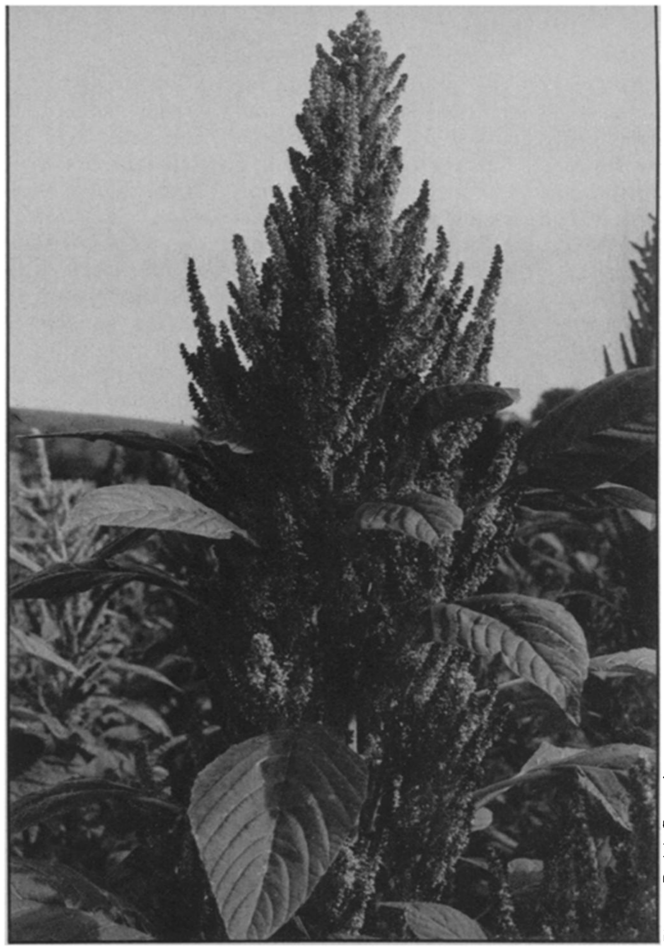
# Reviving the Food of the Aztecs

Amaranth, once a major crop of the Aztec empire, could soon emerge as the first of a new style of supercrop



A seedhead of a grain Amaranthus species. One can expect a harvest of nearly 100,000 seeds from one plant.

Photos: Rodale Press, Inc.

BY KEITH HINDLEY

Despite the high-yield Western crops now grown almost worldwide, many of the world's peoples do not get a balanced diet. This is especially true where meat or other animal products are absent and the diet consists entirely of grains and vegetables. Paradoxically, these people may appear to eat well yet suffer malnutrition because even modern cereals cannot supply all the body's protein needs. But next week scientists from the Americas, Africa, Europe, India and the Far East meet at Kutztown State College in the farmlands of Pennsylvania to discuss the rebirth of amaranth, an ancient crop that holds the promise of a balanced diet for all.

Amaranth really does have everything going for it. Its leaves and seeds contain a balance of proteins of unusually high quality. In particular, they contain a high concentration of lysine, an essential amino acid lacking in most cereals. The leaves can be eaten as green vegetables and the plant produces a mass of tiny seeds. As well as being exceptionally nutritious, amaranth actually tastes good. The leaves have a mild spinach flavor and remain soft and tender right through the summer. The seeds have an agreeable nutty flavor and their flour, unlike soy and bean flour, produces excellent bread and pastries. Amaranth seeds can also be popped like cornseed.

These qualities were well known to the ancient civilizations of Central and South America, where amaranth had been cultivated for at least 8,000 years. Just five centuries ago, the plant was a major staple of the Aztec diet and formed an important part of religious rites. The Aztec priests fashioned statues of the war and fire gods Huitzilopochtli and Xiuhtecutli out of toasted amaranth seeds bound together with the blood of human sacrifice victims. During ceremonies, these images were worshipped, broken up and then consumed by the faithful.

The Spanish conquistadores regarded this rite as a pagan parody of the Christian Eucharist, and so in 1519 they banned the Aztec religion and with it the growing of amaranth. Overnight, one of the most important food crops in Central America fell into disuse. The loss was staggering. The tribute list of Montezuma, the last Aztec emperor, shows that he received more than a quarter of a million bushels of amaranth seed annually in taxes from the twenty Aztec provinces. Yet today, 460 years later, the crop is only cultivated on a very limited scale in Mexico and then only to make candies.

The modern revival of interest in amaranth was sparked by John Robson, a nutritionist from the Medical University of South Carolina. Robson's work on the diet of prehistoric cultures has shown that a remarkably varied diet of seeds, nuts, berries and other wild foods was eaten. Civilization has steadily simplified this varied and balanced diet and Robson partly blames this for the increase of such modern complaints as obesity, diabetes, cancer and heart disease. After looking at many now-forgotten crops from less sophisticated societies, he plumped for amaranth as the ideal plant to diversify modern diets. It is particularly suited to underdeveloped countries where the failure of modern western crops due to extended drought or lack of fertilizers has on occasion left people starving.

Robson's enthusiasm aroused the interest of Robert Rodale, the editor of ORGANIC GARDENING, and they enlisted the help of several thousand of the magazine's readers. This band of unpaid researchers has now completed four seasons of growing trials all over North America and has amassed a great deal of cultivation data. Amaranth is a vigorous grower and remarkably resistant to drought, an impor-

*The seedheads of the amaranth plant are cut off, hung to dry and then threshed to loosen and separate the seeds.*

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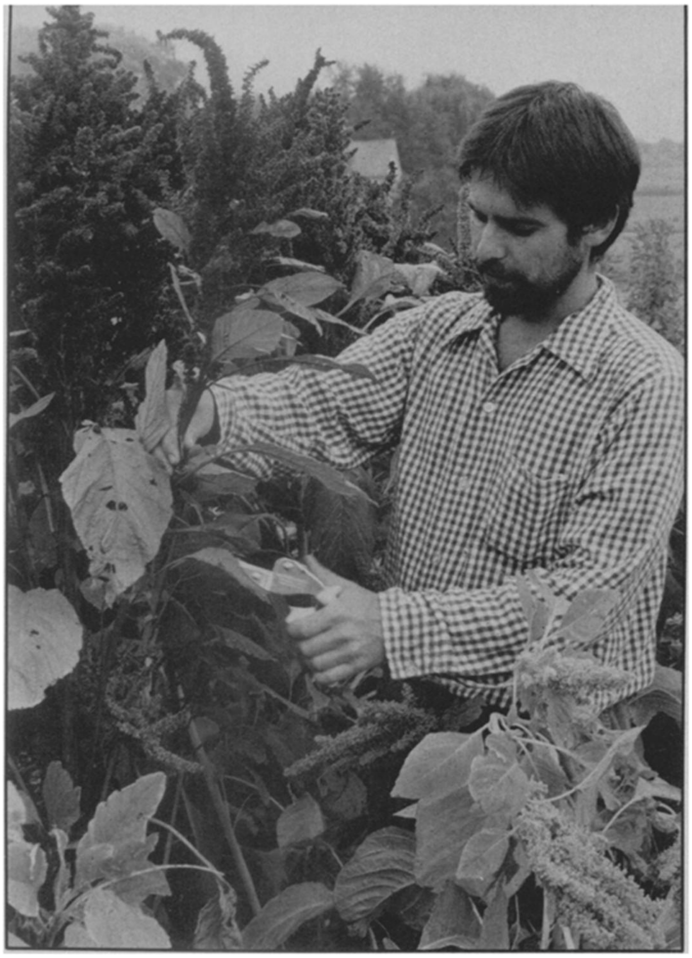

*The early amaranth growth at the Organic Gardening and Farming Research Center was of varied heights, most surpassing 6 feet.*

*By 1978, the plant height was reduced to a uniform 4 feet. Researcher Laurie Feine examines one of the most promising varieties.*

tant characteristic in a world running short of water. The plant uses what is termed the C4 pathway for fixing carbon and building up its tissues, a process characteristic of sorghum, maize, millets, sugar-cane and a few other fast-growing plants. The process is especially efficient at high temperatures, under brilliant sunlight and under moisture stress, and far more efficient than the C3 pathway used by ordinary plants.

As a crop, amaranth produces seed yields that compare very favorably with maize and rice, the top of the high-yield league. But there are problems with harvesting. Modern farm machinery developed for cereals cannot handle the rather fragile tiny amaranth seed which splits easily, but specialized machinery is now under development. This is not a serious drawback since those parts of the world most in need of the plant's nutrition do not boast a great deal of machinery anyway.

The main project of the last two years has been to build a collection of the many wild and cultivated amaranth varieties. This will establish the various sub-species and allow the cross breeding of the most important varieties to produce super amaranths specialized for either leaf or grain production. Weedy varieties of the plant are widespread — the American pigweed for example, which sprouts between paving stones across the continent. Even in Britain, Love-lies-bleeding, a classic component of the English cottage garden, is nothing more than an ornamental variety of amaranth. To date, field surveys have found more than 400 distinct varieties.

The existence of widespread wild varieties presents problems, since cultivated amaranth could cross fertilize with weedy types. Genetic studies already completed, however, point to several possible breeding routes that could minimize or prevent this. Other genetic studies, carried out in India, have revealed polyploid amaranths, plants that carry a chromosome number which is double, triple or even four times the normal count. These polyploids produce much heavier seeds than do the normal amaranths.

The international nature of next week's conference shows how much interest amaranth is now generating. Research groups in Taiwan, India, Nigeria, the Netherlands, Mexico, Puerto Rico and at nine U.S. institutions are now studying the plant. At the Rodale Press-sponsored Organic Gardening and Farming Research Center alone, the last few weeks have seen the ripening of plots carrying amaranth yield trials, plant density trials, vegetable leaf trials, a very wide range of outcrossing studies and even a 2-hectare pilot production field. Amaranth is the leading contender of a group of now largely ignored nutritious plants that were once major crops. It will first make itself felt in underdeveloped countries where its resistance to drought, high food value and responsiveness to hand cultivation should reap great benefits. And it should not be too long before we will be able to buy amaranth seeds and flour. Perhaps initially they will only be available in the local health food shop, but eventually, as the public becomes more aware of food value, amaranth products could find their way onto the supermarket shelf. □

| | Chemical score | Limiting Amino Acid |
|---|---|---|
| Amaranth | 75-87 | Leucine |
| Maize | 44 | Lysine |
| Wheat | 57 | Lysine |
| Sorghum | 48 | Lysine |
| Barley | 62 | Lysine |
| Broadbean | 67 | Sulphur containing acids |
| Peanut | 52 | Sulphur containing acids |
| Soybean | 68 | Sulphur containing acids |
| Mungbean | 35 | Sulphur containing acids |
| Kidney bean | 55 | Sulphur containing acids |
| Walnut | 45 | Sulphur containing acids |
| Pecan | 49 | Sulphur containing acids |
| Cow's milk | 72 | Sulphur containing acids |

*The protein value score of various plant seed products (left). The higher the numerical score the closer the plant matches the ideal chemical balance for a human diet. Amaranth yields (right) from recent trials, others from U.S. Department of Agriculture.*

| average | US average yield kg/hectare | World yield kg/hectare |
|---|---|---|
| Rice | 5,100 | 2,300 |
| Maize | 4,500 | 2,400 |
| Barley | 2,000 | 1,910 |
| Wheat | 1,800 | 1,560 |
| Oats | 1,700 | 1,660 |
| Soybean | 1,580 | 1,370 |
| Rye | 1,350 | 1,740 |

The range of amaranth varieties is 683-5,000 kg/hectare.

*Comparative yields of amaranth and other crops.*