg of seed) or carbendazim (2.5g/kg of seed) to save the crop against *Fusarium* wilt.
- If both seed inoculation and fungicide treatments are to be given, then firstly the seeds are treated with fungicide followed by inoculation with *Rhizobium* culture.

NUTRITIENT MANAGEMENT

- FYM @150-200q/ha is to be applied 15 days before sowing the seeds.
- Nitrogen, phosphorus and potassium should be applied in the ratio of 50:75:40 kg/ha, respectively.
- Entire quantity of phosphorus, potash and half quantity of nitrogen is to be thoroughly mixed in the soil at the time of field preparation.
- The remaining nitrogen is to be top dressed at flowering time along with irrigation.

USE OF PLANT GROWTH REGULATORS

- Foliar spray of MH at 25mg/L, before flowering has given best pod yield in pea.
- Seed treatment with cytozyme @ 1 per cent improve the fresh pod yield in pea

IRRIGATION

- The water requirement of pea is very low and it can be grown even without irrigation.
- In general, one pre-sowing irrigation is essential for proper germination.
- Two or three light irrigations at 10-15 days interval especially at flowering, fruit set and at grain filling period are essential for good yield.

INTERCULTURE OPERATIONS

- Hoeing and earthing up are to be done after 2-3 weeks of sowing and second at flowering initiation to get higher yield.
- Hoeing helps in removing the weeds and pulverizes the soil for proper aeration.
- Root injury should be avoided during the operation.
- Therefore, hoeing should be followed by earthing up to strengthen the plants and to encourage the root growth.

- The useful method of weed control practised in India is mechanical or manual.
- Manual weeding is uneconomical and time consuming.
- Chemical weed control has been reported to be effective as compared to hand weeding.
- At the same time, it is cheaper and less time consuming.
- Application of Lasso @ 0.75 kg a.i/ha or Tribunal @1.87 kg a.i. /ha as pre-emergence application have been recommended under wide range of agro-climatic condition.

HARVESTING AND YIELD

- The maturity of pea is tested mechanically with a tendrometer.
- Generally, three to four pickings are taken during the season.
- Harvesting should be done either in the morning or late in the afternoon.
- About 50-60q of green pods per hectare are obtained in case of early varieties
- Shelling percentages of pea cultivars ranges from 30-56 per cent depending upon varieties.
- The peas are harvested when the pods are fully green and well developed.
- The seeds should be near full size and should not have begun to harden.
- The high quality of pea is associated with tenderness and high sugar content.
- During maturity, sugar contents decreases rapidly and there is an increase in starch and other polysaccharides and insoluble nitrogenous components such as protein.
- Calcium migrates to seed coat and toughness of skin increases during ripening.
- Picking should be done as soon as green ovules are fully developed and pods still not over mature.
- Early varieties give 2-3 pickings while 3-4 pickings at 7-10 days interval are taken from main season.
- Picking should be done either early in the morning or late in the afternoon. Picking during mid day deteriorates the quality of pea by heat.

YIELD

- Early varieties give 60-85 q/ha where as main season varieties yields 100-150q/ha green pods per hectare.

HEAT UNITS

- A heat unit system is used in commercial pea production to predict relative maturity dates and to schedule planting dates.
- This system uses 4.4^{o}C as the thresh hold temperature or base temperature & 29.4^{o}C as the maximum temperature.
- The daily heat units accumulating during the development of a cultivar are calculated from the daily temperature mean.
- Heat units accumulate slowly during the cool spring & rapidly as the season progresses.
- With this information, the expected time of maturity of a cultivar can be determined from the mean temperature of the few seasons.
- For early cultivar 1534 heat units whereas for late cultivars 3942 heat units are required.
- The edible types are picked when pods have reached full length and seeds are just developing.

POST HARVEST HANDLING

- Green peas loose much of their sugar content unless they are promptly cooled to 0^{o}C.
- Hydro cooling is the preferred method for pre cooling.
- At 0^{o}C & 95-98% RH, green peas can be stored for 1-2 weeks.

- If the crop is packed with crushed ice, storage may be extended for 1 additional week.
- It can be stored better for 2 weeks in cold storage at 0°C & 85-95 % RH. Temperature at 21.5°C becomes unfit for sale at the end of 5 days.

STORAGE

- Peas can also be stored in crushed ice for about 2 weeks.
- The pods will freeze at 10°C and 90-95 per cent relative humidity.
- Fresh unshelled peas may be kept for two weeks at 0°C.

DISEASES

Fungal Diseases

Powdery mildew : (*Erysiphe polygoni*)

- It is characterized by white powdery mass on foliage, pods and stems.
- It is favoured by hot and dry climate.

Control Measures:

- Spray dinocap@ 0.05per cent or wettable sulphur@ 0.2 per cent or carbendazim @ 0.05 per cent. Repeat after 10-15 days if necessary.

Fusarium wilt: (*Fusarium oxysporum* f. sp. *pisi*)

- The disease is characterised by yellowing of lower leaves and stunting of plants.
- Optimum temperature for development of disease is 25-28°C.

Control Measures:

- Since wilt is soil borne, a long crop rotation is recommended.
- Seed treatment with carbendazim (2.5g/kg seed) for two hours followed by spraying with carbendazim (0.05%) is recommended.
- Avoid early sowing in badly infested soils. Follow three years crop rotation in infested areas.

Ascochyta blight: (*Ascochyta pinodes*, *Ascochyta pinodella*, *Ascochyta pisi*)

- Infected plants wilt.
- Roots become brown.
- On stems and leaves, brown spots are observed.

Control Measures:

- Use bold and healthy seed.
- Treat seed with carbendazim (2.5g/ kg seed).
- Spray carbendazim (0.1%) or mancozeb (0.25%) before appearance of flowers on infected plants.
- Repeat after 10-15 days if needed.

Bacterial Diseases

Bacterial blight: (*Pseudomonas syringae* pv. *pisi*)

- The disease affects all the aerial parts of plant.
- It appears as spots on leaflets which are round, oval or irregular 2-5 mm in diameter and reddish with translucent center having dark brown margins.

Control measures:

- Use clean healthy seed. Remove affected plants and weeds.
- Treat seed with Streptocycline @ 0.01 per cent for 1-2 hours.
- Spray the same chemical @0.01 per cent and repeat after seven days if needed.

Viral Diseases

Pea mosaic:

- The diseased plants are pale, weak and dwarf.
- The young leaves and stipules show general mottling.
- Light brown discoloured areas are seen on petioles, stems and tendrils.

Control measures:

- Control insect vectors carefully, pull out affected plants and burn them
- Grow resistant varieties.

PESTS

Pea thrips:

- Pea thrips may be problem in very dry weather.
- Adult feed inside the flower, while young ones feed on leaves and pods.
- They lay their eggs in the pods.
- Mottled patches appear which later turn brown.
- Yield is severely affected if attack persists.

Control measures:

- Spray the crop with cypermethrin (0.0075%) or dichlorovos (0.04%) as soon as the attack is noticed.
- If harvesting coincides with spray, spray immediately after harvest and wait for 10-15 days for another harvest.

Pea leaf miner

- More serious damage is caused by larvae.
- They make prominent whitish tunnels in the leaves which interfere with proper photosynthesis activity of plants.
- The manufacture of the food by leaves is severely affected.

Control measures:

- The population of the pea leaf miner is naturally kept under control by a large number of larval and pupal parasitoids which include Braconids and Eulophids.
- Application of oxy-demeton methyl (0.025%) or dichlorvos (0.04%) during the second week of February helps in reducing the population of this pest.

Pea pod borer:

- Caterpillars feed on foliage and later bore into the pods to eat the developing seeds.

Control measures:

- Spray carbaryl (0.1%) on the crop. Repeat after 15 days if attack persists.

SEED PRODUCTION

- The cultivation practices which are followed for table crop are same for seed crop also. In addition to this,
- Isolation distance of 10 meter for certified and 20 meter for foundation seeds between two cultivars should be followed.
- Rogue out off type and diseased plants before flowering and during pod setting stage.
- Harvesting the crop when pods are fully ripe and plants start drying.

SEED CERTIFICATION STANDARDS

A. Field Standards

a. General requirements

Isolation:

- Seed fields should be isolated from the contaminants shown below:

Contaminants	**Minimum distance (Meters)**	
	Foundation	**Certified**
Fields of other varieties	10	5
Fields of the same variety not conforming to varietal purity	10	5

B. Specific requirements

Factors	Maximum Permitted (Per cent)	
	Foundation	Certified
Off types	0.10	0.20

C. Seed Standards

Factors	Standards for each class	
	Foundation	Certified
Pure seed (minimum) %	98	98
Inert matter (maximum) %	2.0	2.0
Other crop seeds (maximum) Number/kg	-	-
Weed seeds (maximum) Number/kg	-	10
Germination (minimum) %	75	75
Moisture (maximum) %	9.0	9.0
For vapour-proof containers (maximum) %	8.0	8.0