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An archive of general information on the variety of internationally traded oilseeds, which have been compiled by experts in these commodities

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Coconut

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The Coconut Palm – Tree of Life

The coconut palm (Cocos nucifera, L) is commonly called the "Tree of Life" because of its myriad uses. All parts of the palm, from the roots to the leaves and particularly its fruit, have special uses as a provider of food, beverage, shelter, animal feed and as an important raw material for various industries like the oleochemical industry. Traditionally, it requires little attention throughout its life span of over 50 years, thus the reference as a "lazy man's crop". Commercial farms, however, are tended and developed for improved productivity. The coconut palm reaches a height of 20 metres or higher for the tall varieties, while dwarf varieties grow up to 3 metres upon maturity. The palm is propagated through seednuts, normally from elite parents. These are stored in a shade to germinate in loose and friable soil provided with adequate moisture and drainage facilities. The sprouted seednuts are transferred into polybags to allow proper selection of seedlings. Furthermore, the seedlings in polybags are protected from shock and other damages when transplanted in the fields.

Traditional varieties start bearing fruit in the sixth year from field planting. However, new hybrid varieties developed by Philippine coconut breeders start bearing fruit as early as the fourth year. A method of mass propagation of elite coconut palms is being made possible by tissue culture, where progress has been reported with very encouraging results.

The Coconut

The fruit of the coconut takes 12 months to develop from flowering to maturity. The common mature coconut weighs more than 1 kilogram and is ovoid in shape. Young coconuts are green in colour and turn brown as they mature, although there are those which are naturally yellow in colour. The coconut itself is composed of an outer layer called the "mesocarp" (coconut husk) which covers the hard layer called the "endocarp" (shell). Within the shell is the "endosperm" (kernel, meat) of about 1-2 centimetres thick. A thin brown layer called the "testa" (paring) separates the kernel from the inner surface of the shell. The cavity within the kernel has an average volume of 300 ml and contains the endosperm liquid called "coconut water".

The kernel is considered the most important part of the coconut as it is the source of various coconut products such as copra, coconut oil, desiccated coconut, coconut milk, coconut cream, coconut flour, protein powder and copra meal. The coconut water is a sterile liquid and is considered a healthy beverage capable of dissolving renal stones. The testa, which is pared off from the kernel during desiccated coconut production, is extracted of its oil which contains a fair amount of unsaturated fatty acids (C18:1 and C18:2).

The shell is converted into charcoal and is further processed into activated carbon. As raw shell, it is often used as material for decorative items, fuel in copra making or, when finely ground, serves as a filler for synthetic resin, glues and components in mosquito repellent coils. The husk is processed for coir fibre, rubberised fibre, rope, geotextiles and the dust by-product from coir manufacture is used as soil extender.

Of the products from the kernel, copra or dried coconut meat is the most widely traded commodity. This is because it is the feedstock in coconut oil extraction by the conventional mechanical extraction method. Apart from this, so far, no other method of coconut oil extraction is presently used commercially. Various copra drying methods are employed, such as sun-drying, direct fire-drying and hot-air drying. Drying reduces the moisture content of the kernel from approximately 50% down to 6-8%.

The trading of copra goes through a series of intermediate buyers. In the case of the Philippines, small volumes are sold either to barrio (village) traders or to town buyers who, in turn, sell accumulated truck loads of copra to oil millers.

About Coconut Oil

Coconut oil is by far the richest commercial source of lauric fatty acid from vegetable origin. It shares this distinction as a lauric fatty acid source only with palm kernel oil. This vegetable oil pair is thus called the "lauric oils". Although there are yet other vegetable oil sources of lauric fatty acid, such as babassu, cohune and cuphea, volumes are not of commercial quantity. Other vegetable oils traded commercially in the world market do not contain lauric fatty acid, which is why coconut oil is normally priced at a premium over these oils. Another peculiarity that sets coconut oil apart from other oils is its medium chain fatty acid (MCFA) components, fatty acids of 12 carbons or less, which have important application in nutrition and medicine. MCFAs account for 64% of the fatty acids in coconut oil. Although coconut oil is 92% saturated, it is low in melting point (24-27 degrees Celsius) because of its shorter carbon chain length and is easily absorbed, digested and utilised by the body as a preferred energy source. The saturated character of the fatty acids also accounts for the stability of coconut oil as it resists rancidity due to oxidation and other forms of degradation. Food processors who are aware of this good quality of coconut oil have given it a high preference in their formulations, particularly in products that require long shelf lives.

In the countries where it is produced, coconut oil is used mainly as a cooking oil or a frying oil. It is also an important raw material for margarine and shortening production. In the Philippines, a 90/10 blend of coconut oil/corn oil is used as a milk fat in filled milk formulations. In the non-food sector, the use of coconut oil is mainly for technical applications, as raw material for the production of chemical derivatives for the surfactant industry. These derivatives are the fatty acids and its salts, fatty alcohol, methyl ester, fatty amines and amides. For these applications, coconut oil is desired because of its high lauric acid content.

New Markets for Coconut Oil Products

The use of coconut oil in industry has advanced more recently. From the traditional food applications as spray oil in crackers and cookies to lengthen shelf life, or as cream fat in biscuit cream and confectionery oil, among others, the use of coconut oil in nutrition and medicine has now come about. Such products are derivatives from coconut oil like medium chain triglycerides (MCT), structured lipids and monoglycerides.

Medium chain triglycerides are obtained largely from the fractionated fatty acid of coconut oil. It is a preferred energy booster for athletes and geriatrics. MCTs in capsules are taken by athletes for increased endurance during athletic activities. MCT is also used today as a dietetic measure in patients with fat assimilation disorders. A number of medical and infant food formulations have MCTs as the principal source of fat supplemented with polyunsaturates. Structured lipid is a speciality fat which can be used as a healthier alternative to traditional fats in food product formulations. Most structured lipids currently manufactured use medium chain triglycerides of a lauric oil, supplemented by long chain triglycerides of a polyunsaturated oil. In commercial terms, structured lipids are medium chain lipids.

Coconut oil-based monoglycerides have a specific function as an anti-microbial agent due to their lauric acid content. Studies have shown that lauric acid exhibits anti-viral and anti-microbial activity. The anti-pathogenic action of monoglycerides has recently been providing much interest. Monolaurin, the monoglyceride of lauric acid, has been reported to have the highest anti-bacterial, anti-viral and anti-fungal activities and was found to have potential medical value for AIDS, tuberculosis, ulcers and other ailments. Likewise, monolaurin's anti-microbial properties allow it to ideally function as an antiseptic, a disinfectant and, in lower concentrations, as a preservative for foods, cosmetics and drugs. Being sourced from plant material, the coconut monolaurin is a natural and non-toxic ingredient, making it a desirable preservative for the food, cosmetics and drug industries.

World Trade

World production of coconut averaged 9.65 million metric tons, copra terms (1992-96 average), which is equivalent to about 51.068 billion nuts. Of this total, close to 70% is supplied by the major producers viz. Indonesia, India and the Philippines. Of the three leading producers, the Philippines is the biggest supplier to world trade in the form of coconut oil, which accounts for some 80% of her total coconut production. Indonesia and India use the bulk of their production internally, both as food nuts and as coconut oil.

Coconut is widely traded in the world market in the form of coconut oil. Coconut oil accounted for 6.39% of world vegetable oils market during the 90's.

Cottonseed

Cottonseed article was written by Lynn A Jones and Jarrod H Kersey of the National Cottonseed Products Association (USA) www.cottonseed.com

Introduction

Cotton has the dual role of both clothing and feeding mankind. Its history is closely wound with the human journey, having been domesticated in both the Old and New Worlds and being key to the Industrial Revolution. Of course the fibre aspect of cotton is the most prominent and is the reason cotton is grown. However, the seed has always been a critical part of cotton production and technology now makes the most of the seed. Cotton is grown around the world primarily in tropical and subtropical latitudes and as far north as 45N latitude in the People's Republic of China (PRC).

Cottonseed was the second most commonly produced oilseed in the world in the 1993/94 to 1997/98 period, averaging one-fourth that of soybeans in the same period, just slightly ahead of rape/Canola. World cottonseed production has averaged about 33 million metric tons annually in this decade. Cottonseed oil falls to about fifth or sixth in world production of oils, however, due to the relatively low amount of oil in the seed (about 18%) and to the great amount of cottonseed which is fed unprocessed to cattle, especially dairy cattle. World production of cottonseed oil was about 4 million metric tons in both 1997 and 1998.
The relationship between fibre production and the fortunes of cottonseed are unique in the oilseed world. In the United States, which is the world's second largest cotton producer behind the PRC and just ahead of India, about 15% of the producer's income is from the seed portion of the crop. World cotton fibre stocks are currently high, putting downward pressure on prices and the outlook for acreage expansion.

About Cottonseed Oil

Cottonseed oil's history is closely related to the history of the modern vegetable oil refinery business. Cottonseed oil was the first vegetable oil used in the United States and its development followed by several decades the 1793 invention of the cotton gin. David Wesson and other edible oil refining pioneers developed and employed their machinery first on cottonseed oil.

Cottonseed oil is a versatile oil prized by chefs for its unique ability to allow the flavour of foods to come through. Whether making salad dressing or deep-frying, cottonseed oil has many applications, such as snack foods, mayonnaise, pastries, baked goods, margarine, shortening and oil blends. Noted as a slightly nutty or buttery flavoured oil, cottonseed oil is well regarded for its ability to avoid overpowering the flavour of foods and its composition prevents an unpleasant greasiness on food.

Cottonseed oil's functional qualities in the kitchen make it a popular choice. It has a high smoke point of 428F (220C), which makes it a good choice for stir fry. When heated at deep-frying temperatures for a long time, it tends to give a more intense note of its original flavour, which is not objectionable. Also, cottonseed oil is considered a highly stable vegetable oil and has a good level of natural antioxidants, including Vitamin E. A saturated fat level of 27% contributes to this stability. The principal saturated fatty acid is palmitic at 24.4%, while the main monounsaturated fatty acid is oleic at 17.2%. The principal fatty acid is linoleic at 55%. The flavour of the oil does not deteriorate like other cooking oils, which allows for longer fry-life. When cooking with cottonseed oil, very few undesirable odours or off-flavours are produced due to its ability to carry the flavour of the food. These factors make it very popular with potato chip and fried snack makers, which is its major use in the United States. Indeed, they are the same characteristics that make it a popular oil for local falafal shops in Egypt. Falafal is deep fried to order in oil kept hot all day. Fine tempura restaurants in Japan also use cottonseed oil to ensure that the delicate food can be properly heated without the oil affecting the taste.

Cottonseed oil is a heart-healthy oil choice. The percentage of saturates is below that commonly found in the dietary fat consumed in the West. Cottonseed oil, like other oils of plant origin, is cholesterol free. Also, pure cottonseed oil with a trans fatty acid level below 0.4% is virtually trans free. It can be used in formulations to reduce trans fats and can act to lower total trans in cases where some hardening is needed because less hydrogenation is required, than many other vegetable oils with lower levels of saturated fats. Cottonseed oil has three times as many polyunsaturated fats as saturated fats. As

mentioned, linoleic, an essential fatty acid, is the major polyunsaturated fatty acid. Refined and deodorized vegetable oils, including cottonseed oil, are some of the purest food products available.
Since most cottonseed meal and seed used in the animal feed industry is, by and large, fed domestically in the countries of production, the prime cottonseed product of significance in international trade is cottonseed oil. The United States is the most significant cottonseed oil exporter in the world with an annual volume of about 100,000 metric tons. Argentina is second. Cottonseed oil largely follows the soy oil complex and responds similarly to international prices for vegetable oils. The oil maintains about a 10-15% premium over soybean oil. As it is not traded on any exchange, its ties to other, larger oil markets are important to international customers.

Other Products of Cottonseed

Along with oil, linters, hulls and meal are also produced in the processing of cottonseed. Intact cottonseed, as it comes from the cotton gin, has short linter fibres remaining on it. These are removed at the oil mill for their cellulose value. Products such as paper, diapers, mattress padding and even currency are manufactured from linters. Since cottonseed linter fibres are nearly 100% cellulose, they can also be used as a dietary fibre for baked goods, dressings, snacks and processed meats. Dissolved cellulose derived from cottonseed linter pulp is used for products such as plastics, rocket propellants, rayon, pharmaceutical emulsions, cosmetics and photography and x-ray film. While linter pulp is typically higher in price than competing products, it is used for superior quality and performance.

Cottonseed hulls are the tough outer covering of the cottonseed and, when removed, provide an excellent roughage for cattle, with a similar feeding value to that of good quality grass hay. Since cottonseed hulls mix well with other feed ingredients and require no grinding, they are typically used in ruminant rations. Also, cottonseed hulls can be pelleted to allow for better flowability, handling and lower transportation costs.

Cottonseed meal is produced principally by the extraction of oil by solvent methods, with very little still extracted by mechanical means. Solvent extraction of cottonseed can result in as little as 0.5% fat in meal, while mechanically extracted meal can leave 2% or more. Cottonseed meal is a high quality protein feed ingredient typically ranging from 36-44% crude protein. However, it is most commonly sold in the United States as 41% crude protein. Maximum fibre levels for 36, 41 and 43% protein meals are 17, 14 and 13% respectively. The meal offers good palatability for a variety of species. After soybean meal, cottonseed meal is the second most abundant plant protein produced. From cattle to catfish, the meal is used as a protein concentrate that can have economical advantages over other plant protein sources. Cottonseed meal is purchased by ranchers and feedlots for beef rations, by dairymen for milk cattle and by other producers for catfish, as well as for some poultry and swine.

Whole cottonseed is a compact energy source that contains protein, fat and fibre. In the past two decades, it has become a key feed ingredient for North American milking cows. Whole seed has approximately 18% fat and 20% protein. It is commonly used by dairies at a typical feeding rate of 1.8 to 3.2 kg per dairy cow each day. Gossypol, a natural pigment in the cotton plant and seed, can reduce animal performance if ingested at excessive levels. Gossypol typically binds with lysine or other compounds when seed are extracted due to the heat and pressure involved. With normal feeding practices of cottonseed meal, gossypol is typically not considered the most limiting agent, but it must be managed properly to avoid any concern. Feeding practices with whole seed need to be managed more carefully.

Jatropha

<u>Cultivation</u>

Jatropha is a genus of approximately 175 succulent plants, shrubs and trees (some are deciduous, like Jatropha curcas L.), from the family Euphorbiaceae. Jatropha is native to Central America and has become naturalised in many tropical and subtropical areas, including India, Africa and North America. Originating in the Caribbean, the Jatropha was spread as a valuable hedge plant to Africa and Asia by Portuguese traders. The hardy Jatropha is resistant to drought and pests and produces seeds containing up to 30-40% of non-edible oil. When the seeds are crushed and processed, the resulting oil can be used in a standard diesel engine, while the residue can also be processed into biomass to power electricity.

Although Jatropha comprises approximately 70 species, there is only one - the Jatropha curcas L. Euphorbiaceae - suitable for Jatropha oil production. The botanic name Jatropha is derived from Greek "Jatras" meaning Doctor and "trophe", Nutrition. The tree grows up to a height of 3 metres, which means harvesting is an easy task. A hybrid variety of Jatropha could give three harvests a year, compared to two harvests by other varieties of jatropha. It takes two years for a 'Jatropha' sapling to begin producing seeds and they can produce seeds for up to 30 years. The seeds are crushed to extract the raw oil.

Jatropha curcas grows almost anywhere, even on gravelly, sandy and saline soils. It can thrive on the poorest stony soil. It can grow even in the crevices of rocks. The leaves shed during the winter months form mulch around the base of the plant. The organic matter from shed leaves enhance earth-worm activity in the soil around the root-zone of the plants, which improves the fertility of the soil. Climatically, Jatropha curcas is found in the tropics and subtropics and likes heat; although it does well even in lower temperatures and can withstand a light frost. Its water requirement is extremely low and it can stand long periods of drought by shedding most of its leaves to reduce transpiration loss. Jatropha curcas is also suitable for preventing soil erosion and shifting of sand dunes.

Some of the properties which make it useful as source of oil for the biodiesel industry are as follows:

- Jatropha grows well on low fertility soils. However, increased yields can be obtained using a fertiliser containing small amounts of magnesium, sulphur and calcium.
- Jatropha can be intercropped with many cash crops such as coffee, sugar, fruits and vegetables, with the Jatropha offering both fertiliser and protection against livestock.
- Jatropha needs at least 600mm of rain annually to thrive. However, it can survive three years of drought by dropping its leaves.
- Jatropha is excellent at preventing soil erosion and the leaves it drops act as a wonderful soil enriching mulch.
- Jatropha prefers alkaline soils.

<u>Production</u>

All crops need fertile soils with adequate moisture to be productive. As any other crop, Jatropha plants absorb nutrients from the soil. Jatropha plants grow on medium and low fertility soils and in low and high rainfall areas. Jatropha seeds have high oil content (30-40%). The plant can produce seeds between the first and second years under very favourable conditions. Seed production become stable after 4-5 years depending on soil fertility and rainfall. Jatropha trees develop fruit during the winter the leaves have fallen. However, in optimal conditions (warm temperatures and moist soil) several crops per year are possible. The fruits form in bunches of around ten and are initially olive green in colour. Over the following three or so months, the seeds contained within the fruits mature, while the fruit changes from green to yellow to black. At this stage, the fruits should be harvested either by hand or using olive harvesting equipment. The fruit is made up of a husk (seed coat) which must be removed (can be composted) and the Jatropha seeds which hold the oil. After a couple of days of sun-drying, the seeds can easily be popped out of the fruits by hand.

Seeds must be well dried before pressing since moist seeds can develop mould and can also jam the pressing equipment. Pressing of the seeds is carried out by a mechanical seed press; human-powered or with an electric or diesel motor. Where a direct injection diesel motor is used to power the seed press, pressed oil can be used directly as a fuel; typically around 5% of the pressed oil would be used in this way. There is no need to heat the seeds as warm ambient temperatures are sufficient to obtain high yields with cold-pressing.

The important aspects of production can be summarised as:

- After the first five years, the typical annual yield of a Jatropha tree is 3.5kg of beans.
- Jatropha trees are productive for up to 30-40 years.
- 2,200 trees can be planted per hectare (approximately 1,000 per acre).
- One hectare should yield around 7 tonnes of seeds per year.
- The oil pressed from 4kg of seeds is needed to make 1 litre of biodiesel.
- 91%+ of the oil can be extracted with cold-pressing.
- One hectare should yield around 2.2-2.7 tonnes of oil.
- Press cake (seed cake) is left after the oil is pressed from the seeds. This can be composted and used as a high grade nitrogen-rich organic fertiliser (green manure).

Composition and Properties

The basic details of the genus are shown in the following table:

- Size : up to 6 metres high.
- Productive life : 30-40 years.
- Stem straight, thick branches.
- Green leaves : 6-15 cm long and wide.
- Fruit : oval 40 mm long approximately.
- Each fruit contains 2-3 seeds.
- Seeds colour : black.
- Seeds : average long 18 mm (11-30).
- Seeds : average width 10mm (7-11).
- 1000 seeds : 0.750 a 1.0 Kg approximately.
- Oil in seeds : more than 30%.
- Branches contain whitish latex.
- Normally five roots in germinated seeds.
- One central root and four laterals in seed. Each Jatropha seedling should be given a 2m x 2m area to grow into.
- Without leaves in drought and winter.
- Plant without leaves remain latent.
- Do not stand cold or frost.

The Composition of the Seed and Shell

Product	Mass 60%	Shell 40%	Meal
Crude protein	25.6	4.5	61.2
Lipids (crude oil)	56.8	1.4	1.2
Ash	3.6	6.1	10.4
Neutral detergent fibre	3.5	85.8	8.1

Acid detergent fibre	3.0	75.6	6.8
Lignin acid detergent	0.1	47.5	0.3
Gross energy (MJ/Kg)	30.5	19.5	18.0

The fatty acid profile of Jatropha oil is mainly unsaturated, which is useful when considering the cold flow properties when used in the biodiesel process. The profile is compared with those of palm and coconut in the table below. As with all plants, this profile will vary with origin and variety and, in particular, the C18:1 content is shown in the literature as being 43% in the Nicaraguan variety and 34% in material from Mali.

Comparison of Fatty Acid Profile

Fatty Acid	Jatropha	Palm	Coconut
Caprylic Acid (C8:0)	-	-	8
Capric Acid (C10:0)	-	-	8
Lauric Acid (C12:0)	-	-	48
Myristic Acid (C14:0)	0.38	3.5	16.0
Palmitic Acid (C16:0)	16.0	39.5	8.5
Palmetoleic Acid (C16:1)	1-3.5	-	-
Stearic Acid (C18:0)	6-7	3.5	2.5
Oleic Acid (C18:1)	42-43.5	46	6.5
Linoleic Acid (C18:2)	33-34.5	7.5	2.0
Linolenic Acid (C18:3)	0.8	-	-
Production kg/Hectare	1590	5000	2260

Uses

Until recently, Jatropha had few uses other than a malaria treatment, a windbreak for animals, live fencing and candle-making. An ingredient in folk remedies around the world, it earned the nickname "physic nut", but its sap is a skin irritant. Being a perennial crop, it can be used for carbon capture and to alleviate soil degradation, desertification and deforestation. The oil from Jatropha seeds can also be used for production of soap, bio-pesticides and bio-diesel.

There is some discussion concerning the toxicity of the plant. Feeding studies on rats and fish established that the seed meal prepared from seeds collected from a wild variety of Jatropha curcas which originated from Mexico is non-toxic. The protein, energy, lipid and amino acid contents in the seeds of the non-toxic provenance are similar to those of toxic varieties. The meals contained significant levels of trypsin inhibitor, lectin and phytate, and their levels did not differ between the non-toxic and toxic varieties. However, it is unlikely that absence of phorbol esters in the seeds of non-toxic variety from Mexico suggests that one of the toxic principles in meals from toxic varieties is phorbol esters. The non-toxic variety of Jatropha from Mexico can be a suitable alternative to the toxic Jatropha varieties. This non-toxic variety of Jatropha could be a potential source of oil for human consumption, and the seed cake can be a good protein source for humans as well as for livestock.

Keeping in view the advantages of the non-toxic variety, the seeds of this variety have been sent to Nicaragua, Zimbabwe, Mexico and India for cultivation through traditional and tissue culture techniques and comparison for yield, resistance to diseases, survival and nutrient requirements with the toxic varieties of the region. However, the material is not likely to become part of the food versus fuel debate in the near future.

The major use being discussed in the current climate is the fact that filtered Jatropha oil can be used as is in many diesel vehicles, with only small modifications required to the engine. It can also be used as a kerosene substitute for heating and lamps as it burns with a clear smokeless flame.

Future Prospects

The non-edible vegetable oil of Jatropha curcas has the requisite potential of providing a promising and commercially viable alternative to diesel oil since it has desirable physico-chemical and performance characteristics comparable to diesel. The Jatropha bush seems an unlikely prize in the hunt for alternative energy, being an ugly, fast-growing and poisonous weed. Hitherto, its use to humanity has principally been as a remedy for constipation. Very soon, however, it may be powering your car.

Almost overnight, the unloved Jatropha curcus has become an agricultural and economic celebrity, with the discovery that it may be the ideal biofuel crop, an alternative to fossil fuels for a world dangerously dependent on oil supplies and deeply alarmed by the effects of global warming. Some statistics from a major investment company are also of interest when considering its use as biodiesel:

- Crushing 1 tonne of Jatropha seeds costs around $40 (£23).
- One tonne of seed cake (the leftovers after pressing) can be sold for $100 (£55).
- The transport costs of shipping 1 tonne of Jatropha from India to Northern Europe is $100 (£55).
- The landed cost of 1 tonne of Jatropha oil to Northern Europe is between $348 and $500 for oil contents of 29-40% (£180 to £260). Refining Jatropha oil into bio-diesel costs less than $125 (£65) per tonne.

There have been several announcements recently of investments by joint venture companies, including major petroleum oil companies, into the production of Jatropha. This is in marked contrast to the lack of interest by the oil majors in bio-diesel and other first generation bio-fuels. It certainly appears that with further research in the agronomics of the plant, there is potential for it to become a major bio-fuel raw material.

Linseed

Linseed article was written by Mr Paul Rooke of the United Kingdom Agricultural Supply Trade Association Ltd (UKASTA) - www.ukasta.org.uk

Linseed comes from the family Linaceae, Genus Linum, which includes the vast majority of the herbs and shrubs found in temperate and sub-tropical regions bordering the Mediterranean Sea. Linseed/flax, linium usitassium is certainly not a new crop. Flaxfibre and linen have been discovered with remains of stone age man and it is known that flax was a well-established crop in the Nile Valley around 1000 BC. Within modern day Europe, however, linseed is most widely grown for its oil content – a very high quality drying oil.

The relatively unique properties of linseed oil have provided it with a market in the paint, lacquer and varnishes markets, as well as being used in soap, putty, printing ink and, of course, linoleum – a market which saw something of a revival in the early 1990s. The meal content is more problematic. Due to a deficiency in the amino acid lysine, it has only a limited use in the animal feed industry and will, therefore, trade at a discount to the meals of other vegetable oils such as soya and colza (rape).

In terms of EU support for both linseed and fibre flax, a subsidy system of one sort or another has been in operation since 1976. In the early days of the scheme, France was the single biggest producer of linseed. French production fell away significantly towards the end of the 1970s and it was not until linseed began to be grown in the UK during the early 1980s that linseed's EU fortunes were revived to any extent. Canada remains the world's largest producer of linseed and is the single biggest exporting country. It has also been the provider of many European-grown varieties, although in recent years Hungary has also emerged as a strong presence in the development of linseed varieties, particularly for winter sowing.

The recent popularity of linseed, particularly in the UK, has been aided by the fact that it has helped to spread the workload on farm during the autumn bottleneck. This has become an increasingly important factor for some growers, evermore reliant on fewer staff and more mechanisation. Furthermore, linseed can be grown without the need to purchase specialised machinery and, in terms of its variable costs, it has a relatively low requirement for both fertiliser and chemical inputs compared to other combinable crops.

Whilst spring sown linseed crops have been the tradition, newer varieties have been developed which are more tolerant of winter sowings. Additionally, one or two specific winter sown varieties of linseed have been introduced with claimed yield advantages over spring sown crops. Whilst winter sown varieties are aiming at the same market as their spring sown counterparts, the husbandry of such crops can be significantly different, particularly in terms of fertiliser and pesticide management programmes.

Linseed is traded on the world market on the basis of a 38% oil content and a 9% maximum moisture content. As previously mentioned, its single biggest market is that of crushing for oil extraction. Linseed oil is able to rapidly form a durable, sticky film on exposure to air due to a high content of unsaturated fatty acids, particularly oleic, linoleic and linolenic. These give it good surface coating properties but subsequent oxidation is a disadvantage when trying to investigate food markets for the oil as it has a very short shelf-life.

Whilst the oil has limitations in the animal feed market due to its amino acid make-up, the expeller meal is a valuable protein livestock feed (particularly for ruminants) and has a crude protein level of 38%. Whilst this does not compare directly with the higher protein feeds such as soyabean meal, it is comparable with more direct competitors such as oilseed rape.

Limitations in the food market mentioned earlier are also being overcome in some areas and the recent introduction of an edible form of linseed – linola – has helped improve the standing of linseed in such areas as the health food market. Linola is helping to utilise the high linoleic and linolenic amino acid levels in linseed. These are the amino acids also present in high levels in fish oils and are an important part of a low cholesterol diet.

More recently, there has been renewed interest in the use of linseed straw and flax in the UK. Recent work has looked at a wide variety of uses for fibre from linseed in both industrial products and textiles. One particular area has been the automotive industry where a number of interior components are now constructed using linseed fibre as an alternative to moulded plastics. The adoption of new techniques and technologies has also brought flax back into UK production. Harvesting using mainstream combining machinery rather than the traditional flax puller has meant an improvement in the management of the crop.

Flax is harvested at the point of total defoliation. The crop is then retted using one of two main techniques. Dew retting involves spreading the crop thinly over the ground after harvesting and allowing fungi to colonise and ret the semi-dessicated stems over a period of around eight weeks. Alternatively, water retting involves placing the crop in tanks and utilising the actions of anaerobic bacteria such as Clostridium felsinium. This process is speedier with the crop being completely retted in around seven days. More recently, enzyme retting has been looked at. Whilst this is a quicker process, there are concerns that it leads to poorer quality fibres.

Future European production of both linseed for oil and flax remains heavily dependent on the structure of a support system. Recently, changes have signalled a reduction in the level of support for linseed and for the more modern methods of flax production. In addition, the non-food production of linseed on set-aside land continues but at a relatively low level. It is only through the continued development of uses for the products that the crops will continue to be seen both in the UK and the EU.

Palm Kernel Oil

Palm Kernal article was written by T P Pantzaris and Mohd Jaaffar Ahmad, Palm Oil Research Institute of Malaysia (PORIM Europe)

ORIGIN, COMMERCE, PROPERTIES AND USES

In the world of oils and fats, the lauric oils are the "aristocrats". There are very few of them, they move in their own higher price plateau and they do not mix comfortably with the common oils and fats. Among the seventeen major oils and fats in world trade, there are only two lauric oils, namely, coconut oil (CNO) and palm kernel oil (PKO). They are called "lauric" because lauric acid is the major fatty acid in their composition (at about 50%), while no other major oil contains more than about 1% (butter fat contains 3%).

Oil Palm Cultivation

Palm kernel oil is very similar to coconut oil in fatty acid composition and properties. The two trees also look rather similar, both are called "palms" but they belong to different genera. Coconut palm is "Cocos nucifera", while the oil palm, which gives both palm oil (PO) and PKO is "Elaeis guineensis". This tree is generally believed to have originated in the jungle forests of East Africa and there is some evidence that palm oil was used in Egypt at the time of the Pharaohs, some 5000 years ago. Nowadays, however, its cultivation is confined mostly to South East Asia.

The variety cultivated in nearly all the world's plantations is the hybrid "Tenera" which gives the highest yield of oil per hectare of any crop. The relative economic efficiency of the oil palm is easily seen from the following simple calculation – soyabeans in the USA give a yield of about 2.5 tonnes of beans per hectare (1 hectare = 2.47 acres), which translates into about 0.5 tonne of oil and 2 tonnes of meal. Taking the price of meal at about 40% of the price of the oil, the total income to the farmer is equivalent to 1.3 tonnes of oil. In Malaysia, oil palms yield an average of 3.75 tonnes of palm oil, plus 0.6 tonnes of palm kernel oil, plus 0.6 tonnes of palm kernel meal, with income equivalent to 4.5 tonnes of oil. Furthermore, the oil palm is capable of vastly greater yields. PORIM has found trees which give more than double the above yields and their palm oil has the iodine value and fluidity of current super-olein. PORIM is also researching tissue culture which, one day, could push yields to twice as much again.

The palm fruit looks like a plum. The outer fleshy mesocarp gives the palm oil, while the kernel (which is inside a hard shell) gives palm kernel oil. It is rather strange that the two oils from the same fruit are entirely different in fatty acid composition and properties. In palm oil, most of the fatty acids are C16 (i.e. have 16 carbon atoms) and higher, while in palm kernel oil, they are C14 and lower.

Production and Exports

The largest palm kernel oil producing country by far is Malaysia, which accounts for more than 52.8% of world production, while two countries, Malaysia and Indonesia together, account for about 80% of production and 90% of exports. No other country produces more than 8% or exports more than 3%.

A record production of 19.904 million tonnes was registered in 1999; an increase of 19.3 percent over the previous year's production of 16.681 million tonnes. Palm oil share in the global oils and fats production jumped from 16.26 percent in 1998 to 18.7 percent in 1999. The year saw significant rebounds in palm oil supply, exports and consumption.

Palm oil is expected to demonstrate an annual growth of 4.57% over the next five years. Production is expected to reach 26.2 million tonnes by the year 2005, and anticipated to account for around 20% of the global oils and fats supply.

Malaysia and Indonesia will be at the forefront of this production growth, with production forecasts of some 12.2 million tonnes by the year 2005 in Malaysia, while Indonesia is expected to reach 9.4 million tonnes in production.

Exports are likely to grow at an annual rate of 5.55% during the period and jump from 13.8 million to 18.1 million tonnes. Accounting for some 41% of global exports of oils and fats.

Composition and Properties

The major fatty acids in palm kernel oil are about 48% lauric acid (C12), 16% myristic acid (C14) and 15% oleic acid (C18:1). No other fatty acid is present at more than 10% and it is this heavy preponderance of lauric acid which gives palm kernel oil and, indeed, coconut oil, their sharp melting properties, meaning hardness at room temperature combined with a low melting point. This is the outstanding property of lauric oils which determines their use in the edible field and justifies their usually higher price compared with most other oils.

Even after full hydrogenation, the melting point of palm kernel oil does not rise much above mouth temperature and fractionation gives a stearin, which is even sharper melting. Sharp melting fats leave a clean, cool, non-greasy sensation on the palate, impossible to match by any of the common non-lauric oils. Cocoa butter and palm mid-fraction come to mind, but they are much more expensive.

Palm kernel oil is about 82% saturated, which is much more than the major liquid oils, such as soybean which is only 16% saturated or sunflower oil which is 12% saturated. Nutritionally, this may be thought of as a great disadvantage, but such simplistic comparisons are misleading. Lauric oils are only used in foods where a solid fat is needed and, when liquid oils are hydrogenated to a similar consistency, they form not only more saturates, but also trans fatty acids which recent studies have shown to be even more objectionable in regard to blood cholesterol profiles than the saturated ones. Another consideration is that because of their higher price and special properties, lauric oils are only used where clearly necessary and so only reach a modest level in our diet. In the UK, for example, annual per capita disappearance (use for all purposes) for both lauric oils combined is 2.2 kg, as opposed to 35 kg for the non-laurics.

Malaysian palm kernel oil bought from origin is often traded according to the Malaysian Edible Oil Manufacturers' Association (MEOMA) specifications, details of which are shown in Table 3. The same body also sets the trading specifications of the other major products derived from palm kernels, such as palm kernel meal, palm kernel stearin, palm kernel olein and palm kernel fatty acids.

Uses

Because of their similarity in composition and properties, palm kernel oil has similar uses to coconut oil in both the edible and non-edible fields. There are, however, some small differences. Palm kernel oil is more unsaturated and so can be hydrogenated to a wider range of products for the food industry, while coconut oil has a somewhat greater content of the more valuable shorter-chain fatty acids, which makes it a little more valuable for the oleochemical industry.

Palm kernel oil and its hydrogenated and fractionated products are widely used either alone or in blends with other oils for biscuit doughs and filling creams, cake icings, ice-cream, imitation whipping cream, substitute chocolate and other coatings, sharp-melting margarines, etc.

Lauric oils (CNO, PKO) are indispensable in soap making. Good soap must contain at least 15% lauric oils for quick lathering, while soap made for use in sea water is based on virtually 100% lauric oils. Lauric oils also confer hardness, solubility and a feel of quality to soap. Coconut oil has been the traditional fat for this application but, by all accounts, palm kernel oil can substitute it perfectly and possibly with some subtle advantages.

In the oleochemical industry, very large amounts of palm kernel oil are now used for the manufacture of short chain fatty acids, fatty alcohols, methyl esters, fatty amines, amides, etc, for use in detergents, cosmetics and innumerable other products. Until relatively recently, these oleochemical products were traditionally made from coconut oil, but with palm kernel oil supplies increasing at a much faster rate and usually at a price advantage, this oil has been making ever increasing in-roads.

This is a remarkable feat by palm kernel oil given the fact that, in world terms, it was much less well known than coconut oil and its supplies have been rising much more rapidly. The main reason is, no doubt, that users have been increasingly able to substitute one lauric oil for the other and so even out price differences. Malaysia, absorbing over half a million tonnes per annum for her oleochemical industry, no doubt helped palm kernel oil prices, but it cannot be the main reason since, in spite of that, in the last five years world exports of palm kernel oil increased by 33%, as opposed to 25% for coconut oil. The good news for buyers is that the rate of Malaysia’s oleochemical expansion is bound to slow down and her palm kernel oil exports should start rising again.

Future Prospects

In world terms, palm kernel oil is still smaller than coconut oil by about one third, but the future belongs to it. It is a co-product of palm oil, it has lower cost of production and it is rising at a much faster rate. Furthermore, the coconut producing countries have exactly the climate and soil conditions required for replanting with oil palms which are more profitable. In the working lifetime of most readers of this article, palm kernel oil will become the major lauric oil.

Peanuts / Groundnuts

Peanut article was written by American Peanut Council - www.peanutsusa.com

Peanuts (groundnuts) are pulses, the seeds of the leguminous plants (Arachis hypogaea) and belong to the same botanical family as beans, peas and lentils.

The peanut, while grown in tropical and subtropical regions throughout the world, is native to the Western Hemisphere. It probably originated in South America and spread throughout the New World as Spanish explorers discovered the peanut's versatility. When the Spaniards returned to Europe, peanuts went with them. Later, traders were responsible for spreading peanuts to Asia and Africa before making their way to North America.

By the end of the nineteenth century, the development of equipment for production, harvesting and shelling peanuts, as well as processing techniques, contributed to the expansion of the peanut industry. The new twentieth century labor-saving equipment resulted in a rapid demand for peanut oil, roasted and salted peanuts, peanut butter and confections.

In the USA four basic varieties of peanuts are commonly grown: Runner, Virginia, Spanish and Valencia. Each type is distinctive in size and flavour.

Runner

Runners have become the dominant type due to the introduction in the early 1970's of a new runner variety, the Floorunner, which was responsible for a spectacular increase in peanut yields. Runners have rapidly gained wide acceptance because of their attractive kernel size range; a high proportion of runners are used for peanut butter.

Virginia

Virginias have the largest kernels and account for most of the peanuts roasted and eaten as in shells. When shelled, the kernels are sold as salted peanuts.

Spanish

Spanish type peanuts have smaller kernels covered with a reddish-brown skin. They are used predominantly in peanut candy, although significant quantities are also used for salted nuts and peanut butter. They have a higher oil content than the other types of peanuts which is advantageous when crushing for oil.

Valencia

Valencias usually have three or more small kernels to a pod. They are very sweet peanuts and are usually roasted and sold in the shell; they are also excellent for fresh use as boiled peanuts.

Growing and Harvesting

Peanuts are the seeds of an annual legume which grows close to the ground and produces its fruit below the soil surface. U.S. peanuts are planted after the last frost in April or May when soil temperatures reach 65–70° Fahrenheit (20° Celsius). Preplanting tillage ensures a rich, well-prepared seedbed. Seeds are planted about two inches (five centimeters) deep, one every two to four inches (5–10 centimeters) in the Southeast, and four to six inches (10–15 centimeters) in the Virginia-Carolina area, in rows about three feet (one meter) apart. The row spacing is determined to a large extent by the type of planting and harvesting equipment utilized.

Peanuts may be cultivated up to three times, depending on the region, to control weeds and grasses. A climate with approximately 200 frost free days (175 for Spanish peanuts) is ideal for a good crop. Warm weather conditions, coupled with rich, sandy soil, will result in the appearance of peanut leaves 10-14 days after the first planting. Farmers generally follow a three year rotation pattern with cotton, corn or small grains planted on the same acreage in intervening years to prevent disease. In addition, many farmers are utilizing irrigation in an effort to reduce crop stress and thereby enhance opportunities for the production of high quality peanuts.

The peanut harvesting process occurs in two stages. Digging, the first stage, begins when about 70 percent of the pods have reached maturity. At optimum soil moisture, a digger proceeds along the rows of peanut plants driving a horizontal blade four to six inches (10-15 centimeters) under the soil. The digger loosens the plant and cuts the tap root. A shaker lifts the plant from the soil, gently shakes the soil from the peanuts and inverts the plant, exposing the pods to the sun in a windrow. The peanuts are now ready for the second phase of the harvest—curing. After curing in the field for 2 or 3 days, a combine separates the pods from the vines, placing the peanut pods into a hopper on the top of the machine. The vine is returned to the field to improve the soil fertility or baled into hay for livestock feed. Freshly dug peanuts are then placed into drying wagons for further curing with forced hot air slowly circulating through the wagons. In this final stage of the curing process, moisture content is reduced to 8-10 percent for safe storage.

Shelling and Grading

After proper curing, farmers' stock peanuts (harvested peanuts which have not been shelled, cleaned or crushed) are inspected and graded to establish the quality and value of the product. The inspection process determines the overall quality and on-farm value of the shelled product for commercial sales and price support loans.

The inspection and grading of peanuts by the Agricultural Marketing Service of the U.S. Department of Agriculture (AMS/USDA) occurs at buying stations or shelling plants usually located within a few miles of where the peanuts have been harvested. A pneumatic sampler withdraws a representative quantity of peanuts from the drying wagon, and from this sample the USDA inspector determines the meat content, size of pods, damaged kernels, foreign material and kernel moisture content. Once the grade is established, the loan value is determined from USDA price support schedules.

Peanuts are separated into three classifications at this farmers' stock marketing and grading stage: Segregation I, Segregation II, or Segregation III. These classifications based on USDA grades are mainly concerned with the amount and type of damage in the kernels. Peanut shellers can buy only Segregation I for use in edible products. Those peanuts which are not classified as Segregation I are crushed for oil.

Segregation 1 peanuts move on to the shelling process where they are first cleaned; stones, soil, bits of vines and other foreign material are removed. The cleaned peanuts move by conveyor belt through shelling machines in which the peanuts are forced through perforated grates which separate the kernels from the hulls. Shakers separate the kernels and the pods. The kernels are then passed over the various screens where they are sorted by size into market grades.
The edible nuts are individually inspected with electronic eyes which eliminate discolored or defective nuts as well as any remaining foreign material.

Inshell peanuts are usually produced from large Virginia type peanuts or Valencias that have been grown in light colored soil. Very immature and light-weight pods are removed by vacuum. The largest remaining pods are separated into size categories by screens. Stems are removed and any remaining immature pods are removed by specific gravity. Dark or damaged pods are then removed by electronic eyes so that only the most mature, brightest pods remain.

Peanut Oil

Peanut kernels range in oil content from about 43% to 54%, depending on the variety of the peanut and the seasonal growing conditions. Peanuts supply one-sixth of the worlds vegetable oil. Oil is extracted from shelled and crushed peanuts by one or a combination of the following methods: hydraulic pressing, expelled pressing and/or solvent extraction. Peanut oil is an excellent quality cooking oil with a high smoke point (440º Fahrenheit), neutral flavour and odour. It allows food to cook very quickly with a crisp coating and little absorption. Peanut oil is liquid at room temperature. Highly aromatic 100% peanut oil and peanut extract are high value products with a strong roasted peanut flavour and nut aroma. These products have applications in flavour compounds, confections, sauces and baked goods.

The World Market

World peanut production totals approximately 29 million MT. India and China are among the largest producers of peanuts, accounting for approximately 2/3 of total world production. The majority of their production is consumed internally, particularly crushed for oil use. Total exports of peanuts top 1.5 million MT, with the largest market being Europe. Among the other major importing countries are Indonesia, Canada and Japan.

The US is one of the world's leading edible peanut exporters, with an average annual export of approximately 240,000 MT. Argentina, China and India are also major suppliers to the world market. Share of world exports varies based on crop conditions and internal market demand (particularly in China). Changing weather patterns, infrastructure improvements, seed varieties – all are factors which influence a market which increasingly demands innovation and quality (at a reasonable price).

Market Demand

Demand for peanuts has been steady in North America and Europe, although under competition within a dynamic snack market. Two significant factors affecting peanuts in the world market are (1) consumer concerns for nutritious foods and (2) stricter import standards for food safety and quality.

Nutrition in a nutshell

Considerable research is pointing to the benefits of regular consumption of peanuts and nuts. Peanuts have traditionally been a central component of the diet in many African and Asian countries, providing an inexpensive source of valuable protein and fiber. Recent studies are now changing consumer perceptions in other countries, particularly in North America and Western Europe, pointing to the role peanuts can play in contributing to a healthy diet.
When comparing peanuts to similar foods, peanuts have more protein than any other legume or nut.

Peanuts contain mostly monounsaturated and polyunsaturated fats. These fats as compared to saturated fats have been shown to help lower blood cholesterol levels.

Peanuts are a good source of folic acid – recent studies have shown that when women get sufficient amounts of folic acid (a B vitamin) during the earliest weeks of pregnancy, it can prevent 50-80% of neural tube defects

Rapeseed / Canola

Canola article has been submitted by the Canola Council of Canada – www.canola-council.org

Origin and History

Canola's roots are firmly planted in an oilseed crop known as "rapeseed". History suggests that ancient civilisations in Asia and Europe used rapeseed oil in lamps. Later it was used in foods and as a cooking oil.

Although the crop was grown in Europe in the 13th Century, its use was not extensive until the development of steam power, when it was found that rapeseed oil would cling to water and steam-washed metal surfaces better than any other lubricant. In fact, the need for Canadian rapeseed production arose from the critical shortage of rapeseed oil that followed the World War II blockage of European and Asian sources of rapeseed oil in the early 1940s. The oil was urgently needed as a lubricant for the rapidly increasing number of steam engines in naval and merchant ships.

Prior to World War II, rapeseed had been grown in Canada, but only in small research trials at experimental farms and research stations. These research trials showed that rapeseed could be successfully grown in both Eastern and Western Canada.
Rapeseed oil for edible purposes was not fully exploited by Western nations until the end of World War II. The merits of the crop as a source of food were acknowledged by the agricultural industry who felt success could be achieved if proper processing techniques could be adopted. Entrepreneurs and researchers in Western Canada made the essential improvements and a food oriented industry, plus a new market, were created.

The first edible rapeseed oil extract in Canada was in 1956/57. This event marked the beginning of a rapidly expanding industry. All of the rapeseed varieties grown produced oils containing large amounts of eicosenoic and erucic acids, which are not considered essential for human growth.
As early as 1956, the nutritional aspects of rapeseed oil were questioned, especially concerning the high eicosenoic and erucic fatty acid contents. In the early 1960s, Canadian plant breeders responded quickly with the isolation of rapeseed plants with low eicosenoic and erucic acid content. In addition to the erucic acid controversy, it was found that the protein meal fraction of rapeseed concerned livestock nutritionists because of the sharp tasting and anti-nutritive glucosinolate which it contained.

In 1974, Dr Baldur Stefansson, a University of Manitoba plant breeder, developed the first "Double Low" variety which reduced both erucic acid and glucosinolate levels. This Brassica Napus variety was the first to meet specific quality requirements used to identify a greatly improved crop known as "Canola". The name "canola" was initially registered by the Western Canadian Oilseed Crushers' Association for reference to oil, meal, protein extractions, seed and seed hulls from or of varieties with 5 per cent or less erucic acid in the oil and 3 milligrams per gram or less of the normally measured glucosinolates in the meal.
In response to a request by the Canola Council, canola oil must contain less than 2 per cent erucic acid and the solid component of the seed must contain less than 30 micromoles per gram of glucosinolates. The statutory definition in Canada makes absolutely no mention of "Canada" or "Canadian". Canola has become a generic term – not just a Canadian term – and no longer just an industry trademark.

The acknowledgement of significant differences between the original rapeseed plant and the genetically improved variety low in erucic acid and glucosinolates, distinguishes canola as a superior plant variety.

CROP PRODUCTION

Area of Adaptation

Canola is a cool season crop that requires more available moisture than wheat, as well as cool night temperatures to recover from extreme heat or dry weather. This crop is best adapted to the Parkland and transition zones of Canada's Western Prairie Provinces. The highest concentration of canola acreage is in the black and grey soil zones of Western Canada.
Although canola grows well in most soil types, it is best suited to loamy soils that do not crust severely and hamper seedling emergence. Good yields can also be obtained when the crop is grown in peat and heavy clay soils.

Acreage

Several domestic and international factors played a major role in the initiation of commercial production and in canola's attainment of such a significant place in the Canadian economy.
An over-supply of wheat in the late 1960s and early 1970s led many farmers to diversify their production. As opportunities evolved for marketing canola, farmers responded. In turn, the industry rose to the challenge of processing and utilising the products and researchers developed better varieties, improved processing techniques and established guidelines for utilisation of the products. Canola is second only to wheat as a revenue generator among crops grown in Canada.
Improving Quality is a Constant Focus of Research

Research has helped to provide significant economic returns to canola processors, growers and exporters. Canola breeding efforts have emphasised quality, disease and agronomic improvements. These efforts include increases in seed oil and protein levels, increased seed yield, improved disease tolerance and earlier maturity and the development of integrated methods for the control of insects and diseases.

The focus of significant research activity for the canola industry continues to be the improvement in quality characteristics of canola seed, oil and meal. The development of technology for the dehulling of canola seed is a priority of the canola industry in order to produce a meal higher in protein and energy and lower in fibre. In the plant breeding area, the development of larger, yellow-seeded canola is on-going. Seeds from such varieties are lower in fibre and higher in oil and protein.

Adding to the bright future of canola are recent advances in biotechnology, through which specific plant genes can be identified and incorporated into canola lines to address specific situations such as herbicide and insect resistance. Hybrid development is increasing with the assumption that canola hybrids will significantly out-yield pure line varieties and offer the possibility for specific crosses adapted to regional growing areas.

Research efforts have also improved the market potential of canola through alterations to oil and meal chemistry to suit particular nutritional and/or industrial markets. These technological adaptations will enable growers to realise more income per acre and processors to compete more profitably and effectively with other world sources of oil and protein.

Canada has become a market leader by developing, producing and marketing canola as a world oilseed. This achievement would have been impossible without the canola breeding research that has been conducted by dedicated Canadian scientists who had the support of the government and on-going funding of the canola industry.

Oil Extraction

Canola oil is extracted by rolling or flaking the seed to fracture the seed coat and rupture the oil cells. Canola seed contains approximately 42 per cent oil. The remaining flakes are then cooked to rupture any intact cells which remain after the flaking process.
Flaked and cooked canola seed is then subjected to a mild pressing process which removes some of the oil and compresses the fine flakes into large cake fragments. These fragments are then solvent-extracted to remove most of the remaining oil. The solvent is removed from the oil by a solvent recovery system which ensures a solvent-free oil. This is combined with the pre-pressed or expressed oil to form crude oil which is then passed through a degumming process. After separation of the gums, a semi-refined oil remains.

Meal

The cake fragments which remain after oil extraction are stripped to remove the remaining solvent by injection of live steam into the meal. The final stripping and drying of the meal is accomplished in kettles and the meal emerges free of solvent, containing 1.5 per cent residual oil and having a moisture content of 10-12 per cent.

After cooling, the meal is often granulated to a uniform consistency and is either pelletised or sent directly to storage ready for marketing as a high protein feed supplement for livestock and poultry.

Edible Uses

Shortening, liquid shortening, margarine, salad oils, cooking sprays, mayonnaise, sandwich spreads, coffee whiteners, creamers, prepared foods (cookies, cake mixes, breads) and fried snack foods.

Inedible Uses

Cosmetics, dust suppressants, industrial lubricants, hydraulic fluids, biodiesel, carriers for fungicides, herbicides and pesticides, oiled fabrics, printing inks, plasticisers, suntan oil and anti-static for paper and paper wrap.

Meal

Livestock feed, poultry feed, pet food, fish food and fertiliser.

THE FUTURE

From simple beginnings in the 1940s, many challenges have faced the canola crop. As each obstacle surfaced, the Canadian industry worked diligently to overcome roadblocks to canola’s success. Alternative markets were developed, nutritional studies were implemented and extensive plant breeding to modify the genetic make-up of rapeseed was undertaken.

Canola is a highly versatile and adaptable crop which persistently tests the management and marketing skills of growers. There is constant refinement and improvement in Canada’s canola from both a research and production perspective. Plant breeders are working diligently to keep canola on the leading edge. Growers are modifying their production techniques to improve quality and to ensure optimum yields. The entire industry is striving toward greater success.
Canola has been and continues to be a revolutionary crop and, as a result, will always be a bright spot for Canada.

Sesame Seed

Sesame article has been written by Oscar Woltman, International Dipasa Group
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History of the Seed

Sesame seed is believed to be one of the oldest seeds to have been used as a condiment, as well as for the home-based production of oil. The English word sesame traces back to the Arabic word of simsim, the Coptis semsem and the early Egyptian word semsent. The earliest records mentioning the use of sesame seed as a spice come from the Assyrian myth which claims that the gods drank sesame wine the night before they created the earth. A more common name is Sesamum Indicum L. which clearly links the sesame seed to India. Sesame domestication began in Africa and, more particularly, in what is now known as Sudan. It traveled eastwards to Japan, leaving a clear trail in Egypt, India and China and westward to Latin America along with the slaves. China and India are today the largest producers of sesame seed. It is already known that some 5000 years ago, the Chinese were burning sesame as a source of light and used it to produce soot for their ink bloks.

Growing Areas and Harvesting

Sesame seed grows in tropical and sub-tropical areas with a dry and a rainy season. It requires a lot of water in order to grow and ripen and a dry season during the harvesting. It is an annual plant, growing on average between 50 to 250 cm high and is rich in flowers. It has numerous pods growing along its stem and these pods pop open (hence "open sesame") when the seeds are almost ripe. It normally grows at altitudes below 1250 metres above sea level, although some high altitude varieties have been cultivated. Germination of the sowed seed occurs best at temperatures between 25 and 27°C. Temperatures below 20°C will seriously slow the growth of the plant, while temperatures below 12°C will stop any growth at all. During the period of flowering, low temperatures or temperatures above 40°C will harm the growth of the seeds. This, in turn, will affect the oil level in the seeds. Ideal growing temperatures lie between 27 and 30°C. Even though the planted sesame seeds can resist a drought, they require some 500 to 650 mm of rainfall. Yields vary per region and variety but, on average, lie between 400-500 kilos per hectare. Harvesting is done by hand, with the plants being cut manually and dried in the field. They are then shaken so that the seeds fall out of the open pods. The harvesting period in the Northern Hemisphere is between October and December and, in the Southern Hemisphere, March. The largest producers in Asia are China and India; in Africa it is Sudan followed by Nigeria while, in Central America, it is Mexico and Guatemala.

Why use Sesame Seed?

Farmers like the crop because it can be harvested after 3 months, thereby allowing them to crop other products in tropical areas. The taste of sesame also helped the growth in the demand for the sesame seed. It has a typical nutty, slightly sweet flavour which can be further enhanced by roasting the seeds. Another reason for its ever growing popularity is the longevity of the seed. After long periods of storing, the germination rate of the seed remains very high. Probably the most important reason is that the oil itself is a very stable oil and has valuable uses which, until today, have not been fully recognised by the user/consumer. The presence of sesamin, sesaminol, sesamolinol, all being lignans, are only found in sesame seeds and have a remarkable antioxidant function. According to several studies, this could have a positive effect on cholesterol levels. Other studies claim that sesame seed could assist against the ageing of the human body due to the presence of niacin which, for example, cannot be found in soyabeans or rapeseed oil.

As an example, in South America, sesame oil is called the "Queen of Oils" due to its extraordinary cosmetic qualities, while Armenian Turks eat a liquid sesame seed product called "Matahina" which makes reference to the rejuvenation of mental and physical capacities one supposedly gets after drinking it. The seeds are also rich in linoleic acid, vitamin E and proteins, as well as calcium and, to some extent, vitamins A, B1 and B2. Since sesame oil has such a high level of unsaturated acids (85%), it is assumed that it has a reducing effect on plasma-cholesterol, as well as having a reducing effect on coronary heart disease. In comparison, sesame seed has more calcium than milk, cheese or nuts.

Finally, it must be mentioned that sesame seeds have a positive amino acid structure. There is a high level of methionine and a low level of lysine. This makes sesame an excellent protein complement to other plant proteins. It goes beyond the present scope of this article to go into the details of the scientific value of sesame seed or its oil. The value has always been recognised in the Near and Far East where sesame seed and sesame oil have always formed part of the local diet. There are a myriad of varieties of sesame seeds which may have more or less the same characteristics. These varieties can be found in the colour (varying from pure black seeds to white seeds), size, taste, resistance to certain pests, hardness of the seed and oil content. In India, there are already 52 different commonly known varieties.
Sesame seed has a thin skin which can be removed. There are several methods of doing this but the major advantage is to reduce the oxalic acid level of the seed which is mainly found in the skin. The skin also contains calcium, minerals and crude fibre. Hulled sesame seeds are most often used on top of hamburger buns.

Free Fatty Acid Composition of Sesame Seed

Palmitic **C16:0**
7 - 12%
Saturated

Stearic **C18:0**
3.5 - 6%
Saturated

Oleic **C18:1**
35 - 50%
Mono - unsaturated

Linoleic **C18:2**
35 - 50%
Poly-unsaturated

Linolenic **C18:3**
1% max
Poly-unsaturated

Arachic **C20:0**
1% max
Saturated
> C20:0
1% max

The Uses of Sesame Seed and Sesame Oil

Sesame seed is used mainly for human consumption on bread, bread sticks, cookies, health snacks (such as sesame bars), in prepared breakfasts (as an additive to cereal mixes) or on breakfast crackers. Several other products for human consumption are made from sesame seed like Tahina (a paste made of ground, roasted sesame seeds), Halva (made of Tahina and sugar and, at random, one may add walnuts, pistachios, peanuts or cocoa, Humus (made from Tahina, chickpeas and sweet additives) and Chalbe (sesame mixed with lemon and honey). All of these products are strongly influenced by cultural and traditional habits in countries where sesame has been used for centuries. Sesame oil is also mainly used for human consumption but a small percentage is used in the soap, cosmetic and skin care industries. The market for sesame oil is mainly located in Asia and the Middle East where the use of domestically produced sesame oil has been a tradition for centuries. In 1998, the world production of sesame oil was slightly more than 715,000 MT (FAO statistics) but the exported volume totalled a mere 29,500 MT. This equals only slightly more than 4% of the world production of sesame oil being traded internationally.

Growth of the Sesame Market Worldwide

The total production of sesame seeds has grown by 57% since 1980 or 2.4% per year. This growth is mainly accounted for by Asia where China tripled its production from 225,000 MT to 725,000 in 2000. It is clear that the only area that has reduced its production is Central America, which lost half of its capacity. The FAO statistics show that the exports more than doubled to 525,000 MT in 2000, representing an increase of almost 5% per year. In these figures, large intra-regional trade is included, as is re-exports (as is the case in The Netherlands which imports much more than it uses). Nevertheless, the growth has been significant and reflects the increasing demand for sesame seed in non-producing countries.

The world import figures show an annual increase of more than 5% and the largest importers of sesame seed in the world are Japan and Korea who are responsible for 54% of all Asian imports and over one third of all world imports in1998. Europe and the 15 members of the European Union also saw their level of import more than triple in this period.

Future Expectations and Trends

It is expected that, due to the constant increase in fast and convenience foods on one side and the health concerns on the other, the consumption of sesame seed will grow. Furthermore, the rising wealth in countries such as China and Africa, will certainly increase the local demand for sesame products within these countries. Taking these aspects together, the general expectation lies at an annual growth of between 2 and 4%, which would be similar to the growth realised over the last 20 years. As long as there are still several advantages of sesame seed and its oil which have not been fully researched, the growth will be limited. Nevertheless, it is expected that through increased research in the health and medical capacities of sesame seeds, the knowledge and better use of these advantages will increase. Therefore, it is important for all of us to "open ourselves to sesame seed".

Soyabean

Soyabean article written by Dr Ignace Debruyne of the American Soybean Association, Brussels Office - www.oilseeds.org

The soybean is one of the oldest vegetables known to man. Soybeans have been grown and consumed for more than 5000 years in China and the Far East. They are, however, a relative newcomer to the Western consumer, particularly when looking at soyfood consumption only.

Soyfoods, for example, soymilk, soynuts, tofu and tempeh, are the most visible form of soy containing foods to the consumer. Soybeans and soybean products have a much wider application area. They contain all components necessary for optimal food and feed application. Soya is not only an excellent source of vegetable protein (34 – 39%, with a balanced composition containing all the essential Amino acids) and of vegetable oil (18 – 20%, containing all the essential fatty acids), it is also rich in fibre, carbohydrates, phytoestrogens, steroids, vitamins and minerals. The functional properties of soy protein based ingredients and the versatility of soybean oil based components add to its widespread use.

A more recent development is the application in technical areas. Oil derived products are already used as fuel (biodiesel), in lubrication, printing ink formulations, dust control and as pesticide and herbicide solvents. Technical protein applications still remain limited (wood adhesives, paper coatings).

Soybean Growing

Soybean has proved adaptable to a wide variety of climatic conditions. Although sub-tropical in origin, cultivation now extends much farther. Soybeans only arrived in the United States in 1804 and were a relatively minor crop until the 1920s. Since then, commercial growing has been continuously increasing. In the United States, nearly 400,000 farmers grow soybeans on more than 29 million hectares of land. At a record of $17.7 billion, soybeans are the second most valuable US cash crop after corn. Since the early 1980s, South American farmers have also expanded their soybean planting area, with Brazil and Argentina adding considerable volumes to the world production and trade of soybeans. The Chinese production is huge, but is used exclusively for local consumption.

Processing

The number one soybean process is the crushing of the beans, i.e. extraction with the use of a volatile solvent. The major products of this bulk process are protein rich soybean meal (with 48 or 44% protein dependent on preliminary hull removal) and crude soybean oil. The natural emulsifier (lecithin) is a valuable by-product obtained by water-degumming this crude oil.
Large scale crushing plants are operational in not only the major soybean growing countries, but also in the importing countries where they provide a balanced use of protein and oil according to local needs. Plants differ in size from a few hundred metric tons per day to as large as 10,000 metric tons per day.

Soybean Trade

The soybean complex refers to the soybean and its two principal by-products (soybean meal and soybean oil) and their special inter-relationship throughout the production, processing and marketing processes. They are traded as separate commodities on a world market scale. Futures exchanges, such as the Chicago Board of Trade and the MidAmerica Commodity Exchange, provide vital functions for the market place, i.e. risk transfer and price discovery. Agri-business participants use futures to offset potentially adverse changes in price. The many factors influencing supply and demand converge on the trading floor and result in the determination of commodity prices.

FOSFA International contracts deal with the actual buying, selling, transport and delivery of soybeans and soybean oil on a world scale; while GAFTA contracts handle the soybean meal trade.

The United States exports almost half of its soybean production to the world market. It is also the world's largest consumer of soybeans, soybean meal and soybean oil. A growing world population, rising incomes and changing diets around the world are pushing up the market for soybeans and derived products. Vegetable protein and vegetable oils replace or add to animal protein and fats. Eating more eggs and meat requires the production of more animal feed.

The European Union is the major importer whilst China is the strongest growing market for soybeans, meal oil. Southeast Asian countries, Turkey and the Turkish Republics, are the other major growth markets for soybeans, meal and oil.

Feed Applications

The soybean's strong potential as a feed ingredient for poultry, cattle and swine is the primary driving force for its worldwide market growth. In feed applications, soybeans are used as such, or as soybean meal, the product obtained after solvent extraction of the oil. Soybeans always need an appropriate heat treatment to eliminate anti-nutritional factors (such as trypsins) and to stabilise the high product quality (enzyme and protein denaturation; eliminating lipid oxidation processes). Various toasting and extrusion processes are available to obtain this. Similarly, soybean meal is heat treated by thorough toasting after desolventising.

The widespread applicability of soybean commodities in the feed industry is first of all protein based. However, the soybean oil as such, or as a component of full fat bean products, is also a basic energy source in many feed formulations. As such, full fat beans replace both competing protein rich meals, for example, fishmeal and added oils and fats. Many high energy rations can be economically optimised by using appropriately treated soybeans as a protein and energy source.

For feed mill use, the crude soybean meal is handled as such or as pellets. A further size reduction might be needed for speciality feed product applications. Soy flour, for example, is obtained by milling solvent extracted soybean flakes or meal. For piglet starters and calf milk replacers, a much stronger denatured product is preferred. This is obtained, for example, in the production process of soy concentrates. Concentrates are produced by further alcohol washing the solvent extracted soybean flakes. The removal of carbohydrates and some of the minerals results in an increased protein content (65-70%).

Food Applications

Soybean commodities can also be processed to valuable, versatile and functional food ingredients. Crude and degummed soybean oil is refined, bleached and deodorised before use in food. During the chemical refining step, free fatty acids, soaps and remaining gums are removed. The bleaching process is used for the control of product colour. Deodorisation finally eliminates unwanted taste and flavour components. The refined, bleached and deodorised oil is commercialised as salad oil or for other low temperature applications. It is also a major ingredient in many oils and fats containing products, for example, shortening and margarine, biscuits, cookies and bread, chocolate type products and candy coating.

For many of these applications, refined and bleached soybean oil needs to be hydrogenated before deodorising. During hydrogenation, a more saturated fatty acid composition can be obtained, yielding products with a higher melting point. This results in a wide range of hardstocks with different melting characteristics. Combining these components enables the composition of shortenings and bakery margarines with adapted functional characteristics, for example, optimal plasticity and suitable spreadability.

White flakes (the defatted soybean flakes obtained after oil extraction) can be further processed for the production of soy concentrates (65-70% of protein) and soy isolates (more than 90% of protein). Concentrates and isolates are available with a wide range of functionalities, for example, with optimal emulsifying characteristics, improved water-binding capacity, enhanced fat-binding properties or adapted gelling characteristics. These speciality products are developed for applications in speciality meat and bakery products.
Soybean flour is an important ingredient for bakery products, either as a functional component or for protein enrichment. Indeed, protein fortification of foods is a major outlet for soybean flour in developing countries. Extrusion-type processes transform soybean flour, concentrates and isolates to textured vegetable proteins, which can directly be used as meat extenders and meat replacers.

The ever widening use of soybean oil and protein based ingredients in food is one of the major driving forces in the expanding world market of soybean seeds. Indeed, about 60% of all products in the Western market contain one or more soybean-derived ingredient. Soyfood products, however, remain very new in the Western diet; soybean milk and derived products (desserts, fermented, yoghurt-type), tofu, tempeh and miso.

The trend for health foods, together with the growing number of vegetarians, are major driving forces for the soyfood market expansion. The presence of natural, health promoting and sustaining components, for example, isoflavons, tocopherols and a balanced fatty acid composition high in mono- and poly-unsaturated fatty acids, is adding to this trend.

Sunflower

Sunflower article has been written by Larry Kleingartner, Executive Director of the National Sunflower Association (USA) - www.sunflowernsa.com

The history of world sunflower production in the last 20 years has been directly related to the political changes in the Soviet Union. The former Soviet Union was the largest producer of sunflower seed and also the largest consumer of sunflower oil. It was also a leader in the research and development of the crop. However, in the last few years, Argentina has become the largest producer of sunflower seed and international based seed companies have taken the hybrid seed and new genetics to all corners of the earth.

The decline in sunflower production in the former Soviet Union regions has limited the growth of sunflower as it relates to other oilseeds. From 1992/93 to 1997/98, the world's growth in sunflower production was just under 9 percent. This compares poorly to the other major oilseed crops, such as rapeseed's 24 percent growth and soybean's 23 percent growth.
However, the changing role of country production has not impacted the volume of sunflower oil exports as dramatically when compared to the other oilseeds. The percentage increase of sunflower oil exports during the five year period of 1992/93 to 1997/98 was 39 percent, compared to rape oil of 42 percent and soybean oil of 48 percent. The difference, of course, is that Argentina and the US export a majority of the sunflower oil that they produce; the former Soviet Union only exported limited volumes to several of their trading partners, such as Cuba.

The Impact of Market Economies

What is the potential impact on sunflower production as more countries switch to market economies? Today, more and more of the world's farmers are being given flexibility to plant crops according to market signals and environmental factors. Plant breeders are also providing new and better planting seeds for a variety of crops, especially in the hybridised crops. In the US, for instance, sunflower is being planted in more arid areas of the country compared to ten years ago. The situation is somewhat similar in Argentina where soybean has pushed sunflower out of the higher rainfall areas. In many arid areas of the US, farmers planted one crop, mainly wheat, and then idled the land the next year in what was called "fallow". Today, the concept of fallow or idling land is not economically feasible. Through a reduction of tillage and better use of herbicides and fertilisers, farmers are continuously cropping their land. Sunflower works well in rotation with wheat in these arid areas. The situation is again similar in parts of Argentina. Both are examples of market functions.

It is likely that the same situation will occur in Western and Eastern Europe and in Russia if market forces continue to gain political favour. As high protein meal demands increase in Eastern Europe and Russia, soybean acreage is likely to increase at the expense of sunflower. However, the expansion of sunflower (the more arid crop) is likely to expand into arid areas of Russia. Rapeseed has already enjoyed growth in these areas and that is likely to continue, possibly again at the expense of sunflower in some of the higher rainfall and humidity areas.

Changes in the Importing Markets

As changes are occurring in the production side, the same thing is happening in the importing countries. Sunflower oil used to enjoy the same price premiums as soybean and rapeseed in the world market, largely because several large importers specified sunflower oil in their tenders. That was largely a function of a number of North African countries. These countries depended on central buying agencies to purchase raw materials and most of the agencies bought either sunflower or cotton oil. In the early 1980s, one Egyptian government buyer of vegetable oil had a simple message "we buy sunflower oil if it is 7 percent cheaper than cotton oil". Other oils were not considered because they gave off offensive odours when heated which led to trouble in the

streets and, eventually, the buyer's job. Most of the central buying agencies have been replaced by the private sector who depend on their bottom line when buying vegetable oils.
The same situation occurred in Mexico during the era of Conosupo, the central government buying agency. When Conosupo decided it wanted to buy sunflower seed from the US, it did not look to Chicago soybean oil futures prices. The agency simply bid the sunflower price high enough in the States to get the required amount.

In the early 1980s, the US crushing plants loaded their sunflower seed on rail cars for Mexico; the margins being better to ship to Mexico and close the plants in the US. The situation is very different today, with Mexico's private businessmen competing in the world market.
However, the net result of this change to a market economy is that sunflower oil has lost its consistent premium. The premium does still occur but, today, it is a function of supply and demand. In fact, the potential record sunflower crop in Argentina this year will likely push world sunflower oil prices under soybean oil values.

What is the Direction of Sunflower in the Future?

It has already been indicated that sunflower is likely to be grown in the more arid areas of the world and it is believed that this trend will accelerate over the next ten years. The next trend will be to find a higher value in sunflower oil in the market place. It is unlikely that most of the world's sunflower producers can profitably produce this crop and compete with palm and soybean oil in the world market as the cheapest bulk oil. This will be accelerated as import tariffs on vegetable oil are reduced through world trade agreements. However, consumers are also growing more sensitive to altered fatty acid structure for health purposes and continue to be discriminating in their taste preferences. The growing middle class consumers around the world are watching food labels and making their purchases according to their taste and health requirements. A good example is India. Sunflower oil has gained a considerable and consistent market share, based on taste and health perception.

A number of fatty acid alterations have been made on sunflower oil over the years. Oleic acid values have been increased to make it more stable; the higher oleic acid also differentiates sunflower oil from other high linoleic acid oils such as soybean. More and new developments in sunflower oil are expected.

Other generic work is going on in sunflower. As with the major crops, gene transfer is indeed possible in sunflower. Despite consumer concerns in several countries, it is this science that can reduce some of the serious production problems in sunflower. The sunflower crop must have the same opportunity for new technology as other crops, as this is the only way in which it can compete for acreage in the international market place and remain a viable crop for the world's farmers.