Production and Marketing Dimensions of Sunflower in Gadag District

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Abstract:

Sunflower is an important oil seed crop in the world, which is known as the "Champion" of the oil seed crops. Sunflower is becoming popular among farming community because of its wide adaptability to different agro- climatic region and soil types, easy crop management, optimum seed rate, drought tolerance, photo period insensitively, early maturity, high multiplication ratio (1:50) and high oil content (45-50%) with anti-cholesterol properties which fetches higher price in the market. There are two types of sunflowers seed produced, oilseed and confectionery. About 95% of world production is the oil seed type and only 5% the confectionery type. Sunflower has contained appreciable quantities of proteins, vitamins A, B, E & K. The sunflower meal is nutritious and can be used to feed the milk cattle, poultry and pigs.

Key words:- Sunflower important oil seed crop world, which is known "Champion"

Introduction:

Sunflower is grown in many semi- arid regions of the world from Argentina to Canada and from central Africa into the Soviet Union. It is tolerant of both low and high temperature, but more tolerant to low temperatures. Sunflower seeds will germinate at 39^0 F but temperature at least 46 to 50^0 F are required. Sunflower needs less than 50 cm rain. It is grown both in the Kharif and Rabi season.

Cultivation of sunflower

In India the sunflower is traditionally cultivated in Karnataka, Maharastra and Andhra Pradesh. In recent years its cultivation has also been taken up in non-traditional states like Haryana, Punjab, UP, Gujarat, Tamil Nadu, Orissa, MP, and Rajasthan. Among the important sunflower growing states in the country, Karnataka is one where in it occupies an area of 9.85 lakh hectares with annual production of 3.62 lakh tones and productivity of 336 kg per hectare. Karnataka is one of the states selected by the Oil Seed Technology Mission (OSTM) for the development of oil seed crops in the National Oil seed Development Project (NODP) in the country. Out of 180 districts considered for the development of oil seeds under NODP ten districts are selected from Karnataka namely, Belguam, Bellary, Bidar, Bijapur, Chitradurga, Gadag Gadag, Gulbarga, Raichur, and Tumkur. Major sunflower growing districts in Karnataka are Raichur, Bijapur, Bellary, Bidar, Chitradurga, Belguam, Gadag Gadag, and Gulbarga.

Agronomy

Sunflower is sown by Dibbling method which requires 5-6 kg seed per hectare, while furrow sowing needs 8-10 kg per hectare. The excess seedlings are thinned 10-15 days after seedling emergence. Seeds should be treated with captan or ceresan @ 3 g/kg seed under dry

land conditions. In downy mildew prone areas, seed treatment with apron 35 SD @ 6 g/kg seed is necessary. Climatic conditions with relative humidity of 50 to 85 percent could render seeds to lose viability within 40-60 days. The optimum population varies from 40-74,000 plants/ha depending on variety and availability of moisture. Under dry land conditions, 40-50,000 plants/ha, while under irrigated conditions, 50-60,000 plants/ha is the optimum plant density. A plant density of 55,556 plants/ha (60 cm x 30 cm) in tall cultivars and 74,000 plants/ha (45 cm x 30 cm) in dwarf cultivars/hybrids has been found to be optimum.

Manures and Fertilizers

Sunflower is an exhaustive crop and responds well to application of manures and fertilizers. Application of 10-12 tonnes of FYM or compost/ha is necessary especially in dry lands and poorly fertile soils.

Water management

Usually no irrigation is needed for kharif crop. However, a irrigation may be given in case of uneven distribution of rainfall. Rabi crop may be irrigated thrice after 40, 75 and 110 days of sowing. Sunflower crop is highly sensitive to water stress between flowering and grain filling stages. Therefore, a irrigation may be provided in case of moisture deficiency during this stage. Irrigation requirement of crop during summer is relatively higher. Irrigation at grain-filling stage should be light and given on calm and windless evening to avoid lodging. Among the various stages, bud initiation, flowering period and seed development stages are critical stages in terms of irrigation.

Consumption of Sunflower

Roughly one-quarter of all sunflower seed production is used to produce birdseed. The 2006 National and State Economic Impacts of Wildlife Watching survey by the U.S. Fish and Wildlife Service found that people spent $3.35 billion feeding wild birds, up 64 percent from 2001. Consumers spent $2.7 billion on commercially prepared bird food, up 33 percent from 2001, with the rest spent on bulk wild bird food. Sunflower seeds are considered a premium birdfeed ingredient because of their high oil content and thin hulls. Most birdfeed uses oil-type sunflower seed, though small confection seeds are also used.

Confectionary sunflower seeds are a familiar component of snack products. Approximately 10-20 percent of U.S. sunflower production is used in shelled kernels, whole seeds, and nut and fruit mixes containing sunflower seed. Kernels are also used in processed foods, such as granola bars and breads. Confectionary sunflower seed competes with nut crops such as peanuts, almonds, walnuts, cashews, and specialty grains such as millet and flax used in the production of multi-grain breads.

Sunflower Meal

Livestock, typically beef and dairy cattle, consume sunflower meal as part of a feed ration. Sunflower meal is consumed near crushing plants in North Dakota and Kansas in feedlots, and to a lesser extent in dairy operations. Export demand for sunflower meal is limited, with small amounts shipped to Canada. The price of sunflower meal is generally discounted from other protein meals, partly because of its lower protein content (28-38 percent vs. 44-49 percent

for soybean meal). High fiber content and limited availability of lysine (an important nutritional component in swine and poultry production) also limit demand. Retaining the hulls increases fiber content and meal volume, but lowers overall feed energy value, which results in lower prices.

Sunflower Oil

Domestic demand for sunflower oil has increased in recent years as processors have built refineries and large buyers have committed to future purchases. Food processors use the oil for frying foods (including potato chips) and in salad and cooking oil, margarine, and dairy substitutes. Sunflower oil is preferred in many high-quality dining establishments for its neutral taste. A small supply of high-oleic oil is used in industrial frying applications where high temperatures require good oxidation stability. A small amount of oil is also used in cosmetics, resins, and lubricants. Linoleic, high-oleic, and mid-oleic sunflower oils are sold in the United States. Until recently, linoleic oil was the predominant oil. Linoleic oil must be partially hydrogenated to maintain its stability in various uses, a process that also creates Trans fats. Plant breeders began developing mid-oleic seed after research uncovered a link between Tran's fats and heart disease. Today, the majority of the sunflower oil supply is mid-oleic, which does not require hydrogenation. Mid-oleic oil has no Tran's fats, low monounsaturated fat, and a neutral taste. It is also more durable than most other vegetable oils when used in industrial frying. Such qualities make food processors willing to pay a premium for sunflower seed oil over soybean oil.

U.S. prices for sunflower oil generally move in unison with other vegetable oil prices, with sunflower oil commanding a premium. It is a common practice for those trading sunflower oil to hedge in the soybean oil futures market. Strong demand for sunflower oil in edible uses raises its price and limits its use for producing biodiesel.

World Area under Production of Sunflower

World Sunflower area accounts 22.81 Million hectors and production around 27.41 million tones, account for around 8%and 9% of world edible oil seed and oil production. Major cultivating countries are Russia (5.41 Million Hectares), Ukraine (3.59 Million Hectares), India (2.16 Million Hectares), Argentina (1.89 Million Hectares), USA (1.06 Million Hectares) and China (1.05 Million Hectares) occupying about 68% of the total world sunflower acreage. The leading commercial producers of sunflower seeds are Russia, Ukraine, Argentina and China contributing 55% of the total world production. About 3 million tones of sunflower are traded in the world market. Bulgeria, France, Hungary, Russia and Romania are the major exporters contributing around 1.8 million tones of the total exports. Spain, Turkey, Netherlands, Italy and Germany altogether accounts for 70% of the total imports.

Sunflower oil is widely used in parts of Russia, Europe, and the Middle East, and U.S. production began with immigrant groups from these regions. With the introduction of high-oil-yielding Soviet cultivators in the late 1960s and the development of oilseed crushing capacity in the United States, sunflower production increased to over 2,00,000 acres by 1970. Acreage continued to rise throughout the 1970s, fueled by strong prices, improved varieties (including Argentine and hybrid seed), and ready export markets in Europe and Mexico. Planted acreage peaked at 5.6 million acres in 1979. Through the 1970s, sunflowers were touted as one of the

most promising growth crops. However, U.S. sunflower production declined by more than two-thirds in the 1980s as foreign sunflower production expanded and U.S. farmers increased production of alternate oil crops (primarily soybeans).

During the 1990s, sunflower acreage rebounded largely as a result of the Food Agricultural Conservation and Trade Act of 1990 that included sunflower and other minor oilseeds in the Marketing Assistance Loans/Loan Deficiency Payments program. Sunflower seed producers became eligible for Direct Payments and Countercyclical Payments in 2002 and the Average Crop Revenue Election Program in 2008. However, sunflower production has not regained levels seen in the late 1970s, largely because of decreased export prospects.

World Production of Sunflower

The world production of sunflower has increased from 1996-97 to 2005-06. In 1996-97 the total production of sunflower was 23722 thousand tones and 27419 thousand tons in 2005-06. The highest production of sunflower was 29084 thousand tones in1998-99.

Sunflower varieties are separated into two types: oil and confection (non-oil). Oil-type sunflower seed is selected for specific characteristics such as oil yield, the amount of oleic acid in the oil, and the protein content of the meal (the residual left after extraction of the oil). Oil-type sunflower seeds are black with thin hulls. Oil-type seeds contain 35-55 percent oil (as compared with 18 percent for soybeans) and about 20 percent crude protein by weight, depending on the seed variety and irrigation use. Confection sunflower seeds are relatively thick and large, with striped hulls that are only loosely attached to the kernels. Approximately 90 percent of U.S. production is oil-type sunflower seed and 10 percent confection.

Sunflower production is concentrated in the northern Midwest, where the shorter growing season makes corn and soybean production less attractive (see 2007 Census of Agriculture maps for Oil Varieties and Confection (Non-Oil) Varieties). Sunflowers are able to thrive in these dry and windy areas because of a deep root structure. In 2009, 44 percent of production was in North Dakota, 28 percent in South Dakota, and the rest, scattered throughout California, Colorado, Kansas, Minnesota, Nebraska, Oklahoma, and Texas. Sunflowers can also be grown in a double crop rotation in the southern Midwest, Delta, and South, but widespread adoption has yet to take place.

In the northern Midwest, optimal planting time is May 1-20, but planting can extend into June. Further south, in States such as Texas, sunflower seed can be planted several months later, providing additional sources of seed in years with poor growing conditions in the Northern Plains. Most production is contracted prior to planting. Typically, buyers provide specific types of hybrid seed and agree to purchase the crop at a set price. Quality standards also affect the future payment, especially for confection seed. Sunflowers are harvested between late September and early November.

In the northern Midwest, sunflowers are often planted in rotation with small grains such as wheat, barley, and oats, as well as with potatoes, sugar beets, and dry peas. Ideally, crop rotations include sunflowers every 3-4 years to limit the risk of disease and insects. Because sunflowers are susceptible to the disease Sclerotinia (white mold), other susceptible crops (such as canola, soybeans, dry beans) should not be rotated with sunflowers.

Producers apply nitrogen, potassium, and potash (potassium carbonate) in the spring. Pesticides and herbicides are commonly applied because pests, weeds, and disease can be significant problems. Recent improvements in sunflower varieties that are resistant to Sclerotiniawilt (stalk and head rot) have reduced pesticide use, though disease resistance lags improvements in other major crops, such as corn and soybeans.

Yield of Sunflower (Per hectare)

There has been a substantial decline in the yield per hectares of sunflower in the world during the period from 1996-97 to 2005-06. The average yield per hectare was 1217Kgs in 1996-97 and 1208 Kgs in 2005-06. The maximum yield per hectare was 1245 kg in 1998-99 and minimum was 1110 Kgs in 2001-02. A trend of fluctuation in the yield per hectares is observed in table No. 2.4.

Russia, Ukraine, Argentina and European Union are the major producers of sunflower contributing more than 55% of the total world production. Russia has produced only 2670 thousand tons in 2001-02 and it has increased to 5100 thousand tons in 2005-06 Now Russia Stood first places in the production of sunflower in the world i.e. 18.60% of world production. In 2001-02 Argentina secured first place in production of sunflower in the world (17.99%) now it is in third place (14.22%). Other Major producers of sunflower in the world are European Union, USA, India, Romania, total global sunflower production accounting 18.60% of the production. Other major producers are Ukraine (14.58%), Argentina (14.22%) and European Union (12.81%). All these four countries are contributing more than 60% of the world production of sunflower. India contributes only 6.74% of the world production in 2005-06.

Ukraine, Romania, Russia, Bulgeria, Argentina are the major exporters of sunflower in the world, European Union, Turkey, USA, Maxico and other countries are importing sunflower seeds. Spain, Turkey, Netherlands, Italy and Germany alltogether accounts for 70% of the total imports of the world.

Trade

The sunflower industry in the United States initially evolved to export seed to Europe, which was the world's largest export market. Two-thirds of U.S. sunflower seed production between 1970 and 1985 was exported. In subsequent years, U.S. exports of sunflower seed declined as global competition for sunflower exports increased (primarily in Argentina), and Europe, the primary importer of sunflower seed, rapidly increased its own production. Global increases in planted acres and yield improvement, coupled with increased crush capacity near production areas, dramatically decreased world trade in sunflower seed from 2000 onward. By 2008/09, U.S. sunflower seed exports were primarily sent to Canada, Japan, and Mexico.

Between 1980/81 and 2000/01, sunflower oil exports averaged a quarter of a million metric tons annually, or 76 percent of U.S. sunflower oil production. The Export Enhancement Program (EEP) and the Sunflower seed Oil Assistance Program (SOAP) supported strong U.S. sales of sunflower oil to developing markets by providing credit guarantees, export subsidies, and food aid. SOAP last operated in 1996 and, though EEP remained active through 2007, EEP program support for sunflower oil exports fell into disuse years earlier.

With the end of government support programs, U.S. sunflower oil producers faced strong competition from other exporting nations, especially the rapidly maturing Argentine sunflower industry. In 2008/09, only 91,000 metric tons of sunflower oil was exported from the United States, representing 31 percent of U.S. domestic production. The industry has grown recently, owing to the adoption of mid-oleic sunflower varieties, which produce trans-fat-free oils. Production for mid-oleic sunflower oil production is buoyed by support from some of the largest companies in the frying food industry. As exports of crude sunflower oil have declined, exports of refined oil have risen. Since the late 1990s, the U.S. sunflower industry added refining facilities to retain a higher share of value-added processing. In 2003/04 the United States exported 24,000 metric tons of refined sunflower oil and by 2008/09 that total reached 81,000 metric tons, the majority of which was shipped to Canada.

because U.S. seed is valued for its consistently larger size and uniform quality. Spain and Turkey are the primary destinations of U.S. in-shell confectionary seed exports, with a handful of Middle East and European countries importing the remainder. Half of U.S. shelled seed exports go to Germany and the United Kingdom, and the remainder is sent to other countries in the EU-27, Canada, and Mexico.

Export and Import of Sunflower

European Union, Russia, Ukraine, United States, Argentina, Canada and China are the major exporters of sunflower seed in international market. The major importers include Turkey, European Union, Pakistan, United States and Argentina. The E.U. and U.S. are net exporters of sunflower seeds, while, Argentina is a net importer. European Union, India, Turkey, Egypt, Algeria and Iran are the top importers of sunflower oil. India imports sunflower oil mainly from Ukraine, Russia and Argentina. There is no import duty on crude sunflower oil while for refined oil the duty is 7.5 per cent. Export of sunflower oil with a container weighing more than 5 kg is banned from India.

India majorly exports sunflower cake which increased from 5511.33 tonne (triennium ending 2002) to 18440 tonne during 2009. The direction of sunflower meal trade shows that Nepal and Republic of Korea have improved their share while the United States and Bangladesh have lost their relative shares between 2002 to 2009 period. India exported 912 tonne sunflower oil in 2002 which increased to 3041 tonne for the triennium ending period 2009. The sunflower oil exports to United Arab Emirates and Singapore have increased, while that of Nepal and the other countries share has decreased substantially. Export of sunflower as seed has increased about three times from 1317.33 tonne to 4396 tonne. Among the major buyers of sunflower seed, UK, Philippines, Pakistan and Belgium have improved their relative position, while the Netherlands and Germany have drastically reduced their imports from India between 2005 and 2009 period.

Sunflower import shows that between 2005 and 2009 shows that India depended on Argentina for major part of her imports. The shifts in import pattern show that Russian Federation, Ukraine and the Netherlands meet major portion of import demand of India's demand for sunflower in the form of seed for further value addition. Negligible quantities of oil and meal are imported by India (table 2.5).

Sunflower production in India

Sunflower is one of the few crop species that originated in North America. It was probably first introduced to Europe through Spain, and spread through Europe as a curiosity until it reached Russia where it was readily adapted. The high-oil lines from Russia were reintroduced into the U.S. after World War II, which rekindled interest in the crop. Production of sunflower subsequently increased in the Great Plains of United States as marketers found new uses for the seeds as an oil crop, a birdseed crop, and as a human snack food. In India, sunflower as an oilseed crop introduced in 1969, prior to which it was used as an ornamental plant.

Six states with Karnataka in the lead are the major producers of sunflower in the country. Karnataka with a production of 3.04 lakh tonnes from an area of 7.94 lakh hectares followed by Andhra Pradesh, Maharashtra, Bihar, Orissa and Tamil Nadu are major sunflower producing states of India (Fig 10). Sunflower production follows a systemic weather risk as about 80 per cent of the area is under rain-fed production. In terms of productivity, Bihar leads with 1402 kg/ha followed by Tamil Nadu with 1328.7 kg, although both the states have less than 25000 hectares under the crop which is mostly irrigated. The average productivity at all India level was 900 kg/ha depending on the climatic conditions and irrigation, which are critical factors for high yields.

There is a considerable shift in acreage and production of sunflower which is shown in figure 11. In 2000-01, Karnataka, Maharashtra and Andhra Pradesh were leading with 45 per cent, 31 per cent and 18 per cent, respectively covering almost 94 per cent of total acreage of sunflower in India which then found shifted to Karnataka accounting for 54 per cent in 2009-10 from the previous level of 45 per cent share (2000-01) followed by Andhra Pradesh with 24 per cent. Maharashtra reported substantial reduction in sunflower area between 2001 and 2009 registering 31 per cent & 15 per cent of sunflower area respectively. Country as whole has registered negative growth in sunflower area.

India is one of the major producers of sunflower in the world. It contributes nearly 4 percentage (one million tons) of the world total production. The area under sunflower in India is about 2.34 million hectares (10% of the world sunflower area) with annual production of 1.44 million tones and yield is 615 kgs per hectors in 2005-06. The major sunflower growing states in India are Karnataka (54.86%), Andra Pradesh (20.83%) and Maharastra (14.58%). These three states are contributing about 90% of Indian total output. In recent years cultivation of sunflower has also spread to non- traditional areas like Bihar, Tamil Nadu, Haryana, Gujarat and Uttar Pradesh. These states are contributes remaining 10% percentage of the Indian output. According to the market sources, 70% of the crop are produced in Rabi (November- March) Season, and remaining 30% in Kharif (June -September) season.

The trends in area under sunflower, production and yield per hectare during the period from 2001-02 to 2010-11 are shown in the below table

** First Advance Estimates as released

On 23.09.2010.

Note: The yield rates given above have been worked out on the basis of production & area figures taken in '000 units.

Source: Directorate of Economics and Statistics, Department of Agriculture and Cooperation.

The above table shows the area under sunflower has been continuously increased from 2001-02 to 2005-06 and later on it shows decreasing trends. It was 1.18 million hectors in 2001-02 and 2.34 million hectors in 2005-06. In 2006-07 the area under sunflower was 2.16 million hectors and decreased to 1.81 million hectors in 2008-09. But the area under sunflower has estimated at 1.48 million hectors in 2009-10 and 0.31 million hectors in 2010-11.

The year wise production of sunflower in India indicates increasing trend between 2001-02 and 2005-06. There is a fluctuation trend for the rest of the years. This is clear from the above table. The total production of sunflower was 0.68 million tons in 2001-02 and 1.44 million tons in 2005-06. But the production of sunflower is fluctuating for the remaining period.

The yield per hectare of the sunflower has indicated a trend of fluctuation during the ten years from 2001-02 to 2010-11. The average yield per hectare varied from 464 kgs per hectare in 2003-04 to a maximum of 765 kgs per hectare in 2007-08. This indicates of consistency in the yield performance of sunflower in the country. There appears to be a correlation between increase and decrease in production during a particular year with a simultaneous increase or decrease in the yield per hectare. This is clear from the details in the above table.

State wise Area, Production and Yield:

State wise area, production and yield of sunflower in India are provided in the following table. table shows that the major sunflower cultivating and producing states in India are Karnataka, Andra Pradesh and Maharastra. These three states Contributing 95% of total area and 90% of total production of the country. Karnataka stood first place in the area and production of sunflower in country. It was 1. 27 million hectares (58.79) in 2004-05, it rose to 1.43million hectares (61.11%) in 2005-06 with the production of 0.60 million Tones (52.42%) in 2004-05 it rose to 0.79 million tons (54.86%) in 2005-06. Andra Pradesh is the second major producer of sunflower in the country. The area under sunflower production was 0.48 million hectares (22.23%) in 2004-05 and production was 0.29 million tons (24.37%). The production of sunflower increased to 0.30 million tons in 2005-06. Maharastra is the third important state to produce of sunflower in India. It contributes nearly 14.82% of area and 14.27 % of total production in 2004-05.It rose to 15.38% of area and 14.58% of production in 2005-06.

Other States like Bihar, Haryana, Tamil Nadu, U.P and etc the average yield per hectare is maximum 1667 kg in Haryana, 1345 kg Bihar, 1278 kg in UP, 1240 kg in T.N; 671 kg per hectares in A.P. & minimum is 552 kg in Karnataka.

The above table shows that the major sunflower cultivating and producers' states in India are Karnataka, Andra Pradesh and Maharastra. These three states are Contributing 95% of total area and 90% of total production of the country. Karnataka stood first place in the area and production of sunflower in the country. It was 1 million hectares (55.22%) in 2008-09, it decreased to 0.79 million hectares (53.78%) in 2009-10 with the production of 0.50 million tons (42.83%) in 2008-09 and it decreased to 0.30 million tons (35.74%) in 2009-10. Andra Pradesh is the second major producer of sunflower in the country. The area under sunflower production was 0.42 million hectares (23.11%) in 2008-09 and production was 0.33million tones (28.15%). The production of sunflower decreased to 0.27 million tons in 2009-10. Maharastra is the third important state to produce of sunflower in India. It contributes nearly 14.56% of area and 13.39

% of total production in 2008-09. In the year 2009-10 the area increases to 14.83% and production decreases to 13.4%.

Other States are Bihar, Haryana, Tamil Nadu, U.P etc. The average yield per hectare is maximum 2286 kg in UP, 1667 kg Haryana, 1403 kg in Bihar, 1329 kg in T.N, 771 kg in A.P, 521 kg in Maharastra and minimum is 383 kg in Karnataka.

Cost of Production of Sunflower in India

The cost of Production of sunflower varied between Rs.880.23 per hectare and Rs. 2380.10 per hectare between 1995-96 and 2005-06 in Andhra Pradesh. The cost of production of sunflower varied between Rs. 760 and Rs. 1980 in Karnataka. The cost of production of sunflower is not similar throughout the country. It is fluctuate in different states of the country. In recent year the cost of production of sunflower has been continuously increases.

The total area of sunflower and production in Tamil Nadu during 2005-06 was 0.17 lakh hectares and 0.21 lakh tones respectively. The productivity of sunflower in Tamil Nadu is 1240 Kg/hect, which is higher than the national average of 615 kg/ha. About 68% of the crops are raised under irrigated conditions.

Production of Sunflower in Karnataka:

Karnataka is the leading producer of sunflower in India. The following table shows the details of the production of sunflower in Karnataka from 1991-92 to 2010-11.

The details in the above table indicate an overall trend of fluctuations during the period from 1991-92 to 2010-11. The area under sunflower varied from a minimum of 87734 hectors in 2002-03 to a maximum of 1469302 hectares in 1993-94. However, the area under cultivation of sunflower has decreased during the last four years from 2006-07 to 2010-11.

The production of sunflower in Karnataka varied from a minimum of 25000 tonnes in 2000-01 to a maximum of 548600 tonnes in 2005-06. However, the area under cultivation of sunflower has rapidly decreased during the last four years from 2006-07 to 2010-11.

The yield per hectares of sunflower in Karnataka varied from a minimum 293 Kgs in 1997-98 to a maximum of 552 Kgs in 2005-06. There have been fluctuations in the yield per hectares from year to year during the period mentioned above. There is no uniformity of the growth trend in this parameter too. There does not appear to be any co-relationship between the production trend and yield per hectare of sunflower during study years covered by the study. Similarly there is no co-relationship between the total area under the sunflower crop and the total production of sunflower during the same period.

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