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SUNFLOWER

Family: *Compositae*

Genus: *Helianthus*

Species: *annus*

Source: CSL Files

Contents

General Background

Sunflowers are tall annuals. Modern cultivated varieties of sunflower reach a plant height of between 1.5 and 2.5 m at flowering and have strong taproots, from which deeply-penetrating lateral roots develop. There is one apical inflorescence on a stem of 20-30 leaves. Leaves are large, dark green and roughly heart shaped, they have a wrinkled surface and prominent veins. The leaves are individually stalked and arranged round the stem in such a fashion that light interception is maximised. The flower head typically has a maximum diameter of 15-30 cm which consists of mostly yellow and sterile ligulate or ray flowers and the fertile disc or tube flowers. The flowers tend to be cross-pollinating and the best temperature range for the production of seed is 20-25°C. Seed and oil yield are reduced under conditions of stress. Oilseed producing varieties have a 1000 seed weight of 40 to 60g and non-oilseed varieties have a 1000 seed weight of sometimes over 100g.

The crop originated in subtropical and temperate zones, but through selective breeding has been made highly adaptable, especially to warm temperate regions. Sunflower is adapted to a range of soil conditions, but grows best on well-drained, high water-holding capacity soils with a near neutral pH (6.5-7.5). Production on high-stress soils such as those affected by drought, salinity or wetness is not exceptional but compares favourably with other commonly grown commercial crops.

Native sunflower and the early varieties were self incompatible and required insect pollination for economic seed set and yield. However, because the number of pollinators was often too low current hybrid varieties have been selected for and possess high levels of self compatibility. Modern hybrids still benefit from insect pollination.

Details of Quality Characteristics

Average oil content of the seed: 40-50% (Entire fruit), 50-60% (kernel only).
Oil composition: Over 90% oleic and linoleic acids in reciprocal proportions [1], although [2] states 25.1% oleic, 66.2% linoleic.
Average protein content of the seed: 20-30% [1]

To date, sunflower oil has only been used as an edible oil due to it's higher price and limited supply in comparison to other oils. But due to its naturally high proportion of linoleic acid and

advances in oil processing technology, the oil has advantages as a drying oil over linseed oil as it does not yellow with time. (The yellowing is due to the high linolenic acid content of the linseed oil). With the development of varieties high in oleic acid, and if a reduction in production costs can be achieved, sunflower oil could be used in the oleochemical industry.

There is limited production of non-oilseed varieties for use in confectionery and as bird feed.

Current Production and Yields

Crop production statistics:

Country	Area Harvested '000 ha	Yield t/ha
Austria	20.33	2.49
Belgium	n/a	n/a
Denmark	n/a	n/a
Finland	n/a	n/a
France	707.26	2.29
Germany	24.91	2.48
Greece	17.46	1.31
Ireland	n/a	n/a
Italy	207.82	2.05
Luxembourg	n/a	n/a
Netherlands	n/a	n/a
Portugal	50.00	0.66
Spain	858.20	1.01
Sweden	n/a	n/a
UK	n/a	n/a
USA	1,033.98	1.50
World	18,015.86	1.16

Source: FAO (2001)

Constraints upon Production

1. Cold wet seasons (from establishing and harvesting point of view).
2. Lack of very early maturing cultivars of sunflower specifically selected for UK.
3. Disease, especially *Sclerotinia sclerotiorum* and *Botrytis cinerea*.
4. Birds in the short term, until a reasonable area of sunflower is established. Finches in particular can cause severe seed loss prior to harvest.

Markets and Market Potential

Anecdotal estimates suggest 60,000 ha could be grown in southern Britain, based upon land capacity [4].

An edible semi-drying oil is obtained from the seed. Some varieties contain up to 45% oil. The oil is also used to make soap, candles, varnishes, paint etc, as well as for lighting and is said to be unrivalled as a lubricant. A blotting paper can be made from the seed receptacles and a high quality writing paper can be made from the inner stalk. The pith of the stems is one of the lightest substances known, having a specific gravity of 0.028. It has a wide range of applications, being used for purposes such as making life-saving appliances and slides for microscopes.

The dried stems make an excellent fuel, the ash is rich in potassium. Both the dried stems and the empty seed receptacles are an excellent kindling. Fibre from the stem can be used to make paper and fine quality cloth. A yellow dye is obtainable from the flowers and a purple-black dye is obtainable from the seed of certain varieties.

Sunflowers can be grown as a spring-sown green manure, they produce a good bulk of material, although root secretions from the plant can inhibit the growth of some plants.

Other Information

Sunflower is perceived to be a drought tolerant crop as it roots deeply and extracts water at depths not reached by other crops. Sunflower is comparable to maize in many ways although it can extract water more efficiently in low-rainfall areas. The seedbed should be prepared so that a moist soil environment is available for germination and growth. The soil surface should

be left as rough as possible to reduce the risk of soil erosion, drifting and blowing soil can seriously damage young seedlings. If the soil becomes compacted prior to planting reduced aeration and restricted water movement will occur, these conditions will increase the risk of downy mildew occurring. Breakdown of soil structure also reduces nutrient and water uptake and therefore yield.

Sunflower has a wide potential sowing window. High yields may be produced from early plantings yet yields may be reduced by increased pest problems. Soil temperature should be a minimum of 7ºC for planting and around 10ºC for germination. Lower temperatures will increase the susceptibility of seedlings to diseases such as downy mildew. The main insect problems in sunflower crops include cutworms, sunflower bud moth, sunflower stem weevil, sunflower root weevil and the sunflower midge. Major disease problems include downy mildew, alternaria leaf and stem spot, septoria leaf spot, sclerotinia, botrytis, phoma, stem canker, verticillium wilt and nematode diseases. One of the major problematic weeds in the sunflower crop is wild oat, this can cause severe yield loss and should be treated if the threshold level is reached. Other potentially damaging problems include birds, rabbits, deer, mice, flooding and frost.

Soils are often found to be deficient in nitrogen, phosphorus and sulphur. Potassium, calcium and magnesium are also frequently deficient in high-rainfall areas. Boron may also be required in some soils. Nitrogen applications of 50-75kg/ha are generally sufficient.

The crop is generally harvested in September-October after a growing season of around 120 days (depending on summer temperatures, relative moisture distribution and fertility levels).

Sunflowers should be grown in a suitable rotation to reduce the risk of weed, pest and disease attack, volunteers establishing, soil moisture depletion or phytotoxicity of the sunflower residue to the sunflower crop.

Research

In the future it is believed that sunflower will be grown in the more arid areas of the world, this trend is predicted to accelerate particularly in the next ten years. The next trend will be to establish a higher value market for the product and to make sunflower oil more competitive with palm and soybean oil on the world market. Recent developments in the fatty acids in

sunflower oils have occurred, oleic acid values have been increased to make the oil more stable. More developments in this area are expected.

As with many other major crops, gene transfer is possible in sunflowers. This is the only method of reducing some of the production problems relating to the sunflower crop despite consumer concerns in some countries.

Useful Websites

http://www.ext.nodak.edu/extpubs/plantsci/rowcrops/eb25w-2.htm - US sunflower production (includes a vast amount of detailed information)

BioMat Net

Sunflower (*Helianthus annuus*)

FAIR-1625 - New Valorisation of Rapeseed/Sunflower Lecithins, in Cosmetic and Fermentation Industries - AVAIL

AIR3-CT94-2003 - Sunflower Oil For Industrial Applications - SOFIA

AGRE-0039 - Seed Oils for New Technical Applications SONCA

AIR3-CT94-2218 - Reactivity Of Fatty Esters And Glycerol : New Methods

FAIR-0512 - European Energy Crops Processing and Utilisation in Europe

National Research - Italy - Microeconomic Analysis of Herbaceous Energy Crops - A Case Study in Italy

AIR3-CT94-2199 - The Use of Enzymes in the Processing of New Oilseeds (UEPNO) to Industrial Raw Material

AIR1-CT92-0513 - ASHLI - Fundamental Studies on the Selective Hydrogenation of Fats and Oils

AGRE-0029 - Improvement of Sunflower Dehulling Capacity

FAIR-PL97-3884 - CTVO-NET Chemical-technical utilisation of vegetable oils

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2. **Lide, D. L.** (1991) *Handbook of Chemistry and Physics*. 71st Ed, CRC.

3. **Askew M. F.** 1993. *Novel oil, fibre and protein crops in UK, A Future Perspective*; Brighton Crop Protection Conference 1993 6A-2 pp 658.

4. **Askew M F** 1992 - *A review of novel oil seed and fibre crops and their potential for UK.*