



UNION OF CHAMBERS OF COMMERCE

CHAMBER OF EXPORTERS

THE FIRST INTERNATIONAL CONFERENCE ON OIL SEEDS
CORINTHIA HOTEL, KHARTOUM-SUDAN, NOVEMBER 24th, 2012

SUNFLOWER PRODUCTION IN THE SUDAN: OPPORTUNITIES AND CHALLENGES

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INTRODUCTION

Sunflower (*Helianthus annuus*) is considered as one of the most important oilseed crops in the world. Sunflower oil represents about 13% of the world vegetable oil production. The major usage of sunflower oil is for food industry (96%). The world production of sunflower seed was about 31 million tons and sunflower oil about 11.5 million tons in 2010. Total area harvested in 2011 was about 23.9 million Hectares with a seed yield of 1.34 metric tons/hectare (FAO 2011). Yields between 500 and 2600 kg seeds/ha are reported. The whole seed contains about 40% oil and about 25% protein suited for animal feeding.

The four largest world producers (The Russian Federation, Ukraine, European Union and Argentina) account for 70% of global volume. The exponential growth of production that took place in the last ten years in the Black Sea region was due to the increased acreage and the higher yields achieved by the replacing old varieties by hybrid seeds.

The Russian Federation, Ukraine and Argentina are often referred as the “sunflower triangle”. The change in the market situation of one country has a great influence on the market situation in the other two countries, and affects the world market of sunflower seeds and sunflower by-products.

Sunflower seeds are crushed mostly locally and seed world trade represents less than 10 % of global production. World sunflower oil trade accounts for 30 % of total consumption. The European Union is the major destination of the Ukrainian and Argentine exports. Global production grew steadily in last 25 years (PS&D - USDA, 2011), and FAO expect a total world output close to 60 million tones towards 2050 (Figure 1).

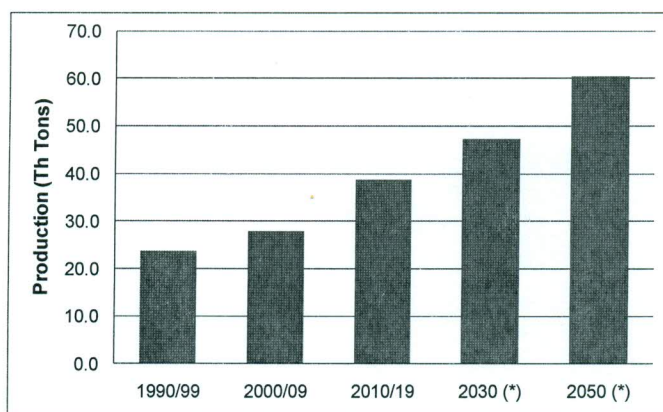


Figure 1: World sunflower production – Projection to 2050.

SUNFLOWER IN THE SUDAN

Sunflower was first introduced to the Sudan in research plots of Agricultural Research Corporation (ARC) in early 1960's. Research work started in Gezira research Station at Wad Medani and Kenana Research Station at Abu Na'ama.

Large scale commercial production started in 1985 in Blue Nile State. This initiative was led by the private sector (Alshaikh Agricultural Co.). A number of large producers was then involved in sunflower large scale mechanized production. In early 1990's a sunflower growers union was established to organize producers and enhance production of the new crop. Table (1) shows the expansion that took place in sunflower production in the Sudan. The early years (1987/88-1991/92) sunflower was cultivated in mechanized rainfed areas of Blue Nile, Sennar, and Gadaref. Irrigated production started in 1992/93 in Rahad Project and expanded to Gezira Scheme and New Halfa Scheme. Lately flood areas of Gash Delta were also included.

Table 1. Sunflower area, production, and yield from 1987/88 season to 2011/12 season.

SEASON	AREA '000' Fed	PROD. '000'Ton	YIELD Kg/Fed	SEASON	AREA '000' Fed	PROD. '000'Ton	YIELD Kg/Fed
				1999/2000	49	8	163
1987/88	260	39	150	2000/01	13	4	308
1988/89	367	46	125	2001/02	26	4	154
1989/90	145	22	152	2002/03	29	18	621
1990/91	234	23	98	2003/04	13	6	462
1991/92	75	11	147	2004/05	25	13	520
1992/93	221	40	181	2005/06	72	44	611
1993/94	144	32	222	2006/07	147	73	479
1994/95	175	48	274	2007/08	296	100	338
1995/96	110	25	227	2008/09	730	247	338
1996/97	73	20	274	2009/10	118	46	393
1997/98	65	12	185	2010/11	206	124	602
1998/99	46	10	217	2011/12	238	92	387

Source: Ministry of Agriculture and Forests, Department of Agricultural Statistics

In 2001 the Federal Ministry of Agriculture stated an ambitious project to develop the production of sunflower. The objectives of the project included:

- Utilizing excess water in winter season in irrigated projects.
- Diversifying the crop mix in rain fed areas.
- Supplying oil mills with inputs.
- Act as a model of linking manufacturing/production/financing in agriculture.

Partners were Federal ministry of Agriculture and Forests, Ministry of industry, Sudanese chamber of industries, irrigated projects, Sudanese farmers Union, and the Agricultural Bank of Sudan (ABS). Four ministerial committees were formed. These included a finance committee, a production committee, marketing committee, and a technology committee. The work started by purchasing 450 tons of sunflower hybrids. These were distributed to the irrigated projects of New halfa, Rahad, Suki, and Sennar. In the season 2001/2002 30,000 feddan were cultivated in the irrigated projects. The cultivated areas were extended lately to rainfed areas. Finance for production was availed by ABS. Huge efforts were put to promote the new crop and follow up execution of the production plans. The main problem that faced the project was a marketing problem.

In 2004, Savola Edible Oil Co. Ltd. and the Federal Ministry of Agriculture and Forests established a partnership to finance and produce Sunflower. The new partnership was organized such that Savola Edible Oil Co. Ltd. was the guaranteed buyer of the production, the Federal Ministry of Agriculture was responsible for coordinating production, while the Agricultural Bank of Sudan was in charge of providing finance.

With the auspices of Federal Ministry of Agriculture and Forests the Higher Technical Committee for sunflower production was re-established at federal level, supported with a network at state level with addition of farmer unions and Sheikan insurance company.

The new partnership established an agricultural administration to follow up execution of the plans. Research and development activities were organized in collaboration with Agricultural Research Corporation to support technology generation and transfer. The production plan targeted increasing crude sunflower oil production from 30,000 tons to 100,000 tons to satisfy the requirements of Savola newly established refining plant in Khartoum. The plan also targeted increasing crop yield for rainfed areas from 125 kg/fed to 220 kg/fed and from 400 kg/fed in irrigate areas to one ton/feddan. The project objectives also included exporting crude oil to Savola plants in Saudi Arabia, Egypt, Turkey, Morocco, and Algeria.

In the first four seasons (2004/05- 2007/08) areas increased from 18,000 feddan to 335,000 feddan. The first two seasons showed concentration on irrigated project: New halfa, Rahad, Suki, and Sennar. Areas increase from 18,000 fed. To 70,000 fed. The third year showed a movement to rainfed areas of Blue Nile, Gedaref, south Kordofan, Sennar, and White Nile. Rainfed areas increased in 2006/2007 season to 97,000 fed. and to 295,000 fed in 2007/2008. In 2007/2008 the irrigated production increased to 40,000 fed.

The committee also succeeded in formulation of a 5 year plan for sunflower production. The plan targeted increasing sunflower cultivated area in the first year from 340 000 feddans to 2.5 million feddans in the fifth year and increasing production from 65 000 tons in the base season (2007/2008) to 750 000 tons in the final year (2011/2012) as shown in figure (2).

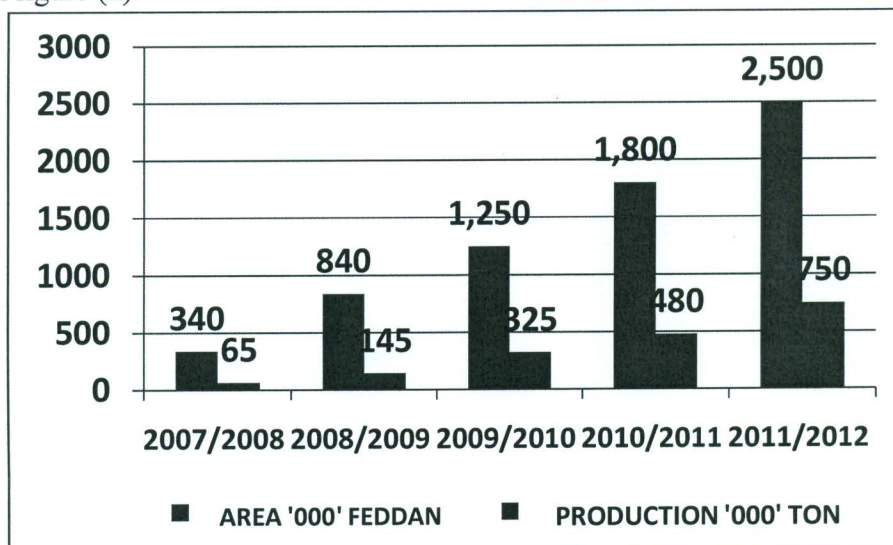


Figure (2) Five Year Plan for Sunflower Production.

The Agricultural Revival program had formed a new set up in 2009. The sunflower higher committee became part of the Oil Crops Board.

CHARACTERISTICS OF SUNFLOWER PRODUCTION IN THE SUDAN

Sunflower is a crop with high adaptability to a wide variety of environments. In the Sudan sunflower is grown as a summer as well as a winter crop. The crop is also produced in rain fed areas as well as in irrigated areas. In addition, sunflower is cultivated in a wide range of soils and farming systems. This unique characteristic can be utilized to formulate a wide and strong production base in the Sudan.

Sunflower in the Sudan is also characterized by the availability of inputs: seeds (hybrids and open pollinated), fertilizers, herbicides, pesticides, as well as machinery for seed bed preparation, seeding, chemical application, harvesting, and handling. The crop is also characterized by availability of a wealth of information and recommended technologies by Agricultural Research Corporation (ARC). Sunflower production could be fully mechanized, hence avoiding problems of manual labor requirement. Weeds could be controlled using herbicides and pests could be controlled using recommended pesticides.

In the Sudan, there is a huge crushing capacity (about one million metric tons) of oil mills. There is also demand for the seed cake from the growing animal production industry. This forms a continuous demand for the crop and other oil crops. The Sudan is also having a great advantage of being at a short distance from the markets of the Gulf countries.

Increase of seed prices in the recent years (about ten folds in the last decade) had motivated many farmers to cultivate sunflower. On the other hand, the sharp increase in inputs such as hybrids and fertilizers caused some farmers to decline from its cultivation.

PROBLEMS OF PRODUCTION

- Fluctuation in cultivated areas and production as a result of poor organization set up for production and the absence production plans.
- Low crop yields due to poor management of the crop and poor knowledge of production characteristics and productivity limitations.
- Poor financing and credit availability.
- Poor linkages between stakeholders.

PRODUCTION POTENTIAL

The Sudan is endowed with huge agricultural resources with diversity in soils, climate, and water resources. Agricultural soils include: the Central Clay Plane that extends from Eastern Sudan (Kassala and Gedaref states) to Central Sudan (Gezira Blue and White Nile states) to Western Sudan (Kordofan and Darfur States). The sand dunes belt extends along the Northern parts of the west (Kordofan and Darfur States). The Blue Nile, the

White Nile and the main Nile embody the river terrace soils. The climatic zones include desert, semi-desert, low rainfall savannah and high rainfall savannah. Water resources amount to about 50.5 billion cubic meters from the Nile in addition to rainfall up to 1000 mm/annum. Ground water amounts to about 7 billion cubic meters.

Two main farming systems are identified: rainfed and irrigated systems. The rainfed farming system includes traditional and mechanized farming systems with a total area of about 38 million feddan (about 16 million Hectare). The irrigated farming system, with a total area of 3 million feddan (about 1.3 Million Hectares), includes Gezira, New Halfa, Rahad, and Suki irrigated projects in addition to pump schemes on the Blue Nile, White Nile, and main River Nile. Flood irrigation includes Gash, Toker, and Abu Habil seasonal rivers.

Sunflower cultivation was tested in all these farming systems and proved to be successful. Today sunflower is cultivated all over the Sudan. The largest areas are grown in rainfed areas. These include; Gedaref State, Sennar State, Blue Nile State, White Nile State and Kordofan States. In irrigated areas, sunflower is grown mainly in the major irrigated projects: Gezira, New Halfa, Rahad, Suki, and Gash. Table (1) shows sunflower area, production, and yield from 1987/88 season to 2011/12 season. The figure shows clear variation and fluctuations in area, yield, and production. Contribution to the total area of production is inconsistent and there is no correlation between irrigated areas and rainfed areas. The figure shows also the high variability of seed yield. Generally seed yields are low. The contribution of the rainfed areas to total production in most seasons is greater than that of the irrigated sector due to its large cultivated areas.

Sunflower is an easy crop to cultivate. It could fit easily in all crop rotations. In irrigated projects it can fit as a winter crop. Its major competitor is wheat crop. Both crops are could be fully mechanized. The decision which crop will farmers cultivate depends mainly on price and credit facilities offered. In mechanized rainfed areas, sunflower had a better potential to expand in the vast production area. It is known that sunflower is drought tolerant and it suited very well in the rainfed environment. The crop is generally produced in areas of rainfall more than 500 mm/annum. The same set of machines used for sorghum, the main crop, could be used for sunflower production. Furthermore, the introduction of pre-emergence herbicides for sunflower made it very easy and convincing for farmers to adopt this new crop. The only obstacle is securing finance for the imported inputs. If this problem was solved, and the high seed prices continued, huge expansion of sunflower in rainfed areas could take place.

Protecting sunflower from pests and diseases is an important issue that should be taken in consideration. Generally no diseases were reported, the major pest is the african bollworm (*Helicoverpa armigera*, **Hb.**). Its occurrence is sometimes observed in high rainfall areas.

PRODUCTION TECHNOLOGIES

Agricultural Research Corporation had issued a set of recommendations for production of sunflower. These include hybrids, cultural practices (sowing dates, seed rates, and irrigation), weed control (mechanical, pre and post emergence herbicides), pest control (fungicides and pesticides), and harvesting (manual and mechanical).

Current production practices for rainfed areas follow the same practices for sorghum crop. These include: discing using the wide level disc (WLD), followed by seeding using the same WLD, manual weeding, manual cutting of sunflower heads and manual feeding to a stationary thresher. This style is now changing with the shortage of manual labor and high cost of manual operations. Manual weeding is replaced by pre-emergence herbicides and semi-mechanized harvesting is being replaced by full mechanization using the combine harvester. As for inputs, hybrids are used but fertilizers are not. On the other hand, large companies and progressive farmers use a high level of technologies including: disc harrowing, row planters, pre-emergence herbicides, fertilizers, as well as combine harvesting. Some companies adopt zero tillage practices and the use of selective herbicides.

In irrigated areas cultivation, seed bed preparation is performed using a wide range of machinery: disc plows, disc harrows, and ridge forming machines. Seeding is manual but the use of mechanical seeding machines is expanding. Harvesting is either fully mechanized using combine harvesters or semi-mechanized using manual cutting of heads and stationary threshing machines. In irrigated agriculture hybrids are used and urea fertilization is often used.

RESEARCH AND DEVELOPMENT

Research and development of sunflower is mainly performed by the Government as well as the private sector. The objectives of Sunflower Research Program (SFRP) of the Agricultural Research Corporation, ministry of Agriculture and Irrigation include:

1. Enhancing productivity and reduce cost of production through breeding high yielding hybrids suitable for productive environments in the Sudan.
2. Availing seeds locally.
3. Identify the best cultural practices to increase efficiency of utilization of inputs.
4. Expand production in both rainfed and irrigated agriculture.

The specific objectives of SFP breeding program include: breeding for high yield, high oil content, early maturity, short plants, resistance for pests and diseases, and drought tolerance.

The seed production project of SFRP targets propagating locally developed hybrids through availing foundation seeds. This project works in parallel with the Seed Maintenance Project.

SFRP has collaborative research activities with three private companies; The Sudanese Arab Seed Company, Harvest Company Ltd, and Kenana Integrated Agricultural Solutions (KIAS) to produce foundation seeds for locally developed hybrids.

The crop variety committee, the official body to endorse crop varieties, had released a number of sunflower varieties. In 1991 two open pollinated varieties were released by ARC. Following that 15 imported and local hybrids were released in the years 2003 – 2011.

YIELD POTENTIAL

Although quality is important for a crop such as sunflower, yield is the most important factor regarding production. Low sunflower yield is the main problem facing producers in the Sudan. There is a very clear variation in sunflower yield in the reported years 1987-2012 (Table 1). The national average yield fluctuated from 98 kg/fed in 1990/1991 season to 602 kg/fed in 2010/2011 season. Rainfed yields amount to one third to one half of irrigated yields. Rainfed sunflower yield ranged from 99 kg/fed to 374 kg/fed, while that of irrigated production ranged from 90 kg/fed to 813 kg/fed.

Research plots showed a potential yield that ranged from 1062 to 513 kg/fed in irrigated areas and from 874 to 410 kg/fed in rainfed areas. This shows that there is a good potential to increase crop yields in both farming systems. This could be achieved by using high inputs, and good management of the crop.

FUTURE PROSPECTS (CHALLENGES)

- There is a strong need to build up an organizational set up and an active network of participants to develop strategies, policies, and production plans for the whole chain of sunflower production, financing, marketing, and manufacturing. This is needed to utilize the available Sudanese resources and satisfy the rising demand for sunflower and contribute to the national economy.
- Specific and optimum technologies for the different production environments should be defined in order to increase yield, improve quality, and minimize cost of production. This could be done by financially supporting an applied research and technology transfer activities.

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