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Production, Performance and Trade of Oryza Sativa (Rice) in India

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Abstract: Rice is considered as one of the main component of the food basket especially in Asian countries. India being one of the largest producers of rice helps in achieving food security providing food, nutrition and export earnings. The paper analysed the trend in area, production and productivity of rice crop in India since 1960s (an era of green revolution in India). The study analysed that the trend has been positive with minor fluctuations only. The study also tests the correlation among the variables being highly correlated are significant or not. It further deals with domestic use and supply of milled rice in the country, with per capita availability of crop in country. Next section attempts to see the pattern of trade i.e. export and import of rice (basmati and non-basmati) to different countries in 1987-88 and 2020-21.

Keywords: productivity, correlation, export, import.

Scope of the study:

The study will be helpful in analysing the status of rice crop in India. Policies can be formulated for efficient production and use of crop in the nation so that per capita availability increases helpful in meeting food security goal. Further studies can be conducted in rice and other crops in India as well as in other parts of the world.

I. INTRODUCTION

Main aim of human civilisation is to provide food to all the people all over the world thus eradicating hunger. In India also many plans have talked about achieving food security in the nation, thus making food availability as main concern for all. Rice being lifeline for many people helps in providing food to a large number of strata around the world. Rice (*Oryza Sativa*) is one of the main staple food all over mainly in Asia and Africa. More than 90 per cent of world's production takes place in Asia and that too mainly in India and China. Green revolution in the nation proved as a milestone, helping the nation in improving production thus enhancing capacity to produce more for the nation as well as for the whole world. Since 1960s India has been main contributor to the world's food basket with increasing its share in exports in both basmati as well as non-basmati rice over time. Production of rice in the country is 178.3 million ton with 124.3 million ton as milled equivalent. Total production of rice in the world is 756 million ton with India's share as 23 per cent of the total production.

II. LITERATURE REVIEW

1. **Jain, A. (2018):** studied the growth in area, production and yield of rice in India from 1970 to 2011. The study reveals that compound annual growth rate in India of area, production and productivity was positive but declining gradually over the time. The decline could be contributed to changing crop pattern in the country.

2. **Adhikari, A. et al. (2016):** examined the growth performance and identified determinants of rice exports from India for the period 1980-81 to 2012-13. The study reveals that rice contributes significantly to national income. Higher growth in basmati rice was due to higher growth in unit value. The estimated regression model analysed that export price, international price, lagged production, domestic consumption, and exchange rate are the major determinants of rice export from India.
3. **Wailles, E. J. and Chavez E. C. (2012):** studied that rice consumption in the country grows at 1.4 per cent annually solely due to population growth. High production of rice in the country helps to export it to foreign markets thus putting downward pressure on domestic and international prices.
4. **Udhayakumar, M. and Karunakaran, K. R. (2020):** assessed that high price of basmati rice make the crop as export competitive in the market. Export destination varies due to variety of the crop. Basmati rice main destinations are Iran, Saudi Arabia, Kuwait, U.S.A., U.K., U.A.E. and Iraq. Saudi Arabia and Iran being highly stable destination for the aromatic rice. Somalia, Senegal and Benin were highly stable market for non-basmati rice from India. The study also reveals that probability retention for U.K. is zero making it highly unstable for the exports.
5. **World Rice Research Conference (2004):** Study revealed that expansion in rice trade has increased after 1990s from 2 per cent in 1961-89 to 6 per cent. The study also highlights the deepening of market as rice imports satisfy more than 40 per cent of domestic requirement in Africa and near East. The study also shows variability of 33 per cent during 1980-1999.

III. NEED OF THE STUDY

Rice is a major crop of the country. Green revolution of 1960s made the crop availability in abundance helping the country to meet its food demand. Therefore there is need to study the progress of crop in area, production, productivity and export-import.

IV. OBJECTIVES OF THE STUDY

1. To study the trend in area, production and productivity since 1960s.
2. To study the growth of crop in India and world from 1961-2020.
3. To study the share of crop in world production since 1960s.
4. To study the correlation among the crop variables from 1961-2020.
5. To make a comparison of India's direction of exports of basmati and non- basmati rice in 1987-88 and 2020-21.
6. To see the composition of non- basmati rice imports in 2020-21 from different nations.

Hypothesis of the study:

1. There is no significant correlation between area and production.

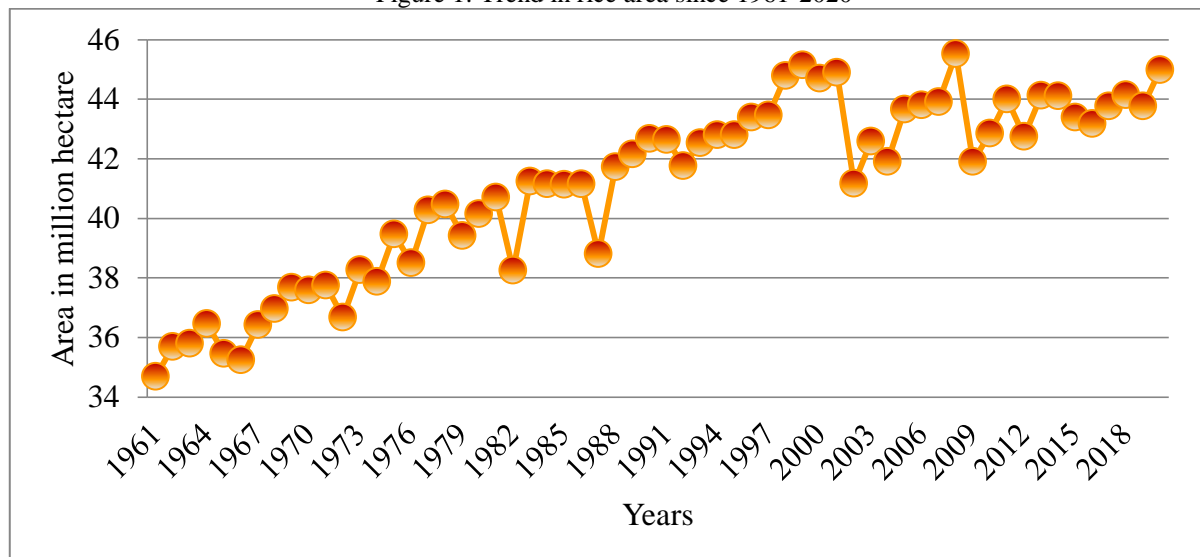
V. RESEARCH METHODOLOGY

The study is based on secondary data from 1960 to 2020. Secondary data has been taken from various annual publications of Reserve Bank of India (RBI), Agricultural and Processed Food Products Export Development Authority (APEDA), Food and Agriculture Organisation (FAO), The World Bank. Data has been presented in the form of graphs, figures and tables for easy comprehension. Statistical tools coefficient of correlation (r), compound annual growth rate (CAGR) have been used for data analysis.

VI. FINDINGS

I. Trend in area under rice crop since 1960s

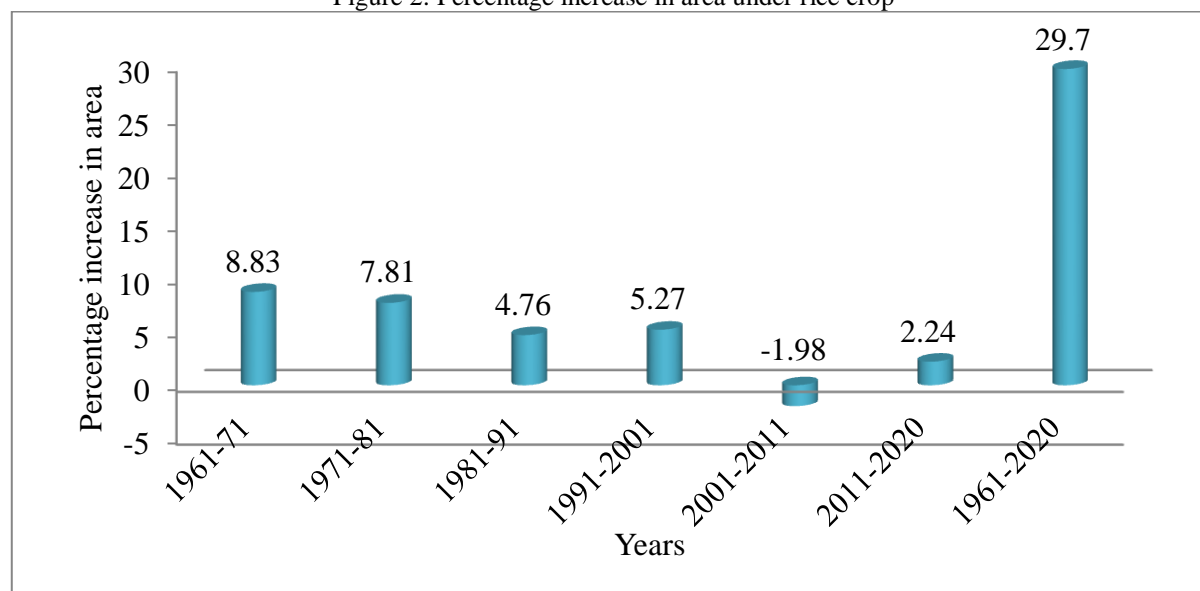
Figure 1: Trend in rice area since 1961-2020



Source: FAO, 2022

Figure 1 highlight the area under rice crop has been on an increase since 1960s making the crop one of the essential crop item in the country. There has been tremendous increase in area under the crop with 29.7 per cent increase from 1960 to 2020. In the years (1961-71) 8.83 per cent increase in the area was recorded following 7.81 per cent increase in the next, which was mainly due to onset of green revolution in India with rice as a major beneficiary from the programme. There has been overall increase in the area under crop except in the years 2001-2011 which recorded 1.98 per cent decrease. This decrease in area could be contributed to crop diversification in farming sector.

Figure 2: Percentage increase in area under rice crop



Source: Author's calculations

Table 1: Growth in area in India and the World

Sr. No.	Year	India (Area MH)	Decadal Growth Rate	World (Area MH)	Decadal Growth Rate	% share of world
1	1961	34.69		115.36		30.07
2	1970	37.59	0.008	132.87	0.014	28.29
3	1971	37.75		134.51		28.06
4	1980	40.15	0.006	144.41	0.007	27.80

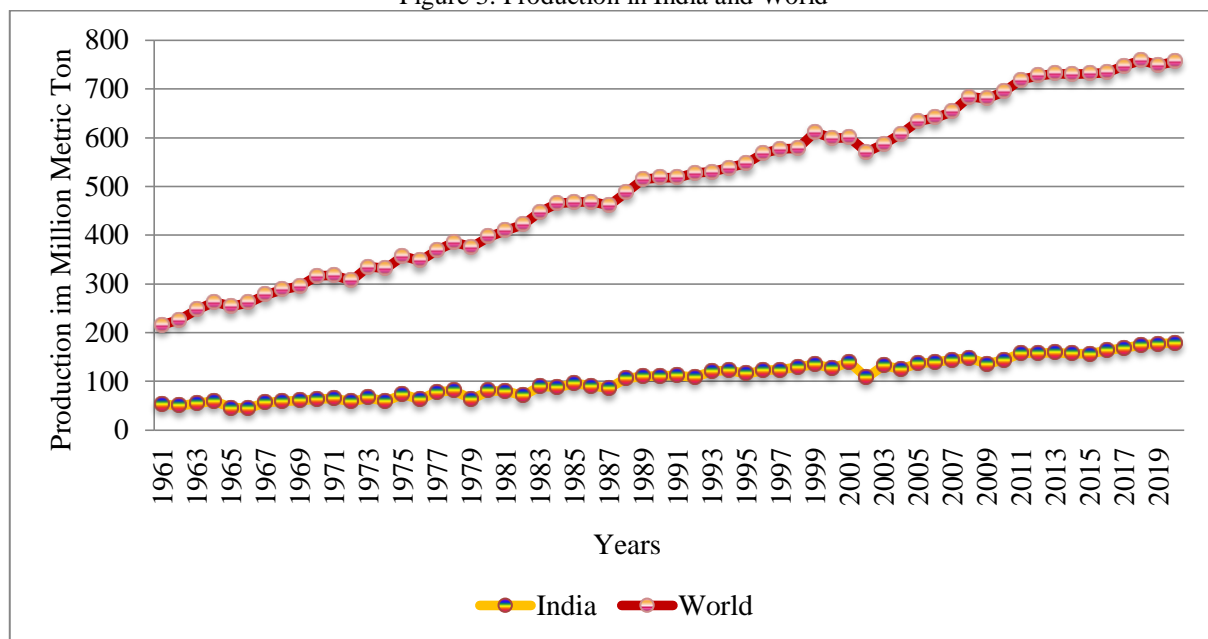
5	1981	40.70		145.04		28.06
6	1990	42.68	0.004	146.96	0.001	29.04
7	1991	42.64		146.63		29.08
8	2000	44.71	0.004	154.00	0.004	29.03
9	2001	44.90		151.95		29.54
10	2010	42.86	-0.004	160.83	0.005	26.65
11	2011	44.01		161.75		27.20
12	2020	45.00	0.002	164.19	0.001	27.40

Source: FAO, 2022 AND author's calculations

Table 1 highlights the decadal growth rate of India and the world and share of India in world. Compound annual growth rate has been declining for India under the crop but remains positive except in the decade 2001-2010. Growth rate under area in the world also shows positive growth but with fluctuations in the area. Overall area under crop has increased from 37 to 45 million hectare in India and from 132 to 164 million hectare in world but the growth rate has declined in both scenarios. Share of the country in world area was 30 per cent in 1960 with declining trend to 27 per cent in 2020.

II. Production: Trend, Growth rate and share in world production:

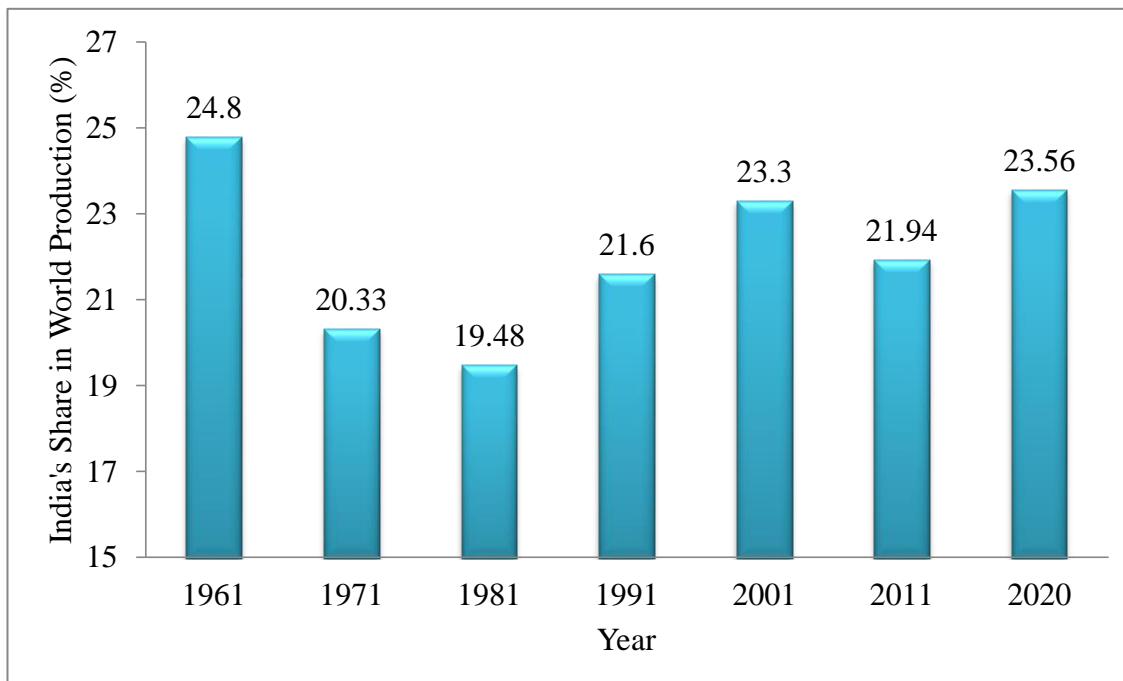
Figure 3: Production in India and World



Source: FAO, 2022

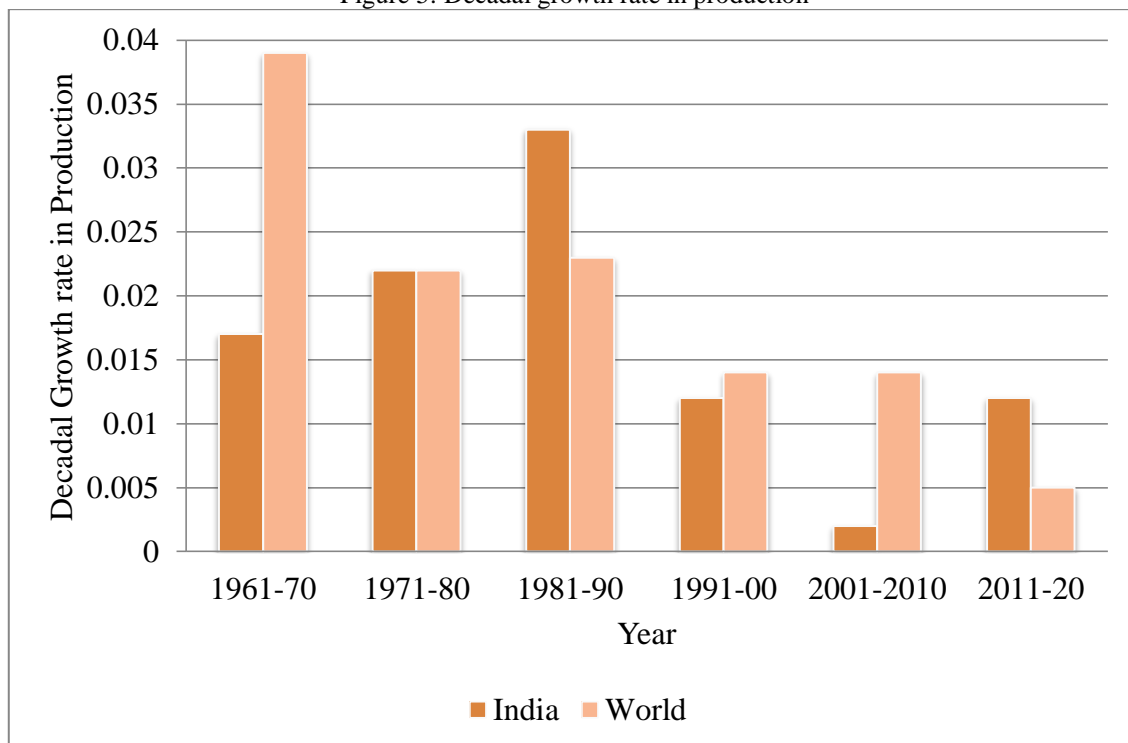
Figure 3 shows that production of rice has been on a continuous increase since 1960s. Since green revolution production has jumped to 64 million metric ton in 1970 with increasing trend thereafter. There was decrease in production in 1987 and 2002-03 which can be attributed to decrease in area under the crop. India's share in world production was 24.8 per cent in 1961 indicating India as one of the largest producer in the world. Although share of country has been declining since 1960 but still holds the maximum share in the world. India contributes about 23.56 per cent to the total production.

Figure 4: India's share in world production



Source: Author's calculations

Figure 5: Decadal growth rate in production



Source: Author's calculations

Table 2: Decadal growth in production India and world

Sr. No.	Year	India	Decadal Growth Rate	World	Decadal Growth Rate	% share of world
1	1961	53		215.64		24.80
2	1970	63.33	0.017	316.34	0.039	20.01
3	1971	64.6		317.71		20.33
4	1980	80.31	0.022	396.87	0.022	20.23
5	1981	79.88		410.07		19.47
6	1990	111.51	0.033	518.56	0.023	21.50

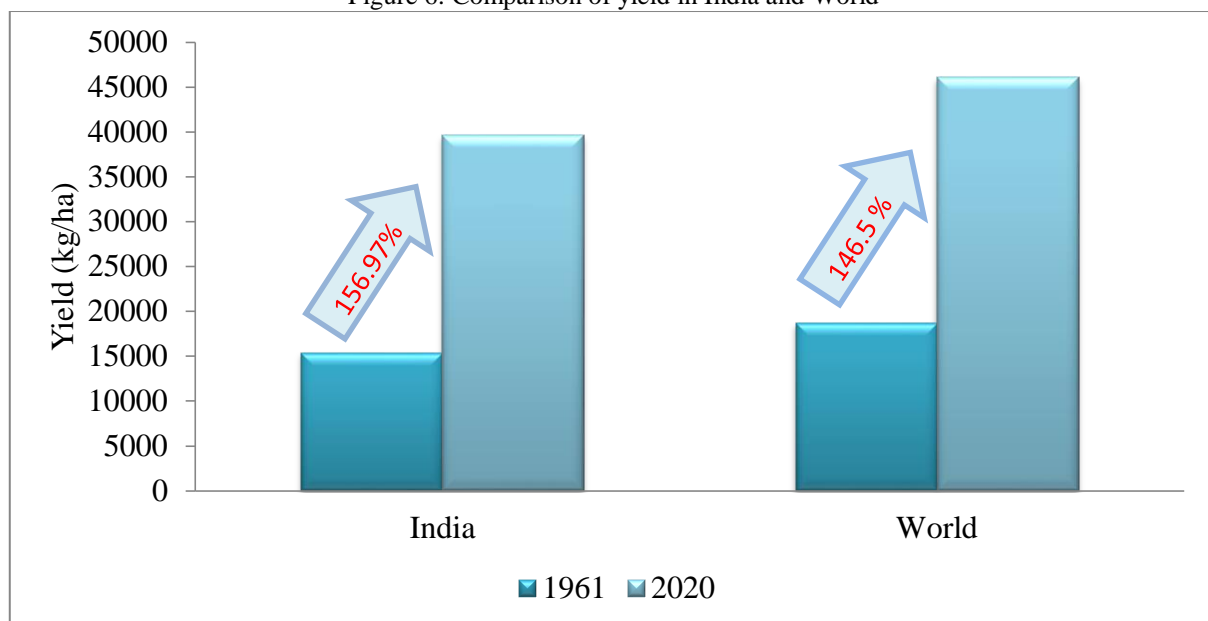
7	1991	112.04		518.51		21.60
8	2000	127.46	0.012	598.66	0.014	21.29
9	2001	139.9		600.24		23.30
10	2010	143.96	0.002	694.47	0.014	20.72
11	2011	157.9		719.46		21.94
12	2020	178.3	0.012	756.74	0.005	23.56

Source: FAO, 2022 and author's calculations

Table 2 and figure 5 highlights the decadal growth in production of rice. Production has increased in India as well as in world since 1960s. Growth rate in India increased from 0.017 to 0.033 till 1990s but later only 0.012 growth could be achieved in the country. In contrast to India's growth pattern world growth decreased from 0.039 in 1961 to 0.005 in 2020. Although rice has emerged as a major component of food basket eliminating hunger and poverty, thus helping to achieve sustainable development goals of zero hunger and eradicating poverty in the world.

III. Yield:

Figure 6: Comparison of yield in India and World



Source: FAO, 2022 and author's calculations

Above figure displays that in 1961 yield of rice in country was only 15419 kg/ha as compared to 18693 kg/ha of the world. In 2020 Yield of both has increased to 39623 kg/ha and 46089 kg/ha in India and world respectively. Although percentage increase in yield in India is greater than that of world with 146.5 per cent and 156.97 per cent increase of the former.

Table 3: Growth rate of yield of India and world

Sr. No.	Year	India	Decadal Growth Rate	World	Decadal Growth Rate
1	1961	15419		18693	
2	1970	16849	0.0089085	23808	0.0244821
3	1971	17110		23619	
4	1980	20002	0.0157395	27482	0.0152633
5	1981	19623		28272	
6	1990	26125	0.0290325	35286	0.0224088
7	1991	26271		35362	
8	2000	28508	0.0082054	38874	0.0095138
9	2001	31158		39502	
10	2010	33587	0.0075351	43179	0.00894

11	2011	35878		44479	
12	2020	39623	0.00998	46089	0.00356

Source: FAO, 2022 and author's calculations

Table 3 displays that Yield has been increasing continuously in both India and the world.

From mere 15419 kg/ha in 1961 with 0.0089 compound annual growth rate, it has increased to 39623 kg/ha in 2020 with slight increase in growth rate. Growth rate of world has been positive but has decreased from 0.024 to 0.003.

IV. Correlation among area and production

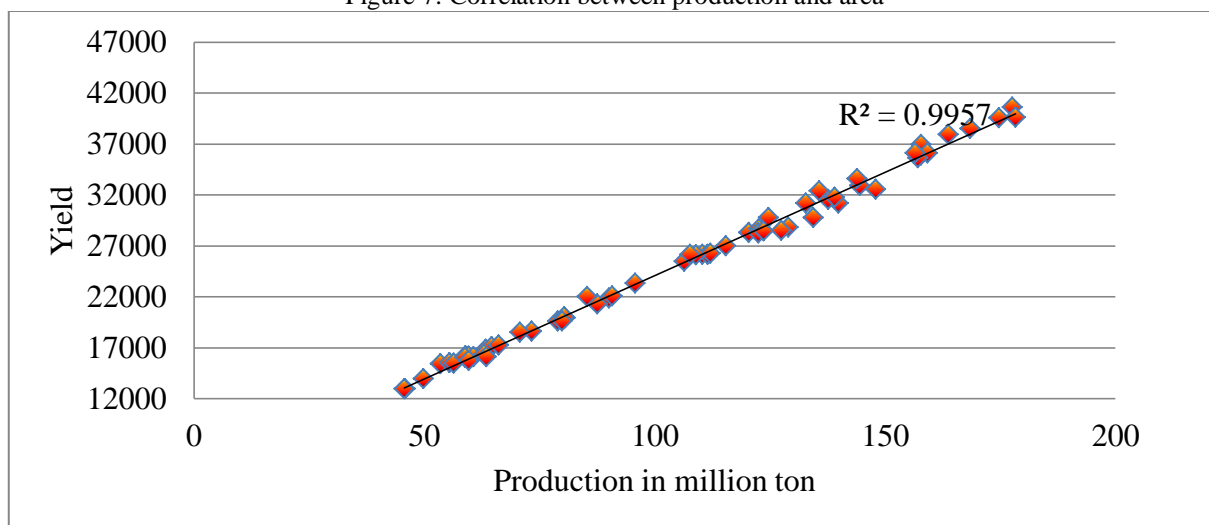
Box 1: Result of correlation among area and production

```
> cor.test(`Area (ha)`, `Production (MT)`)

Pearson's product-moment correlation

data: Area (ha) and Production (MT)
t = 17.107, df = 58, p-value < 2.2e-16
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.8588783 0.9476548
sample estimates:
 cor 0.9135636
```

Figure 7: Correlation between production and area



Section 4 displays that correlation coefficient among the variables is very high and significant. It shows that as area increases production also increases significantly.

V. Domestic Use and Supply

Table 4: Total rice supply and utilisation the country (000 MT)

	1960	1970	1980	1990	2000	2010	2020
Production	34639	42225	53631	74291	84977	95970	124370
Beginning Stocks	3000	5000	7000	14000	17700	20500	33900
Domestic supply	37639	47225	60631	88291	102677	116470	158270
Consumption	35473	41512	53301	73091	75992	90196	101071
Ending Stocks	2500	6000	6500	14500	25000	23500	37000
Domestic Use	37973	47512	59801	87591	100992	113696	138071

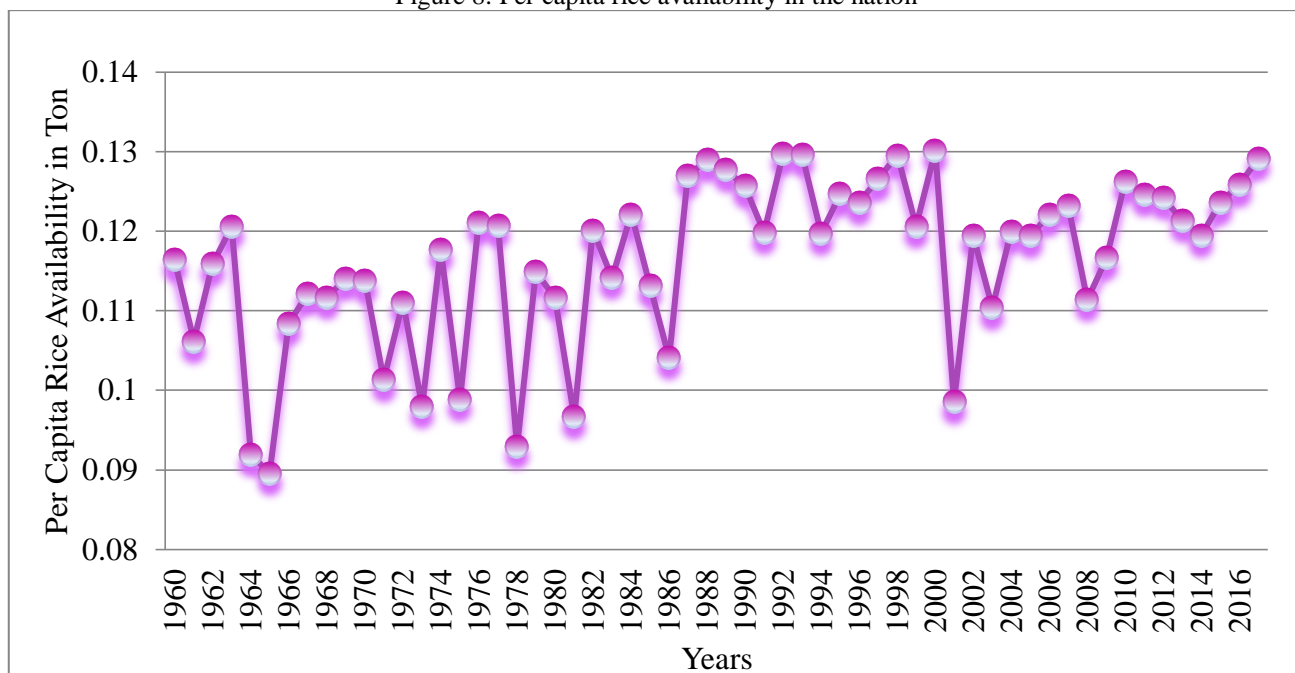
Exports	67	20	900	700	1685	2774	20199
Imports	401	307	70	0	0	0	0
Net trade	-334	-287	830	700	1685	2774	20199
stock to use ratio	7.047613678	14.45365196	12.19489	19.83828	32.8982	26.05437	36.60793

Source: Author's calculations

Table 4 highlights the domestic supply and consumption and use of milled rice in the country. Total rice output has increased from 34 million tons to 124.3 million tons in 2020 which could be due to improvement in yield under rice. From food security and sustainable development goal purpose India has been producing and exporting rice on a large basis. Domestic supply of the crop has increased to 158.2 million tons. Thus, fulfilling the need of people's for consumption and stock purpose. Consumption of rice has increased from 35 million tons to 101 million tons in the country. Despite fulfilling the needs of own nation, country also helps in providing food security to rest of the world though exports of milled rice. From being a major importer India has transformed itself to major exporter of the crop. Stock to use ratio has been showing increasing trend from 7 to 36 since 1960s.

VI. Food security:

Figure 8: Per capita rice availability in the nation



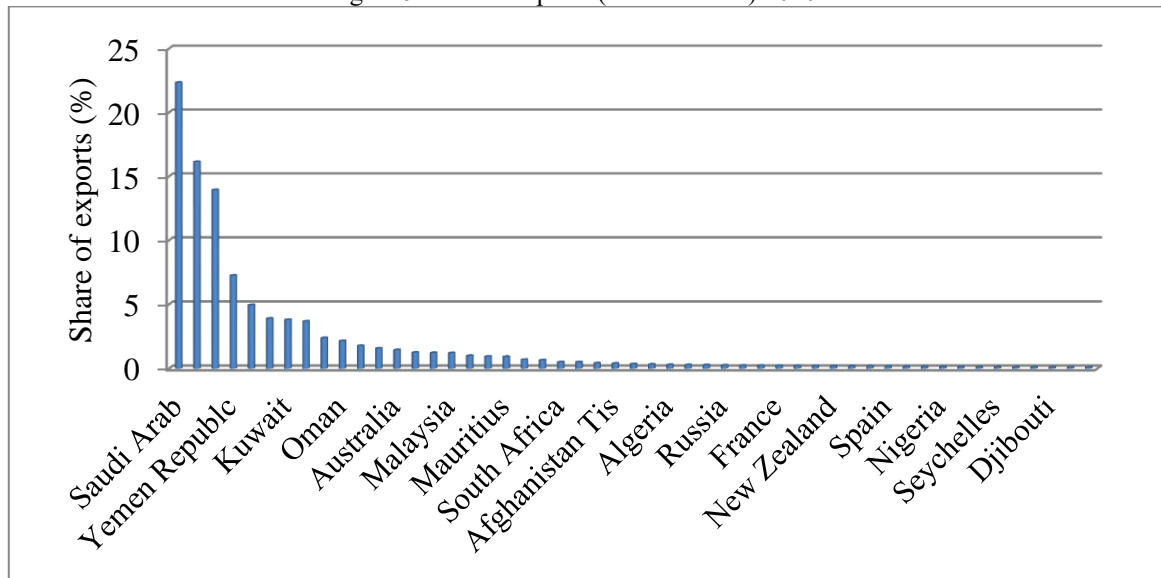
Source: FAO, 2022 and World Bank

Food security is the main concern of every nation. Rice being amply harvested in the country also helps in achieving food security of the nation. Per capita rice availability of the nation was 0.116 ton in 1960. Over the period of time with increasing population being second highest in population in the world, food security remains the main concern of the nation. With increasing production of the rice crop in the country, it still maintains the per capita availability of 0.129 tons.

VII. Export of basmati and non-basmati rice from India

(1) (i): Export of Basmati Rice in 2020-21

Figure 9: India's exports (Basmati Rice) 2020-21



(ii): Export of Basmati Rice in 1987-88

Figure 10: India's exports (Basmati Rice) 1987-88

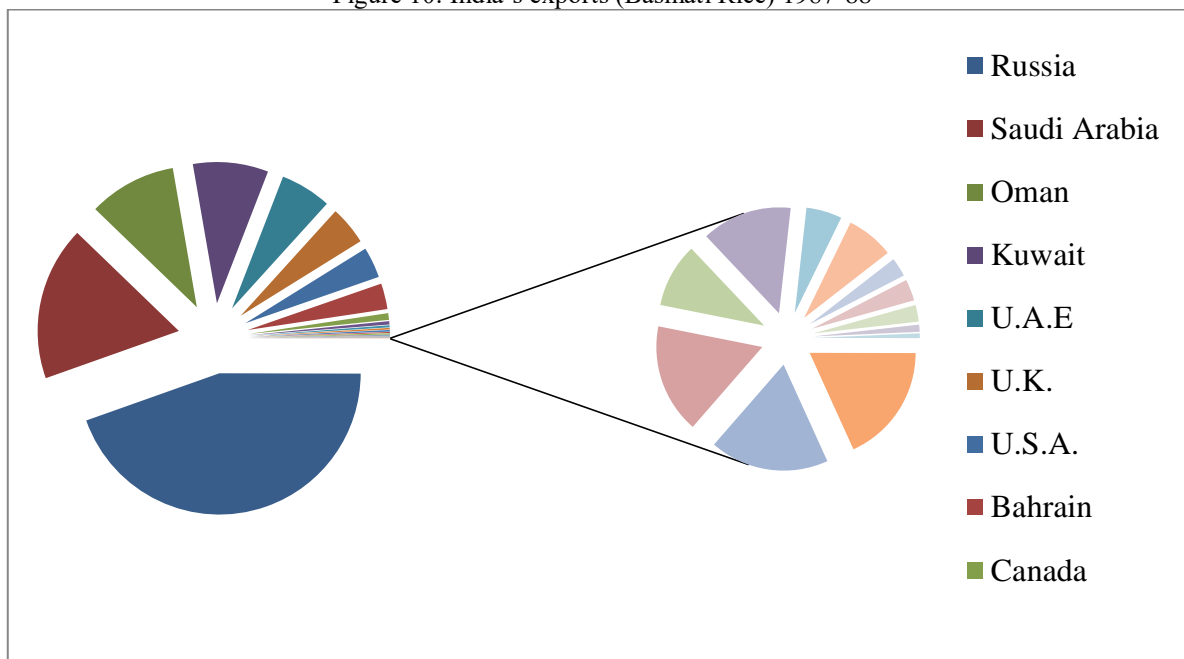
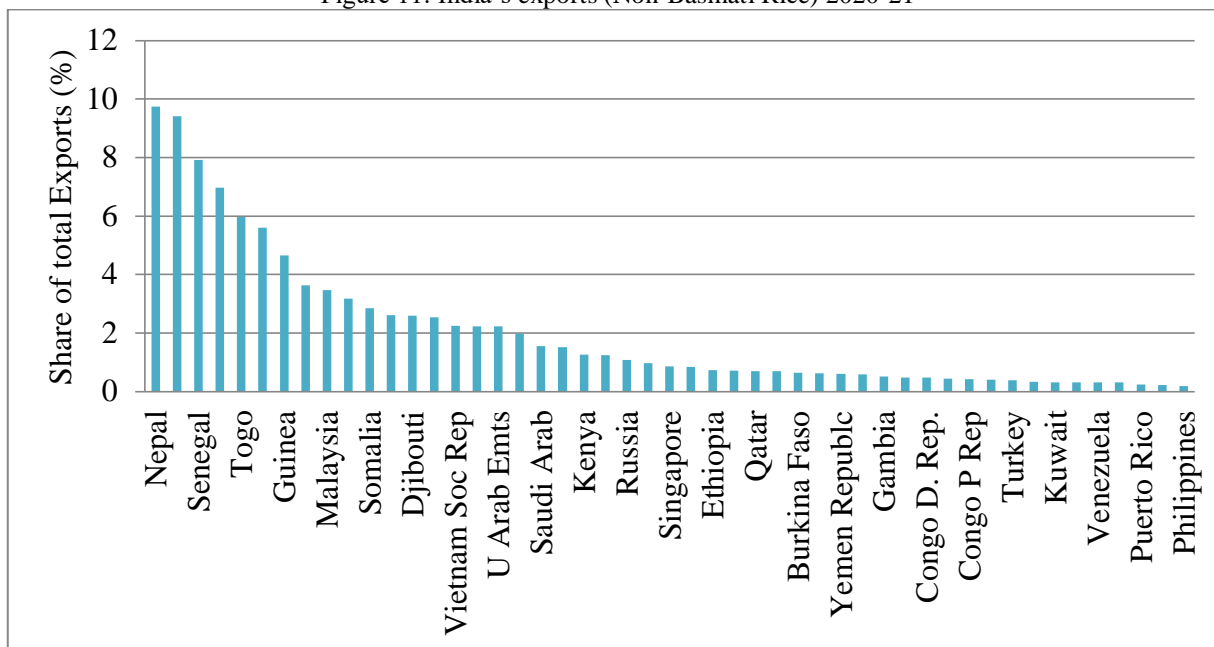


Figure 9 and 10 displays the direction of Basmati rice from the nation in 1987-88 and 2020-21. Export of Basmati rice was only 355277 MT in 1987-88 with Russia (44%), Saudi Arabia (17%) and Oman (10%) as largest importer of the crop among 35 nations. In 2020-21 Export has increased to 46.3 lakh MT with Saudi Arab (22%), Iran (20%) and Iraq (16%) gaining top positions. Saudi Arab remains the main importer of basmati rice over the period.

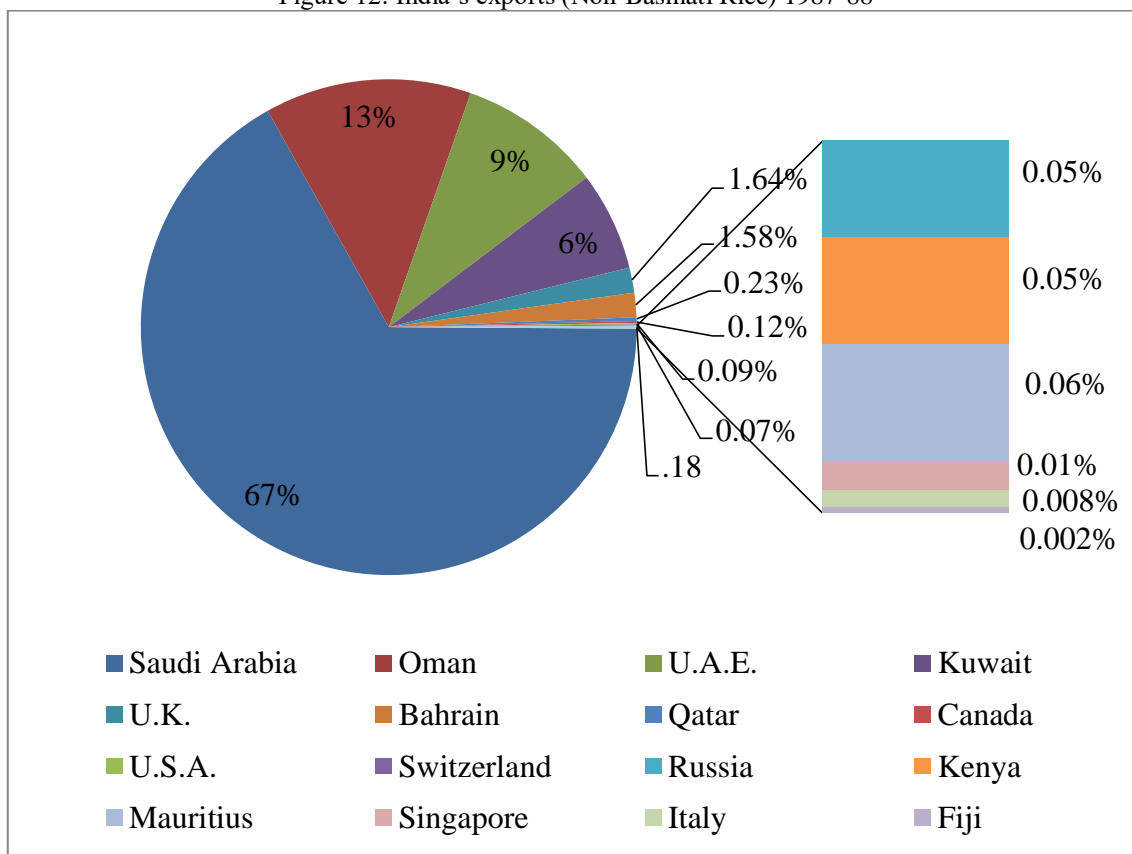
2 (i): Export of Non- Basmati Rice in 2020-21

Figure 11: India’s exports (Non-Basmati Rice) 2020-21



(ii): Export of Non- Basmati Rice in 1987-88

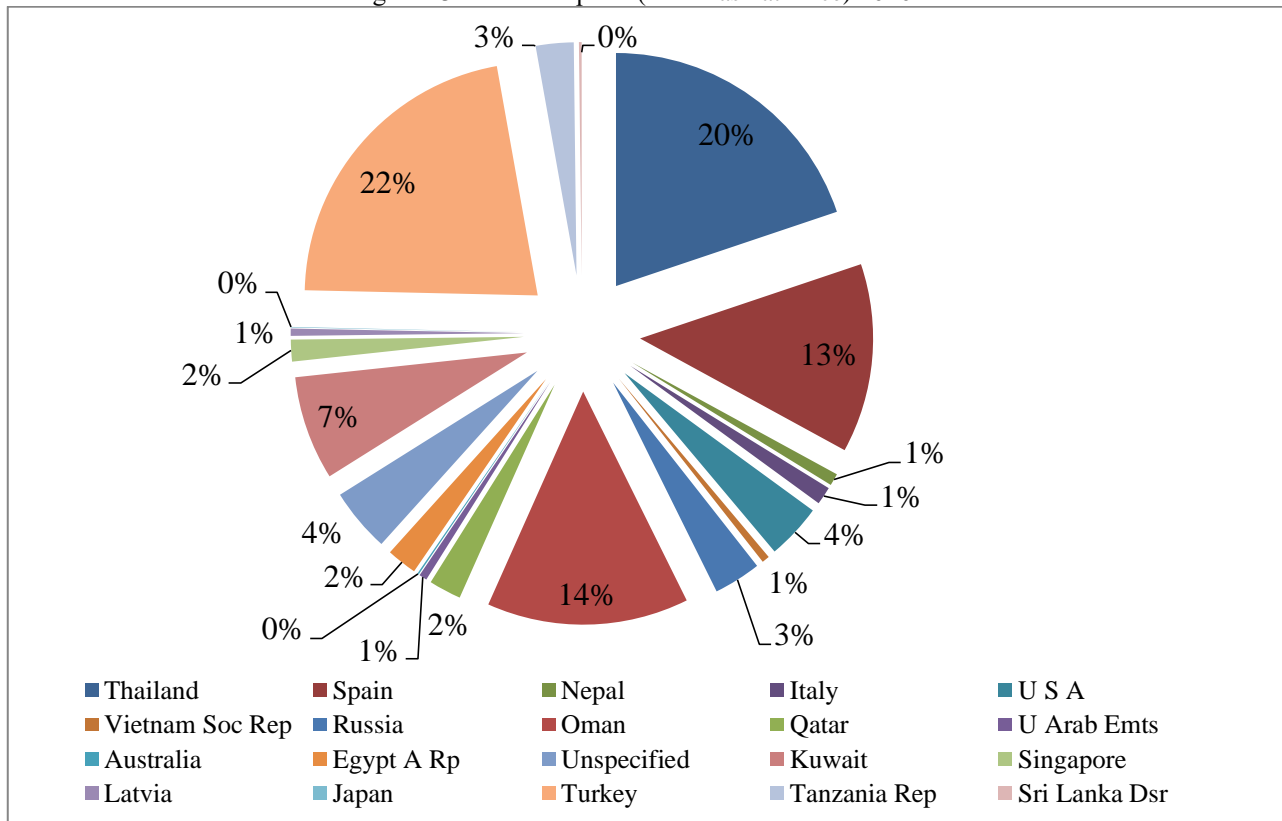
Figure 12: India’s exports (Non-Basmati Rice) 1987-88



The above two figures (11 and 12) show that export of non-basmati rice was only 33519 MT to 16 countries only. Saudi Arabia, Oman and U.A.E. were top importer of the crop with 66%, 13% and 9% respectively. Export of non-basmati rice gained momentum after lifting ban on crop in 2011. In 2020-21, Benin (9.4%), Senegal (7.91%), Nepal (7.45%) and Bangladesh (6.96%) were major destination of non-basmati from the nation.

VIII. Import of Non-Basmati Rice in 2020-21

Figure 13: India's imports (Non-Basmati Rice) 2020-21



India is importer of non-basmati rice in various categories. In non- Basmati rice imports, India stood at 113th position out of 123 in the world. The data indicates that India import only 0.02 per cent of total imports in the world. Turkey, Thailand, Oman and Spain are the major exporter of non-basmati rice to the country.

VII. CONCLUSION

Area, production and productivity has increased in India as well as in the world since 1960s. Growth rate has been positive for area, production and productivity in both but with some fluctuations. Overall growth rate has decreased from the previous levels. Contribution of the nation in World has remained high but with slight decrease in area from 30 per cent to 27.4 per cent and 24 per cent to 23.56 per cent in 1960 and 2020 respectively. It is also seen that there is high correlation among the variable (Area, production and productivity) helping one another to increase share of the crop. It is drawn from the study that India contributes largely to food security of the nation as well as of world with 0.12 ton per capita rice availability for the nation. India has also increased its exports share in both basmati and non-basmati rice since 1987 substantially. The top destined nations of the crop are Benin (9.4%), Senegal (7.91%), Nepal (7.45%) and Bangladesh (6.96%) for non- basmati and Saudi Arab (22%), Iran (20%) and Iraq (16%) of basmati rice. To maintain its top position in the market India has to take measures to increase production and productivity with enhanced quality.

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