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Redefining Food and Agriculture

ROOT CROP: CARROT

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Carrot: An Introduction

Carrot is a biennial herbaceous plant cultivated for its starchy, edible root tubers. For vegetable purposes, carrot is grown as an annual crop. During the first season of growth, the plant completes vegetative growth and produces edible root tubers; during the next season, the plant completes its reproductive cycle and produces seeds.

Taxonomy

Kingdom	Plantae
Order	Apiales
Family	Apiaceae
Genus	Daucus
Species	D. carota
Subspecies	sativus

Origin and Distribution

Carrots are believed to be a native to Europe and south western Asia. China produces more than half of the world's carrots. India is also a leading producer of carrots.

Plant Description

The plant is a small herb with two distinct parts: a cluster of finely-divided, delicate, feathery-like leaves, that originating from a node just above the root system and a thick, prominent conical shaped tap root meant for storing food. Carrot tubers are actually modified taproots. Carrot leaves are highly divided, aromatic and are edible. Seeds are flavourful and can be used for culinary purposes.

Popular Varieties of Rutabaga

Three types of varieties depending upon the season of growing are: early, mid-season, and late varieties. There are also tropical and temperate varieties. Carrot tubers are available in different colours like red, orange, purple, black, white, and yellow.

Growing Carrot

Climatic Requirements: Carrot is originally a crop of temperate climates. They prefer cool, moist climate for its healthy vegetative growth and optimum tuber development. Optimum tuber development and tuber colour happens at a temperature range of 15 - 20 degree C. However, some tropical varieties of carrots can be grown in warmer regions and they can tolerate quite high temperatures. Carrot plants prefer full sunlight; they can be grown in partial shade also.

Soil: Carrots need a deep, loose, well-drained sandy or loamy soil for the best development of tubers. Highly acidic soils do not produce good carrots; so are rich, clayey soils and rocky soils; all these types of soils should be avoided for growing carrots. Maximum yield or tubers is obtained at a soil pH 6.5.

Propagation: Carrots are propagated by seeds. Recommended seed rate is 5-6 kg/ha. Seeds may be directly sown in the fields or seedlings may be raised in the nursery beds. In direct sowing, seeds are sown on ridges or on flat land about 1.5 cm deep. Seeds germinate within a week; a few weeks later, seedlings may be thinned to a spacing of 10cm. Thinning allows sufficient space for proper tuber development. In case of nursery-raised seedlings, they may be transplanted when they are 4-5 weeks old.

Sown Time: In the plains, carrot seeds are sown between August and December. Tropical varieties may be sown earlier while temperature is still high. In the hills, carrot seeds may be sown from March to July.

Fertilizers and Manuring: At the time of land preparation, well-rotted FYM (farmyard manure) or compost@25-30 tons/ha may be applied to the soil to increase soil fertility. Synthetic fertilizers should be applied according to soil type, plant requirements etc; a soil analysis may be done to determine the fertilizer requirements for the plants. As a standard, carrot plant requires low levels of nitrogen, moderate amounts of phosphate, and high levels of potash.

Irrigation: The soil should always be kept moist and therefore, regular watering is needed. Insufficient soil moisture results in low yields and excessive soil moisture may also decrease yield; so avoid both the extremes. Soon after planting, first irrigation is given for the plants. Irrigation is needed after every fertilizer application. Irrigation is necessary before any wilting of leaves takes place.

Insect Pest Management

Major insect-pests that affect carrots are: carrot weevils, six-spotted leaf hoppers and carrot rust flies. IPM (Integrated Pest Management) may be used for effective control of insect-pests. IPM makes use of crop rotation, destroying diseased plants, spraying of biopesticides (such as oil emulsions, nicotine extracts, and pyrethrum-based pesticides), and using beneficial insects such as ladybugs as insect-pest control measures. For weed control, manual weeding or hoeing/earthing up may be done on regular basis.

Disease Management

Major carrot diseases are: Alternaria leaf blight, bacterial leaf blight caused by Xanthomonas campestris, root knot nematodes (Meloidogyne species) that cause forked roots, and Cavity spot caused by Pythium violae and Pythium sulcatum that results in ugly root lesions. Carrot yellowing is a virus disease transmitted through the six-spotted leaf-hopper. IDM (integrated disease management) may be practiced for effective disease control. IDM makes use of cultural control practices such as crop rotation, and seed treatment with a mercury compound before sowing as well as organic control practices such as spraying of Bordeaux mixture and pyrethrum-based fungicides for controlling fungal diseases. Viral disease can be controlled by controlling leaf hoppers and by destroying the virus-affected plants.

Harvesting and Yield

Early varieties can be harvested within 90 days of sowing while late varieties take up to 120 days to mature. Before harvesting, a light irrigation is done so that soil becomes moist and loose; harvesting process will be easier in moist soils. During harvesting process, carrots are pulled out from the soil by using a spade or similar tools. The tubers are then trimmed and washed before sending them to the market. Yield varies from 20 -30 tons/ha.

Seed Production

For seed production, tubers are not harvested; instead plants are left in situ for the next growing season during which the plant completes its reproductive cycle. Flowering begins after the vegetative phase is over; numerous small flowers are produced in an inflorescence (umbel). Sometimes, good quality tubers are selected and transplanted for seed purposes; in such cases quality of seeds will be better. Seed yield is 500-600 kg/ha.

Physical and Physiological Disorders

- ***Splitting of carrots:*** A longitudinal crack along the entire length of the tuber; caused due to wide plant spacing, early sowing, lengthy growth durations, and genotype
- ***Breaking of carrots:*** It occurs after harvest due to the mishandling of the products

Food Uses

As raw, fresh carrots, it can be used in salads. It can also be used for the preparation of sweetmeats, cakes, soups, and stews. It can be used for making fresh carrot juice. As a root vegetable, carrots may be used as stir-fries, and can be added in mixed vegetable preparations.

Nutrition in Carrot

Carrots contain high quantities of alpha- and beta-carotene, a powerful antioxidant. Carotene is responsible for the orange/red/yellow colour of carrots. Carrots are rich in antioxidant mineral, Zinc. Carrots are a good source of vitamin K and vitamin B6. A detailed account of nutrition present in 100g of edible portion of fresh carrots is given below:

	Nutrient	Unit	Value/100 g
1	Protein	g	0.93
2	Fiber	g	2.8
3	Calcium	mg	33
4	Iron	mg	0.3
5	Potassium	mg	320
6	Zinc	mg	0.24
7	Vitamin C	mg	5.9
8	Thiamin	mg	0.066
9	Riboflavin	mg	0.058
10	Niacin	mg	0.983
11	Vitamin B-6	mg	0.138
12	Folate	µg	19
13	Vitamin B-12	µg	0
14	Vitamin A	IU	16706
15	Vitamin E	mg	0.66
16	Vitamin D	IU	0
17	Vitamin K	µg	13.2

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