

ECONOMIC BOTANY OF *SPONDIAS PURPUREA* (ANACARDIACEAE) IN ECUADOR¹

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Macía, Manuel J. (*Real Jardín Botánico, Plaza de Murillo 2, E-28014 Madrid, Spain*), and **Anders S. Barfod** (*Department of Systematic Botany, Institute of Biological Sciences, University of Aarhus, Nordlandsvej 68, DK-8240 Risskov, Denmark*). ECONOMIC BOTANY OF *SPONDIAS PURPUREA* (ANACARDIACEAE) IN ECUADOR. *Economic Botany* 54(4):449–458, 2000. The edible fruits of *Spondias purpurea* are valued highly throughout the Ecuadorian coastal plain and Andes where they are cultivated. They are also exported to Colombia and Peru. The fruits are either eaten fresh or processed into various products such as marmalade, wine, and liquor, all with promising market potential. This paper describes the annual cultivation cycle including, propagation, harvest and processing, yields, and socioeconomic importance of the fruits. In 1995, the total volume of the harvest in Ambuquí, province of Imbabura, was 130 000 kg with an average yield of 3250 kg/ha. Gross earnings was 472 US\$/ha. The net gain was 314 US\$/ha which represents six times the official monthly minimum wage in Ecuador. *Spondias purpurea* can grow and develop normally on rocky substrates and other marginal soils of otherwise low agricultural value.

BOTÁNICA ECONÓMICA DE *SPONDIAS PURPUREA* (ANACARDIACEAE) EN ECUADOR. Los frutos comestibles de *Spondias purpurea* son muy apreciados en la región de la Costa y en los Andes de Ecuador en donde se cultivan. También se exportan a Colombia y Perú. Los frutos se consumen en fresco o se procesan en varios productos como mermelada, vino y licor, todos ellos con un mercado potencial promisorio. En este trabajo se describe el ciclo anual de cultivo, que incluye su propagación, cosecha y procesado, producción e importancia socioeconómica de los frutos. En 1995, el volumen total de la cosecha en Ambuquí, provincia de Imbabura, fue de 130 000 kg con un promedio de producción de 3250 kg por hectarea. Los beneficios totales fueron de 472 dólares/ha. La ganancia neta fue de 314 dólares/ha, lo que representa seis veces el salario mensual mínimo oficial de Ecuador. *Spondias purpurea* puede crecer y desarrollarse con normalidad en sustratos pedregosos y otras áreas marginales de escaso valor agrícola.

Key Words: *Spondias purpurea*; ovo; Anacardiaceae; edible fruit; Ecuador; economic botany.

The genus *Spondias* is native to the Neotropics and tropical southeast Asia. It comprises about 15 species. The nine Asian species have been treated by Kostermans (1991), whereas the New World species are currently being revised by J. Mitchell of the New York Botanical Garden.

In Ecuador, three species are found. *Spondias mombin* L., distributed on both sides of the Andes, is highly polymorphic (Barfod 1987). The fruits are eaten although considered of inferior quality compared to those of the other Ecuadorian species. *Spondias cytherea* Sonn. (syn. *S. dulcis* Forst.) is found in a few places in coastal

Ecuador where it has been introduced for its edible fruits, the largest in the genus.

The third species, *Spondias purpurea* L. is locally known as *ovo* (see Table 1 for other vernacular names). *Spondias purpurea* is cultivated throughout the Neotropics, from central Mexico and the West Indies in the north, to Peru and Brazil in the south (Barfod 1987; Dodson and Gentry 1978; Mahecha and Echeverri 1983). *Spondias purpurea* originated in Mexico and Central America where wild populations are still found (León 1987; House et al. 1995). It is naturalized in the Antilles from cultivation including the Bahamas (Correll and Correll 1996). Some cultivars are also grown in Florida (Popenoe 1979).

Cuevas (1992) mentioned the existence of over 20 different clonal varieties of *ovo* on the

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TABLE 1. VERNACULAR NAMES FOR *SPONDIAS PURPUREA* IN ECUADOR. (IF NOT INDICATED, THE VERNACULAR NAMES ARE SPANISH).

Vernacular name [language]	Locality (Province)	Reference from literature and voucher specimen
A hobo chi [Cha'palachi]	Eloy Alfaro (Esmeraldas)	Yañez et al. 1491 (QCNE)
Ciruela	Isla Puná (Guayas) Daule-Peripa (Los Ríos) Añangu (Orellana)	Madsen (1994) Bonifaz & Becerra 505 (GUAY) Korning & Thomsen 47494 (AAU, QCA)
Ciruela morada	Petrillo (Guayas)	Macía 15 (AAU, MA, QCA)
Ciruela morreña	Petrillo (Guayas)	Macía 15 (AAU, MA, QCA)
Ciruela roja	Yunguilla (Guayas)	Velasco (1977)
Ciruelo	Agua Blanca (Manabí) Jauneche (Los Ríos) Pichilingue (Los Ríos)	Cerón et al. 11717 (QCNE) Dodson et al. (1985) Pennington & Tenorio 10677 (QCA)
Hokos puka [Cha'palachi]	Zapallo Grande (Esmeraldas)	Barfod & Kvist (1996)
Ka hokos pú chi [Cha'palachi]	Eloy Alfaro (Esmeraldas)	Yañez et al. 1492 (QCNE)
Ovita	Progreso (Guayas)	Holm-Nielsen et al. 27777 (AAU, QCA)
Ovito	Ambuquí (Imbabura)	Macía 3 (AAU, MA, QCA, QCNE)
Ovo, hobo	Zapallo Grande (Esmeraldas) Isla Puná (Guayas) Ambuquí (Imbabura) Agua Blanca (Manabí)	Barfod et al. 48140 (AAU, QCA) Madsen (1994) Macía 3 (AAU, MA, QCA, QCNE) Cerón et al. 11717 (QCNE)
Ovo de Ibarra	not indicated	Acosta-Solís (1961)
Ovo de la Costa	not indicated	Acosta-Solís (1961)

Yucatan peninsular that only carry fruits with aborted seeds. According to Snarskis (1989) and Valverde (1991), however, some varieties are fertile and may be propagated by seed (see also, Juliano 1932). The Mexican varieties are often referred to two groups according to the time of frutins: the dry season mombins, and the wet season mombins (León and Shaw 1990).

Ovo was introduced to Ecuador in pre-colonial times (Cuevas 1992; Estrella 1986, 1994; Naranjo 1994) and clonally propagated. The present day distribution of *ovo* is restricted to the coastal plain and the dry and hot valleys of the western mountain range of the Andes (Fig. 1). During this and previous field work we never observed populations other than in orchards and planted as living fence.

Ovo is appreciated widely in Ecuador for its sweet, tasty, and nutritious fruits (Koziol and Macía 1998). These usually are consumed locally, because they perish rapidly after maturing, but also may be processed into marmalade, wine, or liquor. *Ovo* constitutes the major source

of income for the families in the areas with intensive cultivation (Macía 1997).

Little information has been published on the utilitarian value of *ovo* besides the consumption of fruits: medicinal (Cáceres et al. 1990; House et al. 1995), agroforestry (Beer 1989), soap (Machecha and Echeverri 1983), firewood, fibers, and cellulose for paper (Borja and Lasso 1990; Pérez 1956). Koziol and Macía (1998) compared nutritional value and chemical composition of *Spondias purpurea* with other drupaceous fruits. This study presents data on annual cultivation cycle, market, yields, and socioeconomic importance of *ovo* in Ecuador.

METHODS

The major part of the fieldwork was conducted in Ambuquí, close to the Chota River, in the province of Imbabura, in the western range of the Andes in Ecuador (00°26'N; 78°00'W). The altitude is 1825–1850 m and the natural vegetation is thorn shrub, dominated by *Acacia macracantha* Humb. & Bonpl. ex Willd. The yearly

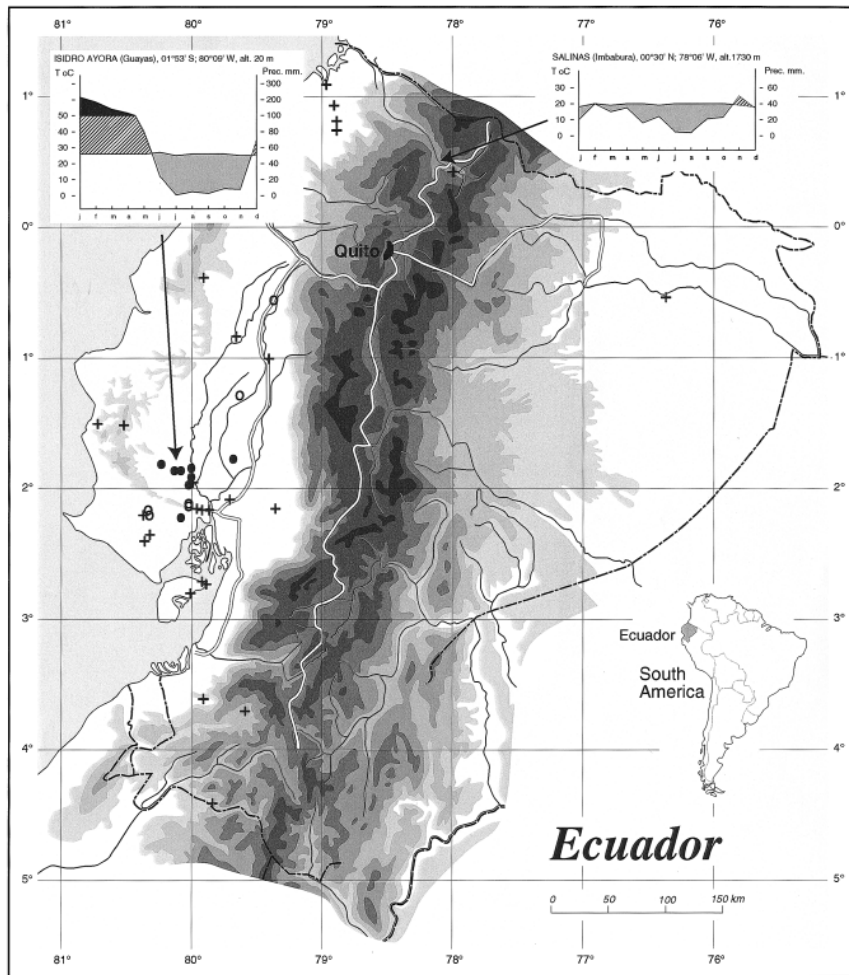


Fig. 1. Distribution map showing the sites from where *Spondias purpurea* have been recorded. Crosses (+) show the distribution of vouchered records. Open circles (○) show the unvouchered records made by the authors. Filled circles (●) show unvouchered records found in the literature. Shaded areas show the elevation gradients in the Andes.

average temperature is 19°C and the yearly precipitation is about 325 mm (Fig. 1).

Fieldwork was also carried out in Petrillo, in the Province of Guayas (01°58'S; 80°00'W) to compare with contrasting edapho-climatic conditions near the Pacific coast. The yearly average temperature is 25°C and the yearly precipitation is 885 mm. Other areas were visited briefly to get an overview of the morphological variation, the differences in phenological patterns and cultivation practices.

The fieldwork was conducted between March and November in 1995. Information on annual cycle of cultivation, propagation, harvest, pro-

cessing, and socioeconomic importance was obtained through interviews and direct observations in the field. Information on the commercialization of the fruits was obtained from markets in Ambuquí, El Juncal, Ibarra, Otavalo, and Quito.

Two plots were established in Ambuquí to obtain figures for yield and economic importance of *ovo*. The first plot covered 1550 m² situated in the Sector del Pueblo and the second one covered 2500 m² in the Sector de la Playa.

All measurements of the fruits were made on the fresh fruit immediately after harvested. A distribution map was prepared from published

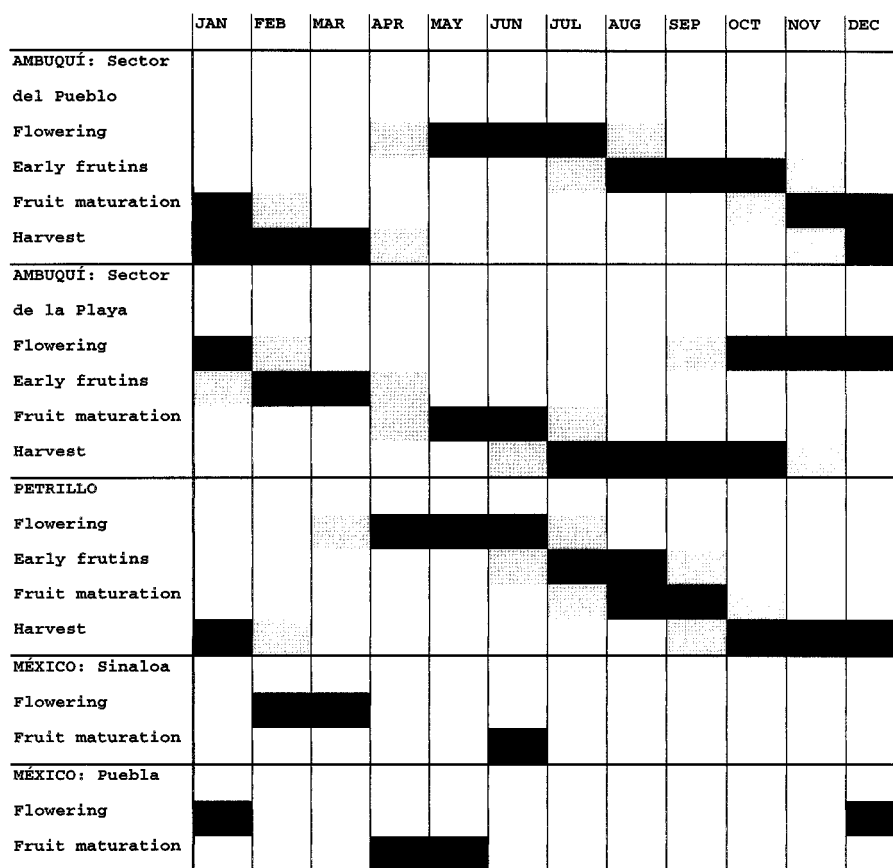


Fig. 2. Comparison of the annual cycles of cultivation of *Spondias purpurea* between two localities in Ecuador and two localities in Mexico, based on Cuevas 1992. (Main activity indicated with black, minor activity indicated with grey).

sources (Dodson and Gentry 1978; Dodson et al. 1985; Velasco 1977) and herbarium collections in AAU, GUAY, MA, QAP, QCA, and QCNE (acronyms according to Holmgren et al. 1990). The climatic data were extracted from Cañadas (1983).

RESULTS

Ovo is mostly grown in monospecific cultures in Ambuquí. Occasionally, small patches inside the orchard are used for other cultures such as papaya (*Carica papaya* L.), banana (*Musa × paradisiaca* L.), and cassava (*Manihot esculenta* Crantz.). It has probably been cultivated for more than a century in Ambuquí. According to our informants, all pruning material is been taken from a 1.5-ha orchard at Pueblo Viejo, the site where the village used to be situated.

In the 1550 m² plot, 117 trees were found

planted on a mean of three meter centers. The trees were 3–3.5 m tall and branched from the base of the trunk with 2–4 thick branches. The 2500 m² plot comprised 302 trees. The distance between individuals and the variation in size and in age was larger than in the other plot.

ANNUAL CYCLE OF CULTIVATION

The annual cultivation cycle can be divided into four periods: 1) flowering, 2) early frutins, 3) fruit maturation and 4) harvest. Figure 2 compares the onset and duration of these four periods at various sites: Ambuquí in the Andes, Petrillo on the coastal plain and two localities in Mexico (based on Cuevas 1992).

Flowering Period. Flowering occurs during the dry season. The orchards are not irrigated during this period. Occasional heavy rain storms outside the rainy season can cause considerable

TABLE 2. THE VARIATION IN DIMENSION AND WEIGHT OF FRUITS SAMPLED IN PETRILLO ON THE COASTAL PLAIN OF ECUADOR. MATURE AND GREEN FRUITS SAMPLED IN ONE POPULATION (ONE ORCHARD). (n = 100 FOR ALL MEASUREMENTS).

	Measurements	Mean	S.D.	Range
Mature fruit	length (cm)	3.66	0.25	3.1–4.5
	width (cm)	2.93	0.23	2.4–3.5
	weight (gr)	17.76	3.87	11.9–31.6
Seed of mature fruit	length (cm)	2.64	0.19	2.3–3.65
	width (cm)	1.69	0.15	1.4–2.3
	weight (gr)	3.48	0.66	2.4–6.1
Green fruit	length (cm)	3.65	0.18	3.1–4.0
	width (cm)	2.94	0.16	2.6–3.3
	weight (gr)	18.14	2.79	10.0–25.9
Seed of green fruit	length (cm)	2.49	0.11	2.1–2.7
	width (cm)	1.61	0.09	1.3–1.8
	weight (gr)	2.91	0.45	1.6–4.15

loss of flowers and twigs, which may lower the yield. Flowering usually begins after the harvest, at the time the leaves are shed. At this time of the year, the branches are cleaned for epiphytes, especially *Tillandsia recurvata* (L.) L. that repress the development of the buds, and consequently lower the yield (Fig. 3). Pruning is done to facilitate access to trees. The decision to prune depends on the productivity of the tree since there is a pronounced drop in the fruit set the following year.

Early Fruiting Period. By the definition applied here, the frutins stage is initiated after flowering and lasts until the fruits have reached their mature size. New shoots carrying the young leaves are produced during this period. Their development is important since they constitute the major part of the potentially flower

bearing ramets. The orchards are weeded during the early frutins stage. Labor intensive weeding is done 3–4 times every year in Petrillo. In the drier Ambuquí, weeding is only necessary once or twice a year. After weeding, the orchards are usually irrigated. Sometimes manuring is also done to improve the yield but with abundant supplies of water this seems an unnecessary measure. At the time when the first fruits reach maturity the populations of insect pests species increase and may damage the harvest. Their appearance coincides with periods of very little or no precipitation. Fumigation by smoke from fires lit along the margins of the orchard is used occasionally to control flies. Use of chemical insecticides is not a common practice in Ambuquí but when used they are applied at regular intervals. In Petrillo irrigation is not necessary, no fertilizers are used and insect pests do not constitute a major problem.

Fruit Maturation Period. By the end of November, the trees are carrying a few fully developed and mature fruits that can be harvested selectively. Trees are watered approximately once a week, but excessive irrigation causes soft and bruised fruits. If the trees are irrigated infrequently, the fruits develop a thinner layer of the fleshy mesocarp. According to growers, sugar content of the fruit depends on the number of hours of exposure to full sunlight.

Harvest Period. The peak of the harvest is February and March in Ambuquí. Irrigation of the orchards ceases when the harvest ends. The

TABLE 3. THE VARIATION IN DIMENSIONS AND WEIGHT OF FRUITS SAMPLED IN AMBUQUÍ IN THE WESTERN RANGE OF THE ANDES. MATURE FRUITS SAMPLED IN THREE ORCHARDS. (n = 100 FOR ALL MEASUREMENTS.)

	Measurements	Mean	S.D.	Range
Fruit	length (cm)	3.3	0.19	2.7–3.9
	width (cm)	2.4	0.18	1.9–3.0
	weight (gr)	8.9	1.9	5.5–15.1
Seed	length (cm)	2.4	0.19	2.0–3.0
	width (cm)	1.3	0.1	1.1–1.5
	weight (gr)	1.7	0.41	1.0–2.7

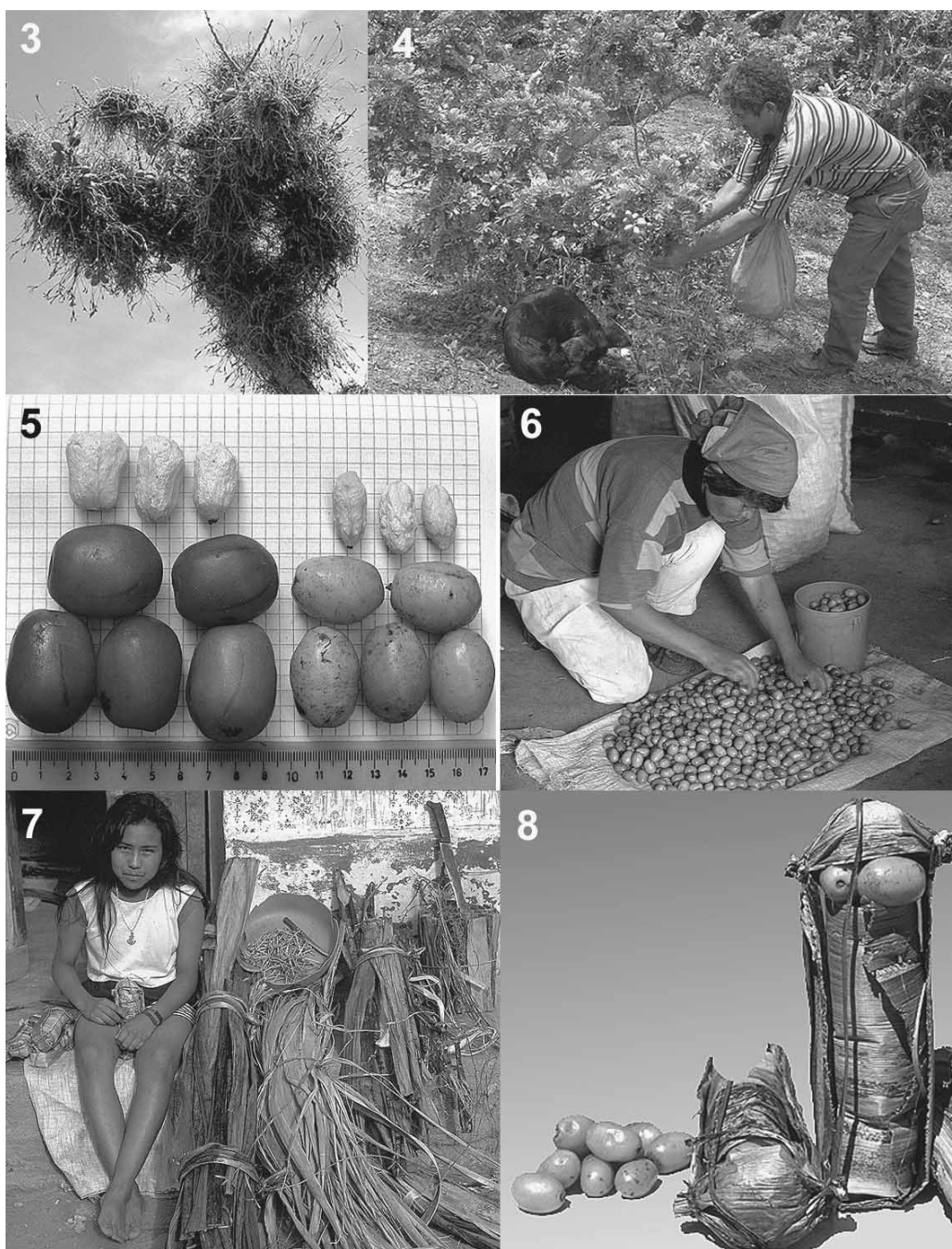


Fig. 3. A tree of *Spondias purpurea* covered by *Tillandsia recurvata*. This tree is in the need of cleaning to produce optimally again.

Fig. 4. *Ovo* fruit harvest in Ambuquí. The height of the trees is controlled by pruning.

Fig. 5. Two varieties of the fruits of *Spondias purpurea*. To the left mature fruits that have been harvested in Petrillo in the coastal Province of Guayas. To the right fruits sold in Ambuquí that have been picked while green and matured artificially.

Fig. 6. Sorting of *ovo* fruits.

trees will shed their leaves soon after and begin to flower. If irrigation is continued after the harvest, the trees will retain their leaves and flowering will be delayed. Trees that grow near rivers seldom shed their leaves and rarely flower.

PROPAGATION

Propagation by vegetative cuttings is initiated after the harvest when the leaves have been shed and flowering has just started. The size of the cuttings vary between 1.3–2.5 m long. They are left in the shade for approximately a week. When the floral buds starts opening, the cuttings are planted at a depth of 0.3–0.4 m. According to our informants, the trees develop well both on rocky substrate and marginal lands of otherwise low agricultural potential. They are planted with a distance of 3–3.5 m in between and in a oblique position, to prevent the trees from growing too tall. The soil is irrigated to stimulate rooting, which assures successful growth of most cuttings. Soon after the irrigation ceases, the cuttings flower. In Petrillo, similar propagation methods are used. The cuttings are prepared in January–February and are not irrigated after transplanting. The trees are generally taller and planted at a spacing of 5–7 m.

HARVEST

Ovos are harvested at two different stages of maturation. Either they are allowed to fully mature in which case they become reddish orange or, they are picked when still green but having attained the full size of the mature fruit (Fig. 4). In Ambuquí, the two grades of *ovo* are harvested separately according to a strictly organized schedule. Green *ovos* constituted 75% of the harvest, the mature *ovos* only 25%. A single tree is harvested repeatedly three to four times. The fruits are mostly picked from the ground in order not to damage the fragile branches. The harvest workers collect the fruits in containers that they hang around neck. In taller trees bamboo ladders are sometimes used to gain access to the upper parts of the ground but many fruits are still left untouched on the upper branches. At the peak of the harvest, one worker in Ambuquí collected

88 kg of green *ovo* in one day (22 kg/hour). Later, when the tree carried less fruits, the same harvester collected 43 kg of green *ovo* in one day (14.3 kg/hour).

The *ovos* from Petrillo are generally bigger and with larger endocarps than those from Ambuquí (Fig. 5; Tables 2 and 3). Green and mature *ovos* are harvested together. Cuevas (1992) reported from Oaxaca, Mexico that green *ovos* are harvested by knocking the trees with wooden poles.

PROCESSING

When stored in the shade at ambient temperature, green *ovos* reach maturity in 4–5 days and will only keep for additional 2–3 days before decomposing. *Ovos* that are matured this way are yellowish orange and never acquire the red tinge characteristic of fruits that have matured on the tree. Green and mature *ovos* are kept in separate places and packed individually for marketing. Processing of the fruits involves an initial sorting step where bruised and rotten fruits are discarded (Fig. 6).

Most of the production is packed in wooden boxes of a standard size measuring 45 × 22 × 32 cm. These boxes are lined with banana leaves to assure that ripening occurs in an even way. One box of green *ovos* contains about 2300 fruits and weighs 25 kg whereas one box of mature *ovos* contains 2050 mature fruits and weighs 22 kg. The time involved packing a single box is approximately 20 minutes (preparation and selection 12 minutes; filling three minutes; sealing five minutes).

In Ambuquí, some of the mature *ovos* are filled in banana leaf packages that hold 20–25 fruits. Green banana leaves are rolled to form cylinders that are held together with the spines of *Acacia macracantha* Gaud. a species growing in the area. Banana leaves are imported from El Juncal for approx. 2.0 US\$ for a pile which is sufficient for more than 400 packages (Fig. 7). An additional layer of dried leaves is then wrapped around the packages (Fig. 8). All the sheets that are needed in one day are normally cut up from the banana leaves in the morning at

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Fig. 7. Materials needed to produce a fruit packages: dried banana leaves, *Fourcraea andina* leaves (for fibers), and spines of *Acacia macracantha*.

Fig. 8. Fruit packages of *Spondias purpurea* ready to be sold.

TABLE 4. VALUE ADDED EXPENSE FOR OTHER PRODUCTS MARKETED FROM OVO FRUITS.

	Amount of fresh fruit used (kg)	Amount of processed product (kg)	Price per kg processed product (US\$)	Price per kg fresh fruit used (US\$)
Green fruits (box)	25	25	0.1–0.3	0.1–0.3
Red fruits (box)	22	22	0.2	0.2
Red fruits (plastic bag)	0.21–0.27	0.21–0.27	1.1–1.4	1.1–1.4
Red fruits in gross (banana leaf packages)	0.22–0.26	0.22–0.26	1.2–1.3	1.2–1.3
Red fruits retail (banana leaf packages)	0.22–0.26	0.22–0.26	1.5–1.8	1.5–1.8
Marmalade	22	9.5	1.8	0.78
Wine	25	5.0	2.1	0.4

a rate of 48 per hour. The package is sealed in both ends with fibers from *Agave americana* L. or *Fourcraea andina* Trel. that also grow locally. Forty-six packages of *ovos* were produced in one man-hour which corresponds to 2.37 minutes spent per package. We estimate that about 10% of the entire production is processed in this way.

In Petrillo, the processing of the fruits consist of sorting the green fruits from the mature ones and packing in wooden boxes lined with newspaper.

MARKET

The two grades of *ovo* are marketed individually and the prices vary. Most of the green *ovos* are sold by the box and exported over land by truck to Colombia and Peru. Middlemen fix the prices according to the actual demand and supply. In the beginning of the 1995 harvest, the price was 0.20–0.30 US\$/kg. The price gradually dropped with increasing supplies until the peak of the harvest where the price was 0.10–0.15 US\$/kg. A minor part of the production is sold in local markets, without middlemen. Lately, this kind of trade has gained in importance.

Mature *ovos* are sold at the markets in Ecuador and rarely for exporting. They sold for 0.20 US\$/kg, during the main harvest season. Outside the season the price was 0.25–0.30 US\$/kg. The banana leaf packages are either sold directly by the producer or they are marketed though one or several middlemen. The retail prices were approximately 0.30 US\$/package.

OTHER PRODUCTS

A cottage industry that processes *ovos* into products such as marmalade, wine, and liquor

recently has developed in Ambuquí. Several families are now collaborating to promote especially the *ovo* marmalade. This product is normally based on the fully ripened red fruits, although green fruits can be used too. From one box containing 22 kg of red fruits approximately 9.5 kg marmalade is produced which is sold for 1.8 US\$/kg.

Only one family in Ambuquí made and sold *ovo* wine at the time the study was conducted. Fruits that have been discarded for consumption because they are bruised, overripe, or partially eaten by birds are used for wine making. About 25 kg of fruit go into producing 5 liters of wine which sell for 2.1 US\$/l. The wine is normally drunk without previous aging. *Ovos* are also used in flavoring liquor simply by letting them soak with sugar-cane brandy or *trago*. The value added by producing liquor is similar to that of wine making (see Table 4). It is produced by several families in Ambuquí and distinct qualities exist depending on the choice of fruits and differences in the way they are treated.

Ovos are also used for an ice-cream flavor and for making juice. In the coastal region, the green fruits are widely appreciated as a snack eaten with salt. Sometimes dried fruits are sold.

Spondias purpurea is employed throughout Ecuador as living fences to demarcate property and to provide fodder for the cattle. When the trees are pruned the twigs and branches are often used for firewood.

YIELD

Based on maps of the area, interviews and personal observations we estimate that the orchards in Ambuquí covers an area of 40 ha. The yield of the orchards is variable because water,

which is the limiting factor in cultivation, is not equally available to all the farmers. The yield from a 4–6 year old tree that is watered on a regular basis is 6–8 kg/year. During the 1995 harvest the yield per hectare ranged between 2250 kg and 5000 kg. The average yield per hectare is 3250 kg, so a rough estimate of the total production for the entire Ambuquí valley is 130 000 kg.

SOCIOECONOMIC IMPORTANCE

The socioeconomic importance of *ovos* is limited at the national level but in areas with intensive cultivation it may constitute the main source of income for many small holders. In Ambuquí, almost half of the cultivated land is covered by *ovo* orchards. Ownership and tenancy arrangements are broadly distributed among the members of the community. Normally a family owns or farms no more than two hectares. In 1995, 50 families owned orchards. There are landowners that live on their property and lease out all their land to other villagers who farm the orchards. The price for a tenancy is variable. In one case, 125 US\$ was paid per hectare per year for a fully productive orchard. Farm workers are employed to help with labor intensive jobs such as weeding, insect fumigation, and harvesting. They typically work part-time in the orchards for eight to nine months a year. During the peak season they dedicate their time exclusively to harvesting fruits.

The production costs are generally low, partly because the entire family is integrated in the work. The cost of fumigating the orchards with insecticide was about 33 US\$/ha. The remaining costs are mainly salaries and depend on the contracts that are made with workers.

In one case in Ambuquí, the total production costs for a property were 158 US\$, including the 125 US\$ paid in tenancy. The yield was 3500 kg/ha. The *ovos* were sold in boxes (3130 kg) or in banana leaf packages (370 kg). The total earnings were 472 US\$ and the net gain 314 US\$. The latter corresponds to six times the official minimum wage per month in Ecuador. It should be noted that the above mentioned figures are based on conservative rough estimates.

DISCUSSION

Ovo cultivation represents an interesting economic alternative for small holders. Production costs are low; cultivation only requires basic

technology and the harvest is facilitated by the small size of the trees, which can be maintained without seriously affecting the yield. Little input is necessary in terms of insecticides and fertilizers. The phenology of the trees can be controlled by carefully planned irrigation schemes and the production can be extended to 8–10 months a year, which further enhance the market potential of fruits. *Ovo* trees develop normally on rocky substrate and also in soils of otherwise little agricultural value. The trees are easily propagated vegetatively by pruning.

Genetic improvement, *e.g.*, looking for fruits with greater pericarp and smaller seeds, will no doubt contribute to the development of the fruits. The variety of fruits that are adapted to local edapho-climatic conditions should ensure a good basis for future breeding programs. The *ovos* fruits from Ambuquí are smaller and sweeter than those from Petrillo which is in accordance with the observations of Acosta-Solís (1961).

The national and international markets for the fruits, and even more promising the processed products, might be promoted by a cottage/small industry (Koziol and Macía 1998). One of the major obstacles preventing an increase in the production is the large profits reaped by the middlemen. Another problem is the softness and short durability of the pericarp which makes transportation and exportation difficult. In Florida, dried slices of the fruits are commercialized (Cuevas 1992). It is a good alternative because dried fruits are easy to store and transport. In Ambuquí, the *ovo* cultivation is in decline due to an accelerated economic growth that the entire region is experiencing. Land use is changing as many farmers prefer to cultivate cash crops such as beans, tomatoes, or grapes.

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