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Tomatoes

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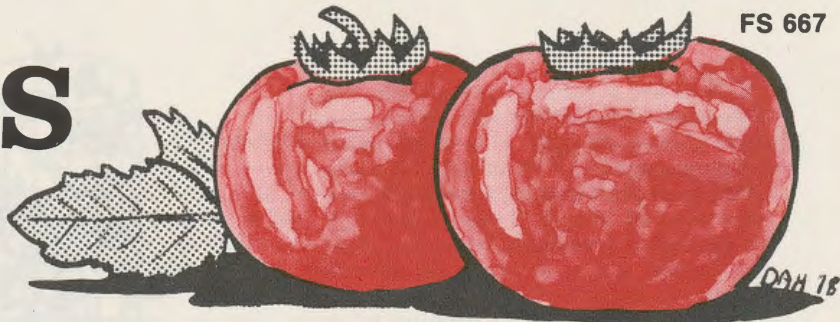
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TOMATOES



COOPERATIVE EXTENSION SERVICE
SOUTH DAKOTA STATE UNIVERSITY
U.S. DEPARTMENT OF AGRICULTURE

TOMATOES



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Tomatoes are a popular commercial crop because they require a relatively small space, bear repeatedly, are widely adapted and easy to grow, and have many culinary uses. Tomatoes are used fresh or canned; the canned product also lends itself to many uses. Frozen tomato juice is delicious and nutritious. Tomatoes are outstanding for vitamin content, first for ascorbic acid or vitamin C, then for vitamin A, thiamin or vitamin B₁ and riboflavin or vitamin B₂ in that order. Tomatoes are low in calories, fats, and protein content; persons on low calorie diets can consume unlimited quantities.

Tomatoes are probably the most widely grown edible horticultural crop in South Dakota. The most concentrated area of production is in the southeastern part of the state. However, market gardens throughout the state produce tomatoes for the fresh market. This is particularly true in the eastern half of South Dakota where climatic conditions are more favorable and the area is more densely populated.

Success in growing tomatoes comes with (1) careful planning and (2) timing of cultural practices. Selecting seed early, setting a date for indoor seeding, "hardening off" plants for outdoor planting, applying fertilizer, using fungicides and insecticides, and adding supplementary water all must be planned ahead and timed to ensure a good supply of ripe tomatoes. These factors will be discussed below.

Choose the best varieties

The choice of good varieties is the most important decision you can make.

There is no one best variety. Soils differ, locations differ, and market preferences vary. Select those varieties that do best in your location, on your soil type, under your cultural practices, and that meet your market needs and demands.

The perfect tomato has not been developed yet—and probably never will. We do know a lot about the desirable characteristics a tomato should have, so you don't have to resort to trial and error in selecting varieties. Some of the qualities to look for in selecting a good market tomato are hybrid vigor, wilt resistance, and earliness.

The larger grower would be wise to plant two to three main-crop varieties, and try one or two new varieties in 10-20% of the field. These are some of the varieties which have been grown

successfully year after year in South Dakota:

Early

Centennial Hybrid
Burpee's Big Early
Rushmore Hybrid
Red Pack

Main Crop

Bonanza
Spring Giant Hybrid
Jet Star Hybrid
Spring Set
New Yorker
Heinz 1350

Excellent small fruited varieties are Small Fry Hybrid and Sugar Plum. Patio Hybrid develops into compact, upright plants having medium fruit size. Golden Delight is an early orange fruited variety. Ballerina is a pear shaped early tomato.

Soil

Market gardeners need a well-drained light, sandy soil for early production, because lighter soils warm up more rapidly. Home gardeners, on the other hand, have little choice of site. If at all possible, choose sites having adequate surface drainage and avoid soil with poor internal drainage or claypan. Tomatoes do not like wet feet.

Use the right fertilizer

The tomato plant is a large consumer of soil nutrients. Many South Dakota soils are low in one or more of the essential elements. A soil test is the only reliable method of determining nutrient level of your soil.

If the test shows that the soil has good fertility or if a soil test has not been taken, disk in 400 lbs of 8-32-16 per acre before planting. In a small home garden, apply 2 lbs of 12-12-12 per 100 sq ft of area. It is desirable to mix the fertilizer throughout the top 6-8 inches of soil. Retest your soil every 3 to 4 years.

Do not apply more nitrogen than recommended by soil test. Excessive nitrogen will encourage vegetative growth and large plants, and will delay flowering and fruit set.

Land preparation

If soil erosion is not a problem, plow the land 6-8 inches deep in the fall. In spring spread the required amount of fertilizer, disk, and drag. This will generally make a desirable field for planting tomatoes. If wind erosion is a problem, prepare the land in spring. It is best to prepare home gardens in the fall.

Windbreaks

Cold spring winds are hard on newly planted tomatoes. Strong winds break off branches and prevent rooting of the stem for additional anchorage. Bacterial and fungal organisms may enter the plant

through these wounds and cause secondary damage.

Windbreaks help keep damage to a minimum. A planting of trees, shrubs, or a strip of rye left in the field will offer much protection. If wind protection is not available, plant a thick row of sudan grass every 60 ft at right angles to the prevailing winds as early as possible. Wind protection can speed maturity.

Setting out plants

To minimize a disease buildup do not plant tomatoes and related crops (such as potatoes, peppers, and eggplants) on the same site more than once in 3 years.

Greenhouse grown tomato plants are usually the best source of supply for home gardeners. Generally they lack experience and the facilities to start plants from seed. Sometimes it is even economical for a truck gardener to have a professional greenhouse grower raise plants for him. Choose plants that are stalky, dark green, and healthy. They should be between 6-8 weeks old, the age when they are just setting the first flower cluster. Younger plants usually delay maturity of the crop and older plants reduce total yield.

Water plants heavily several hours before they are to be set and handle carefully to lessen root injury. Set the plant deep enough so that the first true leaves are just above the ground level. Tall plants should be laid in a 4-6 inch deep trench; bend the tip upward so that 4-6 inches of the plant is above ground; cover the rest of the plant in the trench. (Fig. 1).



Fig 1. Put a short, stocky plant in deep enough that the soil is right up to the first leaf. If the plant is leggy, pull off a few leaves, put the plant in sideways, bend the stem up, and fill with soil to the first leaf. Roots will develop along the buried stem.

If you are a commercial grower and using determinate (bush) varieties, give each plant 8-10 sq ft. If you are using indeterminate (vining) varieties capable of elongation all season, nonstaked, give each plant 15-30 sq ft. If staked, 8-10 sq ft for each plant is enough. However, spacing tomato plants depends on several things, such as method of cultivation, varieties, and amount of pruning to be done.

Staked and pruned plants produce earlier, cleaner, and larger fruits, greater yield per acre, and are easier to harvest. However, staking and pruning require extra labor and cost. There is somewhat greater danger of fruit cracking, sunscald, and blossom end rot.

Home gardeners can train plants to single or double-stem systems (Fig. 2). Plants can also be caged in 18-inch wide round or square cages 4-5 ft high to keep them off the ground (Fig 3).

For more information on pruning and staking, see FS 495, "How to stake tomato plants."

Hardening off

Plants grown indoors are quite tender and must be hardened before planting outside. The most successful way to harden off the plants is to reduce the water supply and slowly expose them to cooler temperatures. This can be done by leaving the plants outside for a couple of weeks before transplanting. If low temperatures are forecast, bring the plants in.

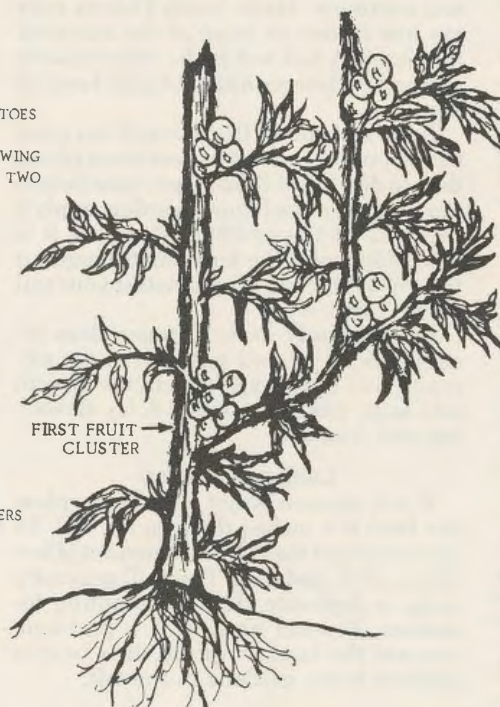
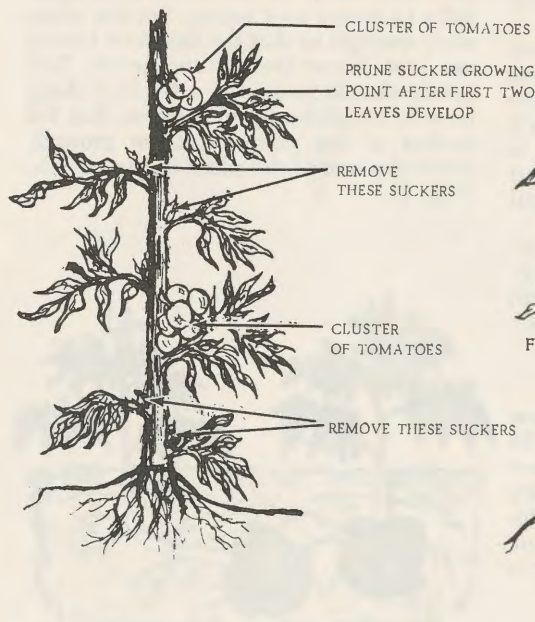


Fig 2. A single-stem tomato will give you fruit a little earlier, but total yield will be reduced. A double-stem plant will give more tomatoes, and there will be better foliage protection against the sun. Note the sucker just below the first cluster of fruit has been allowed to grow and form the second stem. If you are staking, keep the string loose on the vine.

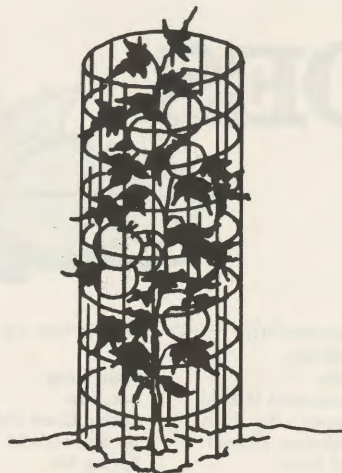


Fig 3. A tomato in a cage has more foliage cover and more protection from the sun. Pick netting large enough that you can get the ripened tomatoes out through the mesh easily. No pruning is required.

Hardened-off plants generally adjust to outside conditions more quickly and start growth faster.

Planting time

Set tomatoes out only after danger of killing frost is past. If frost threatens, protect the plants by covering or by using overhead mist irrigation. Tomato varieties will not set fruit if night temperature drops below 59° F. Nor will blossoms set if day temperature is above 94° F. Tomato plants set fruit best when the average maximum temperature is not above 75° F.

Tomatoes require at least 8 hrs of sunlight daily for best growth. It normally takes 45-50 days to produce a vine ripened fruit from a fully opened blossom.

Starter solution

Experiments have shown that early yield and total yield of tomato plants can be increased by applying starter solution at transplanting time (Fig 4). Use water soluble fertilizer containing a high percentage of phosphorus such as 10-40-10 or the equivalent. Dissolve the fertilizer in water at the rate of 3 lbs per 50 gal (1 oz in 1 gal) and apply 1 pt per plant. A starter solution reduces the shock of transplanting by providing readily available nutrients and water for the plant.

Mulching

Mulch plays an important role in keeping weeds down and saving soil moisture. Mulch reduces the need for cultivation, slows soil erosion, helps prevent blossom end rot, and makes it possible to have cleaner fruit.

Mulch with a thick layer of straw, hay, grass clippings or with black plastic film. A black plastic film is put on the tomato plot before planting. Organic mulches should be 3 inches deep and placed close to the plant after a couple of cultivations and after the soil has warmed. Plants mulched with organic materials may need extra nitrogen. Sidedress with ¼-cup ammonium nitrate per plant at 2-week intervals beginning about July 15. This helps to ensure vigorous growth and continuous fruit set on the plants. Stop sidedressing after two to three applications. When organic mulches are used, be sure they are weed-free.

Blossom set

Tomatoes drop blossoms prematurely for several reasons—cool nights, too much nitrogen fertilizer, overwatering, and strong winds. Fruit set may be improved by using blossom set hormones early in the season when the nights are cool. Apply these compounds only on the blossoms since they can cause distortion of foliage. Hormones can cause fruit to become misshapen and can lower the keeping quality. Use them carefully according to directions on the label.

Water

Normally there is not enough rain during the growing season to produce a full crop of tomatoes. On the average, tomatoes require about 18 inches of water to produce a good crop. Since rain is usually not well distributed during the growing season, tomatoes should be irrigated every 7-10 days. Put on enough water to wet the soil about 8-10 inches down. This will take about 1-1¼ inches water. Never let tomatoes suffer from lack of moisture but do not water too often or too much because several diseases of tomatoes are prompted by improper watering.

(continued on p. 5)

Diseases

Tomatoes are susceptible to a number of diseases and insects. It is beyond the scope of this publication to discuss all of the diseases and insects, but a few of the common ones in this area are listed.

Symptoms	Possible cause	Corrective action
Downward curvature of young leaflets, prominent light colored veins, rolled edges, distorted leaf surface, and sharp pointed leaflets.	2,4-D injury (Fig 6)	Avoid use of 2,4-D near the garden area.
Small light tan to brown spots (1/16-1/8 inch) with dark margins, and usually having tiny black dots scattered within the spot.	Septoria leaf blight (Fig 7).	Spray with approved fungicide once a week from the time the plants are transplanted. The only practical control is sanitation.
Tomato leaf roll (Fig 8).	Excessive moisture in soil. Excessive pruning (sucker-ing). Excessive accumulation of food materials in plants. Disease.	Avoid overwatering. Remove suckers when very small (1-2 inches). None. Identify disease and apply recommended control practices.



Fig 6. This tomato leaf, which shows moderate to severe 2,4-D injury, exhibits downward curvature of young leaflets, prominent light-colored veins, rolled edges, distorted leaf surfaces, and sharp points on the leaflets.

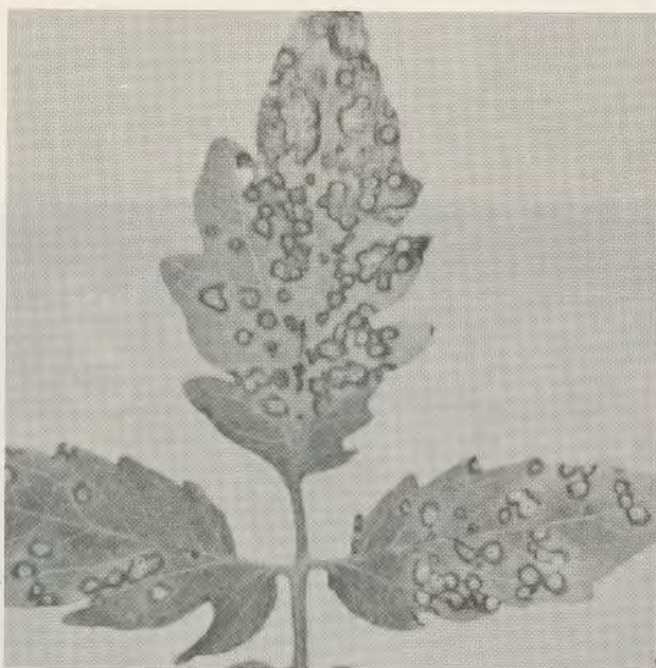


Fig 7. Septoria leaf spot is one of the most destructive leaf diseases of tomatoes, although it rarely attacks fruits. Infection usually occurs on the lower leaves after the plants begin to set fruits.



Fig 8. Leaf roll may be a purely physiological reaction of the plant to excessive water or pruning, or it may be due to disease. The leaves are firm and leathery when touched. The crop yield is usually not affected.

Lack of growth, plant wilting in spite of enough watering, cross section of the main stem shows brown discoloration in a ring to the outside.

Wilt (Fig 9).

Use wilt resistant varieties.

Dark brown to black spots on leaves, most spots irregular and with concentric rings (target spots).

Early blight (Fig 10).

Spray with a recommended fungicide.

Large, dry, brown, leathery, scalelike blemish of the blossom end of the fruit.

Blossom end rot (Fig 11).

Avoid excessive use of nitrogen fertilizer. Avoid deep cultivation. Maintain a uniform soil moisture by applying adequate amount of water every 7-10 days.

Greenish-brown worms usually about 1½ inch long and with light stripes along the sides and back. They commonly burrow into the developing fruit and feed inside.

Fruit worms (Fig 12).

Collect and destroy infected fruit or apply recommended insecticide every 7-10 days two or three times.

Plant cut at ground level.

Cut worm (Fig 13).

1. Wrap the main stem of the transplants with wax paper before transplanting. Allow it to extend about 1 inch into the ground and 1 inch above ground.

2. Apply recommended insecticide at planting.

Blossom drop

Low night temperature (several nights in a row) when temperature is below 60° F.

Avoid planting too early in the spring.

Too much nitrogen in soil.

Avoid using high nitrogen fertilizer in the area where tomatoes are to be planted.

Overwatering.

Avoid soggy conditions.

Low moisture supply in soil with blossoms exposed to hot, dry weather.

Use a 3-inch mulch around plants to conserve moisture or apply a proper amount of moisture.

Disease (early blight, Septoria leaf spot, etc.)

Use recommended fungicide.



Fig 9. A droopy plant that looks like it needs moisture but which fails to respond to water may be infected with wilt. The plant does indeed need water, but the fungus has blocked the cells in the stem which transport the water to the leaves. The fungi live in the soil, so use crop rotation in addition to planting resistant varieties.

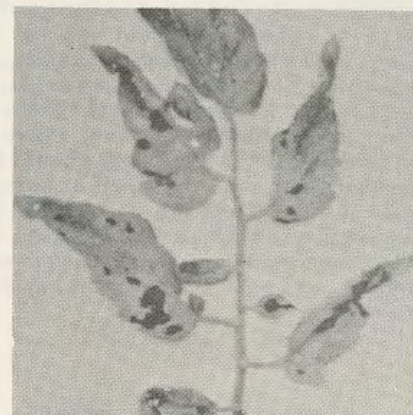


Fig 10. Early blight may occur on the stems, leaves, or fruits. Infected leaves show irregular, dark-brown spots which can enlarge into circular spots with target-like markings. Dark, leathery, decayed spots may appear in the stem end of the fruit.

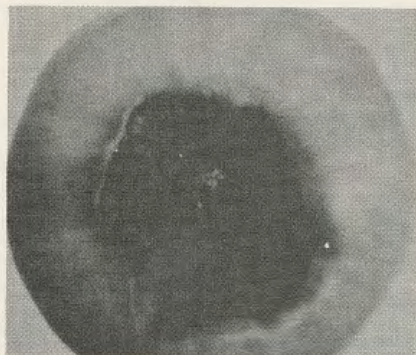


Fig 11. A fruit with blossom end rot has a spot which looks dark, sunken, dry, and leathery.

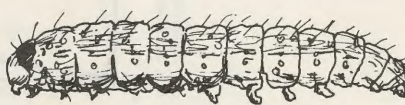


Fig 12. The tomato fruit worm is also known as the corn earworm when it's on corn. It will attack a fruit at any stage of development.



Fig 13. Cutworms curl up tightly into a ball when disturbed. They are usually most troublesome soon after transplanting.

(continued from p. 2)

Tomatoes grow best when there is no serious fluctuation in the moisture content of the soil. The best time to water is forenoon or just after noon, so that the leaves are dry by the time the sun goes down.

Early market tomatoes are a high-cost crop. It will be a very risky investment to grow them without irrigation. Adequate applications of water will produce a more uniform soil moisture level, resulting in high yield and improved quality.

Cultivation

Cultivation should be shallow and frequent enough to control weeds. The first cultivation could be deep and close to the plants, but subsequent cultivations should be away from the plants to prevent damage to the roots. Be sure to stay at least 6 inches away from the plants.

Sidedressing

A tomato plant needs extra nitrogen when the fruit is about half grown. If additional nitrogen is not applied at this stage of growth, the yield will be reduced and the size of the tomatoes will rapidly decline after the first two pickings (Fig. 5). A sidedressing of 100 lbs of ammonium nitrate per acre, every 2 weeks, (one Tbsp per plant) should be applied when the fruit is half its normal size on the first cluster. This should be repeated two to three times. (If the tomatoes are grown on soil too high in nitrogen to start with, the blossoms may fail to set fruit.)

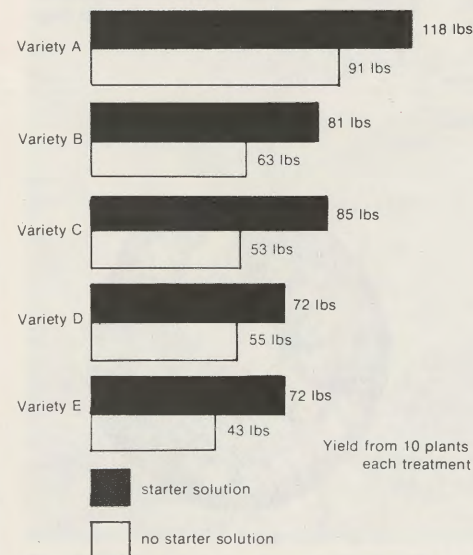


Fig 4. One essential for a good tomato crop is to apply starter solution at transplanting. It reduces transplanting shock.

Care in harvesting

Tomato fruits are highly perishable and must be handled carefully. In harvesting tomatoes, set the container on the ground and harvest fruit with both hands, placing harvested fruit in the container with stem end down. Use only containers with smooth inside surfaces.

Much tomato spoilage is due to mechanical injury or bruising during harvesting operations. Breaks in the skin let disease producing organisms enter the fruit. Tomatoes handle and market with less damage if shallow containers of about 20 lbs or less are used.

Tomatoes for home use are picked when they are fully ripe on the vine. For roadside stands and for local supermarkets the tomatoes should be picked in the pink stage. Tomatoes which are shipped long distances should be picked in the early pink stage. It is best to pack them in boxes in three layers, stem off and stem end facing down. This will increase the quality and shelf life of the tomatoes. Tomatoes of one size and about the same stage of maturity should be packed in each box.

If an early frost threatens, several things can be done to reduce losses. Harvest tomatoes at the white ripe stage or riper and store in a cool place. Pull the vines with fruit still intact and hang upside down in a shed or garage to ripen. Cover the vines in the field with newspapers, straw, or any insulating material to keep a light frost from damaging the crop. Remove the cover every morning and replace it in the evening.

A fresh ripe tomato will not retain its quality in any type of storage. Fresh green tomatoes will ripen in a cool room where the temperature is in upper 50's or 60's.

Commercial growing

If you are going to raise tomatoes commercially, you should consider the following:

Find your market. Before growing tomatoes have your market outlet established. It may be a local wholesaler, a supermarket buyer, restaurants, hotels, a roadside market, mass food service or possibly another market. You are sure to have a problem if you wait until the tomatoes are ready for harvest before looking for a market.

Know what your market wants. Establish with your buyer the type of tomato he prefers, how it should be packed, and when and where it should be delivered.

Meet your market needs. In general, all markets want a tomato that is early, firm, smooth, and crackfree. Markets may differ in their demands as to size, color, and shape of fruit and type of package. Find out what your markets want. A commercial producer must have an early, productive tomato to make a reasonable profit.

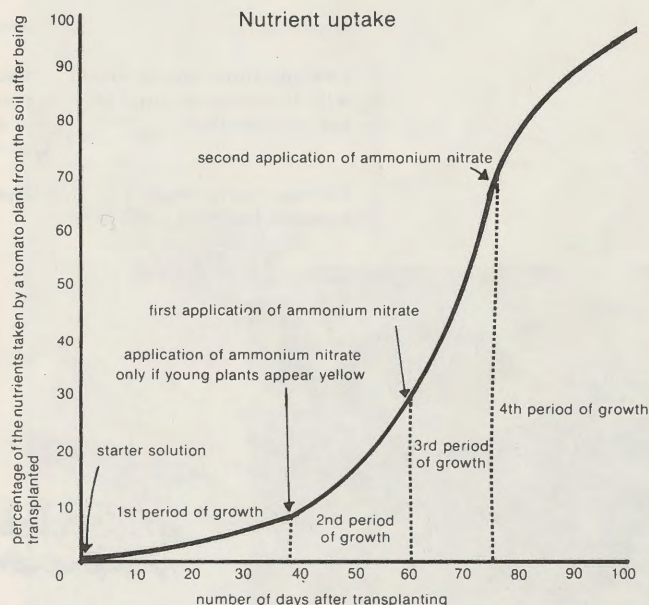
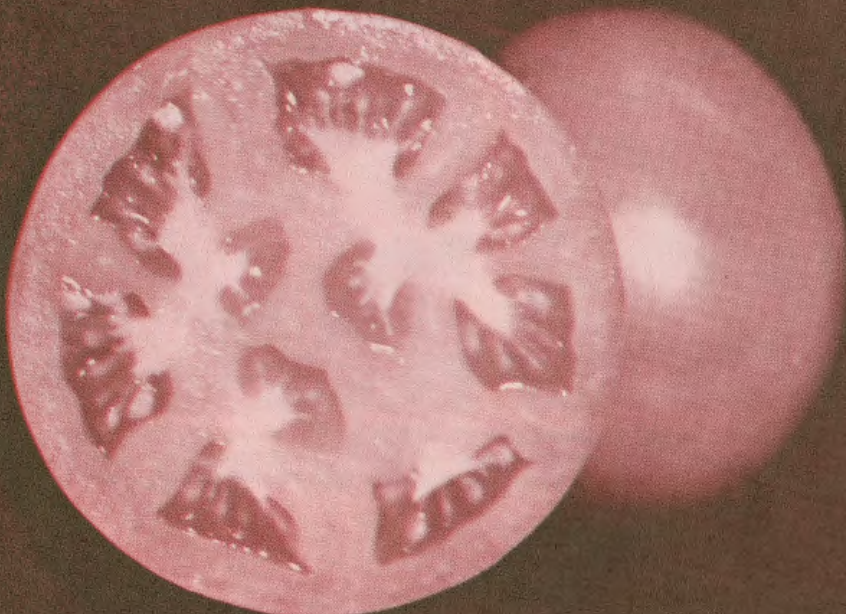


Fig 5. Additional nitrogen is necessary as the plant grows. Use the ammonium nitrate form. At 40 days, go by the color of the plants. If they are yellow, add fertilizer.

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