



By Dave Holman

BUILDING BETTER TOMATOES



Well do I remember the first tomato I ever saw. I was ten years old, and was running down one of those old-fashioned lanes, on either side of which was the high rail fence. . . . Its rosy cheeks lighted up one of these fence-corners, and arrested my youthful attention.

I quickly gathered a few of them in my hands, and took them to my mother to ask, "What they were?" As soon as she saw me with them, she cried out, "You must not eat them, my child. They must be poison, for even the hogs will not eat them. . . . Some call them 'Jerusalem Apples;' others say they are 'Love Apples;' but, now mind, you are not to eat them. . . ."

—A.W. Livingston,
Livingston and the Tomato, 1893

DR. VICTOR N. LAMBETH, professor of horticulture at Mizzou, does not remember the first tomato he ever saw. But he has seen a lot of them since. Under Lambeth's direction, Mizzou's respected tomato breeding program has introduced about 25 new varieties of tomatoes to midwestern growers since 1950.

Tomato growing and home gardening are almost synonymous today in the United States, and the tomato has a place of honor in our diets. But, as the epigraph indicates, it was not always so.

The tomato was unknown as a food in this country long after it was eaten in Europe. The plant is native to the Andes Mountains, and probably tomatoes were first eaten by Indians in Peru, Bolivia or Ecuador. The Spanish probably discovered the tomato in Mexico. Early explorers mentioned the *tomatl*, *tumatle* or *tomatas*, all variations of the word used by the Indians of Mexico, where the plant has been cultivated since prehistoric times.

The tomato (*Lycopersicon esculentum*) belongs to the Nightshade family, some members of which are deadly poisonous; and the glandular hairs on the tomato plant emit a strong, unpleasant odor when broken. This combination of circumstances may have led early Europeans to the mistaken conclusion that the red or yellow fruits were poisonous.

By 1544, the tomato had arrived in Italy. The impetuous natives there actually ate the fruit and elevated it to culinary glory as yet unexcelled. By about 1575, tomatoes could be found in gardens from England to the mid-Continent, but they were grown primarily as an ornamental curiosity.

The French, with their flair for romance, named the "poison" fruit *pomme d'amour*, and the name stuck. When the tomato migrated back across the Atlantic to the colonies, the name "Love Apple" and the bad reputation apparently came with it.

We find no record of tomatoes being grown in this country until after the Declaration of Independence. Then, a progressive Virginia farmer named Thomas Jefferson grew and ate tomatoes in 1781. He survived.

People in New Orleans were eating them by 1812,

but it was many years after that before the tomato was raised for food throughout the country. One Harrison W. Crosby introduced tomatoes packed in tin cans as an article of trade in 1848 in Easton, Pennsylvania. They sold for 50 cents a can. By 1890, the price was down to seven cents. In 1891, the nation's packers canned 3.3 million cases. In 1976, more than 7.5 million tons of tomatoes were produced with a market value of more than \$400 million.

Undoubtedly, those people who ate tomatoes had made efforts to improve them throughout history, but serious breeding programs in the United States began about 1860 as the tomato became an increasingly popular food. Early breeders limited their efforts to selections within existing stocks, mainly of French origin. These people wanted to incorporate desirable traits into true-breeding lines, and the great potential of hybridization was generally overlooked.

"There are some breeders today who believe you can achieve the same degree of perfection by inbreeding that you can get by hybridization," says Lambeth, Mizzou's tomato man. "I don't happen to believe this. I think it takes the inbreeding phases to get the desirable traits fixed. But we should not overlook the great potential of hybridization to pull together more desirable traits."

Mizzou first got involved with tomato breeding about 1930 when Dr. Mitchell Tucker and Dr. Raymond A. Schroeder, along with tomato breeders everywhere, began looking for a cure for a tomato disease called fusarium wilt. The disease is caused by a soil-borne fungus which attacks the water-transporting tissue of the tomato plant, causing it to wilt and die. A field infected by the fungus could be lost to tomato production for years. The disease was costing the nation's agriculture a lot of money.

MISSOURI RESEARCHERS Tucker and S.W. Bolin found a selection of the modern tomato's wild Peruvian ancestor that was immune to fusarium wilt.

That was good news. The bad news? The wild tomato produced a fruit about the size of a pencil eraser and almost as tasty. But the fusarium immunity is controlled by a single dominant gene, which meant odds were good for producing a plant with the disease resistance of the wild tomato and the desirable fruit characteristics of domestic varieties.

It took 15 years, but Mizzou researchers did come up with a wilt-resistant, high-yielding tomato.

Lambeth started work in the breeding program a few years before Tucker's death and became familiar with the lines that his predecessors had developed.

"The fruits were not yet commercially acceptable," Lambeth says. "They were too small. Since this is a single-gene-dominance type of resistance, I saw the quickest way to build fruit size was by hybridization. By using a large-fruited parent, we could step up the fruit size in one cross."

By this time, Lambeth says, there were 15 or 20 stable, true-breeding lines with the fusarium resistance fixed, so he could almost take that trait for granted and concentrate on other characteristics.

"I STARTED TO HYBRIDIZE these with the larger-fruited varieties of several kinds — for the greenhouse, for the home garden and for the market," says Lambeth.

Also at that time, germ plasm from Tucker's resistant varieties was exchanged with breeders throughout the world. Most new varieties of tomato released today have fusarium resistance, and much of that resistance came from Missouri.

The Missouri researchers, Tucker, Schroeder and Lambeth, have continually emphasized yielding ability in selecting breeding lines for their crosses. Consequently, Missouri tomato yields today are about three times higher than during the 1940's. Some credit for increased yield goes to improved cultural practices, too. But there is a genetic factor involved, Lambeth says, because the new varieties respond to improved cultural practices more than the old ones did. No amount of tender loving care

will increase the yields of the old varieties to match the hybrid newcomers.

After fusarium resistance, increased yield, larger fruit size and adaptability to various growing methods, Missouri researchers began investigating several questions regarding acidity in tomatoes.

Many tomatoes, particularly the yellow varieties, are advertised in seed catalogs as being low-acid or non-acid. Mizzou researchers tested the acidity of those varieties and found it about the same as other tomatoes.

"They are not, in fact, low-acid," Lambeth says. "But they don't taste as sour because many of them have a high sugar content along with the high acid."

DEVELOPING FRUIT FIRMNESS, of great concern to commercial tomato processors and to growers who sell for the fresh produce market, is a current Lambeth project. Most market tomatoes are picked many days and hundreds of miles away from the grocer's counter where they are sold. A ripe tomato doesn't last very long under the best conditions, so the fruits are picked while still green to prevent machine damage and spoilage during transportation.



MIZZOU'S TOMATO VARIETIES

The hybrid tomatoes developed by Dr. Victor Lambeth as a result of Mizzou's 40-year-old breeding program and available from commercial seed companies, are listed and described below.

AVALANCHE

Introduced in 1963. Hybrid, wilt resistant, 70 days to maturity. Medium-large, deep globe, red fruit. Good crack resistance. Prone to blossom end rot — keep adequate moisture level. Very productive. Firm. For market and home gardens.

PINK DELIGHT

Introduced in 1975. Hybrid, wilt resistant, 70 days to maturity. Medium-large, smooth, globe shape, pink fruit with good internal characteristics. Best crack and split resistant pink to

date. Very productive, attractive, firm. For market and home gardens.

PINK GOURMET

Introduced in 1968. Hybrid, wilt resistant, 72 days to maturity. Large, pink-purple fruit. Early fruit usually have deep blossom scars and rough lobed shoulders, but by mid-season fruit is large, smooth, meaty and of outstanding quality. Best for home garden use.

RED HEART

Introduced in 1970. Hybrid, wilt resistant, 75 days to maturity. Fruit large, smooth, meaty, red. Tomato center has deep red "heart". Best for home garden use, or local market.

SUN UP

Introduced in 1963. Hybrid, wilt resistant, 65 days to maturity. Fruit medium sized, smooth, red. Plants determinate (bush type) with concentrated early set of fruits. Needs good fertile soil. For early market or home garden.

SUPREME

Introduced in 1957. Hybrid, wilt resistant, 70 days to maturity. Fruit medium-large, smooth, globe shape, red. Moderately crack susceptible. An all-around good tomato for market and home gardens.

SURPRISE

Introduced in 1955. Hybrid, wilt resistant, 68 days to maturity. Fruit medium-large, smooth, slightly flattened globe shape, red. Crack resistant. Slight tendency to blossom end rot — keep adequate soil moisture level. Very productive, firm. For market and home gardens.

TOMBOY

Introduced in 1960. Not a hybrid. Wilt resistant, 68 days to maturity. Fruit large, pink. Early fruit usually have deep blossom scars and rough lobed shoulders, but by mid-season fruit is large, smooth, meaty and of outstanding quality. Home garden use.

BUT EVERY TRUE TOMATO lover knows the fruit must ripen on the vine in order to develop really good flavor. Now, Mizzou horticulturists offer hope to that tomato lover who yearns for a vine-ripened tomato in January, or to the city-dweller who must make a safari to the hinterlands to find a fresh tomato that doesn't taste like a worn-out tennis ball.

"With our current varieties, there is no way you can allow the fruit to ripen on the vine and get the quality that you want — and still get it to the market in acceptable condition," says Lambeth. "But we're making progress now. I think that within a few years we will have varieties that can do this. We already have lines whose fruit will stay on the vines two or three weeks and still be in edible condition. Others are gone in a week."

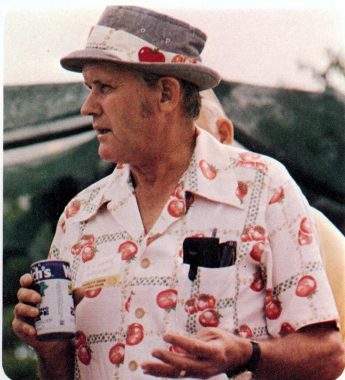
Lambeth has one new hybrid ready for release to the seed companies now. It lasts significantly longer after ripening than anything currently on the market. Those who like a juicy tomato with a lot of seeds may find this variety too hard; but those who like a firm tomato seem pleased with it, says Lambeth.

When the research on fusarium wilt resistance began, some tomato breeders had hopes of developing a tomato that would be adaptable throughout the country — Everyone's Tomato, if you please. As research progressed, it became apparent that no such thing would happen, says Arthur Gaus, horticulture extension specialist. Tomatoes are just more rigidly adapted to their environment than that. So today research is aimed at developing a tomato for everyone. There are dozens of varieties available for a variety of purposes and growing conditions. Whether you want to grow tomatoes in a greenhouse, in your garden, on a truck farm — or even in a pot on your patio — there probably is a variety well-adapted to your specific requirements.

Since we now have tomato varieties that are disease-resistant, highly productive and adapted to almost every kind of growing situation, why not halt this research and channel the time and money elsewhere? The question is asked from time to time, even by people who should know better.

"I think it would be disastrous," says Lambeth, "in view of our growing need for food in the world today. People who are in biology know that we can't afford to do this. We are hard-pressed as it is to keep up with those fungi, bacteria and viruses that cause diseases. There is a new race of fusarium wilt now, called Race 2, that is playing havoc down in Florida and the Southern states."

BREEDERS LIKE LAMBETH have been able to stay even with Mother Nature because of their skill in recognizing superior lines that will combine well and manifest those characteristics that we desire. That skill cannot be acquired without experience. Lambeth owes much of his success to the fact that Missouri's tomato-breeding program has continued uninterrupted for nearly half a century.



Vic Lambeth dresses appropriately for Mizzou's Tomato Field Day.

For those readers who want to know more about tomatoes, several sources are available. Lambeth served as a consultant for a new book called *All About Tomatoes*, available for \$3.95 from Chevron Chemical Company, 575 Market Street, San Francisco, CA 94105. It contains everything from addresses of seed companies to advice on plant culture to recipes for cooking and canning tomatoes. Contact the University Extension Division representative in your area for advice about local varieties and growing conditions. Several guide sheets and pamphlets also are available from the Extension Division.

A TOMATO FIELD DAY is sponsored each summer by the horticulture department at its farm near New Franklin. It usually occurs in mid-July, depending on how the tomatoes mature. The date is announced a few weeks in advance. The event is open to anybody interested in tomatoes — gardeners, truck farmers, seed company representatives or the "just curious." Visitors can see new breeding lines and potential new hybrids, plus demonstrations of irrigation techniques, pruning and staking systems and liquid fertilization.

The field day is also an opportunity for growers to ask horticulture specialists Lambeth and Gaus about any special problems with disease, insects and so forth. Those who are really serious might even get some seed samples from new varieties to try in their own gardens the next year. These tests by private growers give the horticulturists a chance to ask the growers what they think of the research efforts here at Mizzou.

Most of them think a lot of it. □