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Hunt Institute was dedicated in 1961 as the Rachel McMasters Miller Hunt Botanical Library, an international center for bibliographical research and service in the interests of botany and horticulture, as well as a center for the study of all aspects of the history of the plant sciences. By 1971 the Library's activities had so diversified that the name was changed to Hunt Institute for Botanical Documentation. Growth in collections and research projects led to the establishment of four programmatic departments: Archives, Art, Bibliography and the Library.

Variedades Extranjeras introducidas recientemente en Almunecar

De California: "Ott", "Deliciosa" y "Chaffey" ~~De Canarias~~:

De Canarias: "Picon", "Tenerife" y "Teyde"

De Madera: "Hamiltata"

De Chile: "Terciopelo", "Espinosa", "Concha", "Canaria", "Bronceada", "Negra Cordia",

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EL CULTIVO DEL CHIRIMOYO EN ESPAÑA

Historia

Introducción del Chirimoyo en España.-

No hay datos concretos que aclaren, no ya la fecha, pero ni aún la época de la llegada a España de esta especie frutal. Probablemente, y a lo largo de las centurias que siguieron al descubrimiento de América irían llegando a nuestro país y particularmente a las zonas vecinas de los puertos que mantenían estrecho contacto con América, semillas de chirimoyo, que sembradas al azar y con más o menos suerte darían legar a árboles que sobrevivirían o no según las características climáticas de la región.

De esta forma, y por vías de selección natural el chirimoyo acabaría estableciéndose en aquellas zonas de ambiente más propicio, zonas que pueden delimitarse desde Gibraltar a Valencia, a lo largo del litoral meditárráneo, y más particularmente en la llamada Costa del Sol, desde Marbella a Motril; zona que por estar suficientemente alejada de la influencia Atlántica y por beneficiarse todavía en algún grado de sus lluvias, es estimada como subtropical.

En los valles fértiles de toda esa costa se encuentran árboles de chirimoyos. Desde cuando?. Y en qué lugares los hubo primeramente?. No hay respuesta posible, y solamente conjeturas pueden suplirla. Probablemente en Málaga por su contacto marítimo con las Américas se sembrarían antes que en otro lugar los primeros huesos de chirimoyo. Árboles centenarios existen en antiguas fincas de recreo, que lo acreditarían.

De Málaga, la iniciativa privada, alentada por la esquisitez de la fruta, iría extendiendo el chirimoyo más y más a lo largo de la costa malagueña y granadina.

Pero en lo que respecta a Almuñecar la conjetura encuentra datos

más sólidos en que basarse. En efecto,durante el reinado de Isabel II,el Sr Seijas Lozano,hijo de esta ciudad,fué ministro varias veces,y usó de las prerrogativas de su cargo para situar en altos puestos de los posesiones de Ultramar a amigos suyos de Almuñecar. Se sabe de alguna de ellos,que aficionado al campo y poseido de curiosidad científica envió a su pueblo natal semillas y plantas de especies exóticas no conocidas hasta entonces. Y se cree que frutales como el guayabo,el aguacate,el pacano,el chirimoyo,etc,existentes hoy día en el valle,encontrarían en aquella ocasión,coyuntura propicia para establecerse en Almuñecar.

Esta versión, daría al chirimoyo,y restantes especies una antiguedad en el valle de Almuñecar de poco más de un siglo.

Hay que estimar,sin embargo,que a lo largo de todas esas décadas el chirimoyo no haría grandes progresos,y que no pasaría de ser lo que los ingleses llaman "a door-yard tree",es decir,una nueva curiosidad cuyo fruto se destinaba al consumo familiar y al de las amistades de la casa,y de la que existirían ejemplares en todas las posesiones de lujo a lo largo de la Costa del Sol.

Por que los primeros intentos de explotación comercial del chirimoyo no tuvieron lugar hasta tiempos muy recientes. Se tienen datos concretos sobre el primer ensayo comercial del chirimoyo,a finales del siglo pasado,y existe todavía la plantación original,con árboles casi centenarios todavía en producción. El fruto se enviaba a los mercados de Málaga y Granada y el dueño realizó un esfuerzo sostenido en pro de su difusión.

Este esfuerzo desinteresado no tuvo sin embargo seguidores,probablemente por el escaso éxito económico de lo empresa,y hasta mediada la primera mitad del siglo actual no se creó en ambos mercados (Málaga especialmente) la demanda necesaria para despertar el interés de los labradores del valle. De entonces,entre los años veinte y trein-

ta,datan los primeros huertos comerciales hoy existentes.
Pero solamente al aperecer los medios rápidos de transporte por carretera fué cuando se hizo posible el acceso a los mercados más lejanos;fase del desarrollo comercial del chirimoyo en que nos encontramos actualmente.
La expansión comercial tuvo pues lugar principalmente en los años subsiguientes a nuestra guerra civil. A partir de entonces y apoyada solidamente en la exquisitez de su aromática y perfumada pulpa, la chirimoya triunfa rapidamente en Madrid,en donde su consumo se generaliza,y salta más allá hasta mercados alejados como Valencia y Barcelona.
A la hora actual sin embargo,son muchas las capitales importantes que descohocen total o casi totalmente tan preciado fruto,y el progreso por esos mercados inexplotados es lento,debido a las dificultades existentes,a las que nos referimos más adelante,y entre las que destacamos ahora la reducción de su cultivo a zona tan restringida como es el valle de Almuñecar con su prolongación de Jete,con algunos pequeños énclaves en las estribaciones de la sierra,próximos a Almuñecar. Esta área tan reducida de cultivo,limita consiguientemente la producción a cifras muy modestas e imposibilita,aunque la producción almuñequera aumenta de año en año,la capacidad de crear nuevas zonas de producción y nuevas zonas consumidoras.
La zona productora del chirimoyo se limita por tanto a los valles de Almuñecar y Jete,y énclaves citados. Pero si en el angosto y pintoresto valle de Jete casi todas las tierras están ocupadas por chirimoyales,no sucede lo mismo en el valle de Almuñecar donde la mayor parte de la vega está ocupada por la caña de azúcar que constituye el cultivo más importante. De la totalidad de hectáreas que componen la vega almuñequera,cuya extensión puede estimarse en unas 250 ha., solamente unas 50 ha. están ocupadas con chirimoyo,a las que habría

que añadir otras 50 ha. entre los cultivos de Jete y otros, con un total de más o menos 1000 ha.

Esta cifra, tan exigua, merece ser destacad sin embargo, dada la escasa importancia comercial del chirimoyo en el mundo, y permite definir los cultivos de este frutal en Almuñecar como los más importantes de Europa y todo el énclave mediterráneo, incluyendo tambien los territorios insulares del Atlántico tales como Canarias y la Isla de Madera.

Cultivo

La vega de Almuñecar es un valle de reducidas proporciones, situado entre las altas estribaciones de la Sierra Nevada y el mar, y cuya superficie ya hemos indicado.

Está protegido por altas colinas que lo circundan y protegen y que se cierran hacia el mar formando un circo de armoniosas proporciones. El suelo es profundo, formado por materiales de acarreo del río a través de los siglos. Su textura es limosa, suelta, pero la finura de sus partículas dificulta grandemente el drenaje, y el resultado es un suelo dotado de una excesiva retensión del agua, que se filtra muy dificil y lentamente a través del mismo. La capa superficial se endurece rapidamente despues del riego, formando una costra impenetrable al aire, y que se resquebraja en anchas y hondas grietas.

Su riqueza en cal es alta, con un tenor de 600 a 250 p.p.m. El pH es de 8,5. Esta alcalinidad de los suelos limita naturalmente las posibilidades culturales de la vega.

La temporada de lluvias se extiende a lo largo de siete meses más o menos. Normalmente las primeras lluvias de Otoño suelen iniciarse en Octubre. Su régimen se prolonga durante todo el invierno, y suelen cesar a partir del mes de Abril. Las siguientes cifras darán una idea correcta de nuestro régimen de lluvias:

En este hermoso valle de Almuñecar los huertos de chirimoyo ofrecen una característica notable,ya que todos ellos están ubicados sobre las lindes del valle,próximos a las laderas de sus colinas y sierras o aún en bancales y terrazas al pie de las mismas. No existen chirimoyales en el centro de la vega.

No son muy claras las razones que explican este estado de cosas,pero parece ser explicación admitida comunmente el hecho de que el chirimoyo no fructifica en medio del valle y que necesita estar próximo a las montañas para obtener un cuaje abundante de fruto. Chirimoyales de 15 y más años,plantados en medio de la vega han sido arrancados por resultar improductivos. Sin embargo,y aunque excepcionalmente,hay ejemplos en sentido contrario,y existen algunos huertos de chirimoyo en pleno centro de la vega que rinden cosechas rentables,quizás por estar protegidos de los vientos reinantes por "winds-breaks" de banano basto,muy utilizados en el valle a tal fin. En resumen,el valle de Almuñecar cuyo único cultivo frutícola es el chirimoyo,ofrece la curiosa característica de que los márgenes de la vega están ocupados por los chirimoyales en tanto que el centro está cubierto de caña.

El valle se estrecha hacia el interior,y próximo ya a Jete,los cultivos de caña desaparecen casi totalmente para ceder el sitio al chirimoyo,que constituye el único cultivo,ocupando totalmente la angosta vega. De Jete para arriba el valle es un estrecho barranco; los cultivos se instalan en bancales costosamente creados en las escarpadas laderas y el chirimoyo cede primacía a otros frutales,como el níspero del japón,naranjo,mandarino,etc.

El huerto de chirimoyo se planta generalmente con árboles ya injertados.

No existen viveros propiamente dichos en la zona. Es método corriente hacer siembras de semillas a lo largo de los linderos de las fincas,y las plantas bordes así obtenidas son injertadas más tarde cuando alcanzan el tamaño necesario (más o menos unos 2 centímetros de diámetro).

La injertación es invariablemnte de escudete y a "yema despierta", en primavera en los meses de Mayo y Junio. El éxito es total y el porcentaje de fallos muy bajo. La injertación debe de realizarse antes de que el chirimoyo entre en plena vegetación,ya que entonces la savia es demasiado abundante y el escudete "se ahoga". Es preferible injertar patrones de buen diámetro,ya que el chirimoyo tiene la corteza muy gruesa,y en los patrones delgados cabe el peligro de rotura por el viento al ras del corte transversal del injerto, antes de que se produzca la soldadura,con la consiguiente pérdida del injerto y compromiso en la vida del patrón,puesto que forzosamente dicho corte transversal es obligadamente demasiado profundo.

La injertación de escudete a "yema dormida" es asímismo factible y con éxito idéntico,pero no se efectúa nunca.

En ambos casos el escudete se levanta como en el caso de los agrios, es decir haciendo una incisión con la navaja alrededor de la yema en una largo de tres y medio a cuatro centímetros y con un ancho

de 1 y ½ a 2 cms. La corteza se despega sin nada de madera y el escudete es insertado en el patrón en la clásica incisión de T no invertida. Se conserva un corto trozo del pedúnculo de la hoja, de un largo aproximado al cm. Para la atadura se emplea invariablemente la fibra de esparto. No hay que aclarar que este material es muy defectuoso por ser demasiado duro, nada elástico y propenso a aflojarse al secarse (si se emplea humedecido), dejando así expuesto el escudete a la acción del aire, comprometiendo el éxito de la operación; o acarreando el peligro de estrangulación del patrón si el desarrollo del mismo es rápido. La atadura se empieza por abajo. Inmediatamente el patrón es cortado a una altura aproximada de 5 cms por encima del injerto. Esta operación, aunque realizada con éxito casi siempre, no es necesaria, ni aún recomendable. La soldadura se efectúa con mayor seguridad dejando el patrón intacto y, si acaso, suprimiendo su extremidad superior para sujetar la savia y obligarla a bajar al injerto. La ablación total del patrón por encima del mismo es preferible hacerla al cabo de 15 o 20 dias cuando la soldadura está asegurada. El único motivo que justifica la costumbre citada es que cortado el patrón inmediatamente de injertado, se evita el peligro de rotura del mismo por el corte transversal de la T, por la acción del viento.

El injerto no suele efectuarse a la altura normal en estos casos (más o menos 10 cms sobre el suelo). Es corriente una altura de un metro. Tampoco es normal tutorar el brote del injerto sobre el tocón del patrón, por lo que dicho brote, en lugar de prolongar verticalmente al patrón suele formar una rama lateral. No hay que añadir que los injertos de un año así obtenidos adolecen de una presentación defectuosa, fuera aparte de que el nudo del injerto no adquiere la debida solidez.

El patrón utilizado es originado por semillas de frutos cuales quiera. No se concede la menor importancia a las caracterpisticas espe-

cíficas del mismo,tanto en lo que respecta a sus relaciones con el injerto como en lo que atañe al importantísimo campo de relaciones patrón-suelo. No existe la menor idea sobre la enorme importancia del tema. Se ignora todo le referente a los posibles factores de resistencia a las enfermedades de raiz y tronco,resistencia a la excesiva humedad de los suelos,exceso de cal,p,H alto,etc. Ese campo está totalmente inexplorado y las siembras se efectuan utilizando las semillas más a mano.

Puede sin embargo afirmarse que dado que la mayor parte de los chirimoyos injertados proceden de Jete y que en este pueblo la única variedad cultivada es la denominada "de Jete" o "Fino de Jete",los patrones han de ser casi obligadamente procedentes de semillas de esta variedad. Esta consideración sin embargo,carece de gran importancia si consideramos que dicha variedad no es probablemente "clonal",por lo que las semillas han de dar lugar forzosamente a una enorme variedad de tipos de chirimoyo. Es de estimar que en el futuro habrán de realizarse ensayos sobre patrones seleccionados, con vistas,particularmente,a la resistencia a la clorosis.

El transplante se efectúa en primavera,poco antes de que el chirimoyo bote las hojas. El mes de Abril es el más indicado. Sin embargo, transplantes efectuados más temprano,en Marzo y aún en Febrero, suelen ser exitosos. En general,el chirimoyo ofrece gran facilidad al transplante,y es corriente transplantar árboles de 6, 8 y más años, con diámetros de 10 centímetros y superiores, sin que se produzcan pérdidas. Es más, los procedimientos de arranque suelen ser asaz primitivos. Se desconoce el empleo de las palas rectas y suelen arrancarse los árboles a golpes de pico, originando tremendos destrozos en el sistema radicular, dado lo quebradizo de la madera del chirimoyo. Tampoco se toma la precaución de rebajar las partes foliáceas para compensar la supresión de raices. A pesar de ello,el transplante origina pocas pérdidas,

y de ordinario,el brote del primer año suele ser vigoroso y aún producir fruto. Sin embargo sería precaución recomendable,rebajar el tallo y ramas secundarias y suprimir las hojas en gran parte. Y, naturalmente,proceder al arranque de la planta con las herramientas y precauciones corrientemente empleados en los viveros. Recomendable asimismo embadurnar las raices con el llamado en Francia unguento de "Saint-Fiacre",compuesto de tierra arcillosa y boñiga de vaca a partes iguales,lo que favorece la emisión de raicillas y la nutrición de la planta en el primer momento, despues de la brotación.

No se practica poda de formación en los jóvenes árboles,que son abandonados por completo a sí mismos una vez plantados y cuyo aspecto al año o dos de plantación semeja al de palos de escoba. El cruce o entroncamiento no se forma a la altura fijada o convenida,si no donde el árbol buenamente lo hace,que suele ser lo mismo a 0,50 mts que a 1,50,o aún más alto. La falta de poda anual rebajando las ramas hacía la cruz en su debida proporción es causa de troncos excesivamente delgados y sin fuerza para soportar el peso de la copa. Y como por otra parte,no se efectúa la práctica del tutorado de los jóvenes árboles,el resultado son árboles completamente vencidos por los vientos dominantes,y con excesiva propensión a romperse bajo la acción de vientos fuertes.

Variedades.- Se producen excelente frutos dec chirimoyo. La calidad suele ser superior,y en opinión de quienes han gustado esta original fruta fuera de España,nuestras chirimoyas son insuperables. Es de considerar que en general todas las especies frutales producen frutos de máxima calidad cuando son cultivadas al límite más frío de su zona de cultivo. Esta circunstancia,cuyas causas no estan muy claras,se da en el caso de Almuñecar,zona considerada como subtropical,pero que realmente está al borde mismo de la zona tem-

plada,y puede ser el motivo de la exquisita calidad de sus chirimoyas.

Dea antiguo se distinguen varias clases de chirimoyas,que aquí se designan con el nombre de "castas". Otras,serían de creación más reciente y alguna de ellas pudiera ser auténtica variedad "clonal", cuyo árbol madre se conocería. No hay sin embargo una gran seguridad en ello,y la gran variación que existe entre los frutos de árboles estimados como de la misma casta (y aún entre los frutos de un mismo árbol) abonaría la opinión contraria,es decir,que se trata en realidad no de variedades clonales si no de razas o tipo de chirimoyo con ciertas características comunes, La labor de seleccionar las variedades escogidas estaría por hacer.

El tipo más antiguo de chirimoyo es el "pinchudo" del que existen varios tipos. Se caracterizan por tener tetillas muy pronunciadas. Uno de estos tipos de forma de piña,es de una extraordinaria calidad; su carne fundiente y la combinación de sus ácidos y azúcares alcanzan una rara perfección. Desgraciadamente estos chirimoyos pinchudos son de piel fina y por ende sensibles a la picadura de la Ceratitis, por lo que su cultivo no se extiende. Los nuevos insecticidas fosforados,permitiendo el control eficaz de la mosca abrirían campo al cultivo comercial de esta raza cuya excepcional calidad hace méritos para ello.

Otro tipo muy antiguamente conocido es el "Negro" o "Negrito". En opinión de muchos es el chirimoyo más sabroso. Su sabor es realmente exquisito y personalísimo; y en él predomina un tono ácido ligerisimamente agrio cuando muy maduros, lo que le confiere una armoniosa compensación de sabores. La carne es cremosa,como formando lágeros grumos,y tiende a adquirir una apariencia gelatinosa y transparente muy peculiar. Este chirimoyo va perdiendo sin embargo valor comercial por los defectos que se exponen en su descripción; y los árboles existentes son reinjertados sistematicamente,con ex-

cepción de algunas plantaciones aisladas, cuyos propietarios, enamorados de la alta calidad del fruto las mantienen.

Las "castas" comerciales no son más que dos: JETE (ó FINO DE JETE) y Campas. Esta última sería un auténtico "clone". Su origen sería reciente (no más de 30 años) y existiría el árbol madre, su tendencia a producir frutos grandes y bien formados le confiere una preferencia acusada. Con todo, es Jete la variedad más comercial, pese a que su calidad es algo inferior, su carne menos fundiente y sus semillas propensas al defecto del "encamisado". El gusto de "Jete" es más sencillo, y tiende ser simplemente dulce.

Todas estas "castas" y algunas otras que se distinguen, tales como BLANCO, CRISTALINO, etc son indudablemente de origen local. No hay duda de que ninguna de ellas haya podido venir de fuera como planta injertada. Su creación, por lo tanto, debe estimarse como originada por cruces naturales entre los primeros árboles borde del valle.

Las primeras variedades extranjeras son de introducción recientísima y no han producido fruto todavía. Al final, y a simple título de curiosidad, hacemos relación de las mismas, citando su procedencia.

Sería de gran interés la introducción de variedades tardías, que prolongasen la cosecha hasta primavera, realzando así la importancia comercial del fruto al prolongar su presenciar en el mercado.

El chirimoyo es practicamente un "ever-green", o árbol de hoja persistente aunque durante muy cortos días al año; al iniciarse la aparición de nuevos brotes en primavera, el árbol queda desguarnecido de hoja. Una vez en marcha la nueva brotación se produce la floración que aparece indistintamente en brotes nuevos y en ramas viejas, y que se prolonga durante todo el verano. Es la primera flor la que produce mejores frutos, ya que tiene por delante todo el verano, para crecer y desarrollar el fruto. Por otra parte, estos frutos son, na-

turalmente,los más tempranos,circunstancia que les confiere mayor valor.

La fecundación de la flor se produce espontaneámente y no ofrece dificultades. Hay evidentemente fluctuaciones anuales en el cuaje de la flor,que suele ser más o menos abundante según los años. Pero el problema que se plantea a este respecto en otras regiones productoras no existe en Almuñecar, y la práctica de la polinización artificial es totalmente desconocida, y comercialmente innecesaria. Esta afortunada circunstancia que califica acusadamente el cultivo del chirimoyo en Almuñecar no parece ser inherente a nuestras variedades, y debe de ser atribuída,de acuerdo con los comentarios de autores que han tratado este tema (Popenoe,Hodgson), a una feliz coincidencia de factores climáticos diversos durante el transcurso de la floración, particularmente relacionados con el grado de humedad del aire y la temperatura. Lo confirma el hecho de que el cuaje de la primera flor es problemático y casi ningún año satisfactorio, en tanto que la flor subsiguiente es polinizada en un gran pordentaje. A añadir que no se trata de nada relacionado con insectos, que,a todas luces, no intervienen en la fecundación de la flor del chirimoyo. A continuación damos algunos datos concretos sobre el estado higrométrico del aire y temperaturas máximas y mínimas en primavera y en verano:

Existe una enorme diferencia en el tamaño y forma de los frutos. Hemos citado más arriba y de pasada esta observación a la que volvemos ahora y que probablemente en ninguna otra especie frutal es tan acusada.

Varios factores motivan esta desigualdad. En primer lugar la defectuosa fecundación de la flor, que al quedar parcialmente fecundad forma frutos deformes, circunstancia que aunque no afecta a la calidad del fruto si rebaja grandemente su valor comercial. En segundo lugar la fecha de fecundación de la flor; los frutos tardíos son más pequeños, al ser alcanzados por los fríos de otoño que detienen la vegetación. En tercer lugar la situación del fruto en el árbol; los frutos que se desarrollan en las ramas bajas ("fardales") y en la parte interior de la copa del árbol, privados de sol y menos aireados se desarrollan más lentamente y en gran proporción son alcanzados por los fríos sin haber logrado su madurez, siendo en consecuencia frutos con menor proporción de carne con "escamas" sin estirar y de coloración verde más oscura. El fruto de calidad se produce en las partes soleadas del árbol, al exterior del mismo. Aquellos situados en las ramas altas, en donde el cuaje de la flor es muy escaso, bien situados en ramas vigorosas por las que circula una abundante corriente de savia y recibiendo prodigamente la caricia del sol, se denominan aquí "florones" y suelen ser frutos excelentes por su forma perfecta y su gran calidad. En cuarto lugar influye asimismo en el tamaño y forma de los frutos, la edad del árbol; los árboles jóvenes suelen producir una fructificación temprana, de frutos algunas veces de tamaño excepcional (de dos kilos y aún mayores), por lo general de forma perfecta. Los árboles viejos, en cambio, producen frutos pequeños en una gran proporción, quizá debido a su gran producción. Algunas variedades ofrecen peculiaridades a este respecto. Por ejemplo Campas tiene la cualidad ya citada de producir frutos deformes

en mucha menor proporción que las restantes "castas". En cambio NEGRITO tiene la propensión a producir mucho fruto tardío, pequeño y deforme, sin ningún valor comercial. A resaltar la acción benéfica de las primeras lluvias otoñales en el desarrollo y aspecto externo del fruto, y presumiblemente, aunque no tan patentemente, en su calidad. Los árboles que durante todo el verano y gran parte de la primavera no han recibido una gota de agua en sus hojas, reciben con agrado estas primeras lluvias, cuyo efecto es beneficioso en grado sumo. Ningún riego de pie, ni abonado, ejerce sobre el árbol una tan favorable reacción. El árbol cobra vida, y el fruto se desarrolla y "blanquea" según el término usual en el valle, es decir su color verde se aclara. No hay que añadir que en los años en que las lluvias otoñales se retrasan la calidad del fruto se resiente.

La maduración del fruto se realiza a partir de una fecha que varía según los años. En veranos cálidos puede empezar a partir de mediados de Septiembre. Pero nunca se dilata más allá de la primera quincena de Octubre, época en la cual la cosecha suele estar francamente iniciada. Existen pocas variaciones entre las diversas variedades a este respecto. JETE suele adelantarse algunos días, seguido de CAMPAS. NEGRITO y PINCHUDO serían los más tardíos. Pero en términos generales puede delimitarse la época de la cosecha entre los meses de Octubre y Noviembre, y aún Diciembre. Los años de veranos frescos y otoños fríos, la maduración se alarga hasta los meses de Enero y Febrero. El fruto que alcanza el invierno sin haberse hecho, madura muy lentamente. Por otra parte, su calidad no es nunca comparable al fruto primero, de otoño, que ha tenido calor abundante para elaborar sus azúcares, sus esencias y sus aromas.

Existe, sin embargo, alguna variación en la época de la cosecha entre los chirimoyales de Almuñecar y aquellos del interior, en Jete y más arriba, variación que tiene su justificación en las diferencias de temperaturax que caracterizan a dichas zonas. El valle de Jete es

angosto,y el número de horas de sol es menor que en Almuñecar;por otra parte, la mayor altitud y la más próxima vecindad a las altas sierras provocan una disminución en las temperaturas diurnas y nocturnas. Todo ello hace que el fruto madure con más lentitud por lo que Jete suele enviar al mercado fruto tardío de invierno,y aún de primavera,aunque en pequeñas cantidades,que solamente alcazan las plazas vecinas y particularmente el mercado de Málaga. En conjunto,~~el~~ sin embargo,puede afirmarse que la campaña,comercialmente hablando, no se prolonga más allá de Navidad.

Hay que añadir que en general el fruto es cogido casi siempre en malas condiciones. En iniciación de la cosecha,por aprovechar los precios siempre más elevados,el chirimoyo es cogido antes de alcanzar su punto exacto de maduración. Y a terminación de la misma para liquidar rapidamente la cosecha y proceder cuanto antes a la limpieza y poda de los árboles,y preparación del suelo para los cultivos intercalados,que usualmente se realizan aún en plantaciones adultas.

No existe control ninguna a este respecto,ni le compete realizarlo a ninguna autoridad local. Ello es motivo del envío al mercado de mucho fruto inmaduro,con el consiguiente descrédito para la chirimoya, tanto por parte de auqllos que lo prueban por primera vez como para los asiduos consumidores,que a veces lamentan que las chirimoyas que compran en el mercado no son más que "verdes sacos de negras pepitas".

El plazo de tiempo que media entre la cogida del fruto y el momento en que el fruto alcanza el punto exacto para su consumo,es,desgraciadamente,demasiado leve. Este factor constituye una limitación que impide el alcance de mercados lejanos. No existen variaciones a este respecto en que las diferentes "castas", aunque quizás haya en NEGRITO un ligero aumento de ese plazo, que por lo general no excede de 6 a 7 días como máximo.

No hay que añadir, puesto que ello es circunstancia inherente al chirimoyo en todo el mundo, que dicha maduración debe de efectuarse

en condiciones especiales de temperatura y abrigo. Esta circunstancia suele ser común a todas las especies frutales superiores, y cuyos frutos son de alta calidad. La calidad del chirimoyo solamente alcanza su más alta perfección cuando dichas condiciones reunen un grado óptimo.

Cultural Attention

Los cuidados del chirimoyal no son complicados. Se reducen a la poda anual, labores del suelo, abonado y riegos.

La poda es una simple operación de limpieza, en la que se suprimen las ramas secas, y se rebaja la copa del árbol y se cortan las ramas bajas que tocan el suelo y dificultan el paso de la yunta, que de ordinario tira del arado. Al mismo tiempo se suprimen las ramas verticales que nacen en las partes altas (se dice "abrir el árbol"), clareando su interior a fin de provocar una mayor aeración e iluminación del árbol. Esta labor de poda se realiza con hacha pequeña, al igual que la poda del olivo, Se desconoce el uso de las tijeras y de la sierra de podar. A resaltar que las hachas se mantienen muy afiladas con la lima y que son manejadas con una rara habilidad. Los cortes sin embargo, son groseros y provocan demasiado a menudo pudriciones en la madera que pueden acarrear graves daños para el árbol. El empleo del hacha como instrumento de poda debe de ser antiquísimo, y es presumible que date del tiempo de la colonización fenicia cuando el olivo se introdujo en la peninsula.

Es desconocido el empleo de "tree-seals", o "tree-heals", cicatrizantes usados comunmente en el extranjero para cubrir los cortes de poda. En general, en la poda, como en los restantes cuidados de cultivo, no se hace ningún alarde de detalle o buen gusto.

Subsiguientemente a la poda es una labor profunda del suelo dada con arado de vertedera. En esta labor se incorpora el estiércol y los abonos químicos. (1) El chirimoyo es muy sensible a la incorporación de materia orgánica en grandes cantidades. La falta de ganadería

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en el valle impide el empleo de estiércol en cantidades suficientes. En épocas todavía recientes los chirimoyales eran abonados a veces con pescado fresco (excedentes de pesca,no absorbidos por el mercado); no hay que decir que este abonado producía resultado extraordinarios. Desde hace años,sin embargo,la industria de fabricación de harinas de pescado absorbe esos excedentes y tal práctica es ya económicamente imposible. Actualmente, no hay forma satisfactoria de aportar materia orgánica al suelo salvo el empleo de "composts",cuya fabricación se inicia en España.

Ya hemos dicho que los suelos del valle son profundos,de aluvión, formados por los acarreos torrenciales de todos los barrancos que convergen en el valle y por tanto de una complejidad suficiente para asegurar una tenencia elevada en todos los elementos necesarios a la nutrición de las plantas. No se observan,en consecuencia,deficiencias acusadas en ninguno de los elementos fertilizantes; y la única aportación cuyos efectos son sensibles es la de nitrógeno, tanto en los cultivos de caña y maíz,como en el resto.

No existe una fórmula científica de abonado del chirimoyal,basado en las necesidades peculiares del árbol y en las características especiales del suelo. Empiricamente,y a través de la experiencia en la caña de azúcar, se sabe que el sulfato de amoníaco produce efectos seguros en las plantas. Es indudable que este abono químico disminuyendo eficazmente la cantidad de cal en el suelo y rebajando su elevada alcalinidad, favorece notablemente las condiciones del suelo,fuera aparte de su aporte de nitrógeno,del que la caña es,como es sabido,un elevado consumidor. Al uso de este abono se añade el de la potasa en forma de cloruro y el del superfosfato de cal,en cantidades muy variables y a juicio del labrador.

Durante la vegetación los cuidados se limitan a escardas a mano para destruir las malas yerbas,romper la costra que se forma despues de los riegos y mantener la humedad. En Agosto y una vez desa-

rrollado el fruto se efectuan uno o dos abonados nitrogenados, casi siempre en forma de nitrato de Chile con el fin de favorecer la vegetación y aumentar el tamaño del fruto. Este abonado suele hacerse inmediatamente despues de un riego.

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(1) Esta labor profunda destruye totalmente la tupida red de raicillas que se desarrolla en las zonas superiores del suelo y que se denomina "barbillas". Esta operación en apariencia tiene que ser perjudicial para el árbol, que se ve así privado de su sistema radicular superficial que se desarrolla precisamente en la zona del suelo más rica en nutrientes y más aireada. Sin embargo y fuera aparte la consideración de que toda costumbre inveterada suele tener sus motivos que la justifican, hay que considerar que nuestros suelos dadas la finura de su textura y su exagerada compacidad forman una estructura impenetrable al aire en la que las raicillas superficiales se afixian y mueren. La labor profunda anual, destruyendo ese sistema radicular periodicamente y removiendo la capa arable del suelo, favorece una nueva emisión de raicillas que invaden nuevamente ese horizonte asegurando la nutrición del árbol.

Estos -los riegos- se repiten periodicamente, pero no con arreglo a las necesidades del chirimoyal, sino de acuerdo con el turno del agua de riego propiedad de la comunidad de regantes y que fertiliza el valle. Este turno varía grandemente según los años. En los mejores años de lluvia invernal los riegos pueden espaciarse de doce a quince días, pero en los años de inviernos secos este plazo se dilata hasta 40 y más días. Todo comentario al respecto es innecesario.

La longevidad del chirimoyal depende naturalmente de factores diversos, y especialmente de las condiciones de fertilidad del suelo

cuidados de cultivo, abonado, etc; con todo, y aún bajo las mejores condiciones llega el momento en que el árbol envjece y tiende a limitar su producción a una gran cantidad de frutos pequeños de escasos valor comercial.

La práctica del rejuvenecimiento que aquí se denomina "cruzar el árbol", consiste en cortar las ramas grandes cerca de la cruz con el fin de obtener nuevos brotes que formen la nueva armazón del árbol. Esta operación se hace en una sola vez o en dos veces; en este último caso, suprimiendo primeramente la mitad de las grandes ramas y esperando la formación de las nuevas ramas para proceder de la misma forma con la otra mitad. En el caso de variedades no comerciales se aprovecha esta operación para reinjertar el árbol, lo que se hace escudeteando los jóvenes brotes. Esta práctica del "top-working" es corriente para reinjertar con las variedades comerciales JETE y CAMPAS los numerosos árboles bordes o injertados en variedades no comerciales. La operación se efectúa sin desmochar el árbol, dejando desarrollarse los "chupones" mejor situados entre los que anualmente crecen en el interior de la copa del árbol, e injertándolos a escudete. Una vez desarrollado el injerto se procede a desmochar las ramas grandes del árbol lo que generalmente se hace en 2 ó 3 años para evitar al árbol un grave quebranto vegetativo.

Enfermedades y plagas.- Afortunadamente no existen dificultades graves en este orden. El árbol se conduce bien y no se presentan enfermedades que originen problemas, en tanto que las condiciones del suelo se mantengan favorables. En este sentido la única limitación estaría en una excesiva humedad del terreno, que en ciertas zonas del valle llega a impedir el cultivo del chirimoyo, cuyas raices se pudren.
La enfermedad más extendida, sin embargo, es la clorosis de las hojas. Normalmente esta clorosis hace su aprición en primavera y suele desaparecer en algunas ocasiones durante el transcurso de la vegetación,

y más corrientemente al año siguiente; raramente este estado de deficiencia -mejor que enfermedad- persiste lo suficiente para producir la muerte del árbol. No están claras las causas de esta clorosis que nunca se presenta afectando a la totalidad de los árboles de una plantación, si no a árboles aislados dentro de la misma. Pero dado el exceso de alcalinidad del suelo, su elevado pH y su exceso de cal cabe admitir la posibilidad de una clásica clorosis por imposibilidad de utilizar el hierro existente en el suelo, cuya asimilación sería impedida por la cal. No se han hecho experiencias sistemáticas en este orden. El uso del sulfato de hierro, tanto en aplaicaciones en el suelo como en inyecciones en el tronco no produce resultados seguros. El uso de chelates férricos, en ensayo en otros países, es desconocido, y no hay experiencia sobre la materia. La única práctica a disposición del cultivador para evitar y curar la clorosis residiría en un afortunado manejo del riego, y tambien en aplicaciones abundantes de estiercol.

Existe tambien una pudrición de la corteza, sin duda de origen bacteriano y probablemente producida por exceso de humedad de los suelos. E suficiente rascar las partes afectadas hasta alcanzar los tejidos sanos para obtener una cicatrización normal.

No existen tampoco plagas de insectos que afecten seriamente al chirimoyo, ni en hojas ni en frutos, pese a que los áfidos originan en otros frutales dificultades graves en las hojas. El único insecto que ha hecho su aparición aisladamente y que probablemente ha pasado del naranjo es el denominado domunmente "algodón" o "cotonet", que segrega una sustancia serosa en forma de filamentos, semejante al algodón, y que recubre totalmente al insecto. Esta plaga afecta a los frutos, principalmente en los puntos de contacto de los frutos entre sí y da lugar a la proliferación de orugas en el interior de la sustancia serosa. Al mismo tiempo es causa del desarrollo de la "tizne" o "negrilla", enfermedad criptogámica que recubre hojas y

frutos de una capa negruzca. En los casos más graves -muy esacasos- los frutos son recubiertos totalmente por el"algodón" y son invendibles, aunque el desarrollo de esta plaga no penetra dentro de la epidermis del fruto. Ningún tratamiento se efectúa para controlar esta plaga, cuyas molestias no son por ahora de consideración y que sin duda es causada por el mismo insecto que en el naranjo, el "Pseudococus citri", controlado en este caso eficazmente por medio de la lucha biológica.

La mosca del Mediterráneo causa graves daños en el chirimoyo, pero solamente en aquellas variedades de piel fina. JETE y CAMPAS, las dos variedades comerciales son de piel gruesa y muy raramente son afectadas por la mosca. Solamente el chirimoyo pinchudo se resiente te esta plaga, lo que ha dado origen al tratamiento obligatorio de los chirimoyales con malathión.

Las ratas suelen causar daños, a veces importantes en el chirimoyal, royendo los frutos en el árbol, cuando próximos a la maduración. El uso de raticidas llega ser necesario.

Merece asimismo mención, si bien no causado por ninguna enfermedad, el rajado de los frutos. El fruto se raja espontaneamente, a veces muy profundamente, y queda inutilizado para la venta, si bien no para el consumo cuando el rajado no es demasiado profundo. Este rajado suele producirse aveces al simple contanto de la mano en el momento de cosechar el fruto, pero normalmente se produce sin mediar causa aparente, cuando el fruto alcanza tamaño grande (no afecta al fruto mediano o pequeño) y repentinamente, produciendo o chasquido característico. No se sabe exactamente las causas que originas este rajado, que por el hecho de afectar a los frutos grandes causa pérdidas aveces importantes. Probablemente dichas causas están relacionadas con un exceso de nitrógeno en el suelo en coincidencia con circunstancias especiales (efecto de humedad en el aire). Asimismo, parece ser hecho de observación que el rajado se produce subsiguien-

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temente a las primeras lluvias de otoño, y que no se generaliza en aquellos años de otoños secos. Este desconocimiento impide naturalmente la adopción de medidas de control.

Mercado.- El chirimoyo, fuera de algunas pequeñas partidas que se envían al mercado de París esporadicamente, se consume enteramente en los mercados de la Península y del norte de Africa. La relativa rapidez con que el fruto madura una vez que se ha cogido del árbol dificulta los intentos de entrar en mercados alejados, Málaga sigue siendo una de las plazas consumidoras más importantes, tanto por sí misma como por distribuir fruto hacía las plazas del norte de África. La chirimoya es allí una fruta muy apreciada desde hace muchos años. Madrid concede asímismo su estimación a la chirimoya, y su consumo aumenta de año en año, Pero de Madrid para el norte el exquisito fruto es apenas conocido, y todos aquellos importantes mercados están por conquistar. Solamente Barcelona y Valencia han iniciado recientemente un tímido consumo.

La venta del fruto se realiza en su mayor parte en subastas locales, que se denominan "corridas". En menor escala los productores hacen envíos directos a los comerciantes mayoristas de las plazas consumidoras.
El embalaje utilizado es la "banasta", envase de madera con una capacidad de unos treinta kilos. Algunos exportadores locales emplean cajas de madera, o jaulas, más pequeñas con cabida de 10 a 14 kilos.
No se efectúa una selección del fruto por tamaño, y por la general las banastas van a las corridas llenas de fruto de todas clases y tamaños.

Es dificil que la chirimoya vea aumentar sus posibilidades en el futuro como fruto comercial. Los obstáculos que se oponen a ello son grandes. Y en primer lugar el hecho de que su cultivo no puede

extenderse con éxito fuera del valle de Almuñecar y zonas limítrofes. A las dificultades que encuentra la normal fecundación de la flor, que requiere, como ya hemos visto, circunstancias climáticas especiales que se darían unicamente en la zona de Almuñecar, hay que añadir la sensibilidad al frío de esta especie frutal, sensibilidad muy superior a la de los agrios en general.

La producción global del fruto se encuentra, de esta forma, restringida a las posibilidades de Almuñecar y zonas limítrofes, lo que, supone una limitación tajante de sus posibilidades comerciales,

Hay que aceptar por lo tanto que la chirimoya sea siempre una fruta de excepción, imposibilitada para equipararse a frutos como la naranja y otros, y cuyo rango comercial no podrá nunca, pese a sus brillantes cualidades sobrepasar la modestia de sus actuales límites.

Variedad Pinchudo o De Piña

Origen. Local. Esta chirimoya mas antiguamente conocida. No es clonal. Existenten muchas variaciones

Forma y Tamaño. Alargada, en forma de piña, muy armoniosa. Los frutos mal fecundados, son muy deformes y a veces de formas raras. El tamaño no suele ser grande, son raros los frutos de 1 Kg. La proporción de frutos pequeños y deformes no es exagerada.

Epidermis. Verde claro. Con tetillas muy pronunciadas formando pinchos o protuberancias muy abultadas. Piel muy delgada, por lo que el fruto es muy sensible a la ceratitis.

Carne. Muy blanca. Fundente. Ligerísimamente harinosa. Con escasa proporción de pipas, que van sueltas en los alveolos cuando el fruto llega a la madurez (el fruto "suena").

Calidad. Exquisita. Perfecta compensación

de ácidos y dulce. Sabor personalísimo y muy apreciado.
Maduración. Octubre Noviembre.
Fertilidad. Grande. Buen productor
Observaciones. Pese a su extraordinaria calidad, el hecho de ser sensible a la mosca impide que esta variedad tome rango comercial. La tendencia actual, pese a los medios de control eficaces de que se dispone actualmente es a desaparecer.

Variedad. Campas o Las Campas.
Origen. Local. Parece ser una autentica variedad local. Existia el arbol madre.
Forma y Tamaño. Fruto grande, o muy grande. Hasta 2 Kg. y 2½ Kg. Muy escasa proporcion de frutos deformes y pequeños.
Epidermis. Verde oscuro. Escamas grandes, con fetidas profraunciadas muy caracteristicas. Las escamas se estiran enormemente al madurar quedando el epidermis muy liso al tacto. Grueso y resistente a la mosca
Carne. Blanca, muy ligeramente tostada. Consistente. Jugosa. Elevada proporcion de carne. Cantidad reducida de pipas, no "encamisadas"
Calidad. Buena o muy buena.
Maduracion. Octubre Noviembre
~~Conservacion~~. Fertilidad. Grande. Muy productiva con elevada proporcion de frutos de tamaño satisfactorio.

Observaciones. Variedad muy comercial, por sus hermosas frutas, de aspecto atrayente. Es variedad que va ganando terreno, a la par de Jete y en segundo lugar.

Variedad - NEGRITO

Origen: Local. Cultivado desde antiguo. No constituye una autentica variedad clonal. Mas bien parece ser un tipo o raza de chirimoyo con variaciones muy definidas en tamaño forma sabor etc.

Forma. Raramente produce frutos de forma perfecta. Gran proporcion de frutos irregulares. Tendencia a dar mucho fruto pequeño, tardio, sin valor comercial.

Tamaño. Muy raros los frutos grandes que puede llegar hasta dos Kg.

Epidermis. Verde oscuro, que ennegrece al madurar, comunmente formando manchas negras muy finas que a veces pasan a la carne. Protuberancias ligeras que desaparecen al madurar. Muy grueso y portanto muy resistente a la ceratitis.

Carne. Ligeramente tintada con tendencia a tomar una transparencia gelatinosa y grumosa muy caracteristica.

al ponerse en punto de consumición. Mucha variación en la cantidad de pipas no tiene defecto de "encamisado"
Calidad. Exquisita. Muy dulce, pero compensado con una ligera acidez que al alcanzar el punto exacto de consumo varia en un agrior, característico, que le confiere un sabor originalísimo. A juicio de muchos es el chirimoyo mas exquisito.
Maduración. Octubre. Noviembre. Algo mas tardío que "Get"
Fertilidad. Grande. Produce todos los años con regularidad. Pero la proporción de frutos defectuosos es muy elevada.
Observaciones. A pesar de su insuperable calidad y del hecho de que es la Chirimoya que mas tiempo aguanta una vez recolectada, esta variedad tiende a ser suprimida por su escaso valor comercial dadas los defectos citados

Variedad. Gete o Fino de Gete
Origen. Local. No hay seguridad de que sea una variedad Criolla, aunque existe versión que lo acredita. Pero el tipo ofrece demasiadas variaciones, y más bien parece ser una raza de chirimoyo con caracteristicas comunes.
Forma. Proporción satisfactoria de frutos perfectos. Tamaño grande o muy grande. La proporción de frutas pequeñas y deformes es menor que en las otras variedades.
Epidermis. Verde claro, que blanquea en el arbol al madurar. Protuberancias ligeras, que se alisan al madurar. Poco resistente a la mosca en grado supremo.
Carne. Blanca. Más consistente ~~consistente~~ y menos fundente que en las otras variedades. Defecto del encamisado de las pipas o huesos. Tendencia a una elevada proporción de huesos.
Calidad. Buena. Pero su dulzor está menos compensado que en las otras variedades.

Maduracion. Fin de Septiembre a Noviembre. Es la chirimoya más temprana

Fertilidad. Grande. Produce anualmente con regularidad y cosechas elevadas. Es considerada como la variedad más productiva.

Observaciones. Es la variedad mas comercial en la actualidad. Las nuevas plantaciones son invariablemente injertadas con esta variedad. Muchos arboles viejos son asi mismo reinjertadas con Fete.

Algunos datos meteorologicos durante la epoca de floración de los chirimoyos en Almuñecar. Año 1958.

Fecha	Hora	Temp. Fahr.	Humedad Relativa %
21 marzo	8 a.m.	60	48
22 "	8.a.m.	57	60
" "	2 p.m.	68	45
23 "	8 a.m.	60	72
24 "	2 p.m.	67	72
25 "	7.30 a.m.	59	78
" "	4.30 p.m.	68	58

No tengo mas datos hasta el mes de agosto, pero estos son muy importantes pues representan, mas o menos, la epoca mas caliente del año

8 agosto	4 p.m.	82	72
9 "	8 a.m,	78	82
10 "	1 p.m.	82	72
" "	4 p.m.	83	72
11 "	6.30 a.m.	72	90
12 "	8.30 a.m.	78	82
14 "	3.15 p.m.	84	69
15 "	7.30 a.m.	76	85
" "	5.45 p.m.	81	68
"16	12.30 p m	81	75
" 17	12 m.	82	72
" 18	2 p m	85	59
11 Sept	9 a m	75	85

THE CHERIMOYA
A bit of background, and something about Spain

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Though I have been asked to base this paper on cherimoya culture in Spain, I am going to spread out a little and make some comments and ask a few questions. First of all, what do we know about the native home of the cherimoya?

In my paper "The Cherimoya in California" (Pomona College Journal of Economic Botany, May 1912) I wrote that Alphonse de Candolle, our great authority on the origin of cultivated plants, considered it most probable that the cherimoya is indigenous in Ecuador and perhaps in the neighboring parts of Peru. Then I went on to write that Professor Gabriel Alcocer of the Mexican Natural Museum believed that it was exclusively Central American, having been taken from Guatemala to South America. He cited Padre Bernabé Cobo, well known to us avocado men as having been the first to classify avocados in three races, which we now call the Mexican, Guatemalan, and (erroneously) the West Indian. In his "Historia del Nuevo Mundo" (1653) the Padre wrote that in 1629 he wrote that he had seen avocados in Guatemala, and had sent seeds to friends in Peru where this fruit was unknown at that time.

Not many modern botanists accepted Padre Cobo's story, including W.E.Safford, who had found clay artefacts which looked like cherimoyas in pre-Columbian graves in Peru.

When I was in Ecuador in 1921, as an agricultural explorer for the U.S.Department of Agriculture, hunting for avocados but interested in everything else, it occurred to me to hunt for the native home of the cherimoya. So I went down to the Malacatos valley, close to

But time seems to have shown that this wasnt the answer. Horticulturists became interested in hand pollination. I believe Art Schroeder and others have gone into this matter fully. I havent. C.H.Gabñae, a competenet young American horticultirst who spent some time in Madeira, where Cherimoya cultura was supposed to be presperous, wrote me (as quoted in my "Manual of Tropical and Subtroeicak Fruits" that by hand pollination he got 36 fruits from 49 flowers. I wonder if climate did not come into play, as it does At Amuñecar in Spain?

What Happens in Spain?

The fact that there is anice little cherimoua industry on the Med terranean coast of Spain, centered at Almuñecar due south of Granada, but extending, more or less, from Motril on the East to Marbella on the West, tells us more about cherimoyas than any other cherimoya-growing region in the world - or so it seems to me. Chile is, perhaps, the next best example. Nothing in Mexico of Central America, so far as I know, can compare with southern Spain. In the Yearbook for 1960 Luis Sarasola gave us an excellent account of cherimoya culture in that region. All I can do is to add a few comments based upon my recent visit to Almuñecar.

First of all, the soils. There are all kinds, from rather steep slopes on the hillsides to the valley floors, where the soils are silts and silt loams, ~~and where most of the cherimoya orchrds are found.~~ In some places the pH is high, as much as 8.5. The most interesting feature which Luis and I observed when we worked together at ~~Aluñecar~~ during most of 1958 was this: ~~we found that~~ on the silt loams and silts of the valley floor, ~~that~~ too much irrigation resulted in death of the root systems. Irrigation in this region is a matter of law. Sometimes you are given all the water you want, sometimes more, sometimes less. We felt that

cherimoyas cannot take too much water.

I was impressed, xxxx on this recent visit, by the beautiful conditon of the cherimoya orchards in th Almuñecar valley - and Luix thinks there are xxxxxx 250 acres or more. Looking over the valley from the house on Rancho Californ a where Luis lives, not more than 100 feet above the valley floor, one cannot help admire the uniformly green, heakthy appaerace of the orchards. No bad spots, no sickly yellow orchards. What a lovely sight for a hort cultirist!

And then when you get down among the trees, you admire their shapeliness. I dont know just who they form their trees so well; perhaps in part because they bud xxxxxxx (bud graft) them so far abobe the ground, three feet or so.

I talked with a local horticulturest. He says there is no easier tree to graft than the cherimoya. xxxx Just about like citrys. They use, commercially, the T-bud and nothing else, so far as I heard.

They do very little pruning, and I have never heard anyone say that by cutting back the trees, hard, they get more fruit on the young wood.

They give no thought to the matter of pollination. When I was with Luis in 1958 we went into this matter at length. We watched the flowers on numerous trees to see what happened. We could not see that the stigmas had dried up before the next day when xxxxxxxx xxxxxxxxxxxx the anthers had dehisced and pollen was available. We did not observe many insects at work on the flowers. In the literature it is stated that since the cherimoya is not an xxxxxxxxxxxx anemophilous plant (and this seems reasonable, when you note the nature of the pollen) there must be pollination by insects. But this year Luis told me that he xxxxxx does not believe in insect pollination. He believes that air current during the night move the pollen from the anthers to the receptive stigmas. I wonder. The flowers

are not widely open and the pollen grains are not like thoseof a pine tree. But someway or ther, those cherimoya flowers get pollinated and they get good crops of fruit -mas a rule. This year I observed that the crop in the Almuñecar valley is very light, and Luis confirmed this.

Luis has kept records of temperature and humidity at Rancho California, right alongside the cherimoya orchards. Temperatures rarely go above 85 Fahrenheit. Relative humidity is commonly 60 to 75%. Compaee these figures with those in southern California. We dont have any figures - or at least I dont - for those regions in southern Ecuador and northern Peru where the cherimoya xxxxxxxxx is indigenous, and in great abundance as I was able to observe many years ago. But I want to add that I do not recall having seen trees in southern Ecuador with such good crops of fruit as I have seen on hundreds of trees in the Almuñecar valley. How are we going to get crops in sou hern California like those of Almuñecra? I have not been in touch with your situation for years. I should have talked about it with Art Schroeder but I havent, though he has been down here in Central America fairly often and we have talked about avocados. I assume that you are degoting special attention to the cherimoya in this forthcoming issue of the Yearbook because you would like to develop cherimoyasin southern California. I think this subject is worth much study; I would not give up. Incidentally, I want to say that I do not agree with the statement I have seen in print, that the cherimoya is not so cold-resistant as the lemon. Here in Guatemala we have plenty of cherimoyas growing at 7000 to 8000 feet above sea level, and there are not many oranges, - we dont have your lemons here - at 7000 feet. Almuñecar is too cool for xxxx avocados of the West Indian race. There are a few xxxxxxx trees of this race

on the Mediterranean coast, but they are just about as unhappy as they are in California.

If you are going in for commercial cherimoya culture, dont you think that the problem of varieties must receive much more attention than it has in the past? Look back on the avocado industry, how we (I shouldnt say, we, I should say you, but I still feel like a Californian) how we have struggled with varieties ever since we (there's that counfounded we again) ever since we started. We have worked through more than 500 varieties, havent we? And Fuerte, which was in at the start, after 60 years still remains in the picture. As you know, I grafted the first trees of Fuerte, when Carl Schmidt sent us the budwood from Mexico in 1911, and for many years now I have been collaborating in the effort to find something which is better. We will get it in time, but after all these years Fuerte is still among the most important avocados; look at Israel, where it is mostly Fuerte and Nabal; and look at South Africa, and look anywhere you want. Now, what are we going to do about cherimoya varieties (or cultivars, as you call them today). In his paper in the 1960 Yearbook, Luis Sarasola did a good job on the "varieties" at Almuñecar, where more attention should have been given this matter than anywhere else in the world, because the cherimoya industry is probably more there than it is anywhere else in the world.

What do we know about cherimoya varieties? Almost nothing. In talking with cherimoya growers in southern Spain I could not get much information. They have what they call "castas", as Luis Sarasola has pointed out. They say that Negro is the best-flavored of all. Will it be the best-flavored in some other climate? They

say that Jete is slightly inferior to Negro in quality, but still it is the most important "casta". Campas produces large fruits of of uniformly good shape. Is this because it is grown in a favored small area where a "microclimate" favors pollination? I must say that in the Almuñecar region, ~~in general~~ onesees very few fruits which are as imperfectly pollinated as the majority of those we see in Central America.

On terminating this paper, I am stopped by a man who wants to know what is the best rootstock for pears in the Guatemala highlands. Well, what is the best rootstock for cherimoyas in California? In Spain they use nothing but the same species, and that is the only one we have used in Central America, in those few places where cherimoyas have been propagated vegetatively. Of course I cant believe that grafting on *Annona reticulata* would make receptivity of the stigmas synchronize with the dehiscence of the anthers in California, but we think we have found that *reticulata* produces cherimoyas which will tolerate poor, dry soils and I have read that they think, womewhere, that it is a good idea to graft cherimoya on *Annona squamosa*. ~~For the present, I will go along with grafting A. cherimola on A. cherimola, after we spent lots of time studying and evaluating the behavior and quality of cultivars.~~

(Presumably cold resistance will have to be taken into account but I mention this point because in the development of other fruit industries rootstocks sooner or later receive attention. As you have come to it in connection with resistance to Phytophthora cinnamomi on avocados

coccids are not a serious problem in general.

Finally, I want to say that Luis Sarasola, who xxxxxxxxxxxxxxxx xxxxx for ,any y ars has been intimately associated with the cultivation of cherimoyas and avocados on the Mediterran coast of Spain, is confident that there is a good future for the ~~latter~~ cherimoya, a belief which obviously shared by many jor iculturists who are extending their plantings or making new ones. One of the major problems is the short shelf life of the cherimoya, as I believe you would say in Calefornia. xxx Once the fruit is harvested, it xxxx softens in seven or eight days at most and must be sold immediately by that time. Another problem is the variability in the quality of the fruits. Sarasola zays; Golden Delicious apples all taste alike, the only difference is that some are large, some are smaller. But with the cherimoya, you will harvest some large fruits, of excellent quality, and xxxx a little later on you will will be harvesting fruits from the same tree that are not worth dos realse in the market. Thxx Fruits which ripen early in the season, -October - when the weather is warm, are much better than those which ripen later, for example in December. In certain areas, where the trees are planted very close together, they harvest xxxxxxxxxx cherimoyas which have gone through the winter on the tree. xxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxx

The Cherimoya and Some of its Relatives

The horticultiral species of the genus Annona, several of which produce very fine fruits indeed, are all natives of the American tropics. Mark Twain, who was regaled with cherimoyas on the Island of Madeira, called this fruit "deliciousness itself". The sugar-apple is one of the most popular fruits in parts of Brazil and India. The guanabana or soursop (not a very prepossessing name) makes delectable sherbets, refreshing drinks, and ice creams. The little-known biribá of the Amazonian [illegible] (botanically not an Annona, but a very close relative) is considered a fine fruit by those privileged to have tasted it.

Despite all this, and their having been known to [illegible] tropical horticulturists since the early days of the Conquest, annonas have not attained [illegible] great commercial importance except in a few regions. Most of them yield sparingly of their appetizing fruits, [illegible] the result sometimes of unfavorable climatic conditions, in other instances due to faulty pollination, which in turn may be the fault of the climate, or the absence of pollinating insects. This is a subject which still needs investigation, though much has been learned in recent years, especially with regard to the cherimoya, often considered the finest tree fruit which [illegible] tropical [illegible]America has given the world.

THE CHERIMOYA

Rather specialised climatic needs have been the most important factor in limiting the spread of cherimoya culture. This tree, native to moderate elevations in the Andes of southern Ecuador and northern Peru, does not produce good crops or good fruit in wet tropical lowlands, - or even dry ones. It needs altitude. In Central America it is at its best in regions which lie between 5000 and 6500 feet - the upper level indicates that it is nearly as frost-resistant as the orange.

Rather specialized climatic needs have been an important limiting factor in the spread of cherimoya culture. Rainy, tropical lowlands are quite unsatisfactory, for it. Cherimoyas like the cool, but not too wet, climate of highlands in tropical countries, or a rather dry climate in the subtropics. Although it is the most cold hardy of the annonas, it can only tolerate about as much cold as true lemons, and its culture must not be pushed up too near the frost line. The real problem of cherimoya culture, however, is to secure a proper combination of temperature and humidity during the blooming periods so that adequate fruit-setting occurs. The flowers exhibit a condition called proterogyny (or protogyny), common in many fruits, in which the stigmas of the pistils are ready for pollination before the stamens of the same flower begin to shed pollen. In cherimoya flowers pollen is shed the next day after pistils are receptive, and in hot, dry weather, the stigmas may be dry and no longer receptive by the time self-pollination takes place, so that little fruit sets. Pollen from another flower while stigmas are fresh in the first flower will result in good setting, but this transfer depends on insects which are often not present or not active. If the trees are growing in a climate of moderate temperatures and high humidity, the pistils of a given flower do not dry out but remain receptive until that flower sheds pollen. Under these conditions excellent crops are produced; unfortunately, such climatic conditions do not exist in many regions where cherimoyas have been planted with hopes of commercial production.

The cherimoya tree rarely exceeds 25 ft. in height; and its spread may be equal to its height. The thin, light green, rather soft leaves are 4 to 8 in. long, ovate or ovate-lanceolate in form, rounded at the tip, and velvety on the lower surface. As in all annonas, the shoots look somewhat like compound leaves because the spirally arranged leaves are twisted on their petioles so that they all lie flat in the same plane. The tree is usually deciduous for a brief period in subtropical areas.

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THE CHERIMOYA, AND SOME OTHER ANNONAS

The horticultural species of the genus Annona, some of which produce very fine fruits indeed, are all natives of the American tropics. Mark Twain, who was regaled with cherimoyas on the island of Madeira, characterized them as "deliciousness itself." The sugar-apple is one of the most popular fruits in parts of Brazil and India. The guanábana or soursop (not a very prepossessing name) makes delectable sherbets, refreshing drinks, and ice creams. The little-known biribá of the Amazon (botanically not an Annona, but a very close relative) is considered a fine fruit by those privileged to have tasted it.

Despite all this, and ~~of~~ their having been known to horticulturists since the early days of the Conquest, annonas have not attained commercial importance except in a few regions. Some species are exacting at best as the Cherimoya is in their climatic requirements. Most yield sparingly of their appetizing fruits. Cherimoyas, when grown in the tropical lowlands, are inferior in flavor - when any fruits at all are produced by the trees. This species comes from medium elevations in the Andes of southern Ecuador and northern Peru, and needs a ~~cool, rather dry~~ but not cool, climate. The sugar-apple, on the other hand, likes the dry lowlands - it does not thrive at high elevations. The guanábana is a tree of low elevations. It grows and will produce good fruits - but not good crops, as a rule - in regions of high rainfall but does best where precipitation does not exceed 75 to 125 cm. annually, and there is a well-marked dry season.

It is in regard to productiveness that the annonaceous fruits have given horticulturists most trouble. This is especially true of the cherimoya. The flowers are protogynous, which means that the stigmas of the pistils are receptive - ready to be pollinated - before the anthers have ~~opened and released their pollen~~. If the weather is

hot and dry, the stigmas are no longer receptive by the time pollen is available. Pollen must be brought by insects from another flower. If this is not done, the flower drops to the ground, unpollinated, and no fruit is produced.

Even when pollination is effected by insects, unless all of the pistils receive it the resulting fruits are imperfect. This is because annona fruits are syncarps, that is, they are formed by the fusion of numerous carpels (pistils) with the fleshy receptacle. Malformed cherimoya fruits are a familiar sight in the markets of tropical America. This is true also of guanábana fruits, but not so true of sugar-apples.

Wherever annonas are grown, horticulturists observe among seedlings an occasional tree which is more productive than others in the same region. It is assumed that this is not always the result of better pollination, but is a characteristic which may be perpetuated by vegetative propagation. However, little has been done as yet to demonstrate the possibilities which exist in this field. Perhaps seedling variation is not the only factor.

In the early years of this century P. J. Wester, working at Miami, Florida, showed that it is very easy to cross the cherimoya with the sugar-apple. He gave this hybrid the name atemoya, combining one of the common names of the sugar-apple, ate or atis, with the last half of the word cherimoya. Subsequently it was observed, in several parts of the world, that when cherimoyas and sugar-apples are planted in close proximity to each other they hybridize without the intervention of man, and atemoyas are the result. The cherimoya is not a success in Israel. On the other hand, the sugar-apple thrives and produces good crops; the fruits found a ready sale in local markets, but they were difficult to handle, because the carpels cohere so loosely. Dr. Chanan Oppenheimer took advantage of the local occurence of natural hybrids to

select the best and recommend their commercial cultivation. The result is that small commercial plantings of this hybrid now exist in that part of the world.

THE CHERIMOYA

The cherimoya (Annona cherimola) was the best tree fruit (for dessert use) which the New World had to offer the Old. From its native home in the Andean valleys of southern Ecuador and northern Peru, it was carried northward to Mexico, where it was not previously known, perhaps by Spanish missionaries who travelled up and down the Pacific side of the Americas in the 16th century, taking the avocado and capulin cherry southward and the cherimoya northward. While it has not become a crop of great commercial importance anywhere, the cherimoya is well established on an orchard basis in Chile, Argentina, Queensland, and Southern Spain; and it is a home garden fruit in many other parts of the world. Some years ago it was thought that California would become an important producer, but the cherimoya industry in that State has not prospered. In Mexico, Central America, and the highlands of northern South America, cherimoyas are seen mainly as dooryard trees, but from them considerable quantities of fruit reach local markets.

While the common name used in Guatemala is simply anona, everywhere else the name cherimoya has gone with the fruit; it comes from the aboriginal Quechua name in Peru, chirimuyu. This word means "cold seeds," apparently an allusion to the impression one gets from putting the seeds in his mouth.

Rather specialized climatic requirements have been an important factor in limiting cherimoya culture. As has been mentioned above, rainy tropical lowlands are altogether unsuitable; the tree likes the cool rather dry climate of tropical highlands or rather dry climate in the subtropics. But it is not quite as frost resistant as the orange.

The tree, which normally is deciduous or nearly so during the cooler months, may attain a height and spread of 6 to 8 m. The light green, rather soft leaves are 10 to 20 cm. long, ovate or ovate-lanceolate in form, rounded at the tips, and velvety on the lower surface. The leaves are twisted on their petioles, which results in their lying flat in the same plane.

The fragrant flowers are 2-3 cm. long, solitary or sometimes two or three together, on short nodding peduncles set in the axils of the leaves. The three exterior petals are oblong-linear, greenish outside and pale yellowish within, the three inner ones are minute and scale-like; they enclose the conical receptacle with numerous stamens around the base and numerous pistils around the upper part.

The fruits may be heart-shaped, conical, or oval; far too often the form is quite irregular because some pistils failed to be pollinated and did not develop. Mature fruits usually weigh from 300 or 400 grams to 1 kilogram, but may attain as much as 3 or even 4 kilograms. Within the thin, pale green skin is a creamy white, smooth flesh, melting in texture (sometimes likened to ice cream), subacid but with plenty of sweetness. The flavor has been compared to a combination of banana and pineapple, but this does not describe it adequately. Numerous dark brown seeds, the size of common beans, are scattered through the flesh, one for each pollinated pistil. Where climatic conditions are not entirely suitable - too warm - the flavor may be disappointing.

To a greater extent than other annonas, cherimoya fruits present a wide variety of forms, based upon the character of the surface, which is divided into well-defined spaces termed <u>areoles</u>, each representing a matured carpel. In the Standard Cyclopedia of Horticulture, W. E. Safford, who made a profound study of the genus Annona, published a botanical classification of cherimoya fruits, as follows: <u>forma impressa</u>,

with U-shaped areoles resembling finger-prints in wax; forma laevis, in which the surface is quite smooth; forma tuberculata, with wart-like tubercles near the apex of each areole; forma mamillata, the name of which adequately describes it; and forma umbonata, in which the surface is studded with conical protuberances. This classification is of interest as showing the range of surface characteristics, but horticulturists have never paid much attention to it when selecting seedlings for vegetative propagation. Safford considered that a certain degree of correlation existed between these forms and flavor and quality of fruit. It appears that the few named varieties which are grown today in Australia, in California, in Spain and perhaps one or two other regions have been selected for quality more than any other factor, though size of fruit, appearance, and most of all productiveness, have sometimes been given consideration. The fact of the matter is, no well-organized work of cherimoya improvement has been carried out. Hand-pollination will increase production but commercially has not been found very satisfactory.

Cherimoyas are easily grown from seeds, which may be kept for a year if well-dried. In those regions where this fruit has become an orchard crop, seedling trees which were considered superior have been propagated vegetatively. This has usually been done on rootstocks of the same species, though it is thought in tropical America that Annona reticulata might be preferable in some places because of its resistance to drought and poor soils. Seedlings to be budded should be 1 to 1.5 cms. in diameter at the base, and buds should be cut larger than for citrus.

The development of veneer (sometimes called side-veneer) grafting has brought about a revolution in the propagation of many tropical fruit trees. In Florida and in tropical America veneer grafting has

proved to be more reliable than shield-budding. ~~This has been true of avocados, mangos, and several other fruit trees, including the~~ annonas. ~~Though shield budding may continue to be~~ is still preferred in some regions, ~~for some fruits~~, veneer grafting is gaining ground ~~and should be borne in mind~~.

Almost any well drained soil of good structure is satisfactory for cherimoyas, ~~but it is generally believed that a high lime content is unfavorable~~. ~~Still more important, however, is~~ perfect drainage is essential. Too much irrigation on soils retentive of moisture is dangerous. Sandy loams are to be preferred for this reason.

Trees should be spaced 8 m. apart, even 10 if on good soil. Very little pruning is required, beyond the elimination of the small branchlets which die off. It has been observed in a few instances that trees which are severely pruned produce more fruit in succeeding years, but pruning for fruit is not an established practice.

There is little information available regarding fertilizer programs suitable for this tree. In most parts of tropical America where cherimoyas are grown, they are dooryard trees which receive no cultural attention. In a few regions such as the labores in Atlixco, state of Puebla, Mexico, where cherimoyas are cultivated in mixed plantings with citrus and avocados, they receive the same treatment as these do, which includes irrigation on a regular cycle. In the valley of Almuñecar, on the Mediterranean coast of Spain, there are probably more acres planted to cherimoyas than in any region of similar size in all the world. Since climatic conditions in Almuñecar favor the production of large crops of fruit, not only are the orchards irrigated, but the surface is kept free of weeds and in good tilth at all times.

Cherimoya trees are not commonly attacked by serious pests, either insects or diseases, but this is unfortunately not true of the fruits. In many countries it is rare to find a cherimoya in the market which

is not infested with insect larvae. These destroy the seeds and render the flesh unattractive. The chalcid Bephrata cubensis has given much trouble in Cuba, and probably elsewhere; the moth Stenoma annonella is troublesome in Central America. A residual spray like DDT every 2 weeks while the fruits are very small will control these pests, but fruits more than half-grown must not be sprayed because the residue is poisonous. Another common pest is anthracnose, a fungus disease which causes ripening fruits to become hard and dry, or "mummified." It is more serious in humid than in semi-arid climates. Copper or zineb sprays weekly during fruit development will control it, but at considerable expense. Scale insects occasionally infest cherimoya trees, but are easily controlled by standard scalecides. Mature, unripe cherimoyas will carry for a week to market, or can be laid aside at home to ripen in a week or so. Ripening should take place at 18 degrees C. or slightly higher.

THE SUGAR-APPLE

Of all the annonas, the sugar-apple (A. squamosa) is the most widely grown throughout the tropics of the world. It is native to the tropical lowlands of America and thrives in hot climates where the cherimoya does not succeed. It is cultivated on a small commercial scale in Egypt, Israel, and Java, but it is in India that the sugar-apple is most esteemed. Hundreds of thousands of sugar-apple trees grow in the states of Andhra and Madras, and many thousands more in gardens in Assam. It is a favorite in large parts of interior Brazil, and is abundant throughout the West Indies and Central America.

This species is much less fortunate than the cherimoya as regards common names: it has too many. Usually the term sugar-apple is used in English-speaking countries, but in India the name in English is custard-apple, which confuses it with A. reticulata; in some former British colonies the name sweetsop is used; while in most of Spanish-

speaking America it is anon or anona, though in Brazil it is fructa do conde and pinha. East Indian esteem for the sugar-apple is shown by two vernacular names, sharifa (meaning "noble") and sitaphal (fruit of the god Sita).

While successfully grown in humid lowlands, the sugar-apple delights in a hot and rather dry climate, from sea level up to 800 or 1000 meters. It is a little less tolerant of frost than the cherimoya but more so than the custard-apple and soursop. In tropical America poor, stony soil is sometimes covered with escaped, seedling sugar-apple trees, but of course, they grow and fruit better on good loams. Good drainage is essential.

Sugar-apple trees are small, from 4 to a maximum of about 6 meters, in height. During dry seasons they are deciduous. The leaves are narrow and pointed, 7 to 10 cm. long, pale green above and gray-green below, glabrous when mature. Flowers are very similar to those of the cherimoya and are borne in the same manner. The fruits differ from those of other annonas in that the carpels composing the fruit or syncarp are not fused on their outer surfaces into a continuous rind. Each carpel remains distinct, and when the fruit ripens they are easily pulled apart. The fruits are typically heart-shaped, 5 to 10 cm. across, with yellowish-green surface covered with a bluish-white (sometimes purplish), waxy bloom. Usually the weight is less than 500 grams. The soft, custard-like flesh, which is somewhat granular in texture and very sweet (15 to 20% sugar), contains brown seeds smaller than those of the cherimoya, one to each carpel. Sugar-apples are eaten out of hand, or used to prepare sherbets.

Pollination problems do not seem to be as troublesome as they are with the cherimoya. There are reports that hand-pollination has increased production in some places, though it has not been carried out

extensively and reports are conflicting. It takes three or four months for the fertilized flowers to develop into mature fruits.

As has been mentioned, this fruit is not well adapted for shipment to distant markets, nor has it a long "shelf life." The carpels cohere so loosely, especially as the fruit softens, that careful handling is required. After harvesting, it is difficult to keep sugar-apples in good condition more than four or five days.

The culture of this tree is so simple that little horticultural attention has been given it. Most sugar-apple trees are seedlings, which come into bearing at the age of 3 or 4 years, but are short-lived and usually die when 20 to 30 years old. Pruning old branches to leave younger, more vigorous ones may prolong productiveness. Trees planted in orchard form should be spaced 4 to 6 m. apart. On poor soils fertilizers will, of course, encourage growth and yield. While the sugar-apple withstands drought remarkably well, in dry climates irrigation results in better growth and more fruit.

The horticultural future of the sugar-apple lies in the selection of superior seedlings and their propagation by vegetative means. Studies by horticulturists of the vast seedling populations in India have shown as much variation in size, shape, and surface characters of sugar-apples as has long been known in cherimoyas, and an even greater range in fruit color. Occasionally they are almost purple. Seedlings in India sometimes bear fruits weighing almost a kilogram. A seedless form was found in Cuba some years ago, but the fruits were too small to be of value. Budding and veneer grafting are easily done on sugar-apples, using as stocks seedlings of this species or those of the custard-apple.

In general, the same pests which attack the cherimoya can be expected on sugar-apples. Little attention has been given this subject in tropical America.

THE CUSTARD-APPLE

It would be well if the name custard-apple could universally be limited to this species, Annona reticulata, thereby protecting the reputations of two much better fruits, the cherimoya and the sugar-apple. Anona is the name used in Mexico and Central America; in Puerto Rico it is called corazón; while in Cuba and some lowland areas of South America, the name cherimoya is used, which has led numerous horticulturists to think that the true cherimoya could be grown in humid, tropical lowlands. The rather unappetizing name bullocks heart is often seen in the literature.

While the custard-apple is inferior to the sugar-apple in quality, as a fruit tree it has certain virtues. It is a really handsome ornamental which adds beauty and grateful shade to many a tropical dooryard. It is more vigorous than other annonas, and more tolerant of unfavorable environmental conditions--wet as well as dry climates and poor, stony soils. It is this ability to thive on poor soils which makes the custard-apple a promising stock for some of its relatives.

Like the sugar-apple, the custard-apple is native to the lowlands of tropical America. It has been introduced into all tropical and warm subtropcial regions of the world, but nowhere has it become an important commercial fruit. It is a little less tolerant of cold than the sugar-apple, but in general thrives in the same regions.

Custard-apples attain a height of 6 to 10 meters, with well rounded and handsome heads of foliage. There is no reason for confusing this species with the cherimoya if one compares the leaves of the two: in the custard-apple they are oblong-lanceolate or lanceolate, commonly 10 to 15 cm. in length, acute and glabrate. The flowers are similar to those of the sugar-apple but produced over a longer period.

The fruit is usually heart-shaped or globose-ovate, about 500

grams in weight, with a range from 300 to 600 grams. It has a rather leathery skin, almost smooth although the areoles indicating the fused carpels are clearly marked by impressed lines. An unusual feature is the development of the fruit stem to a much greater diameter than that of the twig which bears it. The custard-like flesh is cream-colored, granular near the skin, less sweet and less pleasantly flavored than that of the sugar-apple; in fact the custard-apple is usually considered uninteresting by connoisseurs. Yet custard-apples find a ready sale in many tropical markets. Numerous dark brown seeds, the size and shape of common beans, are imbedded in the flesh. There seem to be two seedling races, differing only in the color of the fruit: one is yellowish-green, the other reddish-yellow at maturity.

Propagation by budding and grafting is not difficult, but no sufficiently good seedlings have appeared to justify selection as varieties. Seeds germinate in 4 to 6 weeks and retain viability for a year if stored dry. The value of seedlings as vigorous rootstocks for better anonas has already been noted.

THE ILAMA

This species, Annona diversifolia, was called to the attention of tropical horticulturists about 1915, with the recommendation that it might well be termed "the cherimoya of the lowlands." It is native to semi-arid lowlands and foothills along the Pacific coast from southern Mexico to Nicaragua, where the climate is too warm for cherimoyas. It is somewhat handicapped by the large seeds and fact that the fruits show a tendency to split open upon approaching maturity, a defect which might be controlled by harvesting the fruits before they ripen on the tree. Although it is grown in dooryards here and there throughout the region in which it is believed to be indigenous, it is abundant in only a few places: at Tapachula, in the State of Chiapas,

Mexico, where it is called papauce; around Retalhuleu, Guatemala, and in a few towns in El Salvador and Honduras, where it is commonly known as anona blanca. The name ilama is used in south-central Mexico.

Climatic requirements are similar to those of the sugar-apple, except that the tree does not tolerate quite so much cold and does not seem so well adapted to humid regions. Ilamas grow well on volcanic clay loams and sandy loams, in fact on all soils good for other annonas.

The tree may reach a height of 6 meters or a little more. It is upright in habit, often branching near the ground to form 3 or 4 main trunks. The leaves are much like those of the cherimoya except that they are glabrous on the under surface. The name diversifolia refers to a peculiarity of this species: at the base of twigs (especially flowering branchlets) are two small orbicular leaflets opposite each other, clasping the stem.

The flowers are much like those of the above-described annonas in size and shape; on some trees they are maroon colored, on others greenish-yellow with a tinge of red. The fruits resemble cherimoyas in shape but are often smaller, averaging 500 gms. in weight. They vary in color from pale green to magenta-pink, suggesting the possibility of two seedling races as in the custard-apple. The flesh is white in green-skinned fruits and rose-pink in the others, the former being considered a little sweeter than the latter. Like sugar-apples, ilamas have a thick, waxy, white bloom on the fruit surface. The season of maturity coincides with that of the sugar-apple. The fruit is much like the cherimoya in flavor and is popular in the markets of the few regions where it is abundant. Invariably it is eaten out of hand.

Trees are not easily grown from seeds. There is much variation among seedlings in productiveness, size, and quality of fruit; superior individuals should be selected and propagated by budding or veneer

grafting either on ilama or custard-apple stocks. Pest problems are likely to be the same as for the cherimoya.

THE SOURSOP

The historian, Gonzalo Fernandez de Oviedo, wrote in 1526 that this tree, for which he used the indigenous Carib name guanábano, was abundant in the West Indies and on the mainland. He goes on to say that "it is a beautiful tree and has long, wide, green leaves. It bears cones, or fruits that resemble them, as large as melons but longish in shape. On top the fruit has certain decorations that look like scales but are not, nor can they be removed. It is covered all over with a rind as thick as that of a melon. Inside it is filled with a white pulp that, although firm, is juicy and of a delicious taste that is somewhat sharp and pleasant."

This species, Annona muricata, is now cultivated in all tropical regions of the world. It does well in humid lowlands, but better in ~~semi-arid regions~~ regions of moderate rainfall. The least cold-resistant of all annonas, it is rarely seen in tropical America at elevations above 800 meters. In Spanish-speaking countries the common name is guanábana, sometimes shortened to guanába; in English-speaking countries it is called soursop, ~~an unappetizing name for an excellent fruit~~.

The tree is evergreen, rather slender in habit, rarely over 8 m. in height. The leathery leaves are 10 to 12 cm. long, oblate to elliptic, glossy dark green in color, with curious tiny pits in the axils of the larger veins on the glabrous lower surface. The flowers are very unlike those of the annonas previously discussed, being larger, about 4 cm. broad, with inner petals nearly the same size as the outer ones. Each of the 6 petals is broadly triangular and yellowish-green in color; the 3 inner ones are thin and overlap each other while the 3 outer ones are thicker and valvate. The flowers are borne on new

shoots, but many arise cauliflorously on the main trunk and larger limbs.

The fruit is the largest of all the annonas, ranging in weight from 500 gms. to 1 or 2 kgs., fruits of 4 kilograms are not uncommon. The form is elongated cordate or oblong, largest at the stem end, and often misshapen, especially toward the apex, due to failure of unpollinated carpels to develop. The skin or outer covering is dark green, with a fleshy spine about 1 cm. long from each of the fused carpels recurved at the tip. The flesh is white, cottony in texture (which renders it unpopular for eating out of hand); the abundant juice is sub-acid, with about 10 to 12% of sugar and 1% or more of acid, making a pleasingly tart blend, with a distinctive aroma. Guanabanas are much used for refreshing drinks, sherbets, and ice cream flavoring; they can be preserved by freezing or may be canned. The famous champola of Cuba is prepared by putting the flesh through a sieve, then mixing the juice with milk, sugar, and cracked ice. There seems no reason why canned or frozen juice could not be exported to northern countries for use in various ways. As with other annonas, numerous, flattened, brown seeds are imbedded in the flesh.

The soil best suited to soursops is probably a good loam, but it has succeeded on sandy ~~clays~~ soils and ~~light~~ sands, though requiring plenty of fertilizer on the latter. Good drainage is essential. Unfortunately, the tree is not very productive, only a few good, large fruits being matured annually. Hand pollination might increase fruit setting when the proper pollinating insects are not active. Considerable variation in yields of seedlings has been noted, especially in Venezuela, and it seems likely that selection of heavy bearing trees and their propagation as varieties would greatly increased production. Propagation by veneer grafting is recommended.

Unfortunately, soursop fruits are attacked by the same insects as other annonas, and in addition the trees are sometimes bothered by red spiders, mealybugs, and lace bugs. Malathion controls the first two, and lindane the last.

SOME MINOR ANNONACEOUS FRUITS

In southern Mexico and Central America the soncoya (Annona purpurea) is occasionally seen in the markets. This is a large, round, pale green or brownish green fruit, covered with pyramidal protuberances which terminate in short hooks curved toward the stem. The carpels separate readily; each one contains an obovate brown seed about 2 cm. long. The flesh is bright orange in color, subacid in flavor and somewhat pungent. The tree is grown in dooryards, up to elevations of about 750 meters.

In parts of this same region, but at higher elevations (up to 1200 m. or a little more) Annona scleroderma, called posh-té in northern Guatemala, occurs as a wild tree and the fruit is occasionally brought to market. It is roundish oblate in form, 7 or 8 cm. in diameter; the "shell" is nearly a centimeter thick, and harder than that of other annonas. People who are not familiar with this fruit often mistake it for the cherimoya, which it greatly resembles in flavor. When the tree is examined confusion becomes even greater, for it resembles the cherimoya closely, the main difference being that the leaves are smaller and acute at the apex. Annona testudinea of Honduras is closely related to this species, if not the same thing.

Of more interest than any of the above is the biriba of the Amazon basin. Botanically, this is not an annona, but the fruit so closely resembles a cherimoya in appearance and flavor that it may easily be mistaken for a member of that genus, from which it is differentiated mainly by the structure of the flower. The tree, Rollinia deliciosa,

has large oblong or elliptic leaves; the fruits, which are the size of small cherimoyas, are light green or greenish yellow, with the areoles distinctly outlined on the surface. The flesh is white or cream-colored, juicy, sweet, and pleasantly flavored. It seems probable that this tree may eventually attain the importance it deserves - that of a fine annonaceous fruit for tropical rain-forest regions.

THE CHERIMOYA, AND SOME OTHER ANNONAS

The horticultural species of the genus Annona, some of which produce very fine fruits indeed, are all natives of the American tropics. Mark Twain, who was regaled with cherimoyas on the island of Madeira, characterized them as "deliciousness itself." The sugar-apple is one of the most popular fruits in parts of Brazil and India. The guanábana or soursop (not a very prepossessing name) makes delectable sherbets, refreshing drinks, and ice creams. The little-known biribá of the Amazon (botanically not an Annona, but a very close relative) is considered a fine fruit by those privileged to have tasted it.

Despite all this, and of their having been known to horticulturists since the early days of the Conquest, annonas have not attained commercial importance except in a few regions. Some species are exacting in their climatic requirements. Most yield sparingly of their appetizing fruits. Cherimoyas, when grown in the tropical lowlands, are inferior in flavor - when any fruits at all are produced by the trees. This species comes from medium elevations in the Andes of southern Ecuador and northern Peru, and needs a cool, rather dry climate. The sugar-apple, on the other hand, likes the dry lowlands - it does not thrive at high elevations. The guanábana is a tree of low elevations. It grows and will produce good fruits - but not good crops, as a rule - in regions of high rainfall but does best where precipitation does not exceed 75 to 125 cm. annually, and there is a well-marked dry season.

It is in regard to productiveness that the annonaceous fruits have given horticulturists most trouble. This is especially true of the cherimoya. The flowers are protogynous, which means that the stigmas of the pistils are receptive - ready to be pollinated - before the anthers have opened and released their pollen. If the weather is

hot and dry, the stigmas are no longer receptive by the time pollen is available. Pollen must be brought by insects from another flower. If this is not done, the flower drops to the ground, unpollinated, and no fruit is produced.

Even when pollination is effected by insects, unless all of the pistils receive it the resulting fruits are imperfect. This is because annona fruits are syncarps, that is, they are formed by the fusion of numerous carpels (pistils) with the fleshy receptacle. Malformed cherimoya fruits are a familiar sight in the markets of tropical America. This is true also of guanábana fruits, but not so true of sugar-apples.

Wherever annonas are grown, horticulturists observe among seedlings an occasional tree which is more productive than others in the same region. It is assumed that this is not always the result of better pollination, but is a characteristic which may be perpetuated by vegetative propagation. However, little has been done as yet to demonstrate the possibilities which exist in this field. Perhaps seedling variation is not the only factor.

In the early years of this century P. J. Wester, working at Miami, Florida, showed that it is very easy to cross the cherimoya with the sugar-apple. He gave this hybrid the name atemoya, combining one of the common names of the sugar-apple, ate or atis, with the last half of the word cherimoya. Subsequently it was observed, in several parts of the world, that when cherimoyas and sugar-apples are planted in close proximity to each other they hybridize without the intervention of man, and atemoyas are the result. The cherimoyas is not a success in Israel. On the other hand, the sugar-apple thrives and produces good crops; the fruits found a ready sale in local markets, but they were difficult to handle, because the carpels cohere so loosely. Dr. Chanan Oppenheimer took advantage of the local occurence of natural hybrids to

select the best and recommend their commercial cultivation. The result is that small commercial plantings of this hybrid now exist in that part of the world.

THE CHERIMOYA

The cherimoya (Annona cherimola) was the best tree fruit (for dessert use) which the New World had to offer the Old. From its native home in the Andean valleys of southern Ecuador and northern Peru, it was carried northward to Mexico, where it was not previously known, perhaps by Spanish missionaries who travelled up and down the Pacific side of the Americas in the 16th century, taking the avocado and capulin cherry southward and the cherimoya northward. While it has not become a crop of great commercial importance anywhere, the cherimoya is well established on an orchard basis in Chile, Argentina, Queensland, and Southern Spain; and it a home garden fruit in many other parts of the world. Some years ago it was thought that California would become an important producer, but the cherimoya industry in that State has not prospered. In Mexico, Central America, and the highlands of northern South America, cherimoyas are seen mainly as dooryard trees, but from them considerable quantities of fruit reach local markets.

While the common name used in Guatemala is simply anona, everywhere else the name cherimoya has gone with the fruit; it comes from the aboriginal Quechua name in Peru, chirimuyu. This word means "cold seeds," apparently an allusion to the impression one gets from putting the seeds in his mouth.

Rather specialized climatic requirements have been an important factor in limiting cherimoya culture. As has been mentioned above, rainy tropical lowlands are altogether unsuitable; the tree likes the cool rather dry climate of tropical highlands or rather dry climate in the subtropics. But it is not quite as frost resistant as the orange.

The tree, which normally is deciduous or nearly so during the cooler months, may attain a height and spread of 6 to 8 m. The light green, rather soft leaves are 10 to 20 cm. long, ovate or ovate-lanceolate in form, rounded at the tips, and velvety on the lower surface. The leaves are twisted on their petioles, which results in their lying flat in the same plane.

The fragrant flowers are 2-3 cm. long, solitary or sometimes two or three together, on short nodding peduncles set in the axils of the leaves. The three exterior petals are oblong-linear, greenish outside and pale yellowish within, the three inner ones are minute and scale-like; they enclose the conical receptacle with numerous stamens around the base and numerous pistils around the upper part.

The fruits may be heart-shaped, conical, or oval; far too often the form is quite irregular because some pistils failed to be pollinated and did not develop. Mature fruits usually weigh from 300 or 400 grams to 1 kilogram, but may attain as much as 3 or even 4 kilograms. Within the thin, pale green skin is a creamy white, smooth flesh, melting in texture (sometimes likened to ice cream), subacid but with plenty of sweetness. The flavor has been compared to a combination of banana and pineapple, but this does not describe it adequately. Numerous dark brown seeds, the size of common beans, are scattered through the flesh, one for each pollinated pistil. Where climatic conditions are not entirely suitable - too warm - the flavor may be disappointing.

To a greater extent than other annonas, cherimoya fruits present a wide variety of forms, based upon the character of the surface, which is divided into well-defined spaces termed <u>areoles</u>, each representing a matured carpel. In the Standard Cyclopedia of Horticulture, W. E. Safford, who made a profound study of the genus Annona, published a botanical classification of cherimoya fruits, as follows: <u>forma impressa</u>,

with U-shaped areoles resembling finger-prints in wax; forma laevis, in which the surface is quite smooth; forma tuberculata, with wart-like tubercles near the apex of each areole; forma mamillata, the name of which adequately describes it; and forma umbonata, in which the surface is studded with conical protuberances. This classification is of interest as showing the range of surface characteristics, but horticulturists have never paid much attention to it when selecting seedlings for vegetative propagation. Safford considered that a certain degree of correlation existed between these forms and flavor and quality of fruit. It appears that the few named varieties which are grown today in Australia in California, in Spain and perhaps one or two other regions have been selected for quality more than any other factor, though size of fruit, appearance, and most of all productiveness, have sometimes been given consideration. The fact of the matter is, no well-organized work of cherimoya improvement has been carried out. Hand-pollination will increase production but commercially has not been found very satisfactory.

Cherimoyas are easily grown from seeds, which may be kept for a year if well-dried. In those regions where this fruit has become an orchard crop, seedling trees which were considered superior have been propagated vegetatively. This has usually been done on rootstocks of the same species, though it is thought in tropical America that Annona reticulata might be preferable in some places because of its resistance to drought and poor soils. Seedlings to be budded should be 1 to 1.5 cms. in diameter at the base, and buds should be cut larger than for citrus.

The development of veneer (sometimes called side-veneer) grafting has brought about a revolution in the propagation of many tropical fruit trees. In Florida and in tropical America veneer grafting has

proved to be more reliable than shield-budding. This has been true of avocados, mangos, and several other fruit trees, including the annonas. Though shield budding may continue to be preferred in some regions, for some fruits, veneer grafting is gaining ground and should be borne in mind.

Almost any well drained soil of good structure is satisfactory for cherimoyas, but it is generally believed that a high lime content is unfavorable. Still more important, however, is perfect drainage. Too much irrigation on soils retentive of moisture is dangerous. Sandy loams are to be preferred for this reason.

Trees should be spaced 8 m. apart, even 10 if on good soil. Very little pruning is required, beyond the elimination of the small branchlets which die off. It has been observed in a few instances that trees which are severely pruned produce more fruit in succeeding years, but pruning for fruit is not an established practice.

There is little information available regarding fertilizer programs suitable for this tree. In most parts of tropical America where cherimoyas are grown, they are dooryard trees which receive no cultural attention. In a few regions such as the labores in Atlixco, state of Puebla, Mexico, where cherimoyas are cultivated in mixed plantings with citrus and avocados, they receive the same treatment as these do, which includes irrigation on a regular cycle. In the valley of Almuñecar, on the Mediterranean coast of Spain, there are probably more acres planted to cherimoyas than in any region of similar size in all the world. Since climatic conditions in Almuñecar favor the production of large crops of fruit, not only are the orchards irrigated, but the surface is kept free of weeds in good tilth at all times.

Cherimoya trees are not commonly attacked by serious pests, either insects or diseases, but this is unfortunately not true of the fruits. In many countries it is rare to find a cherimoya in the market which

not infested with insect larvae. These destroy the seeds and render the flesh unattractive. The chalcid Bephrata cubensis has given much trouble in Cuba, and probably elsewhere; the moth Stenoma annonella is troublesome in Central America. A residual spray like DDT every 2 weeks while the fruits are very small will control these pests, but fruits more than half-grown must not be sprayed. Another common pest is anthracnose, a fungus disease which causes ripening fruits to become hard and dry, or "mummified." It is more serious in humid than in semi-arid climates. Copper or zineb sprays weekly during fruit development will control it, but at considerable expense. Scale insects occasionally infest cherimoya trees, but are easily controlled by standard scalecides. Mature, unripe cherimoyas will carry for a week to market, or can be laid aside at home to ripen in a week or so. Ripening should take place at 18 degrees C. or slightly higher.

THE SUGAR-APPLE

Of all the annonas, the sugar-apple (A. squamosa) is the most widely grown throughout the tropics of the world. It is native to the tropical lowlands of America and thrives in hot climates where the cherimoya does not succeed. It is cultivated on a small commercial scale in Egypt, Israel, and Java, but it is in India that the sugar-apple is most esteemed. Hundreds of thousands of sugar-apple trees grow in the states of Andhra and Madras, and many thousands more in gardens in Assam. It is a favorite in large parts of interior Brazil, and is abundant throughout the West Indies and Central America.

This species is much less fortunate than the cherimoya as regards common names it has too many. Usually the term sugar-apple is used in English-speaking countries, but in India the name in English is custard-apple, which confuses it with A. reticulata; in some former British colonies the name sweetsop is used; while in most of Spanish-

speaking America it is anon or anona, though in Brazil it is fructa do conde and pinha. East Indian esteem for the sugar-apple is shown by two vernacular names, sharifa (meaning "noble") and sitaphal (fruit of the god Sita).

While successfully grown in humid lowlands, the sugar-apple delights in a hot and rather dry climate, from sea level up to 800 or 1000 meters. It is a little less tolerant of frost than the cherimoya but more so than the custard-apple and soursop. In tropical America poor, stony soil is sometimes covered with escaped, seedling sugar-apple trees, but of course, they grow and fruit better on good loams. Good drainage is essential.

Sugar-apple trees are small, from 4 to a maximum of about 6 meters, in height. During dry seasons they are deciduous. The leaves are narrow and pointed, 7 to 10 cm. long, pale green above and gray-green below, glabrous when mature. Flowers are very similar to those of the cherimoya and are borne in the same manner. The fruits differ from those of other annonas in that the carpels composing the fruit or syncarp are not fused on their outer surfaces into a continuous rind. Each carpel remains distinct, and when the fruit ripens they are easily pulled apart. The fruits are typically heart-shaped, 5 to 10 cm. across, with yellowish-green surface covered with a bluish-white (sometimes purplish), waxy bloom. Usually the weight is less than 500 grams. The soft, custard-like flesh, which is somewhat granular in texture and very sweet (15 to 20% sugar), contains brown seeds smaller than those of the cherimoya, one to each carpel. Sugar-apples are eaten out of hand, or used to prepare sherbets.

Pollination problems do not seem to be as troublesome as they are with the cherimoya. There are reports that hand-pollination has increased production in some places, though it has not been carried out

extensively and reports are conflicting. It takes three or four months for the fertilized flowers to develop into mature fruits.

As has been mentioned, this fruit is not well adapted for shipment to distant markets, nor has it a long "shelf life." The carpels cohere so loosely, especially as the fruit softens, that careful handling is required. After harvesting, it is difficult to keep sugar-apples in good condition more than four or five days.

The culture of this tree is so simple that horticultural attention has been given it. Most sugar-apple trees are seedlings, which come into bearing at the age of 3 or 4 years, but are short-lived and usually die when 20 to 30 years old. Pruning old branches to leave younger, more vigorous ones may prolong productiveness. Trees planted in orchard form should be spaced 4 to 6 m. apart. On poor soils fertilizers will, of course, encourage growth and yield. While the sugar-apple withstands drought remarkably well, in dry climates irrigation results in better growth and more fruit.

The horticultural future of the sugar-apple lies in the selection of superior seedlings and their propagation by vegetative means. Studies by horticulturists of the vast seedling populations in India have shown as much variation in size, shape, and surface characters of sugar-apples as has long been known in cherimoyas, and an even greater range in fruit color. Occasionally they are almost purple. Seedlings in India sometimes bear fruits weighing almost a kilogram. A seedless form was found in Cuba some years ago, but the fruits were too small to be of value. Budding and veneer grafting are easily done on sugar-apples, using as stocks seedlings of this species or those of the custard-apple.

In general, the same pests which attack the cherimoya can be expected on sugar-apples. Little attention has been given this subject in tropical America.

THE CUSTARD-APPLE

It would be well if the name custard-apple could universally be limited to this species, Annona reticulata, thereby protecting the reputations of two much better fruits, the cherimoya and the sugar-apple. Anona is the name used in Mexico and Central America; in Puerto Rico it is called corazon; while in Cuba and some lowland areas of South America, the name cherimoya is used, which has led numerous horticulturists to think that the true cherimoya could be grown in humid, tropical lowlands. The rather unappetizing name bullocks heart is often seen in the literature.

While the custard-apple is inferior to the sugar-apple in quality, as a fruit tree it has certain virtues. It is a really handsome ornamental which adds beauty and grateful shade to many a tropical dooryard. It is more vigorous than other annonas, and more tolerant of unfavorable environmental conditions--wet as well as dry climates, and poor, stony soils. It is this ability to thive on poor soils which makes the custard-apple a promising stock for some of its relatives.

Like the sugar-apple, the custard-apple is native to the lowlands of tropical America. It has been introduced into all tropical and warm subtropcial regions of the world, but nowhere has it become an important commercial fruit. It is a little less tolerant of cold than the sugar-apple, but in general thrives in the same regions.

Custard-apples attain a height of 6 to 10 meters, with well rounded and handsome heads of foliage. There is no reason for confusing this species with the cherimoya if one compares the leaves of the two: in the custard-apple they are oblong-lanceolate or lanceolate, commonly 10 to 15 cm. in length, acute and glabrate. The flowers are similar to those of the sugar-apple but produced over a longer period.

The fruit is usually heart-shaped or globose-ovate, about 500

grams in weight, With a range from 300 to 600 grams. It has a rather leathery skin, almost smooth although the areoles indicating the fused carpels are clearly marked by impressed lines. An unusual feature is the development of the fruit stem to a much greater diameter than that of twig which bears it. The custard-like flesh is cream-colored, granular near the skin, less sweet and less pleasantly flavored than that of the sugar-apple; in fact the custard-apple is usually considered uninteresting by connoisseurs. Yet custard-apples find a ready sale in many tropical markets. Numerous dark brown seeds, the size and shape of common beans, are imbedded in the flesh. There seem to be two seedling races, differing only in the color of the fruit: one is yellowish-green, the other reddish-yellow at maturity.

Propagation by budding and grafting is not difficult, but no sufficiently good seedlings have appeared to justify selection as varieties. Seeds germinate in 4 to 6 weeks and retain viability for a year if stored dry. The value of seedlings as vigorous rootstocks for better anonas has already been noted.

THEEILAMA

This species, Annona diversifolia, was called to the attention of tropical horticulturists about 1915, with the recommendation that it might well be termed "the cherimoya of the lowlands." It is native to semi-arid lowlands and foothills along the Pacific coast from southern Mexico to Nicaragua, where the climate is too warm for cherimoyas. It is somewhat handicapped by the large seeds and fact that the fruits show a tendency to split open upon approaching maturity, a defect which might be controlled by harvesting the fruits before they ripen on the tree. Although it is grown in dooryards here and there throught the region in which it is believed to be indigenous, it is abundant in only a few places: at Tapachula, in the State of Chiapas,

Mexico, where it is called papauce; around Relalhuleu, Guatemala, and in a few towns in El Salvador and Honduras, where it is commonly known as anona blanca. The name ilama is used in south-central Mexico.

Climatic requirements are similar to those of the sugar-apple, except that the tree does not tolerate quite so much cold and does not seem so well adapted to humid regions. Ilamas grow well on volcanic clay loams and sandy loams, in fact on all soils good for other annonas.

The tree may reach a height of 6 meters or a little more. It is upright in habit, often branching near the ground to form 3 or 4 main trunks. The leaves are much like those of the cherimoya except that they are glabrous on the under surface. The name diversifolia refers to a peculiarity of this species: at the base of twigs (especially flowering branchlets) are two small orbicular leaflets opposite each other, clasping the stem.

The flowers are much like those of the above-described annonas in size and shape; on some trees they are maroon colored, on others greenish-yellow with a tinge of red. The fruits resemble cherimoyas in shape but are often smaller, averaging 500 gms. in weight. They vary in color from pale green to magenta-pink, suggesting the possibility of two seedling races as in the custard-apple. The flesh is white in green-skinned fruits and rose-pink in the others, the former being considered a little sweeter than the latter. Like sugar-apples, ilamas have a thick, waxy, white bloom on the fruit surface. The season of maturity coincides with that of the sugar-apple. The fruit is much like the cherimoya in flavor and is popular in the markets of the few areas where it is abundant. Invariably it is eaten out of hand.

Trees are not easily grown from seeds. There is much variation among seedlings in productiveness, size, and quality of fruit; superior individuals should be selected and propagated by budding or veneer

grafting either on ilama or custard-apple stocks. Pest problems are likely to be the same as for the cherimoya.

THE SOURSOP

The historian, Gonzalo Fernandez de Oviedo, wrote in 1526 that this tree, for which he used the indigenous Carib name guanábano, was abundant in the West Indies and on the mainland. He goes on to say that "it is a beautiful tree and has long, wide, green leaves. It bears cones, or fruits that resemble them, as large as melons but long-ish in shape. On top the fruit has certain decorations that look like scales but are not, nor can they be removed. It is covered all over with a rind as thick as that of a melon. Inside it is filled with a white pulp that, although firm, is juicy and of a delicious taste that is somewhat sharp and pleasant."

This species, Annona muricata, is now cultivated in all tropical regions of the world. It does well in humid lowlands, but better in semi-arid regions. The least cold-resistant of all annonas, it is rarely seen in tropical America at elevations above 800 meters. In Spanish-speaking countries the common name is guanábana, sometimes shortened to guanába; in English-speaking countries it is called soursop, an unappetizing name for an excellent fruit.

The tree is evergreen, rather slender in habit, rarely over 8 m. in height. The leathery leaves are 10 to 12 cm. long, oblate to elliptic, glossy dark green in color, with curious tiny pits in the axils of the larger veins on the glabrous lower surface. The flowers are very unlike those of the annonas previously discussed, being larger, about 4 cm. broad, with inner petals nearly the same size as the outer ones. Each of the 6 petals is broadly triangular and yellowish-green in color; the 3 inner ones are thin and overlap each other while the 3 outer ones are thicker and valvate. The flowers are borne on new

shoots, but many arise cauliflorously on the main trunk and larger limbs.

The fruit is the largest of all the annonas, ranging in weight from 500 gms. to 1 or 2 kgs., fruits of 4 kilograms are not uncommon. The form is elongated cordate or oblong, largest at the stem end, and often misshapen, especially toward the apex, due to failure of unpollinated carpels to develop. The skin or outer covering is dark green, with fleshy spine about 1 cm. long from each of the fused carpels, recurved at the tip. The flesh is white, cottony in texture (which renders it unpopular for eating out of hand); the abundant juice is sub-acid, with about 10 to 12% of sugar and 1% or more of acid, making a pleasingly tart blend, with a distinctive aroma. Guanabanas are much used for refreshing drinks, sherbets, and ice cream flavoring; they can be preserved by freezing or may be canned. The famous champola of Cuba is prepared by putting the flesh through a sieve, then mixing the juice with milk, sugar, and cracked ice. There seems no reason why canned or frozen juice could not be exported to norther countries for use in various ways. As with other annonas, numerous, flattened, brown seeds are imbedded in the flesh.

The soil best suited to soursops is probably a good loam, but it has succeeded on sandy clays and light sands, though requiring plenty of fertilizer on the latter. Good drainage is essential. Unfortunately, the tree is not very productive, only a few good, large fruits being mature annually. Hand pollination may increase fruit setting when the proper pollinating insects are not active. Considerable variation in yields of seedlings has been noted, especially in Venezuela, and it seems likely that selection of heavy bearing trees and their propagation as varieties would greatly increased production. Propagation by veneer grafting is recommended.

Unfortunately, soursop fruits are attacked by the same insects as other annonas, and in addition the trees are sometimes bothered by red spiders, mealybugs, and lace bugs. Malathion controls the first two, and lindane the last.

SOME MINOR ANNONACEOUS FRUITS

In southern Mexico and Central America the soncoya (Annona purpurea) is occasionally seen in the markets. This is a large, round, pale green or brownish green fruit, covered with pyramidal protuberances which terminate in short hooks curved toward the stem. The carpels separate readily; each one contains an obovate brown seed about 2 cm. long. The flesh is bright orange in color, subacid in flavor and somewhat pungent. The tree is grown in dooryards, up to elevations of about 750 meters.

In parts of this same region, but at higher elevations (up to 1200 m. or a little more) Annona scleroderma, called poshe-té in northern Guatemala, occurs as a wild tree and the fruit is occasionally brought to market. It is roundish oblate in form, 7 or 8 cm. in diameter, or "shell" is nearly a centimeter thick, and harder than that of other annonas. People who are not familiar with this fruit often mistake it for the cherimoya, which it greatly resembles in flavor. When the tree is examined confusion becomes even greater, for it resembles the cherimoya closely, the main difference being that the leaves are small and acute at the apex. Annona testudinea of Honduras is closely related to this species, if not the same thing.

Of more interest than any of the above is the biribá of the Amazon basin. Botanically, this is not an annona, but the fruit so closely resembles a cherimoya in appearance and flavor that it may easily be mistaken for a member of that genus, from which it is differentiated mainly by the structure of the flower. The tree, Rollinia deliciosa,

has large oblong or elliptic leaves; the fruits, which are the size of small cherimoyas, are light green or greenish yellow, with the areoles distinctly outlined on the surface. The flesh is white or cream-colored, juicy, sweet, and pleasantly flavored. It seems probable that this tree may eventually attain the importance it deserves - that of a fine annonaceous fruit for tropical rain-forest regions.

THE CHERIMOYA, AND SOME OTHER ANNONAS

The horticultural species of the genus Annona, some of which produce very fine fruits indeed, are all natives of the American tropics. Mark Twain, who was regaled with cherimoyas on the island of Madeira, characterized them as "deliciousness itself." The sugar-apple is one of the most popular fruits in parts of Brazil and India. The guanábana or soursop (not a very prepossessing name) makes delectable sherbets, refreshing drinks, and ice creams. The little-known biribá of the Amazon (botanically not an Annona, but a very close relative) is considered a fine fruit by those privileged to have tasted it.

Despite all this, and of their having been known to horticulturists since the early days of the Conquest, annonas have not attained commercial importance except in a few regions. Some species are exacting in their climatic requirements. Most yield sparingly of their appetizing fruits. Cherimoyas, when grown in the tropical lowlands, are inferior in flavor - when any fruits at all are produced by the trees. This species comes from medium elevations in the Andes of southern Ecuador and northern Peru, and needs a cool, rather dry climate. The sugar-apple, on the other hand, likes the dry lowlands - it does not thrive at high elevations. The guanábana is a tree of low elevations. It grows and will produce good fruits - but not good crops, as a rule - in regions of high rainfall but does best where precipitation does not exceed 75 to 125 cm. annually, and there is a well-marked dry season.

It is in regard to productiveness that the annonaceous fruits have given horticulturists most trouble. This is especially true of the cherimoya. The flowers are protogynous, which means that the stigmas of the pistils are receptive - ready to be pollinated - before the anthers have opened and released their pollen. If the weather is

ot and dry, the stigmas are no longer receptive by the time pollen is available. Pollen must be brought by insects from another flower. If this is not done, the flower drops to the ground, unpollinated, and no fruit is produced.

Even when pollination is effected by insects, unless all of the pistils receive it the resulting fruits are imperfect. This is because annona fruits are syncarps, that is, they are formed by the fusion of numerous carpels (pistils) with the fleshy receptacle. Malformed cherimoya fruits are a familiar sight in the markets of tropical America. This is true also of guanábana fruits, but not so true of sugar-apples.

Wherever annonas are grown, horticulturists observe among seedlings an occasional tree which is more productive than others in the same region. It is assumed that this is not always the result of better pollination, but is a characteristic which may be perpetuated by vegetative propagation. However, little has been done as yet to demonstrate the possibilities which exist in this field. Perhaps seedling variation is not the only factor.

In the early years of this century P. J. Wester, working at Miami, Florida, showed that it is very easy to cross the cherimoya with the sugar-apple. He gave this hybrid the name <u>atemoya</u>, combining one of the common names of the sugar-apple, <u>ate</u> or <u>atis</u>, with the last half of the word cherimoya. Subsequently it was observed, in several parts of the world, that when cherimoyas and sugar-apples are planted in close proximity to each other they hybridize without the intervention of man, and atemoyas are the result. The cherimoyas is not a success in Israel. On the other hand, the sugar-apple thrives and produces good crops; the fruits found a ready sale in local markets, but they were difficult to handle, because the carpels cohere so loosely. Dr. Chanan Oppenheimer took advantage of the local occurence of natural hybrids to

select the best and recommend their commercial cultivation. The result is that small commercial plantings of this hybrid now exist in that part of the world.

THE CHERIMOYA

The cherimoya (Annona cherimola) was the best tree fruit (for dessert use) which the New World had to offer the Old. From its native home in the Andean valleys of southern Ecuador and northern Peru, it was carried northward to Mexico, where it was not previously known, perhaps by Spanish missionaries who travelled up and down the Pacific side of the Americas in the 16th century, taking the avocado and capulin cherry southward and the cherimoya northward. While it has not become a crop of great commercial importance anywhere, the cherimoya is well established on an orchard basis in Chile, Argentina, Queensland, and Southern Spain; and it a home garden fruit in many other parts of the world. Some years ago it was thought that California would become an important producer, but the cherimoya industry in that State has not prospered. In Mexico, Central America, and the highlands of northern South America, cherimoyas are seen mainly as dooryard trees, but from them considerable quantities of fruit reach local markets.

While the common name used in Guatemala is simply anona, everywhere else the name cherimoya has gone with the fruit; it comes from the aboriginal Quechua name in Peru, chirimuyu. This word means "cold seeds," apparently an allusion to the impression one gets from putting the seeds in his mouth.

Rather specialized climatic requirements have been an important factor in limiting cherimoya culture. As has been mentioned above, rainy tropical lowlands are altogether unsuitable; the tree likes the cool rather dry climate of tropical highlands or rather dry climate in the subtropics. But it is not quite as frost resistant as the orange.

The tree, which normally is deciduous or nearly so during the cooler months, may attain a height and spread of 6 to 8 m. The light green, rather soft leaves are 10 to 20 cm. long, ovate or ovate-lanceolate in form, rounded at the tips, and velvety on the lower surface. The leaves are twisted on their petioles, which results in their lying flat in the same plane.

The fragrant flowers are 2-3 cm. long, solitary or sometimes two or three together, on short nodding peduncles set in the axils of the leaves. The three exterior petals are oblong-linear, greenish outside and pale yellowish within, the three inner ones are minute and scale-like; they enclose the conical receptacle with numerous stamens around the base and numerous pistils around the upper part.

The fruits may be heart-shaped, conical, or oval; far too often the form is quite irregular because some pistils failed to be pollinated and did not develop. Mature fruits usually weigh from 300 or 400 grams to 1 kilogram, but may attain as much as 3 or even 4 kilograms. Within the thin, pale green skin is a creamy white, smooth flesh, melting in texture (sometimes likened to ice cream), subacid but with plenty of sweetness. The flavor has been compared to a combination of banana and pineapple, but this does not describe it adequately. Numerous dark brown seeds, the size of common beans, are scattered through the flesh, one for each pollinated pistil. Where climatic conditions are not entirely suitable - too warm - the flavor may be disappointing.

To a greater extent than other annonas, cherimoya fruits present a wide variety of forms, based upon the character of the surface, which is divided into well-defined spaces termed <u>areoles</u>, each representing a matured carpel. In the Standard Cyclopedia of Horticulture, W. E. Safford, who made a profound study of the genus Annona, published a botanical classification of cherimoya fruits, as follows: <u>forma impressa</u>,

with U-shaped areoles resembling finger-prints in wax; forma laevis, in which the surface is quite smooth; forma tuberculata, with wart-like tubercles near the apex of each areole; forma mamillata, the name of which adequately describes it; and forma umbonata, in which the surface is studded with conical protuberances. This classification is of interest as showing the range of surface characteristics, but horticulturists have never paid much attention to it when selecting seedlings for vegetative propagation. Safford considered that a certain degree of correlation existed between these forms and flavor and quality of fruit. It appears that the few named varieties which are grown today in Australia in California, in Spain and perhaps one or two other regions have been selected for quality more than any other factor, though size of fruit, appearance, and most of all productiveness, have sometimes been given consideration. The fact of the matter is, no well-organized work of cherimoya improvement has been carried out. Hand-pollination will increase production but commercially has not been found very satisfactory.

Cherimoyas are easily grown from seeds, which may be kept for a year if well-dried. In those regions where this fruit has become an orchard crop, seedling trees which were considered superior have been propagated vegetatively. This has usually been done on rootstocks of the same species, though it is thought in tropical America that Annona reticulata might be preferable in some places because of its resistance to drought and poor soils. Seedlings to be budded should be 1 to 1.5 cms. in diameter at the base, and buds should be cut larger than for citrus.

The development of veneer (sometimes called side-veneer) grafting has brought about a revolution in the propagation of many tropical fruit trees. In Florida and in tropical America veneer grafting has

proved to be more reliable than shield-budding. This has been true of avocados, mangos, and several other fruit trees, including the annonas. Though shield budding may continue to be preferred in some regions, for some fruits, veneer grafting is gaining ground and should be borne in mind.

Almost any well drained soil of good structure is satisfactory for cherimoyas, but it is generally believed that a high lime content is unfavorable. Still more important, however, is perfect drainage. Too much irrigation on soils retentive of moisture is dangerous. Sandy loams are to be preferred for this reason.

Trees should be spaced 8 m. apart, even 10 if on good soil. Very little pruning is required, beyond the elimination of the small branchlets which die off. It has been observed in a few instances that trees which are severely pruned produce more fruit in succeeding years, but pruning for fruit is not an established practice.

There is little information available regarding fertilizer programs suitable for this tree. In most parts of tropical America where cherimoyas are grown, they are dooryard trees which receive no cultural attention. In a few regions such as the <u>laborea</u> in Atlixco, state of Puebla, Mexico, where cherimoyas are cultivated in mixed plantings with citrus and avocados, they receive the same treatment as these do, which includes irrigation on a regular cycle. In the valley of Almuñecar, on the Mediterranean coast of Spain, there are probably more acres planted to cherimoyas than in any region of similar size in all the world. Since climatic conditions in Almunecar favor the production of large crops of fruit, not only are the orchards irrigated, but the surface is kept free of weeds in good tilth at all times.

Cherimoya trees are not commonly attacked by serious pests, either insects or diseases, but this is unfortunately not true of the fruits. In many countries it is rare to find a cherimoya in the market which

is not infested with insect larvae. These destroy the seeds and render the flesh unattractive. The chalcid Bephrata cubensis has given much trouble in Cuba, and probably elsewhere; the moth Stenoma annonella is troublesome in Central America. A residual spray like DDT every 2 weeks while the fruits are very small will control these pests, but fruits more than half-grown must not be sprayed. Another common pest is anthracnose, a fungus disease which causes ripening fruits to become hard and dry, or "mummified." It is more serious in humid than in semi-arid climates. Copper or zineb sprays weekly during fruit development will control it, but at considerable expense. Scale insects occasionally infest cherimoya trees, but are easily controlled by standard scalecides. Mature, unripe cherimoyas will carry for a week to market, or can be laid aside at home to ripen in a week or so. Ripening should take place at 18 degrees C. or slightly higher.

THE SUGAR-APPLE

Of all the annonas, the sugar-apple (A. squamosa) is the most widely grown throughout the tropics of the world. It is native to the tropical lowlands of America and thrives in hot climates where the cherimoya does not succeed. It is cultivated on a small commercial scale in Egypt, Israel, and Java, but it is in India that the sugar-apple is most esteemed. Hundreds of thousands of sugar-apple trees grow in the states of Andhra and Madras, and many thousands more in gardens in Assam. It is a favorite in large parts of interior Brazil, and is abundant throughout the West Indies and Central America.

This species is much less fortunate than the cherimoya as regards common names it has too many. Usually the term sugar-apple is used in English-speaking countries, but in India the name in English is custard-apple, which confuses it with A. reticulata; in some former British colonies the name sweetsop is used; while in most of Spanish-

Speaking America it is anon or anona, though in Brazil it is fructa do conde and pinha. East Indian esteem for the sugar-apple is shown by two vernacular names, sharifa (meaning "noble") and sitaphal (fruit of the god Sita).

While successfully grown in humid lowlands, the sugar-apple delights in a hot and rather dry climate, from sea level up to 800 or 1000 meters. It is a little less tolerant of frost than the cherimoya but more so than the custard-apple and soursop. In tropical America poor, stony soil is sometimes covered with escaped, seedling sugar-apple trees, but of course, they grow and fruit better on good loams. Good drainage is essential.

Sugar-apple trees are small, from 4 to a maximum of about 6 meters, in height. During dry seasons they are deciduous. The leaves are narrow and pointed, 7 to 10 cm. long, pale green above and gray-green below, glabrous when mature. Flowers are very similar to those of the cherimoya and are borne in the same manner. The fruits differ from those of other annonas in that the carpels composing the fruit or syncarp are not fused on their outer surfaces into a continuous rind. Each carpel remains distinct, and when the fruit ripens they are easily pulled apart. The fruits are typically heart-shaped, 5 to 10 cm. across, with yellowish-green surface covered with a bluish-white (sometimes purplish), waxy bloom. Usually the weight is less than 500 grams. The soft, custard-like flesh, which is somewhat granular in texture and very sweet (15 to 20% sugar), contains brown seeds smaller than those of the cherimoya, one to each carpel. Sugar-apples are eaten out of hand, or used to prepare sherbets.

Pollination problems do not seem to be as troublesome as they are with the cherimoya. There are reports that hand-pollination has increased production in some places, though it has not been carried out

extensively and reports are conflicting. It takes three or four months for the fertilized flowers to develop into mature fruits.

As has been mentioned, this fruit is not well adapted for shipment to distant markets, nor has it a long "shelf life." The carpels cohere so loosely, especially as the fruit softens, that careful handling is required. After harvesting, it is difficult to keep sugar-apples in good condition more than four or five days.

The culture of this tree is so simple that horticultural attention has been given it. Most sugar-apple trees are seedlings, which come into bearing at the age of 3 or 4 years, but are short-lived and usually die when 20 to 30 years old. Pruning old branches to leave younger, more vigorous ones may prolong productiveness. Trees planted in orchard form should be spaced 4 to 6 m. apart. On poor soils fertilizers will, of course, encourage growth and yield. While the sugar-apple withstands drought remarkably well, in dry climates irrigation results in better growth and more fruit.

The horticultural future of the sugar-apple lies in the selection of superior seedlings and their propagation by vegetative means. Studies by horticulturists of the vast seedling populations in India have shown as much variation in size, shape, and surface characters of sugar-apples as has long been known in cherimoyas, and an even greater range in fruit color. Occasionally they are almost purple. Seedlings in India sometimes bear fruits weighing almost a kilogram. A seedless form was found in Cuba some years ago, but the fruits were too small to be of value. Budding and veneer grafting are easily done on sugar-apples, using as stocks seedlings of this species or those of the custard-apple.

In general, the same pests which attack the cherimoya can be expected on sugar-apples. Little attention has been given this subject in tropical America.

THE CUSTARD-APPLE

It would be well if the name custard-apple could universally be limited to this species, Annona reticulata, thereby protecting the reputations of two much better fruits, the cherimoya and the sugar-apple. Anona is the name used in Mexico and Central America; in Puerto Rico it is called corazon; while in Cuba and some lowland areas of South America, the name cherimoya is used, which has led numerous horticulturists to think that the true cherimoya could be grown in humid, tropical lowlands. The rather unappetizing name bullocks heart is often seen in the literature.

While the custard-apple is inferior to the sugar-apple in quality, as a fruit tree it has certain virtues. It is a really handsome ornamental which adds beauty and grateful shade to many a tropical dooryard. It is more vigorous than other annonas, and more tolerant of unfavorable environmental conditions--wet as well as dry climates and poor, stony soils. It is this ability to thive on poor soils which makes the custard-apple a promising stock for some of its relatives.

Like the sugar-apple, the custard-apple is native to the lowlands of tropical America. It has been introduced into all tropical and warm subtropcial regions of the world, but nowhere has it become an important commercial fruit. It is a little less tolerant of cold than the sugar-apple, but in general thrives in the same regions.

Custard-apples attain a height of 6 to 10 meters, with well rounded and handsome heads of foliage. There is no reason for confusing this species with the cherimoya if one compares the leaves of the two: in the custard-apple they are oblong-lanceolate or lanceolate, commonly 10 to 15 cm. in length, acute and glabrate. The flowers are similar to those of the sugar-apple but produced over a longer period.

The fruit is usually heart-shaped or globose-ovate, about 500

grams in weight, with a range from 300 to 600 grams. It has a rather leathery skin, almost smooth although the areoles indicating the fused carpels are clearly marked by impressed lines. An unusual feature is the development of the fruit stem to a much greater diameter than that of twig which bears it. The custard-like flesh is cream-colored, granular near the skin, less sweet and less pleasantly flavored than that of the sugar-apple; in fact the custard-apple is usually considered uninteresting by connoisseurs. Yet custard-apples find a ready sale in many tropical markets. Numerous dark brown seeds, the size and shape of common beans, are imbedded in the flesh. There seem to be two seedling races, differing only in the color of the fruit: one is yellowish-green, the other reddish-yellow at maturity.

Propagation by budding and grafting is not difficult, but no sufficiently good seedlings have appeared to justify selection as varieties. Seeds germinate in 4 to 6 weeks and retain viability for a year if stored dry. The value of seedlings as vigorous rootstocks for better anonas has already been noted.

THEEILAMA

This species, Annona diversifolia, was called to the attention of tropical horticulturists about 1915, with the recommendation that it might well be termed "the cherimoya of the lowlands." It is native to semi-arid lowlands and foothills along the Pacific coast from southern Mexico to Nicaragua, where the climate is too warm for cherimoyas. It is somewhat handicapped by the large seeds and fact that the fruits show a tendency to split open upon approaching maturity, a defect which might be controlled by harvesting the fruits before they ripen on the tree. Although it is grown in dooryards here and there throught the region in which it is believed to be indigenous, it is abundant in only a few places: at Tapachula, in the State of Chiapas,

Mexico, where it is called papauce; around Relalhuleu, Guatemala, and in a few towns in El Salvador and Honduras, where it is commonly known as anona blanca. The name ilama is used in south-central Mexico.

Climatic requirements are similar to those of the sugar-apple, except that the tree does not tolerate quite so much cold and does not seem so well adapted to humid regions. Ilamas grow well on volcanic clay loams and sandy loams, in fact on all soils good for other annonas.

The tree may reach a height of 6 meters or a little more. It is upright in habit, often branching near the ground to form 3 or 4 main trunks. The leaves are much like those of the cherimoya except that they are glabrous on the under surface. The name diversifolia refers to a peculiarity of this species: at the base of twigs (especially flowering branchlets) are two small orbicular leaflets opposite each other, clasping the stem.

The flowers are much like those of the above-described annonas in size and shape; on some trees they are maroon colored, on others greenish-yellow with a tinge of red. The fruits resemble cherimoyas in shape but are often smaller, averaging 500 gms. in weight. They vary in color from pale green to magenta-pink, suggesting the possibility of two seedling races as in the custard-apple. The flesh is white in green-skinned fruits and rose-pink in the others, the former being considered a little sweeter than the latter. Like sugar-apples, ilamas have a thick, waxy, white bloom on the fruit surface. The season of maturity coincides with that of the sugar-apple. The fruit is much like the cherimoya in flavor and is popular in the markets of the few areas where it is abundant. Invariably it is eaten out of hand.

Trees are not easily grown from seeds. There is much variation among seedlings in productiveness, size, and quality of fruit; superior individuals should be selected and propagated by budding or veneer

grafting either on ilama or custard-apple stocks. Pest problems are likely to be the same as for the cherimoya.

THE SOURSOP

The historian, Gonzalo Fernandez de Oviedo, wrote in 1526 that this tree, for which he used the indigenous Carib name guanábano, was abundant in the West Indies and on the mainland. He goes on to say that "it is a beautiful tree and has long, wide, green leaves. It bears cones, or fruits that resemble them, as large as melons but longish in shape. On top the fruit has certain decorations that look like scales but are not, nor can they be removed. It is covered all over with a rind as thick as that of a melon. Inside it is filled with a white pulp that, although firm, is juicy and of a delicious taste that is somewhat sharp and pleasant."

This species, Annona muricata, is now cultivated in all tropical regions of the world. It does well in humid lowlands, but better in semi-arid regions. The least cold-resistant of all annonas, it is rarely seen in tropical America at elevations above 800 meters. In Spanish-speaking countries the common name is guanábana, sometimes shortened to guanaba; in English-speaking countries it is called soursop, an unappetizing name for an excellent fruit.

The tree is evergreen, rather slender in habit, rarely over 8 m. in height. The leathery leaves are 10 to 12 cm. long, oblate to elliptic, glossy dark green in color, with curious tiny pits in the axils of the larger veins on the glabrous lower surface. The flowers are very unlike those of the annonas previously discussed, being larger, about 4 cm. broad, with inner petals nearly the same size as the outer ones. Each of the 6 petals is broadly triangular and yellowish-green in color; the 3 inner ones are thin and overlap each other while the 3 outer ones are thicker and valvate. The flowers are borne on new

shoots, but many arise cauliflorously on the main trunk and larger limbs.

The fruit is the largest of all the annonas, ranging in weight from 500 gms. to 1 or 2 kgs., fruits of 4 kilograms are not uncommon. The form is elongated cordate or oblong, largest at the stem end, and often misshapen, especially toward the apex, due to failure of unpollinated carpels to develop. The skin or outer covering is dark green, with fleshy spine about 1 cm. long from each of the fused carpels, recurved at the tip. The flesh is white, cottony in texture (which renders it unpopular for eating out of hand); the abundant juice is sub-acid, with about 10 to 12% of sugar and 1% or more of acid, making a pleasingly tart blend, with a distinctive aroma. Guanabanas are much used for refreshing drinks, sherbets, and ice cream flavoring; they can be preserved by freezing or may be canned. The famous champola of Cuba is prepared by putting the flesh through a sieve, then mixing the juice with milk, sugar, and cracked ice. There seems no reason why canned or frozen juice could not be exported to norther countries for use in various ways. As with other annonas, numerous, flattened, brown seeds are imbedded in the flesh.

The soil best suited to soursops is probably a good loam, but it has succeeded on sandy clays and light sands, though requiring plenty of fertilizer on the latter. Good drainage is essential. Unfortunately, the tree is not very productive, only a few good, large fruits being mature annually. Hand pollination may increase fruit setting when the proper pollinating insects are not active. Considerable variation in yields of seedlings has been noted, especially in Venezuela, and it seems likely that selection of heavy bearing trees and their propagation as varieties would greatly increased production. Propagation by veneer grafting is recommended.

Unfortunately, soursop fruits are attacked by the same insects as other annonas, and in addition the trees are sometimes bothered by red spiders, mealybugs, and lace bugs. Malathion controls the first two, and lindane the last.

SOME MINOR ANNONACEOUS FRUITS

In southern Mexico and Central America the soncoya (Annona purpurea) is occasionally seen in the markets. This is a large, round, pale green or brownish green fruit, covered with pyramidal protuberances which terminate in short hooks curved toward the stem. The carpels separate readily; each one contains an obovate brown seed about 2 cm. long. The flesh is bright orange in color, subacid in flavor and somewhat pungent. The tree is grown in dooryards, up to elevations of about 750 meters.

In parts of this same region, but at higher elevations (up to 1200 m. or a little more) Annona scleroderma, called poshe-te in northern Guatemala, occurs as a wild tree and the fruit is occasionally brought to market. It is roundish oblate in form, 7 or 8 cm. in diameter, or "shell" is nearly a centimeter thick, and harder than that of other annonas. People who are not familiar with this fruit often mistake it for the cherimoya, which it greatly resembles in flavor. When the tree is examined confusion becomes even greater, for it resembles the cherimoya closely, the main difference being that the leaves are small and acute at the apex. Annona testudinea of Honduras is closely related to this species, if not the same thing.

Of more interest than any of the above is the biriba of the Amazon basin. Botanically, this is not an annona, but the fruit so closely resembles a cherimoya in appearance and flavor that it may easily be mistaken for a member of that genus, from which it is differentiated mainly by the structure of the flower. The tree, Rollinia deliciosa,

has large oblong or elliptic leaves; the fruits, which are the size of small cherimoyas, are light green or greenish yellow, with the areoles distinctly outlined on the surface. The flesh is white or cream-colored, juicy, sweet, and pleasantly flavored. It seems probable that this tree may eventually attain the importance it deserves - that of a fine annonaceous fruit for tropical rain-forest regions.

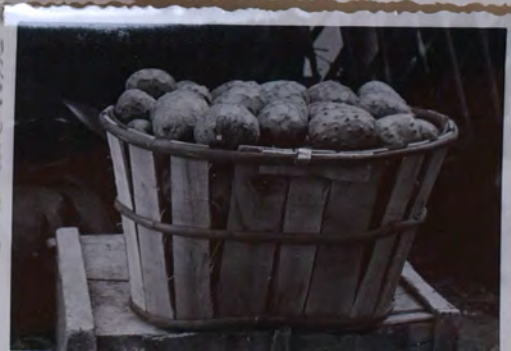
Cherimoyas are easily grown from seeds, which can be stored for a year if ~~well~~ thoroughly dried; usually they germinate in 30 to 40 days. In those countries where cherimoyas have become an orchard crop, seedling trees which produced fruit of superior quality, ~~or were well above the average in productiveness,~~ have been propagated as varieties by budding or grafting. Seedling cherimoyas or custard-apples (Annona reticulata) may serve as stocks. ~~There are appreciable differences in flavor among cherimoya seedling trees grown in a given area of favorable climate, as well as differences in yield, and it is well worth while to search for these.~~

Cherimoya trees will grow in almost any type of soil if it is well drained, but a high lime content is unfavorable. Spacing of trees can vary from 20 to 30 ft. apart, depending on soil fertility. Very little pruning is practiced, unless the mistake has been made of planting too closely; light heading-back will then prevent crowding. ~~A fertilizer program suitable for oranges will be satisfactory if heavy crops are borne.~~

A Few Minor Annonaceous Fruits

In southern Mexico and Central America, the soncoya (Annona purpurea) is sometimes offered in local markets. This is a very large, round, pale green or yellowish-green fruit, the exterior of which is covered with short, blunt, soft spines. The flesh is of attractive orange color, soft, subacid in flavor, and somewhat pungent. The tree is occasionally seen in dooryards of the lowlands.

In parts of this same region Annona scleroderma, the posh-te, occurs as a wild tree and the fruits appear occasionally in the markets. They are round, about 3 in. in diameter, characterized by a rind or "shell" nearly ¼ in. thick. People who are not familiar with this fruit, and see it in the markets, sometimes take it to



Fecha 22 FEB. 1967 No F13

Nombre: Dr Popenoe

Dirección:

Para entregar el día Sábado

FOTO

SOLIS

PORTAL DEL COMERCIO
FRENTE AL PARQUE CENTRAL
SANTIAGO DE LOS CABALLEROS
ANTIGUA G.

Trabajo Garantizado

Imp. Aznitia

El chirimoyo en Chile :

La polinización del chirimoyo en Chile se produce en forma natural , si no en forma tan abundante como en España. Se han hecho ensayos con una polinización artificial por mano, consiguiendo una mayór producción de frutas completamente desarolladas y uniformes, pero se ha visto que esta mayór producción a lo largo agota el arbol y posiblemente no compensa la intervención manual un tanto costosa. El porcentaje de frutas deformes es considerable, pero como el peso termino medio por fruta es bastante mayór que en España en las variedades seleccionadas (Bronceada, Concha, Piña) y el precio en el mercado es por kilo sin considerar la forma, hoy en dia nadie se esfuerza en producir frutas polinizadas por mano.

La producción media por arbol en buenas condiciones y de edad en plena producción (arriba de 1o/12 años) puede estimarse en unos 8o - 12o kgs. peso término medio en las variedades nombradas en unos 6oo grs. no siendo raro un peso de mas de 2 y 2 1/2 kgs.por fruta, que desde luego en las variedades arriba citadas tiene pocas semillas comparadas estas con la fruta de España.

La mayór diferencia entre el cultivo del chirimoyo en España y en Chile consiste en que en España la fruta alcanza a madurar en Otoño, o sea en los meses de octubre hasta diciembre. En cambio en Chile el chirimoyo produce sus frutas en la primavera, pasado el tiempo relativamente frio y lluvioso de invierno, q.d. en los meses de septiembre hasta noviembre. Este hecho repercute favorablemente en el precio del mercado que aparte de fruta cítrica y nisperos, no ofrece otra fruta. Es así que en los últimos años se han pagado un precio t.m. por kilo de mas de un dólar en moneda chilena por fruta de primera. Se entiende así que esta fruta es de todo lujo , ya que la producción es bastante limitada debido a la escasa extención de terrenos aptos para este cultivo en las muy pocas zonas que reunen condiciones de clima (exención de heladas, gran porcentaje de humedad del ambiente o cercania relativa al mar y neblimas que faciliten la polinización natural en los meses de octubre y noviembre). Practicamente la zona de cultivo del chirimoyo comprende las localidades de La Cruz/Quillota y mucho mas al norte en La Ligua. En total la superficie ocupada por chirimoyos no puede superar mucho las 2oo has. y cada año de va disminuiendo a favór del cultivo del avocado que no requiere tanta inversión y trabajo que garantiza mejores rentas, ya que su demanda es grande y su consumo al alcance tambien de la gente menos adinerada e incluso trabajadores en las ciudades y centros industrializados.

Literatura: "La polinización artificial del chirimoyo" por D.Carlos Schwarzenberg. ing.agr. Memoria Univ.de Chile.

QUALITY COURTS

50 ROOMS

TOWN MOTEL

FRANKLIN, N. C.

MR. and MRS. LEE WOOD, Operators

AAA

PHONE: 4-4451

Monday, Oct. 3, 1966

Dear Uncle Wilson,

I have completed the experiment on boiling guava seed. The results are as follow - fresh untreated seed germinated in 3 weeks - seeds boiled for 5 minutes, didn't germinate atall.

Now lets go into the annonas —

At principio on Pg 1, line 19 you say the guanábana likes it low and wet - I'll agree that guanábana can't take quite as much drouth as squamosa, but I still think it likes a dry climate - as with other annonas, anthracnose rots the young fruit in wet weather. It yields much better where the rainfal is only 30 - 50 inches. for ejemplo - in Puerto Rico, all most all the guanábana production is on South coast - in Venezuela the good production was in the drier areas.

On page 6 - pests of Cherimoya - the ambrosia beetles can be very serious in Fla - especially in the nursery where the young plants are killed before you know it. I think there is more than one species involved. You also ought to mention the rust fungus - Phakopsora cherimoliae (Sagh.) Cumm. which can defoliate the trees in summer. This thing has knocked most of the leaves off of my African Pride Atemoya in the last month or so. I don't know how serious this is elsewhere.

On page 8 line 14 + 15 you say sugar apples are particularly appreciated, for some reason or other, by people who live in hot dry regions. Then you say Perhaps because sugar apples are more abundant in such regions! This seems like poor reasoning and a poor statement to me. I would say they are appreciated in some such regions because they will grow there and other fruits won't and ain't obtainable. This is the case in some of the Bahamas - the only fruits that will grow are dillies, mononcillo, sugar apple, lime + maybe Ties. Thus the sugar apples have little or no competition in their season.

OVER

On page 11 - names of ilama - it was my impression in El Salvador that the white fleshed green skinned ilamas were called anona llanera, and that the purple fleshed + or skinned ones were called anona morada.

Seymour Youngbans - of the Rare Fruit Council got a number of good ilamas off of his tree this year. It is the grafted Emery variety which I gave him. Unfortunately I didn't get a chance to taste them but Bill Whitman did and both of them assured me that they were of excellent quality and ripened perfectly. Unfortunately some of the crop did have the dry rot which I understand is caused by anthracnose. I assume that this was due to the heavy rains we had this year in May + June. Nevertheless, good ilamas can be produced in Dade Co. in spite of the fact that fruit from a seedling tree or 2 from the Subtropical Experiment Station didn't produce good fruit.

Pg. 12 - I saw an ilama tree growing well in the orchard in Maracay, Venezuela where the soil was very heavy - what information do you have regarding their adaptability to stiff clays? - Why say its questionable - if the clay is very stiff, nothing will grow on it.

also pg 12 - last P- Trees are difficult to grow from seed - I've planted hundreds of seeds and none germinated. Finally, Dr Campbell + I found that treating the seed with a dilute solution of gibberellic acid would stimulate germination and that's how I got all of my seedlings. We are going to publish on this soon.

On propagation of the annonas - I have found it much easier to side veneer graft them than to shield bud. On pg 14 you say that shield budding granadana presents no problem. This is not true. There is the problem of getting blind eyes - of the proper time of year and diameter of wood. Actually this statement sounds like it was written by someone who never tried to shield bud an annona and I don't think such statement should be in the manuscript.

On pg 15 you say that A. montana resembles granadana in flavor - not so any that I have tried - They are very resinous and unpalatable. I agree with you on Biriba - it is a good fruit - will stand more cold than

Please pardon delay in letter – it was interrupted by Inez

Oct 5, 1966

Soursop. It also requires higher rainfall if our Dade Co. experience is valid. It may be the best of the annonaceous fruits for a hot humid climate. Unfortunately, in common with the annonas it doesn't stand much high wind. Perhaps this aspect of the tribe should be brought out in the chapter. Our Dade Co. Biriba's have been greenish in color rather than the cream yellow that you describe.

In summation, I think the chapter is weak on propagation – the side-veneer method is not mentioned and this is the only method that some of us can use successfully with anona. You ought to mention the purple sugar apples – They have anthocyanin pigments in the stem as well as the fruit. The Indians say that this comes true to seed but I haven't had a chance to test it yet – maybe you have to boil the seeds.

Your manual has been a standard reference on tropical fruits for 45 years – this new book should be, to span the next 50 years, or so that your writings will span a full century as the authoritative source of info on tropical fruits. With this in mind, it seems to me that you can't afford to use the English system of weights & measures. Even J. J. Ochse used the metric system. Incidentally J J's book has been translated into Spanish and printed in Mexico – It is an excellent job in my opinion, but doesn't improve the text, of course.

Will you have a chapter in your book of fruits recommended for different climatic situations – such as a list that withstands high pH, high winds, drouth, heavy rainfall, wet soils etc? or do you think the reader should get this out of the individual chapters and descriptions?

over

Joey didn't do as much damage - there's lots of leaf burn on the trees from salt but only a few trees blew over. None of my annuals was hurt.

Send more chapters!

John

Almuñécar octubre 18, 1966

Dr.Wilson Popenoe
1722 N W 2nd Avenue
Gainesville, Fla.

Mi querido Don Wilson:

Aquí tengo su carta del 15 Sept.ppdº. a la que no he correspondido antes esperando poder enviarle las fotos "chirimoyescas". Pero el asunto se dilata, y prefiero ponerle estas líneas incluyéndole el breve informe de Don Roger sobre el chirimoyo en Chile, que le envía juntamente con sus más expresivos saludos. Sigue todavía con nosotros, hasta Diciembre, en que regresa nuevamente a Chile.

No conservaba los clichés de las fotos hechas en 1958 en nuestros chirimoyos. Las fotos las hizo entonces un profesional local, y esos negativos han desaparecido. Entonces, como nosotros no tenemos árboles de chirimoyo en el Rancho (pero es que ni uno solo..!) le encargué al mismo artista, que aún vive pero un poquito más gordo y más viejo que entonces..!, que me hiciese nuevas fotos en cualquier árbol que tuviese una llamativa cosecha. Y ya conoce Vd el percal de estos excelentes indígenas, que toman las cosas con excesiva calma, dándonos una buena lección de conducta a todos aquellos que tenemos la sangre viva, y pretendemos hacer todas las cosas al mismo tiempo.. Total, que las fotos no están hechas, y que en último caso lo que voy a hacer es que Don Roger tire unas cuantas placas mañana o pasado. Cuente Vd con las fotos en cuestión en brevísimo plazo.

Los arbolitos traidos por Vd van muy bien. Especialmente los dos guayabos. Pero el mango también está bonito, lo mismo que la sapodilla cuyo fruto espero alcanzar edad suficiente -con permiso de los dioses..!- para probarlo. El lychee no es que crezca con inusitado vigor, pero es el ejemplar más prometedor que ha crecido en el Rancho, hasta la fecha. Lleva una mezcla de tierra idónea, enriquecida con "estiércol bacteriológico", etc. Me temo sin embargo que no lleguemos a pagar nuestros impuestos con los ingresos que nos proporcione "par la suite"...!

En Chile no existe el lychee, según dice Don Roger. Por lo menos él no los tiene en sus fincas.

No he recibido la visita de Mr.Beasley. Paso con alguna frecuencia por el Rincón de la Victoria, para ir a Málaga, y con gusto me hubiese detenido para saludar a dicho señor, simplemente por el hecho de ser amigo de Vd. Pero sin saber su dirección...

Gran cosecha de mangos este año. Y excelente fruto, de tamaño regularcito (250/300 grms). Dª Eva se ha deleitado con ellos, y hoy mismo le he entregado los dos últimos. Los cuatro arbolitos existentes no es que crezcan mucho, pero a fuerza de cuidados van adelante. Fructificación muy fácil, al parecer, y hay que quitarles fruto. Pero las hojas viejas se secan por los bordes y las puntas, y el árbol no se encuentra muy a gusto. Eso sí, las semillas las siembro, y las plantitas en maceta me las pagan muy caras...

Le dirijo la carta a Fla. sin estar muy seguro de que se encuentre Vd por aquellas tierras. Pero espero se la retrasmitan, caso de estar fuera.

Le ruego quede a la espera de mi carta con las fotos.
Suyo afmº

P.D.- Rebuscando, encuentro unas fotos hechas para el artículo para el Y.B. Se las incluyo. Pero le enviaré las prometidas.

ORGANIZED IN 1915
CALIFORNIA AVOCADO SOCIETY
P.O. Box 4606 • INGLEWOOD, CALIF. 90302
Telephone (213) 673-0939

August 13, 1970

Mr. Wilson Popenoe
Calle de la Nobleza Num.2
Antigua, Guatemala
C.A.

Dear Mr. Popenoe:

The Sub-Tropical Fruits Committee of the California Avocado Society Board of Directors has decided to devote a section of its 1970-71 yearbook to the Cherimaya. We would be indeed gratified and highly honored if you would contribute an article for this section.

Mr. Walter Beck and Mr. Elwood Trask, of that committee, commented to me that, while you were eminently well qualified to discuss any aspect of the Cherimaya, it would be particularly interesting to learn of Cherimayas in Spain.

Can we count on you to accept? We are striving for a November first deadline.

Sincerely,

James L. Todd
Exec. Sec. - Treasurer
California Avocado Society

jt:st

Antigua, Guatemala 26 Sept 1970

Mr James L. Todd
California Avocado Society
Inglewood, California.

Dear Mr Todd:

On arriving here from Madrid a few days ago I found your letter of 13th August. What a coincidence! Two weeks ago I was in Almuñecar, probably the greatest center of cherimoya culture in the world, and tho I didnt learn much that I didnt learn when Mrs Popenoe and I spent most of 1958 at the Rancho California, I did have a good look at the cherimoya orchards and therefore will be glad to contribute a short article as requested in your letter of 13 August. I will meet what my Guatemalan secretary at Escuela Agricola Panamericana calls the "death line" of 1 November.

You will have other papers from men better qualified to discuss cherimoya culture in California, but I would like to talk a bit about the general subject of climatic adaptation and productiveness, based on observations here in tropical America and in Spain. The Lord may have created a better climate for cherimoyas than that of Almuñecar, but I dont think the Lord ever has.

Incidentally, the man with whom I worked at Almuñecar in 1958, helping get the avocados on their feet, is getting $1.50 U.S. per kilo for Hass fruits. When I arrived and asked him what varieties he is now growing, he said three; Hass, Anaheim, and more Hass. He only has about one hundred Anaheims. His neighbors are going in for Fuerte more than anything else. Isnt it interesting? The avocado world based on Fuerte and Hass.

Sincerely,

Wilson Popenoe

.11

C

Antigua, Guatemala, 22 Oct 1970

Mr. James L. Todd, Exec. Sec.-Treas.,
California Avocado Society
P O Box 4606 Inglewood, California.

Dear Mr. Todd:

Referring to your letter of 16 August, I have pleasure in handing you herewith a paper on "The Cherimoya", together with two photographs. I trust this will reach you before the November first deadline.

Sincerely,

Wilson Popenoe
Director Emeritus

UNIVERSITY OF CALIFORNIA, LOS ANGELES

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LOS ANGELES, CALIFORNIA 90024

November 3, 1970

Dr. Wilson Popenoe
Casa Popenoe
Antigua, Guatemala

Dear Wilson:

Indeed it is good to have your recent letter and the reprint. Our thoughts drift to Central America on many occasions when we wonder if life is still pleasant somewhere on this planet. It is sometimes difficult to find a reasonable answer to some of the problems in Southern California. There is so much destruction of the environment and very little sympathy for mother nature. An attitude of laughter at the situation or "if they (animals and plants) can't take it, they will have to disappear". This latter was stated by a colleague of mine while discussing the effects of DDT on the failure of reproduction in sea birds and possibly in other sea animals. Many of us also would want to know the ultimate effects of the potent chemicals on human genetics and physiology. I trust you are not faced with the seriousness of the problem yet and that some new approach to insect control can be developed or utilized before the beautiful tropical flora and fauna are injured beyond repair.

Back to the topic at hand -- I look forward to your account of the cherimoya in Spain. I have drawn up a very brief statement of some observations made in cherimoya in South Africa and have discussed hand pollination in general. You mention the well formed fruit found in the market. These would be selected without doubt. Have you any idea of the total number of fruits which might develop on the trees and the percentage of well formed fruits? I would suggest the pollination problem is highly variable in its degrees of expression.

I am convinced that hand pollination will improve fruit quantity and quality (size and form) under most circumstances. Indeed I would like to have an opportunity to investigate this problem in Spain sometime or in Central America too. I feel certain a beneficial response could be demonstrated with hand pollination. I believe the results of hormone treatment, as investgated in Israel, are not too promising or of practical application at the moment.

I wish we had enough materials to do some work of this sort. You may realize I am almost restricted to laboratory work, which I enjoy in part. Fortunately, I am able to get into the field on occasion for a look-see but not for extensive experimental studies.

I have located some of the few old cherimoya trees in the Will Rogers State Park and am induced by the preparation of the paper to plan some experimental procedures for next season to answer some of the questions which have bothered me throughout the years. I have an idea that some sort of vibrator or shaker might be developed to apply to a limb carrying flowers to cause a mechanical transfer of pollen by gravity from the stamens to the stigmatic surface of the inverted flower. Possibly the premature shedding of pollen could be induced by blowing dry air over the flowers. My limited trials with growth hormone application have been highly variable and not promising.

I always try to have a plan for the summer in Central America. Last summer it was a trip to Costa Rica but a series of events terminated the trip in Mexico City so we had to return from that point. We are talking again about next summer so possibly I may see you then if all is well. The situation at the University is not the brightest. Budgets have been hard hit. The general economic condition probably is as well known to you as to me. Regardless, travel by car is usually within my budget. My major limitation is time and coordination with that of my family as we like to travel together.

I am sorry to report that Dr. W. H. Chandler died yesterday in Berkeley. The news just arrived. I need not indicate more than "we have lost a real friend in several fields of endeavor".

Ira J. Condit and J. Eliot Coit are in fairly good health and active in writing and receiving visitors. I see Ralph Cornell on occasion as he strolls around the campus contemplating the addition of new specimens of lovely trees. I admire his selection and taste in this respect as he maintains an informal botanical graden campus wide.

Indeed I hope that all is well for you and that our paths may cross soon.

Very sincerely yours,

C. A. Schroeder
Professor of Botany

CAS:ch

Antigua, Guatemala 6 November 1970

Dr C A Schroeder
Dept of Botanical Sciences
University of California at Los Angeles 90024.

Dear Art:

Your highly interesting letter of the 3rd November has got me all steamed up about this cherimoya business, but before jumping into it I want to thank you for giving me the news of Dr Chandler's death. I had heard nothing about him in a year or more. Knowles used to keep me informed. Those of us who are working with temperatezzone fruits down here in the tropics owe Dr Chandler's writings a very great deal. He really laid the groundwork for what we have been able to do, - or shall be able to do.

I am enclosing you my only copy of the paper I sent Jim Todd for the Yearbook. You dont need to send it back, but hang onto it for the time being, in case the copy I set Todd should be lost. I want to mantion that the reason I went into so much detail about previous publication on the cherimoya in California, is that I hope the renewal of interest which seems to be taking place may cause students of the subject to want to know what has been written, and mentioming some of the early papers might same them some time. I especially have in mind good olf Dr Franceschi's "Santa Barbara Exotic Flora". I hope you have a copy of this in your library. There must be one at Riverside; which reminds me to remark that some years ago I sent them an old field book of mine, with descriptions I made at Altadena of the avocados from Mexico which Carl Schmidt sent in when my father financed that trip in 1911. I still have, here in Antigua, a bound volume of my field notes, "Guatemalan Explorations 1916-1917" and my "Central and South American Explorations 1919-1921". I have kept thes because I use them

from time to time, but I will be kicking the bucket onepof these days (my life insurance age is now 79) and I believe these notes should be permanently housed and available to avocado cranks 50 years from now. I am sure there will still be avocado cranksleft in this world, though as you point out with such feeling, we begin to wonder where we are going. What doyou suggest I do with my field Journals?

Now as to the cherimoya business. You say of my last letter, "You mention the well-formed fruit found n the market. These would be selected without doubt." Ofcourse you are right. Here is another interesting feature: these fine fruits we have been buying recently have been pretty free from insect damage, whereast the fruits which fall from the tree in our patio - it is certainly 50 years or more in age - are riddled with holes where the bugs have come out and the insides not only unattractive buy not fitnto eat. Even I cant eat them, though I having a glass of grapefruit juice every morning made from fruits taken from the tree in our garden, which are pretty uniformly inhabited by Anastrepha larvae. My wife objects to my using such fruits but I ask he if she thinks the Cuban guavas from which they used to make that delicious guava jelly didnt have any larvae in them? And these Anastrepha larvae in the grapefruit - havent they grown on a strictly grapefruit diet, and arent they probably just as full of those essential vitamins as the grapefruit itself?

You ask if I know how many cherimoyas a tree in Spain might produce - or rather, looking over your letter, I think you are asking about our Guatemalan cherimoyas. No, I have never made any counts on trees here. In my paper, enclosed, I have given you the figure which Luis Sarasola gave me, production in kilos. And I sent Todd a foto, very similar to the one Sarasola published in the Yearbook, which shows what I would call a maximum fruit set. I have

never seen any such production in tropical America, and I'll bet a pre-Roosevelt dollar that you havent in California, even with hand pollination.

And now about this pollination business. I think I feel as you do, that hand pollination could not fail to give us better crops, in climates where natural pollination is not adequate. But I hate to think that we must base the future of the cherimoya industry on hand pollination. Of coourse we do it with vanilla, and if we cant get good crops any other way it may be the answer, even with your high taxes and expensive water and almost prohibitive hand labor.

Like yourself, I dont think much ofthe hormone business and I am not too much worried about the hourduring which we must collect pollen. It may be too idealistic, but in all such mattters I cant help remembering that I live in Guatemala. We have a tough enough job getting our horticulturists to take good care of his trees, and use a little fertilizer. Ticho of Israel has written quite a bit about oil sprays for inducing dormancy in our spples. I am aiming at apples which dont need oil sprays or anything else. Of course we might get our Indians to unders and the neee of oil sprays the way they understand the fertilizer business. I asked a friend of mine, who had used some of the fertilizer Henry Wallace gave him for his corn, and he said, Yes it is great stuff; but the darn corn gets fond of it and wont grow any more without it.

From your letter, yougather you dont believe in insect pollination of the cherimoya flowers any more than Luis Sarasola and I do. But this brings us up against reality, as regards the whole pollination business. Sarasola thinks (as mentioned in my paper) that even light currents of air suffice to get pollen offn the anthers onto the receptive stigmas. I say receptive stigmas; that's what they have

in Almuñecar and what we dont seem to have in California (or other dry climates) when the anthers cut loose with their abundant pollen. You have this in mind when you write "Possibly the premature shedding of pollen could be induced by blowing dry air over the flowers." I would be more inclined to tackMetthe other angle: keep the stigmas from drying out until pollen in that flower is available. Dont you feel, as I do, that cherimoyas are not built - as they say avocados are - to receive pollen from flowers on other trees?

Incidentally, this is obviously an "on" year for cherimoyas here in Guatemala. (In my paper I mention that they have them in Spain). I dont know why it is an "on" year, but I do know that right here in my garden we have had a lot more rain during the flowering season than we had last year, Whiche cannot assume that the quantity of rain is a major factor; I believe it is temperature and relative humodity during the flowering season. Not too hot and dry.

Well, all of this rambling isnt getting us anywhere - or me at least, You probably less. Here is what I want to suggest: You are called by the Lord to solve this cherimoya problem. Give California the kind of cherimoya crops they get in Spain. What I think you need is a whole lot of time, watching a whole lot of individual trees, andsee why some bear more than others, and to really learn all there is to know ab ut the pollination business. You cat drive your family over to Almuñecar in your 1962 station wagon. But you can drive them to Mexico. I believe Atlixco would be a good place to work on the problem. Plenty of cherimoya trees and I would say a very interesting region from any point of view. I'll bet you could get an AID grant which would take care of the gasoline and your living expenses if tov stuck to the official Mexican dietary.

Warmest regards to all.

Siempre su afmo y SS