Trend and Growth Rate Estimation of Principal Crops in Karnataka state in India

Abstract

The study undertaken to analyse the growth rate performance of area, production, productivity of selected crops in Karnataka from year 1997 to 2019. At state level, it was found that, the productivity of cereals showed positive growth with 1.22 percent. The area under maize increased by 5.30 percent by displacing Jowar, Bajra, minor millets The rice and maize became stable crops in cultivation due its assured support prices and procurement from government. The production of pulses increased by 4.17 percent. The area under oil seeds showed negative trend with -5.87 percent which may be due to its high cost of production and unremunerative prices where as the commercial crops has recorded positive growth rates of production (2.69 percent) and productivity (2.43 percent) despite of its 0.24 percent area growth. The farmers prioritised sugarcane, cotton because of less labour requirements, good market prices. The Technology mission on oilseeds and Pulses in post 1990's could be reason for increased production and productivity of pulses.

Keywords: Growth rate, Crops, Phases, Karnataka

1. Introduction

Karnataka is one of the semi arid state in India and the agriculture system forms the backbone for the economic development in State which contributes 37 percent of the total State Domestic Product. The State covers an area of 1,92,204 sq km which occupies 5.35 percent of the total geographical area. Food grain crops dominate the cropping pattern accounting for over two-third of total gross cropped area in Karnataka. Among food grains, coarse cereals occupy prominent place in the cropping pattern. The decline in area under food grains is offset by increase in area under commercial crops and Pulses. The main crops grown in state are Rice, Ragi, Jowar, maize, ,Redgarm, ,bengal gram in addition to oilseeds like groundnut ,sunflower and commercial crops like cotton, sugarcane, tobacco are also cultivated. Karnataka experiences varying climatic conditions of arid, semi-arid and humid. The state is having the second largest rain fed agricultural area in the country after Rajasthan however it contributes good share in production of crop every annually. In the state, the food crops share an area of 64.6 per cent of the total cultivated area while remaining 35.4 per cent of the cropped area was shared by non food crops. As per the year 2019 estimates , it was

observed that , food grain production accounted for almost 11 million metric tons. The state has large arable area under different crops having potential to increase further. It has paddy area of 13.27 lakh ha, ragi area of 8.02 lakh ha, jowar area of 14.32 lakh ha, bajra area of 3.14 lakh ha, maize area of 10.15 lakh ha, minor millets area of 0.40 lakh ha making a total cereal area of 49.3 lakh ha. Bengal gram has an area of 7.22 lakh ha, red gram area of 6.97 lakh ha with a total pulse area of 19.08 lakh ha. The area under groundnut is 8.21 lakh ha while cotton and sugarcane are grown in area of 5.33 lakh ha and 3.74 ha respectively. The study shows the major changes in growth performance of selected crops during first phase 1997-98 to 2007-08 while second phase as 2008-09 to 2018-19 and as a whole study period of twenty two years from 1997-2019.

2. Study area and Methods

Karnataka is bordered on the west by the Arabian Sea, and the Laccadive Sea, Goa on the northwest, Maharastra on the north, Andra Pradesh on the east, Tamil Nadu on the southeast, and Kerala on the south west. It has a 350 km Long coastline, which is the western boundary. It is the eight largest Indian State in area and the 9^{th} largest state in population. The state has 31 districts, comprising 176 taluks and 747 villages.. Information about area, Production yield of major crops was collected from various abstract issues of agriculture crops, Directorate of Economics and statistics, Government of Karnataka. Eleven Principal Crops like Rice, Maize, Bajra, Jowar,Ragi,Redgram,Bengal gram, Sunflower, Groundnut Cotton, Sugarcane were chosen for the study and the necessary secondary data collected for a period of 22 years 1997-98 to 2018-19**.** CAGR (Compound Annual Growth Rate) is used to find the growth of major crops.

$$r = \{\text{Antilog } (B)-1\} * 100$$

Where,

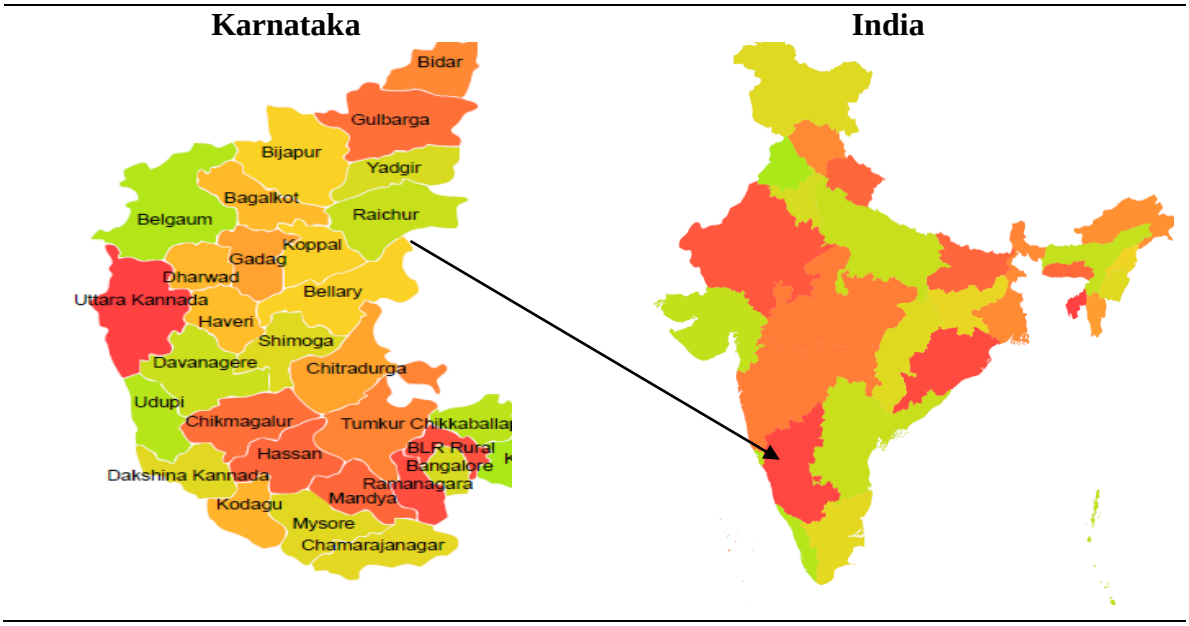
Yt = Area/yield of major crops in ‘t’ period

A= Constant: B= (1+r)

r= Compound growth rate: t= Time variable (1, 2, 3...n)

After log transformation and estimation of the above function as

$$\ln Yt = \ln A + t \ln B,$$



Map 1 : location of Karnataka State in India

3. Results and Discussions

3.1 Growth in area, production and productivity of cereals in Karnataka (1997-98 to 2018-19)

As shown in (Table 1 c) The average area under rice in the state is 13.27 lakh ha which forms about 26.91 per cent of the area under total cereals in the state during 1997 to 2019. The area under rice has witnessed a marginal decrease of -0.90 per cent per annum. The average annual production of rice in the state is around 35 lakh tonnes forming about 37.35 per cent of the cereals produced in the state. Rice production in the state is growing at around 0.11 per cent per annum and its fluctuation is also not all that conspicuous. The rice productivity in the state is hovering 2673.85 Kgs per ha. The rice productivity in the state witnessed an annual increment of 1.03 per cent. Thus the growth in the production of rice in the state has come mainly from the growth in the rice productivity than from the growth in area (Bathla 2008, Saraswathi 2012). The area under Jowar in the state has registered a negative growth of -3.44 per cent per annum and the fluctuation in area under Jowar was about 23.08 per cent. The production of Jowar recorded a negative growth rate of -1.83 per cent per annum. The productivity of Jowar in the state recorded a slight positive growth with 1.67 per cent per annum. The area under Bajra has declined during the study period with -2.88 percent per annum. The growth in production in Bajra was 0.94 per cent per annum in which the productivity also increased with 3.94 percent per annum.

The state registered a increase in maize area with 5.30 percent per annum and area under maize almost doubled during the reference period. Remunerative support price and

market intervention operations taken up by the government of Karnataka for purchasing maize helped in area expansion under maize. Maize productivity has been increasing at the rate of 0.65 per cent per annum. In Karnataka, maize production was increasing at 5.98 per cent per annum during 1997 to 2019, Similar trend was reported by Singh and Singh (1991) and Sinha and Thakur (1993), saraswathi (2012) who observed an increasing trend in yield level in their study. There was a decrease in area under Ragi with -2.26 percent per annum which might be due to low output price in the market for this crop. However, Ragi production also showed decreasing trend in the state with -2.12 percent per annum. The fluctuation in growth of production of Ragi in the state was 29.26 and there is mild increasing trend observed in Productivity of crop with 0.14 percent per annum. The area under minor millets in the state showed deceleration trend with -7.16 percent per annum which might be due to low prices for these crops. The production and productivity of crop also registered negative growth rate. However, the decline in the area of millets was compensated by maize area which grew at more than 5.3 per cent per annum .As shown in (Table 1a) , the area under cereals slight decreased with -0.77 per cent per annum during first phase 1997-98 to 2007-08 when compared to second phase 2008-09 to 2018-19 which the area decreased by -0.27 (Table 1b) .The productivity of Cereals registered positive growth in second phase with 1.34 per cent per annum. The area Jowar, ,ragi area were decreased which is compensated by Maize crop. It is observed that, farmers prefer Rice, Maize crop to cultivate. The linear trend of productivity of all cereals showed upward slope as shown in Figure 1.

3.2 Growth in area, production and productivity of Pulses in Karnataka (1997-98 to 2018-19)

Among the pulses, Redgram and Bengal gram are major crops grown in the state. They have shared about 37.65 percent and 47.29 percent respectively as shown in (Table 2c) .The growth rate in area under Red gram was about 4.17 per cent per annum. Red gram production in the state is growing at around 7.84 per cent per annum. The Red gram productivity showed an annual increment of 3.51 per cent per annum. The area under Bengal gram showed a positive growth rate of 6.98 per cent per annum and registered positive growth in production with 7.57 percent per annum with productivity of 0.55 percent per annum. It is interesting to observed that area under Bengal gram increased despite its stagnant yield levels. The growth analysis of green gram production revealed almost a similar trend with mild increase of 0.66 percent per annum as that of the area growth performance. The area under green gram registered negative trend of of -0.40 per cent per annum but had

positive growth in both production and productivity with 0.66 and 1.07 percent per annum respectively. However black gram showed declining growth rate -2.77 percent per annum with respect to its area and increased trend with respective to its productivity with 3.48 percent per annum. The growth in production of black gram was 0.61 per cent per annum..The area , production and productivity of pulses increased during second phase when compared to first phase (Table 2a). During Second phase ,the area under Redgram and Bengal gram increased .However, the production and productivity of black gram increased despites its decrease of area during second phase (Table 2b).The simple linear trend showed positive an upward slope in pulses in general and constant intercept for black gram in specific as shown in figure 2.

3.3 Growth in area, production and productivity of Oilseeds in Karnataka (1997-98 to 2018-19)

The total area under oilseeds in the state is 16.27 lakh hectares. The trend in growth rate of area and production decreased for all oil seeds crops .The productivity of sunflower registered highest with growth rate of 2.59 per cent per annum during 1997 to 2019 as shown in (Table 3c). The crops like Ground nut , sesamum showed mild positive growth in productivity where as Safflower has showed negative productivity The area under sunflower showed a negative growth rate of -7.21per cent per annum however productivity of sunflower showed positive performance .The growth in groundnut area during the period was -3.29 per cent per annum. It can be observed that yield growth of groundnut was negative with -3.02 per annum. Groundnut experienced decline in area as well as yield resulting in reduction in groundnut production. Un remunerative prices and high cost of seeds had negative effect on farmers to cultivate groundnut. At the state level, the area growth of safflower was declining at the rate of -7.25 per cent per annum. Production of safflower decreased at -7.52 per cent per annum. This was due to combined effect of decline in yield and area. The growth performance of safflower yield in the state revealed that there is no growth during the study period. The growth analysis of area under sesamum revealed a negative growth of -5.83 per cent per annum. The sesamum yield growth analysis showed a growth of 1.81per cent per annum at the state level. During the 1997 to 2018 , the production growth rate of sesamum was -4.11 per cent per annum. The area, production of oilseeds decreased double during its second period (Table 3b) with negative growth rate of -9.72 and -6.80 per cent per annum respectively. However the growth rate of productivity has increased with 3.23 per cent per annum when compared to first period (Table 3 a). The oilseeds showed

positive slopes for productivity of selected pulse crop as shown in figure 3 depicted by simple linear trend equation.

3.4 Growth in area, production and productivity of Commercial crops in Karnataka (1997-98 to 2018-19)

The total area under commercial crops in the state is 11.29lakh hectares. The area growth rate analysis of cotton increased by 1.45 per cent per annum during 1997 to 2019 as shown in (Table 4c). The total area under cotton in the state was 5.33 lakh hectares. At state level, cotton production increased at a rate of 6.16 per cent .Cotton productivity experienced positive growth rate of 4.63 per cent per annum with fluctuation of about thirty six per cent. The average productivity of cotton in the state was 177.83 Kgs per ha. The state registered a highly increase in area under sugarcane with 2.00 per cent per annum. Irrigated area growth, better prices and less labour requirement contributed a lot to the growth of total area under sugarcane. The sugarcane production was increasing at 1.60 per cent per annum but the productivity of sugarcane has showed slight decrease in growth rate performance by -0.38 percent per annum. The tobacco area was slight positive with 0.54 percent per annum .The production of tobacco was increasing at 2.68 per cent per annum. The yield growth of tobacco in the state was increasing at the rate of 2.05 per cent per annum. An increasing growth in production and productivity of chilli was observed while the growth rate for area under chilli was declining. The growth in area under chilli in the state was -3.02 per cent per annum. The growth rate of production of chilli was 0.33 per cent per annum which have similar results with Veena (1996) in their study . The growth rate in productivity of chilli increased at 3.45 per cent per annum. The area, production under commercial crops increased during second phase when compared to first period. Area under tobacco has positive growth during first phase with 5.54 percent per annum (Table 4b) where its area drastically decreased during second period with -7.22 per cent per annum. During second phase, it was observed that, the area, production under chilli crop had 9.78 and 9.42 percent per annum respectively (Table 4c)which accounted high positive growth rate. In linear trend equation, all commercial crops showed positive slope except for sugarcane as shown in figure 4.

Table 1: Compound annual growth rate of cereals in Karnataka

Table 1 a) Growth Performance of cereals in Karnataka for 1997-98 to 2007-08

Cereals	Mean area (lakh ha)	C.V. (%)	CGR (% pa)	Mean Production (lakh tons)	C.V. (%)	CGR (% pa)	Mean Productivity tons/ha)	C.V. (%)	CGR (% pa)
Rice	13.60	9.80	-0.28	34.38	15.62	0.75	2517.81	8.81	1.04
Jowar	17.10	11.70	-3.30	13.86	20.67	-1.32	818.90	23.22	2.04
Bajra	3.75	21.25	1.74	2.35	41.41	3.50	607.85	26.21	1.72
Maize	7.23	27.05	7.32	20.14	34.48	7.07	2723.79	15.40	-0.23
Ragi	9.09	13.55	-2.50	13.56	28.67	-3.17	1484.20	21.09	-0.68
Minor Millets	0.57	22.83	-7.60	0.30	29.43	-7.85	535.59	11.94	-0.26
Total	51.34	17.69	-0.77	84.59	28.38	-0.17	8688.14	17.77	0.60
Table 1 b) Growth Performance of cereals in Karnataka for 2008-09 to 2018-19									
Rice	12.94	14.75	-3.93	36.61	15.27	-3.31	2830.53	5.33	0.64
Jowar	11.71	11.96	-3.37	11.84	19.15	-3.92	100.87	14.07	-0.56
Bajra	2.53	17.72	-4.12	2.40	33.84	1.60	951.16	31.80	5.98
Maize	12.98	7.34	1.45	38.34	20.36	2.68	2948.76	18.45	1.21
Ragi	7.03	12.17	-2.39	11.39	28.13	-4.36	1598.67	21.57	-2.02
Minor Millets	0.24	17.78	-0.10	0.12	38.52	2.72	523.33	30.32	2.83
Total	47.33	13.62	-2.07	100.7	25.87	-0.76	8953.32	20.25	1.34
Table 1 c) Growth Performance of cereals in Karnataka 1997-98 to 2018- 19									
Rice	13.27	12.37	-0.90	35.50	15.41	0.11	2673.85	9.22	1.03
Jowar	14.32	23.08	-3.44	12.74	21.80	-1.83	910.60	20.51	1.67
Bajra	3.14	28.22	-2.88	2.76	36.88	0.94	779.50	37.74	3.94
Maize	10.15	32.21	5.30	29.42	40.28	5.98	2836.27	17.20	0.65
Ragi	8.02	17.99	-2.26	12.48	29.26	-2.12	1541.44	21.20	0.14
Minor Millets	0.40	47.89	-7.16	0.21	54.07	-7.23	529.13	22.17	-0.06
Total	49.30	26.96	-1.89	93.11	32.95	-0.69	9270.09	21.34	1.22

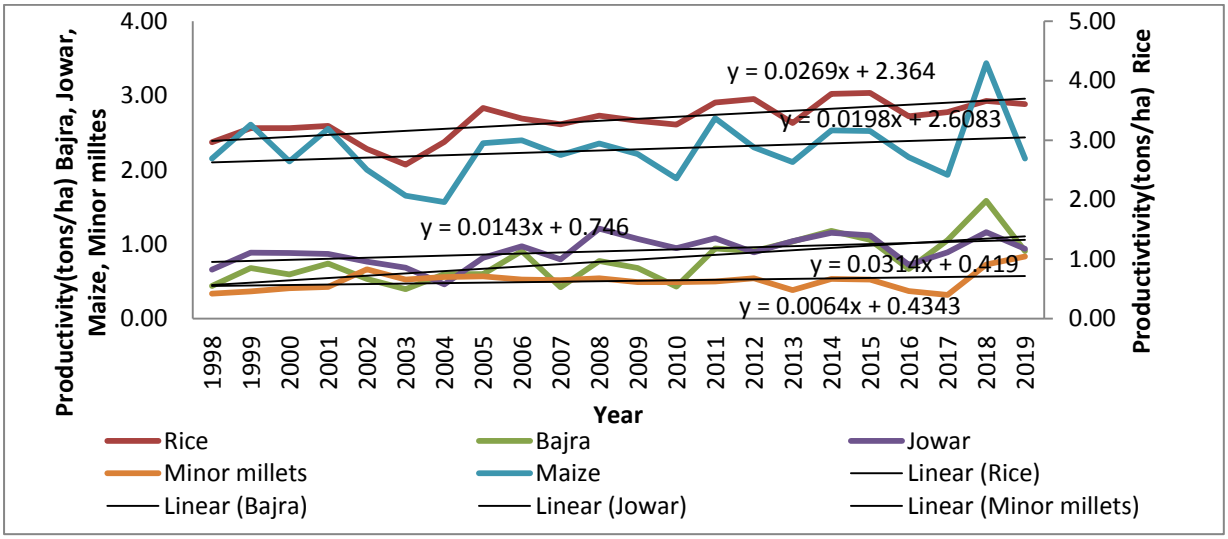


Figure 1). Simple Linear Trend of Cereal Productivity

Table 2: Compound annual growth rate of Pulses in Karnataka

Table 2 a) Growth Performance of pulses in Karnataka for 1997-98 to 2007-08

Pulses	Mean area (lakh ha)	C.V. (%)	CGR (% pa)	Mean Production (lakh tons)	C.V. (%)	CGR (% pa)	Mean Productivity tons/ha)	C.V. (%)	CGR (% pa)
Red Gram	5.41	13.34	3.53	2.61	39.12	9.33	470.13	29.03	0.47
Bengal Gram	4.72	29.18	7.07	2.47	24.55	5.23	535.56	17.66	-1.72
Green Gram	4.01	23.30	3.96	0.87	54.06	-2.07	219.30	46.82	-5.80
Black gram	1.40	14.41	-1.19	0.38	46.83	-3.52	271.26	39.37	-2.35
Total	15.54	20.05	3.34	6.33	41.14	2.24	1496.25	33.22	-2.35
Table 2 b) : Growth Performance of pulses in Karnataka for 2008-09 to 2018-19									
Red Gram	8.53	34.37	6.61	5.82	53.96	11.22	657.43	32.57	4.32
BengalGram	9.49	32.87	10.08	5.62	39.15	10.86	588.86	21.78	0.70
Green Gram	3.37	24.04	3.20	0.80	46.50	9.05	236.24	32.24	5.66
Black gram	1.02	19.79	-1.89	0.39	41.02	7.03	385.23	33.35	9.09
Total	22.41	27.76	4.5	12.63	45.15	9.54	1867.76	29.98	4.94
Table 2 c) : Growth Performance of pulses in Karnataka for 1997-98 to 2018-19									
Redgram	6.97	37.65	4.17	4.21	66.63	7.84	563.78	35.43	3.51
BengalGram	7.22	47.29	6.98	4.12	55.26	7.57	563.48	20.23	0.55
Green Gram	3.68	24.77	-0.40	0.84	49.49	0.66	228.17	38.50	1.07
Black gram	1.21	22.80	-2.77	0.38	42.80	0.61	328.43	39.27	3.48
Total	19.08	33.17	1.99	9.55	53.45	4.17	1683.86	33.35	2.15

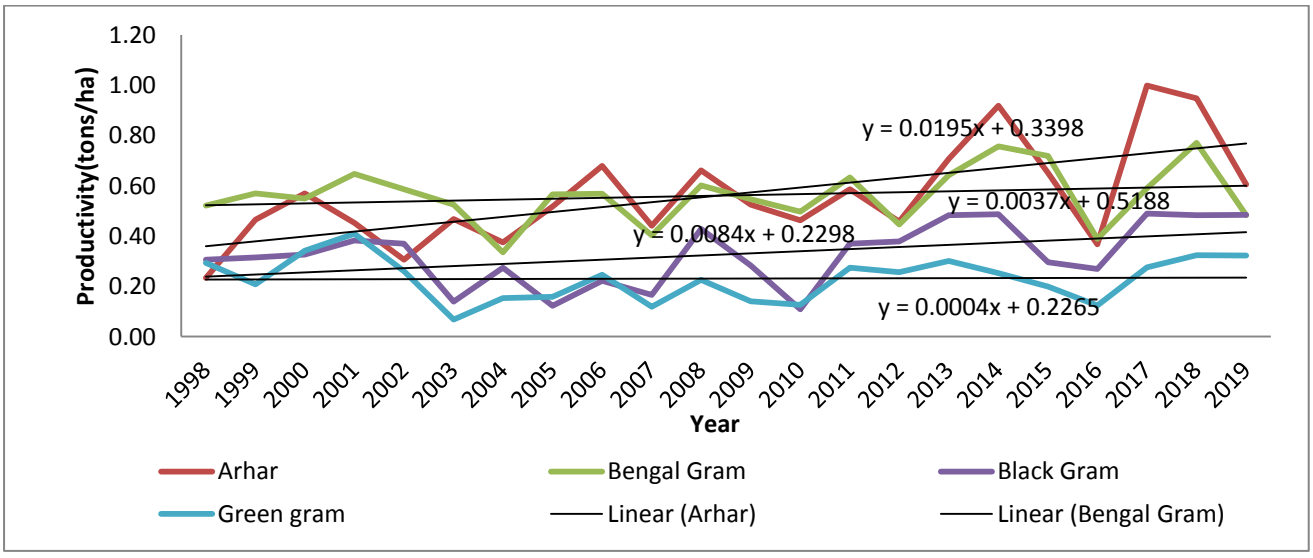


Figure 2) Simple Linear Trend of Pulses Productivity

Table 3: Compound annual growth rate of Oilseeds in Karnataka

Table 3a) Growth performance of Oilseeds in Karnataka for 1997-98 to 2007-08									
Oilseeds	**Mean area (lakh ha)**	**C.V. (%)**	**CGR (% pa)**	**Mean Production (lakh tons)**	**C.V. (%)**	**CGR (% pa)**	**Mean Productivity tons/ha)**	**C.V. (%)**	**CGR (% pa)**
Sunflower	9.35	36.18	10.39	3.77	39.45	11.21	408.01	16.68	0.74
Groundnut	9.67	14.86	-2.71	6.90	36.92	-6.36	697.46	24.82	-3.75
Safflower	0.88	12.09	-3.31	0.60	17.72	-2.26	692.42	20.19	1.08
Sesamum	0.90	19.88	-1.71	0.46	40.01	3.88	505.98	29.11	5.69
Total	20.80	20.75	0.66	11.73	33.52	1.61	2303.87	22.70	0.94
Table 3b) Growth performance of Oilseeds in Karnataka for 2008-09 to 2018-19									
Sunflower	4.30	60.32	-15.30	2.04	44.79	-10.39	530.82	31.11	5.79
Groundnut	6.75	16.85	-4.18	4.72	18.95	0.23	715.05	23.99	4.60
Safflower	0.43	34.31	-10.63	0.30	40.64	-12.36	705.70	22.30	-1.96
Sesamum	0.50	37.00	-8.80	0.26	35.96	-4.69	547.53	26.04	4.50
Total	11.98	37.12	-9.72	7.32	35.08	-6.80	2499.10	25.86	3.23
Table 3c): Growth performance of Oilseeds in Karnataka for 1997-98 to 2018-19									
Sunflower	6.71	58.11	-7.21	2.86	51.62	-4.80	472.34	29.68	2.59
Groundnut	8.21	23.85	-3.29	5.81	37.36	-3.02	706.25	23.84	0.27
Safflower	0.66	39.59	-7.25	0.45	41.53	-7.52	699.06	20.75	-0.00
Sesamum	0.69	39.32	-5.83	0.36	48.48	-4.11	527.74	27.05	1.81
Total	16.27	40.21	-5.89	9.48	44.47	-4.86	2405.39	25.33	1.16
Source :Authors calculation based on data available from aps.dac.gov.in									

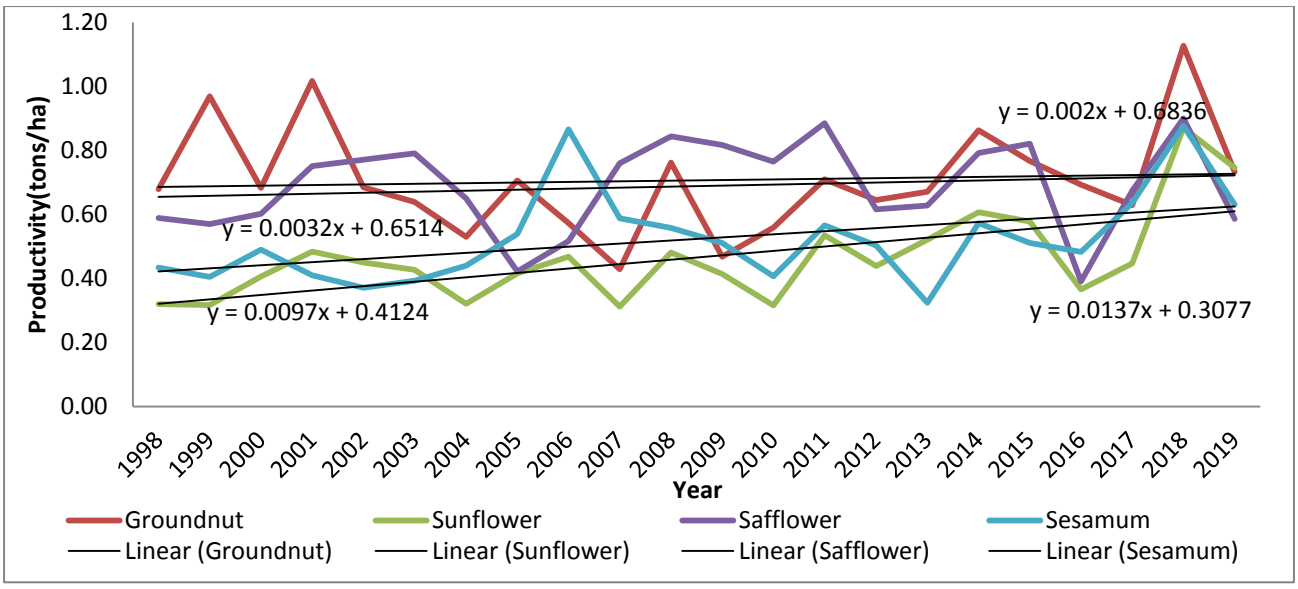


Figure 3) Simple Linear trend of Oilseeds Productivity

Table 4: Compound annual growth rate of Commercial crops in Karnataka

Table 4 a) :Growth Performance of Commercial crops in Karnataka for 1997-98 to 2007-08									
Commercial crops	**Mean area (lakh ha)**	**C.V. (%)**	**CGR (% pa)**	**Mean Production (lakh tons)**	**C.V (%)**	**CGR (% pa)**	**Mean Productivity tons/ha)**	**C.V. (%)**	**CGR (% pa)**
Cotton	4.76	22.94	-5.21	6.15	34.66	-3.86	127.76	24.36	1.43
Sugarcane	3.20	21.66	-3.94	284.42	28.84	-5.53	87.68	11.90	-1.65
Tobacco	0.96	16.64	5.54	0.58	23.48	3.17	612.98	20.79	-2.24
Dry Chilli	1.52	23.32	-4.41	1.32	16.48	-2.54	90.36	21.14	1.95
Total	10.44	21.14	-2.00	292.47	25.86	-2.19	918.78	19.54	-0.12
Table 4b):Growth Performance of Commercial crops in Karnataka for 2008-09to 2018-19									
Cotton	5.84	22.64	3.82	13.25	37.04	6.38	223.35	23.38	2.46
Sugarcane	4.27	10.48	1.68	374.90	13.34	-0.01	87.82	9.63	-1.67
Tobacco	0.99	18.17	-7.22	0.84	32.47	-8.94	832.28	17.71	-1.86
Dry Chilli	0.98	37.88	9.78	1.33	44.79	9.42	154.60	53.27	-0.32
Total	12.08	22.29	2.01	390.32	31.91	1.71	1298.05	25.99	-0.34
Table 4 c):Growth Performance of commercial crops in Karnataka for 1997-98 to 2018-19									
Cotton	5.33	24.61	1.45	9.87	52.92	6.16	177.83	36.36	4.63
Sugarcane	3.74	21.07	2.00	329.66	24.50	1.60	87.75	10.53	-0.38
Tobacco	0.97	17.19	0.54	0.69	34.55	2.68	710.49	24.43	2.05
Chilli	1.25	35.87	-3.02	1.33	33.06	0.33	122.48	54.68	3.45
Total	11.29	24.68	0.24	341.55	36.25	2.69	1098.55	31.50	2.43
Source :Authors calculation based on data available from aps.dac.gov.in									

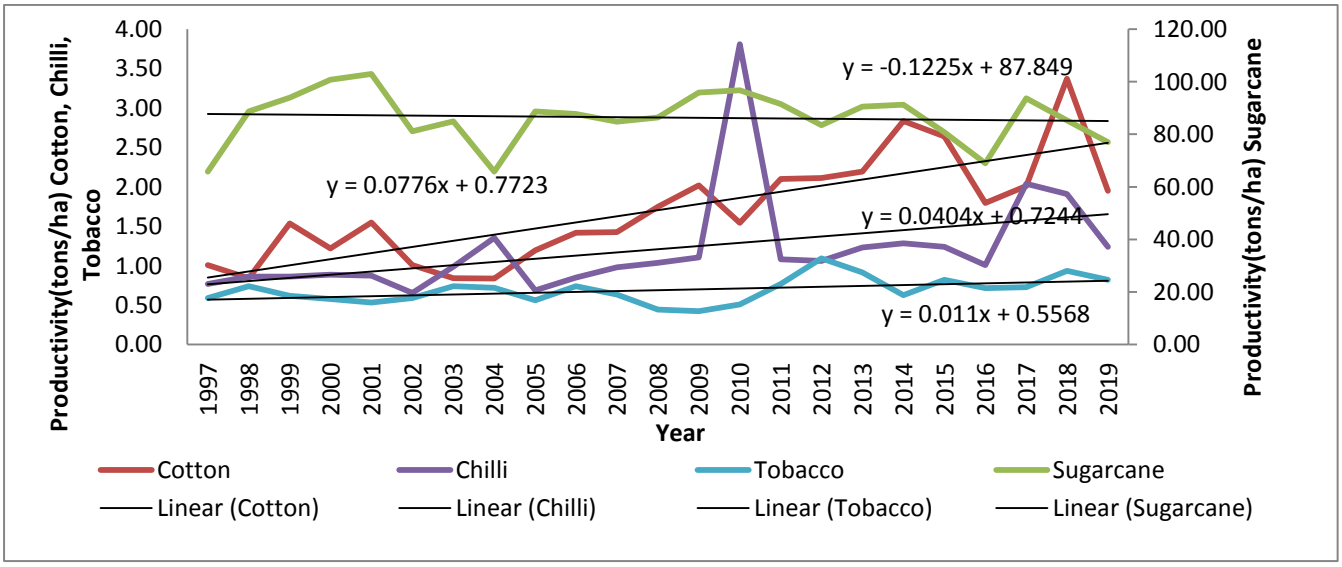


Figure 4) Simple Linear trend of Commercial crops Productivity

4. Conclusion

The area under pulses , commercial crops were increased whereas cereals ,oil seeds decreased during 1997 to 2019. The mission of TMOP has positively contributed towards pulses production but it hasn't showed positive impact on Oilseed production. The study revealed that except maize, the area under rice, jowar, bajra, ragi and minor millets are

decreasing. Therefore, government has to take measures to improve the area for cultivating cereals in order to increase the food grain production in the state.

Acknowledgments

This paper is a part of the Ph.D. research work of the author. The authors are thankful to ICAR-IARI for their financial assistance to carry out the research work and extend their gratitude to SAU-ANGRAU for granting study leave.

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