

# Importance of the Tomato as Medicinal Plant

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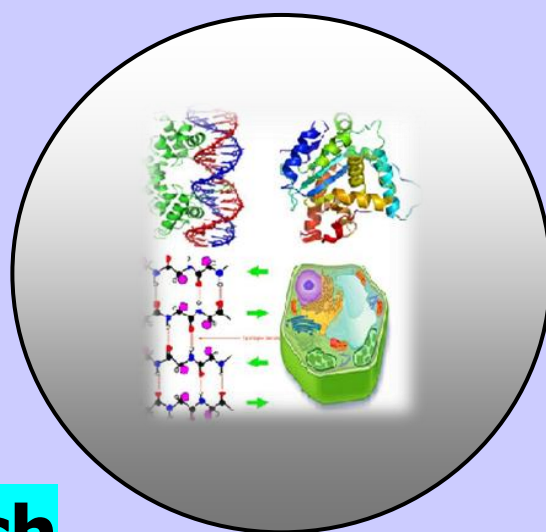
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## Importance of the Tomato as Medicinal Plant

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**ABSTRACT**

*The tomato is a major vegetable crop that has achieved tremendous popularity over the last century. It is grown in practically every country of the world – in outdoor fields, greenhouses and net houses. The tomato plant is very versatile and the crop can be divided into two categories; fresh market tomatoes, which we are concerned with and processing tomatoes, which are grown only outdoors for the canning industry and mechanically harvested. In both the cases, world production and consumption has grown quite rapidly over the past 25 years. Tomatoes can make people healthier and decrease the risk of conditions such as cancer, osteoporosis and cardiovascular disease. People who ate tomatoes regularly have a reduced risk of contracting cancer diseases such as lung, prostate, stomach, cervical, breast, oral, colorectal, esophageal, pancreatic, and many other types of cancer. Some studies show that tomatoes and garlic should be taken together at the same time to have its cancer preventive effects. Whatever it is, we really do not know how or why tomatoes work against cancers. We believe that lycopene and the newly discovered bioflavonoids in tomatoes are responsible as cancer fighting agents. Not only raw tomatoes but also cooked or processed tomato products such as ketchup, sauce, and paste, are counted as good sources of cancer prevention. Tomato is also good for liver health. Tomatoes, aside from being tasty, are very healthy as they are a good source of vitamins A and C. Vitamin A is important for bone growth, cell division and differentiation, for helping in the regulation of immune system and maintaining surface linings of eyes, respiratory, urinary and intestinal tracts. Vitamin C is important in forming collagen, a protein that gives structures to bones, cartilage, muscle and blood vessels. It also helps maintain capillaries, bones and teeth and aids in the absorption of iron.*

**Key words:** Tomatoes, Vitamin C and Cultivation.

## INTRODUCTION

The tomato (*Lycopersicon esculentum* Mill.) is the most widely grown vegetable in the United States. Almost everyone who has a garden has at least one tomato plant. They can even be produced in window box gardens or in single pots. Commercially, it is of equally great importance. From processing to fresh market, and from beefsteak to grape tomatoes, the variety and usefulness of the fruit is virtually boundless. Tomatoes are members of the *Solanaceae* family, which includes peppers, eggplant, Irish potatoes and tobacco. The tomato originated in the area extending from Ecuador to Chile in the western coastal plain of South America. The tomato was first domesticated in Mexico where a variety of sizes and colors were selected. The fruit was introduced to Europe in the mid-1500s. The first ones introduced there were probably yellow since they were given the name *pomodoro* in Italy, which means "golden apple." Later the names *poma armoris* and *pomme d'amour* were used in Italy and France. These names are both translated as "love apple."



**Fig 1. Show tomatoes in the plant.**

Tomatoes are members of the nightshade family and, because of this, were considered for many years to be poisonous. Indeed, many crops in this family contain highly toxic alkaloids. Tomatine occurs in toxic quantities in the tomato foliage but is converted enzymatically to a non-toxic form in the fruit. Because of these beliefs, the crop was not used for food until the 18<sup>th</sup> century in England and France. Tomatoes were introduced to the United States in 1710, but only became popular as a food item later in that century. Even as late as 1900, many people held the belief that tomatoes were unsafe to eat. Use of the crop has expanded rapidly over the past 100 years. Today more than 400,000 acres of tomatoes are produced in the United States. The yearly production exceeds 14 million tons (12.7 million metric tons), of which more than 12 million tons are processed into various products such as soup, catsup, sauce, salsa and prepared foods. Another 1.8 million tons are produced for the fresh market. Global production exceeds 70 million metric tons. Tomatoes are the leading processing vegetable crop in the United States (Blum et al., 2006). California is the leading producer of processing tomatoes in the United States. Indiana, Michigan and Ohio are other major producers.

California and Florida are the leading fresh market tomato producers in the United States. Ohio, Tennessee, Virginia and Georgia produce significant amounts of fresh market tomatoes as well (Blum et al., 2005).

Tomatoes have significant nutritional value. In recent years, they have become known as an important source of lycopene, which is a powerful antioxidant that acts as an anticarcinogen. They also provide vitamins and minerals. One medium ripe tomato (~145 grams) can provide up to 40 percent of the Recommended Daily Allowance of Vitamin C and 20 percent of Vitamin A. They also contribute B vitamins, potassium, iron and calcium to the diet. There are two types of tomatoes commonly grown. Most commercial varieties are *determinate*. These “bushy” types have a defined period of flowering and fruit development. Most heirloom garden varieties and greenhouse tomatoes are indeterminate, which means they produce flowers and fruit throughout the life of the plant.

Tomato is considered a tender warm season crop but is actually a perennial plant, although it is cultivated as an annual. It is sensitive to frost and will not grow perpetually outdoors in most parts of the country. Most cultivated tomatoes require around 75 days from transplanting to first harvest and can be harvested for several weeks before production declines. Ideal temperatures for tomato growth are 70-85 degrees F during the day and 65-70 degrees F at night. Significantly higher or lower temperatures can have negative effects on fruit set and quality. The tomato is a self-pollinating plant and, outdoors, can be effectively pollinated by wind currents.

#### **Soil Requirements and Site Preparation**

Tomatoes can be produced on a variety of soil types. They grow optimally in deep, medium textured sandy loam or loamy, fertile, well-drained soils. Avoid sites that tend to stay wet. Also, rotate away from fields that have had solanaceous crops within the past 3-4 years. Select sites that have good air movement (to reduce disease) and that are free from problem weeds. In field production, plants depend on the soil for physical support and anchorage, nutrients and water. The degree to which the soil adequately provides these three factors depends upon topography, soil type, soil structure and soil management (Boatright and Mc Kissick 2003).

For tomato production, proper tillage is crucial for adequate soil management and optimal yields. Land preparation should involve enough tillage operations to make the soil suitable for seedling or transplant establishment and to provide the best soil structure for root growth and development. The extent to which the root systems of tomato plants develop is influenced by the soil profile. Root growth will be restricted if there is a hard pan, compacted layer or heavy clay zone. Tomatoes are considered to be deep rooted and, under favorable conditions, some roots will grow to a depth of as much as 10 feet. The majority of roots, however, will be in the upper 12 to 24 inches of soil. Since root development is severely limited by compacted soil, proper land preparation should eliminate or significantly reduce soil compaction and hard pans. Tillage systems using the moldboard (“bottom” or “turning”) plow prepare the greatest soil volume conducive to vigorous root growth. This allows the development of more extensive root systems, which can more efficiently access nutrients and water in the soil. Discing after moldboard plowing tends to re-compact the soil and should be avoided. Compaction pans are present in many soils. They are formed principally by machinery and are normally located at or just below plow depths.

Although compaction pans may be only a few inches thick, their inhibitory effects on root growth can significantly reduce tomato yields. If a compaction pan exists just below or near moldboard plow depth, this hard pan can be disrupted by subsoiling to a depth of 16 to 18 inches to allow the development of a more extensive root system. Subsoiling also helps increase water infiltration (Boatright and Mc Kissick (2004).

**Table 1. Tomato varieties that have exhibited acceptable performance either in variety trials or in grower fields in Georgia.**

Variety	Days to Maturity	Fruit Size	Shape	Disease Resistance
<b>Large Round</b>				
Amelia	78	L, XL	Oblate	F <sup>123</sup> , ST, TSWV, V, FCR
BHN 444	80	L, XL	Globe	F <sup>12</sup> , TSWV, V
BHN 640	80	L, XL	Globe	F <sup>123</sup> , TSWV, V
Biltmore (trial)	80	L	Deep Oblate	F <sup>12</sup> , ST, ASC, V
Carolina Gold	78	L, XL	Deep Oblate	F <sup>12</sup> , V
Crista	78	XL, L	Round	F <sup>123</sup> , TSWV, V
Florida 47 R	75	VL	Deep Oblate	F <sup>12</sup> , GLS, ASC, V
Florida 91*	72	L	Deep Oblate	F <sup>12</sup> , GLS, ASC, V
Mountain Crest	75	XL, L	Flat-Globe	F <sup>12</sup> , V, FCR
Mountain Spring	78	XL	Deep Oblate	F <sup>12</sup> , St, V, FCR
Sebring	75	XL, L	Deep Oblate	F <sup>123</sup> , ST, FCR, V
Solar Fire*	75	L	Flat-Round	F <sup>123</sup> , ST, V
Solar Set*	75	M, L	Flat-Round	F <sup>12</sup> , ASC, GLS, V
Solimar	78	L	Globe	F <sup>12</sup> , ASC, GLS, V
Talladega (trial)	78	XL, L	Globe	F <sup>12</sup> , TSWV, V
Tygress (trial)	78	L	Deep Oblate	F <sup>12</sup> , V, GLS, TYLC
<b>Cherry</b>				
Cherry Grande	65	Cherry	Globe	F <sup>1</sup> , ST, ASC, V
Mountain Belle	68	Cherry	Round-Oval	F <sup>1</sup> , V
<b>Roma/Saladette</b>				
BHN 685	75	Roma	Blocky Globe	F <sup>123</sup> , TSWV, V
Plum Crimson	75	L, XL	Saladette	F <sup>123</sup> , V
Plum Daddy	75	Roma	Elongated Roma	F <sup>1</sup> , V
Puebla	72	M	Elongated Cyl.	F <sup>12</sup> , ST, ASC, V, BS

F = Fusarium Wilt; ST = Stemphylium; TSWV = Tomato Spotted Wilt Virus; V = Verticillium Wilt; FCR = Fruit Cracking; ASC = Ascomycetes; GLS = Gray Leaf Spot, BS = Bacterial Spot; TYLC = Tomato Yellow Leaf Curl

\* hot-set varieties.

If there is an abundance of plants or plant residues on the soil surface, discing or mowing followed by discing is usually advised prior to moldboard plowing. This should be done 6 to 8 weeks ahead of planting to bury residue and allow it to decay. Immediately prior to plastic mulch installation or transplanting, perform final soil preparation and/or bedding with a rotary tiller, bedding disc or a double disc hiller in combination with a bedding press or leveling board. This provides a crustless, weed-free soil for the installation of plastic mulch or the establishment of transplants. Tomatoes are usually transplanted into plastic mulch on raised beds. A raised bed will warm up more quickly in the spring and therefore will enhance earlier growth. Since tomatoes do poorly in excessively wet soils, a raised bed facilitates drainage and helps prevent water logging in low areas or in poorly drained soils. Raised beds are generally 3 to 8 inches high (LDL, 2007). Keep in mind, however, that tomatoes planted on raised beds may also require more irrigation during drought conditions.

### **Cover Crops and Minimum Tillage**

Winter cover crops help protect the soil from water and wind erosion. When incorporated into the soil as "green manure," cover crops contribute organic matter to the soil. Planting tomatoes in reduced tillage situations has been tried with variable results in different parts of the country. Often cover crops can be killed with a burn down herbicide. Then tomatoes are either transplanted directly into the cover, or a narrow strip is tilled and prepared for transplanting while leaving the residue between rows. While these residues can protect the fruit from direct contact with the soil, currently the impediments outweigh the benefits for large-scale commercial production. Leguminous covers can provide nitrogen to the crop and there are certainly soil conservation advantages (Periago et al., 2008). The primary encumbrance to success in reduced tillage systems is adequate weed and disease control. The application of phosphates, potash and lime are also more difficult in these systems, so reduced tillage is used only on a limited basis in commercial tomato production. With advances in weed and disease control technology, this type of production may become more feasible in the future.

**Cultivation Methods:** Determinate and semi-determinate tomatoes and fresh market tomatoes in the outdoor fields are grown either with determinate bush tomato varieties, (which grow on the ground without staking), or with semi-determinate varieties using the stake and string method. The latter method involves the use of wooden stakes placed within the row of plants and running a number of parallel pieces of string or wire from stake to stake and trapping the new growth of the plant between the strings. This keeps the plants in an upright position preventing the fruit from touching the ground. Determinate tomatoes require very little plant care and have a predetermined number of clusters, which is not very high. Their yields and quality are usually not very high but the inputs are very low. This type of crop is more popular in developing countries where prices are lower and quality is not a major concern. Semideterminate varieties usually grow to a height between 1 - 2 metres and have more clusters and hence yield than the determinate varieties. The quality is much better because the tomatoes do not lie on the ground. However, neither method involves the removal of side shoots, while the semideterminants require only a minimum of leaf removal. In both of these types the fruit is irregular in shape. i.e. They are more beefsteak than round in shape.

**Indeterminate tomatoes**

Indeterminate tomatoes are traditionally grown in greenhouses, which are either glass or plastic. However, since greenhouse tomatoes are considered to have the best quality, the indeterminate tomato is often cultivated in net houses and open fields. Indeterminate tomatoes do not have a pre-determined number of fruit clusters as do the determinate and semi-determinate types. The indeterminates can be, and very often are grown for periods of up to 12 months and over 30 clusters.



**Fig 2. Show tomatoes by different variety.**

In greenhouses they can be grown in the ground or in soilless media which is often referred to as hydroponics. There is a crop wire above the plants at a height of 2.5 to 3.2 m. String is tied to the wire and then the plant, which is then twisted around the string as it grows. Side shoots or suckers and some leaves are removed on a regular basis. The flower clusters are pruned to a pre-determined number, usually 3 - 5 so as to help the plant maintain balance between the vegetative and generative states. The resulting fruit is more even in size and usually bigger than it would be if all the flowers were left to fruit. The fruit itself maintains size and shape better than the other two types. Most indeterminate are rounder in shape but there are beefsteak varieties because the American and some European Markets prefer greenhouse beefsteak tomatoes. Indeterminate varieties thus require more work than the other two types but the monetary returns can be much higher (Lucier and Plummer 2003). As greenhouse indeterminate varieties gained popularity (the fruit gets higher prices and demand is constantly growing), people started growing these varieties outdoors using the indoor methods where possible. In many places of the world such as Australia, Sinaloa, and Mexico the growers are highly successful. Nevertheless, there are many circumstances where growing indoor varieties outdoors is very difficult. The climatic conditions may not be good enough or there may be too much insect pressure both resulting in diseases and low quality crops. The cost of building proper greenhouses may be prohibitive or the problems are such that greenhouses are not necessary and a net house will often suffice. Net houses can be of two types; (a) an insect proof house with 50 mesh net which prevents many insects from entering and has approximately 17 to 20 % shade and (b) an ordinary black or white net of approximately 25 to 35 % shade. Both types of houses protect the crops from the elements, which include wind, blowing sand, hail, excessive sunshine and insects, although the insect proof is far superior when protecting against some of the major pests such as white fly.













Fig 3. Show Tomatoes in green house.



Fig 4. Tomatoes seedling.

Table 2: Production of Tomatoes in world.

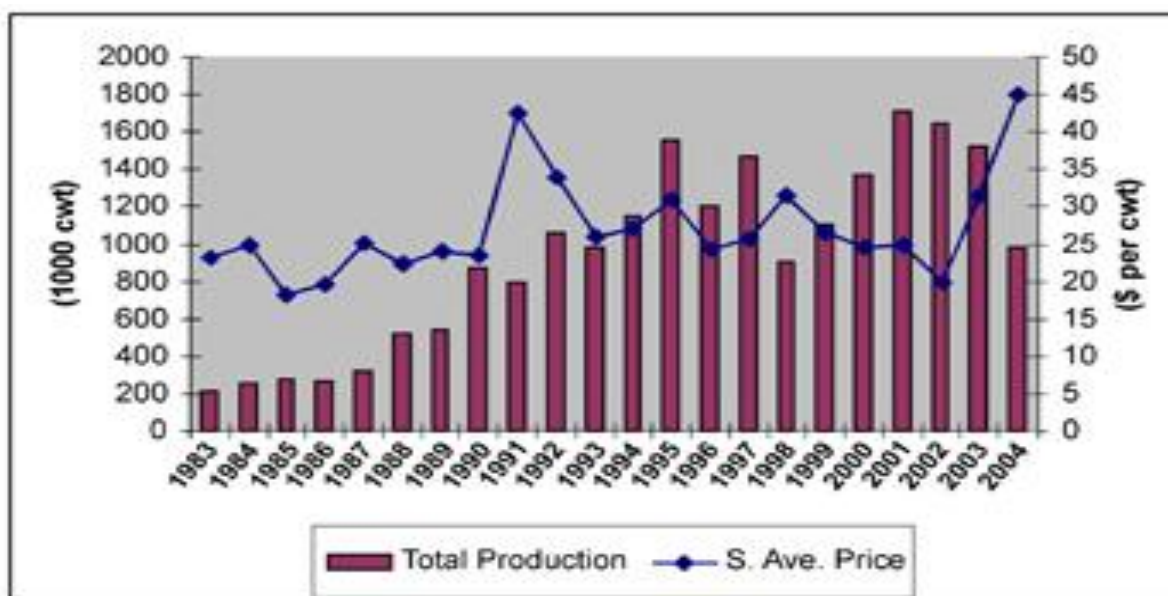
Rank	Country	Production millions of tonnes
1	 <u>China</u>	52.6
2	 <u>India</u>	18.7
3	 <u>United States</u>	14.5
4	 <u>Turkey</u>	11.9
5	 <u>Egypt</u>	8.3
6	 <u>Iran</u>	6.0
7	 <u>Italy</u>	5.6
8	 <u>Spain</u>	4.9
	<b>World</b>	<b>170.8</b>



There is definitely a worldwide trend to covered cropping especially in tomatoes. When consumers demand better quality they are really saying that they want indeterminate type tomatoes. When a farmer starts to build net-houses and greenhouses his investments and growing costs increase dramatically. He must learn how to optimize revenues and minimize expenses so as to attain the maximum profits.

#### **Why extension help is necessary and who would use it**

It is clear that growing tomatoes can be a complicated business. Today's hybrids require more knowledge and skill than ever before. A hybrid variety can be compared to a thoroughbred racehorse. They are high strung, strong and ready to move. However, an inexperienced jockey does not ride a winning race the first few times out and is actually very likely to finish last in the race. It takes time, experience, a large investment, a good teacher and a lot of patience. Growing new hybrid tomato varieties is very similar. When a farmer or a grower has a sizable investment in something like a new variety of tomato in a covered structure they want to be sure that they achieve the best possible return for their investment. The learning curve for this can turn out to be very expensive as it can take a long time to learn the ins and outs of a new system. Government extension services, which in the past were well organized and able to help growers in these kinds of situations, have had budgets slashed and today have very limited services to offer. Growers making the switch to new hybrids and new technologies can often get the help they need from the seed companies, local private extension and advisory services and from consulting companies on the internet. The young jockey learning to ride the thoroughbred race horse always has a trainer to help him. The same logic applies to growers trying new varieties and methods. The grower, with proper help and advice, will shorten the time needed to complete the learning curve. He will be able to maximize his profits much quicker by using good professional help and like the well-trained jockey on the thoroughbred; the grower will be well ahead of the pack (Mcgee, Harold 2009).



**Fig 5. Georgia Tomato Production and Average Seasonal Prices, 1983-2004. [Source: Georgia Agricultural Statistics Service/USDA, 2002 Census of Agriculture Georgia Profile.**

**Table 3. Hypothetical variable or operating costs of producing tomatoes.**

Item	Unit	Quantity	Price	Amt/Acre	Total
<b>Variable Costs</b>					
Plants	Thou	5.00	183.75	918.75	919
Lime & gypsum	Acre	1.00	45.00	45.00	45
Fertilizer (base & side dressing)	Ton	1.00	250.00	250.00	250
Plastic <sup>1</sup>	Roll	2.80	98.00	274.40	274
Fumigation	Acre	1.00	520.00	520.00	520
Insecticide <sup>2</sup>	Appl	20.00	21.20	424.00	424
Fungicide	Appl	4.0	38.50	154.00	154
Herbicide	Acre	3.00	10.00	30.00	30
Stakes & string	Acre	1.00	125.00	125.00	125
Labor, mach operation	Hr	5.00	5.50	27.50	28
Labor, transplant	Hr	100.00	5.00	500.00	500
Cleanup (plastic & stakes)	Acre	1.00	150.00	150.00	150
Machinery	Acre	1.00	25.76	25.76	26
Irrigation	Acre	1.00	202.71	202.71	203
Land rent	Acre	1.00	0.00	0.00	0
Interest on operation capital	\$	3,647.12	0.09	164.12	164
<b>Pre-harvest variable costs</b>				<b>3,811.24</b>	<b>3,811</b>
*Fertilizer amount and application rates should be based on soil test recommendations.					
<sup>1</sup> Metalized plastic for fall planting costs \$210 per roll or \$378 for 1.8 rolls per acre.					
<sup>2</sup> Fall planting includes injectable insecticides and fertigation.					

## CONCLUSION

The tomato (see pronunciation) is the edible fruit of *Solanum lycopersicum*, commonly known as a tomato plant, which belongs to the nightshade family, Solanaceae

The species originated in Central and South America. The Nahuatl (Aztec language) word *tomatl* gave rise to the Spanish word "tomate", from which the English word tomato originates. Numerous varieties of tomato are widely grown in temperate climates across the world, with greenhouses allowing its production throughout the year and in cooler areas. The plants typically grow to 1–3 meters (3–10 ft) in height and have a weak stem that often sprawls over the ground and vines over other plants. It is a perennial in its native habitat, and grown as an annual in temperate climates. An average common tomato weighs approximately 100 grams (4 oz). Tomato (*Lycopersicon esculentum* Mill.) is termed as "the most popular vegetable fruit".

Tomato is cooked as vegetable alone or in combination with potato besides eaten raw when ripe. It is a fruit of good nutritive value as it is fairly rich in vitamins (vitamin C), and other minerals like calcium, phosphorus and iron.

Considering its low cost, it qualifies for inclusion in the daily diet of young and growing children. A recent study has confirmed that tomato and tomato sauce lower blood pressure and the risk of heart disease. Effectiveness of tomatoes in lowering blood pressure is attributed to lycopene, a chemical present in tomato. Tomato extract contains carotenoids such as lycopene, beta carotene, and vitamin E, (known as effective antioxidants) to inactivate free radicals, and to slow the progression of atherosclerosis (Shidfar et al., 2011).

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