



Strawberry: A potential cash crop in India

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The modern cultivated strawberry (*Fragaria x ananassa* Duch.) is a man made hybrid crop evolved by crossing two species, *Fragaria chiloensis* and *Fragaria virginiana*. This crop can be a good fit for many small-scale and part-time farming operations because its high value creates the potential for significant profit. It gives quickest return in shortest time than any other fruit. Its leaves contains essential oil. The leading strawberry-producing countries are United States, followed by China and Spain. In India, it is commercially cultivated in Himachal Pradesh, Uttarakhand, Uttar Pradesh, Maharashtra, West Bengal, Nilgiri Hills, Delhi, Punjab, Haryana and the some parts of Rajasthan. Nainital and Dehradun districts of Uttarakhand, Mahabaleshwar (Maharashtra), Kashmir vally, Banglore and Kalipong (West Bengal) are the main centers of strawberry cultivation in India. It is used in the many processed products like, ice cream, soft drinks, confectionary and chewing gum.

Health benefits of strawberries : It stimulates the burning of stored fat. The anthocyanins boost short term memory by 100 percent in eight weeks. Strawberries lower blood levels of C-reactive protein (CRP), a signal of inflammation in the body. It contains the flavonoids which are responsible for the colour and flavour development of fruit and also lower the risk for heart disease. It also contains potassium, vitamin K and magnesium which are important for healthy and strong bone. Some studies show freeze-dried strawberry powder may help prevent hman oesophageal cancer. Strawberries are rich in antioxidant ellagic acid, which protects the elastic fibres in our skin to prevent sagging. They also contain the biotin, which responsible for build strong hair and nails.

Climatic requirement : Strawberry is a temperate crop but some varieties can be successfully grown in tropical and subtropical regions. It is a short day plant and requires exposure to about 10 days of less than 8 hours sunshine

for initiation of flowering. In winter, the plants do not make any growth and remain dormant. The exposure to low temperature during this period helps in breaking dormancy. In the spring season when the days become longer and the temperature rises. The plants resume growth and begin flowering. The varieties grown in milder subtropical climate do not require chilling and continue to make some growth during winter. It requires 22-23^o temperature for better growth, development and fruiting. The maximum growth rate was observed at the 22-25^oC day and 70-13^oCnight temperature. Photoperiod is effective for vegetative growth, plant morphology and yield.

Soil requirement : Strawberries can be grown on a variety of soils. But it thrives best on a well-drained medium loam and slightly acidic soil with high organic content. Most the roots are found in upper layer of soil with 15-30 cm depth. It is sensitive to soil reaction and however, it prefers slight acidic soils with 5.5 to 6.5 pH. The presence of excessive calcium in the soil causes yellowing of the leaves. The light soils with high organic contents are found to be good for better runner formation. The alkaline and nematodes infected soils should be avoided. Water should not stagnate in the field.

Varieties : Different varieties of strawberries are available in India for commercial cultivation like cama rosa, festival, winter dawn, sweet charli, belrubi, chandler etc. According to Handbook of Horticulture (2001) following importance varieties are described (Table 1).

Propagation : It is commonly propagated by runners or stolons. The stolon is the creeping branch produced from a leaf axil on the crown. Runner plants are produced at each successive node on the stolon, forming root initials where the node touches the ground. It can produces 7-15 runners per plant under proper management. Now a days micro propagation or tissue culture is also receiving attention but although research is suggest that tissue culture plant may not produce high yield in the first season

Table 1 : Varieties and characteristics of strawberry

Sr. No.	Varieties	Characteristics
1.	Belrubu	Fruit large, conical, skin bright red, average fruit wt.15g., TSS 11.8%, Acidity 0.98%, Sugar 6%, It produce adequate runners.
2.	Chandler (Doglas x K-72361-105)	Popular in North India, Large fruit 15-20g., TSS 12%, Acidity 0.85%, Sugar 6.1%. It is resistance to physical damage caused by rain. It also tolerance to virus. Suitable for processing and table purpose.
3.	Sweet Charli (A.L.80-456 x pajaro)	Early variety, average fruit wt.17g, It is resistance to anthracnose and susceptible to blast, powdery mildew and mites.
4.	Pajaro	Fruit has good dessert and processing quality. Average fruit wt.7.6 g, TSS 12.2%, Acidity 0.97%, Sugar 5.5%.It is resistance to rot, virus and wilt.
5.	Selva	It is suitable for off season cultivation, Fruit large, flesh, and skin firm, good dessert quality, average berry wt.15-18g,TSS 11.1%,Acidity 1.0%,Sugar 5.5%.
6.	Tioga	Early cultivar, It is tolerant to virus, Fruit very large, flesh, and skin firm, good in dessert and processing quality, average fruit wt.9g, TSS12.2%, Acidity 0.98%, Sugar 6.2%.
7.	Torrey	It produce numerous runners, Fruit large flesh and skin medium firm, excellent dessert quality, and good for processing, average fruit wt.6.9g. TSS 12%, Acidity 0.97, Sugar 6.1%, It also tolerate to virus.

Source: Handbook of Horticulture (2001), ICAR, New Delhi.

as runner plants. Micro propagation of strawberry is especially important for buking up new varieties for rapid distribution, for the production of virus free planting materials, and for storage and transportation throughout the world. The plants are planted at 1.2 x 1.2m or 1.8 x 1.8 m distance for propagation only (not field plantation).

Land preparation : The land should be well prepared by deep ploughing followed by harrowing. 10-12 tons FYM, 20 kg nitrogen, 20Kg phosphorous and 15 kg potash per acre should be apply at the time of land preparation. Finally either levelled the land and beds are prepared.

Transplanting : In India, planting time varies from region to region depending up on agroclimate and accordingly recommended planting times are fall (September to November), spring (March) and even in August. In general, transplanting is done in March-April in the hills, in January-February in the plains and in November-December in Mahabaleshwar. Strawberry can be planted on flat beds, in the form of hill rows or matted rows, or it can be planted on raised beds. In irrigated areas, planting on ridges is advised. The planting distance should be kept 45 cm from plant to plant and 60 to 75 cm from row to row.

Mulching : Mulching is necessary in strawberry cultivation to preserve the water in soil, maintain the soil temperature, control weed growth and protect the crop from injury caused by soil freezing /thawing cycles in winter. It also protect the flower bud from temperature below 15°F. It does not decompose in soil, so to be removed from the field at end of fruiting season.

Special cultural practices : The some necessary cultural practices should be adopted in strawberry cultivation for

the higher yield and good quality produce. These are below:

– **Bud and Shoot thinning / Deshooting / Debudding :** Removal of 1-2 buds/plant to improve the fruit yield and quality.

– **Deblossoming :** Removals of the flower truss to prevent fruiting and increased the yields of early saleable runners.

– **Control of runners :** Runners should be allowed to root along the rows until sufficient crowns are formed. Excess runners are not required and should be removed from the rows.

Irrigation : The strawberry plant has a shallow root and it is susceptible to drought. Early planting in autumn allows the plants to make good vegetative growth before the onset of winter. However, in this case it is necessary to ensure that newly planted runners are irrigated frequently after planting, otherwise the mortality of the plants becomes high. In the months of September and October, two irrigation should be given in a week if there is no rain and in December and January irrigation may be given once every fortnight. It may be reduced to weekly intervals during November. The irrigation frequency may should again be increased at the time of fruiting and this irrigation gives larger fruits.

Nutrient management : Fertilizers requirements of strawberry vary with the type of soil, location and production system. It requires moderate amounts of nitrogen. Addition of FYM to the soil @ 50 tons per hectare is highly desirable because it improves the water holding capacity of the soil and good for better runner formation. The fertilizer requirement is vary with 84-112 kg nitrogen, 56-84 kg phosphorus and 56-112 kg potash

per hectare. The phosphatic fertilizer should be incorporated in to the soil before plantings. The nitrogenous fertilizer should be applied in two doses, first three weeks after planting and second at the time of flowering. Potash should be apply at the time of flowering only. Foliar application of urea (2%), zinc sulphate (0.5%), calcium sulphate (0.5%) and boric acid (0.2%) is beneficial for higher and better yields.

Weed management : The intercultural operations like weeding and hoeing should be done lightly to destroy the weed. Applications of paraquat, simazine @3kg/ha and Pendimethalin @ 330g/ha are give good result to control weeds.

Plant protection : Red spider mites and cut worms are the major pests of strawberry. The mites can be controlled with the spray of wetable sulphur @ 1.5 gm/liter water. Aldicarb (10G) @ 5kg/ha or Chlorpyrifos and Carbamates are also effective for the control of red spider mites. The cut worms can be controlled by dusting with 5 percent chloradane or Heptachlor @ 50 kg /ha or drench the soil with chlorpyrifos @ 2ml/l water before planting.

The common diseases of strawberry are gray mold, red stele, powdery mildew and black root rot. The gray mold can be controlled with the spray of Dithane M-45 @ 1.5 g/liter water. Two spray of wetable sulphur @ 1.5 g/liter water at weekly intervals are found effective for the control of powdery mildew. Soil drenching with Ridomil and treating runners with copper oxychloride (0.1%) for 15 minutes are effective for the control of red stele. Proper drainage, crop rotation and the use of resistant varieties like stelemaster are important to reduce the incidence black root rot and red stele diseases. Strawberry also suffers from virus diseases and the raising of nursery in the hills helps to check these problem.

Harvesting : The fruit ripens during late February to April in the plains and during May and June at high elevations like Mahabaleshwar, Nainital and Kashmir. Strawberry are harvested by hand but now a days there have been numerous attempts to develop for mechanical harvesting. The cost of harvesting has been reduced by the development of big size fruited varieties. For local market the fruit should be harvested when fully ripe .For distant market berries should be picked when they become green/white and still hard. Berries should be Pick with the caps (or calyx) or stem one to two inches from the calyx. Harvesting should be done early in the morning in dry conditions. Harvesting early in the day while temperatures are cool and then precooling the fruit before selling or shipping extends the shelf life significantly.

Strawberry is highly perishable fruit; therefore it is packed in flat shallow containers of various types (cardboard, bamboo, paper trays etc.) with one or two layers of fruits.

Yield : The yield varies according to season and locality. It gives 20 to 25 tons fruits per hectare under ideal conditions.

Storage : Rapid postharvest cooling is the best way to maintain the post harvest quality of the fruits. A short period of control atmosphere storage, not exceeding 3 days can help to maintain the quality of fruits during the transportation. But a long period of control atmosphere storage is unsuitable due to reduction in oxygen and ethylene levels will reduce the respiration rate of fruit, loss of flavour and an acidic taste. Ideally it is preferred to pre cool and followed by lower cooling for longer shelf life.

Marketing : Strawberries are so perishable, they are well suited to roadside stand and pick-your-own operations, where time from harvest to sale can be kept to a minimum and provide opportunities to receive relatively high prices for your strawberries. Usually the fruit is picked in the early morning and sent to the market in the afternoon of the same day or is picked in the late afternoon, stored overnight in a cool place, and sent to market the following morning.

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