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Dynamics and Trends of Oilseed Crops in Pakistan

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Abstract The study examines the trends and compound annual growth rates of oilseed crops in Pakistan, spanning from 1971 to 2022. It reveals a significant shift towards dependence on imported edible oilseeds, accompanied by a decline in domestic supply. Despite reductions in cultivation for certain crops like rapeseed and mustard, which experience an annual growth rate of -1.34%, there are encouraging signs with positive trends in production and yield, showing an annual growth rate of 0.18% and 1.54%, respectively. Sesame maintains stability, showing favorable trends in area, production, and yield, with annual growth rates of 2.98%, 3.47%, and 0.47%, respectively. Groundnut area and production witness annual growth rates of 2.19% and 1.15%, although they are experiencing a slight yield decline of -1.02%. Sunflower demonstrates remarkable expansion, with annual growth rates in area, production, and yield standing at 13.02%, 15.04%, and 1.79%, respectively. Soybeans encounter reduced cultivation (-9.38%) and declining production (-7.69%), offset by positive yield growth of 1.86%. Safflower shows yield gains of 1.62% yet faces setbacks in area (-5.15%) and production (-4.43%). Despite declines in area (-2.67%) and production (-2.09%), linseed yields favorably at 0.60%, while castor seed cultivation and output experience a decline (-3.20% and -2.54%), with positive yield growth of 0.68%. This study underscores the need for strategic agricultural policies to ensure food security, stability, and sustainability in Pakistan's edible oilseed industry. Such policies must address shifting trends and annual growth rates,

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providing tailored solutions to fortify the sector against potential vulnerabilities.

Keywords Oilseed crops, Trend analysis, CAGR, Pakistan.

1 Introduction

Agriculture plays a significant role in the development of most emerging economies worldwide, influencing overall economic growth, generating household income and ensuring food security Dube (2016). Pakistan was traditionally self-sufficient in edible oil production until 1950 but has subsequently encountered growing demand, requiring the deployment of edible oil imports to supplement domestic supply. Pakistan, an agricultural country, is under tremendous pressure on its foreign exchange reserves due to a lack of oilseed output and heavy reliance on imported edible oils Badar et al (2002). By the mid-1970s, imports accounted for a substantial 41% of total consumption in 1974-75 Afzal (1996). The agricultural sector remains a major contributor to Pakistan's economy; its share in the GDP has gradually decreased from 30.4% in 1980 to 22.7% in 2021, yet it still employs 37.4% of the nation's workforce (GoP, 2022). With a per capita consumption of 22kg, Pakistan stands as the world's 8th largest consumer of edible oil and ranks as the third-largest global importer of edible oils (PCRA, 2021). Oilseed crops play a vital role in Pakistan's economy, satisfying over 17% of the domestic edible oil demand. Furthermore, major biodiesel crops like rapeseed, soybean, sunflower and safflower are cultivated Flagella et al (2002); Pimentel and Patzek (2005); Vicente et al (2007). Oilseed crops such as soybeans, sunflowers and canola offer opportunities for irrigators aiming to decrease their irrigation needs, diversify their crops, or lower input expenses.

Oilseed crops provide valuable oil and essential raw materials for oleo-chemical industries, serving as a sustainable energy source closely tied to power generation Jankowski and Budzyński (2003). Palm oil, the primary imported edible oil, significantly influences edible oil and ghee prices in Pakistan. Sunflower, cotton and rapeseed-mustard constitute the major oilseed crops in the country Ijaz et al (2021). Despite its fertile fields, an efficient canal system and an economy deeply rooted in agriculture, Pakistan remains reliant on imported edible oil due to inadequate domestic oilseed production Rehman et al (2011). In the fiscal year 2023 (July-March), imports brought in 2.681 million tons of edible oil, including oil extracted from imported oilseed, valued at Rs 826.482 billion (US$ 3.562 billion). Local production of edible oil during the same period is preliminarily assessed at 0.496 million tonnes. The combined availability of edible oil during FY2023 (July-March) from both imports and local production is estimated at 3.177 million tonnes (Economic Survey, 2022-23). Pakistan's growing trade deficit, largely attributed to oil and edible product imports, underscores the urgent need to bolster domestic oilseed production to avert potential future crises. Despite being primarily agrarian, Pakistan lags in oilseed production, with yields significantly below its production capacity. Among the myriad challenges contributing to low oilseed production, seed quality stands out as a paramount concern. Research indicates that hybrid sunflower varieties can yield up to 2-3 times the normal yield, reaching over 3500-3900 kg per hectare Farooq et al (2017).

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The Ministry of National Food Security and Research currently oversees a significant initiative known as the "National Oilseed Enhancement Program." With a total budget of Rs 10.96 billion, this program falls under the purview of the National Agriculture Emergency Program. Under this initiative, oilseed growers are eligible for a subsidy of Rs 5,000 per acre for seeds and inputs related to canola, sunflower and sesame, as well as a 50 percent subsidy on the acquisition of oilseed machinery. In a developing nation like ours, financial constraints are a pressing concern, making it imperative to enhance domestic production to meet the escalating demand for edible oils. This study is dedicated to examining the trends and annual compound growth rates pertaining to the cultivation area, production and yield of edible oilseed crops in Pakistan. This research explores the edible oilseed crop cultivation dynamics to inform policymakers on effective interventions to bridge the gap in edible oil supply, promoting a sustainable and self-reliant future.

2 Materials and Method

The study is based on secondary time series data obtained from the Agricultural Statistics of Pakistan and the Pakistan Economic Survey (various issues). This data encompasses a time series spanning from the fiscal year 1971 to 2022 and includes key metrics such as area, production and yield of oilseed crops, including rapeseed-mustard, sesame, groundnut, sunflower, soybean, safflower, linseed and castor seed.

The analysis covered a 52-year study period, during which the estimation of growth rates predominantly utilized two commonly employed methods: Linear Growth Rate and Compound Growth Rate. However, the Linear Growth Rate method comes with inherent limitations when it comes to comparing growth rates across different time periods and for different agricultural crops. Therefore, it appears more appropriate to use the Compound Growth Rate method for analyzing the growth trends of agricultural crops between two distinct periods. The Compound Growth Rate is determined by fitting a semi-logarithmic trend equation. This particular approach has been utilized by various researchers, including Sonnad et al (2011); Kumar and Singh (2014); Rehman et al (2011); Qasim et al (2015), in their respective studies on a variety of crops. The mathematical expression for this trend follows to the semi-logarithmic model and is as follows:

$$lnY = \alpha + \beta t + \epsilon$$

Where; Y = Dependent variable (area/production/yield) of oilseed crops; t = Trend over a specific period; α = Constant coefficient; β = Slope coefficient of trend; ln = Natural logarithm; ϵ = Error term

This equation (1) can be elaborated in detail as:

$$Y_t = Y_0(1 + r)^t \tag{1}$$

Where; Y_t = Dependent variables (Area/production/yield) of oilseed crops at time t; Y_0 = Initial year (1970-71) area/production/yield of oilseed crops; r = compound growth rate; t = Time variable in year (1, 2..., n)

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By taking logarithms on both sides of the equation, we get

$$lnY_t = lnY_0 + tln(1 + r) \tag{2}$$

Where;
Y = ln Yt a = ln Yo b = ln (1+ r)
Equation (ii) can be rewritten as

$$Y = \alpha + \beta t \tag{3}$$

Where; Y = Dependent variables (area/production/yield) of oilseed crops; α = Constant coefficient; β = Regression coefficient that shows the growth rates in a series; t = Time variable in year (1, 2..., n)

The Compound Annual Growth Rate (CAGR) is computed by taking the exponential value of 'β,' subtracting 1 from it, and then multiplying the result by 100. The sign of 'β' plays a crucial role in determining whether the growth is on the rise or declining. Specifically, a positive 'β' signifies increasing growth, while a negative 'β' indicates decreasing growth. We can calculate the compound growth rate using the following equation:

$$\begin{gathered}\text{Antilog } (\beta) = \text{Antilog } (\log (1+ \text{r})) \\ \text{Antilog } (\beta) = 1+ \text{r} \\ \text{r} = \text{Antilog } (\beta) \text{ -1}\end{gathered}$$

$$r = [Antilog(\beta) - 1)] * 100 \tag{4}$$

Equation 4 was computed using the Ordinary Least Squares (OLS) method. A t-test was subsequently employed to assess the significance of the parameter 'β' within this equation. This equation is based on the assumption that variations in agricultural output for a particular year are influenced by the output from the previous year Deosthali and Nikam (2004).

3 Results and Discussion

3.1 Oilseed Crops Statistics in Pakistan

Table 1 displays 2021-22 statistics for the cultivation and production of various oilseed crops in Pakistan. Rapeseed and mustard were the major contributors, followed by sesame, groundnut, and sunflower. While safflower, castor seed, linseed and soybean had smaller contributions. Rapeseed-mustard and sunflower stood out with both extensive cultivation and high yields. Sesame had a significant cultivated area but a lower yield. Groundnut, despite large-scale cultivation, had a comparatively lower yield. Castor seed cultivation was modest, while linseed and soybean had limited cultivation and moderate yields. Productivity depends on factors beyond the cultivation area, including technological advancements, innovative farming methods and economic considerations.

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Table 1
Oilseed Crops Statistics in Pakistan (2021-22)

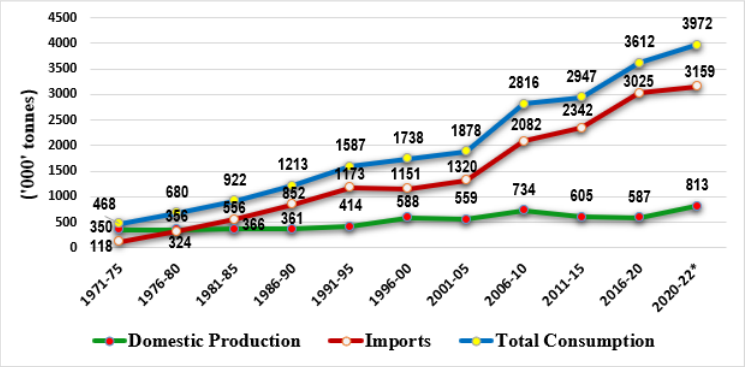
Oilseed Crops	Area (000 ha)	Production (000 tonnes)	Yield (kg/ha)
Rapeseed-mustard	368	558	1515
Sesame	200	128	641
Groundnut	154	145	943
Sunflower	53	84	1565
Safflower	32	0.7	23
Castor seed	5	4.5	917
Linseed	2.2	1.6	712
Soybean	0.06	0.05	873

Source: Agricultural Statistics of Pakistan, 2021-22

3.2 Domestic Oilseed Trends, Imports and Consumption

Figure 1 illustrates five-year average data on domestic production, imports and total consumption of oilseeds in Pakistan from 1971 to 2022. A significant trend observed is the steady increase in imports over the years, contrasting with the fluctuating nature of domestic production. This trend indicates a growing reliance on foreign sources to meet Pakistan's demand for edible oils. Consumption has risen substantially from 468 thousand tonnes/ha in 1971-75 to 3972 thousand tonnes/ha in 2020-22, marking a 749% increase. Similarly, imports have surged from 118 to 3159 thousand tonnes/ha, representing a 2577% increase, whereas domestic production has experienced minimal growth, increasing from 350 to 813 thousand tonnes/ha, a 132% increase. Consequently, imports have increasingly overshadowed domestic production in fulfilling Pakistan's edible oilseed requirements, highlighting the necessity for a 389% more increase in domestic production to address this challenge.

Figure 1
Domestic Production, Consumption and Imports of Oilseed Crops in Pakistan



Source: Agricultural Statistics of Pakistan (*2-Years Avg.)

3.3 Percentage Share of Domestic Production and Imports of Oilseed Crops

Figure 2 depicts five-year average data on domestic production and imports of oilseeds in Pakistan from 1971 to 2022. Pakistan's edible oil production has significantly declined since 1950, with 80% of its consumption coming from imports. This has led to a significant depletion of foreign exchange reserves. In 1971-75, domestic production accounted for 75% of total consumption, while imports

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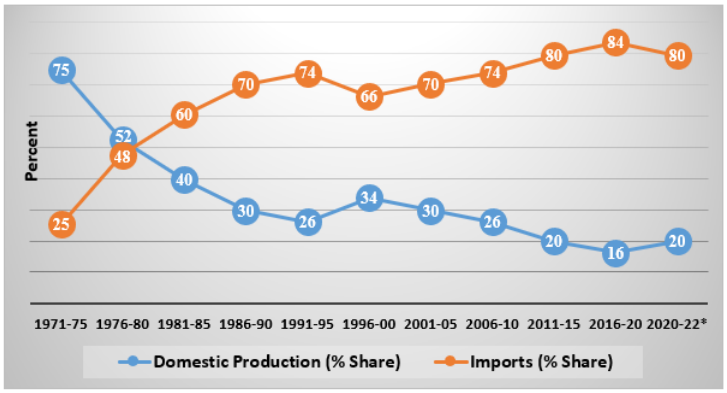
made up 25%. By 2020-22, domestic production dropped to 20%, with imports occupying 80%. This shift highlights Pakistan's increasing dependence on external suppliers to meet its growing demand for edible oil. Strategic planning and diversifying sources are needed to boost domestic production and protect economic stability.

Figure 2
Percentage Share of Domestic Production and Imports of Oilseed Crops in Pakistan



Source: Percentage Share of Domestic Production and Imports of Oilseed Crops in Pakistan

3.4 Trend and Rate of Growth in Rapeseed and Mustard Crop

Table 2(a) reveals a visible shift in the cultivation of rapeseed and mustard crop in Pakistan. Specifically, the data indicates that the area dedicated to this crop decreased from 518.5 thousand hectares during 1971-75 to 324 thousand hectares in 2020-22. Despite the reduction in cultivated area, the production of rapeseed and mustard crop in Pakistan showed a positive trend during the same period, rising from 279.5 thousand tonnes in 1971-75 to 471.2 thousand tonnes in 2020-22. Over the years, the data shows a consistent trend of decreasing land area and increasing crop yield per hectare. This indicates improved agricultural efficiency, hybrid seed utilization and technology utilization. The data (2020-22) showed the highest yield and production levels in the dataset, emphasizing ongoing progress in agriculture.

Table 2a
Trend in Area, Production and Yield of Rapeseed-mustard in Pakistan

Years	Area ('000' hectares)	Production ('000' tonnes)	Yield (kg/ha)
1971-75	518.5	279.5	539
1976-80	448.7	259	577
1981-85	370.7	237.8	641
1986-90	312.6	229.9	735
1991-95	288.7	216.3	749
1996-00	334.8	282.2	843
2001-05	271.7	228.2	840
2006-10	243.7	199.5	819
2011-15	240.9	224.2	931
2016-20	277.8	330.1	1188
2020-22*	324	471.2	1454

Source: Agricultural Statistics of Pakistan (*2-Years Avg.)

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Table 2(b) shows the findings of a semi-log model assessing the trend and growth rate of the rapeseed and mustard crop from 1971 to 2022. According to the F-statistic, the models are statistically significant for acreage and yield but not for production. Analyzing the data, it is clear that acreage is declining, with an annual drop of around -1.34%. Production and yield, on the other hand, show favorable tendencies, with compound annual growth rates of 0.18% and 1.54%, respectively. This indicates a decrease in cultivation area but steady increases in crop production and yields over time.

Table 2b
Trend and Growth Rate of Rapeseed-mustard in Pakistan (1971-2022)

Particular	Area	Production	Yield
F-statistics	69.94**	0.64 NS	323.54**
Trend coefficients	-0.014	0.002	0.015
t-statistics	-8.363**	0.798 NS	17.987**
CAGR (%)	-1.34	0.18	1.54

**Significant at the 5% level of significance; NS= non-significant
CAGR (compound annual growth rate)

3.5 Trend and Rate of Growth in Sesame Crop

Table 3(a) shows the change in sesame crop cultivation, production and yield from 1971 to 2022. Notable trends include continuous increase in crop area and production (1971-1985) while a significant increase in both cultivation area and production from 1991 to 2005, followed by a very stable era with high yields until 2020. The data for 2020-22 shows a large increase in cultivation area, production and yield per hectare, potentially due to technical innovations and improved practices.

Table 3a
Trend in Area, Production and Yield of Sesame in Pakistan

Years	Area ('000' hectares)	Production ('000' tonnes)	Yield (kg/ha)
1971-75	31.6	10.9	345
1976-80	36.4	14.7	404
1981-85	34.4	13.6	395
1986-90	30.3	12	396
1991-95	71.6	30.5	426
1996-00	85.6	38.9	454
2001-05	90.1	38.8	431
2006-10	80.1	34.5	431
2011-15	78.1	31.5	403
2016-20	92	40.3	438
2020-22*	185.2	115.2	622

Source: Agricultural Statistics of Pakistan (*2-Years Avg.)

Table 3(b) outlines trends and growth rates in sesame crop metrics for Pakistan (1971-2022) via a semi-logarithmic model. The F-statistics values show significant trends in area, production and yield, with an increasing trend for area and production and a slight improvement in yield. The t-statistics values also show high levels of significance for these trends. The compound annual growth rate (CAGR) provides insights into the average annual growth rates, with area growing at 2.98%, production at 3.47% and yield at 0.47%. Overall, the findings suggest a notable upward trajectory in sesame cultivation in Pakistan, with substantial increases in both area and production.

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Table 3b
Trend and Growth of Sesame in Pakistan (1971-2022)

Particular	Area	Production	Yield
F-statistics	95.25**	89.88**	14.41**
Trend coefficients	0.029	0.034	0.005
t-statistics	9.76**	9.48**	3.80**
CAGR (%)	2.98	3.47	0.47

**Significant at the 5% level of significance; CAGR (compound annual growth rate)

3.6 Trend and Rate of Growth in Groundnut Crop

Table 4(a) shows that the groundnut cultivated area steadily increased from 36.2 thousand hectares in 1971-75 to a peak of 145.1 thousand hectares in 2020-22, indicating significant expansion. The production of groundnut also grew from 51.5 thousand tonnes/ha in 1971-75 to a peak of 133.3 thousand tonnes/ha in 2020-22. Yield per hectare varied, reaching a high of 1423 kg/ha in 1971-75, declining to 790 kg/ha in 2006-10 and recovering slightly to 919 kg/ha in 2020-22. Overall, the data shows an increasing trend in cultivation area and production, while yield revealed fluctuations and irregular declines. These fluctuations may be attributed to changes in farming practices or environmental factors affecting crop productivity, requiring further analysis.

Table 4a
Trend in Area, Production and Yield of Groundnut in Pakistan)

Years	Area ('000' hectares)	Production ('000' tonnes)	Yield (kg/ha)
1971-75	36.2	51.5	1423
1976-80	43.3	58.8	1358
1981-85	61.4	74.2	1208
1986-90	66.5	69.9	1051
1991-95	91	97.6	1073
1996-00	101	109	1079
2001-05	95.1	94.7	996
2006-10	92.4	73	790
2011-15	90.1	84.8	941
2016-20	96.7	88.9	919
2020-22*	145.1	133.3	919

Source: Agricultural Statistics of Pakistan (*2-Years-Avg.)

Table 4b
Trend and Growth Rate of Groundnut in Pakistan (1971-2022)

Particular	Area	Production	Yield
F-statistics	138.18**	31.52**	79.84**
Trend coefficients	0.022	0.011	-0.01
t-statistics	11.755**	5.614**	-8.935**
CAGR (%)	2.19	1.15	-1.02

**Significant at the 5% level of significance CAGR (compound annual growth rate)

Table 4(b) presents the results of a semi-logarithmic model analyzing trend and growth rate in groundnut area, production and yield from 1971to 2022. The F-statistics results confirm the statistical significance of the models for all three aspects. Notably, groundnut area and production show positive trend coefficients, indicating an upward trend over this period. Specifically, the compound growth rates reveal that groundnut area and production have been increasing at an annual rate of 2.19% and 1.15%, respectively. In contrast, the trend coefficient for groundnut yield is negative, signifying a declining trend. More precisely, the

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compound growth rate for groundnut yield reflects an annual decrease of -1.02%.

3.7 Trend and Rate of Growth in Sunflower Crop

Table 5(a) shows sunflower cultivation, production and yield trends in Pakistan from 1971 to 2022. In 1971-75, the area under sunflower was 0.8 thousand hectares, which increased to 324 thousand hectares in 2006-10 and sunflower production increased from 0.5 to 421 thousand tonnes/ha in the same year. The area of sunflower crop for the years 2020-22 shows a decrease as compared to 2006-10 whereas their production also decreased due to the corresponding decrease in the area while the average yield per acre of sunflower increased. This evolution in sunflower crop cultivation and production underscores the dynamic nature of agricultural practices in Pakistan, influenced by various factors such as technological advancements, market demand and climatic conditions. Further analysis and adaptive strategies may be required to navigate these fluctuations and ensure sustained productivity in sunflower farming.

Table 5a
Trend in Area, Production and Yield of Sunflower in Pakistan

Years	Area ('000' hectares)	Production ('000' tonnes)	Yield (kg/ha)
1971-75	0.8	0.5	618
1976-80	0.4	0.2	550
1981-85	13.8	12.3	890
1986-90	30.3	31.1	1025
1991-95	53	63.1	1190
1996-00	108.4	142.4	1314
2001-05	149.9	191.5	1277
2006-10	324.3	421.1	1299
2011-15	205.3	258.5	1259
2016-20	95.8	123.9	1294
2020-22*	57.5	87.5	1521

Source: Agricultural Statistics of Pakistan (*2-Years Avg.)

Table 5(b) displays results from a semi-log model analyzing sunflower metrics from 1971 to 2022. The F-statistics results confirm statistical significance for sunflower area, production and yield. Positive trend coefficients for acreage, production and yield, along with significant t-statistics values, indicate a consistent increase. Sunflower cultivation area expands annually at 13.02%, production at 15.04%, and yield at 1.79%.

Table 5b
Trend and Growth Rate of Sunflower in Pakistan (1971-2022)

Particular	Area	Production	Yield
F-statistics	95.23**	107.74**	95.38**
Trend coefficients	0.122	0.14	0.018
t-statistics	9.76**	10.38**	9.77**
CAGR (%)	13.02	15.04	1.79

**Significant at the 5% level of significance CAGR
(compound annual growth rate)

3.8 Trend and Rate of Growth in Soybean Crop

Table 6(a) provides a detailed analysis of soybean cultivation, production and yield trends in Pakistan from 1971 to 2022. The data shows significant fluctuations and trends, with soybean cultivation varying from 2.03 hectares in 1971-75

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to 4.17 hectares in 1991-95 and then decreasing to 0.12 hectares in 2020-22. Production experienced similar fluctuations, with notable peaks in 1996-00, where it reached 4.20 tonnes/ha. The yield per hectare varied from 445 kg/ha in 1971-75 to 1239 kg/ha in 1996-00, fluctuating between 700-900 kg/ha in recent years. The significant increase in production from 0.89 tonnes/ha in 1971-75 to 4.20 tonnes/ha in 1996-00 indicates substantial growth in soybean farming in Pakistan. However, recent years have seen a stabilization of production and yield, indicating potential challenges or shifts in the soybean farming landscape.

Table 6a
Trend in Area, Production and Yield of Soybean in Pakistan

Years	Area ('000' hectares)	Production ('000' tonnes)	Yield (kg/ha)
1971-75	2.03	0.89	445
1976-80	2.5	1.08	433
1981-85	4.14	1.63	395
1986-90	3.59	1.98	548
1991-95	4.17	3.43	734
1996-00	3.3	4.2	1239
2001-05	0.64	0.73	1178
2006-10	0.12	0.11	696
2011-15	0.11	0.08	735
2016-20	0.04	0.05	922
2020-22*	0.12	0.12	992

Source: Agricultural Statistics of Pakistan (*2Years-Avg.)

Table 6(b) analyzes semi-log models applied to assess soybean crop metrics in Pakistan from 1971 to 2022. The F-statistic results show statistical significance for area, production and yield, while the trend coefficients reveal negative values for soybean area and production, indicating compound annual growth declines of -9.38% and -7.69%, respectively. However, there is a slight positive increase in soybean yield, with an annual growth rate of 1.86%.

Table 6b
Trend and Growth Rate of Soybean Crop in Pakistan (1971-2022)

Particular	Area	Production	Yield
F-statistics	95.05**	45.15**	39.39**
Trend coefficients	-0.098	-0.08	0.018
t-statistics	-9.75**	-6.72**	6.28**
CAGR (%)	-9.38	-7.69	1.86

**Significant at the 5% level of significance CAGR (compound annual growth rate)

3.9 Trend and Rate of Growth in Safflower Crop

Table 7(a) depicts the trend in safflower cultivation in Pakistan over five-year averages spanning from 1971 to 2022. Over the years, there are visible trends in each aspect like the area under cultivation sees fluctuations, starting from a minimal 0.03 thousand hectares in 1971-75, peaking at 3.83 thousand hectares in 1981-85 and then gradually declining to 0.05 thousand hectares in 2020-22. Production follows a similar track, corresponding with changes in the cultivated area, with peaks in the early 1980s and subsequent declines. Conversely, the yield per hectare shows a different pattern, starting low but gradually increasing over the years, reaching its peak at 1288 kg/ha in 2020-22. These figures indicate potential advancements in agricultural practices or technology, leading

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to improved productivity despite fluctuations in cultivated area and production levels.

Table 7a
Trend in Area, Production and Yield of Safflower in Pakistan

Years	Area ('000' hectares)	Production ('000' tonnes)	Yield (kg/ha)
1971-75	0.03	0.02	272
1976-80	0.10	0.10	626
1981-85	3.83	2.77	731
1986-90	1.4	0.92	576
1991-95	1.24	0.63	528
1996-00	0.99	0.65	611
2001-05	0.06	0.04	731
2006-10	0.06	0.05	864
2011-15	0.04	0.04	1125
2016-20	0.01	0.01	427
2020-22*	0.05	0.13	1288

Table 7(b) presents data on the safflower crop's growth rate in Pakistan from 1971 to 2022. The data shows a significant trend in area and production of safflower cultivation and production in Pakistan over a given time period. However, the yield trend is not statistically significant. The negative trend coefficients indicate a slight decrease in cultivated area and production. The CAGR percentages show an average annual decline of 5.15% for area and 4.43% for production, indicating a decreasing trend. A positive CAGR percentage for yield suggests a slight increase, but it is not statistically significant. Overall, the data indicates a notable decline in safflower cultivation and production.

Table 7b
Trend and Growth Rate of Safflower Crop in Pakistan (1971-2022)

Particular	Area	Production	Yield
F-statistics	13.31**	10.48**	0.46 NS
Trend coefficients	-0.053	-0.045	0.016
t-statistics	-3.65**	-3.24 **	0.68 NS
CAGR (%)	-5.15	-4.43	1.62

**Significant at the 5% level of significance; NS= non-significant
CAGR (compound annual growth rate)

3.10 Trend and Rate of Growth in Linseed Crop

Table 8(a) illustrates the fluctuating trend in the total land area allocated for linseed cultivation over the years, typically ranging between 2.25 and 9.78 thousand hectares. Production of the crop has showed variability over time, with the peak recorded in 1981-85 (5.53 thousand tonnes/ha) and the lowest in 2020-22 (1.62 thousand tonnes/ha). Conversely, yields have demonstrated diverse patterns, reaching their lowest point in 1991-95 (509 kg/ha) and their highest in 2016-20 (737 kg/ha). Notably, higher yields often correlate with increased production and vice versa. However, the most recent data (2020-22) portrays a decrease in both yield per hectare and production compared to previous years, suggesting a potential decline in productivity or changes in agricultural methodologies.

Table 8(b) presents the semi-log model results for the linseed crop trend and growth rate in Pakistan from 1971 to 2022. The F-statistics show significant findings for linseed crop area, production and yield, while the trend coefficients

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Table 8a
Trend in Area, Production and Yield of Linseed in Pakistan

Years	Area ('000' hectares)	Production ('000' tonnes)	Yield (kg/ha)
1971-75	7.96	4.3	540
1976-80	9.78	5.48	560
1981-85	9.42	5.53	587
1986-90	9.42	4.97	528
1991-95	8.12	4.13	509
1996-00	7.92	4.63	585
2001-05	5.69	2.87	504
2006-10	5.07	3.18	627
2011-15	3.56	2.5	702
2016-20	2.78	2.05	737
2020-22*	2.25	1.62	720

Source: Agricultural Statistics of Pakistan (*2-Years Avg.)

for linseed area and production were negative, indicating a consistent decline in compound annual growth rate of (-2.67%) and (-2.09%), respectively. Conversely, the coefficient for yield was positive, with a modest annual increase of 0.60%. The analysis suggests that while linseed crop area and production have steadily decreased, there has been a modest but positive growth in yield over the years in Pakistan.

Table 8b
Trend and Growth Rate of Linseed in Pakistan (1971-2022)

Particular	Area	Production	Yield
F-statistics	158.03**	129.75**	34.94**
Trend coefficients	-0.027	-0.021	0.006
t-statistics	-12.571**	-11.391**	5.911**
CAGR (%)	-2.67	-2.09	0.6

**Significant at the 5% level of significance
CAGR= (compound annual growth rate)

3.11 Trend and Rate of Growth in Castor Seed Crop

Table 9(a) reveals significant fluctuations in the land area, production and yield of the castor seed crop over different periods. The land area and production of castor seed were on a peak of 26.77 thousand hectares and 21.54 thousand tonnes/ha in 1981-85 respectively. Although the yield of castor seed fluctuated, reached a peak of 1,034 kg/ha (2011-15) and a low of 358 kg/ha (1971-75). Despite a moderate rise in cultivation area, the data for 2020-22 indicates higher production, showing advancement in yield.

Table 9a
Trend in Area, Production and Yield of Castor Seed in Pakistan

Years	Area ('000' hectares)	Production ('000' tonnes)	Yield (kg/ha)
1971-75	5.84	2.09	358
1976-80	22.55	17.09	758
1981-85	26.77	21.54	805
1986-90	14.26	10.44	732
1991-95	7.62	5.36	703
1996-00	7.41	5.57	752
2001-05	2.81	1.69	601
2006-10	4.28	2.4	561
2011-15	3.55	3.67	1034
2016-20	1.81	1.79	989
2020-22*	4.54	4.17	919

Source: Agricultural Statistics of Pakistan (*2-Years Avg.)

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Table 9(b) shows the results of a semi-logarithmic model examining the significant statistical findings of castor seed in Pakistan from 1971 to 2022. The F-statistics models were statistically significant for all three variables: area, production and yield. The trend coefficients reveal that there is a negative trend with the decline in area (-0.032), production (-0.026), and a marginal increase (0.007) in yield. The compound annual growth rate provides a clear picture of the trend and shows declines in area and production (-3.20%) and (-2.54%), respectively, while the yield shows a modest growth rate (0.68%). Specifically, both area and production have decreasing trends over time, while yield shows an increasing trend.

Table 9b
Trend and Growth Rate of Castor Seed in Pakistan (1971-2022)

Particular	Area	Production	Yield
F-statistic	12.43**	7.52**	8.45**
Trend coefficients	-0.032	-0.026	0.007
t-statistic	-3.54**	-2.74**	2.91**
CAGR (%)	-3.20	-2.54	0.68

**Significant at the 5% level of significance
CAGR= (compound annual growth rate)

3.12 Overall Annual Growth Rates of Oilseed Crops

Table 10 provides a comprehensive overview of the annual compound growth rates (CAGR) of the oilseed crops in Pakistan spanning from 1971 to 2022. The data reveals diverse trends and growth patterns across different oilseed crops. Notably, sunflower exhibits the highest growth rates in area, production and yield, with impressive growth rates of 13.02%, 15.04% and 1.79%, respectively. This indicates substantial expansion and productivity enhancements in sunflower cultivation over the years. Conversely, soybean display significant negative growth rates in both area (-9.38%) and production (-7.69%), suggesting a decline in soybean cultivation and output in Pakistan. However, soybean's yield remains positive at 1.86%, indicating an improvement in productivity despite the overall decrease in cultivation and production. Sesame and groundnut also demonstrate positive growth rates in area, production and yield, although at relatively lower levels compared to sunflower.

Table 10
Overall Annual Growth Rates of Oilseed Crops in Pakistan (1971-2022)

Oilseed Crops	Area (CAGR %)	Production (CAGR %)	Yield (CAGR %)
Rapeseed-mustard	-1.34	0.18	1.54
Sesame	2.98	3.47	0.47
Groundnut	2.19	1.15	-1.02
Sunflower	13.02	15.04	1.79
Soybean	-9.38	-7.69	1.86
Safflower	-5.15	-4.43	1.62
Linseed	-2.67	-2.09	0.60
Castor seed	-3.20	-2.54	0.68

Source: Agricultural Statistics of Pakistan (*2-Years Avg.)

In contrast, rapeseed and mustard, safflower, linseed and castor seed exhibit negative growth rates in area and production, although their yield are generally positive, indicating potential efficiency gains despite decreasing cultivation and

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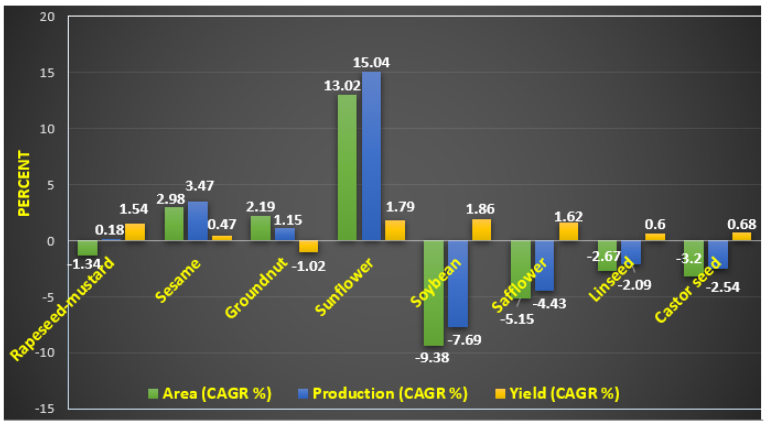

production. Overall, the table highlights the dynamic nature of oilseed crops cultivation in Pakistan, with varying trends and growth rates across different crops, influenced by factors such as market demand, agricultural policies and technological advancements.

4 Conclusion

The study examines edible oilseed patterns in Pakistan from 1971 to 2022, revealing a significant reliance on imports, posing a threat to food security. The country's domestic production has decreased and imports have increased, making it more vulnerable to global market changes. The findings of the study show that sunflower is the most efficient oil seed crop, with an annual growth rate (CAGR) of 13.02%, leading to 15.04% in production. Soybean has experienced a decline in both area and production, suggesting challenges in cultivation or shifting agricultural priorities. Despite negative growth, yields for crops like rapeseed and mustard, safflower and linseed have seen modest increments, suggesting improvements in farming practices or technology adoption. Sesame and groundnut show moderate growth, while castor seed shows a slight decrease in area and production. Pakistan must increase its own oilseed output through hybrid varieties and initiatives like the "National Oilseed Enhancement Program" to improve food security. Strategic agricultural policies are crucial for reducing reliance on imports, managing global economic changes and ensuring food security and sustainability.

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References

Afzal M (1996) Managing water resources for environmentally sustainable irrigated agriculture in pakistan. The Pakistan Development Review pp 977–988

Badar H, Javed MS, Ali A, Batool Z (2002) Production and marketing constraints limiting sunflower production in punjab (pakistan). Int J Agric Biol 4(2):267–271

Deosthali V, Nikam CM (2004) Rice: Regionwise growth trends in maharashtra. Economic and Political Weekly pp 240–242

Dube K (2016) Implications of rural irrigation schemes on household economy. a case of lower gweru irrigation scheme, zimbabwe. South African Journal of Agricultural Extension 44(1):75–90

Farooq M, Iqbal S, Afridi MZ, Munsif F, Tauseef M, Rehman K (2017) Optimization of nitrogen for increasing the productivity of canola. Agricultural Research and Technology 3:1–5

Flagella Z, Rotunno T, Tarantino E, Di Caterina R, De Caro A (2002) Changes in seed yield and oil fatty acid composition of high oleic sunflower (helianthus annuus l.) hybrids in relation to the sowing date and the water regime. European journal of agronomy 17(3):221–230

Ijaz M, Sattar A, Sher A, Ul-Allah S, Mansha MZ, Khan KA, Shahzad MA, Al-Sadi AM, Arif M, Aljuaid BS, et al (2021) Sulfur application combined with planomicrobium sp. strain mssa-10 and farmyard manure biochar helps in the management of charcoal rot disease in sunflower (helianthus annuus l.). Sustainability 13(15):8535

Jankowski K, Budzyński W (2003) Energy potential oilseed crops. Electronic Journal of Polish Agricultural Universities 6(2)

Kumar S, Singh S (2014) Trends in growth rates in area, production and productivity of sugarcane in haryana. International Journal of Advanced Research in Management and Social Sciences 3(4):117–124

Pimentel D, Patzek TW (2005) Ethanol production using corn, switchgrass, and wood; biodiesel production using soybean and sunflower. Natural resources research 14:65–76

Qasim M, Hassan S, Bashir A, Mehmood I, Mahmood HZ (2015) Analyzing production potential of selected food and legume crops for food security in punjab, pakistan. Pakistan Journal of Agricultural Research 28(3)

Rehman FU, Saeed I, Salam A (2011) Estimating growth rates and decomposition analysis of agriculture production in pakistan: pre and post sap analysis. Sarhad J Agric 27(1):125–131

Sonnad J, Raveendaran N, Ajjan N, Selvaraj K (2011) Growth analysis of oilseed crops in india during pre and post-wto periods. Karnataka Journal of Agricultural Sciences 24(2)

Vicente G, Martinez M, Aracil J (2007) Optimisation of integrated biodiesel production. part i. a study of the biodiesel purity and yield. Bioresource technology 98(9):1724–1733

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