Garden peas *(Pisum sativum)*







Guide

agriculture,
forestry & fisheries

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PART 1: General aspects

CLASSIFICATION

Pea is an important frost-hardy, cool-season, nutritious leguminous vegetable that is widely cultivated throughout the world. As a cool-season crop, it is extensively grown in temperate zones; but it is restricted to cooler altitudes in the tropics and winter season in the subtropics. It is a rich source of protein (25%), amino acids, sugars (12%), carbohydrate, vitamins A and C, calcium and phosphorus, apart from having a small quantity of iron. Peas being very rich in proteins are valuable for vegetable purposes.

Scientific name:	*Pisum sativum* L
Common names:	Matar (Hindi, Nepali) Pea; split pea, garden pea, seed pea, shelling pea, combining pea, field pea, dry pea, vining pea (English)
Family name:	Fabaceae

ORIGIN AND DISTRIBUTION

The origin and progenitors of *Pisum sativum* are not well known. The Mediterranean region, western and central Asia and Ethiopia have been indicated as centres of origin. Recently the Food and Agriculture Organisation (FAO) designated Ethiopia and western Asia as centres of diversity, with secondary centres in southern Asia and the Mediterranean region. Archaeological evidence of the use of peas dating from 8000 BC has been found in the Fertile Crescent.

The first cultivation of peas appears to have been in western Asia, from where it spread to Europe, China and India. In classical times, Greek and Roman authors mentioned its cultivation as a pulse and fodder crop. Pea was already known in the mountain regions of Central and East Africa before the arrival of the Europeans and was a well-established and important food crop in Rwanda and southwestern Uganda by 1860. The use of the edible pods was first described in the Netherlands and France during the 16th century, whereas the use of immature seeds as a vegetable began in Europe a century later.

At present, *Pisum sativum* is found in all temperate countries and in most tropical high- lands. In Africa, garden pea and sugar pea are mostly considered exotic products. They are originally of some importance, sugar pea

more in Francophone countries, garden pea more in Anglophone countries. Imported canned garden pea seeds are available everywhere in food shops.

MAJOR PRODUCTION AREAS IN SOUTH AFRICA

South Africa

Commercially peas are grown almost in all parts of the cooler areas in South Africa, particularly in KwaZulu-Natal, Brits and Rustenburg in North West, and in the Mpumalanga Lowveld.

DESCRIPTION OF THE PLANT

P. sativum is an annual plant, with a life cycle of one year. It is a cool-season crop grown in many parts of the world; planting can take place from winter to early summer, depending on location.

The pea is a green, pod-shaped vegetable, widely grown as a cool-season vegetable crop. There are generally three types of peas that are commonly eaten: garden or green peas (*Pisum sativum*), snow peas (*Pisum sativum* var. *macrocarpon*) and snap peas (*Pisum sativum* var*. macrocarpon ser. cv.*)

Garden peas have rounded pods that are usually slightly curved in shape with a smooth texture and vibrant green colour. Inside of them are green, rounded pea seeds that are sweet and starchy in taste. Snow peas are flatter than garden peas and are not fully opaque. Snap peas, a cross between the garden and snow pea, have plump pods with a crisp, snappy texture. The pods of both snow peas and snap peas are edible, and both feature a slightly sweeter and cooler taste than the garden pea.

Botany

Pea is an annual herbaceous plant or leguminous crop.

Roots

Plants have a taproot system with nodules on the surface.

Stem

Stems are hollow, slender, succulent and ridged.

Leaves

It bears pinnately compound leaves with threepairs of leaflets and the termi-

nal one is modified into a branched tendril. At the base of the petiole, a large pair of stipules or bracts is found, and they cover the petioles in such a way that the leaves appear to be sessile.

Flower

The plants are succulent, erect (garden pea) with a plant height of 30 cm in garden pea and 50 cm to75 cm in the case of field peas. Garden peas, being erect, remain erect while field peas have a tendency to climb when provided with a support.

Flowering usually begins 40 to 50 days after planting. Flowering is normally two to four weeks, depending on the flowering habit and weather during flowering.

The flowers are arranged in the form of an axillary raceme. The flowers may be reddish, purple or white. They are self-pollinated and develop into 5 cm to 9-cm-long, inflated or cylindrical pods containing five to 11 seeds inside them.

Seeds

Seeds are globose or angled, smooth or wrinkled, whitish, grey, green, or brownish; 100 seeds can weigh from 10 to 36 g.

CULTIVARS

The following varieties (listed in order of maturity) have wrinkled seeds and are resistant to fusarium wilt.

Early

- Daybreak (54 days to harvest; 50 to 60 cm tall, good for freezing)
- Spring (57 days; 56 cm tall; dark green freezer peas)

Main season

- Sparkle (60 days to harvest; 46 cm tall; good for freezing)
- Little Marvel (63 days; 46 cm tall; holds on the vine well)
- Green Arrow (68 days; 71 cm tall; pods in pairs; resistant to fusarium and powdery mildew)
- Wando (70 days; 60-76 cm; withstands some heat; best variety for late spring planting)

Sugar

- Snowbird (58 days; 46 cm tall; double or triple pods in clusters)
- Dwarf Grey Sugar (65 days; 60 to 76 cm)
- Snowflake (72 days; 56 cm to harvest; high yield)

CLIMATIC REQUIREMENTS

Temperature

Peas are grown in varied weather conditions. It requires cold and dry climate. The longer cold spell helps in increasing yield. Pea seed can germinate even at a minimum temperature of 50^0C but the process is slow. The optimum temperature for germination is about 22^0C. At higher temperatures, germination is rapid. Optimum means that the temperature for good growth is between 10^0C to 18^0C.

SOIL REQUIREMENTS

Peas can be grown on all types of soils but it prefers well-drained sandy loam soils. The soils should rich an organic matter as it enhances better growth by supplying nutrients at a slower rate. It does not thrive in highly acidic or alkaline soils or saline soils. It grows best at a pH of 6,5. If the pH is less than 6,0, then it should be amended to improve the soil conditions.

Site and soil

Peas need an open position in full sunshine and an open soil that has plenty of air between the crumbs. Air is essential for the bacteria that live on the roots of the pea plant to thrive. The bacteria pass nitrogen to the plant in return for sugars. The soil should be neutral or slightly limy, a requirement of most vegetables, and lime status should be adjusted with lime if necessary. Peas prefer soil that does not dry out. The ideal is a silty loam, soft and moist, but not heavy. Well-rotted compost added to light soil improves it and it helps to open up heavy clay soils. If soil conditions are right, peas are very easy and very successful.

PART 2: Cultivation practices

PROPAGATION

Pea is propagated by seed. Approximately 1 000 seeds' weight ranges from 100 g to 500 g.

SOIL PREPARATION

The field should be prepared well by two to three ploughings. The soil should not be much pulverised and fine. However, it must be free from weeds and stubble of the kharif crop grown earlier. Well-decomposed farmyard manure at 25 to 30 t/ha along with 100 kg dolomite per hectare should be applied during final ploughing. After ploughing, the field should be levelled well for proper distribution of irrigation of water.

Seed and seedbed treatments

Seed treatment

Pea seeds may be treated with *Rhizobium* culture. The bacterium used for inoculation is *Rhizobium leguminosarum*. This will not only help to fix atmospheric nitrogen but also to reduce manure application. There are three methods by which pea seeds can be treated. The methods are as follows:

- Depending on seed rate, the required quantity of jaggery is boiled in water and cooled.
- *Rhizobium* inoculation (1,5 kg/ha) is sprinkled, mixed in jaggery solution and mixed with seed followed by drying in the shade.

Soil treatment

The *Rhizobium* inoculum is mixed with the required volume of soil and spread over the field.

Soil application: If *Rhizobium* inoculum is not available, 200 kg of soil (2-10 cm surface soil) can be collected from a particular area, where *Rhizobium* had been applied before or a leguminous crop had been cultivated luxuriantly, and should be broadcasted over the field.

The seed should not be exposed to direct sunlight after treatment with *Rhizobium* inoculum. It should be kept in mind that this inoculation may add nitrogen up to 50 kg per hectare.

PLANTING

Planting period

Peas are normally sown directly where they are to grow to maturity, but they can also be sown early in pots, in a greenhouse, to bring on plants for planting out. Otherwise sow early in March, second sowing in April, third sowing in May and late sowing using early varieties in June or even into early July.

Cultivate the soil well and leave it soft and open. There is generally no need to apply any fertiliser if the soil is fertile and has been fertilised for previous crops and organic material added in previous years. Make a shallow drill about the width of a spade-head and 5 cm deep. Scatter pea seeds along the drill or space these evenly about 20 or 30 peas per metre of row in single or double lines. Cover with soil using a rake to draw it over them. Do not sow in wet or poorly cultivated soil; wait a week or two until it dries. Peas tend to rot in cold, wet soil.

Timely sowing is essential for optimum yields because late-sown crops are often affected by low moisture availability and heavy aphid infestation at medium altitudes and by frost at high altitudes.

Planting dates and harvesting schedule

Type	Sow	Harvest	Sow to harvest (weeks)
First early	March to June	June to September	12
Second early	March to June	June to October	14
Main crop	March to June	July to October	15

Spacing

Garden pea is sown rather densely, with plant densities up to 80 plants per square metre. The seed should be sown 4 to 7 cm deep. Approximately 60 to 200 kg/ha of seed is required, with the highest rates for garden pea.

Another important step to consider when planting peas is to plant peas 3 to 5 cm deep and 2 cm apart in single or double rows. Allow 46 to 60 cm between single or pairs of rows. Allow 20 to 25 cm between double rows in pairs.

The peas can be sown directly into the garden as soon as the soil can be worked about five weeks before the last expected frost. Place the seeds about 3 cm deep, about 10 cm apart into rows that are about 1 m apart. For correct straight rows a string can be used as guidance (pulled tense from one end of the row to the other end). Building a small fence with chicken-

wire, or using climbing guides is also an important step for vining varieties. This is done by guiding the young plants towards the support structure as soon as they start developing long enough shoots to climb.

This keeps the vines free of dirt and too much moisture, which cause the pea plants to rot. Water the peas after planting and keep them moist. Too moist conditions are normally not healthy for pea production. When the plants start to grow, some extra water is essential because the plant development needs more moisture at this stage. The peas will be ready for harvest about three weeks after the first few flowers. The plants should be fertilised about once a month with any fertiliser with a low nitrogen content.

Seeding rate

About 70 to 75 kg seed is required for one hectare of land.

FERTILISATION

For an ideal crop it is required to apply about 25 to 30 t/ha of well decomposed organic manure like compost or farmyard manure (FYM) in case of very light soils. Apart from application of manures, it is essential to treat the seed with *Rhizobium* inoculum for better nodulation, plant vigour and higher grain yield. Initially the crop should be supplied with vermicompost/bokashe/oilcakes or any organic manure at 10 kg/ha as a starter dose.

Field fertilisation

The total uptake of a crop yielding 5 to 6 t of seed per hectare is 30 to 35 kg/ha P and 200 to 250 kg/ha K. Garden pea responds well to a starter dose of N fertiliser, even when nodulation occurs. An indicative fertiliser recommendation on light medium-rich alkaline soils is 40 kg N, 50 kg P, 150 kg K and 30 kg Mg per hectare.

IRRIGATION

The water requirement of peas is comparatively low. Presowing irrigation is essential for proper germination if the soil is dry. The frequency of irrigation depends on the type of soil and winter showers. Generally two to three irrigation intervals are required. Soil moisture deficit reduces growth and hampers nodulation.

Frequent irrigation should always be avoided (as excess moisture results in

yellowing of the crop, reducing the yield) but the crop must be provided with irrigation at the pod-filling stage and when frost is expected during the growth period. Furrow irrigation is generally used for irrigating peas but the sprinkler irrigation method is better. Moisture stress conditions during flowering and subsequent pod-filling stage severely limits the yield and the quality of the pods.

WEED CONTROL

Weeds should be rigorously controlled. The critical period of weed competition is 3 to 8 weeks after emergence. The pea crop severely suffers because of weed growth at the early stages. This may be the result of wider spacing given for hand picking of green pods or for slow growth of pea during the early stage. Later the crop smothers the weed growth by covering the ground.

Generally 2 to 3 weedings are necessary to keep the field free from weeds. Manual weeding is better than mechanical weeding as it may damage the root system. Weeding at later stages is avoided as it may also damage the crop by trumping and mechanical breakage of tender and succulent stems and branches.

Weeds can be controlled by hand weeding where labour is cheap, whereas chemical weed control is more practical in large-scale production. Early land preparation can encourage weed seeds to germinate so that they can be destroyed in subsequent cultivation.

PEST CONTROL

The pea leaf weevil (Sitona lineatus) is an insect that damages peas and other legumes. It is native to Europe, but has spread to other states such as Alberta, Canada, etc. They are about 3,5 mm to5,5 mm long and are distinguishable by three light-coloured stripes running length-wise down the thorax. The weevil larvae feed on the root nodules of pea plants, which are essential to the plant's supply of nitrogen, and therefore diminish leaf and stem growth. Adult weevils feed on the leaves and create a notched "c-shaped" appearance on the outside of the leaves.

Scouting and thresholds

Pea weevils thrive under cool, wet conditions and become less of a problem as the weather warms up. Damage to pea plants is more severe when grow-

ing conditions are cool and wet. Check emerging pea plantings by examining plants and rolling over dirt clods where adults may be hiding. Sweeping can be used for sampling adjacent fields where sufficient foliage has developed. Cone traps with aggregation pheromone also can be used. Economic damage can occur at densities as low as 33% adult weevils per seedling plant. Consider 25% growth-point injury on seedling plants an action threshold.

Management: cultural control

Crop rotation and planting peas away from other legumes is useful. Irrigation and proper fertilisation may help crops outgrow defoliation.

Pod borers (*Etiella zinckenella* and *Helicoverpa armigera)*

The moths are medium sized with a wingspan of 2,5 cm and wing colour is grey with dark marginal lines interspersed with ochreous scales on the forewings. The early larvae are greenish and the full-grown ones are rosy with a purplish tinge.

Damage and symptoms

The caterpillars enter the pods and feed on the seeds. The caterpillars also consume the flowers. Consumed flowers and holes on the pods are the characteristics of the presence of this pest.

Control measures

Deep ploughing is likely to kill the diapausing pupae. The pest population can be kept under control by spraying a botanical pesticide prepared from neem seed.

Pea leafminer (*Phytomyza atricornis*)

It is a small insect with a large globular head and black thorax having yellow markings on the sides. It is a major polyphagus pest of pea.

Damage and symptoms

Adults puncture the leaf either to lay eggs or to feed on the plant sap while the larvae feed on the leaf tissue as they mine. A series of triangular blotches in which eggs are deposited or irregular mined areas are the visible symptoms of attack by this pest.

Cultural control

Remove and destroy the infested leaves identified by the mined areas and blotches.

Biological control

The maggots of this pest are parasitised by the hymenopteran *Solenotus* spp. and *Neochrysocharis* spp. and *Opius* spp.

Aphids

Affected area

Leaf

Description

Small insects found on new stems and the underside of the leaf. They are usually green. They suck fluids from the plant, leaving a honeydew substance behind. Leaves turn pale yellow.

Control

Insecticidal soaps or a strong stream of water. Ladybug beetles are natural predators. A layer of aluminum foil under the plants reflects light to underside of leaves and may deter aphids.

Cutworms

Affected area

Above ground part of the plant

Description

Plants are chewed off just above ground level. Cutworms are caterpillars that are up to 3 cm long and mottled or striped green, brown or grey. When they are disturbed, they roll up in a coil. They usually position themselves at the moisture line in the soil, moving up and down according to the water content. If the soil surface is dry, they will be found a couple of inches below the surface where the moisture begins. When plants have been newly watered, they will be at the surface.

Control

Put a cardboard collar around new transplants to extend 2 to 5 cm above and below soil level.

7.5 Slugs and snails

Affected area

Entire plant

Description

Large parts of young plants missing.

Control

Slugs and snails are very susceptible to desiccation (drying) and require a moist, shady place to live. Cultural practices which promote a sunny and dry environment will discourage them. Avoid too frequent watering, allowing the soil surface to dry out between irrigations. Keep the garden free of debris, boards, bricks, and stones where they hide. Hand picking these pests is very effective. Create traps for hand picking by laying boards in the garden. Slugs and snails will congregate under them. Lift the boards each morning and collect the slugs and snails.

Dispose of them completely as they will crawl back if tossed out of the garden, and eggs inside dead pests can still hatch to produce more of these pests. Slug and snail bait containing metaldehyde can be placed near food plants as long as they do not contact edible portions of the crop. It is most effective when moistened, but not waterlogged. Snail bait attracts slugs and snails from several feet away so bait stations are effective. Stations help protect birds, pets and other non-target animals which are also attracted to the bait.

Place small piles of bit under a slightly propped up board or use a container such as a cottage cheese or yogurt carton. Bury the carton to the mouth of the container. Place a small quantity of commercial bait inside and moisten with apple juice, orange juice or water. Cut a hole in the lid to allow access and place lid on container. Containers may also hold beer or yeast water to attract slugs and snails in, where they drown. Place bait stations wherever slugs and snails are active or around the perimeter of the garden.

8. DISEASE CONTROL

8.1 Wilt of pea (*Fusarium oxysporum f. sp. pisi*)

Symptoms

The plants become stunted, pale yellow green, with leaves curled down-

ward. The stem becomes thickened and brittle at ground level. As a result the plants wilt and die off prematurely. The disease may cause more or less circular bare spots in the field, enlarging each year if peas are planted continuously. The disease is favoured by high soil moisture.

Control measures

- Select wilt resistant varieties.
- Avoid early sowing to escape high humidity and high temperature which are congenial for the disease.
- Crop rotation for at least 2 to 3 years with suitable non-leguminous crops should be followed.

8.2 Powdery mildew of pea (*Erysiphe pisi*)

The disease occurs worldwide and is much more serious than other diseases of pea because it occurs more frequently and covers a larger host surface area. It is worst in dry weather. Early varieties are less damaged. Varieties maturing in January usually escape the maximum intensity of the disease.

Affected area

Leaf

Description

This disease is characterised by small lesions that appear on the upper surface of the lowest and older leaves. These lesions are scattered on the leaves and as they mature and develop they look like white, powdery areas. Severely infected areas may even look blue-white.

Symptoms

The powdery mildew first appears on the leaves and then on other green parts of the plant. Its attack is characterised by the formation of white, floury patches on both sides of the leaf as well as on tendrils, pods and stems. These patches originate as minute discoloured specks from which a powdery mass radiates on all sides. When the disease has advanced, large areas on the aerial parts of the host may be covered with these white, floury patches. The superficial mass consists of mycelium and spores of the fungus causing the disease.

Control measures

- Burn infected pea stubble soon after harvest where practicable.
- Avoid late sowing of the crop.

- Avoid sowing field pea crops adjacent to last season's stubble.
- Control volunteer field peas which can harbour the disease.
- Leave 4 years between field pea crops in the same paddock.
- Use treated seeds.
- Also, planting early and using sprinkler irrigation will minimise the chances of having a crop infected with powdery mildew.

Several fungi such as *Ampelomyces, Cladosporium, Tilletiopsis, Verticillium* and insects (*Thrips tabaci*) have been reported to parasitise the powdery mildew on the host surface.

8.3 Downy mildew of pea (*Peronospora pisi* Syd.)

Affected area

Leaf

Description

This disease is characterised by stunted and distorted plants with fungus growing on all the plant surfaces. These plants may turn yellow while producing more fungi for secondary infections. The plant will develop lesions that are greenish, yellow to brown in colour on the upper leaf surfaces and mouse-grey, fluffy areas on the undersides of the leaves directly under the upper lesions.

Control measures

- Use resistant cultivars.
- Crop rotation for at least 2 to 3 years helps in reducing the primary inoculum.
- The diseased plants should be removed and burnt soon after detecting in the field.

8.4 Rust of pea (*Uromyces* spp.)

Two species of Uromyces occur on cultivated pea viz. Uromyces pisi and U. fabae. It also causes considerable losses to pea cultivation.

Symptoms

The earliest symptom is the development of aecia in round or elongated clusters in February or even later. Pycnia are infrequent or rather inconspicuous. All the spore stages develop on every green part of the host, including pods. The uredial pustules develop on both surfaces of the leaves as well as

on other parts. They present a powdery, light brown appearance. The telia occur in the same sorus as the uredia and develop from the same mycelium. They are formed on the leaves but most commonly on stems and petioles. They are dark brown or almost black in colour.

Control measures

- Destroy all diseased plant debris after harvest.
- Follow suitable crop rotation with non-leguminous crops.

8.5 *Fusarium* wilt

Affected area

Leaf:

Description

Yellowing of lower leaves, stunted growth, wilting, and eventually dying off.

Control

- Pull up and destroy infected plants.
- Rotate the planting location.
- Use disease-resistant varieties.

8.6 *Aphanomyces* root rot

Affected area

Root

Description

This disease is characterised by firm, straw-coloured lesions that are found on the roots. These lesions spread through the cortex and eventually develop a discoloured root system. The disease can be visible one to two weeks after the infection occurs. The best form of control is to check fielding before planting and avoid infested fields.

Control

There are no resistant cultivars available for control at this time.

8.7 Bean leaf roll virus

Affected area

Above-ground part of the plant

Description

This disease is characterised by plants that are suffering from severe stunting and often die off before they bloom. As the disease progresses and matures, the stunting will continue and the plant may experience yellowing of the entire plant and sudden collapse, leading to die off.

Control

The best form of control is to use resistant cultivars.

8.8 Pea enation mosaic

Affected area

Above-ground part of the plant

Description

This disease is characterised by plant distortion, as the plant is still young. As the plant grows and matures, it may take on symptoms of stunted plant growth, yellow spots, leaf and pod distortion and reduced seed size and quality.

Control

The best form of control is the use of resistant cultivars.

8.9 Pea seed-borne mosaic

Affected area

Entire plant

Description

This disease is characterised by stunted and malformed plants that may also never reach maturity.

Control

The best form of control is to use resistant cultivars.

8.10 Pea stunt

Affected area

Entire plant

Description

This disease kills off young plants very early before they get a chance to

bloom. As the plants become older, the infections will cause stunted growth and terminal rotting.

Control

The best method of control is to use resistant cultivars.

8.11 *Rhizoctonia solani* seedling rot

Affected area

Seed

Description

This disease is characterised by lesions that appear to be water-soaked as the seedling emerges. These lesions will develop a reddish-brown to brown colour and often the growth point may be affected, causing it to die off. Mature plants that become infected will also develop the reddish-brown, sunken lesions that may girdle the plant and cause severe stunting.

Control

The best form of control is to apply fungicidal seed treatment chemicals in connection with insecticide applications of Captab (Republic of South Africa).

9. OTHER CULTIVATION PRACTICES

9.1 Inoculation

Garden peas have the inherent ability to obtain much of their nitrogen requirement from the atmosphere by forming a symbiotic relationship with *Rhizobium* bacteria in the soil.

Legumes vary widely in the proportion of the crop's total nitrogen requirement that may be met through nitrogen fixation. The total quantity of nitrogen fixed by the crop also depends on favourable growing conditions. Hot temperatures and dry soils during the later vegetative and early reproductive stages are especially detrimental for N fixation. Garden peas are among the most highly efficient nitrogen-fixing crops and may obtain as much as 80% of their total nitrogen requirement under good growing conditions.

However, for this relationship to occur, the seed must be properly inoculated with the appropriate strain of *Rhizobium* bacteria. Producers must be certain that the inoculum product they obtain is specific for field pea. Use of an inoculum labelled for soya bean, clover or other legume will not allow the

nitrogen fixation process to occur. Inoculants are available in various forms, including dry peat, liquid and granular.

9.1.1 Process

Application of inoculant to the seed is an extremely important procedure. Many failures with nitrogen fixation have been associated with improper application technique. Thorough coverage of the seed is critical because seeds not exposed to the bacteria will result in plants that area unable to fix nitrogen. Inoculants are living organisms, so proper storage and handling are important.

Granular inoculant, a relatively new form of inoculant, has alleviated many of the concerns with inoculant applications. This inoculant is metered through the planter and delivered directly into the seed furrow.

Producers should refer to the manufacturer's package labels to review proper inoculum rate and handling procedure.

Growers should check their fields to determine if inoculation was successful. Normally, nodules will form on the roots two to four weeks after emergence. To check for nodulation, carefully dig up a number of plants and gently clear the soil from the root mass. Nodules will be present both on the primary root and on the lateral roots. Effective nodules will have a pink to red coloration on their interior. If nodulation does not occur and soil nitrogen levels are low, an application of nitrogen fertiliser over the top may be required to optimise seed yields. Nitrogen fixation will take place from about four weeks after emergence through seed formation.

9.2 Trellising

The trellises permit plant foliage to dry out, reducing the threat of mildew and other fungal diseases. Single trellis rows are usually spaced 2 m apart, because this is the smallest spacing that will still accommodate a tractor for spraying and cultivation.

The germinating seeds and small seedlings are easily damaged by direct contact with fertiliser or improper cultivation. Cultivate and hoe shallowly during the early stages of growth. Most dwarf and intermediate varieties are self-supporting. The taller varieties are most productive and more easily picked when trained to poles or to a fence for support; but they are no longer popular. Peas can be mulched to cool the soil, reduce moisture loss and

keep down soil rots. Some of the snap and sugar peas are vining types with heights of 2 m or more that require fencing or other supports.

Garden pea is seldom supported. The stems are not twining, but grasp the support with their tendrils. They do not need vertical poles, but the poles can be crossed, or the plants are supported by wire mesh, horizontal wires, vertical lattices or nets, depending on the potential height of the cultivar grown.

9.3 Integrated pest management

To control insect pests and diseases, integrated pest management (IPM) is recommended:

- use disease-free seed or seed treatment of own seed; keeping fields weed free;
- appropriate fertilising and irrigation; growing pea for seed in semiarid and/or arid areas;
- regular monitoring of the crop; and
- judicious use of biocides.

9.4 Thinning

Thinning is not necessary. Tall peas should be grown along a fence or trellis.

10. HARVESTING

Harvesting period: 58 to 74 days, depending on variety and growing conditions (soil, temperature, and moisture).

Garden peas

Pick garden peas when pods are round and full.

When the pea pods are swollen (appear round) they are ready to be picked. Pick a few pods every day or two near harvest time to determine when the peas are at the proper stage for eating. Peas are of the best quality when they are fully expanded but immature, before they become hard and starchy. The last harvest (usually the third) is made about one week after the first. Pulling the entire plant for the last harvest makes picking easier.

The smooth-seeded varieties tend to have more starch than the wrinkled-seeded varieties. The wrinkled-seeded varieties are generally sweeter and usually preferred for home use. The smooth-seeded types are used more often to produce ripe seeds that are used like dry beans and to make split-pea

soup. Snap peas have been developed from garden peas to have low-fibre pods that can be snapped and eaten along with the immature peas inside. Snow peas are meant to be harvested as flat, tender pods before the peas inside develop at all.

10.2 Harvesting methods

Peas should be picked immediately before cooking because their quality, especially sweetness, deteriorates rapidly. The pods on the lower part of the plant mature earliest. The pods are plucked manually from the plants and harvesting may be done at weekly intervals.

Peas can be picked as soon as they are big enough. Picking the first pods while the peas are still relatively small helps to maintain the quality aspect of the produce. This early picking also helps to extend flowering and cropping by preventing seed setting. Once a few pods set, the plant puts all its energy into swelling these. All the pods should have reached readiness when picking starts.

10.3 Harvest recommendations

Shell type and snap type: pick when pods are full, but not swollen. Large peas are tough and less sweet.

Edible pod: pick before there is much indication of the pea inside the pod. Pods become tougher as pea size increases.

Harvesting the peas every 3 to 5 days will prevent overmaturity and stimulate the plants to continue to produce new pods. Harvested peas should be rapidly cooled to 0 to 1^0C. Optimum storage conditions are between 0^0C to 2^0C and 90% to 98% relative humidity.

PART 3: Post-harvest handling

SORTING AND GRADING

Some fresh market peas are produced and these are hand harvested or harvested by machine and packed in baskets or crates for shipment to local markets. Shipment to distant markets must be under refrigeration to maintain quality.

PACKAGING

Only about 5% of the peas grown are sold fresh; the rest are either frozen or canned. When trying to decide between frozen and canned green peas, the following information may be helpful:

- Frozen peas are better able to retain their colour, texture, and flavour than canned peas. Recent research has confirmed that these “important sensory characteristics” of green peas are not affected by freezing over periods of 1 to 3 months.
- Both canned and frozen peas may contain relatively high levels of sodium. Unless labelled as “low sodium” or “reduced sodium” or containing “50% less sodium” or something similar, you can expect to find 650 mg to 800 mg of sodium in one cup of canned green peas. Some of this sodium can be removed by thorough rinsing. Reduced sodium canned peas will often bring the sodium content down to 250 mg to 300 mg of sodium.
- Neither frozen peas nor canned peas have an unlimited shelf life. In the case of frozen peas, it’s not uncommon to see “use by” dates that indicate a 24 to 30 month shelf life. However, based on the overall research findings on nutrient content of frozen peas during storage, we recommend that you consume your frozen peas within 6 to 12 months of the packing date. (If no packing date is available, just make the “use by” date 50% sooner.)

STORAGE

The initial seed moisture content of peas must be reduced to the required level of about 12% before storage. Optimum moisture content reduces the deterioration rate during storage and prevents or reduces attack by moulds and insects. The seed should be stored in a dry and cool place, free of pests and protected from absorbing moisture from the surroundings. In tropical Africa, e.g. in Ethiopia, pea seed is not stored for more than one season because of insect damage, particularly by bruchids. Garden pea seeds may be

kept for 1 to 3 weeks at temperatures of 0°C to 40°C and a relative humidity of 88% to 92%.

Fresh peas can be kept for 2 to 3 days in the refrigerator. The sugar in them quickly begins to turn to starch even while under refrigeration. As much as 40% of the sugar is converted in a few hours. Fresh peas are canned and kept in brine solution for 3 to 4 months.

MARKET PREPARATION

Classification of peas

The garden pea (*Pisum sativum* var. *hortense*) is green coloured, wrinkled seeded, sweet in taste, used for table and canning purposes. Young green pods are picked and sold on the market, which gives an attractive price.

Premium prices are associated with the human food and seed markets. Selling peas in the premium markets is a greater challenge than marketing a traditional smallgrain crop. Premium pea markets are normally limited and require a more aggressive approach by the grower. Markets should be identified before peas are produced to optimise the ability to harvest a crop that will meet market standards. For example, when marketing food-grade peas, numerous factors that affect market grade include market class (e.g. green or yellow cotyledon, specialty types), seed size and shape, splitting potential, harvesting moisture, seed-handling techniques during harvesting and storage and seed damage factors (e.g. bleach, cracked seed coats, splits, shrivelled seed, earth tag, chalk spot, etc.).

After harvest, the crop has to be graded to determine the markets that are options for the grower.

PART 4: Production schedule

Activities	January	February	March	April	May	June	July	August	September	October	November	December
Soil sampling												
Soil preparation												
Planting												
Fertilisation												
Irrigation												

Activities	January	February	March	April	May	June	July	August	September	October	November	December
Pest control												
Disease control												
Weed control												
Trellising												
Leaf sampling												
Harvesting												
Marketing												

PART 5: Utilisation and nutritional value

The young seeds of garden pea are also boiled for a few minutes. They are commonly offered as canned or in Western countries as deep-frozen products. In Ethiopia the annual consumption per person of pea seeds is estimated at 6 to 7 kg. Main dishes include 'shiro wot' (split pea seeds ground and made into stew) and 'kik wot' (boiled split pea seeds in a stew).

Apart from being an important source of food and feed, pea plays a role in soil fertility restoration as a suitable rotation crop that fixes atmospheric nitrogen. The seeds of pea are claimed to have beneficial effects on many types of skin complaints; face masks made from crushed seeds are used to treat acne and wrinkled skins.

Culinary/Cooking

Uses

- Peas are cultivated for the fresh green seeds, tender green pods, dried seeds and foliage.
- Green peas are eaten cooked as a vegetable, and are marketed fresh, canned, or frozen while ripe dried peas are used whole, split, or made into flour.
- In some parts of the world, dried peas are consumed split as dahl, roasted, parched or boiled.
- Some cultivars are grown for their tender green pods, which are eaten cooked or raw.

- Peas are sometimes preserved to get the taste during off season.
- Seeds are thought to cause dysentery when eaten raw. The flour is considered as an emollient and resolvent, applied as a cataplasm. It has been reported that seeds contain trypsin and chymotrypsin which could be used as contraceptive, ecbolic. fungistatic and spermicide. There are no significant levels of toxicity or anti-metabolites in peas.

Nutritional value

Peas are high in vitamin A, vitamin C, vitamins B and lutein. Dry weight is about one-quarter protein and one-quarter sugar. Pea seed peptide fractions have less ability to scavenge free radicals than glutathione, but a greater ability to chelate metals and inhibit linoleic acid oxidation.

PART 6: References

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