

ABOUT THE DEVELOPMENT AND UTILIZATION OF AMERICAN  
TERNARY HYBRID OIL SUNFLOWER (*Helianthus annuus* L.)  
IN YUNNAN, CHINA

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ABSTRACT

As the most advanced technology of the world's sunflower production today, the principal product, "Sunflower Oil", of the American ternary hybrid has already become the major cooking oil for the population in the western countries because of its high nutritive value. And it has been successfully introduced into our province from the United States through DEKALB Genetics Corporation in 1994.

In this paper, the authors tried to explore the effects of extending sunflower cultivation on the development of oil production, the regulation of oil crops structure and the development of mountain area's economy in our province, in order to obtain better economic and social benefits.

Key word:

Sunflower (*Helianthus annuus* L.); Planting; Crop structure; Utilization.

1. SURVEY OF SUNFLOWER PRODUCTION IN CHINA AND BEYOND

Belonging to *Helianthus* genus of composite family, mainly growing in North America, sunflower, divided into two sorts (edible and oil), is the second chief oil crop, next to soybean, in the world's oil production which has developed speedily in the past 30 years. It was reported that since 1992, the crop acreage of sunflower amounted to about 16,700,000 ha. with a total output of 23,000,000 tons per year, accounted for about 20 percent of the total output of 9 chief vegetable oils in the world, the former USSR took the first place in crop acreage, being 4,650,000 ha. and in seed output, being 5,750,000 tons, accounting for about 26 percent of the world production, the second, Argentina, with a crop acreage of 2,710,000 ha. and output of 2,169,000 tons. Since the mid 1970s, oil sunflower has begun to be planted with large acreage in the united States of America, amounting to 425,000 ha. in 1976 and 839,000 ha. with a total output of 1,811,000 tons

in 1992. The highest yield of sunflower seed has been found in Italy, being 2,760 kg/ha., then 2,265 kg/ha. in Austria, 22,250 kg/ha. in Czech and 2,220 kg/ha. in France, in sequence.

The sunflower production in our country has developed since the foundation of new China, and its crop acreage amounted to about 667,000 ha. in the 1980s, 807,000ha. in 1992 with a seed output of 1,473,000 tons, 723,200 ha. and 1,282,300 tons, respectively in 1993, and it has become one of the five major oil crops in our country. The three provinces in Northeast China, Inner Mongolia and Xinjiang, Shanxi and Hebei constitute the major production areas in our country, accounting for 90 percent in crop acreage and 92.23 percent in overall production, in which, Inner Mongolia took the first place in crop acreage, yield and production in our country, being 183,200 ha., 2,719.5 kg/ha. and 498,200 tons, respectively, and the oil sunflower production has become the leading measure to develop the agricultural production of the above-mentioned provinces. In Yunnan, the crop acreage of sunflower kept stable at about 2,000 ha. year by year and the total output amounted to 4,150 tons with a yield of 2,595 kg/ha., and the oil sunflower's production was started relatively late. An series outstanding species of oil sunflower, ternary hybrid G101, G103 and DK3790, bred by DEKALB Genetics Corporation of America, were introduced successfully in 1994 by Yunnan Hongyuan Science and Technology Development Corporation into our province and grown experimentally for two years and spread about 133 ha. which had shown their wide adaptability, adverse resistance, high yield, easy to cultivate and manage with marked economic benefit, and well accepted by the inhabitants, and it is promising to spread on large acreage in order to develop the high quality edible oil crop in our province.

## 2. SIGNIFICANCE OF DEVELOPING HYBRID OIL SUNFLOWER

The traditional oil crop structure in our province is comparatively simple, mainly Brassica, with its total production unable to meet the demand of the people's raised living standard. With the climate fit to grow sunflower and the habit and experience in planting sunflower in our province, the hybrid was successfully introduced in 1994. This success has provided basis for development of sunflower and adjustment of the oil crop structure. Because of its high economic value, many by-products and wide range of comprehensive use, it is of practical and profound significance in developing positively and steadily the production of oil sunflower.

### 2.1 High oil content with good quality

The result determined in the Test Center of YAAS (Yunnan Academy of Agricultural Sciences) showed that the seed oil content of American Ternary Hybrid oil sunflower amounted to 64.8 - 66.6 %, containing 29.26-

30.08 % oleic acid and 50.86 - 52.48 % linoleic acid which are good for health, also vitamin E, carotin, glucose, etc., helping to prevent and cure cardiovascular diseases, and, if taken for long period of time, reducing cholesterol, softening blood vessels, so as to help cure hypertension, heart disease and atherosclerosis. It is also an ideal health-fit cooking oil having antiaging and beautifying effects to the human body(see Table 1).

Table 1 Fatty acid and oil content of  
hybrid oil sunflower

Variety Item		G101		G103		DK3790	
		before intro.	after intro.	before intro.	after intro.	before intro.	after intro.
Fatty acid ( % )	lino- leic acid	42.87	50.86	43.72	53.26	42.26	52.48
	oleic acid	42.63	29.79	39.09	29.26	39.86	30.08
	palmi- tic acid	10.49	10.35	11.24	10.05	11.61	9.41
Oil content of seed (%)		53.36	66.61	60.64	66.09	56.40	64.82
Oil percent- age (extracted with shell)		--	34.35	--	36.86	--	34.59

## 2.2 Comprehensive use

Besides oil, the by-products of oil sunflower as oil cake, culm, leaf, flower disc, seed shell, flower, etc. are also very useful. Oil cake has high protein content (about 37%), the content of 18 amino acids that man needs amounted to 35.9% (see Table 2) and high content of fat, sugar, phosphorus and potassium, it can be used as material for the manufacture of gourmet powder, soy sauce, cheese, adhesive, water paint and so on, being also a fine animal feed, and containing high quality lecithin which can be extracted and refined and added to feed to promote the animal's growth and development. The culm can be used as material of acoustic

septum and artificial fiber or paper after chemical treatment, and its ashes after burning could be a good phosphate-potash fertilizer, its flöwer disc contains 7 - 9% crude protein, just as that of barley or oats; 6.5 - 10.5 % crude fat; 2.4 - 3.0 % pectins; maceration extract without ammonia ( amylum ) amounted to 48.9 %, being a good animal feed, as its leaf and ground seed shell, the fresh disc can also be used to make wine. Its seed shell can also be used to make furfural, alchool, lignin after it was hydrolysed or to make furfural, acetic acid, methyl alcohol, substitute of citric acid, activated carbon, potassium carbonate, potassium chloride, potassium sulfate, and so on by dry distillation.

Apiculture can be developed in the meantime with oil sunflower planting because of its long florescence, large numbers of flower and high nectar content.

Table 2 Amino acid content of the oil cake of American hybrid sunflower (%)

ASP acid	3.25	THR acid	1.33	SER acid	1.49
GLU	8.05	PRO	4.25	GLY	2.16
ALA	1.53	GYS	0.16	VAL	1.79
MET	0.04	ILE	1.38	LEV	2.17
TYR	0.52	PHE	1.85	LYS	1.77
NH3	0.31	HIS	0.87	ARG	0.98

### 2.3 Short growth period and wide range of planting dates

The growing period duration of hybrid oil sunflower is about 90-115 days and it can be seeded from the first ten-day of April to the second ten-day of July and that's very useful to the reseeding after the damage of summer or autumn crops.

### 2.4 Wide adaptibility and high adverse resistance

Tolerent to poor soil and to droughts, oil sunflower can be cropped under different climate conditions in the area with altitude of from 1,200m to 2,100m above sea-level and varied planting patterns (sole sunflower or inter-cropping with other crops). Planting sunflower is an effective way for the people in poor montainous areas to get rich.

### 2.5 Economizing time and capital, increasing production and income

With its high disease resistance, the planting and management of hybrid oil sunflower is very simple and needs less material input, with seed yield usually amounting to 2,700-3,000 kg/ha., and 300 kg more oil than Brassica, and income increased by 2,250 yuan/ha., and its input-output ratio, 1:3-1:4 higher than that of Brassica.

## 2.6 A bright future market of its high quality vegetative oil

As we know, the nutritive value, palatable and healthful effect of cooking oil will be much valued in the future, with the rising of the people's living standard, better quality of cooking oil is demanded, but the oil of Brassica seed has been sifted out in developed countries because of its content of erucic acid and other alkalizate composition (e.g. glucosinolate, etc.) which are harmful to health. The oil of sunflower seed is naturally pure and has a high content of oleic acid, linoleic acid (2 or 3 times of those in Brassica oil), vitamin E, free of poisonous factors such as erucic acid, glucosinolate and so on. It has already become the first cooking oil in western countries, and a great market potentialities could be forecasted too.

## 3. SUGGESTIONS FOR DEVELOPING THE OIL SUNFLOWER PRODUCTION IN OUR PROVINCE

3.1 Adhere to the spreading method of good quality seed, "experiment-demonstration-popularization", and breed good varieties according to the conditions of our province.

3.2 Using the heterosis and land resource to increase the output ratio and the farmer's income. Putting the focal points of sunflower spreading on the mountain and semimountain areas to develop the local economy.

3.3 The units concerned should guarantee the seed supply and its quality.

3.4 According to the weather condition, early sowing in May should be required in central area in order to make full use of light and heat resources and avoid the rain in florescence; besides the summer sowing in mid-altitude area (1,000-1,400m), sowing in July-August is also possible as a late autumn crops; in the low-altitude and heat regions as Dehong, Xishuangbanna, winter-sowing could be under consideration because of frost-free winters, taking the planting of sunflower as a measure of agricultural development in winter and regulation of crop structure, practising two crops rotation annually of rice-oil to increase the multiple crop index, production and income.

3.5 Practise inter-cropping in suitable area, sowing sunflower in field corners and border to make full use of light and heat resource, e.g. inter-cropping with long-stalked and short stalked crops (stereo cultivation) to make full use of field and space to increase production but they should help each other and not get one thing and lose the another; inter-cropping in the field of perennial crops at their early stage, e.g. sowing sunflower in the newly established orchards or tea groves; using stubble land to crop sunflower, e.g. in the area where the accumulated temperature is not enough for growing ratooning rice, we can plant oil sunflower in the open paddy

field after harvesting the single-crop rice or in dry land after early tobacco, etc.. From these practices, the possibilities of developing sunflower could be found.

3.6 With a series of effective support measures to enhance the enthusiasm of masses to plant oil sunflower, for example, government department should help farmers with necessary capital to buy seed because of its high price and make centralized purchase after harvesting to dispel their misgivings of selling

3.7 Planting of oil sunflower benefits the nation and the people, the propaganda of sunflower planting should be spread among the masses, the agricultural technological department should offer technical services, pass on techniques of sunflower cultivation to guide the farmers to practise scientific planting.

3.8 Set up a circulation and processing system for primary products, facilitating the purchase, the process of sunflower seeds, the supply and marketing of oil, the processing and utilization of by-products and try to realize step by step the industrialization. Try hard to expand the planting acreage of oil sunflower in our province up to 20,000 ha. by the end of the century and make great efforts to develop the oil production, regulate the oil crops structure and supply people with the nutritive oil.

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