

PRODUCTION MANUAL OF CARROTS (*Daucus carota L.*)



Carrots are widely grown in the mid and highlands of Ethiopia. They have high content of carotene (a precursor of vitamin A) which prevents night blindness. They also contain appreciable quantities of vitamin B (thiamine and riboflavin).

Varieties

Nantes and Chantenay are the most widely grown carrot varieties in Ethiopia.

Nantes:- has good yield and quality of roots. Roots are long and cylindrical and orange in color; leaves are few and brittle.

Chantenay:- The roots of Chantenay are shorter than that of Nantes. They are thick at the top and dark orange in color. Leaves are large and strong hence they are preferred for long distant transport and storage.

Climatic requirement:- Carrots are moderately hardy and also tolerate high temperature but seedlings are more sensitive to both extremes of temperature. They grow best above 1000 masl where temperature is between 16 and 21°C and rainfall is between 700 and 800 mm. In Ethiopia carrots are grown up to 2800 masl in the central highlands. Mild freezing weather at maturity stage harms carrot leaves but not the roots. However, carrots grown at lower temperature produce seedstalks before roots attain of market size; such roots have bitter taste and undesirable flavour.

Soil requirement:- Carrots thrive best on deep, loose and well drained loam soils. Long, smooth and slender carrot roots desired for fresh market can be successfully grown in such soils. Heavy clay soils do not allow smooth root growth and make cultivation, harvesting and washing of harvested roots difficult. Carrots grown on soils with high organic matter tend to become rough, course and hairy. The suitable p^H range is from 6.0 to 7.5. Soils which crust at the surface inhibit seed germination and reduce crop stand.

Seed bed preparation:- Carrots need finely prepared soil for good seed germination and proper root development. Therefore, fields to be grown with carrots should be ploughed to a depth of 30 cm, finely prepared and levelled. A raised seedbed 1 m wide, 10 m length and 20 cm height is prepared especially in areas with poor drainage and during long rainy season. About 40 cm wide furrows are used between the beds for irrigation.

Seed sowing:- Carrots are established by direct seeding in the seedbed. The seeding rate is about 5 kg per ha. In rainfed crops, rows 25 cm apart are traced across the width of the seedbed and seeds are drilled 5 cm apart within the row at the depth of 1 cm. In irrigated crops, 4 rows of carrots are sown at the same spacing along the raised seedbed. Seeds are often mixed with sand (2 sand: 1 seed) to ease handling and uniform spacing of seeds. Carrot seeds are slow to germinate and seedlings are rather weak. Cover the seedbed with grass after sowing and water them adequately. Carefully remove the grass when seeds germinate.

Sowing time can be either at the 1st week of March for Belg/short rain season or 1st week of July for main season production. However, it can be done at any time of the year under irrigation.

Thinning:- Carrots are often densely sown. The plants should be thinned to 5 cm spacing within the row. Thinning results in uniform and good sized roots and avoids lodging of plants. Thinning is done several times beginning from 3rd week after sowing, as plants attain 10-15 cm height or during 1st cultivation. Hand thinning is very expensive thus seed should be sown as thinly and uniformly as possible to reduce the need for thinning.

Cultivation:- Carrots grow very slowly for the first few weeks thus they can't compete with weeds. Repeated shallow cultivation is necessary to keep down weeds especially in the early stages of growth. Deep cultivation may be injurious to roots as many of them are found within 5 cm of the surface. Keep the top of the roots covered with soil to avoid greening especially with Nantes types.

Fertilization:- Carrots are heavy feeders of soil nutrients, especially of potash. A yield of 100 q of carrot utilizes about 37 kg of K, 12 kg of N, 8 kg of P from the soil used. As a result low yields result in crops that follow carrots. Application of nutrients depends on soil fertility. The blanket recommendation for carrots is 175 kg DAP ha⁻¹. Farmers in the less fertile region of Tigray apply 40-50 q/ha of decomposed manure before ploughing, then 100 kg/ha DAP at planting and 50 kg of urea at the first cultivation. Applying fresh manure leads to branching of roots; therefore, apply only well decomposed manure.

Irrigation:- Carrots grown during dry season, and must be irrigated to accelerate seed germination and root growth. Irrigation has to be supplied every morning and afternoon after sowing seeds using watering can. Furrow irrigation after sowing or at early stage of the crop washes away and displaces seeds and uproots seedlings. Irrigation can be applied every 5 to 7 days to field capacity depending on soil type and environment. Water-logging should be avoided. Inadequate irrigation increases roughness,



Carrot Aid

decreases root size, and slows growth, and leads to poor color development. Irrigation has to be stopped when the crop matures.

Diseases and insect pests

Carrots can be attacked by several fungal, bacterial and nematode diseases. These diseases can cause poor plant growth, reduced yield and quality of the product. The most important carrot diseases are alternaria leaf blight (*Alternaria dauci*) and powdery mildew (*Erysiphe heraclei*) which are the most widespread and causes significant yield and quality loss on carrots.

Alternaria leaf blight (*Alternaria dauci*):- This fungal foliar disease occurs in all carrot growing regions and is transmitted easily via the seed. The fungus *Alternaria dauci* survives in the volunteer crops, crop debris, in the soil, and on the seed.

Symptoms:- Symptoms appear first on older leaves 8 to 10 days after infection as greenish brown, irregularly shaped leaf spots. Petioles can become infected under increasing pressure and spots may grow and coalesce causing petiole girdling and leaf die back. Under severe infection the most susceptible varieties can lose a considerable amount of foliage and also stem infection thereby resulting in yield and quality reduction.



Figure 1. Symptoms of carrot leaf blight (*Alternaria dauci*)

Control measures

- Use of disease free seeds
- Avoid excess irrigation
- Crop rotation with non host plant species
- Spray with locally registered fungicides such as Ridomil and Agrolaxyl

Powdery mildew (*Erysiphe heraclei*)

Powdery mildew of carrot is very common during hot and humid weather of the cropping season. It attacks the foliage of carrots by covering the leaves with fungal mass sporulations. Severe infection of powdery mildew causes poor plant growth, reduced yield and quality of seeds and roots.

Symptoms:- The disease affects foliage, stems and umbels. Patches of white, fluffy fungus appear on the lower leaves first, and then spread to the terminal growth. The fungus often covers entire leaves with its masses of white mycelium and powdery spores. Severe infection can result in loss of foliage, causing lower yields and in seed crops

poor seed quality.



Figure 2. Symptoms of carrot powdery mildew (*Erysiphe heraclei*)

Control measures

- Removal of alternate hosts and carrot residues from the field
- Crop rotation with none host crops
- Avoid excess irrigation
- Spray with locally registered sulfur fungicides such as Bayleton)

Insect pests

Insects are generally not considered a major problem in carrot production in Ethiopia. However, cutworms are reported to appear in many carrot growing areas of the country.

Harvesting:- Carrot for fresh markets are harvested when the roots are mature, i.e. when they reach 3.5 to 5.5 cm in diameter at the upper end or 90 to 120 days after sowing depending on variety and agro-ecology. Avoid harvesting immature and over-mature roots. Immature roots have light color and low carotene content and may wilt after harvest whereas over-mature roots become tough with hard central core. Carrots can be lifted by hand if the soil is wet. Otherwise, they can be dug with forked hoe and pulled with hand if the soil is dry taking care not to injure the roots. Nantes can produce up to 150 q ha⁻¹ under good management.

Sorting and grading:- All split and branched roots are rejected. Normal roots are packed either as bunched or as topped carrots. Carrots can be topped in the field, washed with clean water and sold as topped carrots. The tops may wilt, darken and begin to decay first. Topping and bagging of carrots greatly reduces the loss of weight and water during transportation to market, and increases the shelflife of the roots. Poly bags of different sizes can be used for packing the roots so long as they allow sufficient air circulation to prevent decay and development of off-flavour.

Carrots with fresh leaves can be sorted into size, washed and tied into bunches of up to 20 roots to indicate the freshness of the roots.

Storage:- Carrot roots cannot be stored for long after harvest under ambient conditions. Farmers can extend harvest period and leave the roots in the field for one to two months if no rain is expected. Carrots can be stored for up to three weeks in double walled chamber made of bricks which contain wetted sand between the walls.

