

HISTORY, PRODUCTION AND PERSPECTIVES OF SUNFLOWER IN CHINA

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ABSTRACT

Sunflower was recorded for the first time in China in 1621. In 1846, WU QU-JUN, a Chinese botanist illustrated sunflower in his famous book "THE TEXTUAL RESEARCH ABOUT THE PLANTS AND THEIR NAMES". JIANG SHAO-HUAI(1936) described sunflower with modern terminology, he introduced the Latin name *Helianthus annuus* and the English name "sunflower" into Chinese literature. Since sunflower showed characteristics like tolerance to salt, to drought and adaptation to wide conditions, it was grown all over China. But sunflower was cultivated piecemeal and mainly as a human food-snack until the second world war. Sunflower production increased gradually from 1978, it peaked in 1985 at 2.21 million tons, then decreased due to the occurrence of sclerotinia in the main production area, the north-east of China. The yield doubled from 1978 to 1984, reaching 1.8 tons/ha, and has remained relatively stable over recent years. The main zone of sunflower production is throughout the north of China, between 35-52 degrees north latitude. In the 1970s sunflowers were grown mainly in the north-east and this region contained 79.3% of the total Chinese sunflower acreage. But in the 1980s, sunflower cultivation developed rapidly all over the north, especially in the mid-north. After a peak in 1985 the total surface declined, particularly in north-east, due to disease and crop rotation problems and the absence of resistant varieties. The situation in the mid-north and in north-west is different, where the climate is dry, sclerotinia damage is small, and the hybrids selected by Chinese specialists are grown. The acreage of the mid-north now exceeds that of the north-east and the acreage of the north-west has increased since 1990. Interestingly in Shaan-xi province, the acreage increased rapidly because of high oil hybrid varieties introduced from the USA. Sunflower hybrids have been grown in the field since 1987, but the hybrid acreage was still limited to 10% of the total surface of sunflower in 1994. In fact, the current price of sunflower seeds is higher than for corn and sorghum. China imported 210 tons of hybrid sunflower seeds from the USA and from France in 1994. The demand will increase and 300-1500 tons is estimated for each year during 1996-2000. The new hybrid varieties from China, America, and France, after 2-5 year's trials, show great promise in the North-West of China. The next revolution in sunflower breeding is predicted to be those hybrids which are medium - short, with high oil content, very good productivity potential, resistant to mildew and other diseases, and with good autocompatibility.

Sunflower originated in North America, is grown widely in China. It is one of the most important oil crops in China after rapeseed, soybean, cotton and peanut. Today, sunflower is used as human snack-food and as an edible oil source. China has become one of the major producing countries in the world in the last two decades, it produces 1.0-2.2 million tons sunflower seeds every year, half of which were used to produce oil.

1. THE HISTORY OF SUNFLOWER IN CHINA

No one has determined the exact time when this foreign species was introduced in China. Sunflower was recorded for the first time in "THE LIST OF FLOWERS" in 1621 (Table 1) when it was called "ZHANG-JU", which means the big (3.33 meters) chrysanthemum. The current name of sunflower in Chinese is "XIANG-RI-KUI" and this name was used in 1635 for the first time. XIANG, means turning towards, RI means the Sun and KUI the herbaceous plants with big flowers. The sunflower was a common plant in China in 1820 where it was cultivated as a garden flower and as a snack food. In 1846, WU QU-JUN, a Chinese botanist, illustrated the sunflower in his famous book "THE TEXTUAL RESEARCH ABOUT THE PLANTS AND THEIR NAMES". WU indicated that "...the stem of sunflower is more than one ZHANG (=3.33 meters), and is as hard as bamboo. It grows vertically. Its leaves are similar to those of flax. It has branches, but usually has only one big flower like a dish. The petals are yellow. The seeds are situated in a plate which is very like honeycomb and gradually become dark purple and hard in the Autumn. This flower is easy to grow if one sows the seeds... The flower shows the habit of turning towards the sun, which gives it the familiar name of sunflower. The roasted seeds are fragrant and can be eaten after stir-frying. But one can become dizzy if one eats too much. The roasted seeds of sunflower, like the seeds of pumpkin and of water melon, are sold in the provinces of YUN-NAN and GUI-ZHOU".

Table 1. First record of sunflower in various countries

Countries	record year	references
Argentina	16-17th.C	Carter, 1978
Australia	1896	Publ. Austr., 1896
Brazil	1924	Granato, 1924
Chile	1917	Opazo, 1917
China	1621	LIU et al., 1994
France	1568	Dodonaeus, 1568
Philippines	1900	Webster, 1920
Russia	18th.C	Pierre le Grand
Spain	1510	Zukovsky, 1950

Sunflower is recorded as an oil plant in 1898, and as a medicinal plant in 1899. JIANG SHAO-HUAI (1936) described the sunflower with modern terminology, he introduced the Latin name *Helianthus annuus* and the English name "sunflower" into Chinese literature. Since sunflower showed some characteristics like tolerance to salt, to drought and adaptation to wide conditions, it was grown all over China. But sunflower was cultivated piecemeal and mainly as human

snack food until the second world war.

In the 1950s, high oil varieties from the USSR were introduced into China. The crop was then cultivated on a large scale. The total production of oil-type and snack-type sunflower increased from 16.8 thousand tons in 1950 to 143.3 thousand tons in 1959, and then declined to 10.2 thousand tons in 1962. During the cultural revolution, economic activity was disrupted, and no data of sunflower production was recorded in national statistical documents from 1964 to 1977.

2. AREA, YIELD AND PRODUCTION

With the opening up and reformation of politics, Chinese economic activity was restored from 1978. According to the data presented in Table 2, sunflower production increased gradually towards a peak in 1985 at 1.72 million tons, then decreased due to the disease of sclerotinia in the main production area, north-east China. The yield per hectare doubled from 1978 to 1982, and has remained relatively stable during the recent years.

Table 2. Sunflower production in China(1978-1994)

Years	Surface (million ha)	Yield (tons/ha)	Total Production (million tons)
1978	0.32	0.78	0.28
1979	0.37	0.92	0.34
1980	0.84	1.08	0.91
1981	1.04	1.28	1.33
1982	0.88	1.58	1.28
1983	0.73	1.83	1.34
1984	1.13	1.68	1.70
1985	1.47	1.17	1.72
1986	1.04	1.49	1.54
1987	0.89	1.40	1.24
1988	0.83	1.43	1.18
1989	0.72	1.49	1.06
1990	0.71	1.88	1.34
1991	0.79	1.80	1.42
1992	0.80	1.82	1.47
1993	0.72	1.77	1.28
1994	0.73	1.82	1.33

3. Change of main producing area

The main zone of sunflower production is the north of China, between 35 and 52 degrees north latitude. In the 1970s, the north-east was the principal area of sunflower cultivation, contributing 79.3% of the total production of China. In the 1980s sunflower cultivation developed rapidly all over north China, especially in the mid-north (see table 3). After a peak in 1985, the total surface declined, particularly in north-east, due to disease and crop rotation problems and absence of resistant varieties. However, the situation in the mid-north and in north-west is

different, where the climate is dry and sclerotinia damage is small. It was in these regions that the hybrids selected by Chinese specialists began to develop. The mid-north now produces more sunflowers than the north-east and the share of north-west has increased since 1990. Interestingly, in Shaan-xi province, the acreage increased rapidly because of the introduction of high oil hybrid varieties from the USA.

Table 3. Main areas of sunflower plantation(in thousand ha) in China

REGIONS	Provinces	1978	1985	1993
NORTH-EAST	JIN-LIN	105.3	296.1	91.2
	HEI-LIONG-JIANG	62.9	338.3	72.8
	LIAO-NING	85.4	77.7	21.5
	% of total surface	79.3	48.3	25.6
MID-NORTH	INNER-MONGOLIA	10.9	300.9	183.2
	SHAN-XI	4.5	158.0	130.0
	HE-BEI	5.7	102.1	60.8
	% of total surface	6.6	38.1	51.7
NORTH-WEST	XIN-JIANG	23.7	111.4	84.7
	SHAAN-XI	0	18.9	36.1
	% of total surface	7.4	8.8	16.7
ST(SUB-TOTAL ABOVE)		298.6	1402.6	680.3
TSS(TOTAL SURFACE OF SUNFLOWER)		319.9	1473.7	723.2
S.T/TSS (IN %)		93.3	95.2	94.1

4. HYBRID SELECTION

Cytoplasmic male sterility (CMS) discovered by French specialist, Patrice Leclercq, was introduced into China via Canada in 1974. The maintainer 1366B died because of susceptibility to disease, but the sterile line 1366A was crossed with Chinese lines. The sterility phenotype was maintained through succeeding generations. The stable lines of 74102-4A and 74102-4B were obtained in 1977 after 7 backcrosses including 3 generations in Hai-Nan (with a tropical climate). At the same time, restorer lines such as Ai 113 were selected and field tested.

The first series of F1 hybrids with CMS were tested during 1979-1980 in multiple field trials. The potential productivity of these F1 hybrids ranged from 2.6 to 3.0t/ha, a yield advantage over the old population variety Peredovic of 9.0-31.9%. The oil content was 33.9-39.7%. One Chinese F1, No1 of Liao-Ning was compared with 94 F1 hybrids from Yugoslavia, Rumania, USA, UN-FAO, and Australia during 1980-1985. The results showed that all the F1 hybrids were more productive than Peredovic. Thirteen of the F1 hybrids from foreign countries yielded more than the No1 of Liao-Ning (control), 63 hybrids yielded less than the control, and 18 hybrids had no significant difference from the control. The average oil content of the control was 25.6-36.9%, that of foreign F1 hybrids was 31.4-44.0%. These results indicated that the potential productivity of Chinese variety is not bad, but there is scope for improvement in oil content.

Since 1981, Chinese breeders have selected a number of CMS-A, B and R lines, such as 7718A, 7533A, 76202A, 7602-1-5R, 1049R, 5R, 3893R, SUO82R and 78383R. These lines show good general combining ability and high oil content. A second series of Chinese hybrid varieties was born in 1987. The yield potential

Sunflower hybrids have been cultivated since 1987, but the hybrid growing surface was still limited to 10% of the total sunflower acreage in 1994. There are many reasons for this, for instance it is very difficult to produce commercial seeds of some varieties due to the very low autocompatibility in the B line, some F1 seed lots have high levels of impurity due to environmental factors, major varieties are sensitive to diseases in the principal production areas where the rotation is difficult because of the limited land per producer. Another problem is lack of sufficient stable support for the specialists required to produce hybrid seed. In fact, the current price of sunflower is higher than corn and sorghum. China imported 210 tons of hybrid sunflower seeds from the USA and from France in 1994. The demand will increase and 300-1500 tons is estimated for each year during 1996-2000.

5. PERSPECTIVES

The oil-type sunflower opens an important market to the world, it gives an opportunity for the international trade of seeds and oil. The total edible oil production in China was 5585kt in 1992. This means one Chinese could consume only 4.6kg oil per year. This quantity is below the world average (15.7kg). The deficit of edible oil in China is estimated to reach about 5000-7000kt in the near future. Sunflower oil now is about 6.3% of total plant oil, the potential is about 20% in 2000. There have not been any controls on the price at which peasants may sell the seeds since 1993, and it is higher than for other competing crops, particularly corn (2.8-5.0 vis-a-vis 1.0-1.4 Yuan/kg). This price difference will be an incentive for sunflower producers in the future.

The new hybrid varieties from China, America, and France, after 2-5 year's trials, show great promise in the north-west of China. We can predict that the next revolution in sunflower breeding will be hybrids which are medium to short, with high oil content, very good potential productivity, resistance to mildew and other diseases, and with good autocompatibility.

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