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COVER PHOTO: Leaves of Pistachio root stocks: *Photo by B. Dell*

WANS

West Australian Nutgrowing Society

This Yearbook published 1980 by the West Australian Nutgrowing Society, P.O. Box 27, Subiaco, W.A. 6008, Australia

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* * *

Officers of the Society, 1978-79

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* * *

SOCIETY PUBLICATIONS

WANS publishes a newsletter QUANDONG 3-4 times a year, devoted to news of meetings and events, details of tree and seed sources, notes on books and leaflets about nuts, reprinted short articles about nuts, and other items of interest The major publication is the annual WANS YEARBOOK, which contains articles drawn from Australia and overseas, covering any aspect of nut horticulture and production, and is regarded as an important research journal in this area.

Members subscribe for the Calendar Year, and receive one copy of all Society publications issued in that year as a subscription benefit.

The current subscription rate is $8.00 per year.

BACK NUMBERS

WANS began publishing in 1975. Back sets of 1975 publications are available to members at a cost of $6.00 per Yearbook and $2.00 per set of Quandong. Contact the Secretary for back numbers. The cost of a set of 1979 publications (same as subscription) is $8.00.

MEMBERSHIP DETAILS

Any person or organization interested in the growing or production of nuts may apply for membership. Members are welcomed from outside Western Australia and overseas, as well as in W.A. Write to P.O. Box 27, Subiaco, W.A. 6008, Australia.

WANSCO

Members of the Society own a co-operative, West Australian Nut Supplies Cooperative Limited, a legally registered Co-operative Company set up to buy and sell nuts and nut products. Shares in the WANSCO co-operative are available to WANS members at par, i.e. $1.00 each. Members wishing to acquire WANSCO shares should write to WANSCO Secretary at P.O. Box 27, Subiaco,WA. 6008. WANSCO operates a retail and wholesale store (Squirrel Nutkin) at 225 Onslow Road, Shenton Park (Tel. [09] 381 8656).

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GLOSSARY OF NUT NAMES

DAVID NOEL

As part of a project to set up a computer data base of information about nuts, I have produced a file of common and botanical names of nuts. In addition, the file includes a 5-letter code for each species. I use this 5-letter code to identify plant species (in the nursery or as seed items, as well as in the computer files).

The computer allows easy sorting of names into alphabetical order, and the two glossaries which are printed here have been produced by computer programs from the same information.

Main List

The first list is in BOTANICAL NAME ORDER. It shows the 5-letter species code, the botanical name, and any common names which are assigned to the species. Also included, as well as the preferred botanical name, are a number of alternative or no longer used botanical names. For these, the 5-letter code given is that of the preferred name, and is followed by an equals sign (e.g. brast= *Amygdalus aethiopica;* the van riebeeck almond, *Brabejum stellatifolium*, was previously wrongly assigned to the almond family, which had the genus name *Amygdalus*).

The 5-letter code is normally made up of the first three letters of the genus name plus the first two letters of the species name, so *Cocos nucifera*, the coconut, becomes cocnu. However, where this system would result in two different species having the same code, one of them has been given a code where the fifth letter is taken from later in the species name (e.g. *Carya tomentosa* is carto; *Carya tonkinensis* is cartn). In this way, every species should have been given a different code.

Also, in the case of some genera which have a large number of species and are important in the nut area, the third letter of the code has been taken from later in the genus name and the first three letters of the code reserved for that genus. For example, there are hundreds of names used for the chestnuts; *Castanea*, and the chestnut species will always have a code beginning 'cas'. The tropical chestnuts, *Castanopsis*, also have many species, and their codes begin 'cat'. In most cases, however, the codes are not likely to be overcrowded, so that the peanut, *Arachis hypogaea*, is 'arahy', while the bunya pine, *Araucaria bidwillii*, is 'arabi', with both genera having the same first three letters.

There are endless arguments over alternative botanical names as to which is 'correct', and that which is 'preferred' here is just my own preference.

In the common names, I have given the one I prefer first. Common names vary very considerably from one area to another, so again I am not claiming my preference is 'correct' (or will stay the same). In both cases (botanical and common) I have tried to include all the alternatives, since a nut tree may be described in an older account by names which were valid then but are no longer used.

Common names, of course, are not unique, so the same common name can be in use for several species. For example, the name 'Java almond' is used for several species of *Canarium*, and also for at least one from the genus *Terminalia*.

Common names given in brackets, e.g. [kursan], are vernacular names, used by people speaking languages other than English. In some cases there is no English common name, in others the native name comes to be used in English (often altered, e.g. pinyon pine nut, from the Spanish word pinon). So, if brackets are used, they are only an indication of origin of the name.

Lastly, the list includes any names of any species which have any pretension at all of being classed as "nuts", and a number of related species which do not produce nuts. So, for example, the Apricot is included (because the kernel of the apricot stone is used in some places as a nut), and a number of *Pistacia* species are included because they are used as rootstocks for the Pistachio nut.

Common-name List

The second list is in COMMON NAME ORDER. It includes each individual common name from the main list, followed by the preferred species name.

Undoubtedly the lists include many mistakes, and have many omissions. Please send me your corrections and additions (to David Noel, P.O. Box 27, Subiaco, W.A. 6008, Australia). If the list proves useful, it may be possible to publish it separately, after it has been cleaned up.

abrpr	Abrus precatorius	love nut: rosary pea
acafl	Acacia flexicaulis	
acalo	Acacia longifolia	sydney golden wattle
acaho	Acanthosicyos horrida	butter pit: [nara]
acana	Acanthosicyos naudinianus	
acavu	Acanthosicyos vulgaris	
acrac	Acrocomia aculeata	gru-gru palm
acrmd	Acrocomia media	
acrme	Acrocomia mexicana	Mexican gru-gru: suppa palm
acrsc	Acrocomia sclerocarpa	gru-gru nut
acrto	Acrocomia tota	
actca	Actinorhytis calapparia	
adadi	Adansonia digitata	baobab; sour gourd; monkey bread
adagr	Adansonia gregorii	boab
adeab	Adenanthera abrosperma	
adepa	Adenanthera pavonina	barbados pride: coral tree: red sanderswood
aescl	Aesculus californlca	california buckeye: california horse-chestnut
aesca	Aesculus carnea	red horse-chestnut
aesch	Aesculus chinensis	chinese horse-chestnut
aeshi	Aesculus hippocastannum	horse-chestnut: conker
aesin	Aesculus indica	indian horse-chestnut
aeslu	Aesculus lutea	
aesoc	Aesculus octandra	sweet buckeye
anspr	Aesculus parviflora	buckeye
aespa	Aesculus pavia	red buckeye
aestu	Aesculus turbinata	japanese horse-chestnut
afrpa	Afraegle paniculata	
afrxx	Afrolicania	[po-yoak]
afzaf	Afzelia africana	
agaur	Agastache urticifolia	giant hyssop: horsemint
agrgr	Agriophyllum gobicum	
aipac	Aiphanes acanthophylla	
aipco	Aiphanes corallina	
aipmi	Aiphanes minima	coyor
alema	Alectryon macrococcus	mahoe
aleco	Aleurites cordata	japan wood oil
alefo	Aleurites fordii	tung
aletr=	Aleurites moluccana	
alemo	Aleurites montana	tung
aletr	Aleurites triloba	candle nut
alets	Aleurites trisperma	soft lumbang
alfxx	Alfanoa species	
allfl	Allanblackia floribunda	tallow tree
allcy	Allantoma cylindrica	skittle nut
amban	Amblygonocarpus andongensis	
ampmo	Amphicarpaea monoica	hog peanut
brast=	Amygdalus aethiopica	
amyna=	Amygdalus campestris	
amyna=	Amygdalus chinensis	
amyna	Amygdalus nana	dwarf almond: steppe almond
amyna=	Amygdalus pallasiana	
amype	Amygdalus pedunculata	cherry almond
anaoc	Anacardium occidentale	cashew nut: [gajus]
anahe	Anacolosa heptandra	
analu	Anacolosa luzoniensis	gala nut
inoed=	Aniotum fagiferum	
anipa	Anisosperma passiflora	jobota chestnut

antmi	Antrocaryon micraster	
apitu	Apios tuberosa	groundnut; wild bean
aquma	Aquilaria malaccensis	aloes wood
arahy	Arachis hypogaea	peanut:groundnut: goober:monkey nut
aratr	Aralia trifolia	groundnut
arabr=	Araucaria augustifolia	
araar	Araucaria araucana	monkey puzzle: chile pine
arabi	Araucaria bidwilli	bunya pine
arabr	Araucaria brasiliana	parana pine
araxx	Araucaria species	
areca	Areca catechu	betel nut; areca nut
areco	Areca concinna	
aregl	Arecaglandiformis	
areip	Areca ipot	
arema	Areca macrocalyx	
arena	Areca nagensis	
arepu	Areca pumilis	
aretr	Areca triandra	
areva	Areca valiso	
areuu	Arecacacea family	areca palms
areen	Arenga engleri	
arepi	Arenga pinnata	kaong: sugar plum
areun	Arenga undularifolia	
argsi	Argania sideroxylon	argan tree
artal	Artocarpus altilas	breadnut
artel	Artocarpus elastica	
artch	Artocarpus champeden	
artal=	Artocarpus communis	
artgo	Artocarpus gomeziana	
urtio-	Artocarpus heterophyllus	
artic	Artocarpus incisa	breadfruit
artin	Artocarpus integra	jak nut: jack nut: [nangka]
artod	Artocarpus odoratissima	
artri	Artocarpus rigida	monkey jak
artxx	Artocarpus species	breadfruit
astac	Astrocaryum aculeatum	
astma	Astrocaryum malybo	
asyne	Astrocaryum mexicana	
astca	Astrocaryum standleyanum	
asttu	Astrocaryum tucumoides	tucum nuts; tucan nuts; awara nuts: [muru-muru] : guere palm
attco	Attalea cohune	cohune nut
attfa	Attalea fagifoli	
attfu	Attalea funifera	coquilla nut
attol	Attalea olelfera	
attsp	Attalea speciosa	
aviof	Avicennia officinalis	new zealand mangrove
bacga	Bactris gasipaes	peach palm: pupunha: pejibaye
bacma	Bactris majur	
balae	Balanites aegyptiaca	soapberry tree:thorn tree: desert date
balwi=	Balanites maughmii	
balpe	Balanites pedicellaris	
balwi	Balanites wilsoniana	[mkonga]
balsa	Balsamorhiza sagittata	oregon sunflower
barbu	Barringtonia butonica	
barca	Barringtonia careya	
bared	Barringtonia edulis	cut nut
barex	Barringtonia excelsa	

barma	Barringtonia magnifica	
barni	Barringtonia niedenzuane	cut nut
barno	Barringtonia novae-hyberniae	cut nut
barre	Barringtonia reticulata	
barsc	Barringtonia scortechinii	
barxx	Barringtonia species	
madla=	Bassia latifolia	
tyles=	Bauhinia esculenta	
pilth=	Bauhinia thonningii	
bauto	Bauhinia tomentosa	st. thomas tree
beiba	Beilschmiedia bancroftii	yellow walnut: wanga
beima	Beilschmiedia mannii	tola: spicy cedar
benhi	Benincasa hispida	wax gourd
berex	Bertholettia excelsa	brazil net; para nut: cream nut
bilxx	Billia species	tropical horse chestnuts
bixor	Bixa orellana	annatto: lipstick tree
blein	Blepharocarya involucrigea	rose butternut
blisa	Blighia sapida	akee
borxx	borassodendron	
borae	Borassus aethiopum	
borde	Borassus deleb	[doleib] ; [tuk]
borfl	Borassus flabellifera	palmyra palm
bosan	Boscia angustifolia	[kursan]
bosse	Boscia senegelensis	
bussr	Boscia serrata	indian olibanum
bosaq	Bosqueia angolenesis	
brast=	Brabejum stellatifolium	
brast	Brabejum stellatifolium	van riebeeck almond; hottentot almond: wild almond
braut	Brachystegia utilis	
braap	Brachystegia appendiculata	
brabo	Brachystegia boehmi	
brasp	Brachystegia spiciformis	
brawa	Brachystegia wangermeeana	
broal	Brosimum alicastrum	Jamaican bread nut;snakewood
brucy	Brugulera cylindrica	
brupa	Bruguiera parviflora	
bruse	Bruguiera sexangula	
bucla	Buchanania lanzan	almondette: cuddapah almond; [calumpang]
bucco	Buchholzia coriacea	musk tree; elephant kola; (kila pimente]
conma=	Bunium flexuosum	
butpa	Butyrospermum paradoxum	shea butter tree
butpk	Butyrospermum parkii	shea nut; shea butter tree
slmca	Buxus chinensis	
caecr	Caesalpinia crista	bonduc nut:nicker nut
cajca	Cajanus cajan	pigeon pea
calco	Calatola costaricensis	
calla	Calatola laevigata	palo de papa
calca	Calodendron capense	cape chestnut
calin	Calophyllum inophyllum	india-oil nut
calbr	Calpocalyx brevibracteatus	
calma	Calumus maneu	rattan
calro	Calumus rotang	
caltu	Calumus tumidus	rattan
canal	Canarium album	chinese olive
canam	Canarium amboinense	
canau	Canarium australianum	
canco	Canarium commune	Java almond

canin	Canarium indicum	kenari nut: java almond; [ngoli]
canke	Canarium kepaIla	
camlu	Canarium luzonicum	pili nut; java almond
canme	Canarium mehenbethene	garlip
canmu	Canarium mueller	
cannu	Canarium nungi	
canol	Canarium oleosum	
canov	Canarium ovatum	pili nut
canpi	Canarium pimela	chinese olive
canru	Canarium rufum	
cansa	Canarium salomonense	
cansc	Canarium schweinfurthii	incense tree; bush candle tree
canxx	Canarium species	pili nut; Java almond
canst	Canarium strictum	
canvu	Canarium vulgare	Java almond
canze	Canarium zeylanicum	
caaen	Canavalia ensiformis	horse bean; sword bean
cabsa	Cannabis sativa	hemp:marijuana
caagr	Carapa grandiflora	
caapr	Carapa procera	
caaxx	Carapa species	
carar	Careya arborea	patana oak
cahti	Carthamus tinctorius	safflower
caral	Carya alba	
caraq	Carya aquatica	water hickory; swamp hickory
carca	Carya cathayensis	chinese butternut; chinese walnut; mountain walnut
carco	Carya cordiformis	bitternut
cargl	Carya glabra	pignut; redheart hickory
caril	Carya iliinoensis	pecan
carla	Carya laciniosa	shellbark hickory; kingnut
carmi	Carya microcarpa	small-fruited hickory
carmy	Carya myristicaeformis	nutmeg hickory
carol	Carya ovalis	loose-bark pignut
carov	Carya ovata	shagbark hickory
carpa	Carya pallida	sand hickory
caril=	Carya pecan	
carxx	Carya species	hickories
carte	Carya texana	black hickory
carto	Carya tomentosa	mockernut; white hickory;bullnut
cartn	Carya tonkinensis	may-chau tree
carvi	Carya villosa	pale-leaf hickory
caoam	Caryocar amygdaliferum	
caoay	Caryocar amygdaliforme	
cacahr	Caryocar brasiliensis	
caobu	Caryocar butyrosum	
caoco	Caryocar coccineum	
caocr	Caryocar coriaceum	-
caogi	Caryocar glabrum	
ceonu	Caryocar nuciferum	swarri nut; butter nut; souari nut; [ingi notto]
caoxx	Caryocar species	
caoto	Caryocar tomentosum	
caovi	Caryocar villosum	pekea nut
caror	Caryodendron orinocense	taccy nut
caaae	Caryota aequatorialis	
caami	Caryota mitis	fishtail palm
caito	Cassia tora	stinking cassia
cascr	Castanea crenata	japanese chestnut

casde	Castanea dentata	american chestnut
cache	Castanea henryi	
casmo	Castanea mollissima	chinese chestnut
caspu	Castanea pumila	chinquapin; virginia chestnut
cassa	Castanea sativa	european chestnut; sweet chestnut; spanish chestnut
casxx	Castanea species	chestnuts
catac	Castanopsis acuminatissima	
catar	Castanopsis argentea	
catag	Castanopsis argyrophilia	[gon]
catci	Castanopsis chinensis	chinese chinquapin
catch	Castanopsis chrysophylla	giant chinquapin; golden chestnut
catco	Castanopsis costata	
cathy	Castanopsis hystrix	
catin	Castanopsis indica	
catim	Castanopsis inermis	braided chestnut
catja	Castanopsis javanica	
catla	Castanopsis lamontii	
catma	Castanopsis malaccensis	
catme	Castanopsis megacarpa	
catph	Castanopsis philippensis	philippine chestnut
catru	Castanopsis rufescens	
catse	Castanopsis sempervirans	bush chinquapin
catxx	Castanopsis species	tropical chestnuts; chinquapins
cattr	Castanopsis tribuloides	[kat] ;[kysin]
cattu	Castanopsis tungurrut	
catwa	Castanopsis wallichii	
camau	Castanospermum australe	moreton bay chestnut; black bean; australian chestnut
cahal	Cathorsmium altissimum	spirit's marbles
ceipe	Ceiba pentandra	silk cotton tree
chama	Champereira malayana	
chric	Chrysobalanus icaco	cocoplum;icaco
chyex	Chydaoasthus excel	
cicar	cicer arietinum	chick pea; egyptian pea
citla	Citrullus lanatus	water melon
citvu	Citrullus vulgaris	water melon
cniol	Cnidoscolus oligandrus	
cocco	Cocos coronata	nicuri palm nut
cocnu	Cocos nucifera	coconut
cocol	Cocos oleracea	[guariroba]
cocuu	Cocosoid family -	cocos palm family
coeam	Coelococus amicarcum	ivory nut
colni=	Cola acuminata	
colca	Cola caricafolia	monkey kola
coldi	Cola digitata	kola nut
colhe	Cola heterophylla	
colmc	Cola microcarpa	vanquisher
colmi	Cola millenii	
colna	Cola natalensis	natal cola; wild mango
colni	Cola nitida	kola nut; cola nut
stequ	Cola quinqueloba	
colxx	Cola species	
colve	Cola vera	kola nut
colvr	Cola verticillata	slippery kola
colvu	Colocynthis vulgaris	bitter gourd; sierra leone gourd; [egusi]
colmo	Colophospermum mopane	mopane
conma	Conopodium majus	pig nut; earth nut; kipper nut
copba	Copaifera baumiana	

coppr	Copernicia prunifera	wax palm; carnauba
cored	Cordeauxia edulis	yeheb nut
coddi	Cordia dichotoma	
coymy	Cordia myxa	sapistan plum; assyrian plum
codse	Cordia sebestena	geiger tree
codxx	Cordia species	
codsu	Cordia subcordata	
elaol=	Cordoso oleifera	
coraf	Cordyla africana	bush mango
coram	Corylus americana	american hazel
corav	Corylus avellana	hazel nut; filbert; cob nut
corch	Corylus chinensis	chinese hazel
corco	Corylus colurna	turkish hazel
corm	Corylus cornuta	beaked hazel
corfa	Corylus ferox	himalayan hazel
corhe	Corylus heterophylla	siberian hazel; japanese hazel
cormn	Corylus mandschurica	manchurian hazel; japanese hazel
corma	Corylus maxima	hazel nut
corro	Corylus rostrata	beaked hazel
corti	Corylus tibetica	tibet hazel
corla	Corynocarpus laevigatus	karaka nut
corum	Corypha umbraculifera	talipot palm
coued	Coula edulis	african walnut; gaboon nut; [nkula]
couod	Coumarouna odorata	tonka bean
crare	Crateva religiosa	
creal	Crescentia alata	mexican calabash
crecu	Crescentia cujete	calabash
crope	Crossonephelis penangensis	
cropr	Crossonephelis pervillei	
crola	Crossostemma laurifolium	
cryla	Cryptocarya latifolia	
crymo	Cryptocarya moschata	brazilian nutmeg
crype	Cryptocarya peumus	
cryxx	Cryptocarya species	
cubbl	Cubilia blancoi	kubili nut
cucme	Cucumis melo	sweet melon
cucfo	Cucurbita foetidissima	buffalo gourd
cucpe	Cucurbita pepo	squash; pumpkin;gourd
cueka	Cuervea kappleriana	karoshiri
capam	Cupania americana	
cycci	Cycas circinalis	
cycme	Cycas media	
cycre	Cycas revoluta	sago palm
cycru	Cycas rumphii	
cycxx	Cycas species	cycads
cycth	Cycas thouarsii	
cypes	Cyperus esculentes	tiger nut;earth almond; chufa nut; rush nut; sedge nut; zulu
deigr	Deinbollia grandifolia	
detse	Detarium senegalense	tallow tree
diaen	Dialium engleranum	
dimmo	Dimorphandra mora	
dioed	Dioon edule	
dippa	Diplodiscus paniculatus	baroba; calobo
dolla	Dolichos lablab	hyacinth bean
drama	Dracontomelum mangiferum	belgian walnut
durzi	Durio zibethinus	durian; civet fruit
elagu	Elaeis guineensis	oil palm nut; african oil palm; [dendezeiro]

elaol	Elaeis oleifera	american oil palm
elaba	Elaeocarpus bancroftii	johnstone river almond; karanda nut
elach	Elaeocarpus chelonimorphus	
elaga	Elaeocarpus ganitrus	olive nut
elaxx	Elaeocarpus species	
elata	Elateriospermum tapos	tapos
eledu	Eleocharis dulcis	chinese water chestnut; water chestnut
eledu=	Eleocharis tuberosa	
encba	Encephalartos barteri	
enchi	Encephalartos hildebrandtii	
endin	Endiandra indignis	boonban
endpa	Endiandra palmerstonii	queensland chestnut
endxx	Endiandra species	walnut bean
engxx	Engelhardtia species	
enhac	Enhalus acoroides	sea fruit
ehnko	Enhalus koenigiia	sea fruit
entsc	Entada scandens	matchbox bean; gilla nut; queensland bean
erija	Erisma japura	japura
eryva	Erythrina variegata	coral tree
escsu	Eschweilera subglandulosa	guatecare; watercare
sanxx=	Eucarya species	
eugtr	Eugeissona tristis	
eugut	Eugeissona utilis	stilt-root palm
eurfe	Euryale ferox	fox nut; gorgon nut
faggr	Fagus grandifolia	american beech
fagxx	Fagus species	beeches
fagsy	Fagus sylvatica	european beech
finca	Finschia carrii	
finch	Finschia chloroxantha	galip
finfe	Finschia ferruginiflora	
finru	Finschia rufa	
finxx	Finschia species	
sanxx=	Fusanus species	
ganmo	Ganua motleyana	
garba	Garcinia barrettiana	
garco	Garcinia conraucana	
garcw	Garcinia cowa	
garin	Garcinia indica	kokan butter tree
garko	Garcinia kola	bitter kola; false kola
garma	Garcinia mangostana	mangosteen
garpl	Garcinia planchoni	
gascr	Gastrococos crispa	corojo
geosu	Geoffraea superba	almandora
gevav	Gevuina avellana	chile hazel; avellano
ginbi	Ginkgo blloba	maidenhair tree; ginkgo; white nut
gluel	Gluta elegans	[rengas]
glure	Gluta renghas	[rengas]
gluve	Gluta velutina	[rengas]
glyma	Glycine max	soy bean; soja bean
gneaf	Gnetum africanum	
gnebr	Gnetum brunonianom	
gnebu	Gnetum buchholzianum	
gneed	Gnetum edule	
gnegn	Gnetum gnemon	gnemon tree
gnela	Gnetum latlfolium	
gneed=	Gnetum scandens	
gnexx	Gnetum species	

gnete	Gnetum tenuifolium	
gomni	Gomortega nitida	keule
gomja	Gomphia jabotapita	button tree
gompa	Gomphia parviflora	
grean	Grevillea annulifera	
greel	Grevillea elaeocarpifolia	
gevav=	Guevlna avellana	
guico.	Guibourtia coleosperma	
bacga=	Guilielma gasipaes	
guiut	Guilielma utilis	palm chestnut; peribaye
guiab	Guizotia abyssinica	niger seed
gymwo	Gymnartocarpus woodii	malanangka
gynpe	Gynandropsis pentaphylla	
hamja	Hamamelis japonica	
hamvi	Hamamelis virginiana	witch hazel
heipa	Heisteria parviflora	
helan	Helianthus annuus	sunflower seeds
helco	Helicia cochinchinensis	
heldi	Helicia diversifolia	helicia nut
heler	Helicia erratica	
herli	Heritiera littoralis	
hermi	Heritiera minor	
hibsa	Hibiscus sabdariffa	red sorrel; roselle
hicpi	Hickbeachia pinnatifolia	rose nut; monkey nut
heldi=	Hickebeachia diversifolia	
hipco	Hippocratea comosa	
hipgr	Hippocratea grahamii	
hodma	Hodgsona macrocarpa	hodgsonia seeds
holja	Holopyxidium jaraua	
horau	Horsfieldia australiana	coconut tree
hydan	Hydnocarpus anthelmintica	
hydku	Hydnocarpus kurzii	chalmoogra nut
hypth	Hyphaene thebaica	doum nut; vegetable ivory palm
hypve	Hyphaene ventricosa	gingerbread palm; doum nut
icase	Icacina senagalensis	false yam
inoed	Inocarpus edulis	tahiti chestnut; [ivi]; otahite chestnut
inoed=	Inocarpus fagiferous	
intbi	Intsia bijuga	
irips	Iris pseudacorus	yellow iris
irvga	Irvingia gabonensis	dika nut; bread tree; wild mango [faveleira]
jatcu	Jatropha curcas	physic nut; purging nut; barbados nut
jacur	Jatropha urens	
jespo	Jessenia polycarpa	seje
jubsp=	Jubaea chilensis	
jubsp	Jubaea spectabilis	pygmy coconut; coquito nut
jubca	Jubaeopsis caffra	pondoland palm; pondoland coconut; mkambati palm
juguu	Juglandaceae family	
jugai	Juglans ailanthifolia	Japanese walnut; heartnut
jugca	Juglans californica	
jugcy	Juglans cathayensis	chinese walnut
jugci	Juglans cinerea	butternut; white walnut
jugco	Juglans cordlformis	heartnut
jugmn=	Juglans draconis	
jughi	Juglans hindsii	north california black walnut
jugma	Juglans major	arizona walnut
jugmn	Juglans mandschurica	manchurian walnut
jugni	Juglans nigra	black walnut

jugre	Juglans regia	walnut; persian walnut; english walnut; madeira nut
jugru	Juglans rupestris	texan walnut
jugsi	Juglans sieboldiana	japanese walnut
jugxx	Juglans species	walnuts
jugmn=	Juglans stenocarpa	
kerle	Kermadecia leptophylla	
kerge	Kerstingiella geocarpa	hausa groundnut
kigpi	Kigelia pinnata	sausage tree
lagsi	Lagenaria ciceraria	bottle gourd; calabash cucumber; naranka; dolphin gourd
lalib	Lallemantia iberica	
lanst	Lannea stuhlmanii	
latma	Lathyrus maritimus	seaside pea
latmo	Lathyrus montanus	bitter vetch
latsa	Lathyrus sativus	chickling vetch
lecda	Lecythis davisii	
lecel	Lecythis elliptica	
lecgr	Lecythis grandlfolia	monkey chestnut
lecla	Lecythis lanceolata	
lecol	Lecythis ollaria	sapucaia nut
lecpi	Lecythis pisonis	
lecxx	Lecythis spacies	sapucaia nuts
lecur	Lecythis urnigera	
lecus	Lecythis usitata	sapucaia nut; paradise nut
lecva	Lecythis validissima	
lecza	Lecythis zabucajo	sapucaia nut; paradise nut
lenes	Lens esculenta	lentil
lepho	Lepidozamia hopei	[arumba]
leugl	Leucaena glauca	horse tamarind
litch	Litchi chinensis	lychee; litchi; dawa nut
litco	Lithocarpus corneus	chinese acorn
litcu	Lithocarpus cuspidatus	
litxx	Lithocarpus species	tropical oaks
livsa	Livistona saribus	
lodse=	Lodoicea maldivica	
lodse	Lodoicea sechellarum	double coconut; coco-de--mar; sea coconut
lonca	Lonchocarpus capassa	lancepod
lopla	Lophira lanceolata	meni oil; red ironwood
luphi	Lupinus hirsutus	lupine
luplu	Lupinus luteus	yellow lupine
luppe	Lupinus perennis	wild lupine
lupte	Lupinus termis	
macin	Macadamia integrifolia	queensland nut; smooth macadamia
macpr	Macadamia praealta	ball nut
macxx	Macadamia species	
mactn	Macadamia ternifolia	
macte	Macadamia tetraphylla	queensland nut; rough macadamia
macwh	Macadamia whelanii	
macmi	Macrozamia miquelii	banga nut
macre	Macrozamia reidlei	zamia palm; [baiyo]
macsp	Macrozamia spiralis	burrawong
madla	Madhuca latifolia	illipe nut
madbu	Madhuca longifolia	
madut	Madhuca utilis	
madsa	Madia sativa	madia oil
magpu	Magonia pubescens	tingui
manin	Mangifera indica	mango
mansa	Manicaria saccifera	monkey cap palm

manaf	Manniophyton africanum	gasso nut
manfu	Manniophyton fulvum	
maufl	Mauritia flexuosa	ita palm; buriti nut; tree-of-life
maxre	Maximiliana regia	cucurite palm; inaja palm
melbi	Melicoccus bijugatus	genip; mamoncillo; spanish lime.
menal	Mentzelia albicaulis	prairie lily
mesed	Mesembryanthemum edule	hottentot fig
mesfo	Mesembryanthemum forskahlei	
mesfe	Mesua ferrea	ironwood
mimca	Mimusops caffra	
mimdj	Mimusops djave	djave nut; african pearwood
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mimhe	Mimusops heckelii	
mimob	Mimusops obovta	
monmy	Monodora myristica	calabash nutmeg; jamaica nutmeg
monte	Monodora tenuifolia	
monua	Monopteryx uacu	
morol	Moringa oleifera	ben nut; horseradish tree
morol=	Moringa pteryosperma	
mucsl	Mucuna sloanei	horse-eye bean
myrfa	Myristica fatua	brasilian nutmeg
myrfr	Myristica fragrans	nutmeg
myrob	Myristica oloba	
myrse	Myristica sebifera	
neine	Nelumbium nelumbo	lotus
nellu	Nelumbo luteum	american lotus
nelnu	Nelumbo nucifera	indian lotus
nelsp	Nelumbo speciosa	lotua; rattle nut; water chinquapin; water nut
nepla	Nephelium lappaceum	rambutan
nepli	Nephelium litchi	litchi nut; lychee
nepmu	Nephelium mutabile	pulasan
nipfr	Nipa fruticans	nipa palm
notgl	Nothofagus glauca	
notpr	Nothofagus procera	
notxx	Nothofagus species	southern beeches
nupad	Nuphar advena	spatter-dock; yellow pond lily
nuppo	Nuphar polysepalum	
xxxxx	nut species generally	nuts
nymat	Nymphaea atellata	
nymlo	Nymphaea lotus	lotus; egyptian water lily
nymxx	Nymphaea species	waterlily seeds
ochco	Ochrosia coccinea	
ochel	Ochrosia elliptica	[pakoidan]
ochop	Ochrosia oppositifolia	[fao]
oendi	Oenocarpus distichus	pataua
olnte	Olnaya tesota	ironwood
ompte	Omphalea diandra	jamaica cobnut
ompme	Omphalea megacarpa	hunterman nut; russell river nut
ompqu	Omphalea queenslandiae	
omptr	Omphalea triandra	Jamaica cobnut; pop nut
ompme=	Omphaliea megacarpa	
ongxx	Ongokea species	
ophpa	Ophiocaryon paradoxum	snake nut
orbba	Orbignya barbosiana	babassu palm
orbxx	Orbignya species	
orbsp	Orbignya speciosa	babacu palm
orexx	Oreomunnea species	

oroin	Oroxylum indicum	midnight horror
otofr	Otophora fruticosa	lunan nut; lanao
ourja	Ouratea jabotapita	
ourpa	Ouratea parviflora	batiputa
owere	Owenia reticulata	desert walnut
oweve	Owenia vernicosa	emu apple; sour plum
pacaq	Pachira aquatica	guyana chestnut; calabar chestnut; saba nut
pacer	Pachira grandiflora	
pacin	Pachira insignis	
pacil	Pachystroma ilicifolium	
jacac=	Pachystroma acanthophylla	
palgu	Palaquium gutta	gutta percha
palhe	Palaquium hexandrum	
palja	Palaquium javense	
palph	Palaquium philippense	
palro	Palaquium rostratum	
panol	Panda oleosa	
panbr	Pandanus brosimus	
panca	Pandanus candelabrum	
panco	Pandanus copelandia	
panfu	Pandanus furcatus	
panju	Pandanus julianetti	karuka nut
panla	Pandanus lauterbachii	
panle	Pandanus leram	
panpe	Pandanus pedunculatus	breadfruit
panxx	Pandanus species	screw pines
panut	Pandanus utilis	[mongo]
paned	Pangium edule	pangi; [kepayang]
pansu	Panopsis suaveolens	palo dm papa; palo de la montanas
papso	Papaver somniferum	opium poppy
popca	Pappea capensis	wild plum
parca	Parinari campestre	
parcu	Parinari curatellifolia	
parmo	Parinari montanum	
parpo	Paris polyphylla	
paraf	Parkia africana	nitta nut; nutta nut
parbg	Parkia biglandulosa	
parbi	Parkia biglobosa	
parfi	Parkia filicoidea	african locust bean
parja	Parkia javanica	
parsp	Parkia speciosa	
parce	Parmentiera cereifera	candle tree
pasco	Pasania cornea	
pascu	Pasania cuspidata	
paucu	Paullinia cupana	guarana
pausu	Paullinia subrotunda	
penma	Pentaclethra macrophylla	oil bean tree: atta bean
penbu	Pentadesma butyracea	tallow tree; butter tree; candle tree; black mango
phyem	Phyllanthus emblica	emblic myrobalan
phyma	Phytelephas macrocarpa	vegetable ivory nut; taqua nut; corozo nut
pilth	Piliostigma thonningii	
pimam	Pimeleodendron amboinicum	
pinal	Pinus albicaulis	whitebark pine; alpine pine
pinar	Pinus armandi	[kuo sung]
pinbu	Pinus bungeana	lacebark pine
pince	Pinus cembra	swiss stone pine
pincm	Pinus cembroides	pinyon pine: pinon pine
pinco	Pinus coulteri	coulter pine: big-cone pine
pincu	Pinus culminicola	
pincm=	Pinus edulis	two-needle nut pine
plnfl	Pinus flexilis	limber pine
pinge	Pinus gerardiana	chilghoza pine: neoza nut; nepal nut pine; neosia
pinje	Pinus jeffreyi	jeffrey pine
pinio	Pinus koraensis	korean pine: cedar pine
pinla	Pinus lambertiana	sugar pine
pinma	Pinus maximartinezii	
pincm=	Pinus monophylla	single-leaf pine: one-needle pine
pinne	Pinus nelsoni	nelson pine
pincm=	Pinus parrayana	mexican nut pine
pinpc	Pinus pinceana	
pinpi	Pinus pinea	stone pine; umbrella pine; [pignolias]
pinpo	Pinus ponderosa	bull pine; ponderosa pine
pinpo	Pinus pumila	
pinpu	Pinus quadrifolia	four-leaf nut pine
pincm=	Pinus roxburghii	chir pine
pinsa	Pinus sabiniana	digger pine
pinsi	Pinus sibirica	russian nut: siberian stone pine
pinto	Pinus torreyana	lone plne: soledad pine: torrey pine
pisat	Pistacia atlantica	
pisch	Pistacia chinensis	chinese pistache
pisin	Pistacia integerrima	
piskh	Pistacia khinjuk	
pisle	Pistacia lentiscus	mastic tree
pisme	Pistacia mexicana	
pismu	Pistacia mutica	
pispa	Pistacia palaestina	
pisxx	Pistacia species	pistachios
piste	Pistacia terebinthus	chiang turpentine tree: cyprus turpentine tree
pisve	Pistacia vera	pistachio nut; pistache
pitbu	Pithecellobium bubalinum	
pitji	Pithecellobium jiringa	jiringa
pitun	Pithecellobium unguis-cati	
pitlo	Pithecellobium lobatum	ngapi nut
pitfe	Pittosporum ferruginium	
plaxx	Platycarya species	
plece	Pleiogynium cerasiferum	burdekin plum
pluco	PIukenetia conophora	owusa nut
pogol	Poga oleosa	inoi nut: african brazil nut; [m'poga]
pompi	Pometia pinnata	fijian longan: langsir
pouci	Pouteria cainito	abiu
pouca	Pouteria campechiana	canistel
pouhy	Pouteria hypoglauca	
pouob	Pouteria obovata	lucuma
pousa	Pouteria sapota	mamey sapote: sapote
pouvi	Pouteria viride	green sapote
priut	Prinsepia utilis	
prico	Prioria copaifera	
prixx	Pritchardia species	
proaf	Prosopis africana	
proal	Prosopis algorobilla	
produ	Prosopis dulcis	algaroba-cashau
proju	Prosopis juliflora	mesquite
propu	Prosopis pubescens	fremont screwbean

pruam	Prunus amygdalus	almond
pruar	Prunus armeniaca	apricot: chinese almond
pruam=	Prunus dulcis	
amype=	Prunus pilosa	
psigu	Psydium guajava	guava: jambu
psote	Psophocarpus tetragonolobus	goa bean; winged bean
ptema	Pterocarpus marsupium	indian kino tree: [bijasal]
ptesa	Pterocarpus santalinoides	
ptefr=	Pterocarya caucasica	
ptefr	Pterocarya fraxinifolia	caucasian wingnut; winged walnut
ptefr=	Pterocarya pterocarpa	
pteal	Pterygota alata	
pycma	Pycnocoma macrophylla	bomah nut
pyrpu	Pyrularia pubera	buffalo nut: oil nut
queae	Quercus aegilops	valonia oak: camata
queag	Quercus agrifolia	californian field oak
queal	Quercus alba	white oak
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queil=	Quercus ballota	
quebi	Quercus bicolor	swamp white oak
quece	Quercus cerris	turkey oak
quech	Quercus chrysolepsis	canyon live oak
queco	Quercus coccifera	kermes oak
quecr	Quercus cornea	
quecu	Quercus cuspidata	
quedi	Quercus dilatata	
queem	Quercus emoryi	emory oak
quega	Quercus gambelii	shin oak
quegr	Quercus garryana	Oregon oak: western oak
quegl	Quercus glauca	
queil	Quercus ilex	holm oat: holly oak: bellotas: ballota
quein	Quercus incana	
queko	Quercus kelloggii	california black oak
quelm	Quercus lamellosa	
quela	Quercus lanuginosa	
quelo	Quercus lobato	valley oak: california white oak
quelu	Quercus lusitanica	Portuguese oak
quema	Quercus macrocarpa	bur oak
queml	Quercus marilandica	black jack
quebi=	Quercus michauxii	
queob	Quercus oblongifolia	live oak
quepa	Quercus palustris	pin oak
quero=	Quercus pedunculata	
quepe	Quercus persica	manna oak
quept	Quercus petraea	durmast oak
queph	Quercus phellos	willow oak
quepn	Quercus prinoides	chinquapin oak
quepr	Quercus prinus	chestnut oak: basket oak
quero	Quercus robur	english oak
queru	Quercus rubra	red oak
quese	Quercus semecarpifolia	
quept=	Quercus sessiliflora	
quexx	Quercus species	oaks; acorns; gall nuts: mecca galls
quest	Quercus stellata	post oak
quesu	Quercus suber	cork oak
queun	Quercus undulata	scrub oak: rocky mountain scrub oak
quevi	Quercus virginiana	live oak

quiin	Quisqualis indica	rangoon creeper
rapfa	Raphia farinifera	raffia palm
rapbe	Rapphiostylis beniniensis	
ravma	Ravenala madagascariensis	travellers tree
ravar	Ravensara aromatica	madagascar clove nutmeg
ricra	Ricinidendron rautenii	manketti nut; featherweight tree
riche	Ricinidendron heudlotii	manketti nut; zambesi almond: mugongo nut
saled	Salacca edulis	salak
salma	Salacca macrostachya	
salpe	Salvadora persica	salt bush
sanac	Santalum acuminatum	quandong: native peach; quondong
sansp=	Santalum cygnorum	
sanla	Santalum lanceolatum	northern sandalwood; plum bush: cherry bush
sanmu	Santalum murrayanum	bitter quandong; ming
sanxx	Santalum species	sandalwoods
sansp	Santalum spicatum	sandalwood: fragrant sandalwood
santr	Santiria trimera	
sapin	Sapindus indicum	
sapmu	Sapindus mukorossi	kashmir soap berry
sapxx	Sapindus species	soap nuts
sapsa	Sapium sabiferum	tallow nut
schmc	Scheelea macrocarpa	
schma	Scheelea magdalenica	mamarron
schtr	Schleichera trijuga	lac tree; ceylon oak
eledu=	Scirpus tuberosus	
sclbi	Sclerocarya birea	homeid
sclca	Sclerocarya caffra	marula; maroela
sclxx	Sclerocarya species	
scobo	Scorodocarpus borneensis	woodland onion
seced	Sechium edule	chayote
seman	Semecarpus anacardium	marking nut: oriental cashew: marany nut; marsh nut
semat	Semecarpus atra	
semau	Semecarpus australiensis	australian cashew; tar tree; marking nut
semca	Semecarpus cassuvium	
serre	Serenoa repens	saw palmetto
sesin	Sesamum indicum	sesame;sim sim; benniseed
sesor	Sesamum orientale	african simsim
sesac	Sesbania aculeata	
sesae	Sesbania aegyptiaca	
shogy	Shorea gynterteiana	
shoma	Shorea macrophylla	engkebang nut; illipe nut
shose	Shorea seminis	
shoxx	Shorea species	illipe nuts
shosu	Shorea sumatrana	
siltr	Siler trilobum	
simca	Simmondsia californica	jojoba: jajoba nut; goat nut; desert box
simca=	Simmondsia chinensis	
sorlo	Sorindeia longifolia	
speru	Spergularia rubra	sand spurrey
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sphma	Sphenostylis marginata	
sphsc	Sphenostylis schweinfurthii	
sphst	Sphenostylis stenocarpa	ground squirrel bean
spodu	Spondias dulcis	hog plum
spomo	Spondias mombin	mombin; hog plum; yellow Spanish plum
stapi	Staphylea pinnata	bladder nut
staxx	Staphylea species	bladder nut

statr	Staphylea trifolia	american bladder nut
steaf	Sterculia africans	mopopaja tree
steaa	Sterculia alata	buddha coconut
steal	Sterculia alexandrii	cape sterculia
steap	Sterculia apetala	panama tree
staba	Sterculia balanghas	
steca	Sterculia carthaginensis	
stech	Sterculia chicha	maranhao nut
stedi	Sterculia diversifolia	bottle tree
stefo	Sterculia foetida	sterculia nut; java olive
steaf=	Sterculia guerichii	
stegu	Sterculia guttata	
steaf=	Sterculia ipomoeifolia	
stemo	Sterculia monosperma	china chestnut; [pheng phok]
stemu	Sterculia murex	lowveld chestnut
steob	Sterculia oblongata	
steqa	Sterculia quadrifida	[gorarbar]
stequ	Sterculia quinqueloba	five-lobed sterculia
stera	Sterculia ramiflora	[an-ji-ur]
stero	Sterculia rogersii	ulumbu tree
steru	Sterculia rupestris	narrow leaved bottle tree
stesc	Sterculia schumanniana	
stexx	Sterculia species	tropical chestnuts
steaf=	Sterculia tomentosa	
stetb	Sterculia treubii	
stetr	Sterculia trichosiphon	broadleaved bottle tree
steaf=	Sterculia triphaca	
steuc	Sterculia urceolata	
steur	Sterculia urens	[gulu]
stequ=	Sterculia zastrowiana	
strgr	Strombosia grandifolia	
strpu	Strombosia pustulata	
strsc	Strombosia scheffleri	
strpo	Strychnos potatorum	clearing nut; lndian gum nut
strsp	Strychnos spinosa	
syaca	Syagrus capiyata	
syacc	Syagrus cocoides	[pururima]
syacu	Syagrus coronata	ouricuru palm
syaro	Syagrus romanzoffianum	palma pindo; chirvana
tamin	Tamarindus indica	tamarind
teloc	Telfairea occidentalis	fluted gourd; iroko;fluted pumpkin
telpe	Telfairea pedata	oyster nut; [kweme]
terar	Terminalia arenicola	
terbe	Terminalia belerica	beleric myrabalan
terca	Terminalia catappa	sea almond; indian almond; java almond; [bodamier]
terch	Terminalia chebula	
terci	Terminalia citrina	
terfi	Terminalia fitzgeraldii	
tergl	Terminalia glabra	
terga	Terminalia glabrata	
tergr	Terminalia grandiflora	[yalu]
terim	Terminalia impediens	
terka	Terminalia kaernbachii	okari nut
terla	Terminalia langanda	langanda nut
terli	Terminalia litoris	
terma	Terminalia mauritiana	false benzoin
tercy	Terminalia myriocarpa	

terka	Terminalia okari	
terpa	Terminalia pamea	
terse	Terminalia sericocarpa	
terxx	Terminalia species	
tetco	Tetracarpidiam conophorum	awusa nut
theca	Theobroma cacao	cocoa; cacao
theju	Theophrasta jussieui	
thepo	Thespesia populnea	portia nut
thepe	Thevetia peruviana	lucky nut
tilxx	Tilia species	lindens; basswood
torca	Torreya californica	california nutmeg
torgr	Torreya grandis	
tornu	Torreya nucifera	kaya nut; japanese torreya
torta	Torreya taxifolia	stinking cedar
trabi	Trapa bicornis	water chestnut; [ling]
trabi=	Trapa bicornuta	
trabs	Trapa bispinona	singhara nut
trana	Trapa natans	water caltrops; jesuit nut; water chestnut; horn chestnut
trana=	Trapa quadrispinosa	
treaf	Tribecula africana	african breadfruit; [okwa]
trite	Tribulus terrestris	land caltrops
tridr	Trichilia dregeana	
triem	Trichilia emetina	
triro	Trichilia roka	
trixx	Trichilia species	
trize	Trichodesma zeylanicum	
trian	Trichosanthos anguina	club gourd; serpent cucumber; snake gourd; viper gourd
trgxx	Trigobalanus species	oaks
trifo	Trigonella foenum-graecum	fenugreek
steaf=	Triphaca africana	
trora	Trohis racemosa	white breadnut; yeilow breadnut
tyles	Tylosema esculentum	gemsbok bean
beixx=	Tylostemon species	
typli	Typhonodorum lindleyanum	
umbca	Umbellularia californica	california laurel
urelo	Urena lobata	
vatin	Vataria indica	dammar
veijo	Veitchia joannis	
venma	Ventilago madraspatana	hindi-pitti
vicre	Victoria regia	water maize; giant water lily
vigca	Vigna catjang	cowpea
voasu	Voandzeia subterranea	bambarra groundnut; madagascan groundnut; bambara
xanza	Xanthoceris zambeziaca	
xerst	Xeroderria stuhlmannii	
ximam	Ximenia americana	tallow nut; beach plum; false sandalwood; wild olive
zamch	Zamia chiqua	
zamfl	Zamia floridiana	coontie; comptie; seminole bread; sago cycad
zamin	Zamia integrifolla	
zampu	Zamia pumila	
zeama	Zea mays	maize; indian corn
zizag	Zizyphus agrestis	jujube; chinese date
zosma	Zosteria marina	water nut

Common or native names, cross-referenced

[an-ji-ur]	Sterculia ramiflora
[arumba]	Lepidozamia hopei
[baiyo]	Macrozamia reidlei

[bijasal]	Pterocarpus marsupium
[bodamier]	Terminalia catappa
[calumpang]	Buchanania lanzan
[dendezeiro]	Elaeis guineensis
[doleib]	Borassus deleb
[egusi]	Colocynthis vulgaris
[fao]	Ochrosia oppositifolia
[faveleira]	Jatropha acanthophylla
[gajus]	Anacardium occidentale
[gon]	Castanopsis argyrophilia
[gorarbar]	Sterculia quadrifida
[guariroba]	Cocos oleracea
[gulu]	Sterculia urens
[ingi notto]	Caryocar nuciferum
[ivi]	Inocarpus edulis
[kat]	Castanopsis tribuloides
[kepayang]	Pangium edule
[kila pimenta]	Buchholzia coriacea
[kuo sung]	Pinus armandi
[kursan]	Boscia angustifolia
[kweme]	Telfairea pedata
[kysin]	Castanopsis tribuloides
[ling]	Trapa bicornis
[m'poga]	Poga oleosa
[mkonga]	Balanites wilsoniana
[mongo]	Pandanus utilis
[muru-muru]	Astrocaryum tucumoides
[nangka]	Artocarpus integra
[nara]	Acanthosicyos horrida
[ngoli]	Canarium indicum
[nkula]	Coula edulis
[okwa]	Tribecula africana
[pakoidan]	Ochrosia elliptica
[pheng phok]	Sterculia monosperma
[pignolias]	Pinus pinea
[po-yoak]	Afrolicania
[pururima]	Syagrus cocoides
[rengas]	Gluta elegans
[rengas]	Gluta renghas
[rengas]	Gluta velutina
[tuk]	Borassus deleb
[yalu]	Terminalia grandiflora
abiu	Pouteria cainito
acorns	Quercus species
africon brazilnut	Poga oleosa
african breadfruit	Tribecula africana
african locust bean	Parkia filicoidea
african oil palm	Elaeis guineensis
african pearwood	Mimusops djave
african simsim	Sesamum indicum
african walnut	Coula edulis
akee	Blighia sapida
algaroba-cashau	Prosopis dulcis
açai	Elaeis oleifera
almandora	Geoffraea superba
almond	Prunus amygdalus
almandette	Buchanania lanzan

aloes wood	Aquilaria malaccensis
alpine pine	Pinus albicaulis
american beech	Fagus grandifolia
american bladder nut	Staphylea trifolia
american chestnut	Castanea dentata
american hazel	Corylus americana
american lotus	Nelumbo luteum
american oil palm	Elaeis oleifera
annatto	Bixa orellana
apricot	Prunus armeniaca
areca nut	Areca catechu
argan tree	Argania sideroxylon
arizona walnut	Juglans major
assyrian palm	Cordia myxa
atta bean	Pentaclethra macrophylla
australian cashew	Semecarpus australiensis
australian chestnut	Castanospermum australe
avellano	Guevlna avellana
awara nuts	Astrocaryum tucumoides
awusa nut	Tetracarpidiam conophorum
babacu palm	Orbignya speciosa
babassu palm	Orbignya barbosiana
ball nut	Macadamia praealta
ballota	Quercus ilex
bambarra groundnut	Voandzeia subterranea
banga nut	Macrozamia miquelii
baobab	Adansonia digitata
barbados nut	Jatropha curcas
barbados pride	Adenanthera pavonina
baroba	Diplodiscus paniculatus
basket oak	Quercus prinus
basswood	Tilia species
batiputa	Ouratea parviflora
beach plum	Ximenia americana
beaked hazel	Corylus cornuta
beaked hazel	Corylus rostrata
beeches	Fagus species
beleric myrabalan	Terminalia belerica
belgian walnut	Dracontomelum mangiferum
bellotas	Quercus ilex
ben nut	Moringa oleifera
benniseed	Sesamum indicum
betel nut	Areca catechu
big-cone pine	Pinus coulteri
bitter gourd	Colocynthis vulgaris
bitter kola	Garcinia kola
bitter quandong	Santalum murrayanum
bitter vetch	Lathyrus montanus
bitternut	Carya cordiformis
black bean	Castanospermum australe
black hickory	Carya texana
black jack	Quercus marilandica
black mango	Pentadesma butyracea
black walnut	Juglans nigra
bladder nut	Staphylea pinnata, Staphylea species
boab	Adansonia gregorii
bomah nut	Pycnocoma macrophylla

bonduc nut	Caesalpinia crista
boomban	Endiandra indignis
bottle gourd	Lagenaria ciceraria
bottle tree	Sterculia diversifolia
braided chestnut	Castanopsis inermis
brazil nut	Bertholettia excelsa
brazilian nutmeg	Cryptocarya moschata
brazilian nutmeg	Myristica fatua
bread tree	Irvingia gabonensis
breadfruit	Artocarpus incisa, Artocarpus species
breadfruit	Pandanus pedunculatus
breadnut	Artocarpus altilas
broadleaved bottle tree	Sterculia trichosiphon
buckeye	Aesculus parviflora
buddha coconut	Sterculia alata
buffalo gourd	Cucurbita foetidissima
buffalo nut	Pyrularia pubera
bull pine	Pinus ponderosa
bullnut	Carya tomentosa
bunya pine	Araucaria bidwilli
bur oak	Quercus macrocarpa
burdekin plum	Pleiogynium cerasiferum
buriti nut	Mauritia flexuosa
burrawong	Macrozamia spiralis
bush candle tree	Canarium schweinfurthii
bush chinquapin	Castanopsis sempervirans
bush mango	Cordyla africana
butter nut	Caryocar nuciferum
butter pit	Acanthosicyos horrida
butter tree	Pentadesma butyracea
butternut	Juglans cinerea
button tree	Gomphia jabotapita
cacao	Theobroma cacao
calabash	Crescentia cujete
calabash cucumber	Lagenaria ciceraria
calabash nutmeg	Monodora myristica
california black oak	Quercus kelloggii
california buckeye	Aesculus californlca
california horse-chestnut	Aesculus californlca
california laurel	Umbellularia californica
california nutmeg	Torreya californica
California white oak	Quercus lobata
Californian field oak	Quercus agrifolia
calobo	Diplodiscus paniculatus
camata	Quercus aegilops
candle nut	Aleurites triloba
candle tree	Parmentiera cereifera
candle tree	Pentadesma butyracea
canistel	Pouteria campechiana
canyon live oak	Quercus chrysolepsis
cape chestnut	Calodendron capense
cape sterculia	Sterculia alexandrii
carnauba	Copernicia prunifera
cashew nut	Anacardium occidentale
caucasian wingnut	Pterocarya fraxinifolia
cedar pine	Pinus koraensis
ceylon oak	Schleichera trijuga

chalmoogra nut	Hydnocarpus kurzii
chayote	Sechium edule
cherry almond	Amygdalus pedunculata
cherry bush	Santalum lanceolatum
chestnut oak	Quercus prinus
chestnuts	Castanea species
chiang turpentine tree	Pistacia terebinthus
chick pea	Cicer arietinum
chickling vetch	Lathyrus sativus
chile hazel	Gevuina avellana
Chile pine	Araucaria araucana
chilghosa pine	Pinus gerardiana
china chestnut	Sterculia monosperma
chinese acorn	Lithocarpus corneus
chinese almond	Prunus armeniaca
chinese butternut	Carya cathayensis
chinese chestnut	Castanea mollissima
chinese chinquapin	Castanopsis chinensis
chinese date	Zizyphus agrestis
chinese hazel	Corylus chinensis
chinese horse-chestnut	Aesculus chinensis
chinese olive	Canarium album
chinese olive	Canarium pimela
chinese pistache	Pistacia chinensis
chinese walnut	Carya cathayensis
chinese walnut	Juglans cathayensis
chinese water chestnut	Eleocharis dulcis
chinquapin	Castanea pumila
chinquapin oak	Quercus prinoides
chinquapins	Castanopsis species
chir pine	Pinus roxburghii
chirvana	Syagrus romanzoffianum
chufa nut	Cyperus esculentes
civet fruit	Durio zibethinus
clearing nut	Strychnos potatorum
club gourd	Trichosanthos anguina
cob nut	Corylus avellana
coco-de-mer	Lodoicea sechellarum
cocoa	Theobroma cacao
coconut	Cocos nucifera
cocoplum	Chrysobalanus icaco
cocos palm family	cocosoid family
cohune nut	Attalea cohune
cola nut	Cola nitida
comptie	Zamia floridiana
conker	Aesculus hippocastannum
coontie	Zamia floridiana
coquilla nut	Attalea funifera
coquito nut	Jubaea spectabilis
coral tree	Adenanthera pavonina
coral tree	Erythrina variegata
cork oak	Quercus suber
corojo	Gastrococos crispa
curozo nut	Phytelephas macrocarpa
coulter pine	Pinus coulteri
cowpea	Vigna catjang
coyor	Aiphanes minima

cream nut	Bertholettia excelsa
cucurite palm	Maximiliana regia
cuddepah almond	Buchanania lanzan
cut nut	Barringtonia edulis
cut nut	Barringtonia niedenzuane
cut nut	Barringtonia novae-hyberniae
cycads	cycas species
cyprus turpentine tree	Pistacia terebinthus
dammar	Vateria indica
dawa nut	Litchi chinensis
desert box	Simmondsia californica
desert date	Balanites aegyptiaca
desert walnut	Owenia reticulata
digger pine	Pinus sabiniana
dika nut	Irvingia gabonensis
djave nut	Mimusops djave
dolphin gourd	Lagenaria ciceraria
double coconut	Lodoicea sechellarum
doum nut	Hyphaene thebaica
doum nut	Hyphaene ventricosa
durian	Durio zibethinus
durmast oak	Quercus petraea
dwarf almond	Amygdalus nana
earth almond	Cyperus esculentes
earth nut	Conopodium majus
egyptian pea	Cicer arietinum
egyptian water lily	Nymphaea lotus
elephant kola	Buchholzia coriacea
emblic myrobalan	Phyllanthus emblica
emory oak	Quercus emoryi
emu apple	Owenia vernicosa
engkebang nut	Shorea macrophylla
english oak	Quercus robur
english walnut	Juglans regia
european beech	Fagus sylvatica
european chestnut	Castanea sativa
false benzoln	Terminalia mauritiana
false kola	Garcinia kola
false sandalwood	Ximenia americana
false yam	Icacina senegalensis
featherweight tree	Ricinidendron rautenii
fenugreek	Trigonella foenum-graecum
fijian longan	Pometia pinnata
filbert	Corylus avellana
fishtail palm	Caryota mitis
five-lobed sterculia	Sterculia quinqueloba
fluted gourd	Telfairea occidentalis
fluted pumpkin	Telfairea occidentalis
four-leaf nut pine	Pinus quadrifolia
fox nut	Euryale ferox
fragrant sandalwood	Santalum spicatum
fremont screwbean	Prosopis pubescens
gaboon nut	Coula edulis
galip	Finschia chloroxantha
gall nuts	Quercus specIes
galo nut	Anacolosa luzoniensis
garlip	Canarium mehenbethene

gasso nut	Manniophyton africanum
geiger tree	Cordia sebestena
gemsbok bean	Tylosema esculentum
genip	Melicoccus bijugatus
giant chinguapin	Castonopsis chrysophylla
giant hyssop	Agastache urticifolia
giant water lily	Victoria regia
gilla nut	Entada scandens
gingerbread palm	Hyphaene ventricosa
ginkgo	Ginkgo biloba
gnemon tree	Gnetum gnemon
goa bean	Psophocarpus tetragonolobus
goat nut	Simmondsia californica
golden chestnut	Castanopsis chrysophylla
goober	Arachis hypogaea
gorgon nut	Euryale ferox
gourd	Cucurbita pepo
green sapote	Pouteria viride
ground squirrel bean	Sphenostylis stenocarpa
groundnut	Apios tuberosa
groundnut	Arachis hypogaea
groundnut	Aralia trifolia
gru gru nut	Acrocomia sclerocarpa
gru-gru palm	Acrocomia aculeata
guarana	Paullinia cupana
guatecare	Eschweilera subglandulosa
guava	Psidium guajava
guere palm	Astrocaryum tucumoides
gutta percha	Pachira aquatica
hausa groundnut	Kerstingiella geocarpa
hazel nut	Corylus avellana
hazel nut	Corylus maxima
heartnut	Juglans ailanthifolia
heartnut	Juglans cordlformis
helicia nut	Helicia diversifolia
hemp	Cannabis sativa
hickories	Carya species
himalayan hazel	Corylus ferox
hindi-pitti	Ventilago madraspatana
hodgsonia seeds	Hodgsona macrocarpa
hog peanut	Amphicarpaea monoica
hog plum	Spondias dulcis
hog plum	Spondias mombin
holly oak	Quercus ilex
holm oak	Quercus ilex
homeid	Sclerocarya birea
horn chestnut	Trapa natans
horse bean	Cannavalia ensiformis
horse tamarind	Leucaena glauca
horse-chestnut	Aesculus hippocastanum
horse-eye bean	Mucuna sloanei
horsemint	Agastache urticifolia
horseradish tree	Moringa oleifera
hottentot almond	Brabejum stellatifolium
hottentot fig	Mesembryanthemum edule
hunterman nut	Omphalea megacarpa
hyacinth bean	Dolichos lablab

icaco	Chrysobalanus icaco
illipe nut	Madhuca latifolia
illipe nut	Shorea seminis
illipe nuts	Shorea species
inaja palm	Maximiliana regia
incense tree	Canarium schweinfurthii
india-oil nut	Calophyllum inophyllum
Indian almond	Terminalia catappa
indian corn	Zea mays
indian gum nut	Strychnos potatorum
indian horse-chestnut	Aesculus indica
indian kino tree	Pterocarpus marsupium
indian lotus	Nelumbo nucifera
indian olibanom	Boscia serrata
inoi nut	Poga oleosa
iroko	Telfairea occidentalis
ironwood	Mesua ferrea
ironwood	Olneya tesota
ita palm	Mauritia flexuosa
ivory nut	Coelococus amicarcum
jack nut	Artocarpus integra
jajoba nut	Simmondsia californica
jak nut	Artocarpus integra
jamaica cobnut	Omphalea diandra
jamaica cobnut	Omphalea triandra
jamaica nutmeg	Monodora myristica
jamaican bread nut	Brosimum alicastrum
jambu	Psydium guajava
japan wood oil	Aleurites cordata
japanese chestnut	Castanea crenata
japanese hazel	Corylus heterophylla
Japanese hazel	Corylus mandschurica
Japanese horse-chestnut	Aesculus turbinata
japanese torreya	Torreya nucifera
japanese walnut	Juglans ailanthifolia
japanese walnut	Juglans sieboldiana
japura	Erisma japura
java almond	Canarium commun
java almond	Canarium indicum
java almond	Canarium vulgare
java almond	Canarium species
java almond	Canarium luzonicum
java almond	Terminalia catappa
java olive	Sterculia foetida
jeffrey pine	Pinus jeffreyi
jesuit nut	Trapa natans
jiringa	Pithecellobium jiringa
jobota chestnut	Anisosperma passiflora
johnstone river almond	Elaeocarpus bancroftii
jojoba	Simmondsia californica
jujube	Zizyphus agrestis
kaong	Arenga pinnata
karaka nut	Corynocarpuslaevigatus
karanda nut	Elaeocarpus bancroftii
karoshiri	Cuervea kappleriana
karuka nut	Pandanus julianetti
kashmir soap berry	Sapindus mukorossi

kaya nut	Torreya nucifera
kenari nut	Canarium indicum
kermes oak	Quercus coccifera
keule	Gomortega nitida
klngnut	Carya laciniosa
kipper nut	Conopodium majus
kokam butter tree	Garcinia indica
kola nut	Cola digitata
kola nut	Cola nitida
kola nut	Cola vera
korean pine	Pinus koraensis
kubili nut	Cubilia blancoi
lac tree	Schleichera trijuga
lacebark pine	Pinus bungeana
lanao	Otophora fruticosa
lancepod	Lonchocarpus capassa
land caltrops	Tribulus terrestris
langanda nut	Terminalia langanda
langslr	Pometia pinnata
lentil	Lenas esculenta
limber pine	Pinus flexilis
lindens	Tilia species
lipstick tree	Bixa orellana
litchi	Litchi chinsnsis
litchi nut	Nephelium litchi
live oak	Quercus virginiana
lone pine	Pinus torreyana
loose-bark pignut	Carya ovalis
lotus	Nelumbium nelumbo
lotus	Nelumbo speciosa
lotus	Nymphaea lotus
love nut	Abrus precatorlus
lowveld chestnut	Sterculia murex
lucky nut	Thevetia peruviana
lucuma	Pouteria obovata
lunan nut	Otophora fruticosa
lupine	Lupinus hirsutus
lychee	Litchi chinensis
lychee	Nephelium litchi
madagascan groundnut	Voandzeia subterranea
madagascar clove nutmeg	Ravensara aromatica
madeira nut	Juglans regia
madia oil	Madia sativa
mahoe	Alectryon macrococcus
maidenhair tree	Ginkgo biloba
maize	Zea mays
malabar chestnut	Pachira aquatica
malanangka	Gymnartocarpus woodii
mamarron	Scheelea magdalenica
mamey sapote	Pouteria sapota
mamoncillo	Melicocous bijugatus
manchurian hazel	Corylus mandschurica
manchurian walnut	Juglans mandschurica
mango	Mangifera indica
mangosteen	Garcinia mangostana
manketti nut	Ricinidendron rautenii
mankettl nut	Ricinidendron heudlotii

manna oak	Quercus persica
maranhao oak	Sterculia chicha
marany nut	Semecarpus anacardium
marijuana	Cannabis sativa
marking nut	Semecarpus anacardium
marking nut	Semecarpus australiensis
maroela	Sclerocarya caffra
marsh nut	Semecarpus anacardium
marula	Sclerocarya caffra
mastic tree	Pistacia lentiscus
matchbox bean	Entada scandens
may-chau tree	Carya tonkinensis
mecca galls	Quercus species
meni oil	Lophira lanceolata
mesquite	Prosopis juliflora
mexican calabash	Crescentia alata
mexican gru-gru	Acrocomia mexicana
mexican nut pine	Pinus parrayana
midnight horror	Oroxylum indicum
ming	Santalum murrayensis
mkambati palm	Jubaeopsls caffra
mockernut	Carya tomentosa
mombin	Spondias mombin
monkey bread	Adansonia digitata
monkey cap palm	Manicaria saccifera
monkey chestnut	Lecythis grandifolia
monkey jak	Artocarpus rigida
monkey kola	Cola caricafolia
monkey nut	Arachis hypogaea
monkey nut	Hickbeachia pinnatifolia
monkey puzzle	Araucaria araucana
mopane	Colophospermum mopane
mopopaja tree	Sterculia africana
moreton bay chestnut	Castanospermum australe
mountain walnut	Carya cathayensis
mugongo nut	Ricinidendron heudlotii
musk tree	Buchholzia coriacea
naranka	Lagenaria ciceraria
narrowleaved bottle tree	Sterculia rupestris
natal cola	Cola natalensis
native peach	Santalum acuminatum
nelson pine	Plnus nelsoni
neosia	Plnus gerardiana
neoza nut	Plnus gerardiana
nepal nut pine	Plnus gerardiana
new zealand mangrove	Avicennia officinalis
ngapi nut	Pithecellobium lobatum
nicker nut	Caesalpinia crista
nicuri palm nut	Cocos coronata
niger seed	Guizotia abyssinica
nipa palm	Nipa fruticans
nltta nut	Parkia africana
north californla black walnut	Juglans hlndsii
northern sandalwood	Santalum lanceolatum
nutneg	Myristica fragrans
nutmeg hickory	Carya myristicaeformis
nuts	nut species generally

nutta nut	Parkia africana
oaks	Quercus species
oaks	Trigobalanus species
oil bean tree	Pentaclethra macrophylla
oil nut	Pyrularia pubera
oil palm nut	Elaeis guineensis
okari nut	Terminalia kaernbachii
olive nut	Elaeocarpus ganitrus
one-needle pine	Pinus monophylla
opium poppy	Papaver somniferum
oregon oak	Quercus garryana
oregon sunflower	Balsamorhiza sagittata
oriental cashew	Semecarpus anacardium
otahite chestnut	Inocarpus edulis
ouricuru palm	Syagrus coronata
owusa nut	PIukenetia conophora
oyster nut	Telfairea pedata
pale-leaf hickory	Carya villosa
palm chestnut	Guilielma utilis
palma pindo	Syagrus romanzoffianum
palmyra palm	Borassus flabellifer
palo de la montanas	Panopsis suaveolans
palo de papa	Calatola laevigata
palo de papa	Panopsis suaveolans
panama tree	Sterculia apetala
pangi	Pangium edule
para nut	Bertholettia excelsa
paradise nut	Lecythis usitata
paradise nut	Lecythis zabucajo
parana pine	Araucaria brasiliana
patana oak	Careya arborea
pataua	Oenocarpus distichus
peach palm	Bactris gasipaes
peanut	Arachis hypogaea
pecan	Carya lllinoensis
pejibaye	Bactris gasipaes
pekea nut	Caryocar villosum
peribaye	Guilielma utilis
persian walnut	Juglans regia
philippine chestnut	Castanopsis philippensls
physic nut	Jatropha curcas
pig nut	Conopodium majus
pigeon pea	Cajanus cajan
pignut	Carya glabra
pili nut	Canarium luzonicum
pili nut	Canarium species
pili nut	Canarium ovatum
pin oak	Quercus palustris
pinon pine	Pinus cembroides
pinyon pine	Pinus cembroides
pistache	Pistacia vera
pistachio nut	Pistacia vera
pistachios	Pistacia species
plum bush	Santalum lanceolatum
ponderosa pine	Pinus ponderosa
pondoland coconut	Jubaeopsis caffra
pondoland palm	Jubaeopsis caffra

pop nut	Omphalea triandra
portia nut	Thespesia populnea
portuguese oak	Quercus lusitanica
post oak	Quercus steliata
prairie lily	Mentzelia albicaulis
pulasan	Nephelium mutabile
pumpkin	Cucurbita pepo
pupunha	Bactris gasipaes
purging nut	Jatropha curcas
pygmy coconut	Jubaea spectabilis
quandong	Santalum acuminatum
queensland bean	Entada scandens
queensland chestnut	Endiandra palmerstonii
queensland nut	Macadamia integrifolia
queensland nut	Macadamia tetraphylla
quondong	Santalum acuminatum
raffia palm	Raphia farinifera
rambutan	Nephelium lappaceum
rangoon creeper	Quisqualis indica
rattan	Calumus maneu
rattan	Calumus tumidus
rattle nut	Nelumbo speciosa
red buckeye	Aesculus pavia
red horse-chestnut	Aesculus carnea
red ironwood	Lophira lanceolata
red oak	Quercus rubra
red sanderswood	Adenanthera pavonina
red sorrel	Hibiscus sabdariffa
redheart hickory	Carya glabra
rocky mountain scrub oak	Quercus undulata
rosary pea	Abrus precatorius
rose butternut	Blepharocarya involucrigea
rose nut	Hickbeachia pinnatifolia
roselle	Hibiscus sabdariffa
rough macadamia	Macadamia tetraphylla
rush nut	Cyperus esculentes
russell river nut	Omphalea megacarpa
russian nut	Pinus sibirica
saba nut	Pachlra aquatica
safflower	carthamus tinctorius
sago cycad	Zamia floridiana
sago palm	Cycas revoluta
salak	Salacca edulis
salt bush	Salvadora persica
sand hickory	Carya pallida
sand spurrey	Spergularia rubra
sandalwood	Santalum spicatum
sandalwoods	Santalum species
sapistan plum	Cordia myxa
sapote	Pouteria sapota
sapucaia nut	Lecythis ollaria
sapucaia nut	Lecythis usitata
sapucaia nut	Lecythis zabucajo
sapucaia nuts	Lecythis species
sausage tree	Kigelia pinnata
saw palmetto	Serenoa repens
screw pines	Pandanus species

scrub oak	Quercus undulata
sea almond	Terminalia catappa
sea coconut	Lodoicea sechellarum
sea fruit	Enhalus acoroides
sea fruit	Enhalus koenigiia
seaside pea	Lathyrus maritimus
sedge nut	Cyperus esculentes
seje	Jessenia polycarpa
seminole bread	Zamia floridiana
serpent cucumber	Trichosanthos anguina
sesame	Sesamum indicum
shagbark hickory	Carya ovata
shea butter tree	Butyrospermum paradoxum
shea butter tree	Butyrospermum parkii
nhmu nut	Butyrospermum parkii
sheilbark hickory	Carya laciniosa
shin oak	Quercus gambelii
siberian hazei	Corylus heterophylla
siberian stone pine	Pinus sibirica
sierra leone gourd	Colocynthis vulgaris
silk cotton tree	Ceiba pentandra
sim sim	Sesamum indicum
singhara nut	Trapa bispinosa
sIngle-leaf pine	Pinus monophyila
skittle nut	Allantoma cyiindrica
slippery kola	Cola verticillata
small-fruited hickory	Carya microcarpa
smooth macadamia	Macadamia integrifolia
snake gourd	Trichosanthos anguina
snake nut	Ophiocaryon paradoxum
snakewood	Brosimum alicastrum
soap nuts	Sapindas species
soapberry tree	Balanites aegyptiaca
soft lumbang	Aleurites trisperma
soja bean	Glycine max
soiedad pine	Pinus torreyana
souari nut	Caryocar nuciferum
sour gourd	Adansonia digitata
sour plum	Owenia vernicosa
southern beeches	Nothofagus species
soy bean	Glycine max
spanish chestnut	Castanea sativa
spanish lime	Melicoccus bijugatus
spatter-dock	Nuphar advaena
spicy cedar	Beilschmiedia mannii
spirit's marbles	Cathorsmium altissimum
squash	Cucurbita pepo
St. thomas tree	Bauhinia tomentosa
steppe almond	Amygdalus nana
sterculia nut	Sterculia foetida
stilt-root palm	Eugeissona utilis
stinking cassia	Cassia tora
stinking cedar	Torreya taxifolia
stone pine	Pinus pinea
suger pine	Pinus lambertiana
sugar plum	Arenga pinnata
sunflower seeds	Helianthus annuus

suppa palm	Acrocomia mexicana
swamp hickory	Carye aquatica
swamp white oak	Quercus bicolor
swarri nut	Caryocar nuciferum
sweet buckeye	Aesculas octandra
sweet chestnut	Castanea sativa
sweet melon	Cucumis melo
a:wise atone pine	Pinus cambra
sword bean	Canavalia ensiformis
sydney golden wattle	Acacia longifolia
taccy nut	Caryodendron orinocense
tagua nut	Phytelephas macrocarpa
tahiti chestnut	Inocarpas edalis
talipot palm	Corypha umbraculifera
tallow nut	Sapium sabiferum
tallow nut	Ximenia americana
tallow tree	Allanblackia floribunda
tallow tree	Pentadesma butyracea
tamarind	Tamarindus indica
tapos	Elateriospermum tapos
tar tree	Semecarpus australiensis
terap	Artocarpus elastica
texas walnut	Juglans rupestris
thorn tree	Balanites aegyptiaca
tibet hazel	Corylus tibetica
tiger nut	Cyperus esculentus
tingui	Magonia pubescens
tola	Beilschmiedia mannii
tonka bean	Coumarouna odorata
torrey pine	Pinus torreyena
travellers tree	Ravenala madagascariensis
tree-of-life	Mauritia flexuosa
tropical chestnuts	Castanopsis species
tropical chestnuts	Stercalia species
tropical horse chestnuts	Billia species
tropical oaks	Lithocarpus species
tucan nuts	Astrocaryum tucumoides
tucum nuts	Astrocaryum tucumoides
tung	Aleurltes fordii
tung	Aleurltes montana
turkey oak	Quercus cerris
turkish hazel	Corylus colurna
two-needle nut pine	Pinus edulis
ulumbo tree	Sterculia rogersii
umbrella pine	Pinus pinea
valley oak	Quercus lobata
valonia oak	Quercus aegilops
van riebeeck almond	Brabejum stellatifolium
vanquisher	Cola microcarpa
vegetable ivory nut	Phytelephas macrocarpa
vegetable ivory palm	Hyphaene thebaica
viper gourd	Trichosanthos anguina
virginia chestnut	Castanea pumila
walnut	Juglans regia
walnut bean	Endiandra species
walnuts	Juglans species
wanga	Beilschmiedia bancroftii

water caltrops	Trapa natans
water chestnut	Eleocharis dulcis
water chestnut	Trapa bicornis
water chestnut	Trapa natans
water chinquapin	Nelumbo speciosa
water hickory	Carya aquatica
water maize	Victoria regia
water melon	Citrullus lanatus
water melon	Citrullus vulgaris
water nut	Nelumbo species
water nut	Zosteria marina
watercare	Eschweilera subglandulosa
waterlily seeds	Nymphaea species
wax gourd	Benincasa hispida
wax palm	Copernicia prunifera
western oak	Quercus garryana
white breadnut	Trohis racemosa
white hickory	Carya tomentosa
white nut	Ginkgo biloba
white oak	Quercus alba
white walnut	Juglans cinerea
whitebark pine	Pinus albicaulis
wild almond	Brabejum stellatifolium
wild bean	Apios tuberosa
wild lupine	Lupinus perennis
wild mango	Cola natalensis
wild mango	Irvingia gabonensis
wild olive	Ximenia americana
wild plum	Pappea caponsis
willow oak	Quercus phellos
winged walnut	Pterocarya fraxinifolia
witch hazel	Hamamelis virginiana
woodland onion	Scorodocarpus borneensis
yeheb nut	Cordeauxia edulis
yellow breadnut	Trohis racemosa
yellow iris	Iris pseudacorus
yellow lupine	Lupinus luteus
yellow pond lily	Nuphar advena
yellow spanish plum	Spondias mombin
yellow walnut	Beilschmiedia bancroftii
Zambesi almond	Ricinodendron heudlotii
Zamia palm	Macrozamia reidlei
Zulu nut	Cyperus esculentes

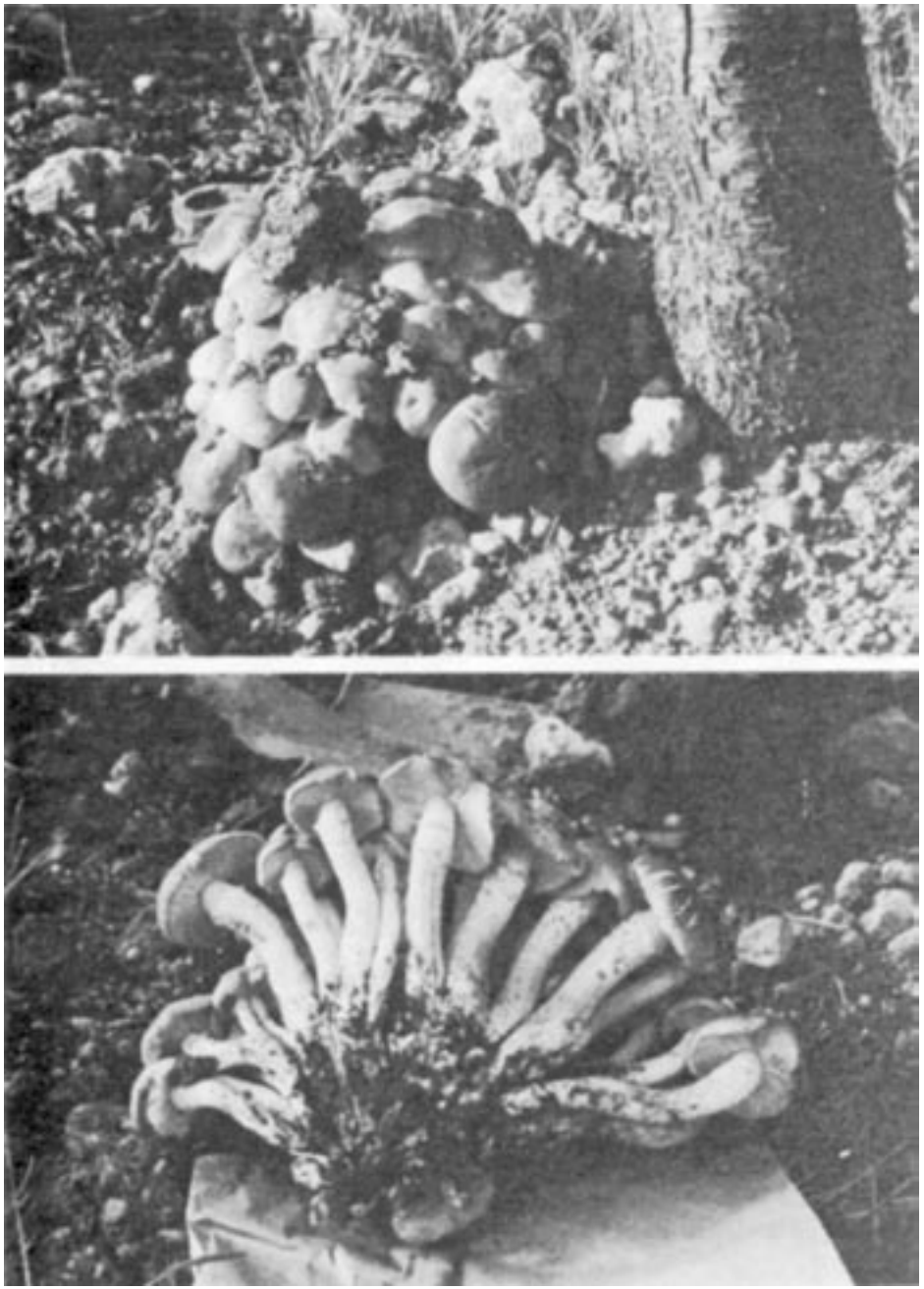
Young chestnut fruits in January at Kalamunda
Photo: B. Dell

Focus on hazel nuts

Hazelnut, about 4 years old near Kalamunda. Height 2.3m. Photo: B. Dell

Young Catkins -- January
Photo: B. Dell

Leaf Scorch. Photo: B. Dell



Armillaria on a young peach tree. Photo: B. Dell

THE NUTRITIONAL VALUE OF NUTS

SUSAN SMITH

INTRODUCTION

The upsurge of interest in nut crops for New Zealand has prompted this investigation into their nutritional value. Nuts are usually regarded as a luxury food, even in the affluent countries, so their contribution to human nutrition on a world scale has never been seriously considered. However, vegetarians have always valued the true nuts (as opposed to legumes) very highly as meat-substitutes. In Great Britain during the Second World War it was possible to register as a vegetarian, surrender one's meat ration and receive in return up to 1kg of nuts weekly.

Nuts are one of the most concentrated forms of food known to man. Not only do they have a high calorific value exceeding that of cheese but they also contain a substantial proportion of protein and are a good source of calcium, magnesium and iron. 100g of nut kernels is equivalent in energy value to 230g bread, 370g steak and 1,230g potatoes. It has been said that, "No man need starve on a journey who can fill his waistcoat pockets with almonds".

At present, nuts tend to be eaten as a snack or addition to a diet which is already high in protein and fat. Rarely are they substituted for other protein foods. Also, the high price of nuts at present prevents them from reaching those sectors of the population which would benefit from them the most - the poor and underfed. Some of the reasons for the high price of most tree nuts are - scarcity and cost of harvesting and shelling. The very hard nature of the shell of some nuts probably limits their use quite significantly, e.g. in India, a large proportion of the crop of cashew nuts goes to waste and those that are shelled (laboriously by peasant women) are exported overseas where they command a high price.

This paper concentrates on those nuts most likely to be grown in New Zealand, although special mention is made of certain tropical nuts where relevant.

GENERAL COMPOSITION

Table 1 shows the composition of 100g portions of the edible parts of nuts and other foods. It can be seen that all nuts, with the exception of chestnuts, have a very high fat content and this is responsible for their high calorific value compared to many other foods. Thus, 400g of walnuts would fulfil the daily calorie requirement for one person (See Table 2).

TABLE 1
Composition of some foods (per 100g edible portion)

	Water %	Protein %	Fat %	Carbohydrate %	Calcium, mg	Phosphorus, mg	Iron, mg	Vitamin A, (IU)	Thiamine B_1, mg	Fuel Value Cals
Egg (without shell)	73.7	14.8	10.5	Trace	56	210	2.5	1,100	0.1	158
Cow's milk	87.5	3.5	4.0	4.8	120	93	0.1	120	0.04	65
Cheese (Cheddar)	40.0	25.0	34.5	2.0	810	495	0.6	1,200	0.04	422
Fish (Cod)	85.0	15.0	0.1	0.0	25	194	1.0	0	0.06	60
Beef (Steak)	50.0	14.0	29.0	0.0	10	85	4.0	0	0.07	317
Butter	13.7	0.6	82.3	0.4	15	16	0.2	3,000	0.00	716
Bread (Wholemeal)	36.0	9.3	2.6	50.4	50	263	2.5	0	0.18	247
Brown Rice (dry)	12.0	7.5	1.7	77.7	39	303	2.0	0	0.32	359
Soya bean (raw, dry)	7.5	36.0	18.0	34.8	208	586	6.5	140	1.03	335
Peanut (roasted)	1.8	26.2	48.7	20.6	72	407	2.2	0	0.32	582
Navy beans (raw, dry)	11.5	21.4	1.5	61.6	163	437	6.9	0	0.67	338
Almond										
Prunus amygdalus	5.0	18.6	54.6	19.6	234	504	4.7	0	9.24	598
Walnut (Persian)										
Juglans regia	3.0	14.8	64.0	15.8	99	380	3.1	30	0.33	651
Walnut (Black)										
Juglans nigra	3.0	20.5	59.3	14.8	trace	570	6.0	300	0.22	628
Chestnut (dried)										
Castanea sativa	8.4	6.7	4.1	78.6	52	162	3.3	80	0.32	377
Hazel (Filbert)										
Corylus avellana	6.0	12.8	62.0	17.0	210	7	3.5	trace	0.46	626
Pecan										
Carya illinoensis	3.0	9.4	71.0	15.0	74	324	2.5	50	0.86	697
Pine nut										
Pinus spp.	5.0	14.0	60.0	20.5	12	?	5.2	30	1.28	?
Pignolia										
(stone pine)	5.6	31.1	47.4	11.6	11	?	4.5	-	0.62	?
Pistachio										
Pistacia spp.	5.3	19.3	54.0	18.0	100	500	7.0	230	0.32	594
Beechnut										
Fagus sp.	6.6	19.4	50.0	20.3						568
Brazil nut										
Bertholletia excelsa	4.6	14.3	67.0	10.6	186	693	3.4	10	0.96	654
Cashew nut										
Anacardium occidentale	5.2	17.2	45.7	29.3	38	373	3.8	100	0.43	561

Sources: 1. Manual of Nutrition -- Min. of Ag., Fish and Food, London, 1970

2. Encyclopaedia of Chem. Tech. (1967), John Wiley and Sons, N.Y.

3. Table of Food Values Recommended for Use in Canada, Dept. Nat. Health and Welfare, Ottawa, 1951.

TABLE 2

Recommended Daily Allowance of Nutrients for Adult Male

Protein	45-60g
Calories	2,500-2,800
Calcium	800mg
Phosphorus	800mg
Iron	10mg
Vitamin A	5,000 I.U.
Thiamine B1	1.2mg
Vitamin C	50mg

SOURCE: Food and Nutrition Board - Recommended Dietary Allowance, Edition 7, Publication No. 1694, Washington D.C. Revised 1968. Nat. Acad. Sci. - Nat. Research Council.

The protein content of nuts varies from 6.7% in chestnuts to 31% in pignolia. It is interesting to note that black walnuts (*Juglans nigra*) have a much higher protein content than the Persian type (*Juglans regia*) and so are nutritionally more valuable. Pecans have a fairly low protein content and the highest fat content of all the nuts listed.

The chestnuts are the exception among the tree nuts in that their main food store is carbohydrate. This accounts for their lower calorific value and wider dietary uses. In fact, the European varieties (*Castanea sativa*) closely resemble wheat in composition and can be ground into a flour. Chestnuts still provide a stable food for some peasant communities in Southern Europe. Mineral content of most nuts is quite high, although levels can be affected by growing conditions and storage. Almonds contain the highest amount of calcium, while black walnuts have only a mere trace. However, the black walnuts make up for this in phosphorus and iron content. Most nuts are also a reasonably good source of Vitamin A and B1 but contain no Vitamin C.

In comparing the composition of nuts with other foods, one notable point which is brought out in Table I is the low water content of nuts, especially when compared to the main protein foods of animal origin - eggs, meat, fish and even cheese. Low water content means low weight, easier storage and compactness. This fact, added to their high calorific value, makes them extremely useful as a food supply on expeditions of all kinds and in any situation where food storage space is very limited.

DIGESTIBILITY OF NUTS

The nuts are reputed to be indigestible and can cause discomfort if eaten in large quantities. However, this is usually due to inadequate chewing and it has been shown that the digestibility of nuts is greatly improved by grinding and cooking, otherwise lengthy mastication is necessary to obtain full nutritive value. In an experiment on a human subject living on nuts and fruit alone (Anon, 1967), the absorbabiity by the digestive system was found to be around 90%. Digestibility in rats has been determined for a number of nuts (See Table 3).

TABLE 3

Digestibility of Finely Ground Nuts in Rats (Anon., 1967)

	Protein %	*Fats %*
Pine nuts	95	83
Almond	90	96
Peanut	89	96
Hazel	83	87
Walnut (Persian)	79	68

Nuts, ground and in the form of nut-butters, of which peanut butter is an obvious example, are probably the best way of using both the oil and protein to full advantage. Nut-butters can substitute for ordinary butter and supply a substantial amount of available protein at the same time.

OILS AND FATTY ACIDS

Apart from the chestnuts, most tree-nuts contain between 40 and 70% fats. These, like most oils of plant origin, are in the form of polyunsaturated fatty acids whereas fats of animal origin are mainly saturated fats or triglycerides. There is evidence that a diet in which the fat component consists of a high proportion of unsaturated fatty acids, can lead to a lowering of the blood cholesterol level and this is generally considered to be advantageous to health (Guthrie, 1971).

Table 4 shows the amounts of fatty acids in some nuts and other foods. It can be seen that walnuts are particularly rich in linoleic acid which is an “essential fatty acid” since it cannot be synthesized by the body and is required for tissue growth, in particular for the synthesis of cellular membranes. In addition to this essential metabolic requirement for fat (linoleic acid intake should be at a level of 2% of the daily calorie requirement), fats also make food more palatable, assist swallowing and are used universally in cooking to bring out and enhance flavour.

It is the high fat content of nuts which is responsible for their very high calorific value. Whilst this can be of value for expedition rations, it limits their inclusion as a major component of the diet since calorific requirements are likely to be exceeded before protein requirements are met. Thus, there could be a considerable demand for nuts or nut products with reduced fat content, e.g. almond meal and peanut meal are obtained by pressing the oil from the nuts and grinding the cake. Unfortunately, since much of the flavour is in the oil, defatted nuts are less tasty. It should be possible, however, to modify extraction techniques so as to reach some compromise between maximum oil extraction and palatability of the cake which could supply a useful protein supplement to many dishes.

Within a single species of nut, the composition of the oil may vary considerably from one variety to another. French (1962) analysed the oil from 10 different commercial varieties of pecan and peanut, and found, for example, in pecan varieties, that the linoleic acid content varied from 13-37%. This opens up the possibility of breeding nuts for superior content of essential fatty acids.

NUT PROTEINS AND THEIR ESSENTIAL AMINO ACID COMPOSITION

It can be seen from Table 1 that the percentage of protein in nut kernels varies between species but all compare well with the protein content of, for example, beef. However, the nutritional value of proteins from different sources varies considerably and it is not sufficient to assess the potential of different foods merely by comparing the percentages of protein present.

TABLE 4

Amounts of Fatty Acids in Selected Foods (per 100g Edible Portion)

FOOD SOURCE	*Fatty Acids*			
	Saturated	*Unsaturated*		
	Total, g	*Oleic, g*	*Linoleic, g*	*Linolenic, g*
Almond	4.2	36	16.0	
Pecan	4.5	43	13.5	Trace
Walnuts, Persian			35.0	
Walnuts, Black	3.2	21	29.0	4.3
Pistachio	5.6	37	9.9	
Hazel nut			6.0	
Cheese, Cheddar	18.0	11	2.0	
Egg	4.06	6	1.0	
Butter	45.0	26	3.0	
Corn oil	10.0	28	53.0	

Sources: (1) Nutritive values of the edible parts of foods.
Home and Garden Bulletin No. 72, Washington D.C. (1970), U.S. Department of Agriculture.

(2) The Chemical Constitution of Natural Fats. T.P. Hilditch and P.N. Williams, 4th Ed., Chapman and Hall, Lond., 1964.

The nutritional quality of a protein is determined to a large extent by its content of the ten essential amino acids, i.e., those amino acids which are needed for normal metabolism but which cannot by synthesized in the body (See Table 5). They are required in the exact proportions needed to manufacture new protein in the body and the ideal pattern of amino acids has been established to be close to that of the hen's egg (FAO/ WHO, 1965) which has thus been universally adopted as a reference protein with which all other protein sources may be compared.

Most other proteins and plant proteins in particular are deficient in at least one of the essential amino acids, the most common deficiencies being in lysine, tryptophan and the sulphur-containing amino acids (methionine and cystine). In Table 5, values are given for methionine and for the total sulphur-containing amino acids (Total-S) rather than a separate value for both amino acids. The reason for this is that the amount of cystine required is dependent upon the intake of methionine which can be converted to the former within the body. The table expresses each amino acid as a proportion of the total of essential amino acids (the A/E ratio), as recommended by the FAO/WHO (1965) report.

Several methods can be used to express the nutritional quality of a protein but the main one used here is the Protein Score (P.S.). A deficiency in any one essential amino acid means that the metabolic utilisation of all the other essential amino acids is reduced in direct proportion to this one. Where a protein is deficient in several amino acids, the utilisation of the rest is reduced in proportion to the first limiting amino acid, i.e. the amino acid which is most deficient when compared with the FAO egg pattern. Taking, for example, the protein of walnut, it can be seen from Table 5 that it is deficient in lysine and slightly deficient in isoleucine, Total 5, threonine and tryptophan. Lysine is obviously the most deficient at 58% of the FAO pattern and so the protein score of walnut is 58, based on lysine. The calculated protein score for many foods has been verified by feeding experiments on animals and found in most cases to be equivalent to the **biological value (B.V.)** of the protein (the proportion of absorbed nitrogen that is retained in the body for maintenance and growth). Unfortunately, few feeding experiments have been carried out with nuts.

Amino acid imbalances only pose a serious problem when the diet is composed predominantly of one protein source. In practice, most diets contain a mixture of proteins from different foods and if eaten together at the same meal they can compensate for deficiencies in one another. An example of this "complementary effect" is shown in Table 6 using walnuts and navy beans as an example.

Four-year-old Black Walnut near Kalamunda
Heigt - 5m. Photo: B. Dell

Fruit of Black Walnut (January). Photo: B. Dell

TABLE 5

Essential Amino Acid Composition of Proteins from Nuts and Other Foods

mg amino acid per g of essential amino acids (A/E rations)

Food	Isoleucine	Leucine	Lysine	Phenylalanine	Tyrosine	Total-S	Methionine	Threonine	Tryptophan	Valine	E/T Ratio	Protein Score*
Almond												
Prunus amygdalus	191	202	*81*	159	86	85	36	85	24	156	2.004	65
Hazel												
Corylus avellana	169	186	82	106	68	*60*	27	82	42	185	2.105	56
Pecan												
Carya illinoensis	136	190	107	139	78	*91*	37	96	34	129	2.290	86
Walnut												
Juglans regia	124	200	72	125	95	102	50	96	29	158	2.173	58
Brazil nut												
Bertholletia excelsa	97	184	72	100	78	235	153	69	30	134	2.329	58
Beef muscle	119	185	194	92	76	85	55	99	27	124	2.787	79
Fish	111	167	193	81	56	92	63	100	22	115	2.842	71
White flour	129	218	62	159	86	95	38	86	34	129	2.023	50
Soya flour	129	188	153	120	78	*76*	33	96	33	127	2.580	71
Navy bean	128	194	165	124	88	*45*	23	98	21	136	2.788	42
FAO Hen's egg	129	172	125	114	81	107	61	99	31	141	3.215	100

Sources: 1. N.L. Orr and B. K. Watt (1966) "Amino Acid Content of Foods", Home Economics Research Report No. 4, U.S.D.A.
2. Food and Agricultural Organisation, Rome (1970) "Amino Acid Content of Foods and Biological Data on Proteins",
* Based on 1st. limiting amino acid (italic).

Walnuts are deficient in lysine, whilst navy beans (like most legumes) have abundant amounts of lysine but are deficient in sulphur-containing amino acids and tryptophan; Thus, if we ate equivalent amounts of walnuts and navy beans separately, i.e. at different meals, we would not get such good protein value as if we ate them both together (Lappe, 1971).

TABLE 6

Protein Complementarity of Walnuts and Navy Beans

(mg per g essential amino acids)

	Lysine	*Total Sulphur Amino Acids*	*Tryptophan*	*Protein Score*
Walnut	72	102	29	58
Navy Bean	165	45	21	42
Together*	118	73	25	68
FAO Egg	125	107	31	100

* Calculated as mean value of the two components.

Note the complete restoration of the lysine deficiency in walnut by the legume. The protein score for the mixture is now based on the sulphur amino acids and has increased 10% over the value for walnut alone and 26% over the value for bean.

Not all nuts appear to have been analysed to date for their essential amino acid composition and the values given in Table 5 are based on only a few measurements. Amino acid results can vary considerably, from one analysis to another, and values for sulphur-containing amino acids are particularly unreliable. The value of 60 given for Total-S in the hazelnut is based on an average of three very divergent results obtained by different workers (Orr and Watt, 1966) and so the protein score is somewhat suspect in this case. Incomplete analyses have been carried out on pistachio and acorn (FAO, 1970), but no analysis of black walnut is available. In view of the large differences in general composition between the black and Persian walnut (Table 1), it would be useful to compare the quality of their protein also. (At present only *J. regia* has been analysed.)

From Table 5, it can be seen that pecan protein is exceptionally good, having a score of 85 which is better than that of beef or fish. It is unfortunate that pecans have a relatively low protein content (Table 1) and high oil content which limits their use in the diet. However, the high protein score would indicate that there is potential for using oil-extracted pecan meal as a protein supplement in much the same way as soybean meal. The protein of the brazilnut is also worthy of attention since, although it could not be grown in N.Z., it has an extremely high content of sulphur-containing amino acids, a quality rare amongst plant proteins and, consequently, even small amounts could complement other protein sources which are low in sulphur amino acids, e.g., most legumes.

Another important consideration when assessing the nutritional quality of different proteins is the ratio of essential amino acids to the total of all amino acids in the protein (See Table 5, E/T ratio). The total includes "non-essential" amino acids which are those required for protein synthesis but which can be synthesised by the body from other amino acids. The ratio of essential to total amino acids (E/T ratio) varies from 2.004 in almond to

3.215 in the hen's egg and there is evidence (FAO/WHO, 1965) that values around 3 are greater than optimum at least for adults. This means that some of the essential amino acids in egg would have to be used to produce "non-essential" amino acids. Thus, the lower values, around 2, which are found in the nuts and some other vegetable proteins, appear to be more optimal in that the higher proportion of "non-essential" amino acids has the effect of sparing the essential amino acids so that their full value is used by the body.

CONCLUSIONS

Criteria for selection of improved nut varieties usually include such features as number of nuts per pound, kernel weight, percentage refuse, ease of cracking, growth rate and nut yield. Flavour and keeping quality might also be considered but the nutritional value of the product is usually ignored, a situation which often occurs with food crops designed for human consumption! Full analysis of fatty acid and amino acid composition of each potential new variety would undoubtedly be time-consuming, but routine assay of protein, oil, mineral and vitamin content should be feasible. The large differences in nutritional quality which can occur within the same genus, e.g. between *Juglans regia* and *J. nigra* testifies to the importance of assessing the nutritional value of new varieties and hybrids.

The use of nuts in the diet has declined in modern times. In the past, the peasant populations in Europe collected large quantities of nuts from the great forests of deciduous trees that used to cover much of the continent. Since industrialisation and urbanisation, supplies of "free" nuts have dwindled to the occasional hedgerow of hazelnuts and cultivation of nut trees has not occurred on a scale large enough to compensate for this decline. There now appears to be very few areas of the world where nuts are consumed regularly and in large quantities. However, the high value placed on nuts as a nutritive food may be illustrated by the practice of Chinese mothers who, when their own milk failed, fed their babies on a paste made from walnut flour mixed in boiled water (Douglas, 1972).

We have seen that the nuts are a highly concentrated food source. This makes them highly suitable for persons doing manual work in cold conditions who may need up to 5,000 calories per day. To avoid excessive bulk in the diet, large quantities of fat are usually taken (up to 250g per day). However, for most people, the chief disadvantage of nuts as a food is their high fat content in proportion to other components which means that their use as a major source of protein in the diet is probably not practicable. However, in view of the general world shortage of protein and the capacity of at least some nuts to complement other sources of vegetable protein, the value of nut proteins should not be ignored. Nut "meals" and "cakes" from which some or all of the oil has been removed should make valuable food supplements. The legumes have gained considerable acceptance as protein supplements and even as meat substitutes in recent years, soyabean being the prime example (Altschull, 1965). The palatability of nuts is much greater than that of the legumes and their protein content nearly as high which suggests that there is potential for nuts and nut-products in the food industry also.

The potential of nuts as feed for animals has not been considered here. However, acorns, which are generally too astringent for the human palate, seem to be relished by pigs and many nuts could provide useful additional fodder in autumn. There is evidence (McClatchie, personal communication) that the relative proportions of saturated and unsaturated fatty acids in the flesh of animals is affected by their diet. Some work by Crawford (1967) showed that intensively-reared animals were found to have a much lower proportion of unsaturated fatty acids in their meat than browsing animals in the wild. The implication of this work is that the feeding of nuts (which are high in unsaturated fatty acids) might have the effect of improving the content of these fatty acids in the meat. In view of the proposed link between heart disease

and the consumption of saturated animal fats, Dr. McClatchie believes there may be some nutritional spin-offs for man, if nut trees are planted in paddocks.

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HORTICULTURE'S ANCIENT ROOTS

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Our celebration of the 75th anniversary of the American Society for Horticultural Science is an appropriate time to reflect on the past three-quarters of a century, review our record, and hopefully to revel in our accomplishments. As George Santayana has stated, "Those who can't remember the past are condemned to repeat it." Still it is reasonable to ask ourselves if our profession - Horticultural Science - is really only 75 years old? I think not. It is surely much older. My thesis is that horticulture takes us back to the beginning of man's rendezvous with civilization.

It is obvious to all of us that horticulture is an art and a science. As an art it involves practices that are the basic of our social culture. Its origins are intimately associated with our history and origins. Horticulture is also an art in the aesthetic sense and has become an art form in its own right. Horticulture provides food for body and soul!

Horticulture as a science seeks to understand the art, to explain the practices, and to predict the consequences of change. It is the science of horticulture that unites us and it is the recognition of this facet of horticulture that we celebrate in the founding of our Society.

Nevertheless, a careful analysis of each technological advance - when traced far enough - leads us to antiquity. This is particularly true for horticulture, one of our most ancient, technologies. The examination of its early beginnings leads us inexorably to the analysis and examination of our most creative activities. Horticulture's roots are deep!

In the ancient world, technology was the parent of science; only recently has science become the progenitor of technology. Yet in many cases, the bonds between horticultural technology and horticultural science are difficult to unravel. A detailed study of the history of horticultural science and technology is a subject beyond the scope of this brief presentation. It is possible, however, to illustrate our horticultural heritage using contemporary sources. In horticulture, a blend of science and art, it is particularly appropriate that the artistic record - painting, sculpture,

illustration, and crafts - is a source of scientific information. This visual technique makes it possible to transcend the language barrier which makes the history of horticulture inaccessible to many.

It is interesting to consider that the horticulturists of the Renaissance clearly acknowledged the debt of the past. Thus the front-piece of the 2nd edition of John Gerard's great English herbal acknowledges Theophrastus and Dioscorides along with Ceres and Pomona and refers to horticultural references in the Bible (Fig. 1). Somehow, we have chosen to conveniently forget these links. Perhaps it is embarrassing to consider how old is the turk we cultivate. But, we do a disservice to our students to de-emphasize, much less leave them

completely ignorant of, their heritage.

We have no way of knowing exactly when man first became aware of plants but we know from circumstantial evidence that it developed in Paleolithic times. Burials of 60,000 years ago suggest flowery funerals (9) and the remarkable Paleolithic Cave Art (12) first showed the actual representation of plants (Fig. 2). We can see the mounting awareness of plants in the artistic record (Fig. 3) as man the artist /scientist contemplated, considered, and drew what he saw with his eyes and his brain (Figs. 4, 5). The rigor of many of the early botanical works lies in the illustration rather than the text!

I have chosen to approach the roots of horticultural technology by picture rather than by text. The fields I will cover include cultivation (Fig. 6), irrigation (Fig. 7), crop culture (Fig. 8), viticulture (Fig. 9), landscape horticulture (Fig. 10), perfume industries (Fig. 11), marketing (Fig. 12), grafting (Fig. 13), environmental control (Fig. 14), and gardening (Fig. 15). Fortunately we have a rich source of references to horticultural literature and the story of garden art has recently become a popular subject as witnessed by the recent outpouring of beautiful "coffee-table" books. Interestingly, the richest source seems to be the contributions of Egyptian tomb painters and Renaissance book decorators.

Fig. 1. Title page of Thomas Johnston's 1633 edition of John Gerard's *Herball* (6) engraved by John Payne. John Gerard (lower center) holds a potato stem in flower and fruit. Homage is paid to the Roman goddess Ceres (growing vegetation) and Pomona (fruit trees) along with the "ancients": Theophrastus of Eresos (ca. 372-288 BC), "Father of Botany," and Pedanius Dioscorides of Anazarbos, who flourished during the 2nd half of the 1st century and whose *Re Materia Medica* was the authoritative work on plant medicinals for 1500 years. The Latin quotation from Genesis 1.29 is translated as: *Behold, I have given you every herb bearing seed.*

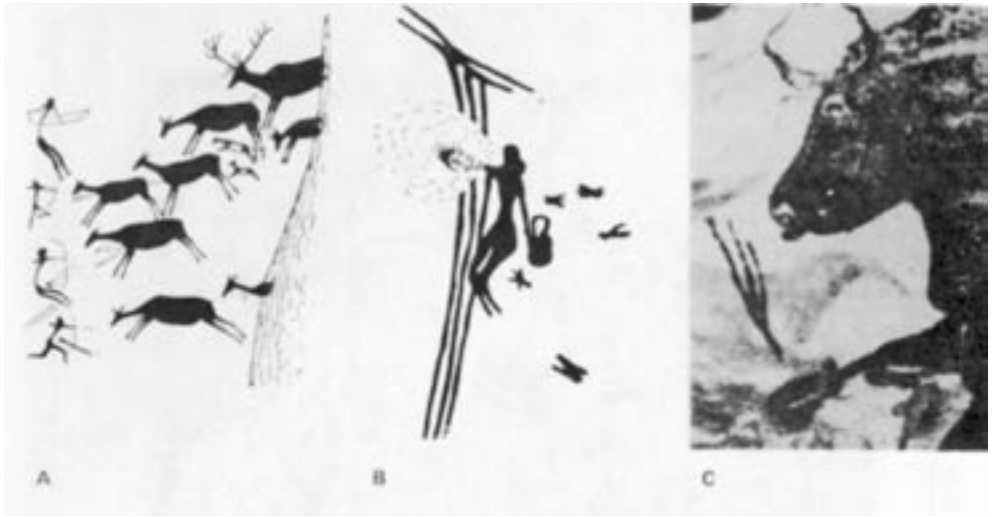


Fig. 2. Beginnings of plant awareness. Upper Paleolithic cave paintings from Castellon, Spain (11) portray hunting of stags (A) and gathering of honey (B). A close-up of the beautifully-wrought bison from Lascaux (C) shows what is likely a representation of a plant (12). Could this be the first horticultural illustration?

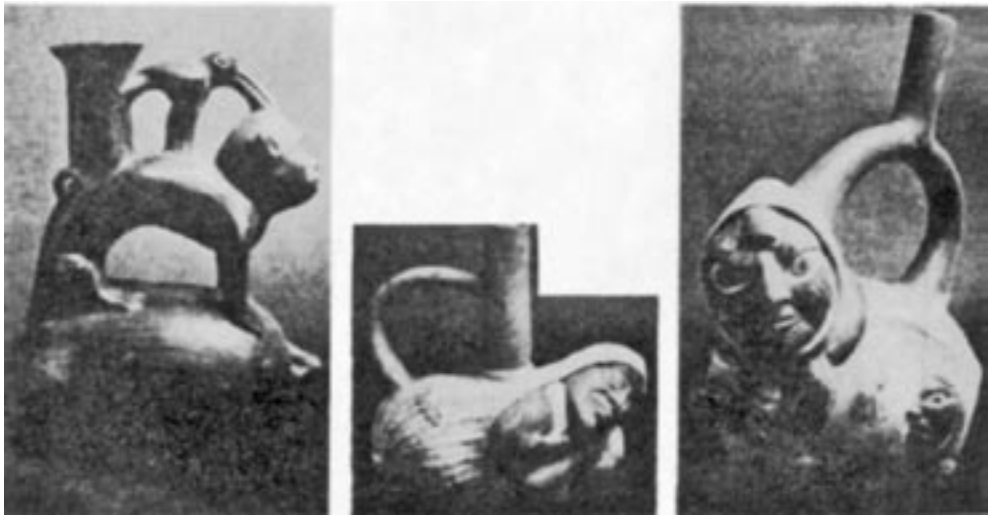


Fig. 3. The greatest of horticultural achievements - domestication of our crop plants - was achieved in prehistory and represents a unique contribution. The ceramic jars above from 4000 BC; A) squash, B) peanut, C) potato (10).

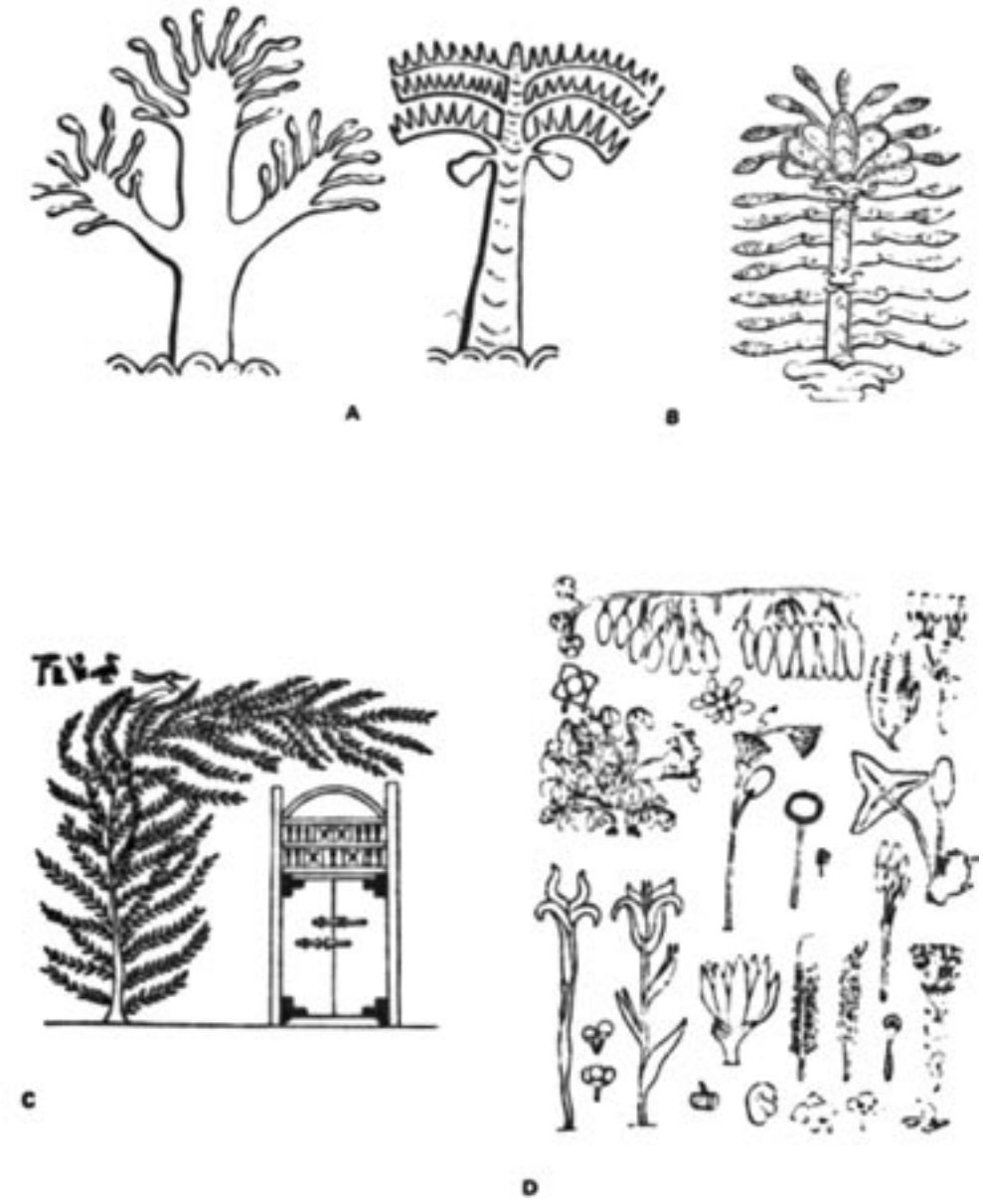


Fig. 4. The origins of botanical illustration trace to ancient Assyria and Egypt. The mounting sophistication indicates an increased awareness of plant form.

A, B) Primitive and sacred trees from Assyria (5)

C) Sacred tamarisk from tomb of Osiris in Egypt (5).

D) Botanical collection carved on the Temple of Karnak, ca. 1450 BC brought back from Syria by Thalmes III (11).

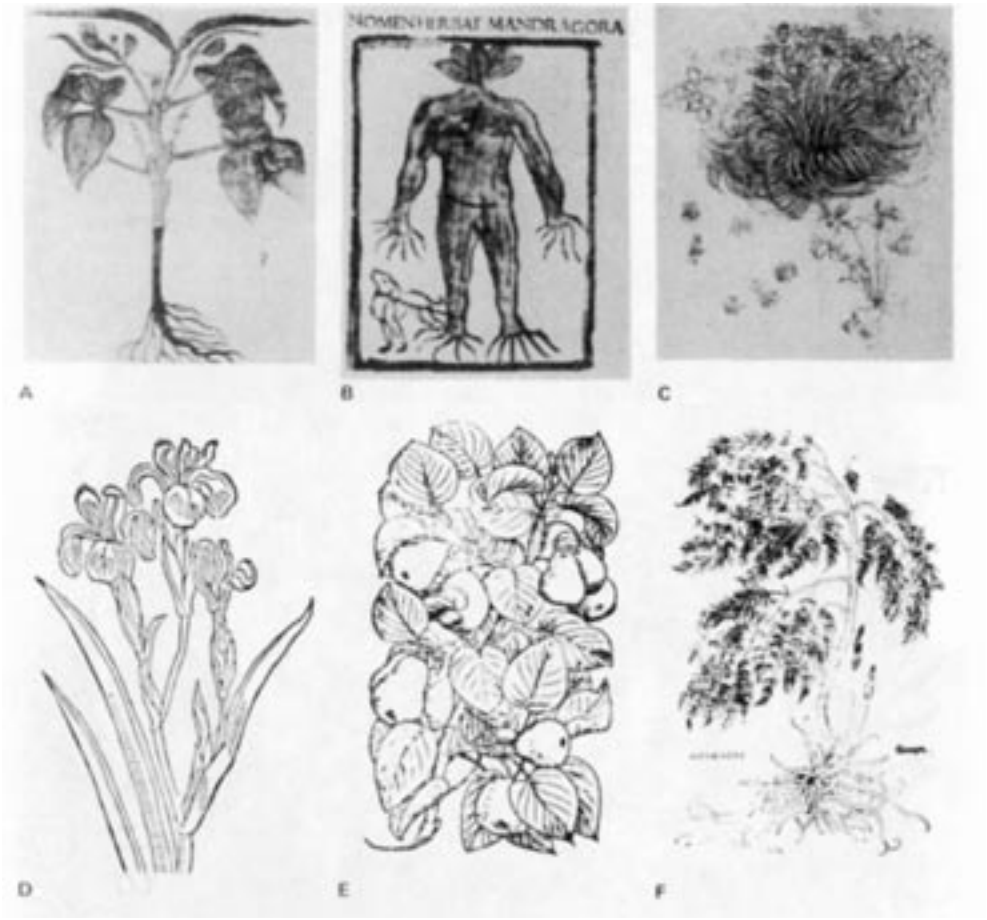


Fig. 5. Herbals, the earliest illustrated botanical works, show the fusion of horticulture, natural history, art and medicine (1)

(A) *Vigna unguiculata* (cowpea or southernpea) from a manuscript of *Re Materia Medica* of Dioscorides (*Codex Aniciae Julianae*) dating to ca. 512, the earliest extant herbal. Dioscorides appears to have taken his illustrations from an even earlier Greek text written in the first century BC by Cratevas, physician to Mithrdates VI.

(B) Mandrake (*Mandragora officinalis*) from the *Herbarium Apuleii Platonici*, 1481, seems to have anticipated the recent report of cell fusion of human and plant cells.

(C) An exquisite study of *Ornithogalum umbellatum*, the Star of Bethlehem, and other plants from the scientific drawings of Leonardo da Vinci (1452-1519).

D) Yellow-flag (*Iris pseudacorus*) from the *Herbarius zu Teutsch Maintz*, 1485.

(E) Pear (*Pyrus communis*) from Pierandrea Mattioli's *Commentarii*, 1560. The superb somewhat stylized illustration either by Giorgio Liberale or Wolfgang Mayerpeek conforms to the dimensions of the wood engraving block.

F) Asparagus (*Asparagus officinalis*) from Leonhart Fuchs, *tt*, 1542.

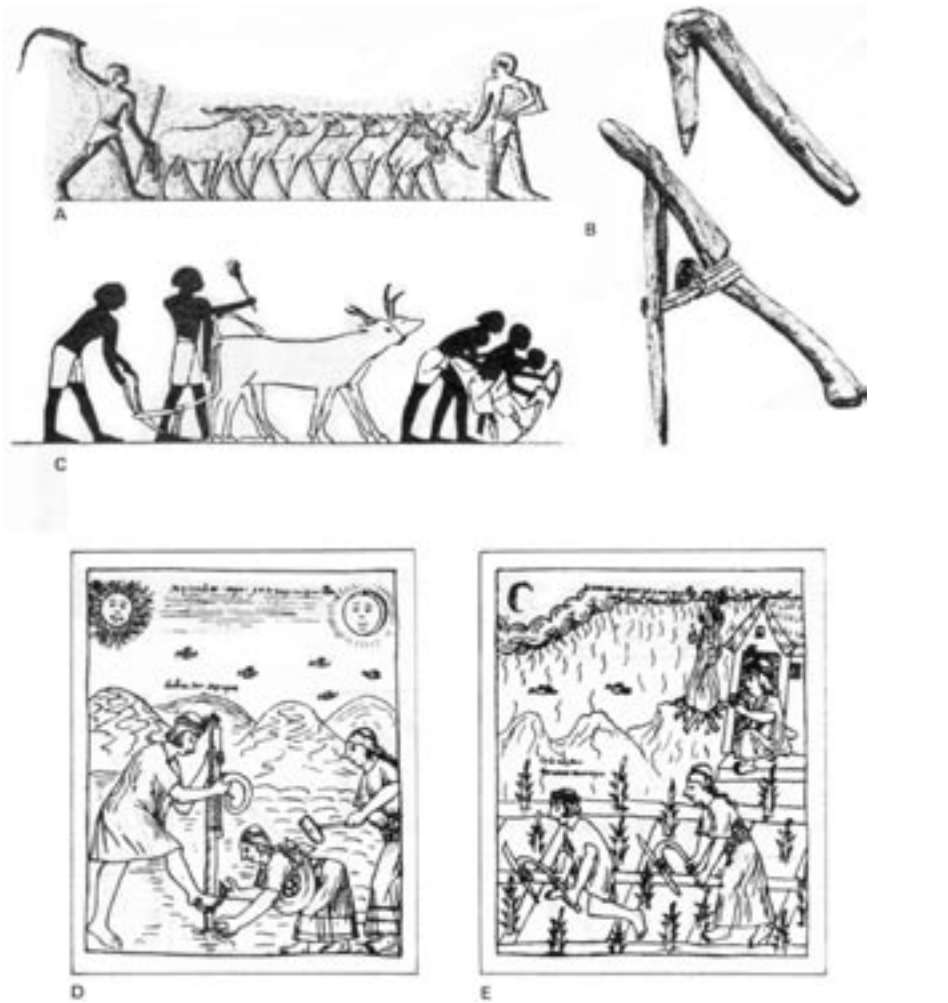


Fig. 6. Development of cultivation technology shows divergent and parallel development in Egypt (11) and the New World (10).
A) *Treading in seed by sheep. From a tomb at Saqqara, Egypt, ca. 2400 BC. Herodotus the Greek historian describes the process as he found it in about 450 BC: They gather in the fruits of the earth with less labor than any other people for they have not the toil of breaking up the furrow with the plough, nor of hoeing, nor of any other work which all other men must labor at to obtain a crop of corn; but when the river has come of its own accord and irrigated their fields, and having irrigated them has subsided, then each man sows his land and turns his swine into it; and when the seed has been trodden into it by the swine he waits for harvest time; then he gathers it in.*
B) A primitive hoe (top) made from a forked branch and more developed form (below) with hafted wooden blade, Middle Kingdom, Egypt, 2375-1800 BC.
C) Ploughing and hoeing. From a tomb at Neni Hasan, ca. 1900 BC.
D, E) New World agriculture based on an illustrated calendar by a Peruvian, half Indian, half Spanish, who drew it in the 1580's to present to the King of Spain as part of a treatise on Inca life. Note the primitive hoe (D) and the foot hoe or taclla (F).

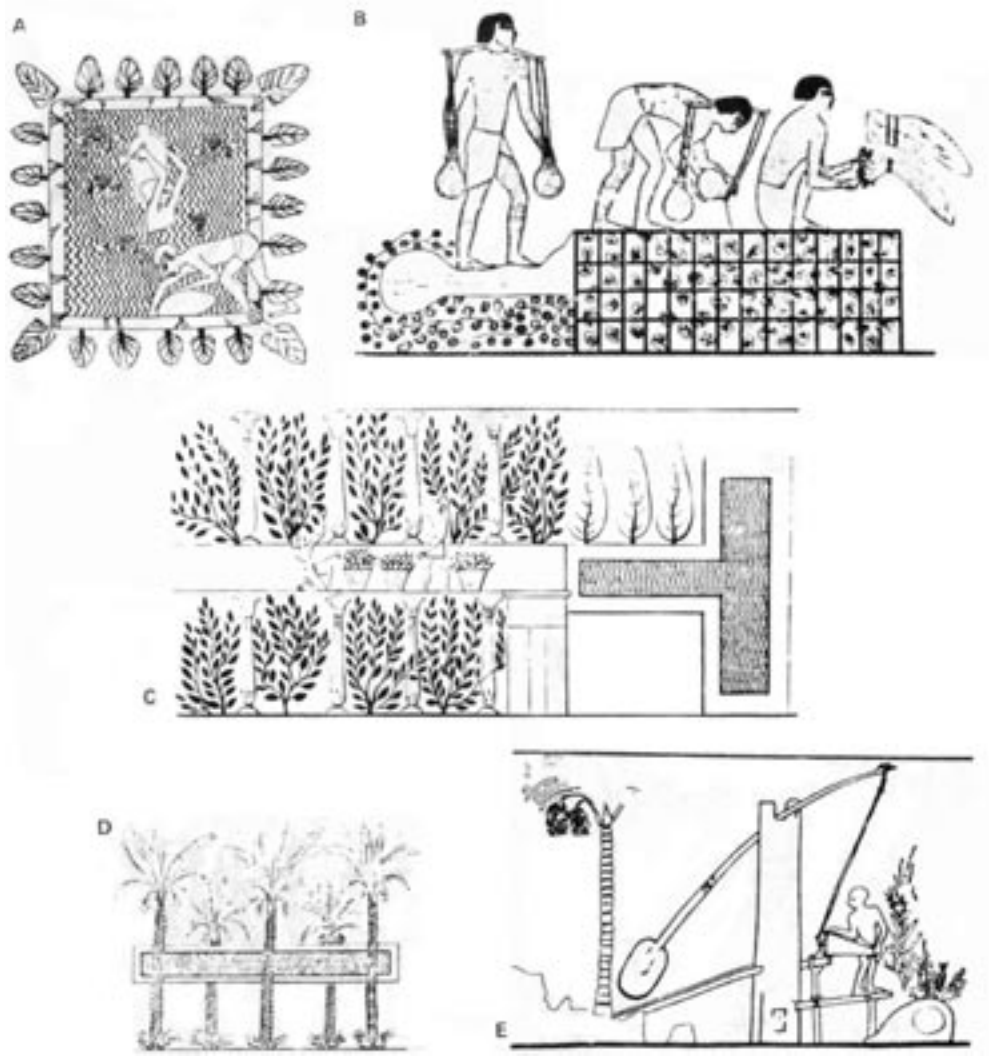
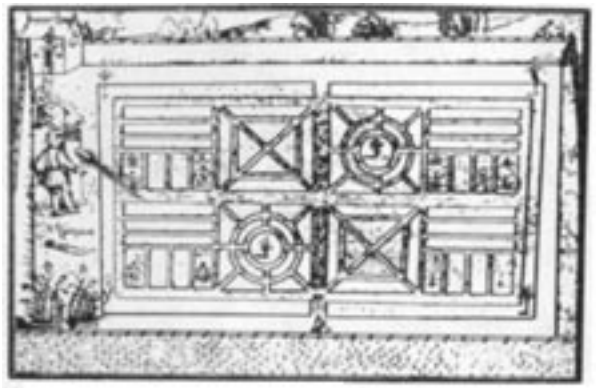
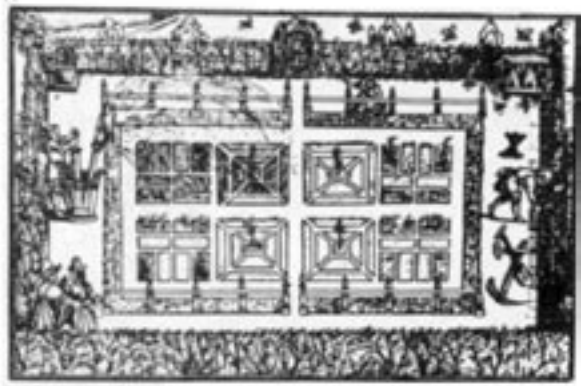


Fig. 7. Irrigation technology.
A) Drawing water from a lily pond.)
B) Irrigating a vegetable garden with the aid of wooden shoulder yokes to carry water, Beni Hasan, ca. 199 BC (11).
C, D) Water tanks in orchard (C) and date palm (D) (8).
E) Irrigating palm garden with a shaduf, utilizing the principle of a balance and counter weight (11).

F, G, H) Furrow irrigation from a Persian miniature (8); Inca (10); and Renaissance (1501) garden (3).

I) Hand watering Renaissance "cages" (3).





J, K) Watering with pump and sprinkler, 1571, (3)

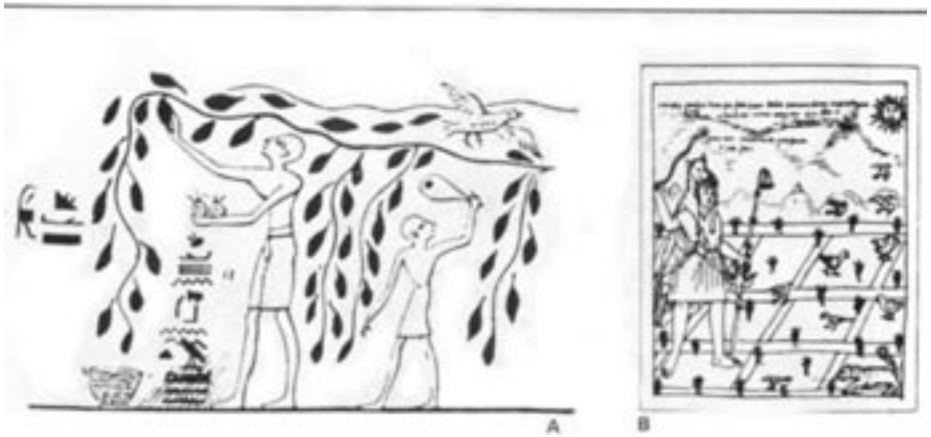
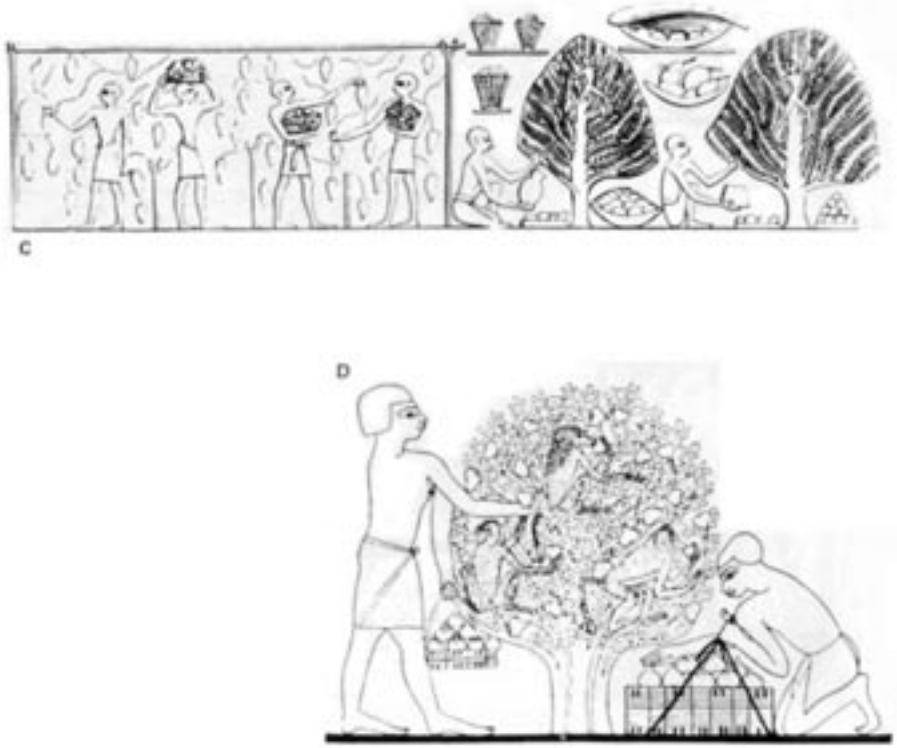


Fig. 8. Horticultural practices - training, pest control, harvesting - are among the most ancient of technologies.

A) Controlling birds with a sling in Egypt (8).

B) An Inca boy in wolf's clothing scares away birds with a sling and noisemaker (10).



C) Egyptian vineyard and orchard (8).

D) Harvesting figs: tame baboons add a light touch to the operation, Beni Hasan, Egypt, ca. 1900 BC (11).

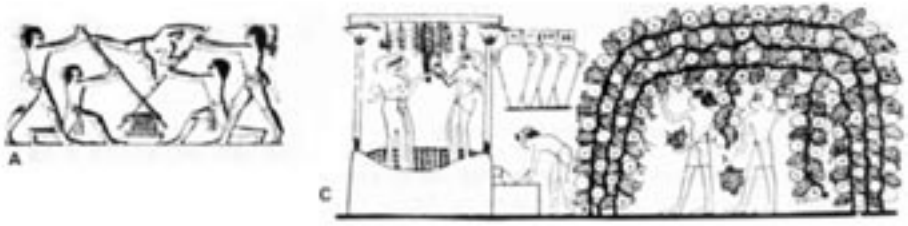
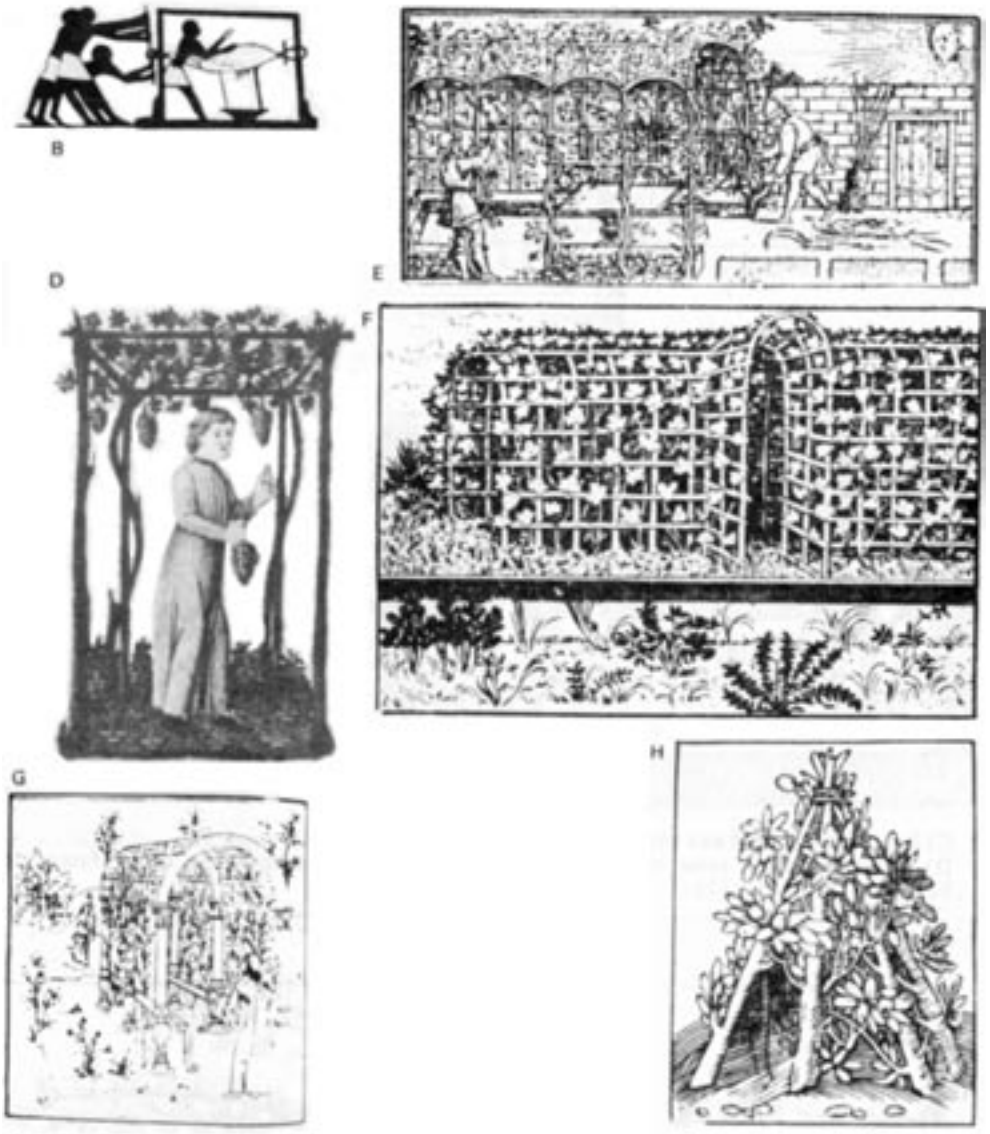


Fig. 9. Viticulture and wine making technology traced to ancient Egyptian horticulture.

A) An early Egyptian bag press; Saqqara, Egypt, ca. 2500 BC (11).

B) An improved bag press using rotary motion (11). (See next page.)

C) Trellis-grown grapes are collected, treaded to express the juice, and stored in amphoras, Thebes, Egypt, ca. 1500 BC (11).



D) A medieval grape arbor shows little change, ca. 1495 (4).

E, F, G, H) Arbors, trellises, and pergolas from the 15th and 16th centuries (2, 3, 6).

Note the pyrimidal arbor (H) brought by Columbus from the West Indies.

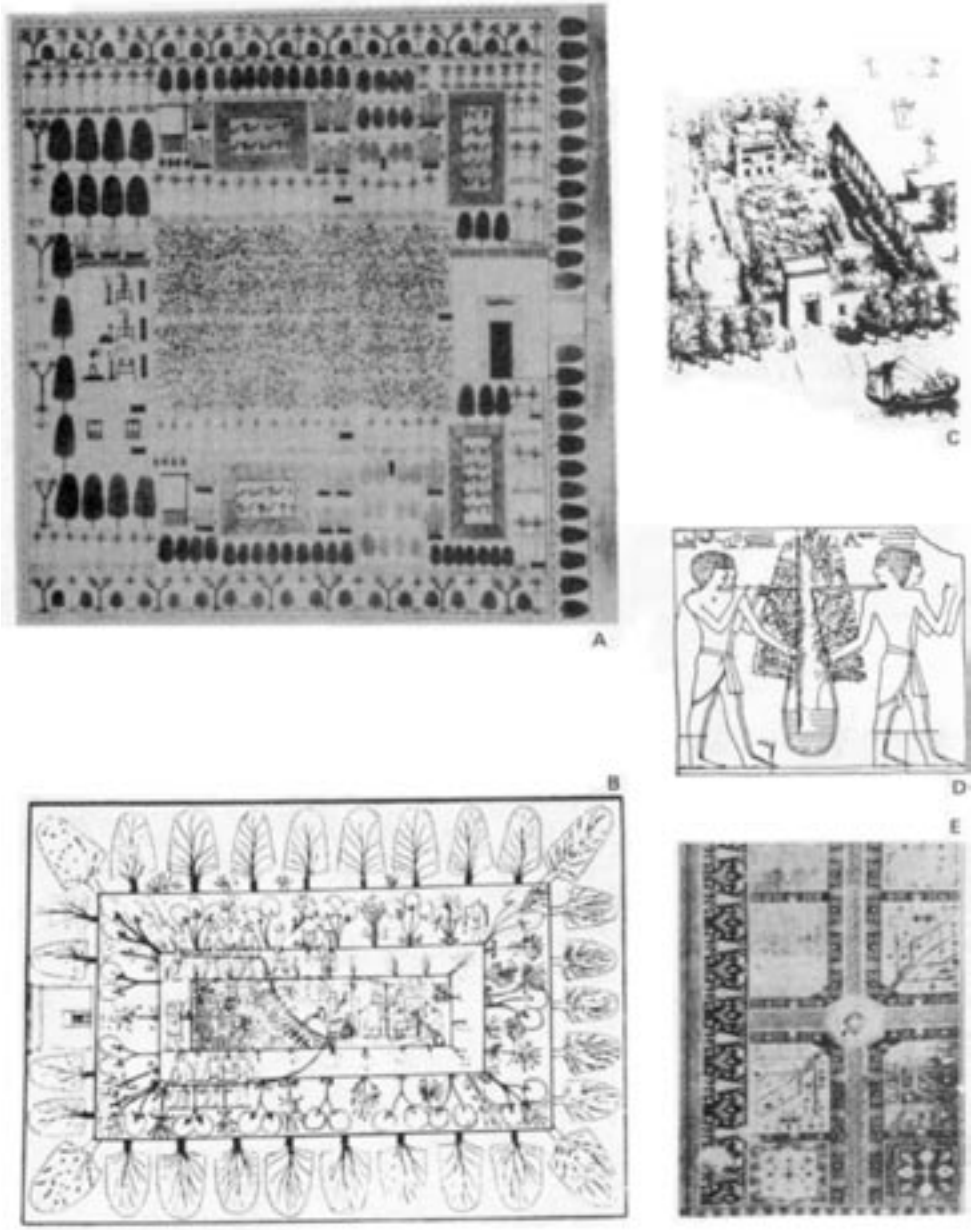


Fig. 10. The Origin of landscape horticulture.

A) Wealthy Egyptian garden estate in the time of the pharoahs, Note the long canal and imposing gateway. Two types of palm trees are suggested in the plan, the single-trunked date palm and the bifurcated doum palm (2).

B) Formal Egyptian garden with a lotus pool and pavilion; Thebes, ca. 1450 BC (11).

C) A 19th century representation of an Egyptian garden (2).

D) Transplanting trees (13).

E) Persian carpet showing formal garden arrangements (2).

F, G) Portion of a three dimensional map of Turin before (left) and after (right) fire of 1659. Note the urban gardens constructed after the rebuilding of the city (3).

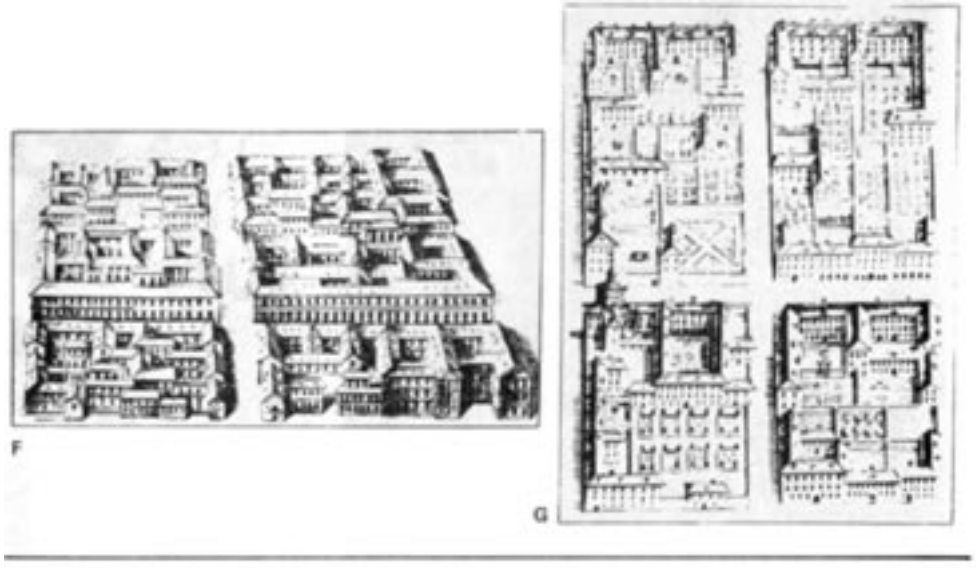


Fig. 11. The cosmetic industry starts with plants; gathering lilies and expressing the oil for perfume, ca. 400 BC (11).

Fig 12. Marketing in the land of the pharoahs: storing barrels(?) (left) and raisins (right); Beni Hasan, Egypt, ca. 1900 BC (11).

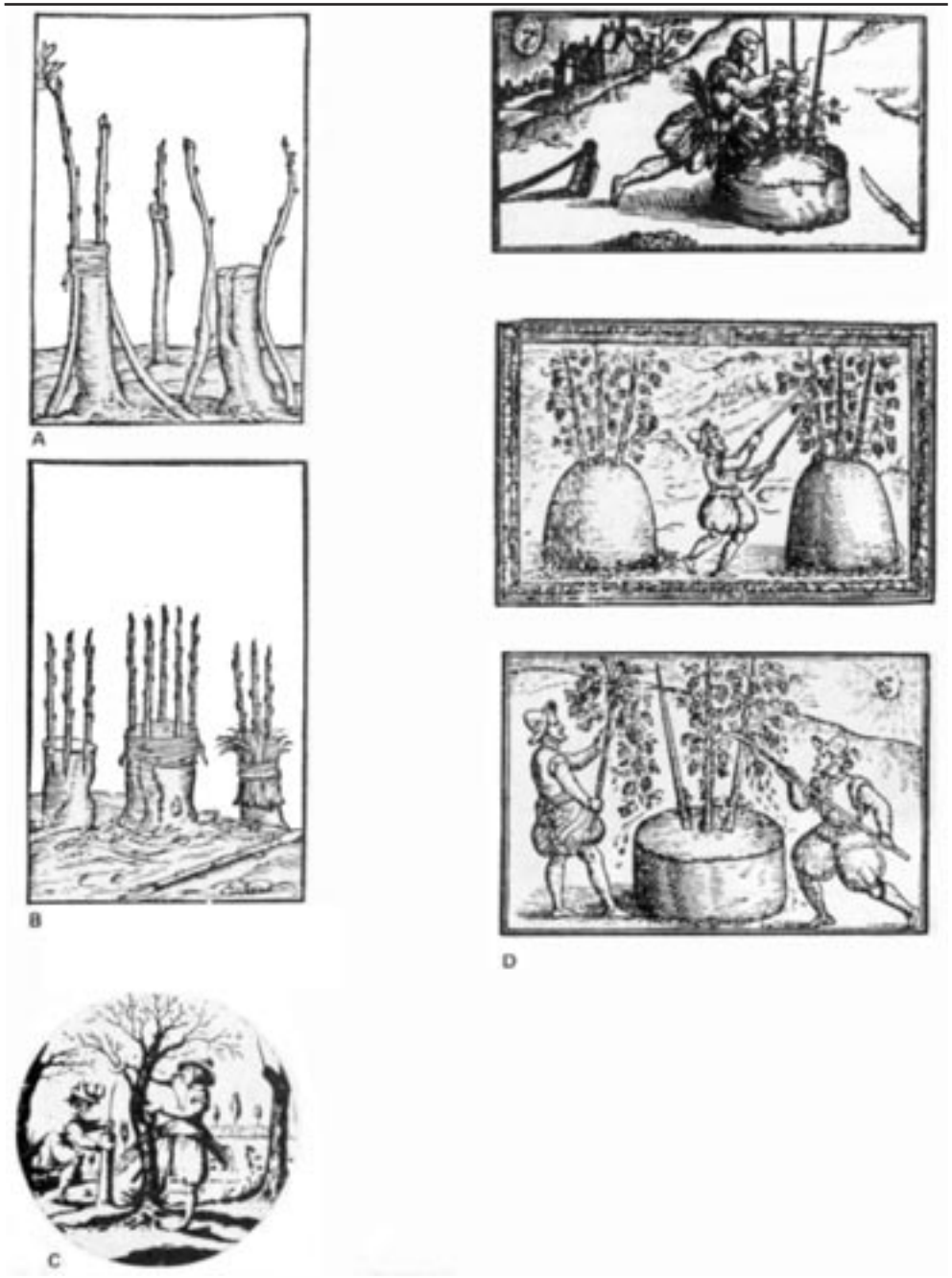


Fig. 13. Intensive horticulture of the Renaissance and Baroque eras.
A, B, C) Grafting: (top) approach (13); (middle) topworking (13); (bottom) scion collection and grafting from a 1625 manuscript (3).
D) Hop culture (6); (top) tying, (middle) training, (bottom) stripping.

Fig. 14. Gardening and environmental control. Although the Romans appeared to have invented the concept of forcing plants in greenhouses, this practice was lost until the Renaissance when a gardening craze seized the Western World.
A) Frantic gardening activity depicted by Peter Brueghel the Elder (2).
B) Eighteenth century garden tools (1787) (2).
C) Winter protection of oranges (1696) (2).

D) Movement of trees from protected orangeries (1730) (2).
E) Bell-shaped glass cloches for frost protection (1718) (2).
F) Cold frames from the Gobelin tapestry (18th century) (2).
G) A forcing glasshouse prepared by Humphrey Repton for Woburn Abbey (2).
H) The Wardian Case named after Dr. Nathaniel Bagshaw Ward (1791-1868), made possible the 19th century craze for international plant collecting (8).

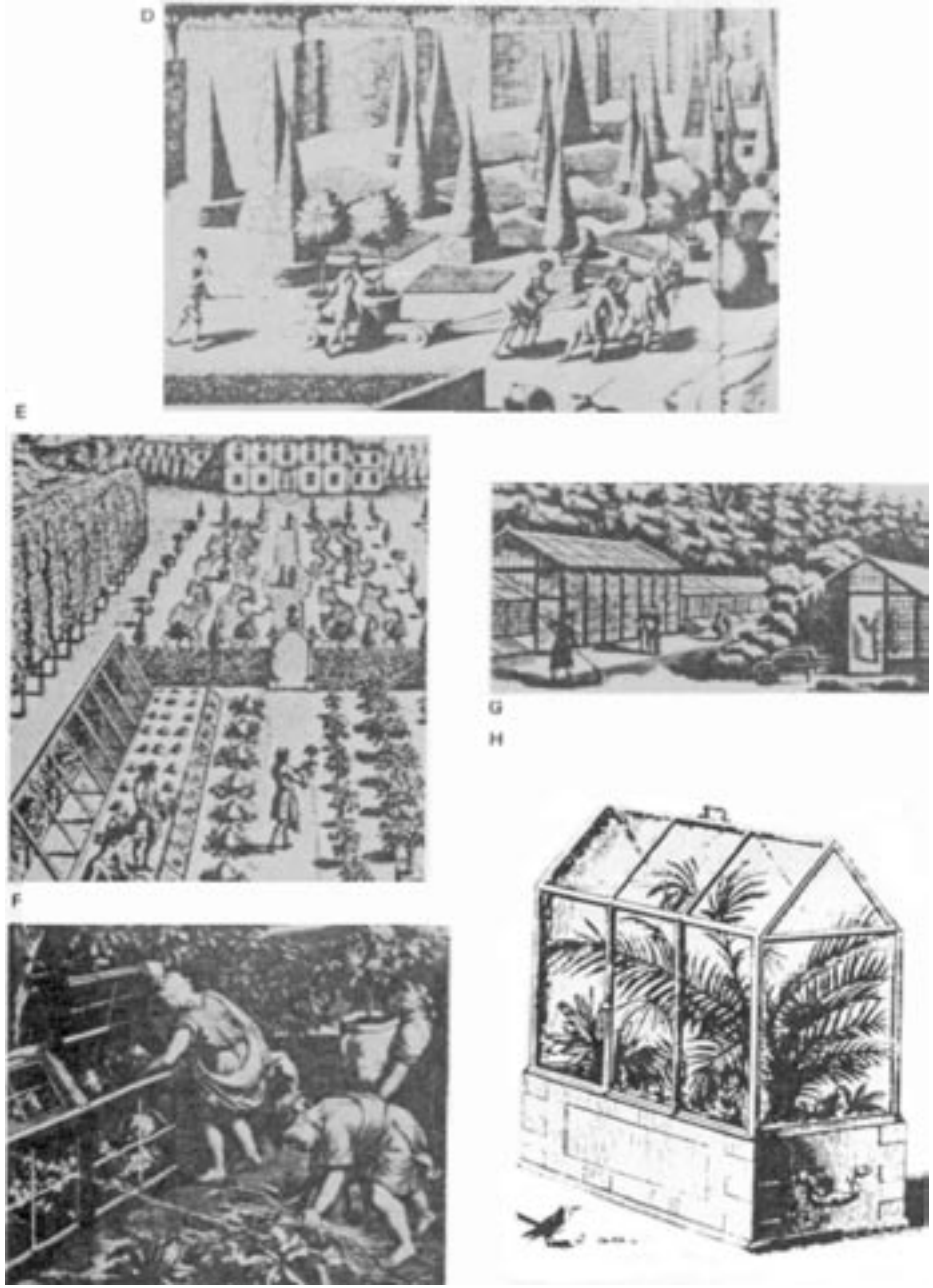


Fig. 15. Post-renaissance gardens.
A) Raised beds and sparse plantings, 1580 (8).
B) Garden with wattle fence, fountain, beehives, trees, and flowering plants (8).
C) An herbal garden from the *Kreuterbuch* of 1587 (3).
D) Rolling turf, 1757 (2).
E) The first lawn mower patented in 1830 by Edwin Budding derives from a machine invented to shear the nap from cloth (2).

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HOW TO DISTINGUISH THE TWO COMMERCIAL SPECIES OF MACADAMIA

Contrasting characteristics of *M. tetraphylla* and *M. integrifolia*

M. tetraphylla (rough-shell type)	*M. integrifolia* (smooth-shell type)
Nuts	
Usually slightly elliptical or spindle-shaped. Surface pebbled.	**Round or very nearly round. Surface smooth or nearly so.**
Mature leaves	
Commonly four leaves at a node but rarely, three or five; young seedlings have two; leaves usually larger and longer than *M. integrifolia*; leaf sessile or stems with very short petioles, leaf margins serrate with many spines along the edges; leaves up to 60cm long.	**Three leaves at a node (except for young seedlings which have two), leaves usually shorter than *M. tetraphylla*, from 10 to 30cm long. Leaf stem usually about 12mm long. Leaf margins on mature trees are much less spiny than *M. tetraphylla* and often without spines.**
Young leaves	
Purple or reddish	**Pale green or bronze**
Flower colour	
Pink	**Creamy white**

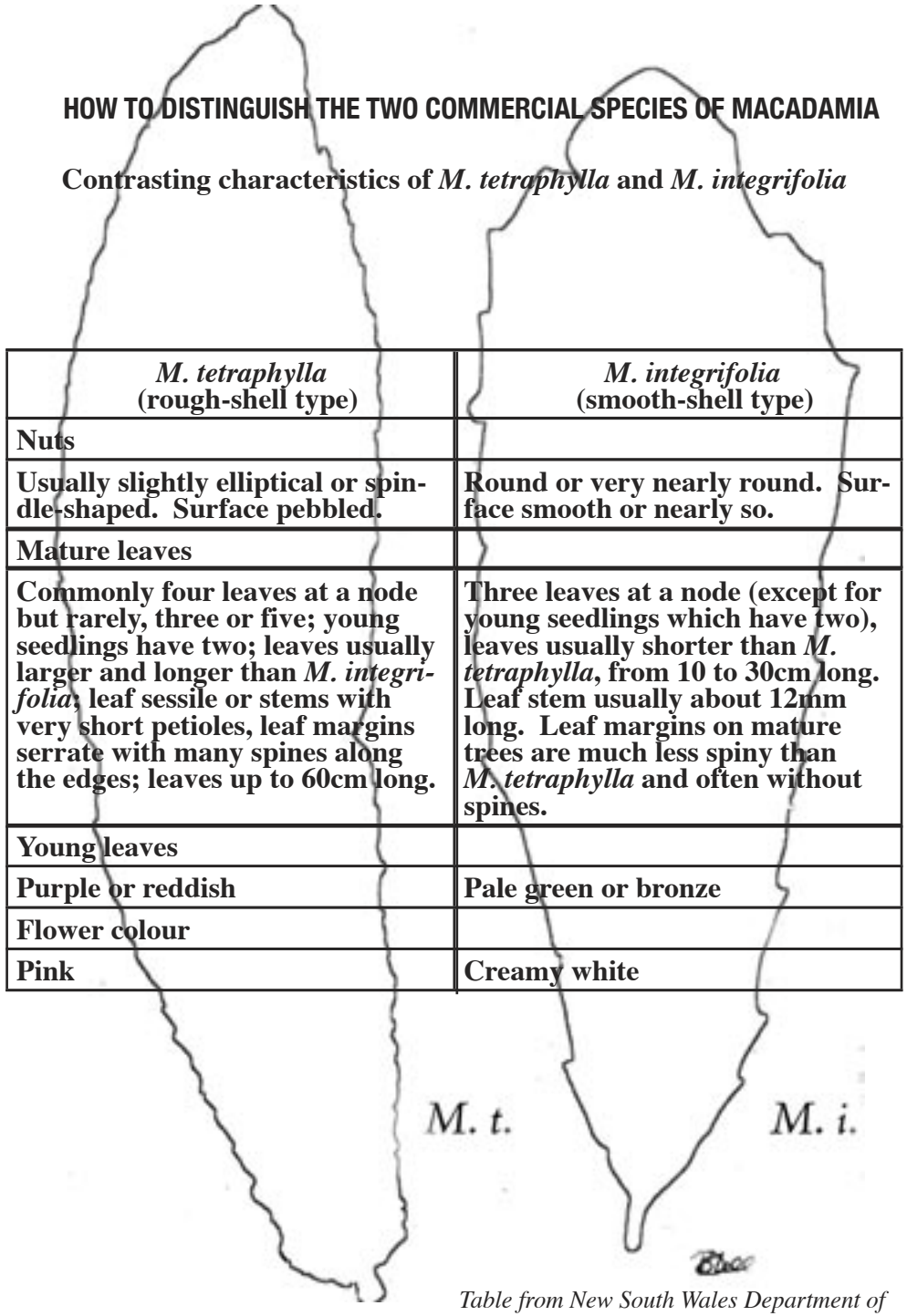

Table from New South Wales Department of Agriculture Bulletin H3.1.6

JOJOBA - A LIQUID WAX PRODUCING SHRUB

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Western Australian Department of Agriculture

The current interest in jojoba arises from the wide publicity it has received as a source of liquid wax which is very similar to that produced from the sperm whale, an endangered species, rather than its promise as an agricultural crop.

Although jojoba has received much favourable publicity, growers should realise that: -

- There are no mature commercial jojoba plantations operating anywhere in the world. There are experimental plantations in the U.S.A. and Israel which are mostly small and immature. Because of this there is little reliable information on production methods or accurate figures on production costs and yields under commercial conditions.
- Jojoba wax is not used on any scale in industry at present due mainly to lack of supplies. The total world production is about 30 to 50 tonnes of seed, yielding 15 to 25 tonnes of wax per year. This is harvested by hand from wild stands in Arizona and California.

Growers who intend to grow jojoba on a commercial basis should be aware that they are entering upon a high cost/high risk enterprise involving many unknowns.

DESCRIPTION OF JOJOBA

- Jojoba (pronounced ho-HO-ba) is the Spanish/Indian name for *Simmondsia chinensis*, a native of the Sonoran desert of California, Arizona and Mexico. Jojoba has no close relatives in the plant kingdom.
- Jojoba is an evergreen multistemmed woody shrub which grows about one metre in height and diameter in its desert habitat but under good conditions can reach five metres. The leaves are oval, blueish-green, thick, leathery and three to five cm long. Considerable variation in form occurs in wild populations.
- Male and female flowers are produced on separate plants. The flowers form in the leaf axils where the leaf meets the stem. A single inconspicuous pale green flower is formed on the female plants. The male plant produces a small cluster of yellow flowers.

Pollination occurs mostly by wind. Under field conditions plants usually flower in their third year.

- Mature seeds are dark brown, grooved, about 1.5cm x 1 cm and have a thin hard seed coat. They are enclosed in an acorn-like capsule which usually contains a single seed during development. When the seed is mature the capsule splits and the seed drops to the ground. Pollination to maturity takes about six months. Flowering starts in winter and the seeds grow through spring and mature in summer.
- Grown from seed under desert conditions, the plants form a deep, powerful branching taproot many metres deep.
- The seeds of jojoba consist of about 50% liquid wax, which is similar in properties to sperm whale oil. The meal remaining after oil extraction has 26 to 32% protein. The seed hull constitutes about 17% Of the seed weight. The nutritional value of jojoba meal in animal feeds is uncertain at present because of an unusual toxic factor in the meal. This substance, simmondsin, severely suppresses appetite.

NATIVE HABITAT

Jojoba is a native of the Sonoran desert of northern Mexico, Arizona and California, where it occurs mainly on the milder, wetter desert margins in areas of annual average rainfall of 300mm. It is restricted usually to coarse, well drained desert soils, and is found mostly on dry slopes and along washes at elevations of 300 to 1,500m. Major ecological factors affecting its distribution appear to be favourable soil moisture conditions during spring and early summer when it is germinating and becoming established; freedom from hard frosts to which it is particularly sensitive in the early stages; and protection from severe grazing by rodents and stock. It is a true desert plant, being able to grow slowly throughout the year despite extremely high summer temperatures and dry conditions.

Considerable variation in habit, foliage, flowers, fruits and the ratio of male to female plants occurs. Distinctly different coastal and desert forms have been identified. This variation is of interest in the selection of superior strains for cultivation.

Seasonal growth and flowering of jojoba takes place in response to winter-spring rains; In drought years jojoba may fail completely to set seed.

Under desert conditions, the life of the shrub may exceed 100 years. Its longevity under plantation conditions of close management, fertiliser application and irrigation is unknown but will almost certainly be shorter.

USES OF JOJOBA OIL

Jojoba seed oil is unique among vegetable oils in that it is not a fat but a liquid wax. In this respect it is similar to sperm whale oil which is the only animal liquid wax. It is difficult to produce synthetic liquid wax commercially and sperm whale oil is the only extensive natural resource at present.

Some potential uses of jojoba oil are:

- As a lubricant. Sperm oil is widely used in lubricants because of the oiliness and metallic wetting properties it imparts and its non-drying characteristics that prevent gumming and tackiness. The composition and physical properties of jojoba are close enough to sperm oil to suggest the use of jojoba oil as a substitute for most of the uses of sperm oil. Both sperm oil and jojoba oil require treatment with sulphur to increase their range of uses as lubricants. Following sulphurization the oil is suitable for extreme pressure and antiwear additive in lubricants for gears in differentials and transmissions; in hydraulic fluids that need a low coefficient of friction; and in cutting and drawing oils. Gear lubricants commonly contain 5 to 25% of sulphurized sperm oil.
- Jojoba oil could become a source of straight chain mono-unsaturated alcohols and acids. These substances are used as intermediates in the preparation of numerous compounds-disinfectants, surfactants, detergents, lubricants, driers, emulsifiers, resins, plasticizers, protective coatings, fibres, corrosion inhibitors, bases for creams and ointments, antifoamers and other products.

Jojoba oil is very stable and resistant to rancidity. This gives it potential use as a carrier for pesticides and plant hormones, as a water evaporation retardant, for sizings and waterproofing and for softening leather, paints and adhesives.

- Jojoba oil reacts with sulphur chloride to form rubbery solids known as factices which are used in varnishes, rubber, adhesives and linoleum.

• Jojoba oil can be hydrogenated to a hard white wax. The wax formed is a hard product with a high melting point with properties competitive with carnauba wax (the king of waxes), beeswax, candelilla wax and spermaceti. This is probably the most promising end use for jojoba oil as the other waxes are in uncertain supply and prices are rising.

The main uses for saturated waxes are in floor polishes, carbon paper, and polishes for shoes, furniture and cars. They are also used to raise the melting point, gloss, and hardness of cheaper waxes such as paraffin for use in paper, textiles, insulating materials, batteries, candles, matches, soap, salves, chalk and crayons. Waxes are used for film coatings in the food industry to retard shrinkage, reduce spoilage, minimize ageing and retain flavour.

A NOTE OF WARNING

As the United States have declared the sperm whale an endangered species and have prohibited sperm whale oil imports, U.S. industry is searching for replacements. The lack of sperm whale oil and inadequate supplies of jojoba oil will continue for at least 15 to 20 years and has forced U.S. industry to seek alternatives. Already products are being reformulated and alternatives sought which may make the large scale production of jojoba oil unnecessary. However, a demand by the pharmaceutical and cosmetic industries and for other specialist uses should continue.

PROPAGATION

Jojoba can be grown from seeds or cuttings and experimentally has been propagated by tissue culture.

SEEDS

Fresh jojoba seed has a germination of 90% or more and no special treatment is required to bring about germination. Best results are obtained by raising seedlings under nursery conditions. A suggested method is to sow seeds three cm deep in a 50:50 sand/sawdust or sand/peatmoss mix, and keep continually moist at 26 to 30C degrees. The tap root is well developed before the leaves emerge in 15 to 20 days. For convenient handling and to allow free taproot development seedlings can be raised in 9 cm x 30 cm polythene “tubes.” The seed should be planted in late summer to allow planting out of seedlings the following spring.

If seeds are sown directly into the field, several seeds should be sown at each location to allow removal of excess males and weak females at a later date. Again, best germination will occur if the seeds’ moisture and temperature requirements for fast germination of seed are met as closely as possible.This would involve planting in spring-early summer and frequent watering, probably as frequently as once a week over the first summer to ensure seedling survival.

Male and female plants arise from a batch of seed. There is no simple way of distinguishing sex of seeds or juvenile plants before flowering in the third to fifth year.

CUTTINGS

Propagation from softwood stem cuttings is proving feasible and has a number of advantages. The sex of the parent material is known so that excess males are not produced as in seed propagation. Also superior plants can be used as parents and similar plant type is produced, a requirement for plantation production.

Propagation from cuttings is a fairly recent development and mature plants are not yet available. It is possible that the more fibrous spreading root system which develops from cuttings will be a disadvantage in comparison with deep rooted, seed propagated plants.

The following rooting technique has been taken from the literature. Recently matured terminal cuttings from young branches and shoot tips taken whilst the plant is growing vigorously are dipped for one minute in IBA (Indole butyric acid) 4,000 ppm. The cuttings are then

held in vermiculite at 20°C, preferably bottom heat, until vigorous roots are formed.

CULTIVATION

Jojoba is still a wild plant. There has been little selection for superior types although much variation exists in native populations. There is no reliable information on best plantation densities, pruning, fertiliser or irrigation regimes. Nor is there information on yields under commercial conditions or tree longevity Because trees take 10 to 12 years to reach maturity, accumulation of knowledge is very slow.

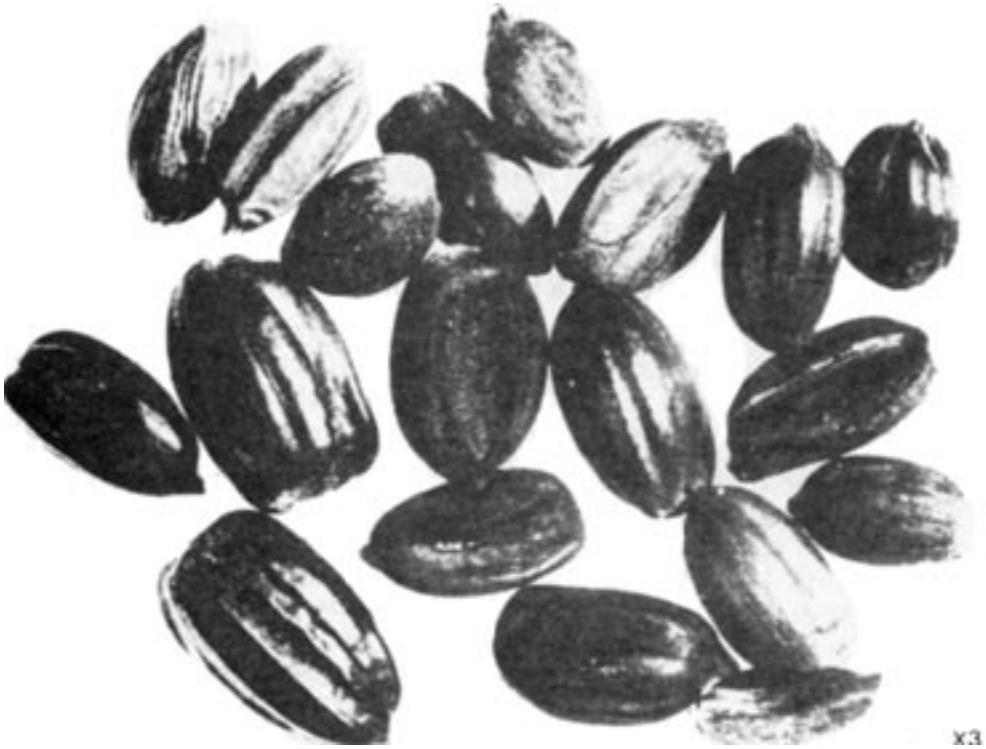
The comments below are meant as a guide and are based on the little known about jojoba and experience with other plantation crops in Western Australia.

• The final aim is to establish about 2,500 plants per hectare at a ratio of seven female to one male plant, with the males evenly distributed throughout the plantation.

Suggested spacing is three m between rows and 1.5 m between plants within the rows. This may be adjusted to fit in with machinery.

Sex of seed grown plants cannot be determined until the third year. To ensure an even plantation in later years with optimum sex ratio, if planting seedlings, plant three per planting site and later eliminate the excess males and weak females. If planting seeds direct, plant five seeds per site.

Propagation from cuttings will allow complete control of sex and produce even plant



Mature seeds of jojoba are dark brown, grooved, about 1.5cm x 1cm and have a thin, hard coat

types.

- Plant seed and seedlings in early spring. It will be essential to water seedlings every 10 to 14 days over the first summer. Watering should not be essential in later years, but the plants are likely to respond to summer irrigation. Watering of seedlings could most easily be accomplished with a mobile tank or trickle irrigation. Long term watering could be by trickle irrigation.

- The conditions under which jojoba grows in its native habitat are better than Western Australian desert conditions. Rainfall is about 300 mm per year and soils are more fertile than ours. Jojoba is likely to do best in areas north of Perth on well drained, sandy loams or loams within 30 kilometres of the coast, to minimise the frost risk Although they are a desert plant, they should respond to better conditions. Avoid saline areas and poor soils.

Jojoba is reported to have some degree of salt tolerance. However, this cannot be compared with the salt tolerant plants such as bluebush, saltbush, puccinellia and sea-shore paspalum that are recommended for growing on salt affected soils on our farming areas. Its salt tolerance is comparable with that of lucerne, strawberry clover and barley.

- About six weeks after seedlings are planted out, fertilise with superphosphate at 100 grams per tree, keeping the phosphate at least 30 cm from the plant. Apply nitrogen fertiliser sparingly.

- During the establishment years it will be essential to keep the area free of weeds either by inter row cultivation or mulches of plastic or sawdust around the plant. Seek advice before using herbicides.

- The plants should respond to summer irrigation throughout their life but adult plants should survive quite well without it in a semi dormant conditions.

OVERSEAS EXPERIENCE

As mentioned previously, there are no mature commercial jojoba plantations anywhere in the world. The only fully mature experimental plantation is one of 0.7 ha of 14 year old bushes at Gilat, Israel. The best bushes in this plantation have yielded three kg seed per tree but very variable plant type has prevented commercial feasibilities being undertaken on this stand. Several recent experimental plantings have been made in Israel but the total area under jojoba probably does not exceed 50 ha. The Israelis are concentrating on selection of superior yielding types and vegetative propagation methods.

There is considerable interest in jojoba in the U.S.A. particularly in Arizona and California, the plant's native habitat. Since the early 1940's, experimental and commercial plantings have been attempted. Most of these have failed due to frost and/or drainage. On some occasions plantations have been destroyed by a single heavy frost after several years of successful cultivation. In the last three to four years there has been a considerable increase in interest and expansion in plantations. Some of these plantations form part of Indian aid programmes, others are being developed by private interests. Severe problems are being encountered and the area of successfully established plantations is probably less than 50 ha. One variety, Vista, has been selected in the U.S.A.

The unknowns and very high risks involved cannot be overstressed.

CULTIVATION OF JOJOBA IN WESTERN AUSTRALIA

About eight years ago the Department of Agriculture obtained seed of jojoba from California and six plants were established at the Gascoyne Research Station at Carnarvon. Of the six plants which are now nearly seven years old, only two are females. Growth has been

slow and the plants have reached about a metre in diameter and height. They have been given monthly irrigations to supplement the natural rainfall to bring the amount of water applied to about 450 mm per year. The planting at Carnarvon has been increased and some three year old bushes are now flowering.

The growth of the plants has not been obviously affected by any pests or diseases but parrots have taken some of the seed. It is possible there is some salt in the soil and that this has caused reduced growth. Measures are being instituted at present to leach the area in an attempt to improve growth. Seed yield has been low and small amounts of seed have been harvested on three occasions.

Since the original sample of seed was received, further samples have been obtained from Israel and Arizona and, together with the seed from the bushes at Carnarvon, these have been used to increase Department of Agriculture plantings.

At present there are about thirty bushes at Avondale Research Station, Beverley, ten bushes at the Wongan Hills Research Station, and a small number at the Desert Gold establishment at Wiluna. These recent plantings are less than two years old and have not flowered yet. Their growth, in general, has been slow.

Further plantings are planned for the Albany, Geraldton and the Kimberley areas and the Forests Department has requested seed to conduct trials on identification of female and male bushes. For future plantings an attempt will be made to obtain male and female, plants by vegetative propagation from bushes at Carnarvon.

JOJOBA AS AN ORNAMENTAL

Jojoba is a drought hardy, moderately attractive shrub which could find a place in "native" gardens. Its unique place in the plant kingdom gives it a curiosity value which makes it an interesting plant to grow in the garden.

Plant jojoba as you would a Western Australian native.

The most useful general references on jojoba are:-

- Daugherty, P.M., Sineth and Wastler (1953). Industrial Raw Materials of Plant Origin.

IV. A survey of *Simmodsia chinensis* (jojoba).

Bulletin No. 17 Engineering Experiment Station of the Georgia Institute of Technology. Atlanta, Georgia.

- Sherbrooke, W.C. and Haase, E.F. (1974). Jojoba: a wax producing shrub of the Sonoran Desert. Arid Lands Resource Information Paper No. 5 University of Arizona, Tucson, Arizona.

- Products from Jojoba: a promising new crop for arid lands. National Academy of Sciences, Washington D.C. 1975.

- Jojoba Happenings.

These and several other references are held in the Department of Agriculture Library, Jarrah Road, South Perth, Western Australia.

For further information on specific aspects of jojoba, contact M.G. Hawson, C.V. Malcolm, M.L. Poole or G.H. Walton at the Department of Agriculture, South Perth.

Reprinted from Western Australian Department of Agriculture "Farmnote' November 1978.

JOJOBA CROPS NO GOLDMINE - CONSULTANT

MARY BUSHER*

Forget promises of easy fortunes from growing jojoba crops was the message given members of the W.A. Nut Growing Society, by visiting agricultural consultant, Dr. Lennox Davidson of Sydney.

Jojoba had sound commercial prospects as a specialist crop and there appeared to be real potential for growing it in some wheatbelt and marginal areas in Australia, Dr. Davidson said.

NO EXPERTS

"But 'experts' promising yields as high as 7.7kg of seed from every bush and prices of between $20 and $40 a kg for seed, should be ignored," Dr. Davidson said.

First, there were no experts even though jojoba has been the subject of some intensive research over the past 20 years in Israel and the U.S.A. and more recently in Mexico. "No responsible person associated with any of this research yet claimed to have all the answers to developing jojoba as a cultivated commercial crop," Dr. Davidson said.

Dr. Davidson was in W.A. to inspect several jojoba plantings here including those of Jenning Industries at Eneabba. He was concerned that unrealistic promotion would result in huge financial losses for some people and hinder the sound development of jojoba.

"It had good prospects for being a profitable, reliable crop, but it won't be a goldmine," he said.

In the U.S.A. too many people getting on the economic bandwagon had retarded real progress. "With jojoba a lot of ingenious ways have been found to make money out of it without actually planting it," he said.

In his view, the people most likely to develop jojoba to a profitable crop in Australia were not city-based syndicates, but practical farmers. Farmers had the skills and practical ingenuity to overcome the many formidable problems facing growers before an industry could be established here, Dr. Davidson said.

There were still serious gaps in research around the world and there would be no harm in Australia hanging back a little to see what happened elsewhere, D. Davidson said.

The University of California which had made a feature of its jojoba work, had been reticent recently about yield results. Also, while it was the only establishment with jojoba bushes planted, managed and mature enough for mechanical harvesting, it had done no work in this area.

Dr. Davidson believes mechanisation, even in a low-labour cost country like Mexico, is the only way jojoba can be a paying crop and is therefore crucial to future development.

BETTER PLACED

On the more positive side, Dr. Davidson believes Australia may be much better placed than America for jojoba production.

Much of the land where commercial U.S. plantings are being made was valued as high as $3,000 to $4,000 a hectare. In the long term he thinks the profit margin will not be great enough to keep this land in production. By comparison Australia had a lot of much cheaper land with less temperature extremes, which could be very suitable for this plant.

MARKET PROSPECTS

It appeared a rainfall of less than l2in. and more than 20 inches was unsuitable, but at this stage no-one could be dogmatic even about environmental and soil needs, he said.

Looking at market prospects, Dr. Davidson said there were sound reasons for Australia developing jojoba commercially. With the closing of our last whaling station, Australia was vulnerable for supplies of sperm oil lubricant and synthetic substitutes available from the U.S.A.

From a defence viewpoint assured supplies were most important. But the total requirement for Australia and New Zealand was only about 1,000 tonnes annually. Dr. Davidson said researchers were now generally less optimistic about yield estimates.

At the 1978 international conference, a branch of the U.S. Arid Land Studies presented a budget for jojoba production based on a recovery of only 1.3kg a bush. At the previous conference the same department had assumed a yield of 4.5kg a bush under cultivation. Some researchers estimated that irrigation would double yields, but this would be at a considerable cost.

Also Israeli irrigation experience with the plants had raised some complex questions.

While improved knowledge and management skills could lift yields, an expectation round 1½kg, particularly because of the need to mechanically harvest, was probably realistic, Dr. Davidson said.

In any crop, mechanical harvesting had never proved 100 per cent efficient and this had to be considered when using yields from hand-picked bushes for budgeting purposes.

EXPECTED YIELD

In a recent brochure the South Australian Department of Agriculture had postulated a yield of about 2,000kg seed a hectare. He believed this was a reasonable estimate.

Dr. Davidson suggested that on this basis and taking a very conservative view of expected prices, a return on invested money about double that from grain growing could be expected.

He concluded that providing people kept their heads, treated all recommendations as experimental and made use of new proven information as it came along, there were good prospects for a viable jojoba industry in Australia.

*Reprinted from "THE COUNTRYMAN", December 13, 1979.

Dr. Lennox Davidson (right) with director of the W.A. Nutgrowers Society, Mr David Noel, preparing to show a film on jojoba cultivation.

CULTIVATION OF PECAN NUTS

N.H. SHORTER and S.R. NEWTON
Horticultural Division, Western Australian Department of Agriculture

Pecan nut growing began in the United States, developed initially by harvesting nuts from natural stands. It has expanded into a large scale industry there involving irrigated plantings of improved cultivars.

Notable developments have taken place in Israel and South Africa, and some interest is now being taken in pecan nut cultivation in Australia.

Pecans should be well suited to many parts of the South-West of Western Australia, if planted on selected sites and irrigated with water of suitable quality. Close attention must be given to cultural requirements and pollination needs.

FLOWERING CHARACTERISTICS

Pecans in common with quite a few of the other nut-producing trees, have a distinctive flowering habit - female flowers and male elements (catkins) occur separately on the same plant. With some varieties, there is a delay between pollen release and receptivity of the female flowers, so many potential nuts may not develop. A further complication with pecans is that pollen is dispersed only by wind currents and not insects.

CLIMATIC REQUIREMENTS

Dry conditions in spring and early summer are therefore critical for effective pollination. Shedding of pollen will not occur when relative humidity exceeds 85 per cent, and similarly a shower of rain will remove pollen from the air. Prolonged showery weather will prevent female flowers from being fertilised during their limited period of receptivity. Production in lower South-West districts of Western Australia is at a disadvantage in this regard.

As with all nut crops, temperatures are also critical during the flowering period. Cold conditions can slow the actual fertilisation process, and reduce subsequent nut formation. Overseas, the pecan has performed best where average summer temperatures are high and day/night temperature variation is minimal.

The map shows areas considered suited to pecan growing. Obviously these zones cover areas where poor soil and lack of irrigation would make it impossible to grow pecans successfully.

Most commercial varieties require a growing season of 180 to 210 days to mature their nuts. Cultivars requiring as little as 170 days are available but as with most earlier fruit varieties, size and quality is sacrificed.

Pecan trees have a moderately low chilling requirement, and insufficient cold is not likely to limit tree performance in most South-West districts. For example in Queensland, pecans have performed equally as well in inland areas and on the coast.

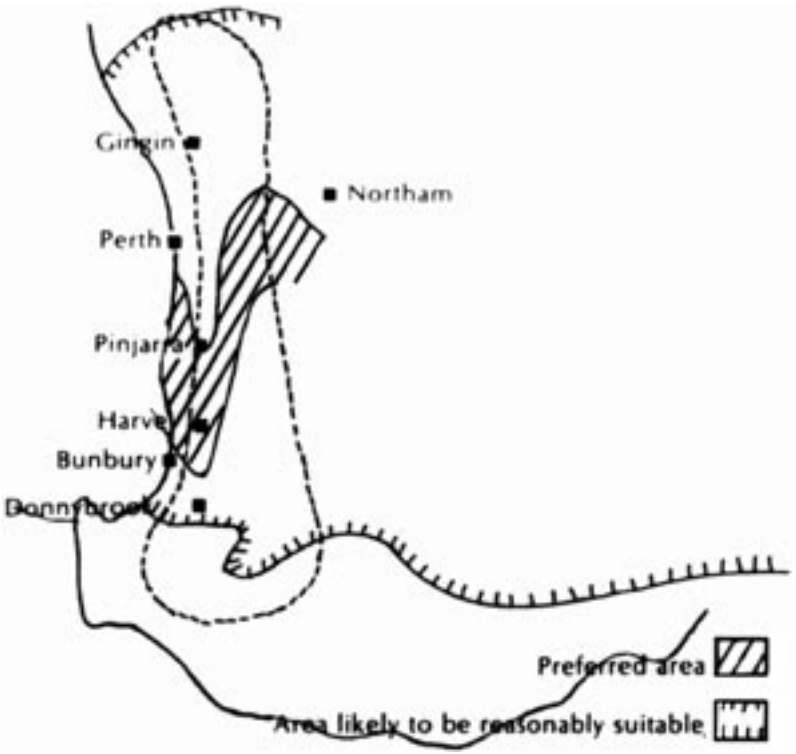
As in most young orchards, late spring frosts can damage young trees.

Ten year old pecan tree on a heavy loam soil near Perth

SOIL REQUIREMENTS

Although pecans are adaptable to a range of soil types, a deep, fertile, well-drained site with a good supply of summer moisture is preferred.

Pecans have requirements for soil acidity similar to other perennial crops, and slightly acid to slightly alkaline soil (pH of 5.5 to 7.5) is preferred. Most South-West soils are suitable.



CULTURAL REQUIREMENTS

It is important to encourage healthy spring growth by irrigation and maintaining soil fertility. Female flowers are produced from this spring growth and they produce the nuts; male flowers are found on last season's tissue.

Pecan trees have a high soil moisture requirement during the growing season and under local conditions irrigation is essential for tree establishment, and beneficial to bearing trees.

Up to 4,000 cubic metres of water storage per hectare may be required depending on the situation, but the actual watering programme should be related to daily evaporation measurements. Water quality is important, and a potential supply should not exceed 500mg/litre of total soluble salts.

Fertiliser needs of pecans are generally similar to those of other perennial fruit crops with a somewhat greater emphasis on nitrogen. Trees are subject to trace element deficiencies particularly zinc, and preventative or corrective sprays, or special soil treatments should be applied in most South-West situations. (See section on trace elements).

As pollination is easily upset by unfavourable conditions, all practical means must be taken to encourage pollination. With some varieties, such as Western Schley, the female flowers are receptive to pollination at the time the pollen is shed. These varieties are relatively self dependant, and can be grown without a pollinating variety, but should still be planted with complimentary varieties to ensure good pollination. The resulting cross pollination also improved nut size and quality.

Other varieties, including Nellis and Burket, have female flowers which are receptive before pollen is released, and varieties with overlapping flowering periods must be planted

nearby.

As pollen is shed mainly in daylight hours, placement of pollinator trees in relation to pattern of air movement can influence setting. Other special techniques could have application to pecan nuts if effective setting is not being obtained. Air blast machines can help pollen dispersal and, as sometimes practised with walnuts, male catkins could be gathered and stored, and then artificially placed in the trees later in the flowering period.

Ripening fruitlets on new season's buds

VARIETIES

Over 180 varieties are now available. These vary in periods of flowering, the time of bud break, cropping pattern, tree vigour, growth habit and fruit quality. Varieties available change constantly as improved selections become available.

United States varieties are classified as 'Western', 'Eastern', or 'Northern' according to their climatic suitability. Proven varieties available in Australia are Western Schley ('Western') Nellis, Moore, Success, Wichita, Mahan and Mohawk. Two notable newer selections, recently introduced to Australia, are Tejas and Chicksaw. Seedlings of Riverside, Western Schley, Apache and Burket are used as rootstocks.

The varieties with the most immediate potential for Western Australia are Western Schley, Moore, Mahan and Nellis. Also of interest are Halbert, Wichita, Burket, Riverside and Grabhols (pollinator for Riverside), along with Tejas and Chicksaw (when available).

Western Schley and Moore are relatively self sufficient in their pollination needs, the pollen being shed around the same time as the female flowers become receptive. However, to ensure good pollination, plant a minimum of four complimentary varieties. Burket can be used with Western Schley and Moore; Mahan and Nellis are varieties which appear to complement one another well; and Burket can be used with Nellis.

SITE PREPARATION

The site should be prepared thoroughly before planting to remove as many stumps and roots as possible. This is achieved by ripping and deep ploughing in two directions. On sloping sites, such working is best completed 'across the hill'.

Newly cleared land should be left two years before planting, to avoid the risk of root infection from the *Armillaria* fungus. Thorough summer workings and root picking should be carried out over this period.

The planting area should be fenced with rabbit-proof netting, as serious damage can otherwise be caused to the bark of young trees.

LAYOUT OF PLANTINGS

Trees can be planted in straight lines using a 'square' or 'diagonal' pattern. Such systems are well suited to flat or gently sloping sites. When planted on the square the normal spacing is 15 to 18 metres. A diagonal system of planting allows for trees to be thinned out when fully grown, while still maintaining a reasonable planting density. With this system, a tree is planted in the centre of each square, at a 9 to 10 metre spacing on the diagonal.

On sloping land, 'a modified contour system' can be used. Tree lines are laid out to conform fairly closely to the natural contours. Inconveniences such as short rows result if a contour system is followed too rigidly. Spacings should be 9 to 10 metres, as for conventional plantings.

Further details are contained in a Department of Agriculture Farmnote "Sites, Layout and Irrigation for Nut Orchards".

PLANTING

Trees are normally planted in late July to mid August, as soon as the main winter rains have ceased.

Moderately sized trees are preferred as they suffer less transplant shock, are more readily established, and grow faster than larger trees.

The rootlets of young trees should be protected from drying out as much as possible from delivery to planting. After delivery, roots should be covered with soil ("heeled in") to prevent drying.

Planting holes should be large enough to comfortably accommodate the roots. The rootlets require very little trimming, and only damaged portions should be removed.

As feeder root initiation can be a problem, stout bare-rooted trees with few feeder roots are often treated with hormone-impregnated wooden toothpicks to ensure adequate stimulation.

One to 2kg of superphosphate, preferably with trace elements, should be mixed in the bottom of the planting hole and the fertiliser covered with topsoil before the trees are planted.

After planting, trees should be watered with about five litres of water, and tamped down, so that there is firm contact between roots and soil.

The tree top should be pruned by one third to a half, to balance the top and roots.

Nuts as they are harvested, ready for drying and eating.

CARE IN THE FIRST YEAR

Close attention should be given to trees in the first year, to minimise losses, and to ensure satisfactory growth. Young trees respond well to irrigation, fertilisers and weed control. Effective weed control can be achieved by clean cultivation, or by establishing weedicide strips before planting.

Eight to 10cm of sawdust, or woodchips, spread around newly planted trees, provides a useful surface mulch in the first year, and should be laid down after applying fertiliser.

An approved acrylic paint should be applied to the butts of young trees to protect against sunscald. Trunk guards using small sheets of 'sisalation' can also be used, but can harbour insects.

Regular insecticidal sprays should be applied to the leaves from when the first shoots appear until mid December, for protection from cutworms, grasshoppers, and other periodic pests. Tree butts and the soil immediately around young trees should also be sprayed in early summer (mid November to early December) for protection against 'black beetle' and the 'cucurlio beetle'. Further details are contained in the 'Spraying Guide for Deciduous Fruits' published by the Department of Agriculture.

TREE TRAINING AND PRUNING

A central leader system is the most favoured system of tree training for pecan nuts. Some pinching out, and shortening back of strong growing side arms is recommended during the early years.

If mechanical harvesting is contemplated, trees should be trained for this. The main scaffold limbs should be chosen where possible with regard to maximum mechanical strength. Similarly, allowances must be made for limb or trunk impaction for harvesting with tree vibrators.

Once established, pecan trees require little pruning, and with most varieties, pruning reduces the bearing area of trees. Some of the newer American selections, with a pronounced branching habit, require periodic trimming. These varieties are adaptable to hedgerow plantings at higher densities than normal.

SOIL MANAGEMENT

Two suitable alternative soil management systems which can be used are clean cultivation, and a modified 'sod' system. Clean cultivation effectively eliminates grass competition during the summer but produces an uneven soil surface. A modified 'sod' system has advantages for ease of management and harvesting.

In this system mown grass sod is interspersed with weedicide strips.

TRACE ELEMENTS

Zinc deficiency is likely to occur in most South-West orchard soils and corrective sprays or soil treatments should be applied. Foliar treatments involve a spray of zinc sulphate at 100g per 100 litres in spring or early summer (more than one treatment may be needed) or alternatively at 400g/lO0 litres, before leaf fall in late summer.

Deficiencies of copper, manganese and magnesium may also sometimes occur and in such instances, a combination spray of up to three elements in a single spray can be applied. Department of Agriculture recommendations relating to other fruit crops are applicable (see Farmnote 'Treatment of Trace Element Deficiencies for Stonefruit').

PESTS AND DISEASE

Insect pests are not generally a major problem after establishment. Although a number of diseases affect pecan trees in the United States, few problems have so far been experienced in Australia.

AVAILABILITY

Pecan trees are not easy to propagate, and although relatively expensive, supplies are usually best ‘obtained from specialised nurseries.

YIELDS

Yields per tree of bearing pecan trees range between 10kg to 30kg per tree. 40kg per tree is regarded as a good crop, and 20kg per tree is average. Some varieties can become biennial in their bearing habit from around the twelfth year.

HARVESTING

Pecan nuts ripen in late autumn when nuts separate from their husks and fall to the ground. Plastic sheeting can be placed on the ground to facilitate collection, and a clean level surface is an advantage. After the nuts have been picked up, they should be washed, to remove foreign matter, and hypochlorite, or similar sterilant and bleaching agent, will improve appearance and storage quality. Careful and prompt drying of the nuts for three to four weeks, in a well ventilated room, is the final phase.

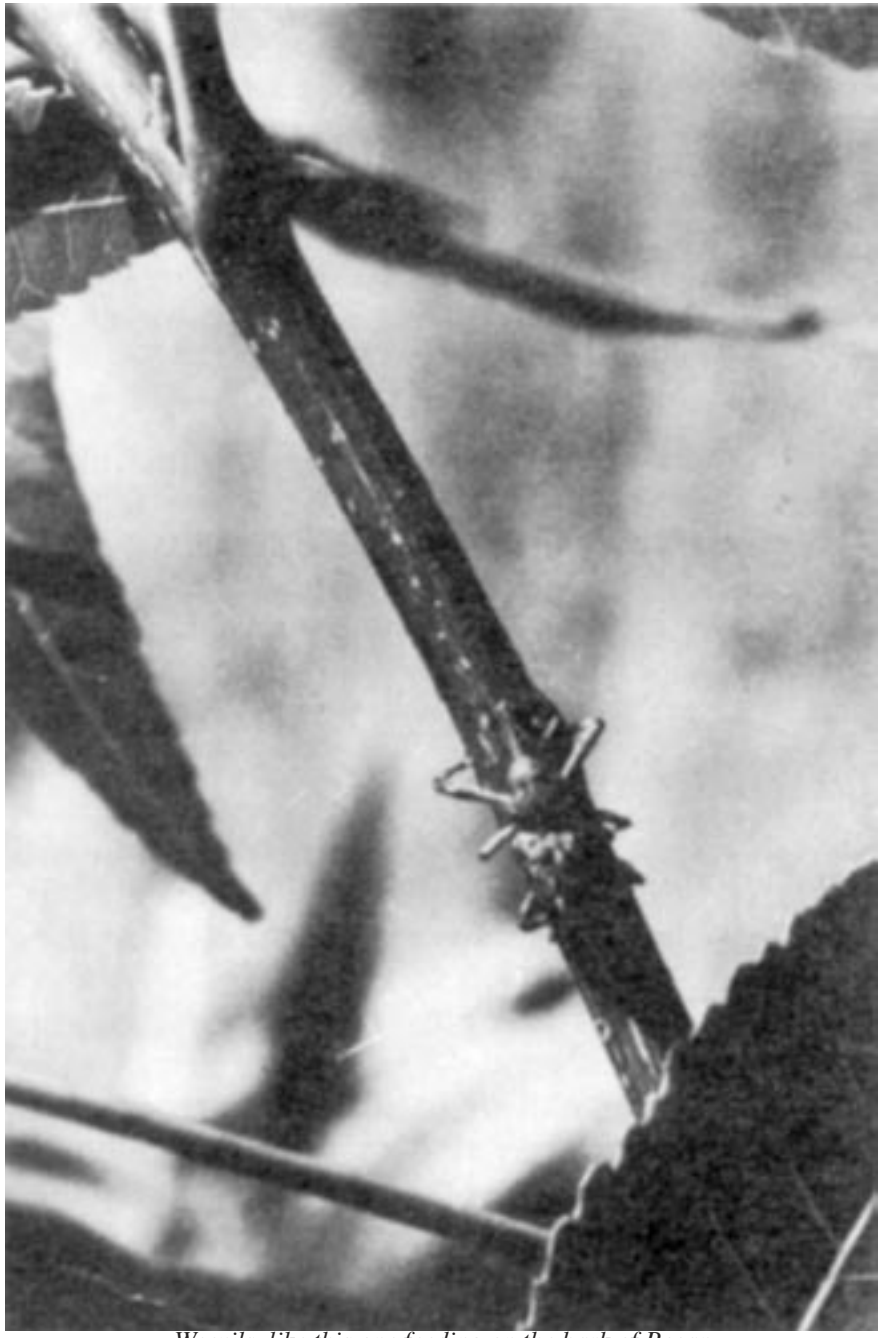
MARKET OUTLOOK

On the Australian market, there is a growing market for ‘in shell” pecan nuts, although the potential is difficult to assess. Significant new plantings are taking place in New South Wales, and to a much lesser extent in the South-West of Western Australia.

On the world scene, there is a strong demand for the shelled product. To create and hold a place in this market, good production per hectare will be needed, and early indications are that high yields are possible if sites are suitable.

Establishment costs in the South-West are high, due to the cost of trees and the need for irrigation in most situations. Studies in Texas showed that establishment costs, without irrigation and any provision for clearing, were around $1,000 per hectare. With irrigation, this would be considerably increased. Investment in harvesting, cleaning and shelling equipment for a 20 hectare planting in the United States was around $1,250 per hectare.

Reprinted from Western Australian Department of Agriculture “Farmnote “, August 1978.



Weevils, like this one feeding on the bark of Pecan are serious pests of many nut trees. Photo: B. Dell

NOTES ON PECAN VARIETIES*

Aggie: Orig. by N.H. Hander, Tex-Han Nursery, Belton, Texas.
Introd. in 1960. Chance sdlg.; disc. about 1953. Nut: clusters large, up to 8 nuts per cluster, averages 63 nuts per lb.; kernel percentage high, up to 65%; shells easily; quality good; resembles Zenith and Nugget. Tree: vigorous; prolific.

Altman: Orig. in Bumet, Texas, probably by Frank J. Wilmann, then living a Mason, Tex., but later at LaGrange, Tex.
Introd. about 1925 when several pecan growers propagated it. Chance sdlg. Nut: large; shell thin; quality considered poor. Tree: very productive. Now apparently obsolete.

Apache: Orig. in Brownwood, Texas, by L.D. Romberg, Pecan Field St., U.S. Dept. Agri.
Introd. in 1962. Burkett x Schley; cross made in 1940; first fruited in 1945; selected in 1947; tested as Tex. 110. Nut: large; blocky, some longer than Burkett, apex slightly flattened at right angle to shell suture, slightly pointed; shell color and markings resembles Schley, thin, cracking quality good; kernel averages 60% of nut, filling of nut normally very good, surface fairly smooth, color bright, deteriorates slowly in storage; ripens with Burkett or somewhat later; shuck thick or slightly thicker than Burkett. Tree: production usually heavy; vigorous; form, foliage shape and chilling requirement similar to its parents; protogynous; subject to scab under humid conditions, recommended for planting from Central Texas westward where dryness is likely to prevail.

B-7: Orig. in Richland Springs, Texas, by J.L. Rainey.
Introd. in 1948. Open-pollinated sdlg. of Mahan; San Saba Improved may have been the pollen parent. Nut: smaller and darker brown shell than Mahan; kernel percentage high; resembles Mahan and Schiey; ripens quite early. Tree: bears well; vigorous.

Barton: Orig. in Brownwood, Texas, by L.D. Romberg, U.S. Pecan Field Sta.
Introd. in 1953. Moore x Success; cross made in 1937 in the orchard of John Barton, Sr., of Utley, Texas; first fruited in 1944; tested as USDA T-l5. Nut: medium length with blunt ends, smaller than that of Success but larger than Moore; shell attractive, unusually thin, being in a class with Schley or even thinner; well suited to cracking by machinery or by hand; shuck (hull) thin and opens well when the nuts have matured; kernel bright, smooth, high oil content, flavor rich, consisting of about 58% dry weight of the whole nut, deteriorates more slowly with age than most vars.; matures between parent vars. Tree: vigorous, branches freely; less spreading than Success; begins to bud and leaf out relatively late, about with Success; comes into bearing early; crop production moderately heavy; catkins mature and shed pollen before the pistillate flowers are receptive.

Bowers: Orig. in Caldwell County Texas. by Elgin R Bowers, Lockhart, Tex.
lntrod. in 1925. Sdlg., disc. in 1925. Nut: large; shell thin; resembles Success. Tree: very heavy bearer.

Brake: Orig. in Rock Mount, North Carolina, by William H. Brake. Introd. in 1937.
Parentage unknown; seed planted in 1910. Plant pat. 47; Nov. 28, 1932. Nut: shell extremely thin; high kernel percentage; easily shelled; shorter and smaller than Schley. Tree: hardy; resistant to disease, especially scab.

Caddo: Orig. in Philema, Georgia, by the late C.A. Reed, U.S. Dept. of Agr., Pecan Field Sta.
Introd. in 1968. Brooks x Alley. Cross made in 1922 or 1923; tested as Philema 1175. Nut: resembles Brooks; shape like football, with points projecting from base and apex; shell dark; 60-75 nuts per lb.; kernel 58% of nut, quality good, flavor excellent, attractive; adapted to mechanical shelling; ripens mid-season. Tree: resembles Schley in form, branching and leaf; precocious; very productive; protandrous type, needing other vars. for pollination; in Louisiana showed more tolerance to scab than Schley but less than Brooks and tolerant of bunch disease for 18 years at Coushatte, La.

Cape Fear: Orig. in Willard, North Carolina, at the Coastal Plain Branch Sta. of the N. Car. Agr. Exp. Sta.
Introd. in 1941. Open-pollinated sdlg. of Schley; seed planted in 1912; reported first in 1937 by Robert Schmidt. Nut: resembles Stuart in size and shape but superior in cracking quality; kernel does not break when shell is cracked; averages 52-62 nuts per lb.; kernel percentage high; quality high and superior in several respects to Stewart. Tree: very vigorous; large, well-formed; productive.

Capers 64: Orig. in Gorman, Texas, by a Mr. Capers.
Introd. in 1955. Open-pollinated sdlg. of Burkett; disc. in 1950. Nut: shape irregular; shell thick; kernel av. 64% of nut; resembles Burkett. Tree: shy bearer. Apparently no longer being propagated.

Carmichael: Orig. in Harwood, Gonzales County, Texas, by John R. Carmichael.
Introd. in 1930. Probably a chance sdlg. Nut: small, averaging about 73 nuts per lb.; shell thin, good commercial cracker, shelling characteristics excellent; kernel averages 62% of nut; flavor excellent. Var. also being used in breeding work; pollen parent of Sioux.

Cheyenne: Orig. in Brownwood, Texas, by L.D. Romberg and G.D. Madden, U.S. Pecan Field Sta.
Introd. in 1970. Clark x Odom. Cross made in 1942, first fruited in 1948, tested as 42-13-2. Nut: size medium, 55-60 per lb.;moderately blocky, with blunt rounded ends, the apical end is slightly pointed; shell has dark stripes and splotches at the apical end on a clear brown background, attractive; kernel slightly wrinkled, bright color, flavor excellent, loose in shell, 57-61% of nut; harvest mid-season. Tree: resembles Clark in form, branching and leaf; very precocious and very productive; blooming is of the protandrous type, therefore needing a protogynous type for good pollination; Cheyenne is an excellent var. for interplanting with the protogynous or late pollen shedding vars. such as Wichita; well adapted to shelling by commercial machinery. Recommended for trial in central Texas and westward, but should not be extensively planted in the humid areas of the Southeast until more is known about its performance in that area; also recommended for planting as a temporary tree or in high density plantings where pruning to control tree size is practised.

Chief: Orig. in Ridgway, Illinois, by H.C. Reeder.
Introd. in 1953 by J.F. Wilkinson, Indiana Nut Nursery, Rockport, Indiana. A native sdlg. selected in 1942. Nut: large, about 45 per pound; kernel plump; quality good to excellent; shell medium thin; maturity as late as Greenriver; resembles Greenriver but is much larger. Tree: very vigorous; protandrous, with very late pistilate flowering.

Choctaw: Orig. in Brownwood, Texas, by L.D. Romberg, U.S.Pecan Field Sta.
Introd. in 1959. Success x Mahan; cross made in 1946; sdlgs. grown in nursery and budded into bearing trees in 1947; first fruited in 1952; tested under USDA 46-15.--276. Nut: size similar to that of Success but of more symmetrical shape; averages 45 per lb.; shell unusually thin, being similar to Schley; kernel averages about 60% or more of dry weight of the whole nut, releases well from shell, color bright, oil content high, flavor rich; suited to cracking by hand or machinery, cracks out very satisfactorily; shuck thin, opens well when nuts have matured; matures about with Success. Tree: vigorous; branches freely; growth starts relatively late in spring; leaves appear resistant to disease; catkins mature and shed pollen after pistillate flowers are receptive; comes into production early; bears heavy crops.

Churchill: Orig. in Seguin, Guadalupe County, Texas, by R.C. Govett.
Introd. about 1922. Chance sdlg.; disc. in 1912. Nut: papershell type; large; averages 50-55 per lb.; kernel 50% of nut. Tree: bears regularly.

Colby: (*Arthur, Orrell*). Orig. by Wm. W. Lawrence and his son, James W. Lawrence, Fayette County, Illinois, and by A.S. Colby and J.C. McDaniel, Ill. Agr. Exp. Sta., Urbana. Introd. in 1957. Open-pollinated sdlg. of native pecan (*Carya illinoensis*); disc. about 1940 on the Wash Orrell farm, Clinton County, Ill.; first propagated by the Lawrences in Fayette County; later propagated by James W. Lawrence in 1942 while a student at Urbana; selected by A.S. Colby and J.C. McDaniel in 1945; tested as Ill. 1-19A (not the "Illinois" of Bradley Bros., Carbondale, Ill.). Nut: northern type, maturing in a 160-day growing season; long, oval; shell thickness medium; flavor good; excels other extra-early vars. at Urbana in size or productivity or both. Tree: protogynous; vigorous; resistant to lea fungi; fruiting annually since 1950. Named in honour of Dr. A.S. Colby, Emeritus Professor, Univ. of Ill.

Comanche: Orig. in Brownwood, Texas, by L.D. Romberg, U.S. Pecan Field Sta.
Introd. in 1955. Burkett x Success. Nut: large; very similar in size and form to Burkett, which it resembles, but kernel bright and free of dark flecks characteristic of Burkett. Tree: vigorous; has shown much greater disease resistance than Burkett when grown under similar climatic conditions; bears moderately. Designed to replace Burkett; recommended for planting only in areas where Burkett is grown.

Commonwealth: Orig. in San Saba, Texas, by E.E. Risien & Son.
Introd. about 1927. Considered to be a sdlg. of Squirrel. Nut: medium to large, averaging 54 per lb.; kernel 60% of nut; shell thin, with good cracking quality; ripens midseason, late Oct. to early Nov. Tree: typical western var., with tendency toward willowy growth; very prolific; begins bearing early; slightly susceptible to pecan scab in areas of high humidity; planting restricted to central and western areas.

Cowley: Orig. in Perkins, Oklahoma, on the O.E. Cowley farm and brought to attention by Dept. of Hort., Okla. Exp. Sta., Stillwater, Okla. Introd. in 1966. Seed of unknown parentage planted in 1951; selected in 1960. Nut: large, 21/2 in. long; oblong cylindrical with a slight depression at mid-section; averaging about 40 per lb.; shell thin; kernel averages 54% of nut; 6-7 nuts per cluster; resembles Williamson. Tree: vigorous; very productive; early bearer; resistant to pecan scab.

Coy: Orig. in Cherokee County, Kansas, by Charles Stevens of Columbus, Kan.
Introd. in 1939. Parentage unknown; disc. about 1928. Nut: small; shell thin; quality excellent; high oil content. Tree: regular producer; comes into bearing late.

Davis: Orig. in Vancleave, Mississippi, by the Davis Nursery.
Introd. in 1921. A natural sdlg. of *Carya illinoensis*; disc. in 1918; original tree killed by lightning in the 1950's. Nut: resembles Van Deman; kernel attractive, but color darkens and varies from year to year; good shelling characteristics. Tree: vigorous and highly productive.

Desirable: (*Dependable*). Orig. in Ocean Springs, Mississippi, by C. Forkert.
Introd. in 1930. Hybrid of Success x Jewett or of Success x Russell; selected about 1903; tested as US-7191. Nut: larger than Stuart, averaging 44-50 per lb., with kernel percentage averaging about 52%; kernel quality very good, meaty. Tree: blooms early; highly resistant to scab; comes into bearing early; very prolific and consistent bearer. Appears to be a much better var. than Stuart, which it resembles.

Dooley: Orig. in Okmulgee, Oklahoma, by Earl Dooley.
Introd. about 1945. Sdlg. of native pecan; disc, in 1940. Nut: shells very well; 80 per lb.; kernel averages 48% of nut; ripens early. Tree: productive; very susceptible to scab. Placed first in Okla. Pecan Growers' Seedling Contest of 1940.

Draime Dream: Orig. in Citronelle, Alabama, by John H. Draime, Draime Brothers.
Introd. in 1920. Parentage unknown; disc. in 1915. Nut: large; meat white, oily; easy to shell; resembles Schley.

Duis: Orig. in Shattuc, Illinois, by J.G. Duis.
Introd. in 1935. A native tree; disc. in 1933, 4 mi. north of Carlyle, Ill., in Kaskaskia River Valley. Tree: one of largest specimens in the most northern area of distribution; bears light crops consistently. No longer in commercial propagation.

Duvall: Orig. in Naylor, Maryland, on the farm on John C. Duvall, by L W. McKay, U.S. Dept. Agr. and H.L. Crane, Plant Industry Sta., Beltsville, Md.
Introd. in 1956. Chance sdlg.; selected in 1952; original tree is estimated to be 100 years old and originated from seed sent to the Duvall family from the vicinity of Iron Mountain, Missouri. Nut: long; small, averaging about 125 per pound; yields about 50% kernel. Tree: very productive; produced annual crops of well-filled nuts in northern regions where pecans are not now grown for nut production.

Elliott: Orig. in Santa Rosa County, Florida; originator unknown.
Introd. about 1925. Parentage unknown; disc, about 1915. Nut: small; base rounded, apex pointed; kernel plump, smooth, straw colored, of excellent flavor and quality; shell medium thick, very good for cracking purposes; resembles Farley. Tree: highly resistant to scab; fairly prolific; grows slowly; numerous terminal twigs; leaflets decidedly curved.

Ewing: Orig. in Glendale, Arizona, by M.D. Ewing.
Introd. in 1944. Parentage unknown. Tree: consistent yielder.

Farley: Orig. in Jackson County, Florida, by B.W. Stone, Stone Nursery Co.,

Thomasville, Georgia.
Introd. about 1925. Parentage unknown; disc, about 1918. Nut: shell thin; quality excellent, being flavored somewhat like a hickory nut; externally resembles Moneymaker and Success. Tree: slightly susceptible to scab [*Cladosporium effusum* (Wint.) Demaree] ; shy but consistent bearer; comes into bearing late.

Fisher: Orig. in New Memphis, Illinois, by Jacob Fisher.
Introd. in 1938. Parentage unknown; a sdlg. tree selected by Joseph Gerardi of O'Fallon, Ill. Nut: size medium; flavor good; good cracker. Tree: heavy bearer at original location, but has performed poorly in orchards. No longer propagated.

F.W. Anderson: Orig. in Le Grand, California, by F.W. Anderson, Merced, Calif.
Introd. in 1963. Plant pat. 2,392; Apr. 21,1964; assigned to Stribling's Nurseries, Inc., Merced. Open-pollinated sdlg. of Govett (Caloro); selected in 1961. Nut: averages 50-60 per lb.; averages 1 7/8 in. long, 7/8 in. wide; shell medium brown, smooth, thin, cracks easily; kernel light tan, plump, fills well, flavor and quality excellent; harvest period early, about 3 weeks before Govett, Stuart, Success, in early Nov. in the California Central Valley, maturing before leaf fall. Tree: growth medium; good co-incidence of pollen shedding and pistillate receptivity; grows successfully and produces good commercial crops in Central Valley of Calif.; precocious bearer.

Gallatin: Orig. in Gallatin County, Illinois, by Arthur Vandenbark and C.W. Richardson of New Haven, Ill.
Introd. in 1945. A native sdlg. disc. in 1934 at the Tri-State Nut Show in New Haven, Ill. Nut: size medium to large; resembles Greenriver in size and shape; kernel quality good. Tree: protogynous; an excellent pollinator for late protandrous vars.; production erratic in orchards. No longer propagated in Ill.

Gildig: Orig. in German Town, Illinois, by Louis Gerardi Nursery, O'Fallon, Ill.
Introd. in 1935. Chance sdlg.; disc. in 1930; tested as Gildig 1. Nut: large; rather attractive; kernels not all plump nor of best quality. Tree: comes into bearing very slowly. Var. apparently obsolete.

Giles: Orig. in Chetopa, Kansas, on the property of A.E. Giles, disc. by J. Ford Wilkinson, Indiana Nut Nursery, Rockport, Indiana.
Introd. in 1930 by Mr. Wilkinson. Parentage unknown; disc. about 1927. Nut: fairly large; shell thin; kernel quality good. Tree: regularly productive near the latitude of origin, not so reliable northward; protogynous.

Gloria Grande: Orig. in Orangeburg, South Carolina, by Whitefield W. Watson, Watson's Pecanwood Nurseries.
Introd. in 1923. Native sdlg.; disc. in 1920. Nut: large, av. 33 per lb.; kernels richer than Stuart, which it resembles. Tree: vigorous; good pollinator for Stuart.

Goforth: Orig. in the Wabash Valley of Illinois by Bert Goforth, New Haven, Ill.
Introd. in 1934. Chance sdlg. Nut: size medium; comes off tree easily; ripens early. Tree: reported as very scab-susceptible at Rockport, Indiana; not regularly productive; protogynous. No longer propagated.

Gormely: Orig. in Okemah, Oklahoma, on the G.G. Gormely farm and brought to

attention by Dept. of Hort., Okla. Agr. Exp. Sta., Stillwater, Okla.
Introd. in 1966. A native tree; disc. in 1946. Nut: small to medium; oblong; resembles other native pecans; maturing early. Tree: excellent shade tree for landscape purposes; dense foliage; excellent branching habits; very productive.

Govett: (*Caloro*). Orig. in Seguin, Texas, by R.C. Govett.
Introd. in 1922. Original tree considered to be 100 years old in 1957. Nut: large, larger than Schley; long, tapering, shell thin, easy to shell by machine; flavor good; ripens late; resembles Schley. Tree: prolific.

GraKing: Orig. in Hugo, Oklahoma.
Introd. in 1959 by O.S. Gray Nursery & Landscape, Arlington, Texas. Chance sdlg.; original tree shown to Mr. Gray at the residence of a Mrs. King in Hugo sometime during the period 1946-1949 at which time the tree was about 12 in. in diam. and 40 ft. tall; seed originally came from Tex. Nut: large, about 35 per lb.; attractive; flavor good; kernel separates easily from shell, averages about 55% of nut; ripens early; resembles Mahan. Tree: production heavy; growth characteristics good; protogynous.

GraTex: Orig. in Arlington, Texas, by O.S. Gray, Jr. and J.A. Evans, 0.S.. Gray Nursery.
Introd. in 1962. Ideal x Success; selected in 1945. Nut: averages 50 per lb.; shell extremely thin; kernel averages 2/3 of nut, flavor excellent. Tree: blooms protogynously.

GraZona: Orig. in Mesa, Arizona, by Lyman Coe on the ranch of J.W. May.
Introd. in 1968 by the O.S. Gray Nursery, Arlington, Texas. Unknown sdlg., disc, in 1952. Nut: large; rectangular, stylar end with distinct depression and ridges on each side of depression; shell thin; kernel 53-55% of nut, approx. 42 nuts per lb., light brown, plump, flavor excellent; resembles Burkett. Tree: characteristics of a western var.; more spreading than Mahan; very productive.

Halsly: Orig. in Mason, Texas, by Frank J. Willmann, La Grange, Tex.
Introd. in 1924. Schley x Halbert; resulting seed planted in 1914; sibling of Slybert. Nut: shell thin, shells easily; size av. 45 per lb.; kernel av. 56% of nut; longer and larger than Halbert, which it resembles. Misspelled "Halsey" in the 1942 edition of Standardized Plant Names, p. 259.

Harper: Orig. in Las Cruces, New Mexico, by Roy E. Harper, N. Mex. Agr. Exp. Sta.
Introd. in 1967. MahanxWestern. Selected and evaluated by Roy M. Nakayama of above sta. Nut: averages 53-60 nuts per lb.; shell thin; kernel 58.7% of nut; resembles Western, being distinctive by ripening 10 days earlier, has 5% less sticktight husks at harvest and 20% larger nuts, which are smoother and longer than Western. Tree: vigorous; sheds pollen early; flowering period comparable to Ideal and Wichita; early spring bud-break, slightly later during some yrs. than for other vars. Named after originator who retired from N. Mex. State Univ. in 1960.

Harris Super: Orig. in Gunnison, Mississippi, by Edward Harris.
Introd. in 1960. Plant pat. 2,051; Apr. 25, 1961; assigned to Simpson Nursery Co., Monticello, Florida. Parentage unknown but may be Stuart x Schley; disc. in 1958. Nut: large; long point on one end; shell very thin; resembles Schley, but kernel not as

smooth and with less oil content; matures No. 1. Tree: appears to be disease resistant, very similar to Schley; productive.

Hastings: Orig. in Monticello, Georgia, by G. T. Chaffin.
Introd. in 1955. Plant par. 1,399; June 14, 1955; assigned to the H.G. Hastings Co., Atlanta, Ga. Open-pollinated sdlg. of Stuart; selected about 1945. Nut: resembles Stuart, but has a thinner shell; cracks easily; quality of kernel good; fills well; matures Oct. 1. Tree: size medium; vigorous; hardy; productive; tolerant to scab.

Hayes: Orig. in Lincoln County, Oklahoma, as a result of a survey of native trees in northeast Okla.
Introd. in 1954 by the Dept. Hort., Oklahoma A. & M. College, Stillwater. Parentage unknown; disc, in 1952. Nut: cluster of 4 or 5 nuts; size medium; 93 per lb., averaging l/4 in. long and 3/4 in. in diam.; oblong to roundish; shell thin, some breakage in shelling because nut well filled; yields 61% kernel; kernel plump, wide, rather dark, flavor and quality good; ripens in midseason. Tree: large; bears regularly and well.

Hodge: (*Hodge 's Favorite, Illinois Mammoth*). Orig. in York, Clark County, Illinois, by H.H. Hodge.
Introd. in 1954 by the Gerardi Nursery, Caseyville, Ill. Open-pollinated sdlg. of a native tree; disc. about 1890; grafted in 1942; one of first northern pecans to attract attention. Nut: large; intermediate between Ni-black and Posey in shape; one of finest flavored of all pecans; kernel tender, probably not adapted to commercial cracking. Tree: generally weak wood subject to crotch-splitting in windy sites; not productive at Urbana, Ill. Useful only as a late-protogynous pollen source, and for breeding purposes.

Humble: Orig. in Uvalde, Zavalla County, Texas, by James A. Simpson.
Introd. in 1933. Plant pat. 73;July 25, 1933;assigned to Humble Oil & Refining Co., Houston, Tex. Nut: large, averaging 45-50 per lb.; cracks well; quality good; ripens about Sept. 1. Tree: bears heavily and regularly; pronounced precocity; vigorous; wide range of adaptability; immune to disease and insects; relatively little chilling requirement.

Ideal: Orig. in San Saba, Texas, by J.A. Evans, Arlington, Texas.
Introd. during the period 1930-35. Sdlg. selected about 1925. Nut: size medium, well-filled; kernel plump, solid, texture good, flavor excellent, quality excellent; kernel covering (testa) is dark and speckled. Tree: initiates growth and blooms later than other vars.; adapted to western pecan areas; subject to scab in eastern states.

Imperial: Orig. in San Antonio, Texas, by Earl Wallace Ross.
Introd. in 1962. Plant pat. 2,211; Jan. 8, 1963; assigned to Aidridge Nursery, Nov Ormy, Tex. Chance sdlg.; selected in 1958. Nut: large, averaging 28 per lb.; shell medium thin, cracks quite easily; kernel large, averaging 58% of nut, plump, fills shell well, golden brown with creamy-white interior, flavor pleasant, sweet. Tree: vigorous; upright; bears well.

Jennings: Orig. in Jefferson Davis Parish, Louisiana, by Jennings Nursery Co., Jennings, La.
Introd. in 1940. Mother tree a native sdlg. Nut: resembles Van Deman averaging about

60 per lb.; slightly more than twice as long as broad, broadest near base; apex moderately pointed; base rounded; green husks unusually pale; shell thickness and color similar to Stuart but more copiously marked with purplish-black lines and splotches and finely dotted; shells out well into halves; flavor similar to Stuart. Tree: moderately spreading; bark rather smooth arid tight; twigs light gray to reddish gray; buds large, plump, medium brown; protogynous; highly productive; susceptible to scab and bunch disease. Leaf: paler than Schley; old trees have 9-15 leaflets per leaf; apical leaflet about 3.0 to 3.5 times as long as broad when fully developed, next 3 pairs of leaflets below it of about equal length; leaflet petioles unusually long; serrations sharp, about 5 per inch on large leaflets.

John Garner (*Garner*). Orig. in San Saba, Texas, by E.E. Risien.
Introd. in 1934 by Wolfe Nursery, Stephenville, Tex. San Saba Improved x Onliwon; Joe W. Terry farm; selected in 1933. Nut: large; shell thin, appearance attractive; resembles Burkett. Tree: vigorous; prolific bearer; thrives and produces best under somewhat arid conditions. Named after John Garner, a Vice President of the United States.

Kelly: Orig. in San Saba, Texas, by J.T. Kelly.
Introd. about 1925. Chance sdlg. disc. about 1920. Nut: size medium, 60 nuts per lb.; shell thin; kernel 50-52% of nut; quality good; ripens mid-season. Tree: very heavy producer. So far as is known, this var. has not proven to be a really profitable one.

Kernodle: Orig. in Camp Hill, Alabama, by the late Julius A. Kernodle.
Introd. in 1957. Plant pat. 1,744; Aug. 26, 1958; assigned to Simpson Nursery Company, Monticello, Florida. Chance sdlg.; disc. in 1948. Nut: large; long with base blunt, similar to Stuart; shell very thin; kernels lighter in color than most other vars.; quality very good, flavor somewhat like that of Persian walnut, cracks out easily; ripens late, about Oct. 21 to about Nov. 10 at place of origin; resembles Frotscher. Tree: appears resistant to scab; productivity good.

Kibler: Orig. in Columba, Michigan, by the Burgess Seed & Plant Co., Galesburg, Mich.
Introd. in 1959. Chance sdlg.; selected about 1940. Nut: smaller than other vars.; flavor and quality equal to some southern vars.; kernels crack out about 90% whole halves; shell of the paper type; one of several vars. occasionally ripening in southern Mich. Var.'s main interest is its ability to mature relatively far north.

Lawrence: Orig. in Clinton County, Illinois, by Wm. W. Lawrence and James V. Lawrence.
Introd. in 1937. Chance sdlg. of native pecan; disc. about 1936; named in 1937. Nut: large; shell rather thick; ripens early; resembles Stuart but smaller and matures before that var. Tree: flowering protogynous.

Mahan: (*Chestnut, Florida Giant, Georgia Giant, Masterpiece, Mayhan, Mississippi Giant*). Orig. in Kosciusko, Attala County, Mississippi, by J.M. Chestnutt.
Introd. in 1927 by F.A. Mahan, Monticello Nursery Co., Monticello, Florida, which purchased the var. Parentage unknown. Nut: very large; long; shell thin; tends toward poor filling on older trees; resembles Schley but about 60% larger. Tree: prolific; early bearing; vigorous.

Mahan-Stuart: Orig. in Monticello, Florida, by Fred A. Mahan, Monticello Nursery Co.

Introd. in 1956. Plant pat. 1,532; Dec. 4, 1956. Mahan x Stuart; selected in 1948. Nut: very large, about 32 or 33 per lb.; shell thinner than Stuart but thicker than Mahan; quality very good; resembles Stuart in shape but somewhat longer; matures 10 days before Stuart. Tree: starts bearing early; vigorous; leaves large and pointed; blooms 1 week earlier than Stuart.

Maramec: Orig. in Maramec, Oklahoma, by Mrs. Emma Charlton.
Introd. in 1969 by Okla. Agr. Exp. Sta., Okla. State Univ., Stillwater, Okla Open-pollinated sdlg. of Mahan. Nut planted in 1933, selected in 1963, tested as 63 M. Nut: large, 40-50 per lb.; oblong, blocky; 4-5 nuts per cluster; shell thin; kernel av. 58-59% of nut; matures mid-season, Oct. 15, ahead of Stuart. Tree: large, spreading; vigor good; hardy; very productive; tolerant to pecan scab; superior foliage until frost.

McCulley: Orig. in Brownwood, Texas, by W.D. McCulley.
Introd. in 1921. Chance sdlg.; disc. about 1918. Nut: size medium; round; shell thin; kernel quality excellent; cracks out about 55% meats. Tree: very susceptible to pecan scab, which has kept it from being more popular; still propagated to a limited degree.

Mcintosh: Orig. in Vernal, Green County, Mississippi, by J.J. McIntosh.
Introd. in 1921. Nut: small; shell very thin; cracks well; does not store well. Tree: bears regularly.

Meicher: Orig. in La Grange, Texas, by J.C. Melcher.
Introd. in 1924. Chance sdlg.; disc in 1924. Nut: averages 58 per lb.; kernel averages 51% of nut. No longer being propagated.

Mohawk: Orig. in Brownwood, Texas, by L.D. Romberg, U.S. Pecan Field Sta.
introd. in 1965. Success x Mahan; cross made in 1946; first fruited in 1953; selected in 1954; tested as US 46-15-195. Nut: cluster size average; individual nuts large, similar to Mahan, av. 35 per lb.; shape blocky, slightly more elongated than Stuart, shell color and markings like Success, flinty, thin, very attractive, relatively little soft inner shell; kernel surface quite smooth, parallel grooves shallow and open, may exceed 60% of weight of entire nut; central septum separates easily from kernel during shelling; high quality; matures early, hulls begin to open first of Oct. Tree: vigorous, semi-spreading; leaf large, appears resistant to disease, held late in Autumn; catkins mature and shed pollen while pistillate flowers still receptive. Recommended for trial throughout the southern pecan-growing area.

Mount: Orig. in Okmulgee, Oklahoma, on the E.E. Mount farm and brought to attention by Dept. of Hort., Okla. Agr. Exp. Sta., Stillwater, Okla.
Introd. in 1966. Parentage unknown; disc. in 1949. Nut: resembles Jersey in size and shape, but has thicker shell; averaging 75 per lb.; kernel averages 52% of nut, and separates freely from shells after cracking; excellent shelling pecan. Tree: hardy; ripens early, 2 weeks before Stuart; well adapted to northern region of pecan belt where most vars. are damaged often by fall freezes.

Natchez: Orig. in Natchez, Adams County, Mississippi, by S,J. Greer, Miss, Agr. Exp. Sta.
Introd. in 1930. Parentage unknown; disc. during the period 1927-1929. Nut: kernel quality excellent. Tree: bears heavily. Some 10 yrs. after introduction it became very

susceptible to scab disease and was discarded. Obsolete.

Nellis: Orig. in Whittler, California, on the property of Mrs. E.T. Stoddard, by Armstrong Nurseries, Inc., Ontario, Calif.
Introd. In 1932 by that nursery. Chance sdlg.; disc. about 1910. Nut: size average; long, pointed; shell thin, shelling readily; quality average. Tree: original tree bore moderate to good crops consistently over 30 yrs. under southern Calif. coastal conditions; its uniqueness lay in its ability to mature fruit under conditions of relatively low temperature; apparently self-fruitful. No longer propagated by Armstrong Nursery.

Oakla: Orig. in Okmulgee, Oklahoma, on the E.E. Mount farm and brought to attention by Dept. of Hort., Okla. Agr. Exp. Sta., Stillwater, Okla.
Introd. in 1966. Parentage unknown; disc. in 1951. Nut: medium to small; 90 per lb.; resembles Nugget; shelling type; shell thin; kernel av. 52% of nut; nuts shed easily from tree; early harvest possible. Tree: resistant to pecan scab.

Odom: Orig. in Toledo, Texas, by R.L. Odom.
Introd. in 1923. Parentage unknown; disc. about 1920. Nut: shell thin; averages 42 per lb., kernel averages 54% of nut; cracking quality good. Tree: shy bearer.

Owens: Orig. in Cuba Island in Moon Lake, Coahoma County, Mississippi, by Frank M. Owens.
Introd. in 1930. Unknown sdlg, among 2,000 received from a nursery company in Monticello, Florida, in 1900; disc. in 1914. Nut: 1/4 in. long, 1 in. in diam.; somewhat flat; shell medium thick, grayish, a few dark markings on blossom end, attractive; kernel averages 46-48% of nut, fills shell well, cracks out well, practically all halves, standard in color. Tree: limb scaffold withstands wind and sleet; stout crotch construction; annual bearer; moderately productive; tolerant to insects and diseases prevalent in Delta areas of Miss. and Arkansas; resistant to pecan scab disease when standard vars. have scabbed severely; catkins plentiful; female flower small; blooms 10 days earlier than Stuart.

Patrick: Orig. in Rogers County, Oklahoma, as a result of a survey of native trees in northeast Okla.
Introd. in 1954 by the Dept. of Hort., Oklahoma A. & M. College. Stillwater. Parentage unknown; disc. in 1952. Nut: small, averaging 115 per lb., 1 3/8 in. long, 11/16 in. in diam.; shape irregular, apex short pointed, base round and blunt; shell thin, excellent sheller, yielding about 60% kernel; kernel elongated, light color, plump, smooth; ripens about midseason. Tree: produces well; bears biennially; apparently resistant to pecan scab.

Pensacola Cluster: Orig. in Pensacola, Florida, by E.W. Moring.
Introd. in 1960. Plant pat. 2,099; Oct. 31, 1961; assigned to Simpson Nursery Co., Monticello, Florida. Chance sdlg., disc. in 1958. Nut: resembles Van Deman; borne in clusters of 6-10; stylar end with long point; shell thin, cracks and releases nut easily, brown with grayish cast; short point on stem end and long point on opposite end; kernel long, amber, flavor excellent, texture fine; matures Oct. 1-15. Tree: bears heavily; apparently disease resistant; abundant and attractive foliage.

Peruque: Orig. in St. Charles, Missouri, by Ralph Richterkessing.

Introd. in 1953. Parentage unknown; disc. in 1936. Nut: earlier and larger than Major; papershell; yields 60% kernel. Tree: yields very well; holds foliage later in fall than do other vars.

Price: Orig. in Gustine, Comanche County, Texas, by Will S. Price, Kerens, Tex.
Introd. in 1928. Chance sdlg.; disc. along the Leon River in 1926. Nut: size medium; oblong, ends pointed; kernel quality good under optimum conditions; resembles Schley.

R-3: Orig. in San Saba, Texas, by E. Guy Risien.
Introd. about 1939. Open-pollinated sdlg. of Schley; disc. in 1935. Nut: 58 per lb., shell thin; long; kernel plump, av. 58.5% of nut. Tree: bears well.

Ranger: Orig. in Ranger, Eastland County, Texas, by B.B. Freeman.
Introd. about 1960. Chance sdlg.; disc, in 1953 in an orchard planted about 1935. Nut: small, averaging about 65 per lb.; shell thin; kernel averages 61.5% of nut, fills well, flavor delicious. Tree: moderate bearer.

Royal: Orig. in Riverside, California, By. Robert A. Harris, Arlington, Calif.
Introd.in 1949. Plant pat. 833;Apr. 26, 1949; assigned to Lawrence Sherwood, Sherwood Speciality Nursery, Fullerton, Calif. Open-pollinated sdlg. of Schley. Nut: size medium; long and slender; 60 nuts per lb.; shell dense but thin, well-sealed; cracks easily; kernel smooth, oily, flavor similar to Schley, fills well; keeps well without becoming rancid; ripens early. Tree: bears early and prolific.

Sequin (*Klein*): Orig. in Seguin, Texas, on the Nolte Starke farm on Guadalupe River by Fred F. Klein.
Introd. about 1948. Chance sdlg.; disc, in 1912. Nut: about 45 nuts per lb.; kernel coarse, texture sub-standard, 50% of nut, color comparable to Ideal or Burkett. Tree: strong, vigorous grower; bears early and very well; late foliation, western-type foliage.

Select: Orig. in Riverside, California, by Robert Alsey Harris.
Introd.in 1943. Plant pat. 5l0;Apr. 28, 1942; assigned to Lawrence Sherwood, Sherwood Speciality Nursery, Fullerton, Calif. Open-pollinated sdlg. of Altman. Nut: large; shell thin, fills well; matures in early fall. Tree: vigorous and pendulous growth; hardy; very productive; wide climatic adaptability; bears at early age.

Seminole: Orig. in Waukeenah, Florida.
Introd. in 1923. Chance sdlg.; selected in 1915. Nut: quality good; smaller and more pointed than Schley; resembles Curtis or Moore more than Schley. Tree: bears regularly; apparently susceptible to scab.

Shawnee: Orig. in Brownwood, Texas, by L.D. Romberg, U.S. Pecan Field Sta.
Introd. in 1968. Schley x Barton. Nut from parent tree planted in 1949; bud from the sdlg. grown, propagated to a branch in a bearing tree in 1950; bud forced into growth in 1951 and bore in 1955; tested as 49-17-166 by L.D. Romberg and G.D. Madden. Nut: slightly elongated; transverse cross section round at center base, flattened at the apex and pointed; shell light brown, relatively few dark stripes, thin; inner shell rarely

adheres as fuzz; 50-70 nuts per lb.; kernel 60% of nut, smooth, bright in color, releases well from shell, keeping quality very good, flavor excellent. Tree: precocious; very productive; vigorous; leafs out in midseason; flowers protogynous type; resembles Barton.

Sioux; Orig.in Brownwood, Texas, by L. D. Romberg, Pecan Field Sta., U.S. Dept. Agr.
Introd. in 1962. Schley x Carmichael; cross made in 1943 in orchard of H. G. Lucas, Brownwood; first fruited in 1948; selected in 1949; tested as Tex. 43-4-6. Nut: large but about 1/5th smaller than Schley; shell apex somewhat flattened, pointed, with small projection from basal end, medium brown with stripes of the usual type, thin, releases well; kernel averages 60% of nut, smooth; quality, flavor, and appearance excellent; colour bright, oil content high, does not deteriorate rapidly in storage; ripens in midseason; easily cracked by commercial machinery. Tree: vigorous; form, foliage shape and chilling requirements those of its parents; growing shoots strong, with pronounced tendency to form lateral branches; production usually heavy; protogynous; recommended for central Tex. and westward; not affected by scab or other fungus diseases of foliage in east central Tex.

Slybert: Orig. in Mason, Texas, by Frank J. Willmann, now of La Grange, Texas.
Introd. in 1924. Nut characteristics indicate Schley x Halbert parentage; resulted from seed planted in 1914; sister sdlg. of Halsly. Nut; shell thin, shells easily; averages 60 nuts per lb.; kernel very plump, averaging 59% of nut; resembles Schley. Tree: semi-dwarf; very prolific; early bearer; initiates growth early in spring, hence susceptible to late spring cold or frost.

Stark Hardy Paper Shell: Orig. in Chariton, Country, Missouri, by Frank Munson.
Introd. in 1949 by Stark Bros. Nurseries & Orchards Co., Louisiana, Missouri. Parentage unknown; disc. in 1932. Nut: large; shell thin. Tree: hardy; short growing season. No longer propagated.

Starking Hardy Giant: Orig. in Brunswick, Missouri, by George James.
Introd. in 1954. Plant pat. 1,361; Mar. 15, 1955; assigned to Stark Bros. Nurseries & Orchards Co., Louisiana, Missouri. Parentage unknown, disc, in 1947. Nut: large; shell thin; kernel halves oblong with short point, flavor distinct, quality good; good crackling characteristics; matures early, last week of Sept. Tree: size medium; vigorous; productivity medium; hardy.

Steuck: (*Hirschi, Hirschi Hardy*). Orig. in Papinsville, Butler Country, Missouri, by J. F. Tiedke, Rich Hill, Mo.
Introd. about 1932. Parentage unknown; disc. in 1922. Var. rediscovered and selected in 1940 by A. G. Hirsch of Oklahoma City, Okla., and Hirschi. Nut: good size; crackling quality good; matures early; resembles Indiana. Tree: disease resistant; bears early and very well; very hardy.

Superdesirable: (*Pseudo-Desirable*). Orig. in Ocean Springs, Mississippi, by Charles Forkert.
Introd. in 1930. Apparently a chance sdlg. Disc. in a var. trial, where one tree of the Pecan Laboratory as Desirable by the nurseryman, Theodore Bechtel, in 1930 proved to be different. Nut: very similar to Desirable. Tree: vigorous, erect grower; bark and foliage darker than Desirable, with foliage remaining on tree longer into the fall and

appearing healthier than Desirable; moderately susceptible to pecan scab and pecan foliage disease; apparently immune to bunch disease whereas Desirable is not.

Sweeney: Orig. in Naylor, Maryland, on the farm of John C. Duvall, by J. W. McKay, U.S. Dept. Agr. and H. L. Crane, Plant Industry Sta., Beltsville, Md.
Introd. in 1956. Chance sdlg. thought to be a sdlg. of Duvall; selected in 1952. Nut: small, averaging 150 per pound; pointed at both ends; kernel light coloured, solid, quality very high; shell thin; yields about 50%kernel; cracking quality very good. Tree: blooms with Duvall and about one wk. later than Busseron and Greenriver; slightly protandrous. very productive; produces annual crops of well-filled nuts in northern regions where pecans are not now grown for nut production. Var. suitable primarily for the home garden, as the nuts are too small to compete with commercial ones.

Swinden: Orig. in Brown Country, Texas, by a Mr. Swinden of Brownwood, Texas.
Introd. about 1923. Open-pollinated sdlg. of a native tree; disc. about 1915. Nut: large, squarish; no particular distinctive merit. Var. now obsolete.

Texas 60: Orig. in San Saba, Texas, by E. Guy Risien.
Introd. in 1924. Open-pollinated sdlg. of San Saba; selected in 1922; no.60 was the chronological number in a long list of selections tested about 1923 by the Dept. Hort., Agr. and Mechanical College of Tex., College Station, for the San Saba Country Chamber of Commerce, this particular one appeared promising and its owner used the no. 60 designation; it has never been given another name. Nut: shell thin, good shelling; quality very good; resembles Ideal and San Saba. Tree: prolific.

Texhan: Orig. in Belton, Texas, by Nelson H. Hander.
Introd. about 1946. Open-pollinated sdlg. of Mahan; disc. in 1941. Nut: large, 45 per lb.; 56.3% kernel; 76.87% oil content; quality good; resembles Moore in colour, Schley in size and shape; ripens early. Tree: vigorous growth; heavy foliage; profuse producer of staminate and pistillate flowers; large nut clusters; heavy producer.

Tucker's Favorite: Orig. in Dawsonville, Dawson Country, Georgia, by William R. Tucker.
Introd. in 1964. Plant pat. 2,156; July 17, 1962. Stuart x Schley; cross made in 1940; selected in 1956. Nut: 3-9 per cluster; very large, averaging 44 per lb.; shape similar to Stuart but slightly more pointed; shell very thin, thinner than Stuart x Schley; kernel well-filled, flavor excellent, smooth, fine-textured, uniform in shape and size; ripens late, last 2 weeks in Nov., about 15 days after Stuart. Tree: size medium; bark smooth; heavy producer; heavy foliage; vigorous; blooms late.

Upton: Orig. in Burlington, Des Moines Country, Iowa, along the Mississippi River by a Miss Upton.
Introd. about 1930. Native sdlg.; disc. about 1924. Nut: size medium; shell thin; well-filled. Tree: alternate bearer.

Vogt: Orig. in La Grange, Texas, by Harry Vogt.
Introd. in 1960. Sdlg. of unknown var.; disc. in 1960. Nut: resembles Delmas; oblong, cylindrical; averages 52 nuts per lb.;kernel 61% of nut, plump, smooth, separates easily from shell; dorsal grooves shallow. Tree: original tree crowded; topworked trees promising; matures Nov.

Wichita: Orig. in Brownwood, Texas, by L. D. Romberg, U.S. Pecan Field Sta.
Introd. in 1959. Halbert x Mahan; cross made in 1940; sdlg. grown in nursery and budded into bearing trees in 1941; first fruited in 1947; tested as USDA 40-9-193. Nut: size medium; averaging about 60 per lb.; moderately long; usually attractive because of neat, purplish-black stripes and splotches on a clear brown shell; shell thickness, central wall, and internal packing material similar to Schley; kernel averages about 60% of whole nut, well-filled: matures about with Western. Tree: moderately upright; vigorous; early and heavy bearer; foliage resistant to various factors which cause early defoliation; protogynous; should cross pollinate well with Western and San Saba Improved. Recommended for trial in areas where western vars. do well.

Wilmann: Orig. in La Grange, Texas, by Frank J. Willmann.
Introd. in 1940. Commonwealth x Schley; selected in 1937. Nut: av. 48 per lb.; kernel av. 58% of nut; good cracking qualities; resembles Schley. Tree: vigorous; heavy and regular bearer.

Wilson: Orig. in Arp, Texas, by R. W. Fair of Tyler, Texas.
Introd. in 1927. Parentage unknown. Nut: long; kernel seldom fills nut completely. Tree: very hardy. Var. now obsolete.

Witte: Orig. in Burlington, Iowa, by John H. Witte.
Introd. about 1925. Chance sdlg.; disc. by a pioneer woodsman who brought it to the attention of Mr. Witte, an amateur horticulturist. Nut: a little larger than Indiana; considered best of the northern vars. Tree: starts bearing very late.

Wright: *(J. Wright)*. Orig. in Pascagoula, Mississippi, by Joe Wright.
Introd. in 1927. Chance sdlg.; disc, about 1923. Nut: borne 3 per cluster; av. 28 per lb. in good years; 2 3/4 in. long and about 3/4 in. in diam;both ends tapered, somewhat flattened at the blossom end; shell quite thick, sometimes poorly filled Tree: exceptionally large, with a trunk circumference (of the original tree in 1960) of 9ft. some 36 in. above ground; very prolific, up to 500 lb. produced on original tree in some yrs., a shy bearer in other yrs.

Zajicek: (*Worley*). Orig. in San Gabriel, Texas.
Introd. in 1925. Chance sdlg.; disc. in 1925 on the Worley farm, along the San Gabriel River, by Joseph Zajicek. Nut: size medium; shell dark brown, cracks very well; kernel flavor good, colour poor.

Zenith: Orig. in Seguin, Texas, by the late J. A. Evens of Arlington, Texas.
Introd. about 1927. Chance sdlg. found in the forest between 1915 and 1920. Nut: size medium, averages 65 nuts per lb.; shell thin; quality good. Not widely propagated.
Not Named: Orig. in Brunswick, Chariton Country, Missouri, by George James.
Plant pat. 2,607; Mar. 15, 1966. Bud mutation; parentage unknown. Nut: large: oblong, with round base and mucronate point; 70-74 nuts per lb.; shell thin, cracks easily; kernel light brown, flavor good; ripens Sept. 23 Sept. 30. Tree: dwarfish; rapid grower; hardy; leaves large, glossy, dark green, resembling a tropical plant; suitable for lawn or shade tree. Included here because of plant patent.

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754 S Korecki 4 Onslow St South Perth 6151
664 P Korsten 25 Madeline St Glen Waverly VIC 3150
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224 T N Lawrance 7 Brolga Promenade Willeton 6155
621 R A Lawson 1 Wharf St Brisbane Qld 4000
595 R S Leandri 71 Queenscliffe Rd Doubleview 6018
741 B Lebbins Post Office Wokalup 6221
495 E T Lee 2 Lee Place Bicton 6157
643 J Leggat 70 Lionel Rd Darlington 6070
319 Mrs M Lehmann 53 Spencer St Bunbury 6230
714 W Lehre 23 Elfreda Ave Sorrento 6020
142 Mr G C Leigh 457 Great Eastern Highway Greenmount 6056
440 Mr R C Lenanton 34 Bailey St Trigg 6020
625 Lenzo Bros Lot 39 Pinjar Rd Wanneroo 6069

623 Mr R H Levison 52 Loftus St Nedlands 6009
483 Mr A A Lewis 5, 40 Victoria Ave Claremont 6010
537 Dr A J Lewis 772 Canning Highway Applecross 6153
535 I R & M A Lewis Gunyulara Farm Carbanup River 6282
16 Librarian Public Library Cathedral Ave Geraldton 6530
650 Librarian Roseworthy Agric. College Roseworthy SA 5371
218 Librarian WES 60500 CSIRO Hortic Research Merbein Vic 3505
458 Librarian ARS Scoresby PO Box 174 Ferntree Gully Vic 3156
681 Librarian Subiaco City Library Bagot & Rokeby Rds Subiaco 6008
375 Librarian Botanic Gardens North Terrace Adelaide SA 5000
550 Dr K Lightfoot The Grange RMB 341 Grange Rd Bridgetown 6255
517 Mr N F Lindsay PO Box 5 Greenbushes 6254
648 D & H Lindsay Smith 183 Glendower St Parkerville 6553
472 Mr R Little Lot 93 Allison Rd Mount Helena 6555
346 D C Livermore Phillip Rd Avonsleigh Vic 3159
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637 C J McDermott Post Office Yallingup 6282
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606 A R Morcom PO Box 179 Keith SA 5267
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511 C S & J M Morrison RMB 351 Bridgetown 6255
404 H M Morrissey Thundelarra Station Wubin 6612
704 M F Morrow Lightbodys Rd Portland Vic 3305
284 Mrs M R Morton 3 Claud St Katanning 6317
460 Mr D Mossenson 3 Greenside St Dianella 6062
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75 Mr W Spence 100 Harrison St Rockingham 6168
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