CATALOGUE OF CROPS

used in the
BIOENERGY AND FOOD SECURITY RAPID APPRAISAL (BEFS RA)

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Bioenergy and Food Security (BEFS) Rapid Appraisal

This document includes short descriptions and fact sheets for 25 crops which can be assessed with the Crop Production and Crop Budget tools under the Natural Resources module of the BEFS Rapid Appraisal.

All information included in this document is derived from the Ecocrop database of FAO. Additional information about the 25 crops described in this document and other crops as well can be found in the Ecocrop database at http://ecocrop.fao.org.

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1 Barley

1.1 *Hordeum Vulgare*, Linnaeus

Family	Liliopsida:Commelinidae:Cyperales:Gramineae
Common names	barley, cebada, orge, damai, cevada, gebs, Gerste

Description: A freely tillering *cultivated grass* and *cereal crop* reaching a height of 50-100 cm. As with wheat and oats, barley also presents two types of root systems. In the first, the seedling roots develop from germination to the tillering stage; in the second, which starts at tillering, the secondary crown roots, or adventitious roots, appear. These will serve to anchor the plant, and to provide it with water and nutrients. The depth they reach will depend on the condition of the soil, its texture and structure, external and internal temperatures, and on the genetic make-up of the variety. The stems of the barley plant are erect and made up of 5 to 7 hollow, cylindrical internodes or joints, separated by the nodes, which bear the leaves.

Uses: In the traditional areas, most barley is use for *animal feed* (half of the world's barley production). In the non-traditional areas, barley's principal use is as *food*, followed by animal feed and use as raw material for the malting industry. Pearl barley (used in soups, or fed to live stock) is the decorticated caryopsis, while barley that is allowed to germinate and is then dehydrated is called malt. A very nourishing drink made from the latter can be used as a substitute for coffee. Barley is also used commercially in the making of beer and whiskey. The cereal is prepared for eating by boiling or parching the whole grain. It can then be ground for gruel or made into flour for baking. Barley can also be grown as a hay crop. The caryopsis is used to prepare decoctions and fluid extract.

Ecology: The main climatic mishap is *frost damage* to the seedlings, when the death of many plants can drastically thin out the crop. At the seedling stage, barley is more susceptible to freezing conditions than wheat. The *minimum temperature* for germination occurs between *3-4°C*, the *optimal temperature* being about *20°C*, and the *maximum temperature* between *28-30°C*.

Growing period: Annual grass, can be *harvested after 90-120 days* for spring varieties, and after 180-240 days for winter varieties.

Common names: barley, food barley, feed barley, malting barley, orge, cebada, gerste, gebs, garbu, segem, schair, sheko, bongo.

Further information: Scientific synonym: *H. sativum*. Barley is grown from *70°N in Europe to arid regions near the Sahara* and *up to 4700 m* in elevation in the Himalayas. In the tropics, the plant can normally only be successfully grown at elevations above 1800 m and in *moderate to low humidity*. Geographically, barley is the most widely distributed of all cereal crops. The crop is cultivated from Alten in Norway (70º N), inside the Arctic Circle, to tropical Timbuktu in Mali at around 17ºN. In the Americas, it is grown from latitude 65ºN in Alaska Nilan, 1964 to 53ºS in southern Chile. The photosynthesis pathway is C3 I. *Yields* in the *United States* vary between *1-5 t/ha* while the *average yields in Africa* are about *1.2 t/ha*. Heavy impermeable soils and light acid soils are unsuitable for barley.

Factsheet

Description			
Life form	grass	**Physiology**	-
Habit	erect	**Category**	cereals & pseudocereals, medicinals & aromatic
Life span	annual	**Plant attributes**	grown on large scale

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	deep (>>150 cm)	medium (50-150 cm)
Temperat. requir.	15	20	2	40	**Soil texture**	medium	heavy, medium, light
Rainfall (annual)	500	1000	200	2000	**Soil fertility**	moderate	low
Latitude	30	-	55	70	**Soil Al. tox**		
Altitude	---	---	-	4400	**Soil salinity**	low (<4 dS/m)	high (>10 dS/m))
Soil PH	6.5	7.5	6	8	**Soil drainage**	well (dry spells)	well (dry spells)
Light intensity	very bright	very bright	very bright	cloudy skies	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar), desert or arid (Bw), steppe or semiarid (Bs), subtropical humid (Cf), subtropical dry summer (Cs), subtropical dry winter (Cw), temperate oceanic (Do), temperate continental (Dc), temperate with humid winters	
Photo-period	neutral day (12-14 hours), long day (>14 hours)						
Abiotic toler.	drought				**Abiotic suscept.**	fire	
Introduction risks	-				**Killing temp.**	**during rest**	**early growth**
						-4	0

Cultivation				
Product. system	large scale, commercial	**Crop cycle**	**Min**	**Max**
			90	240
Cropping system	**Subsystem**	**Companion species**	**Level of mechanization**	**Labour intensity**
permanent rainfield	ley cropping	-	high	low

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	starch, vitamins, minerals	seeds
animal food (feed)	minerals, vitamins	barks, seeds
medicinal	digestive system applications	seeds

2 Cacao

2.1 *Theobroma cacao*, Linnaeus

Family	Magnoliopsida:Dilleniidae:Malvales:Sterculiaceae
Common names	cocoa, cacao, koko, Kakao

Description: A small semi-deciduous cauliflorous tree 5-10 m high with a foliage canopy of 4-5 m in diameter when about 10 years old. When fully developed the taproot is 0.8-2 m deep. The young leaves are very often pigmented. Their colour may vary, depending on the tree type, from pale green, to pink, to deep purple. As they mature the leaves become dark green and rigid. The fruit is 10-15 cm long and yellow or purplish and is variable in shape, ovoid, oblong; sometimes pointed and constricted at the base or almost spherical, with 10 furrows of which 5 are prominent. The pericarp or cortex of the pod consists of three distinct layers; the hairy and thick epicarp, which is more or less hard; the mesocarp, which is thin and hard and more or less woody; and the hairy endocarp, which is of varying thickness. Pods generally contain an average of thirty to forty seeds. However, the number of seeds per pod varies enormously. The cocoa seed or fresh bean is shaped rather like a plump almond, and is surrounded by a white mucilaginous pulp; which is both sweet and rather sour. The average dimensions of the seed are 20-30 mm in length, 12-16 wide and 7-12 thick. Cocoa seeds readily germinate when sown and do not pass through a dormancy period. They lose viability within 5-7 days of extraction from the pod unless specially treated, and germinate within 7-10 days. The plant can easily be propagated vegetatively by leaf-bud cutting, multiple-bud cutting, marcotting, budding, grafting and layering.

Uses: Food: The cocoa bean, with up to 50% fat, is a valuable source of vegetable fat: cocoa butter. The residual cocoa powder is used in cakes, biscuits, chocolate, drinking chocolate and other confectioneries. Fodder: The cocoa-pod husk has low alkaloid content, while tannin is practically absent and husks are used as stock feed. Fuel: The cocoa bean testa has a calorific value of 16 000-19 000 BTU/kg. Lipids: Cocoa-bean fat from unfermented cocoa beans can be extracted and used in soap making. Alcohol: The cocoa-pod husk can be hydrolysed under pressure for fermentation into alcoholic drinks. Medicine: Cacao butter can be used in cosmetics and has medical properties. Soil improver: There is considerable nutrient cycling through the development of a deep leaf litter under the cocoa canopy. Intercropping: Cocoa has traditionally been established in thinned forest following logging and 1-3 years of food-crop production before the canopy closes. Crops such as maize, cocoyam, yams and plantain are commonly intercropped with cocoa in Ecuador, Jamaica and West Africa.

Growing period: Perennial tree, that begins fruiting after 3-5 years and bears well up to an age of 30-40 years, or even 60 years in the best soils before yields begin to decline. Fruit and seed require 180-300 days to mature.

Common names: cacao, chocolate tree, cocoa, Nicaraguan cocoa shade,

Further information.: In its natural habitat it is an under-storey plant of forest in the wet humid tropics. In most of the producing countries of America, Asia or Oceania, permanent shading is provided by specially-planted trees, most commonly *Leucaena leucocephala, Gliricidia sepium*, various *Erythrinae* or even *Albizia* species. Finally, other industrial crops are often used as permanent shading for the cocoa tree, the coconut palm in particular. The amount of nutrients removed in the harvest is not very high if the fruit shells are brought back to the plantation and used as mulch. One ton of cacao beans remove about 20 kg N, 4 kg P, and 10 kg K from the field. Optimum yield of dry beans is more than 2.0 t/ha, while average yields in Africa vary between 0.2-1.0 t/ha. It takes 16-30 kg of pods to produce 1 kg of dry cacao. An estimated 80% of the world's cocoa is now produced by smallholders.

Factsheet

Description			
Life form	Tree	**Physiology**	semi evergreen, deciduous, single stem
Habit	Erect	**Category**	fruits & nuts, medicinals & aromatic
Life span	perennial	**Plant attributes**	grown on large scale

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	deep (>>150 cm)	medium (50-150 cm)
Temperat. requir.	21	32	10	38	**Soil texture**	heavy, organic	heavy, medium, light
Rainfall (annual)	1200	3000	9000	7600	**Soil fertility**	moderate	moderate
Latitude	-	-	10	20	**Soil Al. tox**	low (<4 dS/m)	low (<4 dS/m)
Altitude	-	-	-	900	**Soil salinity**		
Soil PH	5.5	6.5	4	8	**Soil drainage**	Well (dry spells)	Well (dry spells)
Light intensity	Clear skies	Light shade	Very bright	Heavy shade	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar)	
Photo-period	short day (<12 hours), neutral day (12-14 hours), long day (>14 hours)						
Abiotic toler.					**Abiotic suscept.**	fire	
Introduction risks					**Killing temp.**	**during rest**	**early growth**
						5	0

Cultivation				
Product. system		**Crop cycle**	**Min**	**Max**
			180	365
Cropping system	**Subsystem**	**Companion species**	**Level of mechanization**	**Labour intensity**
perennial crops	intercropping			
perennial crops	interplanting			

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	vitamins, mineral, protein, lipids	seed
environmental	soil improvement	fruits
material	lipids/oil and fat; cosmetics and perfumery	seeds
medicinal	metabolic system applications, nervous system applications, nutritional applications, skin applications	seeds
animal food – feed	vitamins	fruits
fuel	non-wood fuel	fruits

3 Cassava

3.1 *Manihot Esculenta*, Crantz

Family	Magnoliopsida:Dilleniidae:Euphorbiales:Euphorbiaceae
Synonyms	Manihot utilissima Pohl, Janipha manihot (L.) Kunth, Jatropha manihot L., Manihot aipi Pohl, Manihot dulcis (J. F. Gmelin) Pax, Manihot manihot (L.) Cockerell, Manihot melanobasis Muell. Arg.
Common names	cassava, tapioca plant, manihot, manioc, maniok, cassave, mandioca, macaxeira (sweet varieties), yuca

Description: An erect shrub with an upright woody stems reaching a height of 4 m or more. The mature tuber may measure 1 m in length and weigh up to 2 kg. The fleshy elongated tuberous roots or rhizomes, are very woody, only slightly thickened in wild varieties; under cultivation up to 2.5 m long and 10-15 cm in diameter, weighing up to 40 kg, averaging 4-7 kg.

Uses: Cassava provides a major source of *calories* for poor families, because of its high starch content. With minimum maintenance, the farmers can dig up the starchy root of the cassava and eat it 6 months to 3 years after planting. The tubers have a high content of carbohydrates, phosphorous, iron, and calcium and are a valuable source of food. Cassava starch is used in cooking and cassava flour is used in puddings, biscuits and other confectionary. In Africa, people also eat the leaves of the cassava as a green vegetable, which provide a cheap and rich source of protein and vitamins A and B. Various industries use it as a binding agent, because it is an inexpensive source of starch. Cassava starch is used in the production of *paper* and *textiles*. In Africa, cassava is beginning to be used in partial substitution for wheat flour, thus providing income to resource-poor farmers and saving foreign exchange for national Governments. The plant is also used in the production of adhesives, cosmetics, textiles, and paper. It is fed to livestock. Alcoholic beverages and *ethanol for fuel* are made from the tubers. The advantage of cassava for ethanol production is that the tubers may be stored in the ground for many months before processing; thus extending the factory window.

Ecology: May *not tolerate 7°C* for prolonged periods and it is easily killed by frost.

Growing period: Short-lived perennial. Mature leaves may be *harvested 50-70 days* from insertion of the cuttings. The 'sweet' cassavas mature in 180-270 days, the 'bitter' in 12-18 months. *Growing period 6-24 months*, depending on cultivar and conditions.

Common names: Cassava, Manihot, Manioc, Tapioca, Guacomote Yuca, Cassave, Kelala, Marachini, Maravalli, Simul Alu, Ubi Singkong, Mangahazo, Ubi Kayu, Mun Sumpalung, Boodin, Kaspe, Katela

Further information: Cassava is seldom grown *above 1800 m* in elevation in the tropics, maximum elevation for successful cultivation is about 1000 m. Latitudinal range is *25°N to 30°S*. Maximum tolerated slope is about 5°. The photosynthesis pathway is C3 II. Prefers *moderate humidity*. Tuber production is delayed and reduced in day lengths greater than 10-12 hours. Cassava is native to the countries between the Amazon region and southern Mexico. Yields from smallholders average 5-15 t/ha, but yields of up to 30 t/ha can be obtained.

Factsheet

Description			
Life form	shrub	**Physiology**	-
Habit	erect	**Category**	roots/tubers
Life span	perennial	**Plant attributes**	grown on large scale

Ecology

	Optimal		Absolute			Optimal	Absolute
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	medium (50-150 cm)
Temperat. requir.	20	29	10	35	**Soil texture**	medium, light	heavy, medium, light, organic
Rainfall (annual)	1000	1500	500	5000	**Soil fertility**	moderate	low
Latitude	-	-	25	30	**Soil Al. tox**		
Altitude	---	---	-	2000	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	5.5	8	4	9	**Soil drainage**	well (dry spells)	well (dry spells), excessive (dry/moderately dry)
Light intensity	very bright	very bright	very bright	cloudy skies	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar), steppe or semiarid (Bs)	
Photo-period	neutral day (12-14 hours), long day (>14 hours)						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	-				**Killing temp.**	**during rest**	**early growth**
						7	0

Cultivation

Product. system	-	**Crop cycle**	**Min**	**Max**
			180	356

Uses

Main use	Detailed use	Used part
food & beverage	starch, minerals, protein	roots, leaves
animal food (feed)	starch, minerals	roots
fuels	alcohol, petroleum substitues	roots

4 Coconut

4.1 *Cocos Nucifera*, Linnaeus

Family	Liliopsida:Arecidae:Arecales:Palmae
Common names	coconut, cocotier, palma de coco, cocotero, côco, narial, thengai, kokospalme, ye, tree of life, tree of heaven, kalpaviriksha

Description: The coconut is an evergreen *palm*, in strict botanical terms it is not a tree. It has no bark, branches, cambium or secondary growth. It is a woody, perennial monocotyledon and its trunk is a stem, which grows to about 25 m and exceptionally 30m; dwarf selections also exist. The nut is 2-2.5 cm in diameter and 3-4 cm long. Inside the shell is a thin, white, fleshy layer known as the coconut meat. The interior of the nut is hollow but partially filled with a watery liquid called coconut milk. The meat is soft and jellylike when immature but becomes firm with maturity. Coconut milk is abundant in unripe fruit but is gradually absorbed as ripening proceeds. The fruits are green at first, turning brownish as they mature; yellow varieties go from yellow to brown.

Uses: Copra, the dried coconut endosperm, contains an edible cooking oil (coconut oil). But also copra meal and coconut cake containing approximately 20% protein, 45% carbohydrate, 11% fiber, fat, minerals and moisture and are used in cattle feed rations. In the apicultural point of view *C. nucifera* is an important pollen source for honey production. Coconut oil can be used as a substitute for diesel oils, for electric generating plants and motor vehicles. Besides there are three types of fibers obtained from the coconut husks. The timber of *C. nucifera* has traditionally been used in tropical countries for the structural framework of houses as it has great strength and flexibility. But it finds also utilization in furniture production and parquet flooring. The oil contains fatty alcohol and glycerin used in soaps, detergents, shampoos cosmetics, pharmaceuticals and explosives. Burnt husks form a useful sort of potash that is used to fertilize the trees. The growth characteristics of Coconut palm are ideal for small production and also for combining with other crops. Therefore it is intercropped with cereals or fruits.

Ecology: Will withstand a *small amount of frost*. The lowest temperatures tolerated for long periods are for palm 10°C, for leaves 15°C, and for flowers 20°C.

Growing period: *Perennial*. Flowering begins at 5-7 years, (dwarf varieties 3.5-4.5 years). The palm reaches full bearing after 10-12 years, maturity at about 15 years and *lives up to* between *60 and 100 years in the wild state*, and 50-70 years under cultivation. There is a *360-365 day yield cycle*. The inflorescence is initiated 16 months before the spathe opens and the nut takes about a year to mature from the time of pollination.

Common names: Coconut, Cocotier, Cocotero, Kokospalme, Palma de coco, Cocotero, Cocoteros, Narel, Nariyal, …

Further information: The coconut palm probably originated from the Melanesian region. It is generally grown within 26°N and S and the most suitable climates are found between 10°N and S. For good yields coconut requires *small temperature differences between day and night*, because of this it is normally grown no higher than 700-950 m above sea level even at the equator. It can though be found up to 1500 m in a few areas near the equator. Areas where drainage is poor are not satisfactory unless the water rises and falls frequently. The photosynthesis pathway is C 3. Normally 84-97% relative humidity is required for good production, 63% is about the minimum for production and the monthly mean should not fall below 60%. It is grown in more than 93 countries in an area of 11.85 million ha with production of *10.39 million tones* of copra equivalent. Coconut and its products including coconut oil is consumed in more than 120 countries.

Factsheet

Description			
Life form	tree	**Physiology**	evergreen, single stem
Habit	erect	**Category**	fruits & nuts, materials, forest/wood
Life span	perennial	**Plant attributes**	grown on large scale, harvested from wild

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	deep (>>150 cm)	medium (50-150 cm)
Temperat. requir.	22	34	14	38	**Soil texture**	medium, light	heavy, medium, light
Rainfall (annual)	1200	2400	650	4000	**Soil fertility**	moderate	low
Latitude	-	-	10	26	**Soil Al. tox**		
Altitude	---	---	-	1500	**Soil salinity**	low (<4 dS/m)	medium (4-10 dS/m)
Soil PH	5	8	4.3	8.4	**Soil drainage**	well (dry spells)	well (dry spells)
Light intensity	very bright	very bright	very bright	cloudy skies	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar)	
Photo-period	short day (<12 hours), neutral day (12-14 hours), long day (>14 hours)						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	-				**Killing temp.**	**during rest**	**early growth**
						-1	0

Cultivation				
Product. system	-	**Crop cycle**	**Min**	**Max**
			270	356

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	vitamins, minerals, lipids, protein	fruits
food additive	sweetener	flowers
animal food(feed)	protein, lipids, vitamins, minerals	fruits
material	timber wood, lipids/oil & fats, fibers, cosmetic & perfumery	bark, fruits, leaves
medicinal	blood system applications, metabolic system applications	fruits
fuels	Charcoal, petroleum substitutes/alcohol	fruits
environmental	erosion control, agroforestry, shade & shelter	fruits, entire plant

5 Coffee

5.1 *Canavalia Ensiformis*, Linnaeus

Family	Magnoliopsida:Rosidae:Fabales:Leguminosae
Synonyms	Canavalia ensifolia (in N.I. Vavilof: "Five Continents"), Canavalia gladiata DC. var. ensiformis DC., Canavalia ensiformis (DC.) Makino, Dolichos ensiformis L.
Scientific Synonym	*C. gladiata* var. *ensiformis. Dolichos ensiformis.*
Common names	jack bean, sword bean, horse gram, Brazilian broad bean, coffee bean, ensiform bean, horse bean, mole bean, bean-jack, Patagonian bean, haricot sabre, pois sabre, haricot sabre à grain blanc, fève jacques,

Description: A bushy or climbing, erect, herbaceous legume normally reaching 0.5-2 m in height, but it can become 10 m long.

Uses: Grown for its young pods and green seeds, eaten as a vegetable, and used as a green manure. It has little value as fodder and is palatable only after drying. It has medicinal properties.

Ecology: The foliage may *not tolerate frosts*, but the beans themselves remain unaffected.

Growing period: Annual or short-lived perennial somewhat shrubby or climbing herb. Green pods can be *harvested after 80-120 days*, and mature seed after 180-300 days.

Common names: Jack bean, Horse bean, Sword bean, Overlook bean, Abai, Awara, Bara sem, Baran chaki, Chickasaw Lima, Cut-eye bean, Dir-daguer, Feijao de porco, Feve Jack, Gisima, Goa bean, Gotani bean, Grudege pea, Haba blanca, Haricot sabre, Pois sabre, Haba de burro, Judia sable, Abai, Bara sem, Vella tamma, Vellai tambatti, Dwara, Kachang parang puteh, Pe-dalet, Goa bean, Habas, Magtambokan, Marutong, Pataning-espada, Pataning Espana, Baran chaki, Popondo, Poponla, Grud bean, Maljoe, Feijao de porco, Puakani, Thua khaek, Kacang parang, Kacang pedang, Pataning dogat.

Further information: Jack bean is indigenous to drought-ridden regions of Arizona and Mexico. In the tropics it can be found at elevations between sea level and 1500 m. Optimum yield is 5.4 t/ha of dry seed, while the *average yield is about 1.3 t/ha*. 40-50 t/ha of green manure/green vegetation can be obtained and dry matter yields may be up to 23 t/ha. Toxicity may occur in cattle grazing jack bean aftermath and consuming too much seed meal.

Factsheet

Description			
Life form	herb, vine, sub-shrub	**Physiology**	multi stem
Habit	erect, prostrate/procumbent/semi-erect	**Category**	pulses (grain legumes), forage/pasture, cover crop
Life span	annual, perennial	**Plant attributes**	grown on large scale

Ecology

	Optimal		Absolute			Optimal	Absolute
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	shallow (20-50 cm)
Temperat. requir.	20	28	14	36	**Soil texture**	heavy, medium, light, organic	heavy, medium, light
Rainfall (annual)	800	2000	600	4300	**Soil fertility**	moderate	low
Latitude	20	-	40	50	**Soil Al. tox**		
Altitude	---	---	-	1800	**Soil salinity**	low (<4 dS/m)	medium (4-10 dS/m)
Soil PH	5	6	4.3	8	**Soil drainage**	well (dry spells)	medium (4-10 dS/m)
Light intensity	very bright	clear skies	very bright	light shade	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar), subtropical humid (Cf), subtropical dry summer (Cs), subtropical dry winter (Cw), temperate oceanic (Do), temperate continental (Dc), temperate with humid winters (Df), temperate with dry winters (Dw)	
Photo-period	short day (<12 hours)						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	-				**Killing temp.**	**during rest**	**early growth**
						-	-

Cultivation

			Min	Max
Product. system	-	**Crop cycle**	80	300

Uses

Main use	Detailed use	Used part
food & beverage	protein, minerals	seeds, fruits, bulbs
animal food(feed)	protein, minerals,	entire plant, seeds, fruits
poison	mammals	seeds
environmental	erosion control, soil improvers, revegetation, manure/fertilizer, nitrogen fixation, cover crops	entire plant, roots
medicinal	blood system applications,	seeds

5.2 *Cassia Occidentalis*, Linnaeus

Family	Magnoliopsida:Rosidae:Fabales:Leguminosae
Synonyms	Cassia foetida Pers., Cassia planisilliqua L., Ditramexa occidentalis Britt. & Wils
Scientific Synonym	Ditremexa occidentalis
Common names	coffee senna

Description: A yellow flowered shrub growing 0.6-2 m tall.

Uses: Seeds are used as a substitute for coffee and some types are used as ornamentals.

Growing period: Annual or perennial shrub lasting 2-3 years.

Common names: Coffee senna, Senna coffee, Bricho, Stypticweed, Stinkweed, Negro-coffee

Further information: Coffee senna is probably native of tropical America. It can be found at elevations between sea level and 1740 m. It is said to be mildly toxic to various stock animals. Undried deeds are poisonous. Can be a troublesome weed in sugar plantations, and in cultivated fields, grasslands and pastures. Increases soil fertility, especially in exhausted peanut fields.

Factsheet

Description							
Life form	shrub				**Physiology**	multi stem	
Habit	erect				**Category**	fruits & nuts, ornamentals/turf, environmental	
Life span	annual, perennial				**Plant attributes**	-	
Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	shallow (20-50 cm)
Temperat. requir.	22	28	9	32	**Soil texture**	medium, light	medium, light
Rainfall (annual)	1000	1700	640	4300	**Soil fertility**	high	moderate
Latitude	-	-	20	20	**Soil Al. tox**		
Altitude	---	---	-	1740	**Soil salinity**	low (<4 dS/m)	medium (4-10 dS/m)
Soil PH	6	7	4.5	8.4	**Soil drainage**	poorly (saturated >50% of year), well (dry spells)	poorly (saturated >50% of year), well (dry spells)
Light intensity	very bright	clear skies	very bright	cloudy skies	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar), subtropical humid (Cf), subtropical dry summer (Cs), subtropical dry winter (Cw)	
Photo-period	short day (<12 hours)						

Cultivation				
Product. system	-	**Crop cycle**	**Min**	**Max**
			210	330

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	vitamins, minerals	seeds, fruits
poison	mammals	seeds
environmental	nitrogen fixation, ornamental/turf	entire plant, roots

5.3 *Coffea Arabica*, Linnaeus

Family	Magnoliopsida:Rosidae:Fabales:Leguminosae
Common names	coffee arabica, arabian coffee, arabica coffee, kafei, kofe, cafe, Kaffee, yebuna fire, buna

Description: A globose evergreen, multi-stemmed shrub or small tree attaining heights of up to 5-10 m. The petiolate leaves are dark glossy green, simple, opposite, acuminate; having a short petiole with undulating margins and a slightly crinkled surface, they are 10-15 cm long and 4-6 cm wide, sometimes bearing interpetiolar stipules. The ovary is in the form of a drupe, and is commonly called a cherry. The cherry is ovoid, red when ripe, 10-15 mm wide and 16-18 mm long, and consists of a colored skin, a fleshy, yellowish-white pulp and two beans or seeds (8.5-12.5 mm long, ellipsoidal in shape and pressed together by flattened surface that is deeply grooved; outer surface convex) joined together along their flat sides. The size and shape of the beans differ depending on variety, environmental conditions, and cropping practices. On average, they are 10 mm long, 6-7 mm wide and 3-4 mm thick. They weigh 0.15-0.20 g. Dried seeds, after removal of the silvery skin, provide the coffee beans of commerce. The *optimum temperature* for the germination of coffee seeds is about *30°-32°C*, below 10°C germination is very slow.

Uses: Dried beans are roasted, ground, and brewed to make 1 of the 2 most popular beverages in the world. Cooked in butter, it can be used to make rich flat cakes. Pulp and parchment are occasionally fed to cattle in India. Honeybees collect nectar and pollen from the flowers. The honey is light with a characteristic flavor. Wood is hard, dense, durable, takes a polish well, and is suitable for tables, chairs and turnery. The pulp and parchment are used as manure and mulches. *C. Arabica* is often intercropped with food crops, such as corn, beans or rice, during the 1st few years. *C. Arabica* seeds contain caffeine, which has been described as a natural herbicide, selectively inhibiting germination of seeds of *Amaranthus spinosus*. Coffee is a folk remedy for asthma, fever, flu, headache, jaundice, malaria, migraine, narcosis, opium poisoning, sores and vertigo.

Ecology: Some varieties have been reported to withstand -4°C. Temperatures at -5- -8°C may kill the plant within an hour or two. At temperatures from 0-2°C, which are not unusual in some production areas, the foliar tissue and green shoots are killed.

Growing period: Perennial. Begins to bear in 2-3 years, is in full bearing at 6-8 years, and produces economic yields *for 30-40 years* on average, though in some cases only 10-15 years, and in others up to 50-70 years. Plants of 80-100 years are known. Fruits mature 210-270 days after flowering, and the growth cycle is 240-330 days.

Common names: (English): Abyssinian coffee, Arabian coffee, arabica coffee, Brazilian coffee, coffee, coffee tree, ((French): café, caféier, (German): Bergkaffee, (Khmer): kafae, (Spanish): café, cafeto, (Trade name): arabica coffee

Further information: *Coffea arabica* is indigenous to the wet highland forests of Ethiopia. It can in equatorial regions be grown at elevations from 1300 to 2800 m, with 1500-1900 being usual, at *15°N or S* it can be grown down to about 500 m. In the subtropics it is grown from sea level to 1000 m. The latitudinal range is between 22°N and 27°S. With too much rainfall the plant tends to develop wood at the expense of flowers and fruits. One to 2 months of less than 50 mm rain facilitates uniform flowering. Heavy rain during and after harvest is not desirable. It will only flower when days are 13 hours or shorter. *Medium humidity* is best, periods of mist and *low clouds* are beneficial but arabica require *2-3 drier months* for the initiation of flower buds. The photosynthesis pathway is C 3.

Processing: The ripe fruits of coffee are normally processed in the production area. Two techniques are used to obtain clean coffee beans:

Wet processing in which the fresh fruit is processed in three stages:

a) Removal of the pulp and mucilage and washing,
b) Drying of parchment coffee,
c) Removal of the inner coverings, parchment, and film (hulling).

Dry processing which consists of two stages:

a) Drying of the fruit (coffee berries or cherry coffee),
b) Removal of the dried coverings in a single mechanical operation (hulling).

Factsheet

Description				
Life form	shrub		**Physiology**	multi stem, evergreen
Habit	erect		**Category**	materials, medicinals & aromatic
Life span	perennial		**Plant attributes**	grown on large scale

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	shallow (20-50 cm)
Temperat. requir.	14	28	10	34	**Soil texture**	medium, organic	medium, light
Rainfall (annual)	1400	2300	750	4200	**Soil fertility**	high	moderate
Latitude	5	-	10	27	**Soil Al. tox**		
Altitude	---	---	-	2800	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	5.5	7	4.3	8.4	**Soil drainage**	well (dry spells)	well (dry spells)
Light intensity	clear skies	clear skies	very bright	light shade	**Climate zone**	tropical wet & dry (Aw), subtropical humid (Cf), subtropical dry winter (Cw)	
Photo-period	short day (<12 hours), neutral day (12-14 hours)						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	susceptible to nematodes				**Killing temp.**	**during rest**	**early growth**
						-	-

Cultivation				
Product. system	large scale/commercial	**Crop cycle**	**Min**	**Max**
			210	330
Cropping system	**Subsystem**	**Companion species**	**Level of mechanization**	**Labour intensity**
perennial crops	alley cropping	beans, Pigeon peas, yams, sweet potatoes, cassava, vegetables, pineapples, bananas	-	-
perennial crops	inter cropping	macadamia nuts, Leucaena leucocephylla, cardamom, pepper, 'coorg' mandarin	-	-

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	vitamins, minerals	seeds
food additive	condiment/seasoning	seeds
animal food (feed)	vitamins, minerals	fruits
environmental	soil improvers, agroforestry	fruits, stems
material	timber wood, cosmetic & perfumery, dye/tammom	fruits
poison	dicot	entire plant
Medicinal	sensory applications, nervous system applications, digestive system applications, muscular/skeletal applications, endocrine system applications	seeds

5.4 *Coffea Canephora*, Pierre

Family	Magnoliopsida:Rosidae:Fabales:Leguminosae
Synonyms	Coffea robusta Linden ex Wild., Coffea canephora Pierre ex Froehner var. robusta
Scientific Synonym	*C. robusta.*
Common names	coffee, robusta coffee, kafei, cafe, Kaffee

Description: A shrub or small tree reaching a height of 2-9 m. It often has a large umbrella shaped growth habit. Berries are small, red when ripe.

Uses: Beans are used in the production of instant coffee. Mentioned as a useful agroforestry species.

Ecology: 5-7°C are the lowest temperatures tolerated for long periods. More sensitive to cold than C. arabica, and killed by frosts.

Growing period: Perennial. Begin to bear in 3-4 years, yield increases to 14 years, and the economic life of the plant is 20-80 years (average 50 years), with declining yields. The tree may live as long as a hundred years. Growth cycle 270-300 days. It may tolerate 21-30 days of mild drought.

Common names: Coffee robusta, Congo kafe, Cafe, Kaffee.

Further information: Robusta coffee is native of West Africa and the equatorial African rain forests. It can be grown at altitudes of *about 1100-1300 m* in equatorial regions, and down to sea level at *11°N and 13°S*, which is also its the normal latitudinal range. Robusta is a more vigorous and hardier species than arabica. Photosynthesis pathway C3. With too much rainfall the plant tends to develop wood at the expense of flowers and fruits. One to 2 months of less than 50 mm rain facilitates uniform flowering. Heavy rain during and after harvest is not desirable. It will only flower when days are 13 hours or shorter. For best growth and development the relative humidity should be between 70 and 90% and periods of mist and low clouds are beneficial, but require a drier period of 1-2 months for initiation of flower buds. Neither lack of wind nor strong winds are desirable. Strong, dry, hot or cold winds, hail and heavy rain cause damage. The species can be grown in shallow soils in high rainfall areas and will stand temporary water logging. Well managed plantations may produce up to 2 t/ha of fresh berries.

Factsheet

Description			
Life form	shrub	**Physiology**	multi stem, evergreen
Habit	erect	**Category**	materials, medicinals & aromatic
Life span	perennial	**Plant attributes**	grown on large scale

Ecology

	Optimal		Absolute			Optimal	Absolute
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	shallow (20-50 cm)
Temperat. requir.	20	30	12	36	**Soil texture**	medium, heavy	heavy, medium, light
Rainfall (annual)	1700	3000	900	4000	**Soil fertility**	high	low
Latitude	-	-	11	13	**Soil Al. tox**		
Altitude	---	---	-	1300	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	5	6.3	4	8	**Soil drainage**	well (dry spells)	poorly (saturated >50% of year), well (dry spells)
Light intensity	clear skies	cloudy skies	very bright	light shade	**Climate zone**	tropical wet & dry (Aw)	
Photo-period	short day (<12 hours), neutral day (12-14 hours)						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	-				**Killing temp.**	**during rest**	**early growth**
						5	5

Cultivation

Product. system	-	**Crop cycle**	**Min**	**Max**
			270	300

Uses

Main use	Detailed use	Used part
food & beverage	vitamins, minerals	seeds
food additive	condiment/seasoning	seeds
medicinal	sensory applications, nervous system applications, digestive system applications, metabolic system applications, blood system applications, muscular/skeletal applications, endocrine system applications	seeds
environmental	soil improvers, agroforestry	fruits, entire plant
fuels	charcoal	fruits
material	dye/tannin	fruits
medicinal	sensory applications, nervous system applications, digestive system applications, muscular/skeletal applications, endocrine system applications	seeds

5.5 *Coffea Liberica*, Pierre

Family	Magnoliopsida:Rosidae:Fabales:Leguminosae
Common names	Liberian coffee, kofe, coffee

Description: A small upright evergreen tree or shrub growing to a height of 5-17 m. Leaves are dark, glossy green, 20-30 cm long, and leathery in texture. Berries are comparatively large, turning dull red or light yellow.

Uses: beans have a bitter flavor and poor liquoring quality and are used as fillers in other coffee. Mentioned as a useful agroforestry species.

Growing period: Perennial. Begin to bear after 4-5 years. It may tolerate 21-30 days of mild drought.

Common names: Liberica coffee, Kafeng barako, Excelsa.

Further information: *Liberica* coffee can be found in tropical lowland forests and is recommended for altitudes between 450-600 m. It is a larger and more hardy tree than the other coffee species. Heavy rain during and after harvest is not desirable. It will only flower when days are 13 hours or shorter. Yields of 670-900 kg/ha have been reported from Malaysia.

Factsheet

Description							
Life form	shrub		**Physiology**		multi stem, evergreen		
Habit	erect		**Category**		fruits & nuts, environmental		
Life span	perennial		**Plant attributes**		grown on large scale		
Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	medium (50-150 cm)
Temperat. requir.	24	30	18	36	**Soil texture**	heavy, medium, light	heavy, medium, light
Rainfall (annual)	1600	2400	1100	3500	**Soil fertility**	moderate	low
Latitude	-	-	11	13	**Soil Al. tox**		
Altitude	---	---	-	1300	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	5	5	15	15	**Soil drainage**	well (dry spells)	poorly (saturated >50% of year), well (dry spells)
Light intensity	clear skies	cloudy skies	very bright	light shade	**Climate zone**	tropical wet & dry (Aw), tropical wet (ar)	
Photo-period	short day (<12 hours)						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	-				**Killing temp.**	**during rest**	**early growth**
						5	5
Cultivation							
Product. system	-		**Crop cycle**		**Min**	**Max**	
					240	356	
Uses							
Main use		**Detailed use**			**Used part**		
food & beverage		minerals			seeds, leaves		
environmental		agroforestry			entire plant		

6 Cotton

6.1 *Gossypium arboretum*, Linnaeus

Family	Magnoliopsida:Dilleniidae:Malvales:Malvaceae
Common names	cotton tree

Description: A much-branched shrub up to 2 m or more, or a sub-shrub with few branches, 50-140 cm heigh.

Uses: It is cultivated for the production of cotton fibers for textiles.

Growing period: Perennial or annual, growing 150-180 days per year.

Common names: Tree cotton.

Further information: Tree cotton originated in southern Africa. In Africa, it can be found at elevations between sea level and 1600 m and in India between sea level and 1000 m. It is sensitive to high winds and heavy rains.

Factsheet

Description				
Life form	shrub	**Physiology**	multi stem, C3 photosynthesis	
Habit	erect	**Category**	forage/pasture, material	
Life span	annual, perennial	**Plant attributes**	grown on large scale	

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	deep (>>150 cm)	medium (50-150 cm)
Temperat. requir.	26	36	18	38	**Soil texture**	heavy, medium, light	heavy, medium, light
Rainfall (annual)	750	1250	500	1500	**Soil fertility**	moderate	moderate
Latitude	10	10	30	30	**Soil Al. tox**		
Altitude	---	---	-	1600	**Soil salinity**	low (<4 dS/m)	medium (4-10 dS/m)
Soil PH	6	7.2	5.3	8.5	**Soil drainage**	well (dry spells)	well (dry spells)
Light intensity	very bright	very bright	very bright	clear skies	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar), steppe or semiarid (Bs), subtropical humid (Cf), subtropical dry summer (Cs), subtropical dry winter (Cw)	
Photo-period	short day (<12 hours), neutral day (12-14 hours)						
Abiotic toler.	wind				**Abiotic suscept.**	-	
Introduction risks	-				**Killing temp.**	**during rest**	**early growth**
						5	5

Cultivation				
Product. system	-	**Crop cycle**	**Min**	**Max**
			190	2010

Uses		
Main use	**Detailed use**	**Used part**
material	fibers, lipids/oil & fats	seeds, fruits
animal food (feed)	vitamins, minerals	seeds
environmental	manure/fertilizer	seeds

6.2 *Gossypium barbadense*, Linnaeus

Family	Magnoliopsida:Dilleniidae:Malvales:Malvaceae
Synonyms	
Scientific Synonym	*G. peruvianum, G. vitifolium*
Common names	cotton, sea island cotton, long-staple cotton, Egyptian cotton, tit

Description: A sub-shrub with few or many strong ascending branches reaching a height of up to 2.7 m. It has large, deep yellow flowers and the seeds are covered with long, strong lint.

Uses: The cotton fiber is used in quality textiles, luxury fabrics, yarns, and sewing thread. The seeds are pressed for an oil used on salads or as lard and butter substitutes. Expressed oil cakes can be used as fertilizer, stock feed, soaps, oil cloth, putty, and nitroglycerine. It can also be grown as an ornamental.

Common names: American pima cotton, Sea island cotton, American Egyptian cotton, Extra long staple cotton.

Further information: American pima cotton is native of the Andean region of Peru, Ecuador and Colombia. In the tropics, it can be found at elevations between sea level and 1500 m or up to 2200 m. Sensitive to high winds and heavy rains. Photosynthesis pathway C3 II.

Factsheet

Description							
Life form	shrub		**Physiology**		multi stem, C3 photosynthesis		
Habit	erect		**Category**		forage/pasture, materials, ornamentals/turf		
Life span	perennial		**Plant attributes**		grown on large scale		
Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	deep (>>150 cm)	medium (50-150 cm)
Temperat. requir.	22	32	15	38	**Soil texture**	medium, organic	heavy, medium, light
Rainfall (annual)	750	1250	500	1500	**Soil fertility**	moderate	moderate
Latitude	-	-	20	20	**Soil Al. tox**		
Altitude	---	---	-	1500	**Soil salinity**	low (<4 dS/m)	medium (4-10 dS/m)
Soil PH	5.2	7.2	5	8.5	**Soil drainage**	well (dry spells)	well (dry spells)
Light intensity	very bright	very bright	very bright	clear skies	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar), steppe or semiarid (Bs), subtropical humid (Cf), subtropical dry summer (Cs), subtropical dry winter (Cw)	
Photo-period	short day (<12 hours), neutral day (12-14 hours)						
Abiotic toler.	wind				**Abiotic suscept.**	-	
Introduction risks	-				**Killing temp.**	**during rest**	**early growth**
						-	-
Cultivation							
Product. system	-		**Crop cycle**		**Min**	**Max**	
					180	210	
Uses							
Main use			**Detailed use**			**Used part**	
material			fibers, lipids/oil & fats			seeds, fruits	
animal food (feed)			vitamins, minerals			seeds	
environmental			manure/fertilizer, ornamental/turf			seeds, entire plant	

6.3 *Gossypium harbaceum*, Linnaeus

Family	Magnoliopsida:Dilleniidae:Malvales:Malvaceae
Common names	cotton root

Description: A small shrub up to 60-130 cm tall.

Uses: It has little economic value as a cotton and oil crop.

Growing period: Perennial, biennial or annual.

Common names: Levant cotton, Arabian cotton, Maltese cotton, Syrian cotton.

Further information: Levant cotton probably originated in southern Africa. In the tropics, it can be found at altitudes between sea level and 1500 m or up to 2200 m. Sensitive to high winds and heavy rains. Photosynthesis pathway C3 II.

Factsheet

Description				
Life form	shrub	**Physiology**	multi stem	
Habit	erect	**Category**	forage/pasture, materials, medicinals & aromatic	
Life span	biennial, perennial	**Plant attributes**	grown on large scale	

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	deep (>>150 cm)	medium (50-150 cm)
Temperat. requir.	26	36	18	38	**Soil texture**	heavy, medium, light	heavy, medium, light
Rainfall (annual)	750	1250	200	1500	**Soil fertility**	moderate	moderate
Latitude	-	-	-	-	**Soil Al. tox**		
Altitude	---	---	-	2200	**Soil salinity**	low (<4 dS/m)	medium (4-10 dS/m)
Soil PH	6	7.2	5.3	8.5	**Soil drainage**	well (dry spells)	well (dry spells)
Light intensity	very bright	very bright	very bright	clear skies	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar), desert or arid (Bw), steppe or semiarid (Bs), subtropical humid (Cf), subtropical dry summer (Cs), subtropical dry winter (Cw)	
Photo-period	short day (<12 hours), neutral day (12-14 hours)						

Cultivation				
Product. system	-	**Crop cycle**	**Min**	**Max**
			190	210

Uses		
Main use	**Detailed use**	**Used part**
material	fibers, lipids/oil & fats	seeds, fruits
animal food (feed)	protein, minerals, vitamins	seeds
medicinal	blood system application, genitourinary system applications	stems
environmental	soil improvers	seeds

6.4 *Gossypium hirsutum*, Linnaeus

Family	Magnoliopsida:Dilleniidae:Malvales:Malvaceae
Common names	cotton, upland cotton, coton, algodón, qutun, mianhua, algodao, baumwolle, bomuld, från amerika, paruthi, kapas, katoen

Description: A shrub or small tree with creamy white flowers that later turns pink or red. The fibers are 2.2-3 cm long.

Uses: Its fiber-covered seeds are harvested for the manufacture of cotton textile. The seeds are pressed for oil used in cooking, in the manufacture of margarine and for other culinary purposes. Low-grade oil is used in the manufacture of soap, lubricants, sulphonated oils and protective coatings. The protein-rich, expressed oilcake is fed to livestock. Low-grade cake is used as manure. The whole seed may also be used as cattle feed. Cotton seed hulls are used as roughage for livestock and as bedding and fuel and also dry stalks are used as fuel.

Growing period: Perennial or annual, usually cultivated as an annual growing 150-220 days.

Common names: American upland cotton, Upland cotton, Cotton, Coton, Kapas, Bulak, Pernambuko, Krabas, Fay hua, Faai, Bong se.

Further information: American upland cotton is native of Central America and southern Mexico. In the tropics, it can be grown at altitudes between sea level and 1500 m or even up to 2200 m. It performs best in desert climates, under irrigation. Low temperature increases the production of vegetative branches and extends the cropping period, while high temperature increases the number of fruiting branches and reduces the cropping period. Commercial cotton production extends from 47°N to 32°S. Upland cotton is sensitive to high winds and heavy rains. Photosynthesis pathway C 3 II. Seed-cotton yields vary between 0.8-3 t/ha, or 0.2-1.1 t/ha of fiber.

Factsheet

Description			
Life form	shrub	**Physiology**	multi stem
Habit	erect	**Category**	forage/pasture, materials
Life span	annual, perennial	**Plant attributes**	grown on large scale

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	deep (>>150 cm)	medium (50-150 cm)
Temperat. requir.	22	36	15	42	**Soil texture**	heavy, medium, light	heavy, medium, light
Rainfall (annual)	750	1200	450	1500	**Soil fertility**	moderate	moderate
Latitude	-	-	32	47	**Soil Al. tox**		
Altitude	---	---	-	1250	**Soil salinity**	low (<4 dS/m)	medium (4-10 dS/m)
Soil PH	6	7.5	5	9.5	**Soil drainage**	well (dry spells)	well (dry spells)
Light intensity	very bright	very bright	very bright	clear skies	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar), steppe or semiarid (Bs), subtropical humid (Cf), subtropical dry summer (Cs), subtropical dry winter (Cw), temperate oceanic (Do), temperate continental (Dc), temperate with humid winters (Df), temperate with dr	
Photo-period	short day (<12 hours), neutral day (12-14 hours), long day (>14 hours)						

Cultivation				
Product. system	large scale, commercial	**Crop cycle**	**Min**	**Max**
			150	200
Cropping system	**Subsystem**	**Companion species**	**Level of mechanization**	**Labour intensity**
perennial crops	permanent rainfed	sole cropping	-	-

Uses		
Main use	**Detailed use**	**Used part**
material	fibers	fruits
animal food (feed)	vitamins, minerals	seeds
material	lipids/oil & fats	seeds
fuels	petroleum substitutes/alcohol	seeds

6.5 *Imperata cylindrical*, Linnaeus, Raeusch

Family	Liliopsida:Commelinidae:Cyperales:Gramineae
Synonyms	Imperata arundinacea Cyr., Imperata cylindrica var. africana (Anderson) C.E. Hubb., Imperata cylindrica var. major (Nees) C.E. Hubb.
Scientific Synonym	*I. arundinacea, I. cylindrica var. major, Lagurus cylindricus.*
Common names	cogon grass, blade grass, blady grass, satintail, lalang, alang-alang, illuk grass, cottonwool grass, silky grass, silver spike

Description: A rhizomatous grass up to 120 cm high with up to 100 cm long, narrow, rigid leaf-blades. Its roots may penetrate to a depth of 60 cm.

Uses: for pasture but cannot withstand continuous heavy grazing. Can be grazed rotationally when young and 15-25 cm tall. The rhizomes are eaten by pigs. Can also be used for erosion control.

Growing period: Perennial grass.

Common names: Blady grass, Alang-alang, Lalang, Kunai, Cotton wool grass, Spear grass, Silver spike, Cogon grass, Satintail, Cotranh, Illuk, Yakha, Gi, Sword grass, Paillotte, Alang-alang, Ilalang, Kampengan, Kogon, Gogon, Bulum, Kyet-mei, Sbo'w, Hnhha:z kh'a:, Ya-kha, Co'tranh.

Further information: Blady grass has a latitudinal distribution between 45°N and 45°S. It can be found at elevations between sea level and 2000 m in the Himalaya and it is common in sub-humid and humid grassland and open woodland. It is quite drought resistant but will not tolerate long periods of flooding. Frequent fires encourage the growth and uniformity of the sward. It has a deeply buried aggressive rhizome, that can penetrate the roots of other plants, causing rot or death. Dry matter yields may be between 2-12 t/ha.

Factsheet

Description			
Life form	shrub	**Physiology**	-
Habit	erect	**Category**	forage/pasture
Life span	perennial	**Plant attributes**	grown on large scale

Ecology

	Optimal		Absolute			Optimal	Absolute
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	shallow (20-50 cm)
Temperat. requir.	25	35	20	40	**Soil texture**	light	heavy, medium, light
Rainfall (annual)	500	500	250	6250	**Soil fertility**	moderate	low
Latitude	-	-	-	-	**Soil Al. tox**		
Altitude	---	---	-	2000	**Soil salinity**	low (<4 dS/m)	medium (4-10 dS/m)
Soil PH	4.5	6	4	7.5	**Soil drainage**	poorly (saturated >50% of year), well (dry spells)	poorly (saturated >50% of year), well (dry spells), excessive (dry/moderately dry)
Light intensity	very bright	cloudy skies	very bright	light shade	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar), steppe or semiarid (Bs), subtropical humid (Cf), subtropical dry summer (Cs)	
Photo-period	short day (<12 hours)						

Cultivation

Product. system	-	Crop cycle	Min	Max
			90	150

Uses

Main use	Detailed use	Used part
fuels	non-wood fuels	entire plant
animal food (feed)	vitamins, minerals	leaves, roots
material	paper	entire plant
environmental	erosion control, ornamental/turf, revegetation	entire plant
food & beverage	minerals, vitamins	roots
medicinal	reparatory applications	roots

7 Groundnut

7.1 *Apios Americana*, Medikus

Family	Magnoliopsida:Rosidae:Fabales:Leguminosae
Scientific Synonym	*I. arundinacea, I. cylindrica var. major, Lagurus cylindricus.*
Common names	apios, groundnut, wild bean, bog potato, wild potato, Virginia potato, Indian potato, potato bean

Description: It is a *perennial* leguminous vine growing 1-6 m in length. Leaves are alternate, odd-pinnately compound, usually with 5 to 7 leaflets. The flowers are usually pink, maroon or brownish-red. They have a typical legume structure, are about 12 mm long and occur in compact racemes 75 to 130 mm in length. The fruit are 50 to 130 mm long containing six to thirteen wrinkled brown seeds. The brown-skinned, white-fleshed tubers are on underground stems (rhizomes) in branched or unbranched series. They can vary in diameter from 1-20 cm. The plant is able to fix nitrogen.

Uses: The tubers, which are *high in protein* and starch, may be used for *food* after cooking. The large seeds are similar to peas, and are also edible. The Native Americans in what is now eastern United States made extensive use of the plant. It contains some antinutrition factors, such as trypsin inhibitors, so it should be *cooked before being eaten*. A few people have shown an allergic reaction from eating apios.

Growing period: *Perennial*.

Common names: Apios.

Further information: It is native of eastern North America. The vine is killed by frost but the tubers survive winters even into southern Canada. In the wild, they are found mainly in low damp bottomland or riparian woods and thickets growing on brush for support, but may be grown in cultivated fields without support. It is better to grow on a trellis if seed production is desired. Unfortunately, it can become a serious weed in cranberry plots.

Factsheet

Description			
Life form	herb, vine	**Physiology**	deciduous, multi stem
Habit	climber/ scrambler/ scadent	**Category**	roots/tubers, vegetables
Life span	perennial	**Plant attributes**	-

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	medium (50-150 cm)
Temperat. requir.	10	20	8	30	**Soil texture**	medium	medium, light
Rainfall (annual)	1000	1200	700	1500	**Soil fertility**	high	moderate
Latitude	30	25	45	48	**Soil Al. tox**		
Altitude	---	---	-	1000	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	5	7.5	4.5	8.5	**Soil drainage**	well (dry spells)	poorly (saturated >50% of year), well (dry spells),
Light intensity	cloudy skies	very bright	light shade	very bright	**Climate zone**	subtropical humid (Cf), temperate oceanic (Do), boreal (E)	
Photo-period	-						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	can become a weed				**Killing temp.**	**during rest**	**early growth**
						-40	0

Cultivation				
Product. system	-	**Crop cycle**	**Min**	**Max**
			0	0

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	starch, protein, vitamins	roots

7.2 *Arachis hypogaea*, Linnaeus

Family	Magnoliopsida:Rosidae:Fabales:Leguminosae
Common names	c groundnut, peanut, monkeynut, arachide, cacahuètes, Erdnuss, goober, mani, mani largo, pindels, pistach, pistache, pinat, pinati,

Description: An annual legume reaching a height of up to 0.6 m. The species includes both runner and bunch types. The flowers are small and yellow. After fertilization the ovaries are pushed into the ground where the fruits develops.

Uses: The seeds can be eaten raw or roasted or as *peanut butter*. They are high in *vitamin B*, protein, and minerals. A non-drying oil pressed from the seeds are used as cooking oil and in margarine, soap, lubricants, and pharmaceutical products. A synthetic textile fiber is obtained from the protein. Oil cakes and vines are fed to livestock.

Growing period: Annual herb or shrub, may be harvested after 90-140 days (bunching cultivars, Valencia group), or 120-150 days (runner cultivars, Virginia group).

Common names: Groundnut, Peanut, Monkeynut, Earth nut, Arachide, Cacahuete, Mani, Erdnuss, Aardnoot, Oilenoot, Mung phali, Nila kadala, Kachang goring, Fa sang.

Further information: Groundnut is *indigenous to South America*, probably upland Brazil. It can in continental environments be grown *between 40°S and 45°N* and it can be grown at elevations between sea level and 1500 m. Photosynthesis pathway C 3 II. Groundnut is sensitive to dry winds and to hail at an early stage. There should preferably be *no rain* on a crop once pods are mature. To improve yields on calcium-deficient soils, *wood ash* can be applied to the groundnut crop at flowering. The average yield varies from 0.6-4.0 t/ha. Seedlings can tolerate salinity better than the mature plant. Mentioned as a *useful agroforestry* species.

Factsheet

Description			
Life form	herb	**Physiology**	-
Habit	prostrate/procumbent/semi-erect	**Category**	pulses (grain legumes), vegetables, materials, medicinal & aromatic
Life span	annual	**Plant attributes**	grown on large scale

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	medium (50-150 cm)
Temperat. requir.	22	32	10	45	**Soil texture**	medium	heavy
Rainfall (annual)	600	1500	400	4000	**Soil fertility**	high	moderate
Latitude	-	-	40	45	**Soil Al. tox**		
Altitude	---	---	-	1650	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	5.5	6.5	4.5	8.5	**Soil drainage**	well (dry spells)	well (dry spells)
Light intensity	very bright	very bright	very bright	clear skies	**Climate zone**	tropical wet & dry (Aw), steppe or semiarid (Bs), subtropical humid (Cf)	
Photo-period	short day (<12 hours), neutral day (12-14 hours), long day (>14 hours)						
Abiotic toler.	-				**Abiotic suscept.**	hail, wind	

Cultivation				
Product. system	large scale/ commercial	**Crop cycle**	**Min**	**Max**
			90	150

Uses		
Main use	**Detailed use**	**Used part**
material	lipids/oil & fats	seeds
food & beverage	protein, minerals, vitamins	leaves, seeds
medicinal	blood system applications	seeds
animal food (feed)	vitamins, minerals, protein	entire plant, seeds
environmental	agroforestry	entire plant
fuels	petroleum substitutes/alcohol	seeds

7.3 Kerstingiella geocarpa, Harms

Synonyms	Macrotyloma geocarpum
Scientific Synonym	*Macrotyloma geocarpum, Voandeziz poissonii*
Common names	Kersting's groundnut, groundnut - Kersting's

Description: A herb with prostrate rooting branches fruiting below ground.

Uses: Immature and mature seeds are highly nutritious and are used as a *protein-rich food* source.

Growing period: Annual herb, *harvested 90-150 days* from sowing.

Common names: Hausa groundnut, Geocarpa, Kersting`s groundnut, Geocarpa Groundnut, Ground bean, Potato bean, Bendi, Bindi, Dieguem tenguere, Dougoufulo, Doyi, Feve de kandela, Haricot de behanzin, Haricot royal, Hausa groundnut, Kandela, Kandelabohne, Kouarourou, Kwaruru, Lentille de terre, Pararu, Eyeya, Pararu, Sempi.

Further information: Hausa groundnut originated in the *savanna areas of West Africa*. In West Africa yields have been estimated to be within the range 450-500 kg/ha of dried seed.

Factsheet

Description							
Life form	herb				**Physiology**	multi stem	
Habit	prostrate/procumbent/semi-erect				**Category**	fruits & nuts	
Life span	annual				**Plant attributes**	grown on large scale	
Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	shallow (20-50 cm)
Temperat. requir.	18	34	12	38	**Soil texture**	medium	medium, light
Rainfall (annual)	600	1200	450	3000	**Soil fertility**	moderate	low
Latitude	8	8	18	18	**Soil Al. tox**		
Altitude	---	---	-	-	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	7	7.5	6	8	**Soil drainage**	well (dry spells)	well (dry spells), excessive (dry/moderately dry)
Light intensity	very bright	very bright	very bright	light shade	**Climate zone**	tropical wet & dry (Aw), steppe or semiarid (Bs)	
Photo-period	short day (<12 hours)						
ultivation							
Product. system	-		**Crop cycle**		**Min**	**Max**	
					90	150	
Uses							
Main use			**Detailed use**			**Used part**	
food & beverage			protein, minerals, vitamins			seeds	

8 Jatropha

8.1 Jatropha curcas, Linnaeus

Family	Magnoliopsida:Dilleniidae:Euphorbiales:Euphorbiaceae
Common names	physic nut, purging nut, tartago, pourghère, pignon d'Inde, yu lu tzu, habel meluk, bagbherenda, purgueira, mundubi assu (Br)

Description: It is a *perennial*, monoecious shrub or small tree up to 6 m high. Leaves are alternate and their petiole is 2-20 cm long. The fruit is an ellipsoid capsule, 2.5-3 cm long, 2-3 cm in diameter, yellow and turning black. Its seeds are black, 2 per cell. Pollination is made by insects. The rare hermaphroditic flowers can be self-pollinating. Fruit development ne*eds 90 days from flowering* until seeds mature. Shrubs begin to produce after 4-5 months and reach full productivity after 3 years.

Uses: Young leaves may be safely eaten when steamed or stewed. The seeds yield up to *31-37%* of a *valuable oil*. The seed oil is renewable source of non-conventional *bio-diesel*. Fruit hulls and seed shells can be used as a fuel. The seed oil as well as seeds, leaves and bark have medicinal properties. It is grown for erosion control, as living fence and as a support for vanilla and other climbers. All plant parts can be used as a green manure.

Growing period: Perennial.

Common names: Barbados nut, castor oil, Chinese castor oil, curcas, fig nut, physic nut, pig nut, purging nut, wild oil nut (English).

Further information: It is best adapted to arid and semi-arid conditions. It occurs in grassland-savannah and thorn forest scrub but is completely lacking from the moist Amazon region. The current distribution shows that introduction has been most successful in drier regions of the tropics. It is very tolerant and thrives under a wide range of edapho-climatic conditions. It is particularly hardy at medium altitude and in humid zones. It is not sensitive to day length. Its strength as a crop comes from its ability to grow on poor, dry sites. However, like any species that being adapted as a crop the yields are correlated with inputs. It is very drought tolerant and can withstand slight frost. It has been widely reported as resistant to pests and diseases; however due to increasing use as a monoculture for bio-diesel this is proving not to be the case. NB.: It is being classified as an invasive species in the Pacific. It is reported as native to Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua and Panama and exotic to Angola, Antigua and Barbuda, Argentina, Bahamas, Barbados, Benin, Bolivia, Brazil, Burkina Faso, Cambodia, Cameroon, Cape Verde, Central African Republic, Chad, China, Colombia, Cote d'Ivoire, Cuba, Democratic Republic of Congo, Dominica, Dominican Republic, Ecuador, Egypt, Eritrea, Ethiopia, French Guiana, Gabon, Gambia, Ghana, Grenada, Guadeloupe, Guinea, Guinea-Bissau, Haiti, India, Indonesia, Jamaica, Japan, Kenya, Laos, Liberia, Madagascar, Malawi, Malaysia, Mali, Martinique, Mauritania, Montserrat, Mozambique, Myanmar, Namibia, Nepal, Netherlands Antilles, Nigeria, Peru, Philippines, Portugal, Puerto Rico, Sao Tome et Principe, Senegal, Sierra Leone, Somalia, South Africa, Sri Lanka, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, Tanzania, Thailand, Togo, Trinidad and Tobago, Uganda, United States of America, Venezuela, Vietnam, Virgin Islands (US), Zanzibar and Zimbabwe.

Factsheet

Description			
Life form	shrub, tree	**Physiology**	single stem, multi stem
Habit	erect	**Category**	materials, medicinals & aromatic, environmental
Life span	perennial	**Plant attributes**	grown on large scale

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	deep (>>150 cm)	deep (>>150 cm)
Temperat. requir.	11	28	7	36	**Soil texture**	medium	medium, light
Rainfall (annual)	500	1500	300	2000	**Soil fertility**	moderate	low
Latitude	-	-	28	30	**Soil Al. tox**		
Altitude	---	---	-	1600	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	5.5	7.5	5	8	**Soil drainage**	well (dry spells)	well (dry spells), excessive (dry/moderately dry)
Light intensity	very bright	very bright	clear skies	very bright	**Climate zone**	tropical wet & dry (Aw), steppe or semiarid (Bs), subtropical dry summer (Cs)	
Photo-period	not sensitive						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	-				**Killing temp.**	**during rest**	**early growth**
						-40	0

Cultivation				
Product. system	-	**Crop cycle**	**Min**	**Max**
			365	365

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	starch, vitamins, minerals	seeds
animal food (feed)	minerals, vitamins	bark, seeds
medicinal	digestive system applications	seeds

8.2 *Ricinodendron heudelotii*, Linnaeus, Pierre ex Heckel

Family	Magnoliopsida:Dilleniidae:Euphorbiales:Euphorbiacae
Synonyms	*Jatropha heudelotii Bail., Ricinodendron africanus Müll. Arg., Ricinodendron tomentellum Hutch. & Bruce*
Scientific Synonym	
Common names	African nut tree, African wood, African wood-oil nut tree, cork wood, muawa, erimado

Description: It is a *fast-growing* tree, reaching 30-50 m in height and 2.7 m in girth. Sometimes it is only 7-10 m. Bole straight with short buttress, bark grey, smooth at first, becoming scaly with ageing. Leaves alternate, digitately 3-5 foliate. Inflorescence yellow tomentose, male panicles are up to 41 cm long, while female panicles shorter and stouter. Fruit indehiscent, 2-3 lobed, 2 celled, with a thick, hard shell containing 2-3 red-brown-black seeds, rounded, flat, over 1 cm across.

Uses: The seeds can be eaten after they have been boiled or roasted. The wood is fibrous, soft, light and perishable. Used for rough planks, coffins, fishing net floats and rafts for heavy timbers. The seed oil is light, yellow, drying and usable in varnish and soft soaps and has industrial application in waterproofing materials. The root is taken is used against constipation and as an antidysentery. The bark is tie to the body after it has been beaten and warmed to cure elephantiasis. A bark decoction is taken in Gabon for blennorrhoea and painful menstruation and as a poison antidote. When not grown in pure stands, it has always been *intercropped with coffee, cocoa or bananas*. Also used as an ornamental and he cake from seed-oil extraction is a good nitrogenous fertilizer.

Growing period: Perennial.

Common names: African nut tree.

Further information: It is a tree of the fringing, deciduous and secondary forests common throughout the semi-dry, wooded-savannah zone of the region. From lower Senegal to west Cameroon and Fernando Po, to Democratic Republic of Congo, Angola and Tanzania, where it is found scattered in gaps at forest edges and in secondary scrub and thickets.

Factsheet

Description			
Life form	tree	**Physiology**	single stem
Habit	erect	**Category**	vegetable, material, ornamentals/turf, medicinals & aromatic, forest/wood, environmental
Life span	perennial	**Plant attributes**	-

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	deep (>>150 cm)	medium (50-150 cm)
Temperat. requir.	20	30	14	34	**Soil texture**	heavy, medium	heavy, medium
Rainfall (annual)	800	4000	500	5000	**Soil fertility**	moderate	low
Latitude	-	-	10	12	**Soil Al. tox**		
Altitude	---	---	-	2000	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	5.5	6.5	5	7	**Soil drainage**	well (dry spells)	well (dry spells)
Light intensity	clear skies	very bright	light shade	very bright	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar)	
Photo-period	-						

Cultivation				
Product. system	-	**Crop cycle**	**Min**	**Max**
			365	365
Cropping system	**Subsystem**	**Companion species**	**Level of mechanization**	**Labour intensity**
perennial crops	inter planting	coffee, cocoa, banana	-	-

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	vitamins, minerals, lipids	seeds
material	timber wood, lipids/oil & fats	bark, seeds
medicinal	digestive system applications, skin applications, genitourinary applications	roots, stems
environmental	agroforestry, ornamental/turf, manure/fertilizer	entire plant, seeds

9 Maize

9.1 Zea mays, Linnaeus

Family	Liliopsida:Commelinidae:Cyperales:Gramineae
Synonyms	Zea mays L. ssp. mays, Zea curagua Molina, Zea indentata Sturtev., Zea indurata Sturtev., Zea japonica Van Houtte, Zea saccharata Sturtev.
Common names	maize, corn, Mais, maiz, milho, yumi, khao phoat, bekolo, sila, sila nivava lagi, tomorokpshi, makai, makki, koane, fiso, sana, keto (Simbo/Roviana), kon, mielie, mahindi, ekidid (Karamojong), maidis stigmata, mbemba, poone, upfu, hupfu, mbila

Description: A tall vigorous *annual grass*, and grain crop varying greatly in size according to race and growth conditions; commercial types are about 2m tall. It has many fasciculate roots. The erect shoot (culm) consists of four basic structures: the internodes, the leaves, the prophyll and the bud or apical meristem, which are collectively called the phytomer. The leaves that emerge from its nodes are alternate, lanceolate, acuminate and parallel-veined with small ligules. Maize is a monoecious plant; it develops inflorescences with unisexual flowers, and these are always born in separate parts of the plant. The female inflorescence - the ear, arises from the axillary bud apices, and male inflorescence, the tassel, develops from the apical growing point at the top of the plant. The kernel or fruit of maize is called a caryopsis.

Uses: It is mainly grown for *food* and *fodder*. The grain is ground to flour and used in starchy foods and breads. It is used in breakfast foods. Fermented grain is made into alcohol, which has become a prime use in the USA. *A ton of dried maize would yield about 370 kg of ethanol*. Maize starch is used in cosmetics, adhesives, glucose and syrup. Oil is extracted from the embryo and used as salad oil, and to make linoleum, paints, varnishes, etc.

Ecology: It is easily killed by *frost*.

Growing period: Annual. In Kenya quick-maturing lowland varieties flower in 60 days and mature in 120 days, varieties grown between 1200-2100 m in elevation flowers in 105 days and mature in 210 days, while varieties grown at 2100-3200 m may take 195 days to flower and more than 365 days to mature. In the United States on average it mature in 90-140 days.

Further information: Maize is one of the most productive species of food plants being the second most important cereal grain after wheat, with milled rice occupying third place. It is the top ranking cereal in grain yield per hectare and is second to wheat in total production. Maize is of great *economic significance* worldwide as *human food* as *animal feed,* and as a source of large number of industrial products. Maize has tremendous variability in kernel color, texture, composition and appearance. It is classified into distinct types based on (a) endosperm and kernel constitution; (b) kernel color; (c) environment in which it is grown; d) maturity; and (e) its use. White, yellow and orange are prominent grain colors. Prominent maize kernel types are flint, dent, pop, sweet, floury, morocho, and waxy. Quality Protein Maize (QPM with improved protein quality), and High Oil Corn are specialty maize types. It can be found at elevations between sea level and 4000 m and it can be grown at latitudes from 48°N to 40°S. The photosynthesis pathway C4 III for tropical lowland types and C4 IV for highland and temperate types. Hot, dry winds may reduce the amount of pollen available for fertilization and humid conditions and hail can do damage. Since the crop leaves much of the ground uncovered, soil erosion and water losses can be severe. The optimum yield is 7-11 t/ha, *world average 3.6 t/ha*. High yields of maize make a heavy drain on soil nutrients. It is probably indigenous to Mexico and Central America.

Factsheet

Description			
Life form	grass	**Physiology**	single stem
Habit	erect	**Category**	-
Life span	annual	**Plant attributes**	-

Ecology

	Optimal		Absolute			Optimal	Absolute
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	shallow (20-50 cm)
Temperat. requir.	18	33	10	47	**Soil texture**	high	low
Rainfall (annual)	600	1200	400	1800	**Soil fertility**	moderate	low
Latitude	-	-	40	48	**Soil Al. tox**		
Altitude	---	---	-	4000	**Soil salinity**	low (<4 dS/m)	medium (4-10 dS/m)
Soil PH	5	7	4.5	8.5	**Soil drainage**	-	-
Light intensity	very bright	very bright	clear skies	very bright	**Climate zone**	-	
Photo-period	-						

Cultivation

Product. system	-	**Crop cycle**	**Min**	**Max**
			65	365
Cropping system	**Subsystem**	**Companion species**	**Level of mechanization**	**Labour intensity**
arable irrigated	ratoon cropping	legumes	-	-
arable irrigated	inter cropping	peanuts, okra, pumpkins, melons	-	-
arable irrigated	alley cropping	grain legumes (Vigna unguiculata), soybeans (Glycine max), Acacia auriculiformis, Cajanus cajan	-	-
arable irrigated	normadism	coconut, mango, mung bean, oil-palm, young rubber trees	-	-

Uses

Main use	Detailed use	Used part
food & beverage	vitamins, starch, protein, lipids	seeds, fruits
material	lipids/oil & fats	seeds
medicinal	skin applications	seeds
animal food (feed)	minerals, vitamins	entire plant
fuels	petroleum substitutes/alcohol	seeds

10 Millet

10.1 *Panicum miliaceum*, Linnaeus

Family	Liliopsida:Commelinidae:Cyperales:Gramineae
Common names	proso millet, hog millet, common millet, millet proso, echte hirse, hirs, vipphirs, äkta hirs, hirse, almindelig hirse, hirssi, viljahirssi

Description: A shallow rooted erect grass and cereal crop reaching a height of 30-100 cm, usually free-tillering with a slender up to 45 cm long inflorescent.

Uses: The grain is highly nutritious, containing about 70% carbohydrate, and 10-18% protein. It is cooked like rice, ground to flour, used to make an alcoholic beverage, or fed to livestock. Green plants provide fodder. It is often used as a substitute for maize or sorghum.

Growing period: Annual, normally *harvested after 55-90 days* but may require up to 280 days depending on growing conditions.

Common names: Proso millet, Hog millet, Common millet, Brown corn millet, Broom corn millet, White Frensh millet, Red French millet, Proso, Vari.

Further information: The latitudinal range of proso millet is 30°N and S. It is best adapted to areas of low or medium relative air humidity. Photosynthesis pathway C4 I. In India, seed yields of 450-650 kg/ha can be obtained, *generally 1-2 t/ha* can be obtained when the crop is irrigated.

Factsheet

Description			
Life form	grass	**Physiology**	single stem, C4 photosynthesis
Habit	erect	**Category**	cereals & pseudocereals
Life span	annual	**Plant attributes**	grown on large scale

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	shallow (20-50 cm)
Temperat. requir.	20	32	15	45	**Soil texture**	medium	heavy, medium, light
Rainfall (annual)	500	750	200	1000	**Soil fertility**	moderate	low
Latitude	-	-	25	30	**Soil Al. tox**		
Altitude	---	---	-	-	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	6	6.5	5.2	8.2	**Soil drainage**	well (dry spells)	well (dry spells), excessive (dry/moderately dry)
Light intensity	very bright	very bright	very bright	clear skies	**Climate zone**	tropical wet & dry (Aw), desert or arid (Bw), steppe or semiarid (Bs), subtropical humid (Cf), subtropical dry summer (Cs), subtropical dry winter (Cw)	
Photo-period	short day (<12 hours), neutral day (12-14 hours)						

Cultivation				
Product. system	small scale (manual), intermediate (animal drawn), large scale/commercial	**Crop cycle**	**Min**	**Max**
			55	280
Cropping system	**Subsystem**	**Companion species**	**Level of mechanization**	**Labour intensity**
permanent rainfed	sole cropping	-	-	-

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	starch, protein, minerals	seeds
animal food (feed)	starch, protein, minerals, vitamins	seeds, leaves

10.2 *Pennisetum glaucum*, Linnaeus, R.Br.

Family	Liliopsida:Commelinidae:Cyperales:Gramineae
Synonyms	*Pennisetum americanum, Pennisetum spicatum, Pennisetum typhoideum Rich., Pennisetum typhodes* (Burm.) Stapf & C.E. Hubb.
Scientific Synonym	*P. americanum, P. spicatum, P. typhoideum, P. typhoides*
Common names	pearl millett, bulrush millett, negrito millet, millet perle, petit millet, cumbu, bajra, bajri, babala, spiked millet, cat-tail millet, cattail millet, pijo perla, panizo Bajra, mil a chandella, mil penicillaire, dukn

Description: An erect, freely tillering, tufted grass and grain crop reaching a height of 0.5-4 m. The stem is solid and leaves up to 1 m long.

Uses: The grain is cooked as rice, made into flour, or used to produce *malt for beer*. Whole grains are fed to poultry and livestock. The grain contain about *70% carbohydrate* and *10% protein*. Green plants provide fodder. Plant straw is used for bedding, thatching, fencing and fuel.

Growing period: *Summer annual*. Early millets, requires 60-95 days of growing period, medium duration types, about 80 days, and long duration types, 100-120 days.

Common names: Pearl millet, Bulrush millet, Dukn, Bajra, Babala, Spiked millet, Cat-tail millet, Cattail millet, Millet perle, Petit millet, Mijo perla, Panizo Bajra, Mil a chandella, Mil penicillaire.

Further information: Pearl millet is probably indigenous to the western Sahel zone in African. In the tropics, it can be grown at altitude between sea level and 1800 m. It can be grown between 14-32°N and S. Pearl millet is the staple food in parts of tropical Africa and India, which are too hot, dry and sandy for sorghum production. Photosynthesis pathway C4 III. In Africa expected yields of grain are 0.25-1.0 t/ha, normally optimum yields are from 3.0-5.0 t/ha and experimental yields of up to 8 t/ha have been reported. When seedlings are established with fresh water and fertilizer applied, multiple irrigations with seawater can give yields of 1-1.6 t/ha of grain and 3.3-6.5 t/ha of fodder. Mentioned as a useful agroforestry species.

Factsheet

Description			
Life form	grass	**Physiology**	-
Habit	erect	**Category**	cereals & pseudocereals
Life span	annual	**Plant attributes**	grown on large scale

Ecology

	Optimal		Absolute			Optimal	Absolute
	Min	Max	Min	Max	**Soil depth**	deep (>>150 cm)	medium (50-150 cm)
Temperat. requir.	25	35	12	40	**Soil texture**	medium	heavy, medium, light
Rainfall (annual)	400	900	200	1700	**Soil fertility**	moderate	low
Latitude	18	14	28	32	**Soil Al. tox**		
Altitude	---	---	-	1800	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	5	6.5	4.5	8.3	**Soil drainage**	well (dry spells)	well (dry spells), excessive (dry/moderately dry)
Light intensity	very bright	very bright	very bright	clear skies	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar), desert or arid (Bw), steppe or semiarid (Bs), subtropical humid (Cf), subtropical dry summer (Cs), subtropical dry winter (Cw)	
Photo-period	short day (<12 hours), neutral day (12-14 hours)						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	-				**Killing temp.**	**during rest**	**early growth**
						2	0

Cultivation

Product. system	home garden, small scale (manual), intermediate (animal drawn), large scale/ commercial	**Crop cycle**	**Min**	**Max**
			60	120
Cropping system	**Subsystem**	**Companion species**	**Level of mechanization**	**Labour intensity**
permanent rainfed	ley cropping	-	-	-

Uses

Main use	Detailed use	Used part
animal food (feed)	vitamins, minerals	seeds, leaves
food & beverage	starch, vitamins, minerals	seeds
fuels	non-wood fuels	leaves
animal food (feed)	minerals	leaves

10.3 *Pongamia pinnata*, Linnaeus, Pierre

Family	Leguminosae: Papilionoideae: Fabaceae
Synonyms	*Derris indica (Lam.) Bennett, Millettia novo-guineensis Kane. & Hat., Pongamia glabra Vent., Pongamia pinnata Merr.*
Common names	Indian beech, oil tree, poonga-oil-tree, seashore mempari, karum tree, arbre de pongolote, báni, kanji, karanj, papar, daay kim, saam hoa, biansu, ki pahang laut, melapari, dok kom koi, mempare, pongu, pongam, ko:m ko:y, day lim, day mau, khoor, karanga

Description: Fast growing, deciduous tree up to ca 25 m tall.

Uses: As an ornamental in gardens and along avenues and roadsides, for its fragrant Wisteria-like flowers, and as a host plant for lac insects. Flowers are considered a good source of pollen for honeybees in India and they yield adequate nectar. With a calorific value of 4 600 kcal/kg, *Pongamia* is commonly used as a fuel wood. A preferred species for *controlled soil erosion* and *binding sand dunes* because of its extensive network of lateral roots. The seeds contain pongam oil, a bitter, red brown, thick, non-drying, no edible oil, 27-36% by weight, which is used for tanning leather, soap, as a liniment to treat scabies, herpes, and rheumatism and as an illuminating oil. The seed oil is *under investigation as a renewable source of bio-diesel*.

Growing period: Perennial.

Further information: It is native to humid and sub-tropic environments and is common along waterways or seashores, with its roots in fresh or saltwater. It is reported as native to Bangladesh, India, Myanmar, Nepal and Thailand and exotic in Australia, China, Egypt, Fiji, Indonesia, Japan, Malaysia, Mauritius, New Zealand, Pakistan, Papua New Guinea, Philippines, Samoa, Seychelles, Solomon Islands, Sri Lanka, Sudan, Tonga and the United States of America. It occurs naturally in lowland forest on limestone and rocky coral outcrops on the coast, along the edges of mangrove forest and along tidal streams and rivers. It can be found at elevations between sea level and 1200 m. In its natural habitat, the species tolerates a *wide temperature range*. Mature trees withstand light frost and temperatures of up to 50°C. Temperature optimum is between 16-38°C. It is drought resistant and well adapted to adverse climatic conditions; prolonged drought may however kill seedlings. Annual rainfall optimum is between 500-2000 mm. In addition to rain, trees require a dry season of 2-6 months. It is a shade bearer and can grow under the shade of other trees, it is, however, not a shade demander and grows well even with full overhead light. It is well adapted to adverse soil moisture conditions and water logging. It can grow on most soil types but best growth is found on deep well-drained sandy loams with assured moisture, it will however also grow on sandy soils and heavy swelling clay soils. It does not do well on dry sands. It is very tolerant of saline conditions and alkalinity.

Propagation methods: Natural reproduction is profuse by seed and common by root suckers. Spontaneous seedlings and root suckers are produced and may cause serious weed problems. Direct sowing is common and most successful. Seeds require no pre-treatment and germinate within 7 days to 1 month of sowing. Seedlings attain a height of 25-30 cm in their first growing season. Transplanting to the field should occur at the beginning of the next rainy season when seedlings are about 60 cm in height.

Factsheet

Description			
Life form	tree	**Physiology**	-
Habit	-	**Category**	-
Life span	perennial	**Plant attributes**	-

Ecology

	Optimal		Absolute			Optimal	Absolute
	Min	Max	Min	Max	**Soil depth**	deep (>>150 cm)	medium (50-150 cm)
Temperat. requir.	16	40	10	50	**Soil texture**	-	-
Rainfall (annual)	500	2000	400	2500	**Soil fertility**	high	moderate
Latitude	10	-	30	40	**Soil Al. tox**		
Altitude	---	---	-	1200	**Soil salinity**	low (<4 dS/m)	medium (4-10 dS/m)
Soil PH	6.5	8.5	6	9	**Soil drainage**	well (dry spells)	well (dry spells), excessive (dry/moderately dry)
Light intensity	clear skies	very bright	light shade	very bright	**Climate zone**	-	
Photo-period	-						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	-				**Killing temp.**	during rest	early growth
						-1	0

Cultivation

			Min	Max
Product. system	-	**Crop cycle**	365	365

Uses

Main use	Detailed use	Used part
material	honey, fibers, timber wood, dye/tannin, lipids/oil & fats	flowers, stems, bark, roots, seeds
fuels	petroleum substitutes/alcohol, fuelwood	seeds, bark
medicinal	skin applications	seeds
environmental	erosion control	roots

10.4 *Setaria italic*a, Linnaeus, Beauv.

Family	Liliopsida:Commelinidae:Cyperales:Gramineae
Synonyms	*Panicum italicum L.*
Scientific Synonym	*Panicum italicum, P. viride var italica, Chaetochloa italica.*
Common names	foxtail millet, millet foxtail, hay millet, foxtail bristle-grass, boer millet, German millet, Italian millet, nunbank setaria, kolbenhirse, kolvhirs, äkta kolvhirs, stor busthirse, Italianpantaheinä

Description: An erect grass and cereal crop reaching a height of 90-150 cm.

Uses: The grain can be cooked and *eaten as rice* or ground for porridge or pudding. It is used for birdseed and it can be grown as fodder.

Growing period: Fast-growing summer annual, mature in 60-70 days or 90-120 days depending on conditions and variety.

Common names: Italian millet, Dwarf setaria, Giant setaria, Hungarian millet, Liberty millet, Foxtail millet, Red rala, German millet, Siberian millet.

Further information: Italian millet is probably *native of China*. The latitudinal range of the grass is 30°N-S. It can be grown at altitude between sea level and 2000 m. Yields of fresh herbage between 15-20 t/ha have been reported.

Factsheet

Description			
Life form	grass	**Physiology**	-
Habit	erect	**Category**	cereals & pseudocereals, forage/pasture
Life span	annual	**Plant attributes**	grown on large scale

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	deep (>>150 cm)	medium (50-150 cm)
Temperat. requir.	16	26	5	35	**Soil texture**	medium, light	heavy, medium, light
Rainfall (annual)	500	700	300	4000	**Soil fertility**	moderate	low
Latitude	-	-	25	30	**Soil Al. tox**		
Altitude	---	---	-	2000	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	6	6.8	5.5	8.3	**Soil drainage**	well (dry spells)	well (dry spells), excessive (dry/moderately dry)
Light intensity	very bright	cloudy skies	very bright	light shade	**Climate zone**	tropical wet & dry (Aw), steppe or semiarid (Bs), subtropical dry summer (Cs)	
Photo-period	short day (<12 hours), neutral day (12-14 hours)						

Cultivation				
Product. system	large scale/ commercial	**Crop cycle**	**Min**	**Max**
			60	120
Cropping system	**Subsystem**	**Companion species**	**Level of mechanization**	**Labour intensity**
arable irrigated	ley cropping	-	-	-

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	starch, protein, minerals	seeds
animal food (feed)	minerals, vitamins, starch, protein	entire plant, seeds
poison	mammals	entire plant

11 Oat

11.1 *Avena sativa*, Linnaeus

Family	Liliopsida:Commelinidae:Cyperales:Gramineae
Common names	oat, oats, hawer, hafer, avena, avoine, avoine farine, vanlig havre, havre, almindelig havre, peltokaura, kaura, akurhafrar, saat-hafer

Description: A grass and cereal crop reaching a height of 60-120 cm.

Uses: The cereals are made into porridges and oatcakes and fed to livestock or used as food. It is also a good hay crop.

Growing period: Annual, spring cultivars growing 110-160 days, and winter cultivars 210-270 days. Monegat; autumn sown in Brazil it provides groundcover in 45-65 days, flowers in 110-140 days and mature in 125-160 days.

Common names: Common Oat, Oat, Oats.

Further information: Oats are native of western Europe. It prefers a cool and moist climate, especially during the summer. Winter varieties are sown in areas with relatively mild winters while spring varieties are used where winters are more severe. Hot dry weather just before heading causes the crop to blast during heading and ripening and produce poorly filled seed of light weight. Heavy, poorly drained soils and soils with high nitrogen levels are likely to cause lodging. Photosynthesis pathway C 3 I. Average seed yield is about 1.8-2 t/ha, while good yields can reach 3 t/ha.

Factsheet

Description			
Life form	grass	**Physiology**	-
Habit	erect	**Category**	cereals & pseudocereals, cover crop
Life span	annual	**Plant attributes**	grown on large scale

Ecology

	Optimal		Absolute			Optimal	Absolute
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	medium (50-150 cm)
Temperat. requir.	16	20	5	35	**Soil texture**	heavy, medium, light	heavy, medium, light
Rainfall (annual)	600	1000	250	1500	**Soil fertility**	high	moderate
Latitude	45	40	60	60	**Soil Al. tox**		
Altitude	---	---	-	-	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	5	6	4.5	7.5	**Soil drainage**	well (dry spells)	well (dry spells)
Light intensity	very bright	very bright	very bright	cloudy skies	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar), desert or arid (Bw), steppe or semiarid (Bs), subtropical humid (Cf), subtropical dry summer (Cs), subtropical dry winter (Cw), temperate oceanic (Do), temperate continental (Dc), temperate with humid winters (D	
Photo-period	neutral day (12-14 hours), long day (>14 hours)						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	-				**Killing temp.**	**during rest**	**early growth**
						-15	-1

Cultivation

Product. system	-	**Crop cycle**	**Min**	**Max**
			110	270

Uses

Main use	Detailed use	Used part
food & beverage	starch, protein, minerals	seeds
animal food (feed)	starch, protein, minerals	seeds
material	cosmetics & perfumery	seeds
medicinal	muscular/skeletal applications, skin applications, digestive system applications, nervous system applications	seeds, leaves
fuels	non-wood fuel	bark

12 Oil Palm

12.1 *Elaeis guineensis*, Jacq.

Family	Liliopsida:Arecidae:Arecales:Palmae
Synonyms	*Elaeis melanococca J. Gaertn.*
Common names	oil palm, palmier à huile, palma aceitera, palma de aceite, dende, Ölpalme, youzonglu, nahkhil al zite, oilepalme, olie palm, kelapa sawit

Description: An unbranched, evergreen palm, reaching a height of 18-30 m with a stout trunk, up to 22-75 cm in diameter, covered with persistent leaf bases. The stem terminates in a crown of leaves at the very top, 70-100 leaves, up to 7.5 m long, are produced in spiral succession from the apical meristem. After fertilization, the female inflorescence develops into the fruit bunch. Each bunch may contain about 200 fruits. A single bunch may weigh 18-25 kg, of which 60-65% is fruit. The fruits are fibrous drupes about 4 cm long and 2 cm broad, with a pointed apex and a leathery, fairly thin exocarp surrounding the fleshy mesocarp, a hard endocarp and a seed.

Uses: Palm oil can be used in the manufacture of *soap* and *candles* and in the tin *plate industry*. It is the most productive species for *bio-diesel*. It contains vitamins A and E. Palm kernel oil is very similar to coconut oil and is used in edible fats, in the preparation of ice cream and mayonnaise, and in the manufacture of soaps and detergents. By tapping the male inflorescence, a wine can be made and the central shoot or cabbage of the palm is edible. The press cake from palm kernel oil can be used for animal feed.

Ecology: 0°C at during rest or at early growth.

Growing period: Perennial.

Further information: African oil palm is indigenous to the humid tropics of West Africa. It occurs wild along the banks of rivers and streams in the transition zone between rain forest and open savanna, at latitudes between 3°N and 7°S. The cultivation is essentially limited to *regions between 10°N and S*. It can be found up to 1300 m in elevation near the equator. Growth rate is significantly affected below 20°C and there is no growth below 15°C. However, yields should not be significantly affected if the temperature drops below 20°C for a few hours at night only. With cold tolerance it can withstand temperatures of 12°C. It can tolerate temporary flooding, provided the water is not stagnant. Relative humidity should be higher than 75% in areas of commercial production and rainfall should be evenly distributed throughout the year. It requires *adequate light* and at least *five hours of sunshine per day* in all months of the year is desirable. Seedling growth stops at temperatures below 15°C. High winds can be harmful.

Cultivation and post harvest treatment: On smallholdings oil palms are often *intercropped with food crops* for up to three years. Seedlings should be between 10-18 months when they are transplanted to the field. It is best to move the seedlings with a substantial ball of earth (35-45 cm in diameter around their roots). The optimum planting density is about 123-140 palms per ha, which is the same as a planting distance of 8-9x9 m. Begins to bear in 3-4 years, is in full production in 8-10 years and is usually cut down at 25-35 years, when the palm gets to tall and unpractical to harvest. Specimens have been known to live 200 years. The inflorescence develops in the apical bud for two years. After pollination fruit takes 150-180 days to mature. The tree requires a growing period of at least 270 days per year, the optimum is more than 300 days and the tree can grow throughout the year. It produces the two distinct oils, palm oil and palm kernel oil. Palm oil is obtained from the fleshy, orange mesocarp of the fruit, which contains 45-55 % oil, and palm kernel oil is obtained from the kernel or endosperm which contains about 50% oil. The fruit bunches are almost always damaged during harvest and must be taken to the factory as soon as possible and should be processed within 24 hours.

Factsheet

Description			
Life form	tree	**Physiology**	evergreen, single stem
Habit	erect	**Category**	forage/pasture, materials
Life span	perennial	**Plant attributes**	grown on large scale/small scale, harvestet from wild

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	deep (>>150 cm)	medium (50-150 cm)
Temperat. requir.	20	35	12	38	**Soil texture**	heavy, medium	heavy, medium, light
Rainfall (annual)	1500	3000	1000	8000	**Soil fertility**	high	moderate
Latitude	-	-	10	20	**Soil Al. tox**		
Altitude	---	---	-	1300	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	4.5	6	3.2	8	**Soil drainage**	well (dry spells)	well (dry spells)
Light intensity	very bright	very bright	very bright	cloudy skies	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar)	
Photo-period	short day (<12 hours), neutral day (12-14 hours), long day (>14 hours)						
Abiotic toler.	-				**Abiotic suscept.**	wind	

Cultivation				
Product. system	small scale (manual), large scale/ commercial	**Crop cycle**	**Min**	**Max**
			300	365
Cropping system	**Subsystem**	**Companion species**	**Level of mechanization**	**Labour intensity**
arable irrigated	inter cropping	maize, yams, millet, cassava, cowpea, cocoyams, groundnuts, bananas	-	-
arable irrigated	inter cropping	Calopogonium mucunoides, Centrosema pubescens, Pueraria phaseoloides	-	-

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	lipids, vitamins, protein	fruits, seeds, flowers
food additive	sweetener	flowers
animal food (feed)	lipids, vitamins, protein	fruits, shoots
material	lipids/oil & fats, cosmetic & perfumery, waxes	fruits, seeds
environmental	shade & shelter, soil improvers, agroforestry	entire plant, leaves
fuels	petroleum substitutes/alcohol	fruits, seeds

13 Potato

13.1 *Alium cepa*, Linnaeus

Family	Liliopsida:Liliidae:Asparagales:Alliaceae
Synonyms	*Allium ascalonicum L., Cepa rotunda Dod., Allium esculentum Salisb., Allium porrum cepa Rehb.*
Common names	onion, potato onion, shallot, echalote, oignon, cebolla, basal, cebola, cipolla, Zwiebel, Küchenzwiebel, lök, rödlök, løg, rødløg

Factsheet

Description				
Life form	herb	**Physiology**	-	
Habit	erect	**Category**	vegetables, medicinals & aromatic	
Life span	biennial	**Plant attributes**	grown on large scale	

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	shallow (20-50 cm)
Temperat. requir.	12	25	4	30	**Soil texture**	medium, organic	wide, organic
Rainfall (annual)	350	600	300	2800	**Soil fertility**	moderate	low
Latitude	-	-	60	60	**Soil Al. tox**		
Altitude	---	---	-	2000	**Soil salinity**	low (<4 dS/m)	medium (4-10 dS/m)
Soil PH	6	7	4.3	8.3	**Soil drainage**	well (dry spells)	well (dry spells)
Light intensity	clear skies	clear skies	cloudy skies	very bright	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar), steppe or semiarid (Bs), subtropical humid (Cf), subtropical dry summer (Cs), subtropical dry winter (Cw), temperate oceanic (Do), temperate continental (Dc), temperate with humid winters (Df), temperate with dr	
Photo-period	short day (<12 hours), neutral day (12-14 hours), long day (>14 hours)						

Cultivation				
Product. system	home garden, large scale/ commercial	**Crop cycle**	**Min**	**Max**
			85	175

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	vitamins	entire plant
medicinal	digestive system applications, immune system applications, blood system applications, skin applications, sensory applications, respiratory applications, muscular/skeletal applicaions	entire plant

13.2 *Alium cepa var. aggregatum*, G. Don f.

Family	Liliopsida:Liliidae:Asparagales:Alliaceae
Scientific Synonym	*A. ascalonicum, A. cepa var. ascalonicum, A. cepa var. multiplicans, A. cepa var. solaninum.*
Common names	potato onion, multiplier onion, Egyptian onion, topset onion, tree onion, Anian

Description: A herb with an up to 50 cm tall pseudostem and 3-8 leaves, with bulbs up to 5 cm in diameter formed by the thickening of leaf-bases a short distance above the true stem.

Uses: The bulbs are used as food, spice and seasoning. It is used fresh, pickled, cooked, or fried. It has medicinal properties.

Growing period: Annual. Ready for harvest after 60-100 days.

Common names: Shallot, Potato onion, Echalote, Ascalonia, Chalote, Schalotte, Sjalot, Alubosa, Multiplier onion, Yabbas, Oignon patate, Bawang merah, Brambang, Bawang beureum, Bawang kecil, Lip anian, Sibuyas tagalog, Lasona, Cebollas, Khtum krahaam, Hoom bwax, Hom, Hom-daeng, Homlek.

Further information: Shallot can in the tropics be grown at elevations between sea level and 2500 m. The optimum photoperiod varies from 12 hours for the short-day cultivars to 15 hours for the long-day cultivars. High temperatures encourage bulb formation, but flower formation and seed production are only possible where the bulbs are subjected to low temperatures. In the tropics, flower and seed formation will therefore only occur at higher elevations. A cool period promotes early leaf production. Moist soil is required throughout the growing period, but excessive soil water and high humidity encourage diseases. A dry period is required for curing the bulbs. Long days normally favor bulb development. Average fresh bulb yields in Indonesia is about 6 t/ha, under good growing conditions yields of 10-18 t/ha can be obtained.

Factsheet

Description			
Life form	herb	**Physiology**	single stem
Habit	erect	**Category**	vegetables
Life span	annual	**Plant attributes**	grown on large scale

Ecology

	Optimal		Absolute			Optimal	Absolute
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	shallow (20-50 cm)
Temperat. requir.	20	25	10	30	**Soil texture**	light, organic	heavy, medium, light
Rainfall (annual)	450	600	300	1000	**Soil fertility**	high	low
Latitude	-	-	60	60	**Soil Al. tox**		
Altitude	---	---	-	2500	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	6	7	5.5	7.5	**Soil drainage**	well (dry spells)	well (dry spells)
Light intensity	clear skies	clear skies	very bright	cloudy skies	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar), steppe or semiarid (Bs), subtropical humid (Cf), subtropical dry summer (Cs), subtropical dry winter (Cw), temperate oceanic (Do), temperate continental (Dc), temperate with humid winters (Df), temperate with dr	
Photo-period	short day (<12 hours), neutral day (12-14 hours), long day (>14 hours)						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	-				**Killing temp.**	**during rest**	**early growth**
						-5	-5

Cultivation

Product. system	-	**Crop cycle**	**Min**	**Max**
			60	100

Uses

Main use	Detailed use	Used part
food & beverage	vitamins, minerals	rhizomes
food additive	condiment/seasoning	rhizomes
medicinal	-	rhizomes

13.3 *Colocasia esculenta*, Linnaeus, Schott

Family	Liliopsida:Arecidae:Arales:Araceae
Synonyms	*Alocasia dussii Dammer, Alocasia illustris Bull., Arum colocasia L, Arum colocasioides Desf., Arum esculentum L., Arum lividum Salisb., Arum nymphaeifolium (Vent.)Roxb., Arum peltatum Lam., Caladium acre R.Br., Caladium colocasia (L.)W.Wight, Caladium col*
Scientific Synonym	*C. antiquorum, C. antiquorum var. esculenta, C. esculentum*
Common names	taro, eddo, kalo, dasheen, cocoyam, elephant ears, potato of the tropics, ciamo, inhame, malanga, tayoba, alcocaz, elefantenohr,…

Description: A herbaceous plant with a underground corm producing a few large leaves with long erect petioles. It can reach a height of 0.4 to 2 m. The tubers are usually up to 30 cm long and about 15 cm in diameter.

Uses: It is mainly cultivated for its tubers, which contain large quantities of small starch grains and are rich in protein, calcium, and phosphorus, but are low in fats and protein. The tubers and leaves are eaten boiled. The tubers are grated and fermented to make poi or fried chips. Flour is made from the dried corms.

Growing period: Perennial, growing 180-540 days but most forms mature in about 210-300 days. Require at least 180-210 frost-free days a year.

Common names: Cocoyam, Taro, Dasheen, Tayoba, Barbados Eddoe, Chinese Eddoe, Curcas, Bari, Koko, Ya Bere, Kolkas Malangay, Malangu, Taioba, Arvi, Dalo, Taro de Chine, Tallas Abalong Dagmay, Gabi, Lubingan, Pising, Colulu Ya, Yu-tao, Elephant`s Ear, Eddoe, Kalo, Talo.

Further information: Cocoyam is indigenous to southern Central Asia. The latitudinal range is 35°N to 18°S. It can be grown up to 1000 or even 2700 m in elevation in the tropics and is well adapted to humid conditions. Yields of up to 37 t/ha have been obtained in Hawaii under flooded conditions, while 25 t/ha have been reported under dry-land cultivation. Average yields may range from 4-6 t/ha.

Factsheet

Description			
Life form	herb	**Physiology**	-
Habit	erect	**Category**	roots/tuber, vegetables, ornamentals/turf
Life span	perennial	**Plant attributes**	grown on large scale

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	medium (50-150 cm)
Temperat. requir.	21	28	10	35	**Soil texture**	medium, organic	heavy, medium
Rainfall (annual)	1800	2700	1000	4100	**Soil fertility**	high	moderate
Latitude	-	-	18	35	**Soil Al. tox**		
Altitude	---	---	-	2700	**Soil salinity**	low (<4 dS/m)	medium (4-10 dS/m)
Soil PH	5.5	6.5	4.3	8.2	**Soil drainage**	poorly (saturated >50% of year), well (dry spells)	poorly (saturated >50% of year), well (dry spells)
Light intensity	clear skies	clear skies	very bright	light shade	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar), subtropical humid (Cf)	
Photo-period	short day (<12 hours), neutral day (12-14 hours), long day (>14 hours)						

Cultivation				
Product. system	-	**Crop cycle**	**Min**	**Max**
			180	300

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	starch, vitamins, minerals, protein	roots, leaves
environmental	ornamental/turf	entire plant

13.4 *Discorea bulbifera*, Linnaeus

Family	Liliopsida:Liliidae:Dioscoreales:Dioscoreaceae
Synonyms	*Discorea latifolia Benth.*
Scientific Synonym	*D. crispata, D. heterophylla, D. latifolia, D. oppositifolia, D. papilaris, D. pulchella, D. sativa, D. sylvestris, D. tunga, D. violacea, Helmia bulbifera*
Common names	potato yam, bitter yam, air potato yam, akam yam, acom, Otaheite yam, Otaheite potato, inhame, cara' de Sao Tome', cara' do ar

Description: A climbing, glabrous vine, with stems up to 10 m in length, producing aerial tubers or bulbils in the leaf axils. The bulbils are large, liver-shaped, about 0.5-1.2 kg, succulent, rounded, 8-10 cm in length and 5 cm in diameter, with grey or brown skin and white or pale yellow flesh. Leaves simple, pale green and up to 30 cm in length.

Uses: The bulbils are prepared like yams. They should be thoroughly cooked or roasted to destroy toxic constituents which include the alkaloid dioscorine. The underground tubers of the plant are hard, bitter, and unpalatable.

Growing period: Perennial vine, bulbils are normally produced 140-180 days after planting, exceptionally after 90-120 days. Harvest continue up to 300 days.

Common names: Potato yam, Air potato, Aerial yam, Bulbil-bearing yam, Ycam, Pousse en l'air, Name de Gunda, Gaithi, Ratuli, Oobi Singapore, Ubi atatus, Man nok, Kattala, Banalu, Bayag-toro, Ubi-ubihan, Kasiena, Khoinga, Akam, Akom, Danda yam, Batata de Rama, Cara de aire, Cara de Espinho, Cara de Sapateiro, Name del aire, Name Congo, Name Criolo, Name de Mata, Papa Caribe, Papa del aire, Acom, Otaheite potato.

Further information: Cultivars vary in dormancy requirements. There are two forms of potato yams, the Asian and the African. Yields of bulbils vary between 2-15 t/ha, with an average yield about 3-5 t/ha.

Factsheet

Description			
Life form	vine	**Physiology**	multi stem
Habit	climber, scrambler, scadent	**Category**	vegetables
Life span	perennial	**Plant attributes**	grown on small scale

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	deep (>>150 cm)	medium (50-150 cm)
Temperat. requir.	20	30	12	38	**Soil texture**	medium	medium, light
Rainfall (annual)	1200	2600	900	4000	**Soil fertility**	high	moderate
Latitude	-	-	-	-	**Soil Al. tox**		
Altitude	---	---	-	-	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	6	6.7	5.3	8	**Soil drainage**	well (dry spells)	well (dry spells)
Light intensity	very bright	clear skies	very bright	cloudy skies	**Climate zone**	tropical wet & dry (Aw)	
Photo-period	short day (<12 hours),						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	-				**Killing temp.**	**during rest**	**early growth**
						9	9

Cultivation				
Product. system	-	**Crop cycle**	**Min**	**Max**
			90	300

Uses		
Main use	**Detailed use**	**Used part**
posison	mammals	unspecified part
food & beverage	vitamins, minerals	unspecified part

13.5 *Discorea esculenta*, Lour., Burkill

Family	Liliopsida:Liliidae:Dioscoreales:Dioscoreaceae
Synonyms	*Dioscorea aculeata L.*
Scientific Synonym	*14 D. aculeata, D. fasciculata, D. sativa, Onchus esculentus*
Common names	fancy yam, potato yam, lesser yam, lesser asiatic yam, igname, inhame de comer, inhame taioba, inhame de enxerto, kawai, ufilei

Description: A herbaceous, spiny vine reaching a length of up to 3 m, often with purple colouration at the base. The leaves are smooth, up to 12 cm long and 15 cm wide. Flowers are rarely formed. The tubers are oval, up to 20 cm long and 6-8 cm in diameter, and each plant may produce 5-20 tubers. The flesh is yellow or white and the average tuber weight may be 0.25-1 kg.

Uses: The tubers are cooked as a vegetable.

Growing period: Perennial. Cultivated tubers reach maturity in 200-365 days, while wild tubers may require 2-20 years.

Common names: Lesser yam, Asiatic yam, Potato yam, Chinese yam, Lesser asiatic yam, Igname des blancs, Kangar, Karen potato, Potato yam, Sasniali, Sathni, Silakandom, Kodi, Ubi torak, Apali, Tongo, Trident yam, Tugi, Tugue, Tungo, Taitu, Taitukava, Ufi lei, Diba, Hausa potato, Name asiatica, Name azucar, Name chino, Name papa, Name pequeno.

Further information: Lesser yam is indigenous to South-East Asia. Latitudinal range is 23°N to 20°S. Optimum growth is obtained from plants grown in hot climates, and yields from plants grown at elevations up to 500 or even 900 m are generally good. Tubers have a short period of dormancy and do not store well. Yields up to 25-35 t/ha have been recorded, in West Africa average yields are 7-20 t/ha. Mentioned as a useful agroforestry species.

Factsheet

Description			
Life form	vine, herb	**Physiology**	-
Habit	climber, scrambler, scadent	**Category**	roots/tubers, forage/pasture, environmental
Life span	perennial	**Plant attributes**	grown on small scale

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	deep (>>150 cm)	medium (50-150 cm)
Temperat. requir.	28	32	17	45	**Soil texture**	medium, organic	medium, light
Rainfall (annual)	800	2000	600	8000	**Soil fertility**	high	moderate
Latitude	-	-	20	23	**Soil Al. tox**		
Altitude	---	---	-	900	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	5.5	6.5	4.5	8.5	**Soil drainage**	well (dry spells)	well (dry spells)
Light intensity	very bright	clear skies	very bright	cloudy skies	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar)	
Photo-period	short day (<12 hours),						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	-				**Killing temp.**	**during rest**	**early growth**
						0	0

Cultivation				
Product. system	-	**Crop cycle**	**Min**	**Max**
			200	356

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	vitamins, minerals	roots
animal food (feed)	vitamins, minerals	roots
material	gums/resins	roots
environmental	agroforestry	entire plant

15 Rape seed

15.1 *Brasica Napus*, L.

Family	Magnoliopsida:Dilleniidae:Capparales:Cruciferae
Synonyms	*B. napus L. ssp. oleifera (Moench) Metzg., B. napus L. var. oleifera (Moench) Delile (ssp. napus), B. napus L. ssp. napobrassica (L.) O. Schwarz, B. napus L. ssp. napus sensu Hämet-Ahti et al.*
Scientific Synonym	
Common names	rape, olraps, colza, raapzaad, rypsi, raps, rapsi, oil-seed rape, canola, rutabaga, fodder rape, hungry gap kale, winter oil seed rape, swede rape, Siberian kale, rape seed, swede

Description: A herb, 0.5-2 m tall with a strongly branched stem. Basal leaves of flowering plant stalked, highest leaves sessile and clasping stem. Flowers with 11-15 mm long, pale to bright yellow petals.

Uses: The seeds are extracted for an oil used especially in margarine and for cooking. Newly bred cultivars with a high content of erucic acid are used for extraction of industrial oil. It is also used as a fodder crop.

Killing temperature: Rape is resistant to frost at all stages of growth. Unhardened plants can survive -4°C, while fully-hardened spring type rapeseed can survive -10 to -12°C, and hardened winter rapeseed can survive short periods of exposure to -15 to -20°C.

Growing period: Annual or biennial herb. Spring cultivars growing 85-160 days, and winter cultivars 160-340 days.

Common names: Swede rape, Rape, Oil-seed rape, Argentine rape, Colza d'hiver, Colza d'ete.

Further information: B. napus var. oleifera (winter rape), B. napus var. oleifera subvar. annua (summer rape). Swede rape is native of Europe. It is a temperate crop but it can be grown in the tropics at elevations between 1500-2200 m. Yields of 2-4 t/ha are considered good, while yields of 0.5-2 t/ha are more usual.

Factsheet

Description			
Life form	herb	**Physiology**	-
Habit	Erect	**Category**	forage/pasture, vegetables, materials
Life span	Annual, bioennial	**Plant attributes**	grown on large scale

Ecology

	Optimal		Absolute			Optimal	Absolute
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	medium (50-150 cm)
Temperat. requir.	15	25	5	41	**Soil texture**	medium, light	heavy,medium, light
Rainfall (annual)	500	1000	400	2800	**Soil fertility**	high	moderate
Latitude	-	-	-	-	**Soil Al. tox**		
Altitude	-	-	-	2000	**Soil salinity**	low (<4 ds/m)	medium (4-10 ds/m)
Soil PH	6.5	7.6	5.5	8	**Soil drainage**	well (dry spells)	well (dry spells)
Light intensity	very bright	clear skies	very bright	cloudy skies	**Climate zone**	steppe or semiarid (bs), subtropical humid (cf), subtropical dry summer (cs), subtropical dry winter (cw), temperate oceanic (do), temperate continental (dc), temperate with humid winters (df), temperate with dry winters (dw)	
Photo-period	neutral day (12-14 hours), long day (>14 hours)						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	-				**Killing temp.**	**during rest**	**early growth**
						-15	-6

Cultivation

Product. system	-	**Crop cycle**	**Min**	**Max**
			85	340

Uses

Main use	Detailed use	Used part
food & beverage	vitamins, minerals,proteins	seeds
animal food (feed)	vitamins, minerals, proteins	entire plant
material	lipids/oil and fats	seeds
environmental	diesel substitutes	seeds

16 Rice

16.1 *Oryza sativa*, Linnaeus

Family	Liliopsida:Commelinidae:Cyperales:Gramineae
Common names	rice, riso, riz, arroz, raisi, chawal, dhan, shali, rais, kumi, kome, ku, dao, tao, kao, cau, byeo, padi, paddy, vrihi, arishi, oruza, lúa

Description: Cultivated rice is an *annual grass*. It has round; jointed culm with long narrow leaves. The culm terminates in an inflorescence called a panicle. The height of the culm may vary from 20 cm to over 5 m in some deep-water rice exhibiting excellent internode elongation ability. The plant height of the modern high yielding varieties may vary from 90 to 110 cm. The rice fruit is a caryopsis with a single seed fused to the ripened ovary wall, pericarp. Lemma and palea enclose the caryopsis. The rice grain is the ripened ovary with lemma, palea, rachilla sterile lemmas. The rice grain is also known as rough rice.

Uses: Raw or parboiled milled rice is *cooked and used as food*. It forms the main course of the meals for millions of people in Asia and elsewhere. Many processed foods such as popped or puffed rice products are produced from brown rice or parboiled rice for use as breakfast cereals and snack foods. Beer, wine and spirits can be produced from the grain. Rice is mainly grown for food but it is also used in cosmetics, laundering starch, and textiles. An oil is produced and used as cooking and salad oil, for soap manufacture and it is made into a plastic packaging material. Husks are used as *fuel*. The harvesting of rice produces straw as a by-product. *Rice straw* has poor palatability, bulkiness, low digestibility, low protein, high lignin and high silica contents. It is the most common *feed ingredient for cattle* in many developing countries in Asia and Pacific region. The chief by-products produced during milling are husks and bran. Husks are used as domestic fuel in many countries. Rice husks on burning produce 20 % (by weight) of ash containing 90% silica. Rice bran is highly nutritious. It contents *lipids, protein, minerals and vitamins*. Because of its nutritional value, it is used as a feed for poultry and livestock.

Ecology: Growth arrested below 10°C; rice exhibits little or *no frost tolerance*.

Growing period: Annual grass, wetland types growing 80-150 days, while floating rice may require 180-200 days to mature.

Common names: Rice, riz, arroz, reis, ris, arishi, arroz, byeo, cau, chawal, dao, dhan.

Further information: Rice is grown in four ecosystems, which are broadly defined on the basis of water regimes:

Ecosystem	world's rice area	world's rice production
irrigated	55%	76%
rain-fed lowland	25%	17%
upland	13%	4%
flood-prone	7%	3%

The cultivation of indica is confined to areas between 0° and 25° latitude, it is seldom grown above 1200 m in elevation and performs best below 600m. They are hardy, resistant to diseases and tolerate unfavourable growing conditions. Rice can be grown very successfully in areas of low humidity and rainfall if there is adequate water available for irrigation but rice prefers medium to high humidity. Hybrid rice yields on an average 6.6 tons/ha compared with 5 tons/ha for conventional rice varieties.

Factsheet

Description			
Life form	grass	**Physiology**	multi stem, C3 photosynthesis
Habit	erect	**Category**	cereal & pseudocereals
Life span	annual	**Plant attributes**	grown on large scale

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	shallow (20-50 cm)
Temperat. requir.	20	30	10	36	**Soil texture**	wide	wide
Rainfall (annual)	1500	2000	1000	4000	**Soil fertility**	high	moderate
Latitude	-	-	36	55	**Soil Al. tox**		
Altitude	---	---	-	2500	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	5.5	7	4.5	9	**Soil drainage**	poorly (saturated >50% of year)	poorly (saturated >50% of year)
Light intensity	very bright	very bright	cloudy skies	very bright	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar), subtropical humid (Cf), subtropical dry summer (Cs), subtropical dry winter (Cw)	
Photo-period	neutral day (12-14 hours)						

Cultivation				
Product. system	intermediate (animal drawn), large scale/ commercial	**Crop cycle**	**Min**	**Max**
			80	180
Cropping system	**Subsystem**	**Companion species**	**Level of mechanization**	**Labour intensity**
arable irrigated	wet-rice system	-	low	high

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	starch, vitamins	seeds
material	fibres, lipids/oil & fats	leaves, seeds
fuels	non-wood fueld	leaves, seeds
material	paper, other material/chemicals	leaves

16.2 *Vigna umbellata*, Thunb., Ohwi & H. Ohashi

Family	Magnoliopsida:Rosidae:Fabales:Leguminosae
Synonyms	*Azukia umbellata (Thunb.) Ohwi, Phaseolus calcaratus Roxb., Vigna calcarata (Roxb.) Kurz*
Scientific Synonym	*V. calcarata, Phaseolus pubescens, P. calcaratus, Azukia umbellata*
Common names	rice bean, bean - rice, red bean, lazy-man pea, haricot de riz, frijol arroz, judia de arroz, mambi bean, anipay, bamboo bean …

Description: A legume with slender twining vines and small leaves, sometimes forming a thick mat and reaching 30-75 cm in height. It has trifoliate leaves, bright yellow flowers and 6-13 cm long, slender pods with 10-16 seeds. The root system is extensive and deep. It has bright yellow flowers and narrow 6-12 cm long pods.

Uses: Grown as a pulse crop and as a green vegetable. Mature seeds are eaten boiled, fried, or sprouted and the leaves and young pods are cooked as vegetable. The beans are a good source of protein, calcium, iron and vitamin B. Plant remains are used as animal feed. The plant can also be used for soil improvement, green manure, living hedge and as a soil cover crop.

Growing period: Fast-growing short-lived perennial, grown as an annual. The young seeds, pods and leaves it may be harvested 40-130 days from sowing. For forage it may be harvested after 70-80 days, but yields are higher at 120-130 days.

Common names: Rice bean, Japanese rice bean, Ohwi, Ohashi, Red bean, Anipay, Bamboo bean, Climbing mountain bean, Crab-eye bean, Dungay, Frijol arroz, Gai-kalai, Ghurush, Haricot de riz, Haricot riz, Reisbohne, Meth, Pan maia, Sem, Sita-mas, Sutri, Kachang sepalit, Katjang otji, Pe-yin, Anipay, Dungay, Kalipan, Kilkilang, Linay, Mangulasi, Pagapay, Paksai, Pagsei, Tapilan, Lung tau, Mai tau, Mu-tsa, Pau maia, Pe-gin, Pe-yin, Pois jaune, Pois pigeon, Pois zombi, Shiltong, Take-azuki, Taklauo, Tapilan, Tsuru-adsuki, Kacang uci, Anipai, Kapilan, Sandaek angkat miehs, Sandaek riech mieh, Thwax la:ng te:k, Thwax sade:t pa:x, Thwax phi, Thua daeng, Thua pae Ma pae, Dau gao.

Further information: The rice bean is found growing wild in India, central China and Malaysia. It is suited to humid tropical lowlands at elevations up to 2000 m. A daylength of less than 12 hours is required for flower initiation and seed production, when grown under long day conditions the crop produces masses of vegetation but little or no seed. The plant is adapted to high humidity. Average yield of green forage is about 2.2-3.5 t/ha but yields of up to 33 t/ha have been reported, while yields of dried beans may average 200-800 kg/ha and yields up to 2.2 t/ha have been reported.

Factsheet

Description			
Life form	herb, vine	**Physiology**	multi stem
Habit	erect, climber/ scrambler/ scadent	**Category**	pulses (grain legumes), forage/pasture, vegetables, cover crop, environmental
Life span	annual, perennial	**Plant attributes**	grown on large scale, grown on small scale

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	shallow (20-50 cm)
Temperat. requir.	18	30	10	40	**Soil texture**	medium	heavy, medium, light
Rainfall (annual)	700	150	300	2000	**Soil fertility**	high	low
Latitude	-	-	25	30	**Soil Al. tox**		
Altitude	---	---	-	2000	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	6	7.5	5.5	8	**Soil drainage**	well (dry spells)	well (dry spells), excessive (dry/moderately dry)
Light intensity	very bright	very bright	very bright	clear skies	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar), steppe or semiarid (Bs), subtropical dry summer (Cs)	
Photo-period	short day (<12 hours)						

Cultivation				
Product. system	home garden, small scale (manual), intermediate (animal drawn)	**Crop cycle**	**Min**	**Max**
			40	130

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	vitamins, minerals, protein	seeds, fruits, leaves
animal food (feed)	vitamins, minerals, protein	leaves, seeds, entire plant
environmental	erosion control, soil improvers, living fence, revegetation, manure/fertilizer, nitrogen fixation, cover crop	entire plant, roots

17 Rye

17.1 *Lolium multiflorum*, Lam.

Family	Liliopsida:Commelinidae:Cyperales:Gramineae
Synonyms	*Lolium italicum A. Braun, Lolium perenne L. ssp. multiflorum (Lam.) Husnot, Lolium perenne var. aristatum Willd.*
Scientific Synonym	*L. scabrum, L. italicum*
Common names	annual ryegrass, Italian ryegrass, ryegrass, raigras Italiano, ray-grass d'Italie, Italienisches raigras, vielblütiges weidelgras, …

Description: It has a bunch-type growth, it is leafy and has a dark green color, and can become up to 120 cm tall.

Uses: It is used as a winter forage grass in Europe. Used in meadows, pastures, and lawns.

Growing period: Annual or biennial.

Common names: Italian ryegrass, Annual ryegrass, Australian ryegrass, Ray-grass Italie, Khortane, Maddoun, Mandjour, Noussel, Zamma.

Further information: In Kenya it can be grown at altitudes above 2350 m.

Factsheet

Description			
Life form	grass	**Physiology**	-
Habit	erect	**Category**	forage/pasture
Life span	annual, perennial	**Plant attributes**	grown on large scale

Ecology

	Optimal		Absolute			Optimal	Absolute
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	shallow (20-50 cm)
Temperat. requir.	14	30	2	38	**Soil texture**	medium	heavy, medium, light
Rainfall (annual)	500	900	200	1800	**Soil fertility**	high	moderate
Latitude	28	25	48	51	**Soil Al. tox**		
Altitude	---	---	-	2440	**Soil salinity**	low (<4 dS/m)	medium (4-10 dS/m)
Soil PH	5	7.5	4.5	8.2	**Soil drainage**	well (dry spells)	poorly (saturated >50% of year), well (dry spells)
Light intensity	clear skies	very bright	cloudy skies	very bright	**Climate zone**	desert or arid (Bw), steppe or semiarid (Bs), temperate oceanic (Do), temperate continental (Dc), temperate with humid winters (Df), temperate with dry winters (Dw), boreal (E)	
Photo-period	long day (>14 hours)						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	-				**Killing temp.**	**during rest**	**early growth**
						-4	0

Cultivation

Product. system	-	**Crop cycle**	**Min**	**Max**
			90	270

Uses

Main use	Detailed use	Used part
animal food (feed)	minerals, vitamins	entire plant
environmental	erosion control, soil improvers, ornamental/turf	entire plant

17.2 *Secale cereale*, Linnaeus

Family	Liliopsida:Commelinidae:Cyperales:Gramineae
Common names	rye, seigle, centeno, roggen, saat-roggen, segale comune, zyto, almindelig rug, rug, råg, rúgur, ruis, rogge

Description: A tufted grass and cereal crop up to 1-2 m high.

Uses: The grain is used for making black bread, whiskey, gin, and beer and as fed for livestock. The grain contains about 13% protein and 80% carbohydrates. Mature plant stalks are to fibrous for fodder but are used for animal bedding, paper pulp, thatching, and hats. It can be used as a hay crop if harvested early.

Ecology: Seedlings of winter rye may tolerate -18°C.

Growing period: Annual grass, grain crop, that provides groundcover in 45-60 days, flowers after 70-90 days and mature in 110-130 days if spring sown and in 210-270 days if autumn sown.

Common names: Rye.

Further information: Rye probably originated in southwestern Asia. In the tropics the crop is grown at high altitudes up to 4300 m in the Himalayas. Photosynthesis pathway C3. In Scandinavia it can be grown within the arctic circle. It is widely grown in areas with cold winters and warm, dry summers. Autumn sown cultivars require exposure to low temperatures as a prerequisite to flowering before they can respond to long days in the spring. Drought, unstable air humidity and early frost may lead to shattering of seed. Strong cold winds and cloudy or moist weather during flowering may hinder pollination.

Factsheet

Description			
Life form	grass	**Physiology**	multi stem
Habit	erect	**Category**	cereals & pseudocereals, forage/pasture, cover crop, environmental
Life span	annual	**Plant attributes**	grown on large scale

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	shallow (20-50 cm)
Temperat. requir.	15	20	3	31	**Soil texture**	heavy, medium, light	heavy, medium, light
Rainfall (annual)	600	1000	400	2000	**Soil fertility**	moderate	low
Latitude	45	-	60	70	**Soil Al. tox**		
Altitude	---	---	-	4300	**Soil salinity**	low (<4 dS/m)	high (>10 dS/m))
Soil PH	5.5	6	4.5	8.2	**Soil drainage**	well (dry spells)	poorly (saturated >50% of year), well (dry spells), excessive (dry/moderately dry)
Light intensity	very bright	very bright	very bright	cloudy skies	**Climate zone**	steppe or semiarid (Bs), temperate oceanic (Do), temperate continental (Dc)	
Photo-period	rt day (<12 hours), neutral day (12-14 hours)						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	-				**Killing temp.**	**during rest**	**early growth**
						-18	-1

Cultivation				
Product. system	large scale/ commercial	**Crop cycle**	**Min**	**Max**
			110	270
Cropping system	**Subsystem**	**Companion species**	**Level of mechanization**	**Labour intensity**
permanent rainfield	sole cropping	-	high	low

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	starch, vitamins, minerals, protein	seeds
animal food (feed)	vitamins, minerals, starch, protein	seeds, entire plant
material	paper, fibres	bark
environmental	cover crop, soil improvers	entire plant

18 Sorghum

18.1 *Sorghum bicolor var. sweet*, Linnaeus, Moench

Family	Liliopsida:Commelinidae:Cyperales:Gramineae
Synonyms	*Sorghum vulgare Pers.*
Common names	broom-corn, sorghum, sweet sorghum, chicken corn, sorgho, sorgo, ipwa, bachanta, tinkish, Hirse

Description: A single-stemmed grass and cereal crop reaching a height of 1-5 m. Leaves (30-135 cm long and 6-13 cm wide) are opposite-decussate and consist of the sheath, blade and tongue or ligule. In dry conditions, the leaf blade will roll up into a tube, reducing the exposed area and thus cutting down the loss of moisture. Flowers are grouped in an apical panicle formed by several reddish spikelets. The shapes and colours of seeds are very varied and are covered by glumes and there are round, flat-round, oval, ellipse shapes etc. In general, the seed of sweet sorghum is smaller than that of grain sorghum; the thousand-seed weight is about 21g varying between 16-28g.

Uses: There are four potential outputs from sweet sorghum: *Food, Fuel, Fodder, & Fibre*. In Asia, R&D has concentrated on maximizing all four outputs to produce the 'multi-purpose' varieties, whilst in Europe, the potential use of sweet sorghum as a *sugar producer* for *fuel ethanol* production has driven the current direction of R&D towards liquid bio-fuel production. In southern Africa, the potential for using sweet sorghum for energy and crystalline sugar production is being explored. A disadvantage is that the stems have to be processed within a matter of hours after harvest. The grain can be ground into flour, some cultivars can be used as popcorn and the grain can be manufactured into beer. Stems are used for thatching, fencing, brushes, and basketry. Grain and straw can be fed to livestock and embryos yield an oil used in cooking and salad oils.

Growing period: *Annual* or short-term perennial grass. Most sorghum plants take 90-120 days to mature, the boot stage is reached in 50-60 days, flowering in 60-70 days and full grain maturity in 90-120 days.

Common names: Sorghum, Sorgho, Sorgo, Great millet, Milo, Jowar, Cholam, Guinea corn, Durra, Mtama, Jowal

Further information: Lowland tropical sorghums are adapted to *warm days* and *night temperatures above 22°C* throughout the growing season. The species is probably indigenous to North-East Africa, north of latitude 10°N and east of longitude 25°E. Sorghum is grown between 40°N and S. Sweet sorghum can be found at elevations between sea level and 1500 m, most East African sorghum is grown between the altitudes of 900-1500 m, and cool-tolerant varieties are grown between 1600 and 2500 m. The global average of grain yields is about *1.3 t/ha*. Like the common grain sorghum, sweet sorghum can produce grain yields of 1500-7500 kg/ha. But the essence of sweet sorghum is not from its seed, but from its stalk; which contains sugar. In general, the stalk yield is 45000-75000 kg/ha. The sugar content in the juice of sweet sorghum varies in different varieties. It's Brix ranges generally from between 15-23%.

Factsheet

Description			
Life form	grass	**Physiology**	single stem
Habit	erect	**Category**	cereals & pseudocereals, forage/pasture, materials, medicinals & aromatic
Life span	annual	**Plant attributes**	grown on large scale

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	shallow (20-50 cm)
Temperat. requir.	27	35	8	40	**Soil texture**	heavy, medium	heavy, medium, light
Rainfall (annual)	500	1000	300	3000	**Soil fertility**	moderate	low
Latitude	-	-	35	40	**Soil Al. tox**		
Altitude	---	---	-	2500	**Soil salinity**	low (<4 dS/m)	medium (4-10 dS/m)
Soil PH	6	7	5	8.5	**Soil drainage**	well (dry spells)	poorly (saturated >50% of year), well (dry spells), excessive (dry/moderately dry)
Light intensity	very bright	very bright	very bright	clear skies	**Climate zone**	tropical wet & dry (Aw), desert or arid (Bw), steppe or semiarid (Bs), subtropical humid (Cf)	
Photo-period	short day (<12 hours)						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	poisonous to man or animals				**Killing temp.**	**during rest**	**early growth**
						-	-

Cultivation				
Product. system	-	**Crop cycle**	**Min**	**Max**
			90	300

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	starch, minerals	seeds
food additive	sweetener	bark
animal food (feed)	starch, minerals	bark, seed
material	dye/tannin, fibres, canes	bark
fuels	petroleum substitutes/alcohol	bark

18.2 *Sorghum halepense*, Linnaeus, Pers.

Family	Liliopsida:Commelinidae:Cyperales:Gramineae
Synonyms	*Sorghum almum Parodi*
Scientific Synonym	
Common names	Johnson grass, Aleppo grass, means-grass, racehorse grass, false Guinea grass, Morocco millet, Egyptian millet, Arabian millet, Cuba grass, evergreen millet, milho zaburro, capim do Alepo

Description: An erect grass, with culms from 60-290 cm in height. It forms extensive underground root systems.

Uses: fodder

Ecology: It is susceptible to frosts but the rhizomes usually survive.

Growing period: Perennial grass growing from spring to autumn.

Common names: Johnson grass, Grama China, Maicillo, Sorguillo, Sorgo de Alepo, Aleppo grass, Don Carlos.

Further information: Johnson grass is believed to be of Mediterranean and western Asian origin. It is common in moist areas on river banks, in clay soils and wet sandy soils. Best known as one of the 10 most noxious weeds in the world. It is a serious weed problem in cotton, corn, soybeans, sugarcane, fruit and nut orchards, and vegetables, and mentioned as a problem in 53 countries. In Texas it can yield 17-18 t/ha of hay under irrigation. Rhizomes production may be 10-50 t/ha. Seed yields of 0.3 t/ha are considered good. At day-length of 12 hours is thought to be the optimum for flowering, with above 14 hours of light the grass fail to flower, and above 16 hours all growth processes are inhibited.

Factsheet

Description			
Life form	grass	**Physiology**	-
Habit	erect	**Category**	forage/pasture, weed
Life span	perennial	**Plant attributes**	-

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	shallow (20-50 cm)
Temperat. requir.	24	32	15	36	**Soil texture**	medium, light	heavy, medium, light
Rainfall (annual)	500	750	450	1500	**Soil fertility**	high	moderate
Latitude	30	-	45	45	**Soil Al. tox**		
Altitude	---	---	-	-	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	6	6.8	4.9	8.2	**Soil drainage**	low (<4 dS/m)	low (<4 dS/m)
Light intensity	very bright	very bright	very bright	cloudy skies	**Climate zone**	tropical wet & dry (Aw), steppe or semiarid (Bs), subtropical humid (Cf), subtropical dry summer (Cs), subtropical dry winter (Cw)	
Photo-period	short day (<12 hours), neutral day (12-14 hours)						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	can become a weed				**Killing temp.**	**during rest**	**early growth**
						-7	-1

Cultivation				
Product. system	-	**Crop cycle**	**Min**	**Max**
			120	210

Uses		
Main use	**Detailed use**	**Used part**
animal food (feed)	vitamins, minerals	entire plant

18.3 *Sorghum x almum*, Parodi

Family	Liliopsida:Commelinidae:Cyperales:Gramineae
Common names	Columbus grass, almum sorghum

Description: A robust grass reaching up to 4.5 m in height usually with a short rhizomes reaching as deep as 50 cm.

Uses: It withstands heavy grazing but not heavy trampling. It can be cut for hay.

Ecology: May withstand -15°C.

Growing period: Short-lived perennial grass growing from spring to autumn, 80-120 days to first harvest. Cutting at 5 cm every six to 12 weeks gives higher yields than cutting at 15 cm. Cutting every three weeks reduce yields.

Common names: Columbus grass, Pasto colon, Sorgo negro, Batag, Gau, Ya-sokum.

Further information: Columbus grass probably originated in Argentina. The latitudinal range of the grass is 25°N to 30°S. It can be found at elevations between sea level and 700 m. In humid areas it becomes more susceptible to leaf diseases and it can also become a weed. Dry matter yields are usually between 4-12 t/ha, but can reach 19 t/ha.

Factsheet

Description				
Life form	grass	**Physiology**	multi stem	
Habit	erect	**Category**	forage/pasture, weed	
Life span	perennial	**Plant attributes**	-	

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	shallow (20-50 cm)
Temperat. requir.	19	26	15	15	**Soil texture**	heavy, medium	heavy, medium, light
Rainfall (annual)	500	800	200	2000	**Soil fertility**	high	low
Latitude	25	25	30	30	**Soil Al. tox**		
Altitude	---	---	-	700	**Soil salinity**	low (<4 dS/m)	medium (4-10 dS/m)
Soil PH	5.5	7	5	8.5	**Soil drainage**	well (dry spells)	well (dry spells), excessive (dry/moderately dry)
Light intensity	very bright	very bright	very bright	clear skies	**Climate zone**	desert or arid (Bw), steppe or semiarid (Bs), subtropical dry winter (Cw), temperate oceanic (Do)	
Photo-period	short day (<12 hours)						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	can become a weed				**Killing temp.**	**during rest**	**early growth**
						-4	0

Cultivation				
Product. system	-	**Crop cycle**	**Min**	**Max**
			80	120

Uses		
Main use	**Detailed use**	**Used part**
animal food (feed)	vitamins, minerals	entire plant

18.4 *Sorghum x drummondii*, Streudel, Millsp. & Chase

Family	Liliopsida:Commelinidae:Cyperales:Gramineae
Scientific Synonym	*Sorghum arundinaceum v. sudanense, S. vulgare v. sudanensis, S. sudanense, S. bicolor ssp. drummondii*

Description: A tall, erect, leafy, medium coarse grass with many stems reaching 1-3 m in height. The root system is fibrous, deep, and very extensive.

Uses: Used for fodder, hay, and summer pasture.

Growing period: Fast-growing annual growing in the summer.

Common names: Sudan grass, Garawi, Pasto Sudan, Batag, Bukakau, Layagah, Ya-sudan.

Further information: Sudan grass originated in southern Egypt and Sudan. It can be found at elevations between sea level and 300 m in Australia. Sudan grass is well adapted to warm conditions with low humidity, but under these conditions it respond well to irrigation. Hay yields in humid areas may be 3.5-16 t/ha while yields in semiarid regions vary between 2-8 t/ha. In the United States the grass can under irrigation yield up to 20-40 t/ha of green fodder. Seed yield is about 0.5 t/ha.

Factsheet

Description				
Life form	grass		**Physiology**	-
Habit	erect		**Category**	forage/pasture
Life span	perennial		**Plant attributes**	-

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	deep (>>150 cm)	medium (50-150 cm)
Temperat. requir.	21	33	12	38	**Soil texture**	heavy, medium	heavy, medium, light
Rainfall (annual)	600	900	500	2500	**Soil fertility**	high	moderate
Latitude	-	-	30	30	**Soil Al. tox**		
Altitude	---	---	-	300	**Soil salinity**	low (<4 dS/m)	high (>10 dS/m))
Soil PH	6	7	5	8.2	**Soil drainage**	well (dry spells)	well (dry spells)
Light intensity	very bright	very bright	very bright	clear skies	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar), subtropical humid (Cf), subtropical dry summer (Cs), subtropical dry winter (Cw)	
Photo-period	short day (<12 hours), neutral day (12-14 hours)						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	-				**Killing temp.**	**during rest**	**early growth**
						-3	-1

Cultivation				
Product. system	-	**Crop cycle**	**Min**	**Max**
			90	120

Uses		
Main use	**Detailed use**	**Used part**
animal food (feed)	vitamins, minerals	entire plant

19 Soybean

19.1 *Glycine max*, Linnaeus, Merrill

Family	Magnoliopsida:Rosidae:Fabales:Leguminosae
Synonyms	*Dolichos soja L., Glycine gracilis Skvortzov, Glycine hispida (Moench) Maxim., Phaseolus max L., Soja angustifolia Miq., Soja hispida Moench, Soja japonica Savi, Soja max (L.) Piper, Soja viridis Savi*
Scientific Synonym	*G. soja, G. hispida, Soja max*
Common names	soya bean, soyabean, soybean, soya, sojaboon, sojaplant, sojaboontjie, fejao soja, soja, dadou, soia piini, bean - soya, Sojabohne

Description: A bushy herbaceous legume reaching a height of 20-180 cm.

Uses: The bean pods and seeds are a source of oil and protein. Fermented pods are used to make soy sauce and other sauces. The seeds are a good source of vitamin B and are dried to produce soya milk. The seeds are ground and used in food. A semi-drying oil is extracted from the seeds and used in margarine, shortening, salad oils and as a wetting and stabilizing agent in food, cosmetics, and pharmaceutical products. The oil is also used in paints, linoleum, oilcloths, printing inks, soaps, insecticides, disinfectants and as a bio-fuel. After oil extraction, the soya meal can be used for manufacturing of fiber, adhesives, and textiles. The plant can also be grown as a cover crop and used for pasture, fodder, hay and silage.

Growing period: Annual herb, growing 75-130 days or 140-180 days, depending on variety. Soybean is a warm-season crop.

Common names: Soya bean, Soybean, Soja, Sojabohn, Sjoaboon, Too-a leu-ang, Tua luang, Utaw, Wong Tau, Coffee bean, Japan bean, Soya, Strock pea, Ta teou, Poi oleagineux de chine, Katjang-boeloc, Daizu, Soya mocchai, Tae-too, Bhatwas, Hwang teou.

Further information: In the tropics soya bean is grown at elevations between sea level and 3000 m. The cultivation extends from 52° N to the tropics. Soya bean is very sensitive to photoperiod, a variation of 15 minutes in day length may be sufficient to inhibit flower development in a specific variety. Generally most cultivars bloom when the day-length is less than 14 hours though some will except up to 16 hours. Very short days (12 hours or less) lead to premature flowering and low yields. Soya bean is best adapted to moderate humidity, but have a fairly wide range. Photosynthesis pathway C 3 II. Inoculation with nitrogen-fixing bacteria is desirable if the crop is taken to a new area, the strain Rhizobium japonicum being specific to soya bean. In the United States 2.5 t/ha is a good yield, 5 t/ha have been achieved and an average yield in the tropics is about 1 t/ha. Mentioned as a useful agroforestry species.

Factsheet

Description			
Life form	herb	**Physiology**	-
Habit	erect	**Category**	pulses (grain legumes)
Life span	annual	**Plant attributes**	grown on large scale

Ecology

	Optimal		Absolute			Optimal	Absolute
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	shallow (20-50 cm)
Temperat. requir.	20	33	10	38	**Soil texture**	medium, organic	heavy, medium, light
Rainfall (annual)	600	1500	450	1800	**Soil fertility**	high	low
Latitude	-	-	47	52	**Soil Al. tox**		
Altitude	---	---	-	3000	**Soil salinity**	low (<4 dS/m)	medium (4-10 dS/m)
Soil PH	5.5	6.5	4.5	8.4	**Soil drainage**	well (dry spells)	poorly (saturated >50% of year), well (dry spells), excessive (dry/moderately dry)
Light intensity	very bright	very bright	very bright	clear skies	**Climate zone**	tropical wet & dry (Aw), steppe or semiarid (Bs), subtropical dry summer (Cs)	
Photo-period	short day (<12 hours)						

Cultivation

Product. system	-	Crop cycle	Min	Max
			75	180

Uses

Main use	Detailed use	Used part
food & beverage	protein, vitamins, minerals, protein	seeds, fruits, seedings, leaves
food additive	condiment/seasoning, stabiliser	fruits, seeds
animal food (feed)	vitamins, minerals, protein	fruits, entire plant
material	lipids/oil & fats, cosmetics & perfumery, fibres	seeds, entire plant
environmental	soil improvers, agroforestry	entire plant
fuels	petroleum substitutes/alcohol	seeds

20 Sugarbeet

20.1*Beta vulgaris var*. saccharifera, L.saccharifera - Alefeld

Family	Magnoliopsida:Caryophyllidae:Caryophyllales:Chenopodiaceae
Synonyms	
Scientific Synonym	
Common names	sugarbeet, remolacha azucarera, betterave à sucre, tiancai, zuckerruebe, barbabietola da zucchero, tensai, sato daikon, sakharnaya svyokla

Description: It is an herbaceous plant which stores reserves in the root during the first growing season and produce a flowering stem 120-180 cm in height and seed in the following summer. After the seed crop is produced the entire plant dies. The taproot is white and deep-penetrating. The root may be 15-20 cm thick and up to 60 cm long. Leaves are glabrous, ovate to cordate, dark green or reddish, up to 60 cm tall, forming a rosette on the underground stem.

Uses: The root contains sucrose used as all-round food sweetener (sugar). Used in the production of yeast, industrial alcohol, alcoholic beverages, ethanol, chemicals and pharmaceuticals. Molasses and fibre residue from the roots is a rich source of minerals and sugar (50%) and is used for production of mixed cattle feeds. Fresh leaves and tops can be collected and used as livestock feed or ploughed back into the soil. They can either be ensiled or fed dried. Tops are good for cattle but poisonous for pigs and horses, as they contain 1% oxalic acid.

Growing period: Biennial, grown as an annual for sugar production and as biennial for seed production.

Common names: Sugar beet.

Furhter information: It can be grown on a wide range of soils but medium to slightly heavy well drained soils are best. An ideal soil would be a deep and homogenous loam or sandy loam with a high content of humus. Soil crusting and compaction may lead to poor germination and formation of deformed roots.

Factsheet

Description			
Life form	herb	**Physiology**	deciduous, single stem
Habit	prostrate/procumbent/semi-erect	**Category**	roots/tubers
Life span	biennial	**Plant attributes**	grown on large scale

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	shallow (20-50 cm)
Temperat. requir.	15	25	7	30	**Soil texture**	medium, organic	heavy, medium, light
Rainfall (annual)	400	700	250	1000	**Soil fertility**	high	low
Latitude	30	30	60	60	**Soil Al. tox**		
Altitude	-	-	-	2100	**Soil salinity**	low (<4 dS/m)	medium (4-10 dS/m)
Soil PH	6	6.8	5.5	8.5	**Soil drainage**	well (dry spells)	poorly (saturated >50% of year), well (dry spells), excessive (dry/moderately dry)
Light intensity	cloudy skies	clear skies	light shade	light shade	**Climate zone**	subtropical dry summer (Cs), subtropical dry winter (cw), temperate oceanic (do), temperate continental (dc)	
Photo-period	long day (>14 hours)						

Cultivation				
Product. system	large scale/commercial	**Crop cycle**	**Min**	**Max**
			60	140
Cropping system	**Subsystem**	**Companion species**	**Level of mechanization**	**Labor intensity**
permanent rainfed	ley cropping	maize, wheat, potato	high	medium
arable irrigated	ratoon cropping		high	medium

Uses		
Main use	**Detailed use**	**Used part**
food additive	sweetener	roots
animal food (feed)	sugar, starch, minerals	roots
animal food (feed)	minerals	leaves
food & beverage	sugar, starch, minerals	roots
fuels	alcohol	roots

21 Sugarcane

21.1 *Saccharum officinarum*, Linnaeus

Family	Liliopsida:Commelinidae:Cyperales:Gramineae
Common names	sugarcane, sugar cane, canna da zucchero, caña de azúcar, cana de acucar, Zuckerrohr, suikerriet, shenkora, dovu, dovu buta, dovu vico, malaqele, kabakabavale, ganna, te kaikawewe (Kiribati), to, tolo (Samoa, Tuvalu), peqi (Simbo), suti (Roviana), suga

Description: The sugar cane plant is a large perennial tropical grass with thick stems that may grow up to 2-3 meters tall, but with extended growing periods it can become much taller. The *stem* of sugarcane is *economically the most important* plant part. Contrary to most grasses, the stem is not hollow but filled, as in maize and sorghum. The terminal meristem of the cane shoot turns reproductive about 3 months before the emergence of the flower.

Uses: It provides *raw sugar*. Important by-products are bagasse, molasses, filter mud cakes, and cane wax. Bagasse is residue used as fuel, livestock feed, and for the manufacture of fiberboard, paper pulp, plastic, furfural, and cellulose. Molasses are fed to livestock, used for industrial purposes, in confectionary, and it is the source of industrial alcohol as well as rum and gin. Filter mud cakes are used as fertilizer. Cane wax is used in the production of furniture, shoe, and leather polishes, electrical insulating material, and waxed paper. Brazil is a major grower of sugarcane, which is used to produce sugar and provide the ethanol used in making gasoline-ethanol blends (gasohol) for transportation fuel.

Ecology: Seedlings may not tolerate -7 to -12°C, and the mature plant not -2°C. Long-term exposure to temperatures below 10°C may also be lethal. When temperatures reach 0°C leaves become chlorotic, at about -3°C young plants turn brown and the terminal buds and leaves of mature cane die, at -5.5°C the millable stem dies. When the temperature reaches -11.5°C the whole plant dies in susceptible clones. There are large varietal differences in cold tolerance and susceptibility to frost.

Growing period: Perennial, growing from 7-24 months, usually 14-18 months, with an additional 12 months for the ratoon crop. It is normally grown as a perennial crop in which several ratoons are taken.

Common names: Sugarcane, Nobel cane, Canne a sucre, Cana de azucar, Zuckerrohr.

Further information: For ripening relative low temperatures in the range of 10-20°C and dry weather are desirable. Sugarcane is photoperiod sensitive. Flowering is induced by a continuous reduction in day length of as little as 1 minute per day from long days of about 13 hours. Most commercial sugarcane is grown between 35°N and S in the tropics usually at altitudes from sea level to 1600 m. Nobel canes are native to islands in the South Pacific, most probably New Guinea. Cane us is considered to be moderately tolerant to saline soil conditions; electrical conductivity of the soil solution should be less than 2 d S m-1 with a threshold value of 4 d S m-1. It prefers moderate to high humidity and high winds cause damage and lower yields. Where sugarcane is grown under irrigation in Africa, a yield of 100-150 tons of cane/ha is obtained from the plant crop and 60-90 tons from the first ratoon crop. Under rain-fed conditions, about half of the above mentioned yield is obtained. Sugarcane is grown on over 20 million ha with an average yield of 64 t/ha to produce a total of 1,25 million t of cane. This is equivalent to about 130 million t of sugar if all the cane were used to produce sugar in moderately efficient factories. Centrifuged sugar production from cane is much less, as large quantities of cane are used to produce alcohol, particularly in Brazil as a liquid fuel.

Factsheet

Description			
Life form	grass	**Physiology**	-
Habit	-	**Category**	-
Life span	perennial	**Plant attributes**	-

Ecology

	Optimal		Absolute			Optimal	Absolute
	Min	Max	Min	Max	**Soil depth**	deep (>>150 cm)	medium (50-150 cm)
Temperat. requir.	24	37	15	41	**Soil texture**	-	-
Rainfall (annual)	1500	2000	1000	5000	**Soil fertility**	high	moderate
Latitude	-	-	30	33	**Soil Al. tox**		
Altitude	---	---	-	1600	**Soil salinity**	low (<4 dS/m)	medium (4-10 dS/m)
Soil PH	5	8	4.5	9	**Soil drainage**	-	-
Light intensity	very bright	very bright	very bright	clear skies	**Climate zone**	-	
Photo-period	-						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	-				**Killing temp.**	during rest	early growth
						-2	0

Cultivation

Product. system	-	Crop cycle	Min	Max
			210	365
Cropping system	**Subsystem**	**Companion species**	**Level of mechanization**	**Labour intensity**
arable irrigated	ley cropping	-	-	-

Uses

Main use	Detailed use	Used part
food additive	sweetener, condiment/seasoning	stems
food & beverage	minderals	stems, flower
material	paper, fibres	bark
animal food (feed)	minerals	stems
fuels	petroleum substitutes/alcohol	stems

22 Sunflower

22.1 *Helianthus annuus*, Linnaeus

Family	Magnoliopsida:Asteridae:Asterales:Compositae
Common names	sunflower, Italian girasole, cut-and-come-again, sonneblom, girasol, tournesol, girassol, xiangrikui, Sonnenblume, girasole, surajmukhi, zonnebloem, auringonkukka, Helianthi flos

Description: An erect, hirsute herb ranging from less than 1 m to more than 3.5 m in height, with a large flower head 10-30 cm in diameter. It has a strong taproot reaching a length of up to 3 m.

Uses: The seeds can be eaten fresh, roasted, or cooked and they can be extracted for oil. The oil is used for cooking, in the salad oil industry and for lighting. The expressed oil cake can be fed to livestock. Seeds have also been roasted and used as a substitute for coffee. Plant leaves are used as fodder and they have been used as a substitute for tobacco and for the manufacture of writing paper. A fiber is obtained from the stem. The flowers yield a yellow dye. Parts of the plant have medicinal properties.

Ecology: Subtropical varieties can stand -6 to -10°C at two-leaf stage but the plant is sensitive to frost at all other stages of growth.

Growing period: Annual herb, can be harvested from 90-160 days or from 70-200 days.

Common names: sunflower, tournesol, soleil, girasol, mirasol, sonnenblume.

Further information: Sunflower is thought to be indigenous to the western United States and the central highlands of Mexico. Sunflowers can be grown between 40°S and 55°N, but greatest production is between latitudes 20-50°N and 20-40°S and it can be grown at elevations up to 2600 m in the tropics, but best below 1500 m. It is generally shallow-rooted, though the giant types can reach as deep as 2.5 m. It can reach a height of 0.5 m to 3 or even 5 m depending on cultivar and cultural conditions. Photosynthesis pathway C 3 II. The crop prefers low to moderate humidity, and excessive rain during early and late crop stages encourages diseases. Many sunflower varieties are open-pollinated with bees usually being the main agents, and to ensure high seed set there must be a high insect population. The average yield of sunflower seed in the world is around 1.4 t/ha, in Africa it is about 0.9 t/ha. Yields of 2-5 t/ha can be obtained.

Factsheet

Description			
Life form	herb	**Physiology**	single stem, C3 photosynthesis
Habit	erect	**Category**	materials, ornamental/turf
Life span	annual	**Plant attributes**	grown on large scale

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	medium (50-150 cm)
Temperat. requir.	17	34	5	45	**Soil texture**	medium, light	heavy, medium, light
Rainfall (annual)	600	1000	300	1600	**Soil fertility**	high	low
Latitude	20	-	50	55	**Soil Al. tox**		
Altitude	---	---	-	2600	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	6	7.5	5.5	8	**Soil drainage**	well (dry spells)	well (dry spells)
Light intensity	very bright	very bright	very bright	clear skies	**Climate zone**	tropical wet & dry (Aw), steppe or semiarid (Bs), subtropical humid (Cf), subtropical dry summer (Cs), subtropical dry winter (Cw), temperate oceanic (Do), temperate continental (Dc), temperate with humid winters (Df), temperate with dry winters (Dw)	
Photo-period	-						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	-				**Killing temp.**	**during rest**	**early growth**
						-10	0

Cultivation				
Product. system	large scale/commercial	**Crop cycle**	**Min**	**Max**
			70	200
Cropping system	**Subsystem**	**Companion species**	**Level of mechanization**	**Labour intensity**
permanent rainfed	sole cropping	-	high	low

Uses		
Main use	**Detailed use**	**Used part**
material	essential oils, fibres, lipids/oil & fats	seeds
animal food (feed)	minerals, vitamins	seeds
environmental	ornamental/turf	entire plant
medicinal	digestive system applications	seeds, flowers
fuels	petroleum substitutes/alcohol	seeds

23 Tea

23.1 *Camellia sinensis*, Linnaeus, O. Kuntz

Family	Magnoliopsida:Dilleniidae:Theales:Theaceae
Scientific Synonym	*C. thea, C. theifera, Thea sinensis, T. bohea, T. viridis*
Common names	tea, ti, chah, cha, tee

Description: Tea is a woody shrub with pale - dark green leaves under natural conditions reaching a height of 5-15 m. In cultivation it is usually trimmed to 1-2 m tallThe true leaves are persistent, alternate with short pedicels 5-10 mm long. Flowers are pedicellate and develop from leaf axils on young branches and are either solitary or in clusters of 2-3. Tea is practically allogamous and pollination is by insects and wind. Fruits are capsules with loculicidal dehiscence and are 1-1.5 cm long and 2-3 cm in diameter with 1 to even 5 loculi, each with 2 seeds. Seeds are spherical to hemispherical, 0.8-1.6 cm in diameter and smooth and brown when mature. There are 400-600 seeds to the kilo.

Uses: Depending on whether the leaves undergo fermentation the tea is black or green. Green leaves are steamed and *dried* to produce *green tea* or leaves are withered, fermented, and dried to provide black tea. It has a *stimulant effect* due to caffeine. Steam distillation of black tea yields an essential oil. Tea extract is used as a flavour in alcoholic beverages, frozen dairy desserts, candy, baked goods, gelatins, and puddings. Refined tea seed oil is suitable for use in manufacture of oil for burning purposes, and in all respects is considered a favourable substitute for rapeseed, olive, or lard oils. The oil is different from cottonseed, corn, or sesame oils in that it is a non-drying oil and is not subject to oxidation changes, thus making it very suitable for use in the textile industry; it remains liquid below -18°.C. Tea is a potential source of food colours (black, green, orange, yellow, etc.).

Ecology: 0 to -5°C depending on the cultivar, var. sinensis withstands -5°C, whereas the leaves of var. assamica are killed by 0°C.

Growing period: Perennial. Harvest of leaves may begin after 2-5 years and reaches a maximum at 7-10 years. The growth cycle is 240-365 days, fruits takes 270-360 days to mature and seeds are normally produced after 4-5 years. The economic life of the plant is about 40 years, but sometimes the shrubs are kept in production 60-70, or even 100 years.

Common names: Tea, The, Te, Tee, Tsa.

Further information: Tea can be grown in subtropical lowland and up to about 1800 m or even 2400-3000 m in the tropics, but the majority of the production takes place between 750 and 1500 m. Tea originates in the mountains of Southeast Asia, it is now grown between 40°N and 33°S. Hail can cause great damage and windbreaks are beneficial. To low and too high humidity can reduce yields and encourage disease. Harvesting: Terminal sprouts with 2-3 leaves are usually hand-plucked, 10 kg of green shoots (75-80% water) produce about 2.5 kg of dried tea. Bushes are plucked every 7-15 days, depending on the development of the tender shoots. One ton of tea removes 45-60 kg N, 4-7 kg P and 20-30 kg K from the field. Optimum yield is about 3.0 t/ha, in Africa average yields are between 0.5-2.0 t/ha. Because most tea plants are grown on hillsides, erosion control is often necessary.

Factsheet

Description			
Life form	shrub	**Physiology**	evergreen, multi stem
Habit	erect	**Category**	materials, medicinals & aromatic
Life span	perennial	**Plant attributes**	grown on large scale

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	deep (>>150 cm)	medium (50-150 cm)
Temperat. requir.	20	30	8	35	**Soil texture**	heavy, medium, light	heavy, medium, light
Rainfall (annual)	1400	2000	1000	5000	**Soil fertility**	high	moderate
Latitude	-	-	27	43	**Soil Al. tox**		
Altitude	---	---	-	2200	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	4.5	5.5	4	6	**Soil drainage**	well (dry spells)	well (dry spells), excessive (dry/moderately dry)
Light intensity	very bright	clear skies	very bright	light shade	**Climate zone**	ropical wet & dry (Aw), tropical wet (Ar), subtropical humid (Cf)	
Photo-period	short day (<12 hours), neutral day (12-14 hours), long day (>14 hours)						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	mono culture may cause erosion problems				**Killing temp.**	**during rest**	**early growth**
						-5	0

Cultivation				
Product. system	large scale/ commercial	**Crop cycle**	**Min**	**Max**
			240	365
Cropping system	**Subsystem**	**Companion species**	**Level of mechanization**	**Labour intensity**
perennial cropping	ley cropping	-	low	high

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	minerals	leaves
material	lipids/oil & fats	leaves
medicinal	muscular/skeletal applications, nervous system applications	leaves

23.2 *Hibiscus cannabinus*, Linnaeus

Family	Magnoliopsida:Dilleniidae:Malvales:Malvaceae
Synonyms	*Abelmoschus verrucosus (Guill. & Perr.) Walp., Furcaria cavanillesii Kostel, Hibiscus unidens Lindl., Hibiscus verrucosus Guill. & Perr., Ketmia glandulosa Moench*
Common names	kenaf, ambary, ambary hemp, brown Indian hemp, mesta hemp, bastard jute, bimli jute, bimlipatum jute, bimlipatam tree, hemp-mallow, mesta, palungi, deccan hemp, ambari, til, teel, teal, Java jute, umbaru, linho de gombo, canhamo brasileiro, papoula de Sao

Description: An erect, herbaceous, single stemmed plant that can reach 1-5 m in height. The flowers are red or yellow with a bright red centre.

Uses: It is mainly grown as a fiber crop. The fiber is used for ropes, bags, cordages, and carpet yarns and it can also be used as pulp fiber. The seeds contain an oil that is used in lubricants, soaps, linoleum, and paint. Young plants can be used as *fodder* and young leaves are used as potherbs. The dried stems can be used as *fuel*.

Growing period: Cultivated forms are erect herbaceous annuals, growing 100-240 days, can be harvested for fodder after 100 days and for fibre after 120-150 days.

Common names: Kenaf, Bimli, Bimlipatum jute, Deccan hemp.

Further information: Kenaf is most probably native of Africa. It can be grown between latitudes 45°N and 30°S and can be found at altitudes up to 1250 m or more. It is adapted to a relative air humidity range of 68-82%. It will flower on a shortening day of 12.5 hours or less. High winds and heavy rain, especially when the crop is near maturity may cause much lodging. Total production of green plants may be about 36 t/ha, yields of fodder from 10-14 t/ha and fiber yields may be 1-6 t/ha. Annual seed yields may be about 350-400 kg/ha. Kenaf has a low resistance to nematodes.

Factsheet

Description			
Life form	herb, sub-shrub	**Physiology**	multi stem
Habit	erect	**Category**	materials
Life span	annual	**Plant attributes**	grown on large scale, grown on small scale

Ecology

	Optimal		Absolute			Optimal	Absolute
	Min	Max	Min	Max	**Soil depth**	deep (>>150 cm)	medium (50-150 cm)
Temperat. requir.	15	28	10	35	**Soil texture**	medium, organic	heavy, medium, light
Rainfall (annual)	600	2000	450	3000	**Soil fertility**	high	moderate
Latitude	-	-	35	40	**Soil Al. tox**		
Altitude	---	---	-	1000	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	6	7.5	4.3	8.2	**Soil drainage**	well (dry spells)	well (dry spells), excessive (dry/moderately dry)
Light intensity	very bright	very bright	very bright	cloudy skies	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar), steppe or semiarid (Bs), subtropical humid (Cf), subtropical dry summer (Cs), subtropical dry winter (Cw), temperate oceanic (Do), temperate continental (Dc), temperate with humid winters (Df), temperate with dr	
Photo-period	short day (<12 hours)						

Cultivation

			Min	Max
Product. system	-	**Crop cycle**	100	240

Uses

Main use	Detailed use	Used part
material	fibres, lipids/oil & fats, dye/tannin	bark, seeds
food & beverage	-	seeds
food additive	condiment/seasoning, petroleum substitutes/alcohol	leaves
fuels	fuelwood	entire plant
animal food (feed)	-	seeds

23.3 *Tectona grandis*, L. f.

Family	Magnoliopsida:Asteridae:Lamiales:Verbenaceae
Common names	teak, tiki

Description: A medium to tall deciduous tree usually 25-30 m tall and 1 m in trunk diameter. However, under favorable conditions the tree can reach a height of 50 m and a diameter of 2 m. On good sites it often develops a tall clean cylindrical bole buttressed at the base.

Uses: The timber is very strong and of high quality, remarkable for its constancy under changes of temperature and moisture. It is used for ship decks, bridges, wharves, railway carriages, wagons, shingles, wheels, carving, general carpentry, veneer, plywood, poles, fence posts, fuel and charcoal. Leaves, seeds and bark have medicinal properties. Leaves contain some tannin and bark dye. It is used for reforesttation and mentioned as a possible agroforestry species.

Ecology: Usually teak may not withstand 3°C, but in some places, in the northern part of its geografical occurrence, it is recorded to tolerate mild frost.

Growing period: Perennial. It can be grown with a rotation period of 30-60 years. On good sites with deep soils it may withstand a dry season of 4-6 months.

Common names: Teak, Tec, Teca, Sagun, Sagwan, Sag, Tegu, Tegina, Teku, Thekku, Kyun, Yati, Ajate, Dati, Djati, Jate, Hadlajate, Dalanang, Kalayati, Sagunyate.

Further information: Teak is native of Southeast Asia. It is usually found on hilly terrain but it may also occur at plains and alluvial flats at elevations from sea level to 900 m. The latitudinal range of natural occurrence is 10-25°N. Teak often leads to soil erosion in pure stands. Young trees should be protected against high winds. The tree is fire resistant when mature. Annual wood production potential is 6-18 m3/ha.

Factsheet

Description			
Life form	tree	**Physiology**	deciduous, single stem
Habit	erect	**Category**	ornamentals/turf, medicinals & aromatic, forest/wood, environmental
Life span	perennial	**Plant attributes**	grown on large scale

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	deep (>>150 cm)	medium (50-150 cm)
Temperat. requir.	22	32	14	43	**Soil texture**	medium	heavy, medium
Rainfall (annual)	1200	3000	500	4000	**Soil fertility**	high	moderate
Latitude	10	10	25	25	**Soil Al. tox**		
Altitude	---	---	-	1200	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	6	7.5	4.5	8.5	**Soil drainage**	well (dry spells)	well (dry spells)
Light intensity	very bright	very bright	very bright	clear skies	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar), steppe or semiarid (Bs)	
Photo-period	short day (<12 hours)						
Abiotic toler.	fire				**Abiotic suscept.**	wind	
Introduction risks	mono culture may cause erosion problems				**Killing temp.**	**during rest**	**early growth**
						3	3

Cultivation				
Product. system	-	**Crop cycle**	**Min**	**Max**
			180	270
Cropping system	**Subsystem**	**Companion species**	**Level of mechanization**	**Labour intensity**
perennial cropping	inter-culture	soy bean	-	-

Uses		
Main use	**Detailed use**	**Used part**
material	timber wood, dye/tannin	bark, leaves, stems
fuels	fuelwood, charocal	bark
medicinal	-	leaves, seeds, stems
environmental	revegetation, agroforestry, ornamental/turf	entire plant

24 Tobacco

24.1 *Nicotiana tabacum*, Linnaeus

Family	Magnoliopsida:Asteridae:Solanales:Solanaceae
Common names	tobacco, cultivated tobacco, tabac, Tabak, tabacco, tavako, tapaka, tabaco, tabaco de cultura, erva-santa, erva do Grao Prior

Description: A herbaceous or woody shrub-like plant reaching a height of up to 2-3 m. When young the plant has a rosette-like growth habit, but later produces a stout, erect main axis about 1.5 m tall. The stem bears large, simple, ovate leaves arranged spirally. The leaves vary in size, thickness and texture. They may be up to 50 cm long and the number of leaves is about 20-30. The nicotine content is highest in the uppermost leaves.

Uses: The leaves are cured and dried and used for tobacco cigarettes and cigars, snuff, and as a source of nicotine for insecticides.

Ecology: Very sensitive to frost and the duration of the frost-free period is an important production factor. Have been recorded to tolerate -3°C.

Growing period: Annual, or short-lived perennial. Normally grown as an annual. Growing 40-60 days in nursery, about 70-120 days from transplanting to harvest in the tropics and 100-150 days in temperate climates.

Common names: Tobacco.

Further information: In the tropics, tobacco can be grown at elevations between 800-1800 m, and it can be grown between 60°N and 40°S. In advanced stages of growth the tobacco leaves can be severely damaged be hail, heavy rain or strong winds. The crop require dry weather when the leaves are maturing, but a prolonged dry period in this period may cause secondary growt

Factsheet

Description			
Life form	herb	**Physiology**	multi stem, C3 photosynthesis
Habit	erect	**Category**	materials
Life span	annual, biennial	**Plant attributes**	grown on large scale

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	deep (>>150 cm)	medium (50-150 cm)
Temperat. requir.	15	30	7	35	**Soil texture**	medium, light	heavy, medium, light
Rainfall (annual)	500	750	350	3000	**Soil fertility**	moderate	moderate
Latitude	-	10	40	60	**Soil Al. tox**		
Altitude	---	---	-	1800	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	5	6.5	4.5	7.5	**Soil drainage**	well (dry spells)	well (dry spells)
Light intensity	very bright	very bright	very bright	light shade	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar), steppe or semiarid (Bs), subtropical humid (Cf), subtropical dry summer (Cs), subtropical dry winter (Cw), temperate oceanic (Do), temperate continental (Dc), temperate with humid winters (Df), temperate with dr	
Photo-period	short day (<12 hours), neutral day (12-14 hours)						
Abiotic toler.	-				**Abiotic suscept.**	hail, wind	
Introduction risks	-				**Killing temp.**	**during rest**	**early growth**
						-3	-1

Cultivation				
Product. system	-	**Crop cycle**	**Min**	**Max**
			70	150

Uses		
Main use	**Detailed use**	**Used part**
poison	insects	leaves
material	essential oils	leaves
social	smoking material	leaves

25 Wheat

25.1 *Triticum aestivum*, Linnaeus

Family	Liliopsida:Commelinidae:Cyperales:Gramineae
Synonyms	*Triticum hybernum L., Sp. Pl. 86 (1753), Triticum sativum Lam., Fl. Franç. 3: 625 (1778), Triticum vulgare Vill., Hist. Pl. Dauphiné 2: 153 (1783), Triticum cereale Schrank, Baier. Fl. 1: 387 (1789)*
Scientific Synonym	*T. cereale Schrank, Baier., T. hybernum L., T. sativum Lam., T. vulgare*
Common names	wheat, bread wheat, blé, alkamh, sinde, xiao mai, trigo, brödvete, vanligt vete, kveite, almindelig hvede, leipävehnä, vehnä, hveiti

Description: Wheat is an hexaploid annual grass; culms are simple, erect, hollow or pithy, glabrous, up to 1.2 m tall; Its leaves are flat, narrow, 20-38 cm long and about 1.3 cm broad. The caryopsis is a dry indehiscent fruit. The dorsal side is smoothly rounded while the ventral side has the deep crease. Wheat is a self-pollinating crop with a very low percentage of cross-pollination - from 1-4%.

Uses: Wheat is one of the most *important food* plants of man. It enters into international trade more than any other food. The economic stability of many nations is affected by the exchange in wheat. Wheat is utilized mainly as flour for the production of a large variety of leavened and flat breads, and for the manufacture of a wide variety of other baking products such as biscuits, and confectionary. Fermented grains are made into various alcoholic drinks and industrial alcohol. Starch is used as cloth-stiffeners. Straws are fed to livestock, used for animal bedding and used in basketry and woven products. According to the phytomass files, annual productivity ranges from 4 to 18 MT/ha. Chaff is estimated to constitute 25% of the grain. Wheat straw is calculated at 1/2-2 times grain yield, more frequently, 1-1/2 times. However, in some countries, wheat biomass averages more than 6 MT/ha, double this if double cropped. The highest phytomass figure is 18 MT/ha/yr.

Ecology: Winter wheat may withstand -20°C in the early and dormant stages, later it is like spring wheat and is sensitive to frost.

Growing period: Some cultivars of wheat are winter annual (winter wheat) and are sown in the autumn others are annual and sown in the spring (spring wheat). Normally the severity of the winter determines whether winter or spring types are grown. If winters are severe spring types are used, if winters are less cold, winter cultivars are grown. Sown in the autumn it may be harvested after 180-250 days, sown in the spring it may require 90-130 days.

Common names: Common wheat, wheat, bread wheat, blé, trigo, weizen.

Further information: Wheat is grown from the tropics to 60°N and 40°S. In temperate regions and in the subtropics it can be grown at altitudes from sea level to 3000 m, in the tropics between 1500-3700 m or where suitable conditions exist in the lowlands. In the tropics and subtropics, it is grown only during the winter season. Principal wheat-growing areas of the world have similar growing conditions: all have fertile dark soils rich in nitrogen; rather hot, cloudless summers; rainfall which, although low, is well-distributed. A good wheat soil has physical structure, which holds together, making good water retention and favorable conditions for nitrate formation. Hot, humid conditions are unfavorable for wheat growing. Wheat prefers a low humidity of about 10%; high humidity encourages disease infestation, especially in combination with high temperatures. The optimum yield of grain in temperate regions is 6.3 t/ha; the optimum yield in the tropics is 2.5 t/ha, while the average yield in Africa is 1.5 t/ha.

Factsheet

Description			
Life form	grass	**Physiology**	single stem, C3 photosynthesis
Habit	erect	**Category**	cereals & pseudocereals, forage/pasture, medicinals & aromatic
Life span	annual	**Plant attributes**	grown on large scale

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	shallow (20-50 cm)
Temperat. requir.	15	23	5	27	**Soil texture**	medium, organic	heavy, medium
Rainfall (annual)	750	900	300	1600	**Soil fertility**	high	moderate
Latitude	30	-	60	65	**Soil Al. tox**		
Altitude	---	---	-	4500	**Soil salinity**	low (<4 dS/m)	medium (4-10 dS/m)
Soil PH	6	7	5.5	8.5	**Soil drainage**	well (dry spells)	well (dry spells)
Light intensity	very bright	very bright	cloudy skies	very bright	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar), desert or arid (Bw), steppe or semiarid (Bs), subtropical humid (Cf), subtropical dry summer (Cs), subtropical dry winter (Cw), temperate oceanic (Do), temperate continental (Dc), temperate with humid winters (D	
Photo-period	neutral day (12-14 hours), long day (>14 hours)						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	-				**Killing temp.**	**during rest**	**early growth**
						-20	0

Cultivation				
Product. system	large scale/ commercial	**Crop cycle**	**Min**	**Max**
			90	250
Cropping system	**Subsystem**	**Companion species**	**Level of mechanization**	**Labour intensity**
permanent rainfield	sole cropping	-	-	-

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	starch, vitamins, minerals, protein	seeds
animal food (feed)	strach, vitamins, minerals, protein	seeds, leaves
material	paper, gums/resins	leaves
fuels	non-wood fuel	leaves
medicinal	skin applications, genitourinary system applications, immune system applications, digestive system applications	seeds

25.2 *Triticum spelta*, Linnaeus

Family	Liliopsida:Commelinidae:Cyperales:Gramineae
Common names	spelt wheat, wheat - spelt, farro, dinkel, German wheat

Factsheet

Description							
Life form	grass				**Physiology**	-	
Habit	erect				**Category**	cereals & pseudocereals, forage/pasture	
Life span	annual				**Plant attributes**	grown on small scale	
Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	shallow (20-50 cm)
Temperat. requir.	10	17	4	24	**Soil texture**	light	medium, light
Rainfall (annual)	700	1000	300	1600	**Soil fertility**	moderate	moderate
Latitude	-	-	-	-	**Soil Al. tox**		
Altitude	---	---	-	-	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	6.5	7.5	5	8.3	**Soil drainage**	well (dry spells)	well (dry spells), excessive (dry/moderately dry)
Light intensity	very bright	clear skies	very bright	cloudz skies	**Climate zone**	steppe or semiarid (Bs), temperate oceanic (Do), temperate continental (Dc), temperate with humid winters (Df), temperate with dry winters (Dw)	
Photo-period	long day (>14 hours)						

Cultivation				
Product. system	-	**Crop cycle**	**Min**	**Max**
			120	180

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	starch, vitamins, minerals	seeds
animal food (feed)	vitamins, minerals	entire plant

26 Yam

26.1 *Amorphophallus paeoniifolius*, Dennst. Nicolson

Family	Liliopsida:Arecidae:Arecales:Palmae
Synonyms	*Amorphophallus campanulatus Blume*
Scientific Synonym	*Amorphophallus campanulatus*
Common names	elephant foot yam, elephant yam, yam

Description: A herb growing up to 1.25 m in height. Its tubers are large, flattened yellow or brown, 20-25 cm in diameter, with central depression. The tubers are formed underground, 5-10 being produced from the main tuber. The leaf blads are 30-80 cm in length with a 50-80 cm long petiole.

Uses: The tubers of cultivars with smooth leaf stalks are used as boiled vegetable, the calcium oxalate crystals present are removed by extensive washing or boiling. The young petrioles are used as a cooked vegetable.

Growing period: Perennial herb. The crop matures in 220-350 days. The corms have a dormancy period of 60-90 days, and after 3 years of growth, the corms weigh 7-9 kg and are marketable.

Common names: Elephant yam, Elephant foot yam, Giantarum, Sweet yam, Suran, Arsaghna, Balukund, Kidaran, Telinga potato, Zaminkund, Chena, Karak-kavanai, Ilis-ilis, Kand godda, Sooweg, Waloor, Anto, Oroy, Pangapong, Tigi, Koe, Konjac, Konniaku, Mo-yu.

Further information: Elephant yam grows wild in southeast Asia, extending to Java, the Philippines and the Pacific. Most production occurs at altitudes below 1000 m. Yields of 20 t/ha have been reported from India.

Factsheet

Description				
Life form	herb	**Physiology**	single stem	
Habit	erect	**Category**	vegetables	
Life span	perennial	**Plant attributes**	grown on small scale	

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	deep (>>150 cm)	medium (50-150 cm)
Temperat. requir.	28	35	25	40	**Soil texture**	medium, organic	medium, organic
Rainfall (annual)	1000	1500	900	1800	**Soil fertility**	moderate	low
Latitude	-	-	20	20	**Soil Al. tox**		
Altitude	---	---	-	1000	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	5.5	6.2	5	7.5	**Soil drainage**	well (dry spells)	well (dry spells), excessive (dry/moderately dry)
Light intensity	clear skies	clear skies	cloudy skies	very bright	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar)	
Photo-period	short day (<12 hours)						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	-				**Killing temp.**	**during rest**	**early growth**
						5	0

Cultivation				
Product. system	-	**Crop cycle**	**Min**	**Max**
			220	350

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	vitamins, minerals	roots, leaves

26.2 *Dioscorea alata*, Linnaeus

Family	Liliopsida:Liliidae:Dioscoreales:Dioscoreaceae
Synonyms	*Dioscorea rubella, Dioscorea atropurpurea Roxb., Dioscorea purpurea Roxb., Dioscorea sativa Del.*
Scientific Synonym	*D. atropurpurea, D. purpurea, D. sativa, D. vul- garis, D. javanica*
Common names	cultivated yam, greater yam, white yam, water yam, winged yam, ten-months yam, Malacca yam, Guyana arrowroot, igname, inhame da India, inhame de Coriola'

Description: It has a thin, twining, winged but spineless stem, broad leaves, and a shallow fibrous root system. The vine may reach a lenght of 2-30 m. Tubers usually weigh 5-10 kg but up to 60 kg have been recorded. USES The roots are baked, boiled, roasted, fried, or used raw as a salad vegetable. The roots are a good source of carbohydrates.

Growing period: Perennial, if cultivated tubers may be harvested (220-240)-300 days from planting. The tubers have a dormancy period of 120-160 days.

Common names: Greater yam, Yam, White yam, Winged yam, Water yam, Ten months yam, Water yam, Asiatic yam, Igname, Igname de Chine, Name, Kachil, Katula, Ratula, Sakourou,Khanulu, Ubi kemali, Ovy, Uwi, Obbi, Oewi, Oowi kelapa, Ubi.

Further information: Greater yam can be grow in the tropics at elevation between 15-1000 m, although some cultivars have been reported to thrive at elevations up to about 2500 m. The common latitudinal range is 23°N to 20°S. It can grow in both dry and humid areas. A daylength of less than 12 hours is required for tuberization, but daylengths longer than 12 hours are necessary for adequate vine development. The species is indigenous to South-East Asia. Yields between 7-25 t/ha have been recorded. Mentioned as a useful agroforestry species.

Factsheet

Description			
Life form	vine	**Physiology**	deciduous, multi stem
Habit	climber/scrambler/scadent	**Category**	roots/tubers, environmental
Life span	perennial	**Plant attributes**	grown on small/large scale

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	deep (>>150 cm)	medium (50-150 cm)
Temperat. requir.	20	32	14	40	**Soil texture**	medium, light	medium, light
Rainfall (annual)	1200	4000	700	8000	**Soil fertility**	high	moderate
Latitude	-	-	30	40	**Soil Al. tox**		
Altitude	---	---	-	2500	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	5.5	6.5	4.8	8.5	**Soil drainage**	well (dry spells)	well (dry spells)
Light intensity	very bright	clear skies	very bright	light shade	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar), subtropical humid (Cf), subtropical dry summer (Cs)	
Photo-period	short day (<12 hours)						
Abiotic toler.	-				**Abiotic suscept.**	-	
Introduction risks	-				**Killing temp.**	**during rest**	**early growth**
						-2	9

Cultivation				
Product. system	-	**Crop cycle**	**Min**	**Max**
			220	300

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	starch, vitamins, protein, minerals	roots
animal food (feed)	starch, protein, vitamins	roots
non-vertebrate food	minerals	roots
environmental	agroforestry	entire plant

26.3 *Oxalis tuberose*, Molina

Family	Magnoliopsida:Rosidae:Geraniales:Oxalidaceae
Synonyms	*Oxalis crenata*
Scientific Synonym	*O. crenata*
Common names	oca, sorrel, oxalis, truffette acide, knollen sauerklee, oqa, okka, okta (Quechua), apiha, apilla, kawi (Aymara), ibia (Colombia), ruba, timbo, quiba (Venezuela), papa roja, papa colorada (Mexico), huisisai, ibias (South America), kao, yam (NZ)

Description: A herbaceous plant first erect and later prostate. The tubers are claviform-ellipsoid and cylindrical, with buds on the whole surface and varigated in white, yellow, red and purple colours. The leaves are trifoliate, with petrioles of 2-9 cm in length.

Uses: The tuber is first sun-dried to make it sweeter and the parboiled or roasted. It can also be grounded into flour and used in porridges and desserts.

Ecology: Frost kills back its foliage, however, the plant's tubers have exceptional regenerative capacity.

Growing period: Perennial, normally grown as an annual. Tubers can be harvested after about 8 months.

Common names: Oca, Oxalis, New Zealand yam, Oqa, O'qa, Ok'a, Okka, Apina, Apilla, Kawi, Ibia, Quiba, Cuiba, Huisisai, Ibias, Papa roja, Sorrel, Kao, Truffette acide, Knollen-sauerklee, Ruba, Timbo, Papa colorado.

Further information: Oca is native of the Andean Mountains in South America. In New Zealand, it can be grown near sea level and in the Andean mountains at elevations from 2800 to 4200 m. Require days shorter than 12 hours to initiate tuber formation. Yields may be up to 40-50 t/ha of fresh tuber or 6-7 t/ha of dry matter.

Factsheet

Description			
Life form	herb	**Physiology**	singel stem
Habit	erect	**Category**	roots/tubers
Life span	annual, perennial	**Plant attributes**	grown on small scale

Ecology

	Optimal		Absolute			Optimal	Absolute
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	medium (50-150 cm)
Temperat. requir.	12	24	5	28	**Soil texture**	medium, light	heavy, medium, light
Rainfall (annual)	800	1300	570	2150	**Soil fertility**	high	moderate
Latitude	-	-	30	40	**Soil Al. tox**		
Altitude	---	---	-	4000	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	6	7	5.3	7.8	**Soil drainage**	well (dry spells)	well (dry spells)
Light intensity	very bright	clear skies	very bright	cloudy skies	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar), subtropical humid (Cf), subtropical dry summer (Cs), subtropical dry winter (Cw), temperate oceanic (Do), temperate continental (Dc), temperate with humid winters (Df), temperate with dry winters (Dw)	
Photo-period	short day (<12 hours)						

Cultivation

Product. system	small scale (maual)	**Crop cycle**	**Min**	**Max**
			180	270
Cropping system	**Subsystem**	**Companion species**	**Level of mechanization**	**Labour intensity**
permanent rainfed	inter cropping	ullucu, mashua, potato, maize	low	medium

Uses

Main use	Detailed use	Used part
food & beverage	vitamins, starch	roots

26.4 *Pachyrhizus erosus*, Linnaeus, Urban

Family	Magnoliopsida:Rosidae:Fabales:Leguminosae
Synonyms	27 *Pachyrrhizus erosus (L.) Urban, Pachyrhizus angulatus Rich. ex DC. nom. illeg., Pachyrhizus bulbosus Kurz. nom. illeg., Pachyrrhizus bulbosus (L.) Kurz., Cacara erosa Kuntze., Dolichos bulbosus L., Dolichos erosus L*
Common names	Wayaka yam bean, Mexican yam bean, yam bean, Mexican turnip, chop-suey bean, manioc bean, three-lobed-leaved yam bean

Description: A herbaceous climbing or trailing vine reach a length of 2-6 m. Roots tuberous, turnip-shaped to elongated. The tubers of cultivars may be up to 30 x 25 cm, with light to dark brown skin and white, whitish yellow or reddish flesh. Leaves trifoliate and fruits oblong, flat, 6-13 x 0.8-1.7 cm, slightly to deeply contracted between the seeds.

Uses: The young crunchy tubers are sliced and eaten raw and also the young pods can be used as a vegetable. The leaves, mature seeds and pods contain a toxic glycoside, the roots and mature seeds contain rotenone and may be useful as an insecticide and fish poison, but can also be toxic to humans. The entire plant can be used as fodder for cattle and pigs and also as green manure.

Growing period: Climbing perennial vine. Immature pods are ready for harvest about 200-240 days from sowing and tubers may be harvested after 150-270 days, before they become fibrous. Seed crops takes about 300 days to mature. In warmer parts of Mexico with loght, rich soil, mature tubers are commenly harvested after only 90 days.

Common names: Yam bean, Potato bean, Dolique bulbeux, Pois batate, Jicama de agua, Sankalu, Sankeh alu, Ubi sengkuang, Pre-myit, Bangkoewang, Bengkuwang, Benkaway, Besusu, Huwi hiris, Sengkuwang, Bunga, Frijol name, Sinkamas, Singkong, Kamah, Kamas, Peek kuek, Pe kuek, Man phau, Man kaeo, Hua pae kua, Man laao, Cu san, Cu dau, Fan-ko, Sha Kot%2

Factsheet

Description			
Life form	herb, vine	**Physiology**	multi stem
Habit	climber/scrambler/scadent	**Category**	pulses (grain legumer), roots/tubers, forage/pasture, environmental
Life span	annual, perennial	**Plant attributes**	grown on small/large scale

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	deep (>>150 cm)	medium (50-150 cm)
Temperat. requir.	20	30	15	36	**Soil texture**	medium, light	heavy, medium, light, wide, organic
Rainfall (annual)	1300	1700	250	7000	**Soil fertility**	high	low
Latitude	10	-	20	25	**Soil Al. tox**		
Altitude	---	---	-	1750	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	6.5	8	4.3	8	**Soil drainage**	-	-
Light intensity	clear skies	very bright	cloudy skies	very bright	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar), steppe or semiarid (Bs), subtropical humid (Cf), subtropical dry summer (Cs), subtropical dry winter (Cw)	
Photo-period	short day (<12 hours), neutral day (12-14 hours)						

Cultivation				
Product. system	home garden, small scale (manual)	**Crop cycle**	**Min**	**Max**
			0	0
Cropping system	**Subsystem**	**Companion species**	**Level of mechanization**	**Labour intensity**
arable irrigated	inter cropping	maize, common bean	low	low
arable irrigated	sole cropping	-	low	low
arable irrigated	ratoon cropping	maize, common bean, onion	low	low
arable irrigated	inter-planting	rice	low	low

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	vitamins, minerals, protein	roots, fruits
animal food (feed)	vitamins, minerals, protein	roots, entire plant
poison	fish, insects, mammals	leaves, bark, fruits
environmental	manure/fertilizer	entire plant

27.1 *Pimenta dioica*, Linnaeus, Merrill

Family	Magnoliopsida:Rosidae:Myrtales:Myrtaceae
Synonyms	*Pimenta officinalis Lindl.*
Scientific Synonym	*Myrtus pimenta, Eugenia pimenta, Pimenta officinalis*
Common names	allspice, pimento, pimienta gorda, piment, kryddpeppar, pepe di Giamaica, pimenta-da-Jamaica, yamayski pyerets, bahar

Growing period: Perennial evergreen tree, that may come into bearing in 5-10 years, require 20-25 years for full harvest and with an economical life of about 50 years. Can be harvested every third year. The berries mature in 90-120 days and berries and leaves are usually not harvested from the same tree.

Common names: Pimento, Allspice, Jamaican pepper.

Further information: Pimento is native of the Caribbean and Central America. In Jamaica pimento can be found at elevations between sea level and 1000-1500 m, but it does best below 330 m. The tree can reach up to 9 m in height. Young trees 10-15 years old may yield up to 23-60 kg of green pimento berries in a good year, but fail to crop in a bad year. Average yield is about 5 kg per tree. Mentioned as a useful agroforestry species.

Factsheet

Description				
Life form	tree	**Physiology**	evergreen, single stem	
Habit	erect	**Category**	fruits & nuts	
Life span	perennial	**Plant attributes**	grown on small scale	

Ecology							
	Optimal		**Absolute**			**Optimal**	**Absolute**
	Min	Max	Min	Max	**Soil depth**	medium (50-150 cm)	shallow (20-50 cm)
Temperat. requir.	15	32	10	35	**Soil texture**	heavy, medium, light	heavy, medium, light
Rainfall (annual)	1500	2500	1000	3500	**Soil fertility**	moderate	moderate
Latitude	12	10	28	30	**Soil Al. tox**		
Altitude	---	---	-	1000	**Soil salinity**	low (<4 dS/m)	low (<4 dS/m)
Soil PH	7	7.5	6.3	8	**Soil drainage**	well (dry spells)	well (dry spells)
Light intensity	clear skies	cloudy skies	very brgiht	cloudy skies	**Climate zone**	tropical wet & dry (Aw), tropical wet (Ar)	
Photo-period	short day (<12 hours)						

Cultivation				
Product. system	-	**Crop cycle**	**Min**	**Max**
			150	365

Uses		
Main use	**Detailed use**	**Used part**
food & beverage	vitamins, minerals	leaves, fruits, seeds
food additive	condiment/seasoning	fruits
materil	lipids/oil & fats	seeds
environmental	agroforestry	entire plant