

Specialty Crop Profile: Pawpaw

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PART 1: Crop Profile and Potential

When you think of the accepted definition of "small fruit" (based on the size of the plant), the native pawpaw is perhaps considered a borderline tree fruit and also a small fruit crop. This is due to its¹ natural bush-like and suckering habit, and the ability to train it easily into a single trunk, small tree.

This first article of a two-part series provides some background information about pawpaw, and its potential and problems in development as a niche specialty crop in the Eastern US.

The pawpaw (*Asimina triloba*) is the largest native tree fruit in the United States. A member of a tropical plant family (*Annonaceae*); there are nine temperate zone species of *Asimina*. The common pawpaw, *Asimina triloba*, has the greatest potential for commercialization. It is widely adapted, and has a native range from Florida to Michigan, and as far west as Nebraska. It is a common species in Virginia, found near creeks and lower and moister elevation sites of mountain drainage areas.

Historically, pawpaw was a well-known and much utilized fruit in the eastern U.S. It was an important food crop for both Native Americans and to early settlers. Today it is a local specialty, gathered in the wild by enthusiasts and grown by hobbyist in backyard orchards. Over the years, wild selections have been collected and named, and many of these cultivars (cultivated varieties) are now available in the commercial nursery trade.

In its ideal native habitat, pawpaws are characteristically found in the deeper, rich soils of river-bottom woodlands, growing as a small (to 25') understory tree. Because of root suckering, it usually forms clumps or thickets. Leaves are long and drooping, very dark green, turning a brilliant yellow in the fall. The fruit itself is borne alone or in multi-fruit clusters, which can resemble a "hand" of bananas (hence it's common names: poor-mans banana, Indiana banana). It has a strong floral and fruity aroma, is creamy textured, and usually bright yellow to orange in color. Typical of its tropical family, the flavor of pawpaw is best described as richly complex, a mixture of papaya, banana, mango and pineapple. Flavor can vary greatly between selections, with sweetness and after-taste characters defining a high quality cultivar. The fruit (a true berry) may weigh up to a pound, is oblong to cylindrical in shape, 1-6" long, and 1-3" in diameter.

CROP PROSPECTS

Pawpaws are not yet a commercial crop in the U.S. However strong interest has been shown in the potential for crop development, with several key institutions working toward that goal. The Pawpaw Foundation, based in Washington DC, is a non-profit organization dedicated to the research and promotion of pawpaws as a commercial fruit.

The national repository for pawpaw germplasm is located at Kentucky State University, Frankfort KY. KSU is a leader in pawpaw research, focusing on breeding and post-harvest handling. The university also coordinates a multi-state cultivar trial with 13 other universities in the East and Midwest. The New Crops Center at Purdue University is also involved with research, and has initiated work into the pharmaceutical / pesticidal potential of pawpaw.

So what are the prospects and hurdles for this new crop? According to pawpaw promoters, the development potential of the crop is based on a number of reasons:

The crop is well adapted to Eastern US climate and soil conditions. Pawpaw is adapted to humid temperate zone growing conditions. It is hardy to zone 5 (-15 F / -30 F), and needs at least 400 hours in annual chill requirements (depending on cultivar). A long warm season is required to mature fruit (2600 degree days; 160 frost-free days), and 30-35" of rainfall is needed annually, with the majority falling in the spring and summer. Contrary to popular belief, pawpaw performs best in full-sun exposure. However seedling protection is needed the first year or two, as young seedling shoots are sensitive to sunlight.

It is a unique/unusual fruit crop with high nutritional value, with potential for both fresh and processed market uses. As a food source, pawpaw exceeds apple, peach, and grapes in vitamin, mineral, amino acid and food energy values. The most current market for fruit is as a fresh product, with farmers markets and other direct sales the primary outlet. With intense flavor and aroma, the fruits' greatest potential may be for processed food products such as blended fruit drinks, baby food, ice cream and as a substitute for banana in various recipes. In Kentucky, various entrepreneurs are utilizing pawpaw as a local cuisine item for restaurants, and in frozen custard and ice cream products.

There are valuable natural compounds in the plant, which have both anti-carcinogenic and pesticidal properties. Aromatic compounds in fruit have potential for use in cosmetics and home products. Research has shown that pawpaws have a diversity of natural compounds in fruit, leaves, bark and twigs. One class of compounds is known as annocoumarins occur in leaves and twigs, and have reported anti-tumor properties.

Nursery trade development, for orchard and edible landscape plantings. Currently in the U.S. there are over 40 nurseries selling pawpaw trees, in the past several years at a brisk pace. Named cultivars are offered as grafted trees. Seedlings are offered as well. Grafted trees are expensive and are selling retail for \$18.00-\$25.00 each. As a landscape tree, the pawpaw has attractive growth form, size and fall color, as well as fruit production with limited input, and it attracts the zebra swallowtail butterfly.

Yet there are several factors that must be overcome to promote development of pawpaw as a new commercial fruit:

Pawpaws, once ripe are very perishable, soft and bruise easily, presenting problems for marketing. Though they can be picked at less than ripe stage, best flavor intensity and sweetness is achieved when fruit is allowed to tree ripen, but not over-ripen. Respiration rate is also higher than most fruit, and much moisture, carbon dioxide and ethylene is emitted as fruit ripen. When completely ripe, pawpaws will last for about two days at room temperature, or about a week under refrigeration (40-45 degrees). If the fruits were picked before fully ripe, but mature, they can be refrigerated for 2-3 weeks, and subsequently ripened at room temperature for several days. As the fruit ripens, it quickly develops handling bruises, blotches, streaks and freckles, much like an overripe banana, which can reduce its fresh market appeal. Research is needed into the post-harvest aspect of fruit management.

Fruit set is poor in nature because of poor pollination. However it has been shown with proper pollination under cultivation, yields can be exceptional. The flowers occur on one-year old wood, and are protogynous, meaning that the female stigmatic surface is receptive before the pollen is mature. Even if released on time, the pollen is often self-incompatible. Thus the flowers require cross-pollination from a genetically different plant. Means of pollination is also an issue, and the natural pollinators are neither efficient nor dependable. The flowers' meat colored flowers and fetid aroma belies the type of pollinating insects (beetles, carrion and bottle flies). Increases in pollination have been observed by introduction of road kills to the orchard. This however is an unusual orchard practice, and may be difficult for growers to adopt.

Fruiting characteristics can be highly variable between cultivars. Important factors of variability include time of maturity, concentration of ripening, fruit size, seed number and seed size. Flavor components and sweetness can also be variable. Breeding and selection for quality and uniformity is part of bringing any new crop to market, and work has only begun with pawpaws.

Currently, a "catch 22" situation is in place with regards to commercialization of the fruit for fresh and processed markets. For the wholesale marketers and processors, a guarantee of fruit availability is needed before any major products or fresh market line is developed. From the growers perspective, a market must be in place before planting. Currently new orchards average 1 acre or less in size. It is hoped that as recently planted orchards come into bearing, the market situation will begin to change. Initially, cooperative marketing of fruit by limited acreage growers may help to address demand issues.

Research is also needed in the food science aspect of processing the crop, and best means of processed product commercialization. Currently one of the best prospects is incorporation into ice cream.

Commercialization of biomass production for drug or pesticide uses is expensive and may be an unrealistic expectation. Corporate investment for research and development of a new drug or pesticide product is expensive due to government approval requirements, and the market potential is a driving factor in decisions to develop a product.

Little is known about the culture, physiology and genetics of this crop. Current research in these areas is underway. However prospective growers must realize that much information is simply not available, and production practices to a great extent are based on assumption and extrapolation from other crops. Because it is a new crop, little if any chemical materials are available for pest management.

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