Art as a Source of Information on Horticultural Technology

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Abstract

Works of art from antiquity to the present constitute an alternate source of information on horticultural technology and science providing significant information on subjects such as the history of technology, crop evolution, lost traits, and crop dispersal. Sources include ancient mosaics, sculpture, illustrations of medieval manuscripts, renaissance paintings, and illustrations from illuminated and printed herbals. The uses of art as a source of horticultural technology will be illustrated using examples of Paleolithic sculpture and painting, Egyptian and Mesopotamian sculpture and painting, ancient Greek paintings, Roman mosaics, Medieval illuminated herbals, and Renaissance art in its many manifestations, including an illustrated prayer book, frescoed ceilings, paintings, drawings, sculpture, and woodcuts from printed herbals. The systematic collection of crop iconography from the artistic record would be an invaluable resource to crop researchers and a project (Plant Image) is being organized to assemble a searchable database of crop images.

INTRODUCTION

The technology (skill and craft) and science (systematic knowledge) of horticulture represents a storehouse of information that is passed on from generation to generation in a number of ways. The classic approach is the oral tradition where information is passed from parent to child, artisan to apprentice, professor to student. The creation of writing has created the literary approach where information transmitted through the oral tradition was preserved in writing impressed in clay, chiseled on tablet, carved in stone, and penned or printed on paper, and stored in libraries in the form of scrolls and books. In the age of science new information becomes the grist for the mill of scientific journals and monographs. There is a third ancient tradition based on artistic representation based on what seems to be the basic human impulse to create images. The artistic tradition developed around drawing, painting, and sculpture has left a record that is part of our heritage that stretches from Paleolithic times to the present. The visual arts have been valued because they constitute both an esthetic and illustrative means of information transmission. The esthetic appeal of art is its ability to transmit an emotional response from the artist to the viewer, probably because the visual sense is so highly developed in humans. However, illustrative art also transmits various types of information. It is no accident that writing developed from pictures and indeed we are returning to this method of transmitting information through the use of icons in signs and in computers. While the esthetic approach to art has been a moving force in its evaluation by art historians, the artistic record also can be used to examine technological information. In this paper we will survey the use of the artistic record to transmit and convey information on horticultural science and technology from prehistory to the Renaissance.

The Paleolithic Record

The Paleolithic period (Old Stone Age) has been considered to extend from 750,000 to 15,000 years ago when humans were hunters and gatherers. Their culture survived chiefly through the remains of stone tools, whose features along with carbon dating can be used to determine chronology. About 500,000 years a surge of hominid expansion occurred from populations that had a brain capacity of 1100-1300 cc, a species

now know as archaic *Homo sapiens*. This group gave rise to Neanderthals, brawny large brained tool-making humans that appeared in Europe about 250,000 years ago but destined to be overtaken by an African group via Asia, *Homo sapiens* or Cro-Magnon, the human species that is us. About 200,000 years ago these two groups coexisted but Neanderthals disappeared about 25,000-30,000 years ago. The artistic legacy in the form of sculpture and cave paintings of this new group in the form of realistic images of humans and emphasizing the hunt represent the beginning of art history. The images were mostly animals but include plants (Fig. 1). Some sculptures of voluptuous women (Fig. 2) known as Venuses, still present an emotional impact related to the keen interest of early humans in fertility, some evidence of clothing made from plant and animal sources indicating the development of weaving and textile technology (Fig. 2).

The discovery of Agriculture about 10,000 to 12,000 years ago occurred in a relatively short period of time in the Neolithic (New Stone Age) period and this "sudden" transformation in culture is referred to as the Neolithic Revolution. The technology associated with the domestication of plants and development of agriculture can be traced in artistic imagery, before the discovery of writing in about 3000 BCE. Individual crop species can be identified (Fig. 3) along with stunning images of women gathering grain in an organized pattern, 5,000 to 6,000 years ago (Fig. 4).

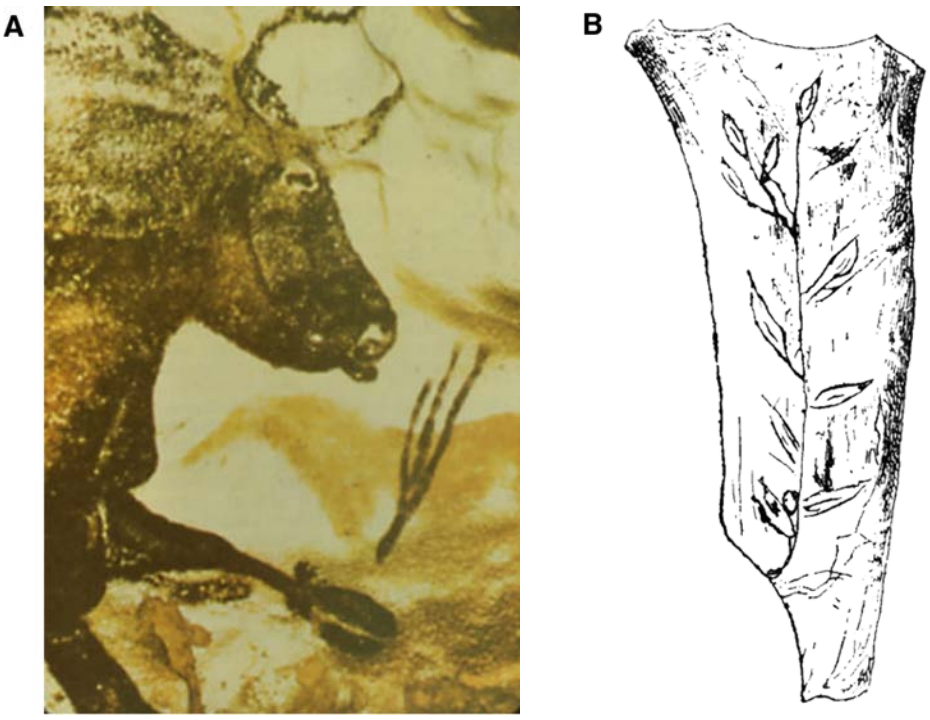

Fig. 1. Paleolithic images of plants: (A) auroch with a primitive image of a plant; (B) a more sophisticated image showing stems and leaves carved on reindeer horn. Source: Tyldesley and Bahn, 1983.

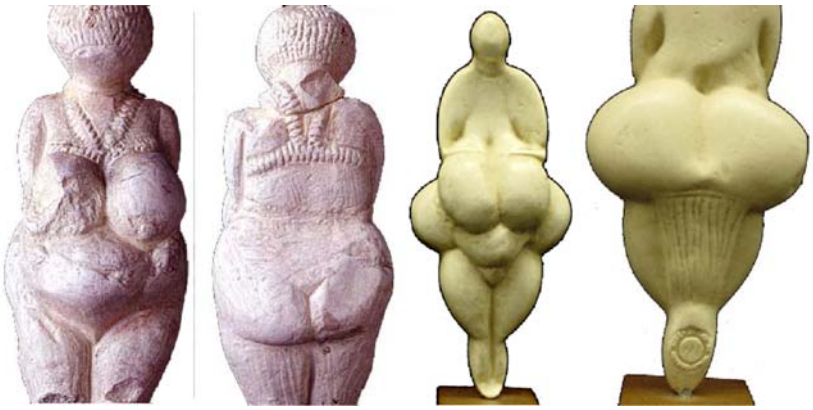

Fig. 2. Venus figurines of the Paleolithic period showing evidence of textile technology.

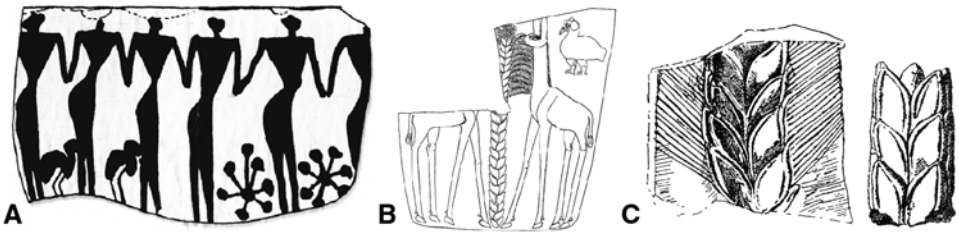

Fig. 3. Early Neolithic and Bronze age representations of crops where plants can be identified: (A) pottery image from Tejpe Sialk, Iran, 7000 years ago showing dancing figures, birds, and plants, perhaps wheat or barley; (B) predynastic Egyptian image of drawing of palm tree and gazelle 5000-6000 years ago; (C) cereal carving, first dynasty, 5000 years ago.

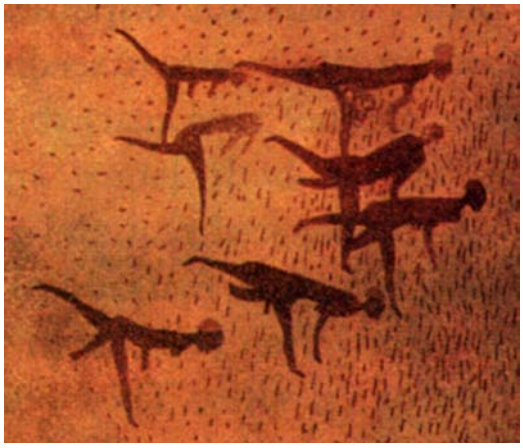

Fig. 4. Women gathering grain, Tassilil n'jjer, Algeria.

Egyptian Art and the Origins of Horticulture

Egyptian civilization dates back to the dawn of civilization and artifacts exist in a continuous 6,000 year-old record. The artistic genius engendered by Egyptian civilization, the superb conditions of many burial chambers, and the dry climate have made it possible to reconstruct a detailed history of agricultural technology. Ancient Egypt is shown to be the source of much of the agricultural technology of the Western world. The available material is almost overwhelming and here a brief sampling of the artistic record connected with horticultural technology is provided: cultivation (Fig. 5), irrigation technology (Fig. 6), harvest and pest control (Fig. 7), wine production, the beginning of biotechnology (Fig. 8), ornamental horticulture (Fig. 9), plant exploration (Fig. 10).

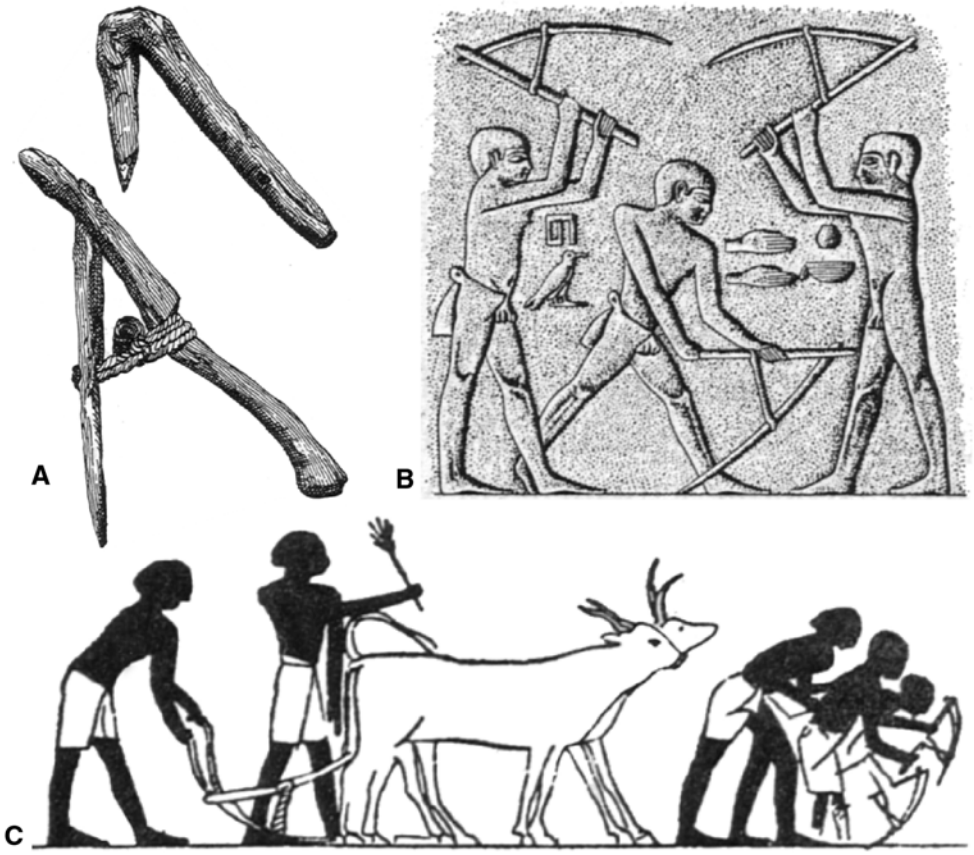

Fig. 5. Cultivation technology from ancient Egypt: (upper left) development of the hoe and hefted hoe; (upper right) primitive land preparation; (bottom) development of the plow with animal traction. Source: Singer et al., 1954.

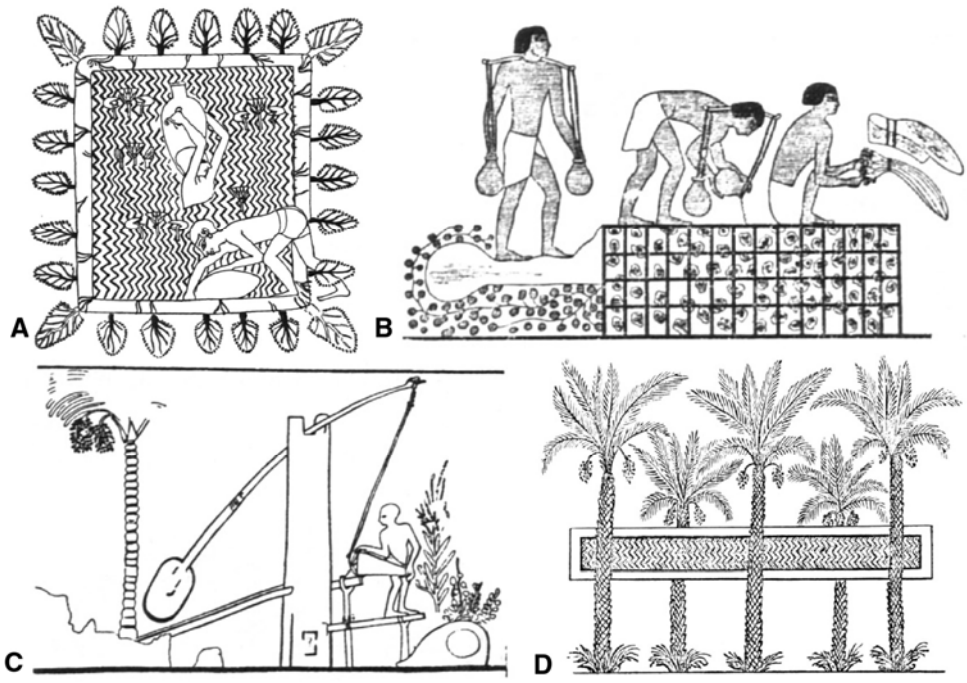

Fig. 6. Irrigation technology from ancient Egypt. Source: Singer et al., 1954.

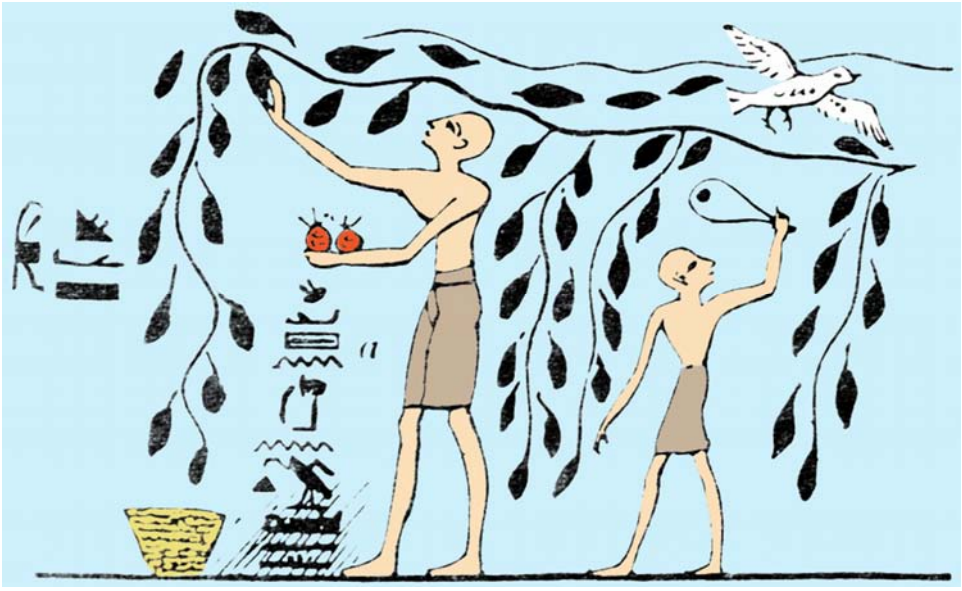

Fig. 7. Harvesting pomegranate and using either a sling (or perhaps a big eye painted on a paddle) to chase birds in ancient Egypt.

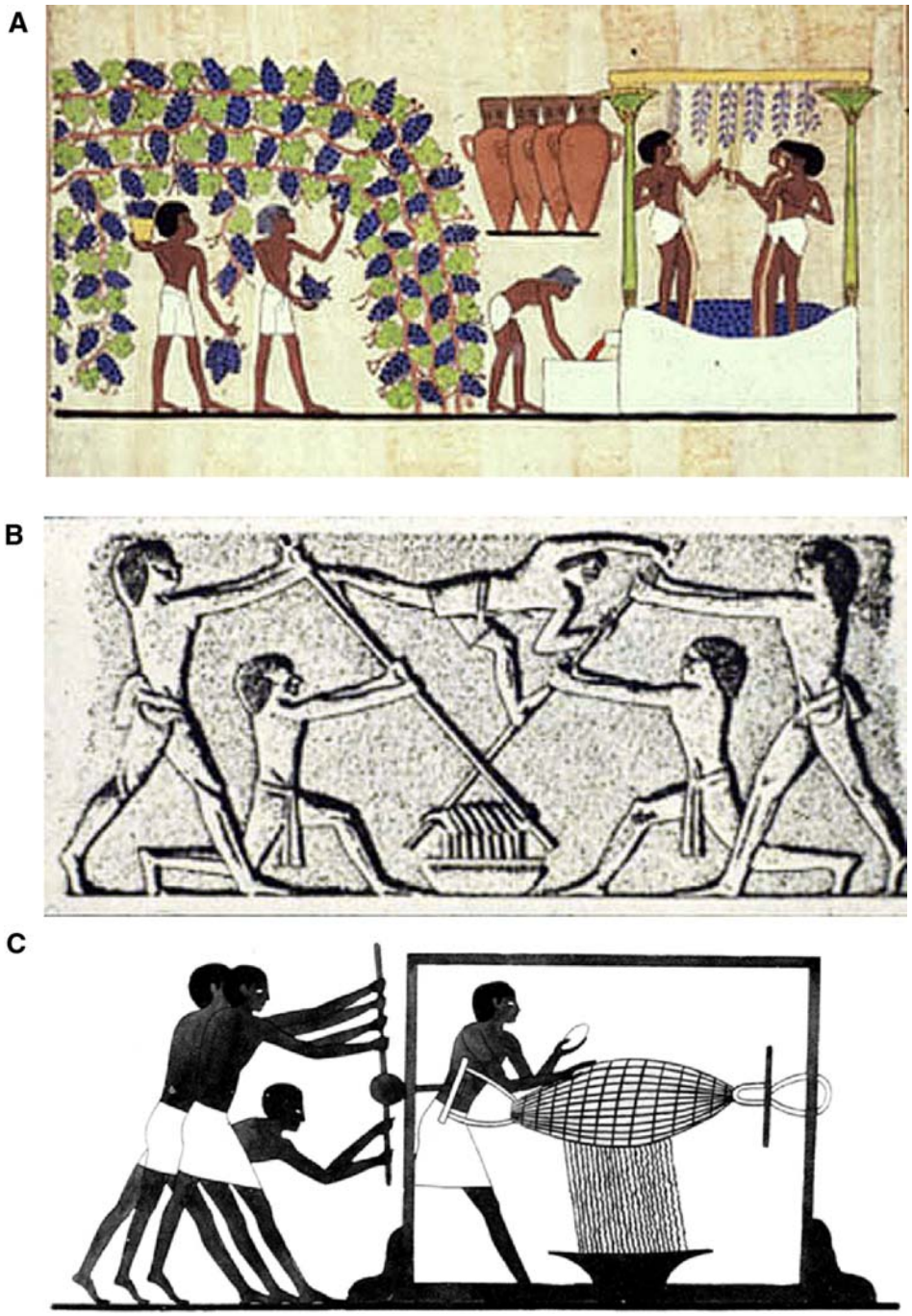

Fig. 8. Wine production in ancient Egypt: (A) grape production under a pergola, expression of juice by foot, and amphoras for fermention, (B) Humorous method of expressing wine from a bagpress, (C) expression of wine from bagpress with a rotary apparatus.

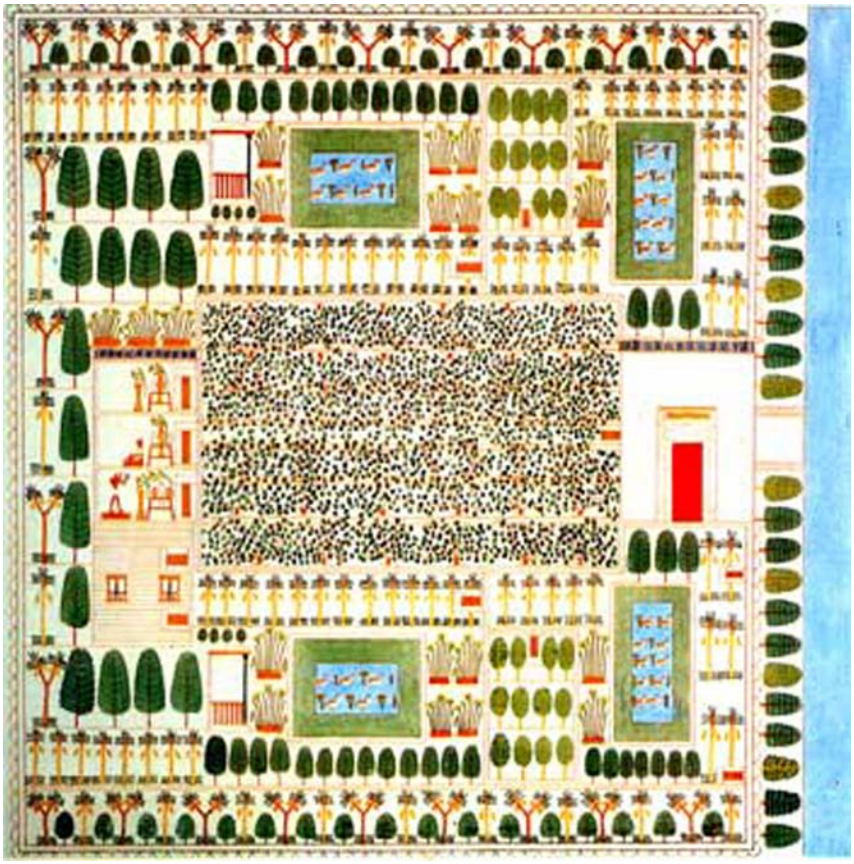

Fig. 9. Ornamental horticulture is typified in a garden plan for a wealthy Egyptian estate. Note two types of palms: single trunk = date palm, bifurcated trunk = doum palms. Source: Berrall, 1966.

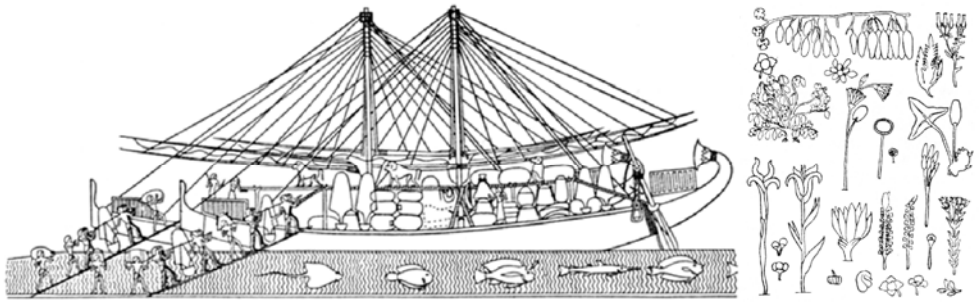

Fig. 10. Plant exploration: (A) Ships of Queen Hatshepsut's fleet lading at Punt (north-eastern coast of Africa) with exotic merchandise for Egypt. From a temple at Deir el-Bahri, 18th Dynasty, Egypt, ca. 1500 BCE. Note the tame baboons, the marine life, and the carriage and storage of growing incense (myrrh) plants. (B) Strange plants and seeds brought back from Syria and carved on the walls of the temple of Karnask, ca 1450 BCE. Source: Singer et al., 1954.

Mesopotamia

The ancient Near East cultures known as Mesopotamian civilization are largely based on Semitic populations that existed between the Tigris and Euphrates Rivers, now present day Iraq, that soon expanded to the area known as the Fertile Crescent including parts of present day Israel, Jordan, Lebanon, Syria, Iraq, and Iran.

A second Neolithic Revolution between 6,000 and 3,000 BCE (Bronze Age) involves the change from villages to urban centers and the development of a settled agriculture coinciding with the beginning of fruit culture. This is well documented in the decorations of a vase, late 4th millennium BCE, found in Uruk (Erech), a town on the Euphrates north of Basra, Iraq that is associated with Sumerian civilizations, where writing was invented (Fig. 11). Other evidence of horticultural technology include the refinement of a plow with a seed drill (Fig. 12), date palm pollination (Fig. 13), and irrigation technology (Fig. 14).

Fig. 11. The Uruk vase, late 4th millennium BCE, showing attendants bearing fruit in a wedding ceremony, probably between a priest king and the goddess Innana (Istar). Source: Pollock, 1999.

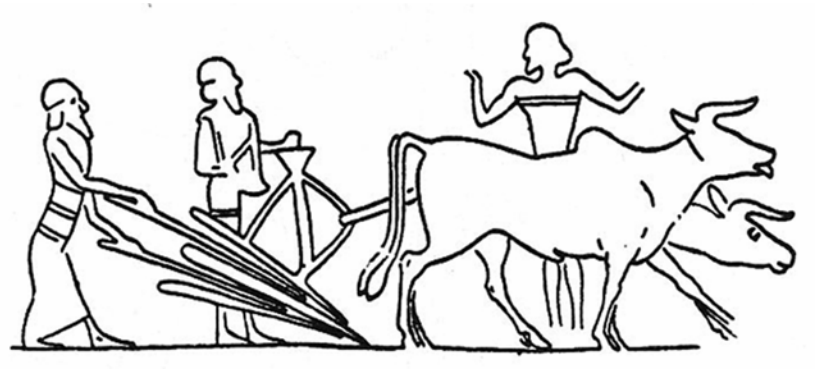

Fig. 12. A Babylonian scratch plow with seed drill from a Cassite cylinder-seal, 2nd millennium BCE. Source: Singer et al., 1954.

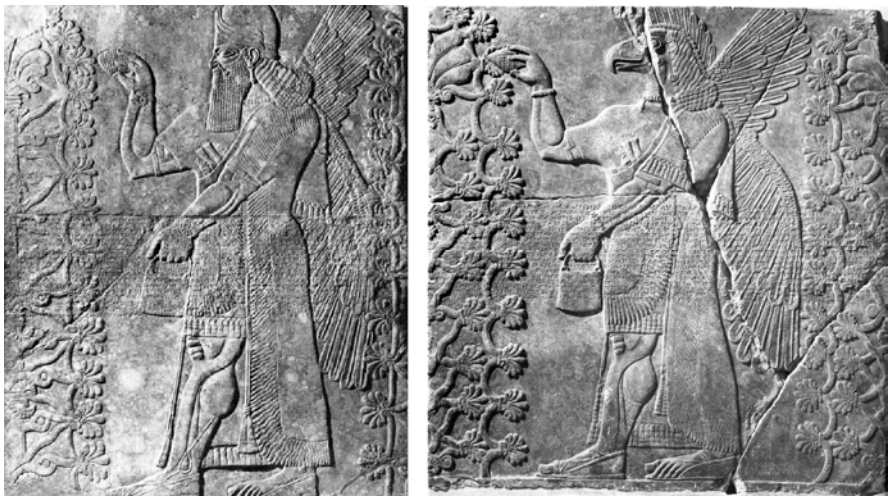

Fig. 13. Date palm pollination depicted in Assyrian bar-reliefs, 883-859 BCE. The pollinator assumes the form of a god-like figure (genie) and the date palm has been transformed into a symbolic tree. Source: Paley, 1976.

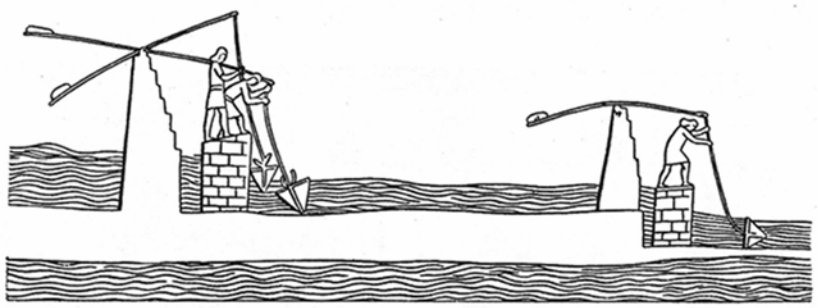

Fig. 14. Raising water from the river with shaduf by Assyrians. Three men operate a double lift. From the palace of Sennacherib at Nineveh, Mesopotamia 7th century BCE. Source: Singer et al., 1954.

Asian World

The beginnings of agriculture in eastern Asia date to Neolithic times, slightly later than the New East. By 2,000 BCE advanced civilizations are found in North China and Manchuria with evidence of canals and extensive irrigation. The writings of Confusion mention 44 food plants including horticultural crops such as peach, plum, Japanese apricot, jujube, chestnut, mulberry, quince, Chinese cabbage, bottle gourds and various melons. First century agricultural manuals describe intensive production of crops, pre-treatment of seed, irrigated rice, ridge cultivation, potculture, composting, and iron tools. Ornamental culture becomes embedded in the culture of China and spread throughout Asia. Flower cultivation became one of the seven arts and assumed mystic importance. Exchange of technology with the West involved sea routes via India and the Mideast as well as overland routes known as the Silk Road. Evidence of ancient technology is depicted in art of the Han dynasty (Fig. 15).

Greek and Roman

The rise of Greek culture from 2000 BCE was to extend throughout the Mediterranean Basin at its peak from 750 to 450 BCE and had a profound influence on Western Civilization. Greek Culture (Hellenism) was associated with the flourishing of the arts and sciences and was based on the domination of ideas rather than technology *per se* and had a powerful influence on Roman culture that superceded it by force of arms. Although Greek culture is remembered by its philosopher/scientists its agriculture is passed down to us via art in the form of paintings on ceramics, sculpture and mosaics (Fig. 16).

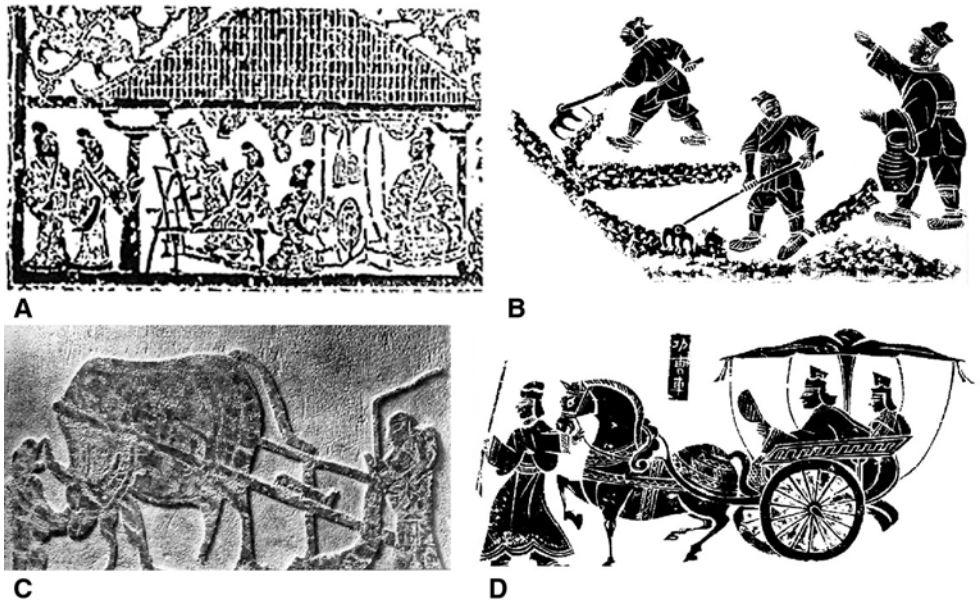

Fig. 15. Ancient Chinese technology depicted in the Han dynasty (206 BCE-220 CE). (A) Silk industry. (B) Hoeing plants in rows with iron tools. (C) Plowing with water buffalo. (D) Horse cart with trace harness.

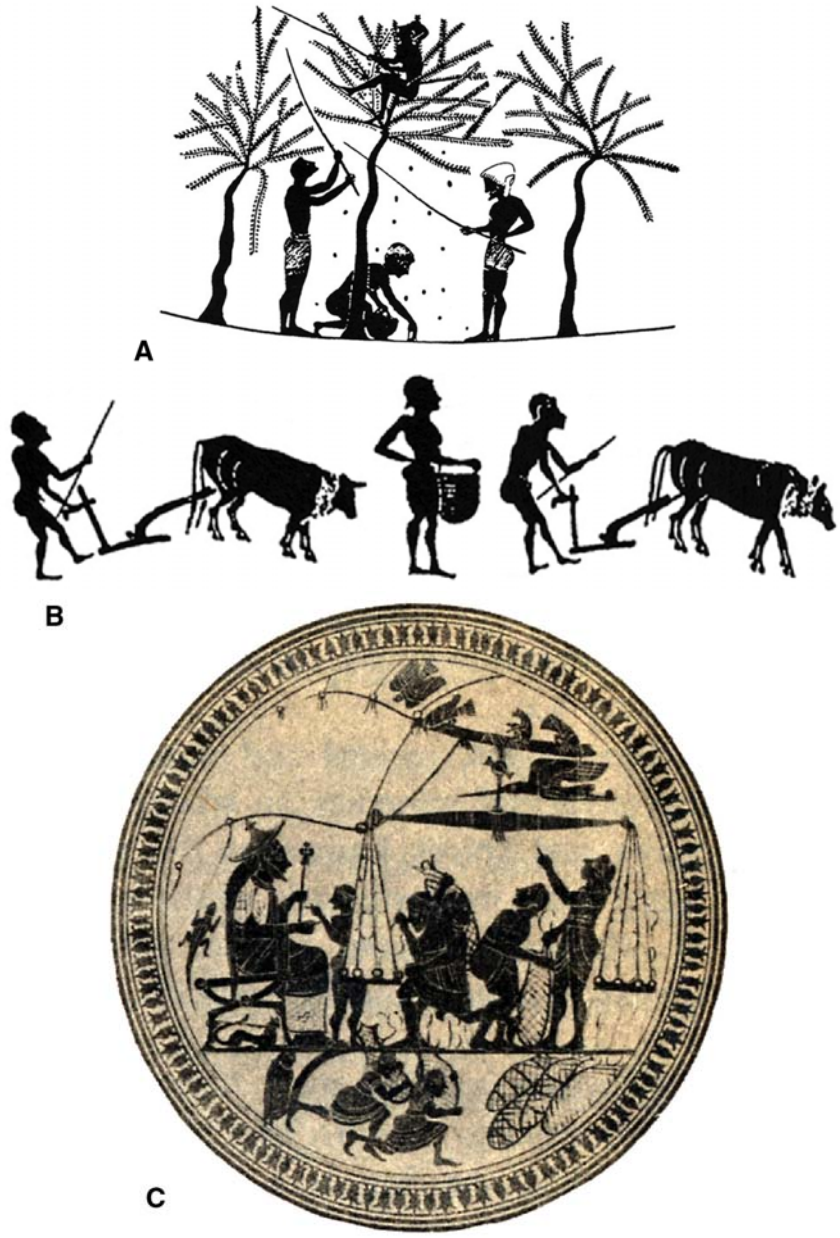

Fig. 16. Greek horticultural technology. (A) Harvesting olives. (B) Greek plow. (C) Laconium cup ca 565 BCE portrays King Arcesilas II of Cyrene supervising the loading of silphion, an ancient spice now extinct.

Roman horticulture survives in a rich written tradition and naturalistic images appear in paintings and mosaics (Fig. 17). Techniques of Roman pomology are included in mosaics illustrating grafting, manuring, and juice extraction (Fig. 18).

PreColumbian Americas

The three great cultures in America at the time of Columbus' encounter with the New World, Aztec, Maya, and Inca, were monumental civilizations, similar in many ways to that of ancient Egypt of 2,000 BCE, with enormous temples in the form of pyramids, pictorial writing, a system of cities and government, a developed agriculture, a bewildering theology, and a magnificent art. There was a dark side involving slavery, constant warfare, the human sacrifice, and cannibalism. The rich art of these civilization includes information on the domestication of indigenous crops as portrayed in ceramics (Fig. 19), the development of land reclamation (Fig. 20), and detailed description of crop culture such as potato (Fig. 21) and maize.

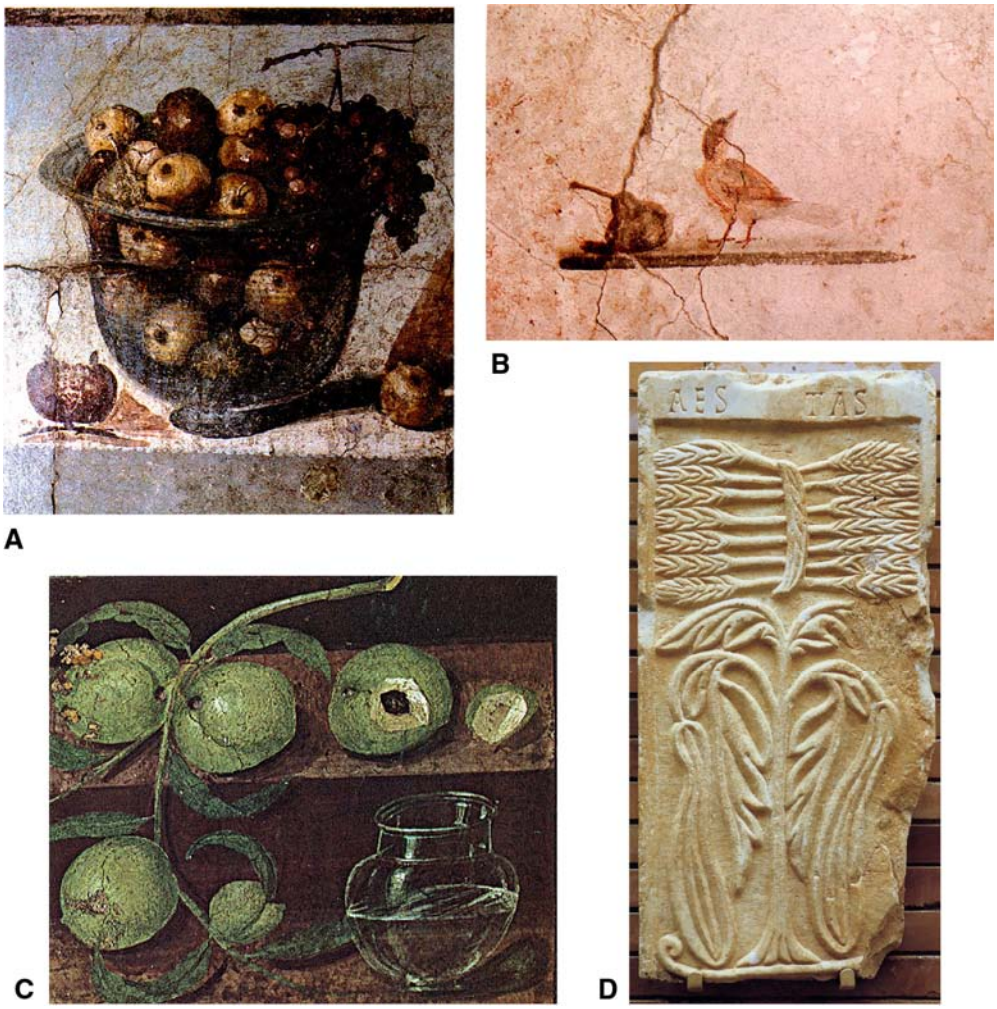

Fig. 17. Roman fruits images: (A) glass bowl with many temperate fruits, (B) pear; (C) peach, from paintings from Pompeii; (D) bar relief of melon (*Cucumis melo* var. *flexuosis*) from Merida, Spain, 4th century CE.

Fig. 18. Roman pomology from 3rd century CE mosaic, St. Roman-en-gal, Vienne, France: (A) detached scion grafting; (B) manuring; (C) fruit harvest; (D) juice extraction.

Medieval

The breakdown of the Roman empire resulted in the destruction of the large cities and a general decline in culture, but rural areas and organizations were left relatively intact. A feudal society developed which involved relation between land and the people who owned it and worked it. Feudal society became organized by mutual exchange of protection and services between the land owning class and serfs and society became stratified through nobility (hereditary land owners), a warrior class (knights), serfs and slaves, and the church which became increasingly powerful and wealthy. Agriculture was originally the principal source of wealth, but an increase in economic activity and urbanization led to the development of a rising mercantile class including guild workers, tradesmen, and bankers. The rise of manufacturing eventually supplemented and then displaced the feudal system where real wealth moved from the ownership of land to trade and manufacturing. The rise of agricultural and horticultural technology is evident in

artwork as artists used everyday scenes to ornament their psalters, religious paintings, and portraits. The church became the reservoir of horticultural information which was preserved in hand illuminated manuscripts, but many images show a decline in accuracy reflecting continuous copying rather than drawing afresh from nature (Fig. 22).

Fig. 19. Pre-Columbian ceramic jars from Peru: (A) peanut; (B) potato; (C) squash; (D) cacao pod. Source: Leonard, 1973.

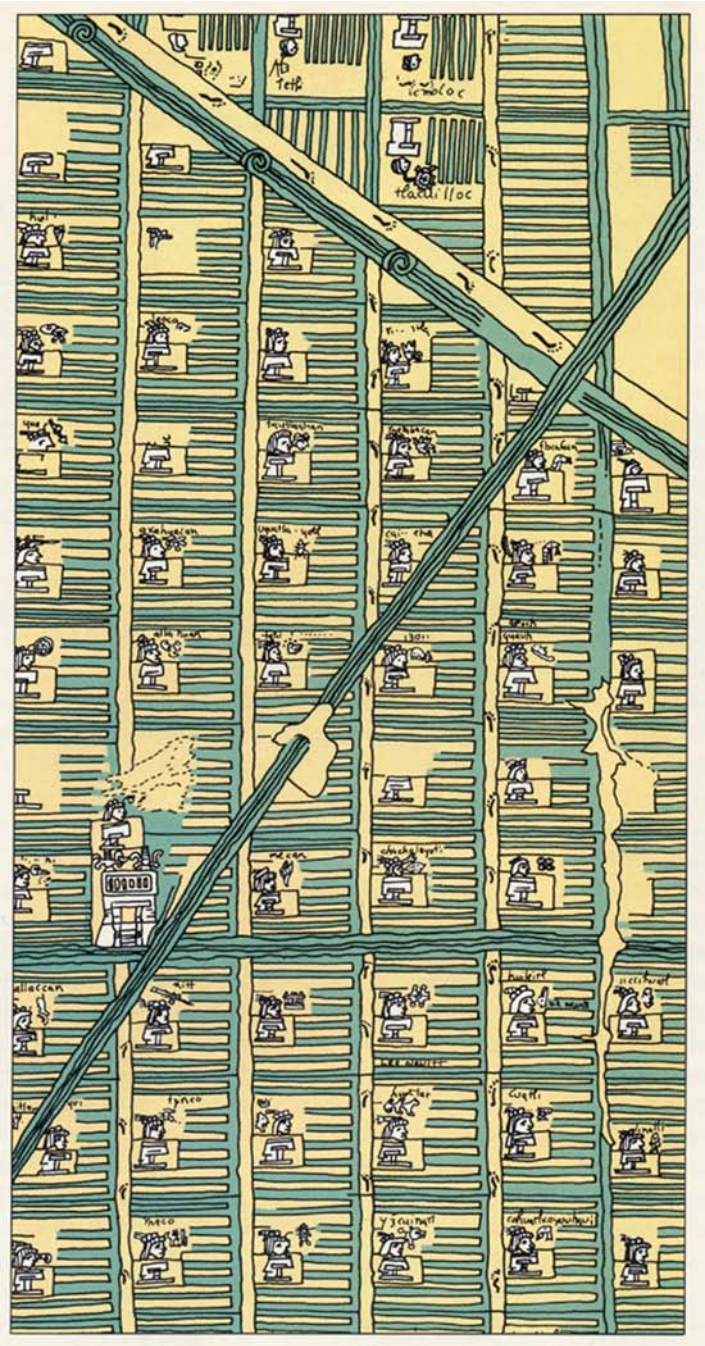

Fig. 20. Land reclamation in Aztec culture. A plant of a small portion of the gigantic chinampa system of island culture ("floating gardens") constructed 2000 years ago in the area of what is now Mexico City. The major canals were large enough for navigation in flat bottom boat. Source: Leonard, 1973.

Fig. 21. Planting and harvesting of potato by the Incas, 1580. Source: Leonard, 1973.

Renaissance

The rebirth of culture that first developed in the 14th century in Italy and spread throughout Europe is referred to as the Renaissance. This period in Western civilization is typified by the flourishing of artistic and scientific activities brought about by the new translations of classical philosophers, the rise of humanism, new methods of inquiry involving science, the explosion of knowledge brought about by the emerging universities, the invention of printing, and the extraordinary discoveries associated with the Age of Exploration. In the botanical sciences, this led to a return to nature with inspiration from the real world rather than mere scholasticism, based on endless copying from the past. As in many fields this new spirit of inquiry is crystallized in the detailed and magnificent art of the Renaissance. Examples include the drawings of Leonardo da Vinci (Fig. 23), the illustrations of Jean Bourdichon (Fig. 24), the frescoes of Giovanni da Udina (Fig. 25), and the woodcuts and paintings made for the herbals of Leonhard Fuchs (Fig. 26). The explosion of art has left a rich legacy that remains a powerful force in Western civilization. The new plants discovered in the Age of Exploration increased the popularity of printed herbals and florigeums that were highly prized and coveted to become the glory of Baroque horticulture. A new art form "Natures Mortes" or Still Life, developed by the artist Michelangelo Merisi, known as Caravaggio was to fuse and coalesced the science of botany, the spirit of horticulture, and the realm of art (Fig. 27). This spirit also remains in landscape architecture and garden art.

Modern World

The modern world typified by the rise of science and the rise of technology has brought new ways to visualize plants both seen and unseen. These include photography, scanning microscopy (Fig. 28), electron microscopy, satellite imaging, and computer modeling.

Fig. 22. Caraway (*Carum carvi*) and nut grass (*Cyperus esculentus*) from illustrations for Dioscorides *De Material Medica*, 9th century (M652, Pierpoint Morgan Library). Source: Blunt and Raphael, 1979.

Fig. 23. Star of Bethlehem (*Ornithogalum umbellatum*) by Leonardo de Vinci is one of the finest images of a plant, carried out when Leonardo was interested in the dynamics of fluid mechanics.

Fig. 24. A page from *Les Grandes Heures d'Anne de Bretagne* produced from 1505-1508 by Jean Bourdichon illustrates pomegranate along with a snail, insect larvae, various insects and a butterfly.

Fig. 25. Old World cucurbits from the frescoed ceiling at the Villa Farnesina, Rome originally built by Agostino Chigi painted between 1515-1518 by Giovanni da Udina, a member of the workshop of Raphael Sanzo.

Fig. 26. The tomato, a painting from an unpublished manuscript by Leonhart Fuchs.

Fig. 27. Caravaggio's painting entitled Still Life of a Basket of Fruit (1601), considered the first fruit portrait, contains detailed images of various diseases and predations.

Fig. 28. Scanning electron photograph of the surface of a tomato leaf.

CONCLUSIONS

The rich connection between art and horticultural technology suggests that the systematic collection of plant iconography would be an invaluable resource to researchers, providing significant information on taxonomy, crop history and evolution, lost traits, and genetic diversity. To this end a project, "Plant Image," is being organized to assemble a searchable database of plant images beginning with the Solanaceae and Cucurbitaceae. Searches have been made from various sources including art (mosaics, paintings, and sculpture), illustrated manuscripts, and hand illustrated and printed herbals and books. We are concentrating our search on antiquity (Old and New World), Medieval, and Renaissance sources but we intend to include more recent images as well. Bibliographic information on primary and secondary sources will be associated with each image and, in the case of herbals, associated text material will eventually be included. The working database is online: www.hort.purdue.edu/newcrop/iconography.

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