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Sunflower Seeds and Their Products

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COMMODITY OF THE QUARTER: SUNFLOWER SEEDS AND THEIR PRODUCTS

BACKGROUND

Asteraceae (or Compositae), the sunflower family, is the largest family of flowering plants, encompassing some fifteen hundred genera and nearly twenty-five thousand species. The plant's Latin name is *Helianthus annuus*, which comes from the Greek hélios (sun) and anthos (flower). Annuus come from the fact that it is an annual plant. Plants of the Asteraceae family bear heads in which fertile flowers are aggregated and bordered by rays, the corollas of sterile flowers. The strap-shaped corollas of the ray florets project outward, giving the entire head the appearance of a single, large flower. The cultivated sunflower stands 5 to 20 feet in height with a rough hairy stem 1 to 3 inches in diameter. The head or disk measures from 3 to 24 inches across and is present from June through September. The seed is an elongated rhomboid achene. The Spanish word for sunflower is *girasol*; in French the word is *tournesol*. Both words mean “to turn toward the sun.” Details of this unusual turning behavior are described in the Growing section below.

HISTORY

The sunflower's bright, open face has served as a symbol of hope and holiness for centuries. Evidence suggests that the sunflower was originally grown by American Indians as far back as 3000 BC throughout North America with a concentration in present-day Arizona and New Mexico. It may have been domesticated even before corn. Sunflower seeds were considered sacred food to the Plains Indians; they placed ceremonial bowls filled with sunflower seeds on the graves of their dead to nourish them on their journey to the other world. Sunflower seeds provided blue and black dyes while the flowers provided yellow dye for the tinting of their

baskets and textiles. When Francisco Pizarro penetrated Peru in 1532, he observed the Indians worshiping the sacred image of the giant sunflower as their sun god. The Incan priestesses-the Maidens of the Sun-wore large sunflower disks made of virgin gold on their breasts (Lehner, 1960).

This exotic plant was taken back to Europe by such Spanish explorers where the plant became widespread throughout present-day Western Europe. After its introduction into Russia in the 18th century, the sunflower became a popular source of cooking oil throughout Europe with Russia as the main producer. By the late 19th century, Russian sunflower seed found its way back to the US. By the late 1970's U.S. acreage escalated to over 5 million due to strong European demand for sunflower oil stimulated by Russian exports of sunflower oil in the previous decades. This healthful alternative to cooking with animal fats was the driving force behind the demand. However, the Russians could no longer supply the growing demand, and European companies looked to the fledging U.S. industry. Europeans imported sunflower seed that was then crushed in European mills. Western Europe continues to be a large consumer of sunflower oil today, but depends on its own production.

Once reestablished in the U.S., the wild sunflower began to thrive again, especially in the Great Plains (NSA, 2010). A tribute to its hardiness was during the Dust Bowl when wild sunflowers took over the wind-eroded land, protecting it from further damage when the rains came in 1940-1941. This allowed perennial vegetation to become reestablished (Martin, Leonard and Stamp, 1976). During World War II, when fats were in short supply, mills were erected to in the mid-West and Canada to extract sunflower-seed oil for extra nourishment. The wild native sunflower is the state flower of Kansas, also called **“**the sunflower state,” and their flag is

emblazoned with a sunflower above the state seal. Today, sunflower crops are grown for seed and oil in many countries throughout the world. And, of course, millions of people enjoy this cheery plant in their gardens.

GROWING

Sunflowers are primarily grown in North Dakota, South Dakota, Kansas, Minnesota and Colorado where cooler temperatures and harsh winters make sunflowers less susceptible to damage from insects and disease. They can be successfully grown on land that will sustain corn- a light loam (with pH between 6.0 and 8.0) is preferred to a heavy wet soil. Seeds may be planted at the same time as corn (April-May), as sunflowers are hardy to a light spring frost. A green manure crop planted the previous fall will help prepare the site. Because of their deep root system, a fallow period is often recommended following sunflowers to replenish depleted soil water reserves. Allow a growing period of 120 days before the first fall frosts.

As the heads grow heavy, support may be useful. Some growers plant their rows north to south to take advantage of the sunflowers' fascinating heliotropic movement, called nutation, as the plants lean against one another for support. Facing east at sunrise, the flower follows the sun across the sky to face west at sunset. During the night (and at noon) the stem straightens out. Sunflowers are ready to harvest when the outer rows are completely dry, the middle rows are ripe but not dry and the center seeds are still somewhat green. Heads are cut off with about a foot of stem attached. Stalks are tied together and hung to dry in an airy, protected area. When completely dry, the seeds are removed by gently rubbing the heads. Sunflowers compete with irrigation for corn, silage crops, dry edible beans and wheat for acreage. Because of the very dry

condition of the soil following sunflower, it has been found useful to catch as much snow as possible by leaving tall stalks standing through the winter so that the soil water profile can be recharged (Nielsen, 2004).

DISEASES

The most serious diseases of sunflower are caused by fungi. The severity of these disease effects on total crop yield might be ranked: 1) sclerotinia, 2) verticillium, 3) rust 4) phoma, and 5) downy mildew. Resistance to these diseases has been incorporated into improved sunflower germplasm. Growing these resistant varieties and following a good crop rotation program can help reduce the likelihood of disease (University of Kentucky, 2009).

PESTS

Besides natural disaster, sunflowers are vulnerable to damage from birds. Scientific surveys revealed that blackbirds can damage $4 million to $11 million worth sunflowers annually in North Dakota, South Dakota, and Minnesota. Entire fields of sunflower may be devoured in just a few days. While killing blackbirds is illegal under U.S. Federal law (Title 50, Code of Federal Regulations, Part 21.43), an exception is made when they are found "committing or about to commit depredations upon ornamental or shade trees, agricultural crops, livestock, or wildlife, or when concentrated in such numbers and manner as to constitute a health hazard or other nuisance." Some States and local governments may have additional restrictions on killing blackbirds (Linz, Dolbeer, Hanzel & Huffman, 1996).

When extensive commercial planting of sunflower began in the 1970s, many of the insects which evolved on native *Helianthus*, a complex of 51 species, transferred to the cultivated crop.

This situation fueled the development of insect problems by providing monocultures where only isolated hosts were previously available. More than 150 insect species have been reported from cultivated and native sunflower. However, only a few insect species have adapted to cultivated sunflower and have become economic pests. They include cutworm, painted lady butterfly, thistle caterpillar, sunflower budworm, budworm moth, sunflower beetle, stem weevil and root weevil (University of Missouri, 1997).

CURRENT USES

Sunflowers are grown primarily for the production of oil. Oilseed varieties have small black seeds with very high oil content and are processed into sunflower oil and meal. It is also the seed found in bird food. Sunflower seed oil is used primarily in cooking and salad oils, margarine and shortening. It is mostly polyunsaturated and contains more vitamin E than any other cooking oil. The oil is also used for making soaps and paints. Sunflower seeds, and the meal that is a by-product of oil extraction, are also an ingredient in many premium livestock feeds. It is also featured in many mixes for birdfeeders. Extremely high in protein, calcium, phosphorous, thiamine, riboflavin and niacin, sunflower oil and seeds are good people food too! The oil contains a significant amount of linoleic acid and lecithin as well. Non-oilseed, or confectionery sunflower, contains a larger black and white striped seed which is used in a variety of food products from snacks to bread.

INDUSTRY TRENDS

The production of sunflowers for cooking oil, confectionary and birdseed has increased throughout the United States since 2000. After setting a new high in 2007, the average price of oil-containing sunflowers declined to $18.60 per cwt in 2008. However, the average price of

non-oil sunflowers continued to rise, reaching $28.00 per cwt. The average price for all types of sunflowers dropped to $20.40 in 2008. The 2008 sunflower crop totaled 3.4 billion pounds, up 19 percent from 2007, and was valued at over $669 million. Average yield also increased to 1,429 pounds per acre. Production of oil-type sunflowers in 2008 totaled nearly 3.0 billion pounds, increasing 21 percent from 2007. The yield increased to 1,452 pounds per acre. On the other hand, production of non-oil sunflowers totaled 429 million pounds and increased 11 percent from last year. The average yield decreased by 30 pounds from last year to 1,285 pounds per acre. Sunflowers grown for non-oil uses continue to have variable yields (NASS 2009).

EXPORTS & IMPORTS

The United States is a dominant supplier of sunflower seeds, exporting nearly 151,412 metric tons (MT) in 2008. Spain continues to be the leading customer, importing sunflower seeds in the shell for snacks. Other top markets for U.S. sunflower seeds are Canada, Turkey, Germany and Romania. In 2008 the United States exported 79,433 MT of sunflower oil. Canada has been the top importer of U.S. sunflower oil since 2004, importing over 66,543 MT of U.S. sunflower oil in 2008, an increase of more than 36 percent. The United States exports considerably less sunflower meal than oil. In 2008 the country exported 12,416 MT of sunflower meal, a 25 percent decline from 2007. The two largest markets for meal are Mexico and Canada. Compared to 2007, U.S. imports of both sunflower seeds and sunflower oil dropped sharply. In 2008 the country imported more than 76,255 MT of seeds, a 38 percent drop from the previous year. Likewise, imports of oil fell to 55,354 MT, or a 23 percent decline. Canada remains the largest supplier of sunflower seeds, providing 90 percent of total imports, and Argentina remains the

largest supplier of sunflower oil, providing 44 percent (Boland and Stroade, 2009).

BIODIESEL

There is some promise that sunflowers may be an ecologically sound source for biodiesel. Biodiesel is a fuel derived from plant and animal sources, such as sunflower oil, canola oil, soybean oil, safflower oil and tallow (beef fat). At least on a blended basis, it can substitute for petroleum-derived diesel in ordinary truck, car, tractor, train and other diesel engines. EPA studies show that using biodiesel reduces various types of emissions when compared well to petroleum-derived diesel, citing EPA studies. Sunflower oil has an energy content equivalent to 93 percent of number 2 U.S. diesel fuel. (National Biodiesel Board).

The National Sunflower Association has tracked the great interest in construction of small processing facilities for sunflower biodiesel production. Sunflower average yields can produce 600 pounds of oil per acre, considerably more than soybeans. North Dakota State University estimated that an acre of sunflowers can produce about 84 gallons of biodiesel, compared to 49 gallons of biodiesel from an acre of soybeans (Hofman, 2003). However, according to the NSA (2010), the price premium of sunflowers compared to soybean and canola oils, may make it cost-prohibitive as a major U.S. source for biodiesel production.

A small scale example of sunflower oil biodiesel production is happening in western Massachusetts where a group of five farms recently formed the Hilltown Farmers Biodiesel Cooperative. By the spring 2010 growing season, they hope to produce biodiesel from sunflower, canola and crambe grown on their own farms, using a mobile biodiesel processing plant in a 20 foot trailer. One of the farms plans to lease the virgin crop oil to restaurants first, on the

condition they return the waste oil for it to be made into biodiesel, generating double value from the crop. When compared to current diesel prices, producing their own biodiesel is not actually cost effective. Despite this economic shortcoming, these farmers believe in the value of using renewable fuel which has the positive effect of reducing greenhouse gas emissions and burns cleaner than ordinary diesel fuel (Broncaccio, 2009).

INFORMATION SOURCES

National Sunflower Association (NSA) http://www.sunflowernsa.com/

NSA, a non-profit commodity organization based in Mandan, North Dakota is the main association for sunflower production. The NSA investigates new markets and products and conducts aggressive promotion activities directed at the food trade and consumers in the US and around the world. They coordinate research programs with universities and USDA. Production and marketing information is made available to producers and industry members through The Sunflower magazine, newsletters, media releases and meetings. An annual Research Forum is held for researchers to present papers and exchange information. The NSA participates in wide range of legislative and policy development issues from US farm legislation to international trade.

Universities

Many research institutions and university extension programs in the United States provide resources about sunflowers. The following organizations represent the type of information these organizations provide.

Purdue University Extension http://www.ag.purdue.edu/hla/Hort/Pages/Extension.aspx

This Web site is hosted by the department of Horticulture & Landscape Architecture, which is recognized as one of the nation's leading contributors to plant science and horticulture. Ongoing research programs range from very basic molecular biology to applied research oriented towards crop productivity, crop improvement, development of new crops and plant products, as well as studies in plant physiology and genetics, including that of sunflowers.

North Dakota State University Sunflower Research

http://ideas.repec.org/p/ags/nddmrs/51172.html

Sunflower research in North Dakota focuses on variety testing. Additional research has been conducted by the departments of Entomology, Agricultural Economics, Food and Nutrition and the state experiment stations on sunflower diseases and pests; feasibility of extracting a red food colorant from the hulls of purple-hulled sunflower; and the impacts of banning methyl parathion application on sunflower.

Texas A & M, AgriLife Research & Extension http://lubbock.tamu.edu/sunflower/

This Web site provides information about growing sunflowers in Texas as well as nationwide field trials, soil management, production, and insect and weed management. Publication related to sunflowers include trials focused on irrigation, weed control, production, evaluating damage from natural disaster, drying and storing, pest control and more.

University of Missouri Extension

http://extension.missouri.edu/publications/DisplayPub.aspx?P=G4290

University of Missouri Extension publishes a wide range of research-based information to help users make informed decisions. Studies on sunflowers include grain storage pests,

integrated crop management, crop performance testing, and much more. They also maintain the active Agricultural Electronic Bulletin Board (AgEBB), an electronic network among farmers, University Extension Specialists and University faculty. AgEBB is sponsored by the University of Missouri as a segment of its Commercial Agriculture Extension Program and draws its information from University of Missouri College of Agriculture, Food and Natural Resources faculty and staff, University Extension specialists, Missouri Department of Agriculture, Missouri Agricultural Statistics Service, Missouri Department of Conservation and farmers.

Western Kansas Agricultural Research Centers

http://www.wkarc.org/DesktopDefault.aspx?tabid=37

Keep an eye on Rob Aiken, a crops research scientist who has conducted sunflower studies in areas such as available soil water, canopy development and productivity; limited irrigation of sunflower in northwest Kansas; crop simulation models in support of sunflower production; dryland strip-till production of sunflower; sunflower yields as affected by strip till; degree days, day length and sunflower development in the Central Plains; management of sunflower stem insect pests; evaluation of sunflower for resistance to stem and seed pests in the Northern and Central Plains; development of host-plant resistance as a strategy to reduce damage from major sunflower insect pests; atrazine tolerance/resistance in sunflower isolines; and sunflower production under various irrigation frequency and timing regimens.

OTHER SOURCES OF SUNFLOWER INFORMATION

Alternative Crop Guide: Sunflower: A Native Oilseed with Growing Markets
http://www.jeffersoninstitute.org/pdf/sunflower_crop_guide_08.pdf

Daily Oilseed Sunflower Price Averages
http://www.sunflowernsa.com/growers/default.asp?contentID=297

High Plains Sunflower Production Handbook
http://www.agmrc.org/media/cms/Sunflowers_C84E1143C31B9.pdf

List of Alternative Crops and Enterprises for Small Farm Diversification
http://www.nal.usda.gov/afsic/pubs/altlist.shtml

Oil Crops Outlook
http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1288

Oil Crops Yearbook
http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1290

Stat Communication's AgReport: Oil Seed Market News
http://www.agreport.com/oilseeds.html

Sunflower Magazine
https://www.sunflowernsa.com/magazine/

Thomas Jefferson Agricultural Institute
http://www.jeffersoninstitute.org/sunflower.php

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http://www.biodiesel.org/pdf_files/fuelfactsheets/emissions.pdf .

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http://www.sunflowernsa.com/oil/default.asp?contentID=255

Nielsen, D.C. (2004, April 4). Conservation tillage fact sheet #1-98. Sunflower water use relationships. Retrieved January 20, 2010 from the Central Great Plains Research Station web site:
http://webharvest.gov/peth04/20041015212719/http://www.akron.ars.usda.gov/fs_sunflower.html

University of Kentucky Cooperative Extension Service. (2009, July). Sunflower for seed. Retrieved January 27, 2010 from: http://www.uky.edu/Ag/NewCrops/introsheets/sunflower.pdf

University of Missouri Extension. (1997, November) Sunflower insect pests I. Retrieved January 24, 2010 from: http://extension.missouri.edu/publications/DisplayPub.aspx?P=PS14

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