11 ANNEXE 11 : FICHE TECHNIQUE DE PRODUCTION D'ANONES

11.1 WHAT IS ANNONA ?

Annona is a genus of tropical fruit trees belonging to the family Annonaceae[1]. There are approximately 119 species of which 7 and one hybrid are grown for domestic/commercial use. 5 species have been selected as important under-utilised species (and are therefore included in this factsheet), 3 are commercially important Annona cherimola (cherimoya), A. muricata (soursop, guanabana) and A. squamosa (sweetsop, sugar apple), and 2, A. reticulata (custard apple, bullock's heart) and A. senegalensis (wild soursop) are used locally. Most species are shrubs or small trees, with height varying from 5-7.5m, having erect or spreading crowns and a grey-brown, rough and corrugated bark. The stems are covered with a fine layer of hairs when young, later becoming smooth. With few exceptions, annonas are deciduous, even the tropical species, especially when cultivated in areas with a pronounced dry season and without irrigation. The fruits vary from species to species with differences in shape (round/oval/oblong/heart-shaped), size (between 2-3 cm up to 30 cm) and colour (mostly green though some cultivars are pink or red). The ripe fruit is called a syncarp. The primitive fruit form has spirally arranged carpels (female structures in the flower), resembling a raspberry, with each segment of flesh surrounding a single hard, black seed. Fruit size is generally proportional to the number of seeds within. The flowers are pollinated by insects, although fruit production is usually very poor. Production of many good quality fruits relies largely on hand pollination.

11.2 WHERE DOES ANNONA GROW ?

Of the 5 species covered i n this factsheet, 4 are thought to have originated in Central and South America (cherimoya, soursop, sugar apple and custard apple) and 1 in East Africa (wild soursop). The first 4 species are now widely distributed and can be found growing, cultivated or naturalised, throughout the tropics. Wild soursop is still restricted to Africa. All species grow well in tropical climates, at high or low altitude and on a range of soil types. As

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[1] International Centre for Underutilized Crops, 2002, « Fruits for the Future, Annona », Factsheet N°. 5, 2p.

they do not tolerate waterlogging, soils have to be well drained. Rainfall requirement ranges between species, from as low as 600 mm (for wild soursop) to 2000 mm (for the more tropical soursop). Soursop is the most tropical species and requires a moist, warm climate for good fruit production. Cherimoya has its origins on the highland plateaus of the Andes and is better adapted to cooler, drier, subtropical climates, producing a good fruit yield in the Mediterranean (Spain, Italy, Egypt, Israel), southern California, South Africa, Argentina and Chile. Sugar apple grows well in moist tropical climates and in drier, subtropical climates. It is the most drought tolerant of the species and does not fruit well in high rainfall situations. It is more resistant to low temperatures than soursop and more tolerant to high temperatures than cherimoya.

11.3 WHY SHOULD YOU GROW ANNONA ?

Annona is a multipurpose tree. The fruits are consumed widely and the tree is also a source of medicinal and industrial products. The fruits contain vitamin C and minerals such as calcium, phosphorous and potassium. They are also an excellent source of energy as they are high in carbohydrate. Annona trees can give an average fruit yield of 50-100kg/tree and the commercial life of a tree is about 15 years. They are generally small trees or shrubs, which makes maintenance and fruit harvesting easy. The trees are easy to cultivate, require comparatively little care and do not suffer from serious pests and diseases.

11.4 ECONOMICS OF ANNONA –

Annona trees can be categorised into two groups. In the first group are custard apple and wild soursop. Fruit quality is generally low and trees are grown by subsistence farmers under smallholder conditions, producing a low but important income to their growers. The second group includes cherimoya, soursop and sugar apple, which are grown on commercial farms as highly remunerative crops for both small and medium scale farmers. No economic information is available at present for the species in the first group. Commercial cherimoya production occurs mainly in Taiwan, Spain, Peru and Chile, with Spain, Taiwan and Chile being the world's largest producers. Estimated world production of cherimoya in 1994 was 213,500 hectares producing 81,000 tons of fruit. This has now been greatly exceeded as Chile alone produces in excess of 213,000 tons for export and 8,000 tons for the internal markets. Soursop is cultivated in several countries including Angola, Brazil, Colombia, India, Mexico, Panamá, Peru, Puerto Rico and Venezuela. Due to an increasing demand for both fresh and

processed soursop, Mexico increased its soursop production area by 88% from 1990 to 1996. This reflects a large increase in market demand. The area of sugar apple production in the Alagoas state of Brazil also showed an increase of 63% between 1995 and 1996. This growth was due to the increasing demand for sugar apple in the north-eastern Brazil market. Like soursop, the development of agroindustry and reasonable price of fresh fruits have encouraged sugar apple growers to expand their cultivated areas in the Americas.

11.5 HOW DO YOU GROW ANNONA ? –

Annona can be grown from seed and by vegetative propagation. Seeds germinate unevenly and irregularly. Germination can take a long time due to variability of seed dormancy; propagation by seed can therefore be difficult and as a result seed-produced plants are usually only used as rootstocks. Soaking of the seeds in gibberelic acid or distilled water can help break dormancy, but scarification techniques can facilitate fungal attack, which reduces germination. Seeds should be sown in seedbeds or pots at 2cm depth, 1-3cm spacing and 10cm between rows. The soil should be well-drained. Vegetative propagation is the usual way of propagating Annona as it is relatively easy and convenient, and the time to tree maturity is shortened. A number of different methods can be used, but budding and grafting are the least expensive and easiest methods to adopt. Both methods involve the removal of a bud or graft-wood from an elite mother tree and grafting it to a compatible seedling rootstock. Budding involves the removal of a small patch (bud) from the stem or a branch of the scion, which is then attached, using polythene tape, to the rootstock. When the bud begins to grow, budding has been successful. Grafting involves the joining of scion to rootstock when both are approximately 1cm in diameter and the union is again bound with tape. When there is a new flush from the scion, the graft has been successful. The trees will bear in 3-5 years. What are the uses of Annona ? - Annonas are generally consumed as fresh fruits, but are also widely used in semi-processed and processed products. Cherimoya is mostly eaten fresh because of its superior taste. It has been the most well researched of the 5 species and is exported to international markets worldwide. Soursop fruit is much larger than the other species and is ideal for processing due in part to the high recovery of pulp, and also because of its properties, especially the exotic taste and smell. Products such as juice, jam and icecream are widely commercialised in latin America and occasionally exported. The fresh fruit does not travel well. Sugar apple is seldom processed as most fruit is consumed fresh. However, when it is processed, it is used to prepare drinks, fermented liquors and ice creams. The fresh fruit

of custard apple is considered to be of poor quality and of little commercial importance. However, like all annonas, chilling improves the flavour. There have been no reports of processing of wild soursop; the fresh fruits are sold in local markets in Africa.

All species can produce seed oil. Essential oils extracted from soursop (pulp) have industrial applications and the oils are also thought to improve the flavour of processed fruit products. A large number of chemical compounds, including flavonoids, alkaloids and acetogenins, have been extracted from annona seeds and many other parts of the plant. Flavonoids and alkaloids have shown insecticidal and antibacterial properties, and have been used for treatment of medical conditions, such as skin disease, intestinal worms and inflammation of the eye. All species are used in traditional folk medicine, however pharmaceutical products have been developed for the international market. Acetogenins are thought to have anti-HIV and anti-cancer effects. A wide variety of products have been developed and are available for cancer treatment. Research is on-going in these areas and although there have been some promising results, further research is necessary. Other uses reported from annonas are the timber for wooden implements, e.g. tool handles and pegs, and for the production of a yellow/brown dye. Annonas offer the potential for agroforestry, although this potential is seldom exploited.

11.6 INVESTISSEMENT

DESIGNATION	Année																														
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
aménagement du site	1	0	0	1	0	1	0	1	1	0	1	0	1	1	0	1	0	1	0	1	1	0	1	0	1	1	0	1	0	0
aspect communicationel sur le site	1	0	1	1	0	3	0	2	3	1	3	2	3	3	3	4	2	5	3	4	5	4	5	4	6	5	5	7	4	5
Bien-être des personnels	1	0	1	1	0	3	0	2	3	1	3	2	3	3	3	4	2	5	3	4	5	4	5	4	6	5	5	7	4	5
choix du matériel végétal	1	0	0	1	0	1	0	1	1	0	1	0	1	1	0	1	0	1	0	1	1	0	1	0	1	1	0	1	0	0
choix du site	1	0	0	1	0	1	0	1	1	0	1	0	1	1	0	1	0	1	0	1	1	0	1	0	1	1	0	1	0	0
entretien du verger	1	0	0	1	1	1	0	2	1	1	2	1	2	2	1	3	1	3	2	2	4	1	3	4	2	5	1	4	4	2
formation des personnels	1	0	1	1	0	3	0	2	3	1	3	2	3	3	3	4	2	5	3	4	5	4	5	4	6	5	5	7	4	5
information sur les produits phyto et engrais	1	0	0	1	1	1	0	2	1	1	2	1	2	2	1	3	1	3	2	2	4	1	3	4	2	5	1	4	4	2
local de protection des plants	1	0	0	1	0	1	0	1	1	0	1	0	1	1	0	1	0	1	0	1	1	0	1	0	1	1	0	1	0	0
local de stockage de récolte	1	0	0	1	0	1	0	1	1	0	1	0	1	1	0	1	0	1	0	1	1	0	1	0	1	1	0	1	0	0
locaux d'entretien et traitement phyto du verger	1	0	0	1	0	1	0	1	1	0	1	0	1	1	0	1	0	1	0	1	1	0	1	0	1	1	0	1	0	0
plantation	1	0	0	1	0	1	0	1	1	0	1	0	1	1	0	1	0	1	0	1	1	0	1	0	1	1	0	1	0	0
préparation du matériel végétal	1	0	0	1	0	1	0	1	1	0	1	0	1	1	0	1	0	1	0	1	1	0	1	0	1	1	0	1	0	0
préparation du site	1	0	0	1	0	1	0	1	1	0	1	0	1	1	0	1	0	1	0	1	1	0	1	0	1	1	0	1	0	0
Récolte	1	0	0	1	0	1	0	1	1	0	1	0	1	1	0	1	0	1	0	1	1	0	1	0	1	1	0	1	0	0
Bien-être des personnels	1	1	1	1	1	2	1	2	2	2	2	1	2	2	2	2	1	2	1	2	2	2	2	1	2	2	2	2	1	1
choix du site	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Achat extérieur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1. Dép. prélim. (Euros)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
entretien du verger	1	1	1	1	1	2	1	2	2	2	2	1	2	2	2	2	1	2	1	2	2	2	2	1	2	2	2	2	1	1
local de protection des plants	1	1	1	1	1	2	1	2	2	2	2	1	2	2	2	2	1	2	1	2	2	2	2	1	2	2	2	2	1	1
local de stockage de récolte	1	1	1	1	1	2	1	2	2	2	2	1	2	2	2	2	1	2	1	2	2	2	2	1	2	2	2	2	1	1

11.7 ELEMENTS DE COMPTE D'EXPLOITATION D'INSTALLATION D'UN HECTARE DE COROSSOL

			Exigence en MO				Exigences en matériels et intrants					
Rubrique_1	**rubrique_2**	**Exigences techniques**	**Désignation**	**Qté (hj)**	**PU_Ar**	**Montant_Ar**	**Désignation**	**unité**	**Qté/nb**	**PU_Ar**	**Montant_Ar/ha**	**Montant Total_AR**
plantation	trouaison	dimension 1m x 1m x 1m	MO trouaison	300	500	150 000	angady				-	150 000
	plantation	grains bien rebouchés par des terres fines	MO plantation	2	2000	4 000	angady				-	4 000
	rejalonnage	remarquage des plants mis en terre	MO rejalonnage	1	2000	2 000	jalons	nb			-	2 000
	remplacement des manquants	garder le même nombre de plants par ha	MO remplacement des manquants	2	2000	4 000	plants de remplacement	nb	45	3 000	135 000	139 000
	écartement de plantation	6m x 5m									-	-
entretien du verger	Taille de formation	donner une forme à l'ensemble des arbres pour faciliter leur	M.O taille de formation	2	2000	4 000	sécateurs	nb	2	5 000	10 000	14 000

			Exigence en MO				Exigences en matériels et intrants					
Rubrique_1	**rubrique_2**	**Exigences techniques**	**Désignation**	**Qté (hj)**	**PU_Ar**	**Montant_Ar**	**Désignation**	**unité**	**Qté/nb**	**PU_Ar**	**Montant_Ar/ha**	**Montant Total_AR**
		entretien										
		limiter les risques d'infections					désinfectants	litres	2	20 000	40 000	40 000
	taille de fructification	favoriser et orienter la fructification	M.O taille de fructification	2	2000	4 000	sécateurs	nb	2	5 000	10 000	14 000
		limiter les risques d'infections				-	désinfectants	litre	2	20 000	40 000	40 000
entretien du verger	gestion de l'eau	éventuelle irrigation en cas de sécheresse	M.O Manipulateur Pompe	2	2000	4 000	Motopompe ayant un débit de 5m3/heure	nb	1	1 600	1 600 000	1 604 000
							tuyau d'aspiration	m	10	60 000	600 000	600 000
							tuyau de refoulement	m	10	40 000	400 000	400 000
							carburant	litre	3 600	3 000	10 800 000	10 800 000
	sarclage	empêcher les concurrences de consommation en élements fertilisants	MO Sarclage	20	2000	40 000						40 000
			M.O détourage	10	2000	20 000						20 000
			M.O Eclaircissage	2	2000	4 000						4 000

			Exigence en MO				Exigences en matériels et intrants					
Rubrique_1	**rubrique_2**	**Exigences techniques**	**Désignation**	**Qté (hj)**	**PU_Ar**	**Montant_Ar**	**Désignation**	**unité**	**Qté/nb**	**PU_Ar**	**Montant_Ar/ha**	**Montant Total_AR**
	Mise en place des légumineuses de couvertures	réduction des temps de travaux pour les sarclages	M.O plantation	10	2000	20 000	semences de légumineuses	kg	40	1 600	64 000	84 000
						-	produit de traitement de semences	kg	0,2	25000	5 000	5 000
			MO fauche annuelle	2	2000	4 000					-	4 000
	Traitement aux produits phytosanitaires	prévention et luttes contres les organismes nuisibles aux fruits	MO traitement phytosanitaire	2	2000	4 000	Pulvérisateurs à dos	nb	1	160 000	160 000	164 000
		Respect du délai avant récolte et du délai avant re-entrée dans le site					produits de traitement	litre	2	30 000	60 000	60 000
Récolte	fruits murs	fruits de grande taille	MO récolte	20	2000	40 000	sécateurs	nb	18	5 000	90 000	130 000
							bacs de collecte	nb	100	5 000	500 000	500 000

11.8 CIRCULARITÉ EN TERMES DE PRODUCTION POUR LE COROSSOL

année	Circularité	PRODUCTION (tonnes par hectare)																somme	sommex1000	% prod	SURF_ha
1		0																0	-	0%	1
2		0																0	-	0%	1
3		3																3,3	3 333	4%	1
4	**1**	4	0															3,7	3 667	4%	2
5		4	0															4	4 000	4%	2
6	**1**	4	3	0														7,7	7 667	8%	3
7		5	4	0														8,3	8 333	9%	3
8	**1**	5	4	3	0													12,3	12 333	13%	4
9	**1**	5	4	4	0	0												13,3	13 333	14%	5
10		6	5	4	3	0												17,7	17 667	19%	5
11	**1**	6	5	4	4	3	0											22,3	22 333	24%	6
12		6	5	5	4	4	0											24	24 000	25%	6
13	**1**	7	6	5	4	4	3	0										29	29 000	31%	7
14	**1**	7	6	5	5	4	4	0	0									30,7	30 667	32%	8
15		7	6	6	5	5	4	3	0									35,7	35 667	38%	8
16	**1**	7	7	6	5	5	4	4	3	0								41	41 000	43%	9
17		7	7	6	6	5	5	4	4	0								43	43 000	45%	9
18	**1**	7	7	7	6	6	5	4	4	3	0							48,3	48 333	51%	10
19		7	7	7	6	6	5	5	4	4	0							50,3	50 333	53%	10
20	**1**	7	7	7	7	6	6	5	5	4	3	0						55,7	55 667	59%	11
21	**1**	7	7	7	7	7	6	5	5	4	4	0	0					57,7	57 667	61%	12
22		7	7	7	7	7	6	6	5	5	4	3	0					62,7	62 667	66%	12

année	Circularité	PRODUCTION (tonnes par hectare)																somme	sommex1000	% prod	SURF_ha
23	**1**	7	7	7	7	7	7	6	6	5	4	4	3	0				68	68 000	72%	13
24		7	7	7	7	7	7	6	6	5	5	4	4	0				70	70 000	74%	13
25	**1**	7	7	7	7	7	7	7	6	6	5	4	4	3	0			75,3	75 333	79%	14
26	**1**	7	7	7	7	7	7	7	7	6	5	5	4	4	0	0		77,3	77 333	81%	15
27		7	7	7	7	7	7	7	7	6	6	5	5	4	3	0		82,3	82 333	87%	15
28	**1**	7	7	7	7	7	7	7	7	7	6	5	5	4	4	3	0	87,7	87 667	92%	16
29		7	7	7	7	7	7	7	7	7	6	6	5	5	4	4	0	89,7	89 667	94%	16
30		7	7	7	7	7	7	7	7	7	7	6	6	5	4	4	3	95	95 000	100%	16
			7	7	7	7	7	7	7	7	7	6	6	5	5	4	4		1 216 000		
			7	7	7	7	7	7	7	7	7	7	7	6	5	5	4		76000		