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Growth and Instability of Soybean Export from India

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***Abstract*: India's vegetable oil economy is the world's fourth largest after USA, China & Brazil. The oil seed accounts for 13 per cent of the Gross Cropped Area, 3 per cent of the Gross National Product, and 10 per cent value of all agricultural commodities accounting for about 19% of the global area, and 2.7% of the global production of the world. Soybean is the leading oilseed produced globally. The soybean (*Glycine max*) is a species of legume, popularly known as the "golden bean" or "miracle bean" of the 21st century. India is one of the major oilseed growers and importers of edible oils. Soybean contributes to 39 per cent of oil seeds production in India. The study estimated the compound growth rate and instability in the area, production and productivity of soybean in India from 2001-2020.**

***Keywords*: Soybean, Trend, Area, Production, Growth, Instability.**

1. Introduction

The soybean (*Glycine max*) is a species of legume, popularly known as the "golden bean" or "miracle bean" of the 21st century. The plant is studied as an oil which contributes to 39 per cent of production. It is an important source of quality protein and oil. Soybean is the leading oilseed produced globally. India ranks 5th in the list of soybean-producing countries of the world by producing about 3-4 per cent of the global production. Soybean is fastest growing oil seed crop in India

Objective: To estimate the compound growth rate and instability in area, production and productivity of soybean in India.

2. Methodology

This study was undertaken on soybean data from an Indian perspective with data collected from SOPA (soybean processors association of India data (2001 to 2020)

Analytical tools:

Compound Growth Rate:

Compound annual growth rates of area, production and productivity of soybean were estimated by using non- linear equation.

$$Y = abt$$

Where,

Y = Area, production and productivity
t = Time period
b = Regression coefficient
a = Intercept
CGR = [(Antilog b1)-1]*100
The equation obtained after transforming (i) is:
Log y =log a + t log b + log ut

The per cent CAGR was calculated as:

$$CAGR = [(\text{antilog of } b) - 1] \times 100$$

The significant CAGRs will be classified into two groups i.e. negative and positive CAGR. The significance of the growth rate was analyzed by conducting a student's t-test at 1 per cent and 5 per cent levels of significance.

Instability index:

The instability index will be analyzed by the Cuddy-Della-Valle Index method developed by John Cuddy and Della Valle for measuring the instability in time series data (Cuddy and Della Valle, 1978). This index is adjusted for trend, so is considered a better measure than the Coefficient of Variation. As CV overestimates the level of instability in time-series data, which is characterized by long-term trends the cuddy-Della Valle index corrects the coefficient of variation.

$$\text{Instability index} = \frac{\textit{Standard Deviation}}{\textit{Mean}} \times \sqrt{1 - \bar{R}^2}$$

Where,
C- D II = Instability Index
CV = Coefficient of variation
$\bar{R}^2$ = Coefficient of determination from a time-trend regression adjusted for its degree of freedom.

When the test statistic is significant, then the Cuddy- Della index is calculated by using the adjusted ^{R2} value. When a test statistic is not significant or the adjusted ^{R2} is less than zero, the unmodified CV is chosen (Adhikari & Sekhon, 2014). The high degree of instability index shows that there were huge fluctuations in the time series data during the study period. High growth and low instability are prerequisites for sustainable agricultural performance. Since the magnitude of growth and

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instability in crops, production has serious implications for policymakers.

The growth and Instability of soybean exports to major importing countries have been presented in Table 4.4. It was found that exporting soybean to all the major destinations, recorded a positive growth rate except for Australia in terms of quantity and value where it recorded negative growth rates of -9.76 per cent for quantity and -0.13 per cent for value, respectively.

Belgium recorded the highest growth rates with 103.27 per cent, and 101.72 per cent in terms of quantity and value, respectively and has shown a significance at 1 % level of significance in terms of quantity and value. Canada recorded significance in growth at 1% level with values of 79.37 per cent and 86.25 per cent in terms of quantity and value. The USA recorded significant growth at a 1% level with values of 55.46 and 61.13 per cent in terms of quantity and value. Kuwait recorded a significant growth at a 5 % level with a value of 9.81 in value terms.

With regards to Cuddy Della Instability values every importing country recorded high instability values which suggest that Indian soybean export to these nations cannot be relied upon and other export destinations has to be looked haven by expanding the export market of soybean and by involving in various trade agreements with different nations for increasing export of soybean.

With regard to the result of growth and instability of soybean exports, Japan recorded the highest instability with values of 300.81 and 259.36 per cent in terms of quantity and value, respectively. USA recorded high instability with values of 68.41 and 65.31 per cent in terms of quantity and value, and Canada and Belgium recorded high instability and growth rates in terms of quantity and value, respectively. Nepal has shown the highest instability in terms of quantity and value followed by Australia with values of 149.54 per cent and 143.55 per cent and 134.57 and 109.97 per cent.

3. Results and Discussion

It can be observed that the USA was the largest importer of soybean in terms of both quantity and value, with a quantity of 26,060,260 kg of soybean and a value of 1233.40 million rupees, respectively. Canada was the second-largest importer with a quantity of 19,330,720 kg and a value of 873.50 million rupees, followed by Belgium with a quantity of 15,685,540 kg and in value terms of 732.40 million rupees. Nepal recorded values of 3,883,260 kg in terms of quantity and 154.80 million in terms of value, France recorded a quantity of 9,89,000 kg and Rs 43.70 million in terms of value. UAE that recorded a quantity of 10, 11,230 kg and value of 43 million. Japan recorded 1,89,300 kg of soybean import and a value of 10.10 million followed by that of Kuwait with 54,650 kg in terms of quantity and 3.30 million in terms of value and Australia recorded a quantity of 45,460 kg and a value of 2.80 million.

The area recorded under soybean cultivation in the year 2000-2001 was 6,417 thousand hectares and production of 5276 thousand tonnes with a yield of 822 kg/ha. The area under soybean was reduced in the following year and recorded a value of 6343 thousand ha of the area and a production of 5963

Table 1
Destination-wise export of soybean during the year 2020-21

Sr. No.	Country	Quantity (Kg)	Value (Million)	Unit Value (Rs./q)	% share in total export quantity	% share in total export value
1	USA	26,060,260	1233.40	4732.87	0.35	0.39
2	Canada	19,330,720	873.50	4518.71	0.32	0.28
3	Belgium	15,685,540	732.40	4669.28	0.20	0.20
4	Nepal	3883260	154.80	3986.24	0.03	0.01
5	UAE	1,011,230	43	4252.27	0.03	0.01
6	France	9,89,000	43.70	4418.60	0.01	0.01
7	Japan	1,89,300	10.10	5335.44	0.01	0.01
8	Kuwait	54,650	3.30	6038.40	0.01	0.01
9	Australia	45,460	2.80	6159.26	0.01	0.01
10	Others	2,335,210	45	1927.02	0.03	0.03
11	World	68,595,630	3142	4580.46	1	1

Source: CMIE commodities

Table 2
Soybean area production and yield from 2000-2010

Year	Production in '000 tonnes	Yield in kg/ha	Area in '000 ha
2000-01	6417	5276	822
2001-02	6343	5963	940
2002-03	6106	4655	762
2003-04	6555	7819	1193
2004-05	7571	6876	908
2005-06	7708	8274	1073
2006-07	8329	8851	1063
2007-08	8882	10968	1235
2008-09	9511	9905	1041
2009-10	9735	9965	1024
mean	7715.7	7855.2	1006.1
St dev	1356.766	2132.905	150.572
cv	17.584	27.152	14.965
cagr	5.732	8.932	3.031

Source: SOPA (Soybean Processors Association of India)

Table 3
Soybean area production and yield from 2010-2020

Year	Area in '000 ha	Yield in kg/ha	Production in '000 tonnes
2010-11	9601	12736	1327
2011-12	10109	12214	1208
2012-13	10841	14666	1353
2013-14	11716	11861	1012
2014-15	10911	10374	951
2015-16	11605	8570	738
2016-17	11183	13159	1177
2017-18	10329	10933	1058
2018-19	11131	13268	1192
2019-20	12193	11226	921
mean	10961.9	11900.7	1093.7
stdev	786.877	1722.827	193.216
cv	7.178	14.476	17.666
cagr	1.529	-1.147	-2.637

Source: SOPA (Soybean Processors Association of India

Table 4
Growth and Instability of soybean export from India from the year 2006-2021

Country	CAGR (%)		Instability (%)	
	Export quantity	Export value	Export quantity	Export value
USA	55.46 **	61.13 **	68.41	65.31
Canada	79.37 **	86.25 **	61.13	59.34
Belgium	103.27 **	101.72 **	52.93	50.75
Nepal	9.14 NS	17.55 NS	149.54	143.55
France	18.42 NS	20.64 NS	86.64	91.28
Kuwait	3.29 NS	9.81 *	54.75	54.76
Australia	-9.76 NS	-0.13 NS	134.57	109.97
Japan	8.59 NS	15.21 NS	300.81	259.36
UAE	0.43 NS	7.62 NS	143.48	66.62
** significant at 1% level * significant at 5 % level				

thousand tonnes and a yield of 940 kg/ha. The area under soybean has shown an increasing trend from 2003-04 to that of 2009-10 recording values of 6555 thousand ha in 2003-04 and increasing till 9735 thousand ha of area.

The production of soybean showed an increasing trend from 2000 -2001 to 2002-03 and it reduced in the next year to 4655 thousand tonnes and showed an increasing trend in production in 2003-04 with a production of 7819 thousand ha it showed a decline in 2004-05 with a production of 6876 thousand tonnes and from then it showed an increasing trend till 2007-08 where it recorded value of 10,968 thousand tonnes and reduced in the next few years with a value of 9905 thousand tonnes which increased to 9965 thousand tonnes during 2009-10.

The yield of soybean did not show any particular pattern and the yield recorded was 822 kg/ha in 2000-2001 which increased to 940 kg/ha in 2001-02 and reduced to 762 kg /ha in the year 2002-03 the yield recorded in 2003-04 was 1193 kg /ha and recorded a yield of 908 kg/ha in the year 2004-05 and showed an increasing trend till it reached a maximum of 1235 kg/ha yield in 2007-08 and it showed a declining trend in the next few years and finished with a yield of 1024 kg/ha in the year 2009-10.

The area of soybean cultivated increased from 9,601 thousand ha in 2010-11 and has shown an increasing trend till 2013-14 where it recorded a value of 11,716 thousand ha and showed a declining trend in the next year with a value of 10911 thousand ha which increased to 11,605 thousand ha and has shown a declining trend till 2018-19 and recorded a value of 12,193 thousand ha in the year 2019-20 the highest recorded value in past 10 years.

The production of soybean recorded in the year 2010-11 was 12,736 thousand tonnes and it reached a maximum of 14,666 thousand tonnes of soybean the production showed a declining trend till the year 2015-16 when it recorded a production of 8570 thousand tonnes which increased to 13,159 thousand tonnes of production and after reaching production value of 13,268 thousand tonnes during 2018-19 it ended with a value of 11,226 thousand tonnes of soybean in 2019-20. The yield recorded in the year was 1327 kg/ha in the year 2010-11n which has shown a decline in the next year and increased to a yield of 1353 kg/ha in the year 2012-13 and it showed a declining trend in the next few years and recorded a value of 1177 kg /ha yield in the year 2016-17 and showed a decline in the next year and ended with a yield of 1192 kg /ha in 2018-19 and recorded a value of 921 kg /ha in the year 2019-20.

With regard to the results of compound annual growth rate and instability it can be inferred that the USA, Canada and Belgium have recorded a significant growth rate at a 1% level of significance both in terms of export value and export quantity nations like Nepal, France, Australia, Japan and UAE recorded non-significant growth in terms of export value and quantity. Kuwait is the country that recorded significant growth at a 5 % level of significance in terms of export value and showed non-significance in terms of export quantity. All the importing nations recorded high instability in terms of export quantity and value terms implying that even though the countries like the USA, Belgium and Canada have shown significant growth in terms of export quantity and value high instability in terms of the value and quantity is not favourable for Indian soybean to be exported to these nations which means that we have to search

for alternate destinations for export of soybean so that we can try to improve the global share in export of soybean.

4. Conclusion

Canada and Belgium have recorded significant growth rate at 1% level of significance both in terms of export value and export quantity. Nations like Nepal, France, Australia, Japan and UAE recorded non-significant growth in terms of export value and quantity. Kuwait is the country that recorded significant growth at a 5 % level of significance in terms of export value and showed non-significance in terms of export quantity. All the importing nations recorded high instability of soybean in terms of export quantity and value terms.

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