

THE SOLANACEAE

LESSON FOUR

History of the Solanaceae

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In this lesson we will learn about the early history and DOMESTICATION of some members of the Solanaceae. Parts of the lesson are underlined. Younger members can ignore these parts. **Make sure you do everything that is in bold print**, answer all the questions and do one of the projects at the end of the chapter. WORDS PRINTED IN ALL CAPITALS are in the glossary at the end of the chapter.

INTRODUCTION

Agriculture is one of the greatest inventions of mankind. Agriculture is the:

1. deliberate planting and harvesting of plants and
2. deliberate herding of animals.

People would grow plants they liked and take them with them when they moved. Many plants spread all over the world as people moved from place to place. As people grew plants, they tried to change them. People tried to make the plants more useful. For example, Native Americans wanted sunflowers to have big seeds. People also looked for plants that would grow well where they were living. These changes were brought about in many different ways. One technique was seed selection. People would look for plants they thought were the best and save the seeds from that plant for use the next season.

If you wanted a new type of tomato, what would you look for?

Some members of the Solanaceae family have been selected for fruit shape, fruit size, and fruit taste. One example some of you may have noticed is the small sweet peppers now available at the store. They are quite small, only a couple of inches long, and come in a wide variety of colors.

Most people would not recognize the wild ancestors of many plants farmers grow today. Wild plants have evolved to cope with a certain environment, with the goal to reproduce. Success for a farmer is not necessarily a plant reproducing, for example the success of seedless oranges as a crop. Success as an agricultural crop may be measured by fruit size, seed size, or seedless fruit.

Modern crops also have lots of help from the farmer, for example fertilizers and pesticides. Many of our modern crops would not last long in the wild.

Before we begin, let us review the eight groups (GENERA) of the potato family that we are studying. These are:

Solanum - Name four members of the *Solanum* genus: _____
_____, _____, and _____

Lycopersicon – Name a member of the *Lycopersicon* genus: _____

Capsicum - Name three members of the *Capsicum* genus: _____
_____ and _____

Petunia – Name a member of the *Petunia* genus: _____

Nicotiana – Name three members of the *Nicotiana* genus: _____,
_____, and _____.

Brugmansia – Name one member of the *Brugmansia* genus: _____

Datura –Name two members of the *Datura* genus _____ and

Physalis – Name two members of the *Physalis* genus: _____
and _____

In this lesson we will talk about the origin of three GENERA and the people who first DOMESTICATED them.

I. Origins and spread of potato, pepper, and tomato

A. *Solanum*

There are 1500 SPECIES in this GENUS. Most of the SPECIES originated in the New World. However, *Solanum melongena*, egg plant is an Old World SPECIES. Some TAXONOMISTS include the tomato in this GENUS, but we will

consider it in a separate GENUS. Members which are important as crops in the GENUS include the all important potato and the eggplant. There are many other SPECIES which are used for food or as medicines. Fruits, leaves and tubers may be used. These include the tree tomato (*Solanum betaceum*), the pepino, (*Solanum muricatum*), naranjilla (*Solanum quitoense*), and New World eggplants (*Solanum aethiopicum* and *Solanum macrocarpon*). Many members of this GENUS are important as weeds and poisonous plants.

The origin of the potato (*Solanum tuberosum*) was the Andes Mountains of Peru and Bolivia. There is evidence that potatoes were used 8,000 years ago. It was probably DOMESTICATED 6,000 years ago, making it one of the first plants to be grown as a crop in the New World. The Incas used potatoes 2,000 years before Spanish explorers arrived in western South America. The word for potato comes from the Inca word for potato, "papa." The potato was central to the Inca way of life. They built an entire empire on the tubers of this plant. See II. below for more information on Inca agriculture and the potato.

The Spanish, in their quest for gold, did not realize the importance of the tubers they saw in the Inca store houses. The Spanish used it as food for the indigenous people and had little other interest in this plant. In the quote below however it is called a treasure.

"The Spanish conquistadores first encountered the potato when they arrived in Peru in 1532 in search of gold. The Spanish colonizers weren't aware, however, that the potato, not gold or silver, was the true treasure of the Andes." <http://www.cipotato.org/Potato/History/history.htm>

In later chapters we will learn the importance of the potato as a source of food and as a possible solution to world hunger, truly a treasure.

Potatoes were probably introduced by the Spanish and other slave traders to Africa as a cheap food for slaves. In about 1570 the potato was introduced to Spain. It was taken to the other countries of Europe. At first it was considered poisonous. Within 100 years, potatoes were grown all over Europe. It was introduced to India in 1610, to China in 1700, and Japan in 1766. In the early 1700's Scotch-Irish migrants took the potato to North America. Potatoes became more and more important as people realized that this crop could provide more calories at a lower cost than grain.

B. *Lycopersicon*

Most scientists consider that the GENUS *Lycopersicon* has 8 to 10 SPECIES. Most of the SPECIES are wild. *Lycopersicon esculentum*, the tomato, is the

important DOMESTICATED SPECIES. There are five varieties of *L. esculentum* which are grown. Two of the varieties are the common tomato and the cherry tomato. The word tomato comes from 'tomati' or 'xitomatl', from languages indigenous to Mexico.

The wild ancestor of tomato was probably found in Peru. Tomatoes slowly made their way north. By the time the Spanish explored Central America in the early 16th century, Native Americans were actively growing *Lycopersicon esculentum* var. *cerasiforme*, or the cherry tomato. Plant breeders think that the cherry tomato is the direct descendent of the original wild form.

Although the ancestral home of the tomato was probably Peru, the DOMESTICATION of the tomato was the work of the Native American plant breeders of Central America. There is no evidence that the people of Peru grew tomatoes. It was a common practice to decorate pottery and textiles with plants which were important. There are no images of tomatoes on the pottery or on the textiles of the peoples of the west coast of South America. There are also no references in stories about tomatoes and no ancient word for tomato among these people. The Aztecs called the tomato 'xitomatl' while other indigenous people used the word 'tomati'. In ancient Aztec writings there are references to a dish made of tomatoes, salt and peppers. Could this have been the original salsa?

An interesting question remains. How did the tomato get from Peru to Mexico where it was DOMESTICATED? Tomatoes may have spread by birds. Birds love the sweet small fruit of wild tomatoes. The seeds may have been spread in their feces. There is another thought. Corn and beans were actively cultivated. As seeds were being traded among people, seeds of the tomato may have been included during trading as hitchhikers. People would have planted the tomato seeds along with the corn and beans, probably at first being treated as a weed.

Cortez conquered the Aztec city Tenochtitlan, now Mexico City, in 1521. Shortly after this, yellow cherry tomatoes found their way to Europe. These tomatoes are mentioned in 1544 in the HERBAL written by Matthiolum. Many years later two priests introduced the red tomatoes to Italy. In many parts of Europe the tomato was only grown as a decoration. People were afraid to eat the fruit. Colonists from England brought tomatoes, as a decorative plant, to North America. Thomas Jefferson actually did use tomatoes as a food. Eventually, using tomatoes in the kitchen took off in the rest of the United States.

Although tomatoes were first DOMESTICATED in Central America, further DOMESTICATION took place first in Europe and in the 18th and 19th century in North America. People were very interested in having new types of tomatoes. There are over 10,000 types of tomatoes!

Many CULTIVARS have interesting stories. One tomato is named the ‘Mortgage Lifter’. The owner of a radiator repair shop in West Virginia was having a very difficult time during the Depression. Many people did not have their cars repaired, so he had little work. He had a \$4,000 mortgage on his house which he was having a hard time paying. He took four tomato plants with the largest fruits and crossed them repeatedly until he got tomatoes which weighed 2 pounds each. He sold the tomatoes for \$1, claiming they would feed a family of six. In four years he was able to pay off his debt.

C. *Capsicum*

There are approximately 22 wild SPECIES and 5 domesticated SPECIES. The members of this GENUS include all the sweet and hot peppers, also called chiles (or chilis). The words used for members of *Capsicum* are confusing. Chili, chile, chilli, aji, pepper, and *Capsicum* are used interchangeably. The Spanish word ‘chile’ comes from the Nahuatl, or Aztec, word ‘chil’ which means pepper. In English, the ending ‘e’ has been changed to an ‘i’. “Aji” comes from an extinct Caribbean language, while ‘paprika’ comes from Hungarian.

For our purposes, there are three main SPECIES: *Capsicum annuum*, *Capsicum frutescens* and *Capsicum chinense*.

Capsicum annuum may be the most popular of the peppers. It is grown all over the world and is a favorite green vegetable. We commonly call it a bell pepper. There are three important varieties of this SPECIES:

- 1a. *Capsicum annuum* var. *grossum* is the bell or sweet pepper we grow commonly in the garden.
- 1b. *Capsicum annuum* var. *cerasiforme* is the cherry pepper. The fruits are yellow, small and round. They turn a purple-red.
- 1c. *Capsicum annuum* var. *longum* are long peppers which are red and fiery. This variety includes some of the “chili” peppers.
2. *Capsicum chinense* include the habanero peppers.
3. *Capsicum frutescens* include the Tabasco peppers. It is also known as the red pepper, bird pepper, chili pepper, aji, and Cayenne pepper.



© The Chile Pepper Institute, New Mexico State University. Used with permission

Members of *Capsicum* have been domesticated for 7,000 years. Peppers are among the oldest cultivated plants in the Americas. It is thought that *Capsicum* has been domesticated at least five times by prehistoric people in Central and South America. Pepper SEEDS have been found in archaeological excavations dating back to before 5000 B.C. These SEEDS were found in the Tehuacan Caves in Puebla, Mexico. Plantmasters 4-H members who have studied other plants may remember which other types of SEEDS have been found in these same caves. In contrast to most DOMESTICATED plants, the wild ancestors of peppers are still harvested and sold at markets by farmers.

It is interesting to know that there were already dozens of pepper types bred by the Aztecs by the time the Spanish arrived in Mexico. Bernardino de Sahagun lived in Mexico in 1529 and said “hot green chiles, smoked chiles, water chiles, tree chiles, beetle chiles, and sharp-pointed red chiles” all existed. In addition to using peppers as food, Native Americas used *Capsicum* as medicines. The active ingredients in the medicines are chemicals called “capsaicinoids”. These chemicals make hot peppers hot. The Maya treated asthma, coughs, and sore throats with pepper. The Aztecs used hot peppers to relieve tooth aches. Even today, some of the creams used for sore muscles use a capsaicinoid called capsaicin.

Columbus is credited with bringing peppers to Europe, first to Spain. On his first voyage to the New World he became familiar with peppers. Because of their pungency, Columbus thought they were a type of black pepper. At that time, black pepper was a luxury spice, reserved for the rich. Pepper cultivation spread across Europe to India, China and Japan. For the first time, everyone could afford “pepper”. It is important to remember that black pepper is not related AT ALL to the members of *Capsicum*. Black pepper is a member of the *Piper* GENUS. But people have used *Capsicum* to flavor food as they had used black pepper.

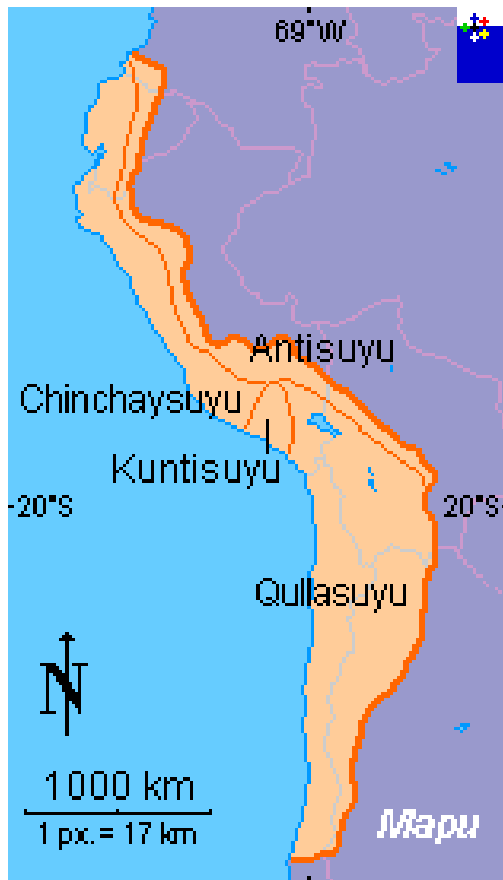
Since the time of Columbus, peppers have become part of most cuisines of the world. The Portuguese probably brought peppers to Africa and parts of Asia. It is just as hard to imagine Indian and Chinese food without peppers, as it is to think of Mexican food without peppers. Peppers are the most consumed spice in the world. Peppers have been grown commercially in the United States since the 1600s. There are hundreds of types of peppers grown all over the world.

II. Native American Agriculture

When the Europeans arrived in the Americas, they found people practicing a sophisticated agriculture. It is now thought that agriculture is as old in the New World as it was in the Old World, starting over 10,000 years ago. It is important to remember that 9 of the 30 most important agriculture crops came from the Americas. These crops were already being used by the indigenous peoples of the Americas when the Europeans came. Sixty percent of the daily diet eaten by people all over the world today comes from crops which the Native Americans domesticated. Appendix 1 and 2 list important crops and where they were domesticated. It is estimated that over 1200 species of plants were used for food and drink by the native peoples of the Americas. Native Americans had domesticated over 300 food crops. New seeds were traded actively between peoples.

There were two big differences between agriculture in Europe and in the Americas. In Europe animals were domesticated widely. Some animals were used in farming, for example to plow. Most of the Native Americans did not have domesticated animals; none used them for help with plowing. Also, most Native Americans did not have iron. Farming tools were made from wood, shells, and animal bones.

The Inca



Copyright: FOTW Inca Empire map by *Mark Sensen* and *António Martins* and boundaries' data by *António Martins*

The Inca of Peru were one of the great civilizations of the Americas. In 1532 the Spanish conquered the Inca, pillaging and plundering their gold and silver. The great wealth they took back to Spain changed the economy of Europe and left the highly developed civilization of the Inca in ruins.

The Inca governed a huge empire stretching along a long part of the west coast of South America. Many scholars would say that the entire empire was based on the potato. The potato provided the “food” an entire civilization became based upon. The Inca people measured time in how long it took to cook a pot of potatoes. A papacancha or topo was the amount of land a family needed to grow enough potatoes to feed themselves. The Inca continued developing new breeds of potatoes that their predecessors had begun. Why was the potato so important?

The Inca became powerful as they moved further and further into the mountains. Very few crops are suited to the cold harsh conditions of high mountain altitudes. The Inca made an “instant potato”. By allowing the potatoes to freeze and then dry in the sun, all the water would be removed. The Inca would then convert this dry potato into flour. This flour could be kept for a very long time.



Photo courtesy of Jules Janick, Purdue University



Photo courtesy of Jules Janick, Purdue University

The Inca themselves placed the potato as the foundation of their society. Many artifacts can be found which use the potato as a model

A single government controlled many different tribes. The empire lasted only 100 years, from 1438 to 1532. With the coming of the Spaniards in the 1530's, the empire was destroyed. Cusco was the center of the Inca Empire. In this city you would have found advanced hydraulic engineering, agricultural techniques, immense store houses of food, marvelous architecture, textiles, ceramics and ironworks.



Photo courtesy of Museo Larco

Although the Inca did not have a written language, they developed a number system. The system was based on knotted strings, called a quipu. A yupana, a type of abacus with a decimal system, was used to do the calculations. It was carved from stone or clay. Little stones or kernels of corn were used to count. After the calculations were made, the information was transferred to the quipu, strings with a system of knots.



Quipu were able to keep accurate records of troops, supplies, population, and agriculture inventories. Based on this type of information, the Inca made plans regarding what would be grown and how to divide the labor needed to maintain a complex society. Special people would be trusted with the quipu for a whole region. Even today villagers use quipu.

Photo courtesy of the Digital Research Center of the Royal Library, Copenhagen, Denmark

The drawing above, and the similar drawings which come later in the lesson, are taken from Felipe Guaman Poma de Ayala's *Primer nueva coronica y buen gobierno* (The First New Chronicle and Good Government). He was a native of Peru and wrote the book around 1615.

Inca Agriculture



Photo courtesy of Jules Janick, Purdue University

Agriculture was difficult for the Inca people. Much of their empire was mountainous with limited amounts of land that could be easily farmed. Water was also scarce. The Inca solved these problems by farming on terraces and building canals. Terrace agriculture had already been used by the pre-Inca people. The Inca improved on their ideas. Stone walls were built to make raised, level fields. These fields formed “steps” on the sides of the hills which were too steep to plough or irrigate. Soil would be carried to the terraces. These terraces created more land to farm. The top soil would not be washed away in heavy rains.

Water was also a problem. It rains from December to May in the Andes. Some years there is hardly any rain at all. The Inca constructed canals that would bring water to the terraces and to other fields. The Inca system of aqueducts rivaled any found elsewhere in the world.

Work was done without beasts of burden. The fields would be plowed using a foot plow called a *tacla*. A *tacla* was a 5 to 6 foot wooden stick with two handles. The tip was either copper or hardened by fire. The farmer would use his weight to turn the heavy soil. Similar tools with steel tips are used today. A stone-tipped club was used to break up soil clods. There were also bronze-bladed hoes and digging sticks.



Photo courtesy of CIP



Photo courtesy of the Digital Research Center of the Royal Library, Copenhagen, Denmark



Photo courtesy of the Digital Research Center of the Royal Library, Copenhagen, Denmark

It is thought that potatoes were planted in September, as they are now. All the work is and was shared. This shared work is called ayni. Today villagers begin potato planting by sprinkling the seed potatoes with chicha, beer made from corn. Everyone looks on as a seed potato and a sacred coca leaf are chosen and sown together into the soil. In this ceremony the villagers ask the mountain gods to allow them to sow their crops. Toasts are made with the chicha. The farmers begin to plant the lowest terrace. They work in groups of three. A man makes holes using a chaki takla, one person drops a potato into the hole, while the third adds sheep manure. Other fertilizers used by the Inca are guano, bird droppings, plentiful on the coast. Farmers also used the remains of slaughtered animals.



Photos courtesy of the Digital Research Center of the
Royal Library, Copenhagen, Denmark



Inca plowing

Drawing from Jules Janick, Purdue University

Farmers keep going, up one terrace at a time until all the terraces are planted. When all the work is done, a festive meal is served. This way of planting may be very similar to how the Inca planted potatoes.



The Inca had an extraordinarily sophisticated agriculture. Around the capital city, experts developed new breeds of potatoes and other plants. They used different terrace levels to mimic the different climates of the empire. From this one “experiment station” the Inca developed plants for the entire empire. These experts would teach and advise the people on breeds to use, new techniques for irrigating or draining land, and how best to terrace and plant. The Spanish conquerors were amazed at the amount of food the Inca had stored in the government granaries. Some of the harvest went to support the ruler and government, but most of the harvest was kept in a central storage place to be given to the people as needed. Food was available even if crops failed.

Photo courtesy of the Digital Research Center of the Royal Library, Copenhagen, Denmark

If you would like to know more about Incan agriculture, look at Treasure of the Andes found at this web site

http://www.hort.purdue.edu/newcrop/history/lecture14/r_14-3.html

QUESTION FOR LESSON FOUR

1. Describe the following: terraces, quipu, and taclla.
2. Look at the drawings in Attachment 2. Make a chart with this information: name of month in English and Quechua; describe what farming activity is occurring.

PROJECTS FOR LESSON FOUR

Do at least one of the Projects described below.

Project A - Make a poster showing the place of origin for at least 15 important crops. You can use Appendix 1.

Project B - Draw a picture for one of the myths in Attachment 1.

Project C – Read http://www.hort.purdue.edu/newcrop/history/lecture14/r_14-3.html on the lives of the Inca. You can either write a summary, or make a set of drawings depicting aspects of Inca life.

Project D – Make a quipu

Project E Make a tacla

ATTACHMENTS FOR LESSON FOUR

Attachment 1 - Andean Legends of the Origin of the Potato

Attachment 2 – Selected drawings from Felipe Guaman Poma de Ayala's *Primer nueva coronica y buen gobierno* (*The First New Chronicle and Good Government*).

APPENDIX FOR LESSON FOUR

Appendix 1 can be found at <http://www.killerplants.com/plants-that-changed-history/20010821.asp>

Appendix 2

GLOSSARY FOR LESSON FOUR

cultivar – A variety of a plant developed from a natural species and maintained under cultivation.

domestication – animals - to tame and breed for human use; plants – to adapt and cultivate for human use

genus/genera – A group of plants (or other living things) . A genus has one or more species which have certain characteristics in common. The italicized names are the scientific names of plants. Plants can have many common names, but they each have only one scientific name. The genus is always capitalized and the species is not capitalized unless it is named after a person.

species – A group of similar organisms which breed only among themselves.

taxonomist - A biologist who classifies organisms into groups on the basis of their structure and origin and behavior.

variety – a plant which retains most of the characteristics of the species, but differs in some way such as flower or leaf color, size of mature plant, etc. A variety is added to the specific binomial and preceded by "var.," such as *saxatilis* in the epithet *Juniperus communis* **var.** *saxatilis*.

Andean Legends of the Origin of the Potato

GIFT OF THE GODS

These are taken from the *Potato, Treasure of the Andes From Agriculture to Culture*, edited by Christine Graves.

A. One myth tells us of the birth of agriculture. Viracocha-Pachacamac, the creator and renewer of the world, the maker of matter and time, sent his two children, Imai Maman and Tocapu, to visit the realm where people lived. He ordered them to observe the plants that grew there, and to study and classify them. They would show people which plants were good and which were bad, which were nutritious, which had medicinal properties, and which were poisonous. They were to teach these people, who Viracocha-Pachacamac had created, the knowledge of sowing crops and how to use them properly so that they would never lack food.

For 8,000 years, farmers have dug deep into the furrows of the earth to extract the food and energy placed by the Creator at the service of humanity. During this time the potato has lived side by side with humans, playing a vital role in rituals such as the summer solstice festival and the sacred ceremony to honor the full moon. The ancient inhabitants of the Andes named the moon Mama Quilla, the lady and mistress who conferred fertility upon women and also made Mother Earth, Pachamama, germinate so that she could offer up her potatoes at harvest time.

B. According to an Andean legend, the people who planted the quinoa grain conquered the highland communities, planning to let them die out slowly by cutting back gradually on their food supplies. On the verge of starvation, the poor prayed to the Heavens. God sent them a handful of large, fleshy seeds which, when sown, grew into beautiful plants that embellished the highland plains with their purple flowers. The invaders showed no opposition, planning instead to confiscate the harvest. When the plants had withered and their fruits appeared to have ripened, the overlords invaded the fields and took what they assumed to be a bountiful harvest.

Desperate and starving, the oppressed prayed to the Heavens once more, and they heard a voice saying: "Dig into the earth and pull out what I have hidden there to fool the evil and raise up the good." They did as they were bid, and found, beneath the soil, the magnificent potatoes. The highlanders harvested all the tubers and hid them in secret stores. Every morning, they added a few potatoes to their hunger rations, and soon they grew strong enough to overthrow their oppressors. The overlords, seeing that they had been defeated, fled. Never again did they disturb the peace of the mountains.

(Based on a myth from Andahuaylas, Apurimac, Peru)

C. But the potato's saga must also be traced in the labyrinth of myth, the fathomless depths of the centuries from which it reaches us in the form of magical tales. One such story is about a woman who was the sole survivor of the extreme poverty that ravaged the first inhabitants of the Andes. She eked out a living in the arid desert sands until one day she fell asleep under the scorching sun. As she slept, she was impregnated. She bore a son and did her best to feed and care for him. But the child died, and his remains were scattered across the land. Maize sprouted from his teeth, manioc from his long white bones; sweet potatoes grew from his brains and potatoes sprang from his testicles. His eyes, his hands and his head, likewise, sprouted food, and the land soon teemed with crops so that people would never again die from hunger.

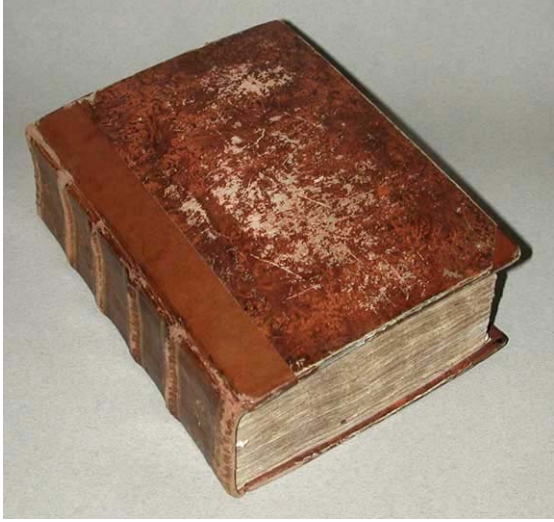
ATTACHMENT 2

The following is taken from V.W. von Hagen's 1957 *The Ancient Sun Kingdoms Of The Americas* published by The World Publishing Company, Ohio. Read it carefully, then look at the 12 drawings from Felipe Guaman Poma de Ayala's book which depict the Inca calendar.

"The state of mind of the Andean Indian, like that of the Roman peasant, was the mind of the farmer-soldier, not farmer, not soldier alone, but farmer-soldier. Although part of an agrarian militia, his life was based on agricultural routine. The caprice of weather might frustrate him and undo his work, but planting, growth, and harvest followed in appointed series.

He was a head count in the decimal system of classification, and a call for so many heads for war could take him from his fields and put him into battle, but no matter how grave the crisis, war was not his life rhythm. So deeply ingrained was this agricultural cadence that when the Inca, with his people, rebelled against their Spanish overlords in 1536 and subjected Cuzco to a terrible siege of 16 months, it failed principally because of this. For even with his very way of life threatened if he did not succeed, still the farmer instincts dominated the soldier instincts and the uprising failed; the army melted away, demobilized so that the farmer-warriors could go back and cultivate their fields."

The drawings on the pages that follow are taken from Felipe Guaman Poma de Ayala's *Primer nueva coronica y buen gobierno* (*The First New Chronicle and Good Government*). Felipe Guaman Poma de Ayala (self portrait on next page) was a native of Peru and wrote the book around 1615, less than 100 years after the arrival of the Spanish. The book is written in Spanish, has about 800 pages of text and about 400 drawings. A copy of the book (photo on next page) is in the Royal Library in Copenhagen, Denmark. It is a fascinating account of the life of the people of Peru. Follow their year by looking at the drawings. We have the drawings thanks to Photo courtesy of the Digital Research Center of the Royal Library, Copenhagen, Denmark. The Quechua, language spoken by the Inca, words are included in the description of the drawing. Quechua, pronounced qheshwa, is the language spoken by the native peoples of the Andes of South America. Thirteen million people in Bolivia, Peru, Ecuador, North Chile, Argentina and Southern Columbia speak this language today. It was the official language of the Inca Empire.



January: Maize, time of rain and digging up the earth; *Qhapaq Raymi Killa*, month of the greatest feast



February:
Time of
watching
the maize
at night;
Pawqar
Waray
Killa, the
month of
donning
loincloths



March:
Time of
chasing
parrots
from the
maize
fields;
*Pacha
Puquy
Killa*,
month of
the
maturation
of the soil



April:
Maturation
of the
maize, time
of
protecting
it from
thieves;
Inka Raymi
Killa,
month of
the Inka s
feastl



May: Time of reaping, of gathering the maize; Aymuray Killa, month of harvest



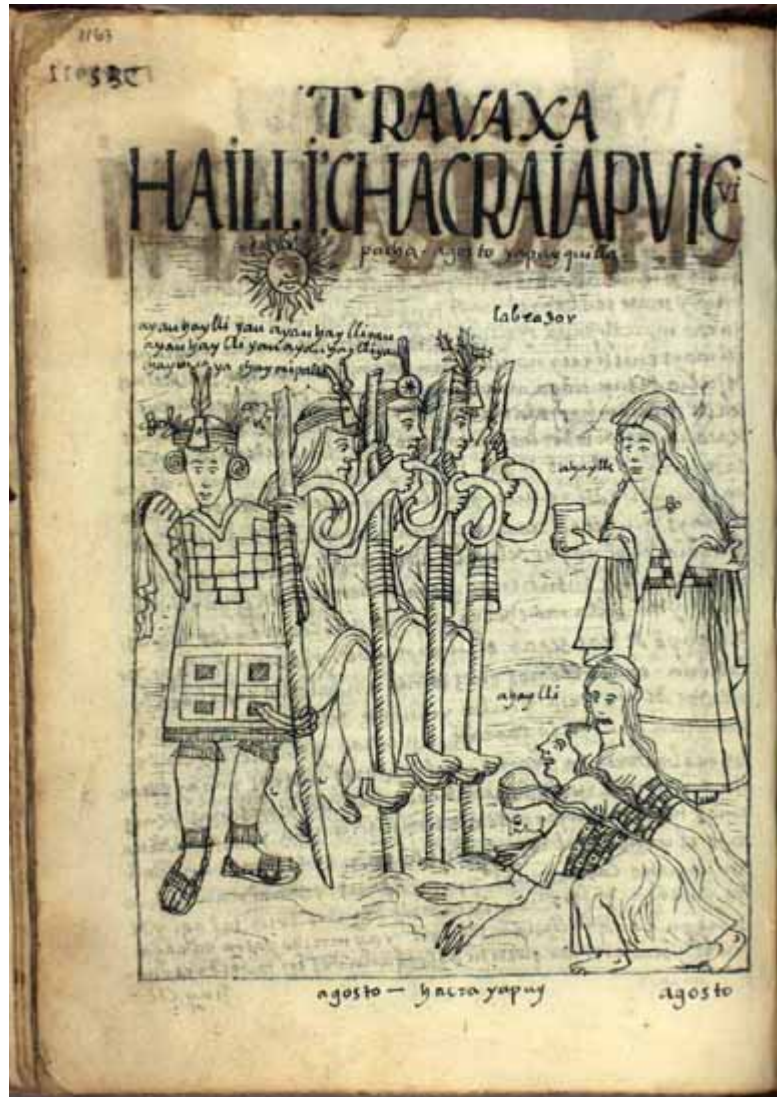
June: Time of digging up the potatoes; *Hawkay Kuski Killa*, month of rest after the harvest



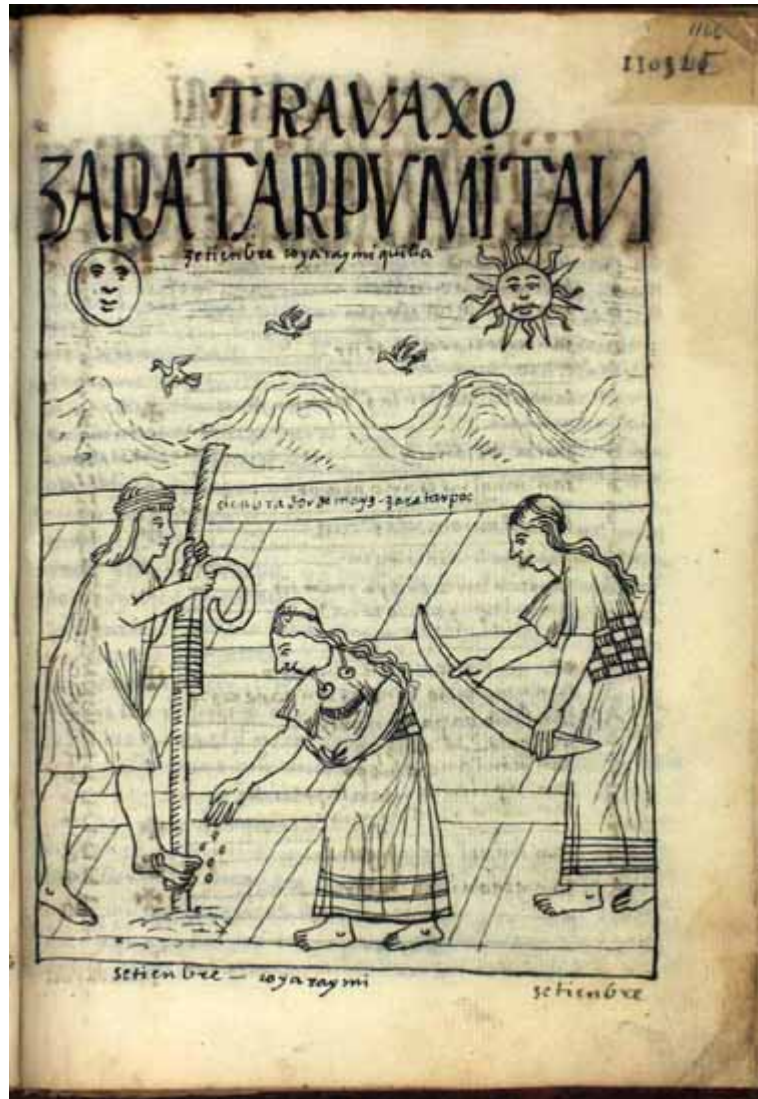
July:
Month of
taking
away the
maize and
potatoes of
the
harvest;
Chakra
Qunakuy
Killa,
month of
the
distribution
of lands



August:
Triumphal
songs, time
of turning
the soil;
Yapuy
Killa,
month of
turning the
soil



September:
Cycle of
sowing
maize;
Quya
Raymi
Killa,
month of
the feast of
the queen,
or *quya*



November:
Time of
watering
the maize,
of scarcity
of water,
time of
heat; *Aya
Marq ay
Killa*,
month of
carrying
the dead



December:
Time of
planting
potatoes
and uqa,
tubers;
Qhapaq Inti
Raymi
Killa,
month of
the festivity
of the lord
sun

