



E-ISSN: 2278-4136

P-ISSN: 2349-8234

www.phytojournal.com

JPP 2021; Sp 10(2): 84-90

Received: 06-01-2021

Accepted: 09-02-2021

Vennila M

Ph. D. Research Scholar,
Agribusiness Management,
Department of Agribusiness
Management, College of
Agriculture, University of
Agricultural Sciences, Dharwad,
Karnataka, India

Dr. C Murthy

Professor of Agricultural
Marketing, Department of
Agribusiness Management,
College of Agriculture,
University of Agricultural
Sciences, Dharwad, Karnataka,
India

Trend analysis of area, production and productivity of finger millet (Ragi)

Vennila M and Dr. C Murthy

Abstract

The present study has been analysed the trend in area, production and productivity of finger millet and the instability by Cuddy Della Valle index. The study has been carried out based on secondary data and the data was collected for the periods from 2007-08 to 2018-19 from various government publications and websites. Compound annual growth rate, co-efficient of variation and instability index was computed. The growth rate of area of finger millet in India showed significant at 1 per cent level with negative trend which is due to diversification of crops and production showed significant at 5 per cent level but negative trend as it is the function of area and productivity. The productivity found insignificant negative trend which is due adoption of traditional varieties. The growth rate of area and productivity of finger millet of Karnataka showed significant at 1 per cent level with negative trend and production showed significant at 5 per cent level with negative trend. Thus there is a need to take up productivity enhancing measures in finger millet like varietal improvement, improved cultural practices and irrigation facilities. The instability indices for area, production and productivity for finger millet is positive which indicates less risk in growing finger millet in future. The fluctuations in area are due to replacement of finger millet cultivated lands by other comparable and competitive crops such as paddy, sugarcane, pulses and vegetables and due to its designation as a low value inferior crop alongside other millets. Even though, Karnataka tops in area under finger millet, the consumption was comparatively less due to consumption of jowar as staple food in north Karnataka region. Government intervention needs to focus on spreading finger millet as a wonder grain for dry lands and infant nutrition.

Keywords: Growth rate, co-efficient of variation, instability index

Introduction

In tropical regions of the world, millets are considered as important crops due to their resistance to pests and diseases, short growing season and productivity under hardy and drought conditions. Finger millet (*Eleusine coracana*) also known as finger millet is one of the important food crop mainly used in India and Africa. It can be cultivated under adverse soil and climatic conditions mostly as a rainfed crop. It is rich in protein, calcium, phosphorus, iron, fiber and vitamin content. The calcium content is higher than all cereals and iodine content is considered to be highest among all the food grains. Finger millet has best quality protein along with the presence of essential amino acids, vitamin A, vitamin B and phosphorus (Gopalan *et al.* 2004) [8]. Finger millet contains higher proportion of carbohydrate which is the form of non starchy polysaccharide and dietary fiber, which provides several nutritional and physiological benefits (Rai, 2000). Finger millet is also recognized for their health beneficial effects such as anti-diabetic, anti-tumorigenic, atherosclerogenic effects, antioxidant and antimicrobial properties. Finger millet contains about 5-8 per cent protein, 1-2 per cent other extractives, 65-75 per cent carbohydrates, 15-20 per cent dietary fibre and 2.5-3.5 minerals.

In India, finger millet is grown and consumed in Karnataka, Andhra Pradesh, Tamil Nadu, Odisha, Maharashtra, Kumaon region of Uttarakhand and Goa. There are significant yield variations observed among the top producing states. The total area under finger millet in India is 891 thousand hectares (2018-19) which was mainly contributed by Karnataka, Maharashtra and Uttarakhand. From this area, 1,239 thousand metric tonnes of finger millet was produced in 2018-19. During this period, productivity of finger millet was recorded as 1390 Kg per hectare.

Identifying the existing trends in area, production and productivity plays an important role in the way of development (Sharma, 2012). By estimating the trend in area, production and productivity of finger millet, gap in demand and supply can also be worked out (Sharma, 2013). In this paper, an attempt is made to study the trend in area, production and productivity of finger millet in India.

Corresponding Author:**Vennila M**

Ph. D. Research Scholar,
Agribusiness Management,
Department of Agribusiness
Management, College of
Agriculture, University of
Agricultural Sciences, Dharwad,
Karnataka, India

Objective of the study

The specific objective is to study the trend in area, production and productivity of finger millet in India.

Data base and Research Methodology

The study was based on secondary data collected from various published sources (Anon., 2020) [1]. Time series data for the period from 2007-08 to 2018-19 pertaining to area, production and productivity of finger millet crop for India as a whole and state wise data were collected from Ministry of Agriculture & Farmers Welfare, Government of India and district wise data of Karnataka state was collected from Directorate of Economics and Statistics, Government of Karnataka. Compound annual growth rate, co-efficient of variation and instability index were analysed for separately for area, production and productivity of finger millet as a whole for India, state wise and district wise of Karnataka state.

To analyse the trend in area, production and productivity of finger millet, exponential functional form was fitted. Based on exponential function, the compound annual growth rate is also computed.

$$Y_t = A B^t u_t \dots\dots\dots (1)$$

Where,

Y_t = data on area or production or productivity in the year 't'

A = intercept indicating Y in the base period (t = 0)

B = (1 + g) regression coefficient t = time period in years

u_t = disturbance term for the year 't'

g = average compound growth rate to be estimated

Equation (1) was converted into logarithmic form in order to facilitate the use of linear regression.

Taking logarithm on both sides of the equation (1)

$$\ln Y_t = \ln A + t (\ln B) + \ln u_t$$

This can be rewritten in the following form

$$Q_t = a + bt + vt \dots\dots\dots (2)$$

Where,

$Q_t = \ln Y_t$

a = ln A

b = ln B

vt = ln u_t

The values of 'a' and 'b' are estimated by using Ordinary Least Squares (OLS) estimation technique.

Later the original parameter 'A' and 'B' in equation (1) were obtained by taking anti- logarithm of the values 'a' and 'b' in the equation (2) as

A = anti ln a

B = anti ln b

Average compound annual growth rate was calculated as

$$CAGR = (B-1)*100$$

The significance of the regression coefficient was tested using student's 't' test.

Instability Index

The agricultural instability can be measured by various methods, such as the coefficient of variation, dispersion,

Cuddy Della Valle Index, Coppock Instability index, etc. The present study applies the Cuddy Della Valle Index for measuring the instability. Cuddy Della Valle index first de-trends the given series and gives a clear direction about the instability. The use of coefficient of variation as a measure to show the instability in any time series data has some limitation. If the time series data exhibit any trend, the variation measured by coefficient of variation can be over-estimated, i.e. the region which has growing production are at constant rate will score high in instability of production if coefficient of variation is applied for measuring instability. As against that, Cuddy-Della Valle index attempts to de-trend the coefficient of variation by using coefficient of determination. Cuddy- Della Valle index was originally developed by Cuddy and Valle (1978) [5] for measuring the instability in time series data that is characterized by trend.

In order to study the stability of finger millet with respect to area, production and productivity, co-efficient of variation was estimated using the expression given below.

The coefficient of variation (CV) is a statistical measure of the dispersion of data points in a data series around the mean. The coefficient of variation represents the ratio of the standard deviation to the mean and it is a useful statistic for comparing the degree of variation from one data series to another, even if the means are drastically different from one another.

$$\text{Coefficient of variation} = \frac{\text{Standard deviation}}{\text{Mean}} \times 100$$

To measure the magnitude of variability in area, production and productivity for the total period, the co-efficient of variation (%) was computed. Further the instability index was also calculated to examine the instability in area, production and productivity finger millet in country over the time period by using the following formula:

$$\text{Instability Index (I)} = \sqrt{1 - R^2} \times CV$$

Results and Discussion

To study the trend analysis in area, production and productivity of finger millet, secondary data of 12 years i.e., from 2007-08 to 2018-19 was considered. Compound annual growth rate and Instability Index were calculated separately for area, production and productivity of finger millet as a whole for India, state-wise and district-wise of Karnataka state.

The growth rate, co-efficient of variation and instability index of area, production and productivity of finger millet is presented in Table 1. The area under finger millet has been fluctuated from 1,387 thousand hectares in 2007-08 to 891 thousand hectares in 2018-19 with an average area of 1,189.17 thousand hectares. The compound annual growth rate (CAGR) of area for the period 2007-08 to 2018-19 was -2.83 per cent which shows significant at 1 per cent level and the co-efficient of variation was found to be 11.81 per cent. The R² value was 0.85 which indicates that 85 per cent of the variation in the area was explained over the years.

In case of production of finger millet during the study period was fluctuated from 2,152 thousand MT in 2007-08 to 1,239 thousand MT in 2018-19 with an average annual production of 1,854.25 thousand MT. The compound annual growth rate (CAGR) of production for the period 2007-08 to 2018-19 was -3.09 per cent which shows significant at 5 per cent level. The co-efficient of variation was found to be 16.26 per cent. The

R2 value was 0.50 which indicates that 50 per cent of the variation in the production of finger millet was explained over the years.

Similarly, the productivity of finger millet during the study period was fluctuating over the year which was 1,552 Kg per hectare in 2007-08 and 1,390 Kg per hectare in 2018-19 with an average annual productivity of 1,553.25 Kg per hectare. The compound annual growth rate (CAGR) of productivity for the period 2007-08 to 2018-19 was -0.28 per cent which was found insignificant. The co-efficient of variation was found to be 8.20 per cent. The R2 value was 0.19 which indicates that 19 per cent of the variation in the productivity of finger millet was explained by finger millet productivity in India over the years.

During the study period from 2007-08 to 2018-19, it was observed that the finger millet scenario in India has been incessantly fluctuating over the years. The results depicted that the area, production and productivity of finger millet in India has shown negative trend. The instability indices for area, production and productivity for finger millet are 4.57, 11.50 and 7.38 respectively. The fluctuations in area are due to replacement of finger millet cultivated lands by other comparable and competitive crops such as paddy, pulses and vegetables and due to its designation as a low value inferior crop alongside other millets. In case of productivity, it is due to adoption of traditional varieties for cultivation. The result is similar to the study of Danish and Amin (2017) which concluded that most of the cultivated land is dominated by cereals groups, therefore, need for crop diversification which ultimately leads to protect soil health, regular returns, employment opportunities as well as better diet balanced for the local people in the region.

The data in Table 2 shows the area under finger millet in different states of India for the period from 2007-08 to 2018-19. The result depicts that the states like Karnataka, Maharashtra, Uttarakhand contributes more than 50 per cent of total area under finger millet in India. The area under finger millet in Karnataka has been fluctuated from 833 thousand hectares in 2007-08 to 527 thousand hectares in 2018-19 with an average of 711.60 thousand hectares which contributes about 59.84 per cent when compared to the average mean value of area under finger millet in India. The compound annual growth rate was found to be -2.71 per cent with significant at 1 per cent level and the co-efficient of variation was 13.31 per cent. The area under finger millet in Maharashtra has been fluctuated from 128 thousand hectares in 2007-08 to 80 thousand hectares in 2018-19 with an average of 112.08 thousand hectares which contributes about 9.42 per cent when compared to the average mean value of area under finger millet in India. The compound annual growth rate was found to be -3.92 per cent with significant at 1 per cent level and the co-efficient of variation was 15.70 per cent. The average area under finger millet in Uttarakhand for the period from 2007-08 to 2018-19 was 117.26 thousand hectares which contributes about 9.86 per cent when compared to the average mean value of area under finger millet in India. The compound annual growth rate was found to be -3.04 per cent which was found significant at 1 per cent level and the co-efficient of variation was 11.41 per cent. The R2 value 0.75 indicates that 75 per cent of the total variation was explained regarding the area of finger millet in Karnataka and in Maharashtra with an R2 of 0.98 respectively. An examination of level of instability in area of finger millet over years revealed that the Karnataka had registered 6.66 per cent level of instability followed by Maharashtra with 2.22 per cent and Uttarakhand with 1.61 per cent respectively.

Production is a function of change in area and productivity. Growth rate of production under finger millet in different states of India for the period from 2007-08 to 2018-19 is represented in the Table 3. The production under finger millet in Karnataka has been fluctuated from 1,497 thousand MT in 2007-08 to 678 thousand MT in 2018-19 with an average of 1,210.57 thousand MT. The compound annual growth rate was found to be -4.65 per cent which was found significant at 5 per cent level and the co-efficient of variation was 21.57 per cent. The production under finger millet in Maharashtra has been fluctuated from 124 thousand MT in 2007-08 to 93 thousand MT in 2018-19 with an average of 118.09 thousand MT. The compound annual growth rate was found to be -2.07 per cent with insignificant and the co-efficient of variation was 13.96 per cent. The average production under finger millet in Uttarakhand for the period from 2007-08 to 2018-19 was 160.32 thousand MT. The compound annual growth rate was found to be -3.24 per cent which was found significant at 1 per cent level and the co-efficient of variation was 13.26 per cent. The R2 value 0.50 indicates that 50 per cent of the total variation was explained regarding the production of finger millet in Karnataka and Maharashtra with an R2 of 0.28 respectively. An examination of level of instability in production of finger millet over years revealed that the Karnataka had registered 15.30 per cent level of instability followed by Maharashtra with 11.83 per cent and Uttarakhand with 7.54 per cent respectively.

Growth rate of productivity under finger millet in different states of India for the period from 2007-08 to 2018-19 is represented in the Table 4. The productivity under finger millet in Maharashtra has been increased from 969 Kg per hectare in 2007-08 to 1,164 Kg per hectare in 2018-19 with an average of 1,060.54 MT per hectare. The compound annual growth rate was found to be 1.92 per cent which was found significant at 1 per cent level and the co-efficient of variation was 8.53 per cent. The average productivity of finger millet in Karnataka for the study period was 1,797 Kg per hectare with the compound annual growth rate of -2.00 per cent which was found significant at 5 per cent and the co-efficient of variation was 11.84 per cent. The average productivity under finger millet in Uttarakhand for the study period was 1,365.67 Kg per hectare. The compound annual growth rate was found to be -0.20 per cent which was found insignificant and the co-efficient of variation was 5.95 per cent. The R2 value 0.59 indicates that 59 per cent of the total variation was explained regarding the production of finger millet in Karnataka and Maharashtra with an R2 of 0.82 respectively. An examination of level of instability in productivity of finger millet over years revealed that the Karnataka had registered 7.58 per cent level of instability followed by Maharashtra with 3.62 per cent and Uttarakhand with 3.20 per cent respectively.

The result was similar to the findings of Sivaraman *et al.* (2018) [14], which concluded that in spite of finger millets remarkable qualities like suitability to rainfed conditions, high in nutrient content like calcium, fibre, iron and methionine content and long storage life, the crop is losing in terms of area and production due to diversification of crops towards cereal crops and other competitive crops. Similar results were found by Amin *et al.* (2017) [2] which concluded that the most of the cultivated land was dominated by cereal crops.

The major growing areas of finger millet of Karnataka were Tumkur, Ramanagar and Hassan which contributes more than 70 per cent of area under finger millet when compared to the average area of Karnataka for the study period 2007-08 to 2018-19 which is presented in Table 5. The average area under finger millet in Tumkur district was 163 thousand

hectares which contributes about 22.90 per cent when compared to the average mean value of area under finger millet of Karnataka. The compound annual growth rate was found to be -3.11 per cent which was found significant at 5 per cent level and the co-efficient of variation was 13.75 per cent. The average area under finger millet in Ramanagar district was 70 thousand hectares which contributes about 9.30 per cent when compared to the average mean value of area under finger millet of Karnataka. The compound annual growth rate was found to be -1.50 per cent with significant at 5 per cent level and the co-efficient of variation was 10.75 per cent. The average area under finger millet in Hassan district for the period was 75 thousand hectares which contributes about 10.53 per cent when compared to the average mean value of area under finger millet in Karnataka. The compound annual growth rate was found to be -1.17 per cent which is insignificant and the co-efficient of variation was 10.56 per cent. Even though, Karnataka tops in area under finger millet, the consumption was comparatively less due to consumption of jowar as staple food in north Karnataka region. The level of instability in major districts of Karnataka in terms of area was Tumkur (4.56 %), followed by Ramanagar (4.16 %) and Hassan (8.31 %) respectively.

The major finger millet producing districts of Karnataka were Tumkur, Ramanagar, and Hassan for the study period 2007-08 to 2018-19 which is presented in Table 6. The average production under finger millet in Tumkur district was 233 thousand MT which contributes about 19.25 per cent when compared to the average mean value of production under finger millet of Karnataka. The compound annual growth rate was found to be -3.35 per cent which was found insignificant and the co-efficient of variation was 27.73 per cent. The average production under finger millet in Ramanagar district was 138 thousand MT which contributes about 11.41 per cent when compared to the average production under finger millet of Karnataka. The compound annual growth rate was found to be -6.96 per cent which was found insignificant and the co-efficient of variation was 28.49 per cent. The average production under finger millet in Hassan district for the period

was 115 thousand MT which contributes about 9.50 per cent when compared to the average production under finger millet in Karnataka. The compound annual growth rate was found to be -3.07 per cent which was found insignificant and the co-efficient of variation was 45.97 per cent. The level of instability in major districts of Karnataka in terms of production was Tumkur (21.30 %), followed by Ramanagar (21.88 %) and Hassan (40.08 %) respectively.

In case of productivity of finger millet in major districts of Karnataka for the study period 2007-08 to 2018-19 which is presented in Table 7. The average productivity under finger millet in Tumkur district was 1,419 kg per hectare with compound annual growth rate of -0.27 per cent which was found insignificant and the co-efficient of variation was 21.20 per cent. The average productivity under finger millet in Ramanagar district was 1,969 Kg/ha per hectare with compound annual growth rate of 5.55 per cent which was found insignificant and the co-efficient of variation was 24.72 per cent. The average productivity under finger millet in Hassan district was 1,484 Kg per hectare with compound annual growth rate of -1.92 per cent which was found insignificant and the co-efficient of variation was 35.69 per cent. The level of instability in major districts of Karnataka in terms of productivity was Tumkur (18.24 %), followed by Ramanagar (18.50 %) and Hassan (32.32 %) respectively.

The result was similar to Bellundagi *et al.* (2016) [4] have used trend analysis to compare ragi production among the districts of Karnataka. They found that both area and production have shown steep decline during the period 1984-85 to 1997-98 and 1999-2000 to 2014-15 while during these periods the productivity has recorded positive growth in a majority of districts due to inadequate rainfall or irrigation, labour availability, adequate credit availability and non-availability of formal market structures were opined by cultivators as major problems in the cultivation of finger. Similar results were observed by Babu *et al.* 2019 [3] which depicts that overall, productivity levels fluctuated due to erratic rainfall, increased temperatures and extreme weather events.

Table 1: Growth rate of area, production and productivity of ragi in India

SL. No.	Year	Area ('000 ha)	Production ('000 MT)	Productivity (Kg/ha)
1	2007-08	1387	2152	1552
2	2008-09	1381	2040	1477
3	2009-10	1268	1888	1489
4	2010-11	1286	2193	1705
5	2011-12	1176	1929	1641
6	2012-13	1131	1574	1392
7	2013-14	1194	1983	1661
8	2014-15	1208	2061	1706
9	2015-16	1138	1822	1601
10	2016-17	1016	1385	1363
11	2017-18	1194	1985	1662
12	2018-19	891	1239	1390
	Total	14270	22251	18639
	Mean	1189.17	1854.25	1553.25
	Std	140.45	301.42	127.41
	CV	11.81	16.26	8.20
	CAGR (%)	-2.83**	-3.09*	-0.28
	R ²	0.85	0.50	0.19
	Instability	4.57	11.50	7.38

Source: Ministry of Agriculture & Farmers Welfare, Govt. of India

Note: Std: Standard deviation CV: Coefficient of variation

CAGR: Compound annual growth rate

R²: Coefficient of multiple determination

** Significant at 1 percentage

Significant at 5 percentage

Table 2: Growth rate of area under ragi in different states

('000 ha)												
Sl. No.	Year	Karnataka	Maharashtra	Uttarakhand	Tamil Nadu	Odisha	Andhra Pradesh	Gujarat	Bihar	Jharkhand	West Bengal	Other states
1	2007-08	833	128	128	94	68	55	22	15	13	13	19
2	2008-09	841	126	135	90	66	50	19	11	12	13	18
3	2009-10	765	120	132	82	59	45	14	10	10	12	18
4	2010-11	788	120	128	3	66	42	20	9	9	12	89
5	2011-12	680	130	125	5	55	42	16	8	12	8	95
6	2012-13	645	125	125	3	57	41	14	8	13	10	91
7	2013-14	671	126	112	119	57	42	14	7	12	10	25
8	2014-15	708	112	113	104	52	33	20	7	14	10	36
9	2015-16	705	92	107	90	46	32	19	7	14	11	15
10	2016-17	598	93	107	61	47	32	19	5	23	10	22
11	2017-18	778	93	103	87	43	35	12	4	19	12	9
12	2018-19	527	80	92	79	37	32	12	3	14	3	12
	Total	8539	1345	1407	816	651	481	201	93	165	124	447
	Mean	711.60	112.08	117.26	68.01	54.23	40.08	16.75	7.78	13.76	10.34	37.27
	Std	94.68	17.60	13.38	41.25	9.86	7.56	3.47	3.23	3.72	2.60	33.52
	CV	13.31	15.70	11.41	60.64	18.18	18.86	20.71	41.54	27.07	25.17	89.93
	CAGR(%)	-2.71**	-3.92**	-3.04**	9.43	-4.87**	-4.65**	-2.85	-11.23**	4.61*	-5.69	-7.91
	R ²	0.75	0.98	0.98	0.72	0.93	0.98	0.75	0.99	0.85	0.89	0.83
	Instability	6.66	2.22	1.61	32.09	4.81	2.67	10.36	4.15	10.48	8.35	37.08

Source: Ministry of Agriculture & Farmers Welfare, Govt. of India

Note: ** Significant at 1 percentage

* Significant at 5 percentage

Table 3: Growth rate of production under ragi in different states

('000 MT)												
Sl. No.	Year	Karnataka	Maharashtra	Uttarakhand	Tamil Nadu	Odisha	Andhra Pradesh	Gujarat	Bihar	Jharkhand	West Bengal	Other states
1	2007-08	1497	124	179	176	47	69	18	9	6	15	13
2	2008-09	1394	125	193	170	41	52	20	9	9	15	13
3	2009-10	1312	109	163	163	38	53	11	8	6	14	12
4	2010-11	1588	117	171	171	47	50	14	7	5	14	10
5	2011-12	1272	138	174	225	31	40	13	9	8	8	11
6	2012-13	975	139	174	138	44	42	14	9	11	12	16
7	2013-14	1180	142	154	362	46	43	14	7	9	11	15
8	2014-15	1298	119	156	350	38	34	16	10	12	11	18
9	2015-16	1188	93	151	271	28	34	15	10	9	13	10
10	2016-17	859	111	160	114	33	35	27	3	20	11	11
11	2017-18	1286	106	141	321	33	45	11	4	18	14	6
12	2018-19	678	93	110	256	25	43	10	3	11	3	7
	Total	14527	1417	1924	2718	451	540	182	90	123	140	140
	Mean	1210.57	118.09	160.32	226.47	37.54	44.99	15.20	7.50	10.23	11.65	11.71
	Std	261.16	16.49	21.26	84.58	7.50	9.99	4.75	2.54	4.76	3.35	3.52
	CV	21.57	13.96	13.26	37.35	19.97	22.20	31.26	33.83	46.55	28.79	30.06
	CAGR (%)	-4.65*	-2.07	-3.24**	4.28	-3.97*	-4.05*	-1.80	-7.83*	10.00**	-6.75	-4.20
	R ²	0.50	0.28	0.68	0.16	0.49	0.51	0.05	0.48	0.61	0.32	0.83
	Instability	15.30	11.83	7.54	34.23	14.21	15.54	30.42	24.49	28.96	23.76	12.39

Source: Ministry of Agriculture & Farmers Welfare, Govt. of India

Note: ** Significant at 1 percentage

* Significant at 5 percentage

Table 4: Growth rate of productivity under ragi in different states

(Kg/ha)												
Sl. No.	Year	Karnataka	Maharashtra	Uttarakhand	Tamil Nadu	Odisha	Andhra Pradesh	Gujarat	Bihar	Jharkhand	West Bengal	Other states
1	2007-08	1797	969	1398	1877	692	1255	818	600	447	1145	671.958
2	2008-09	1658	992	1430	1887	624	1040	1053	816	702	1157	694.444
3	2009-10	1715	908	1235	1976	638	1178	786	808	548	1180	646.409
4	2010-11	2015	975	1331	2260	709	1190	700	800	522	1179	110.112
5	2011-12	1871	1062	1392	2715	562	952	813	1213	662	979	112.159
6	2012-13	1512	1112	1392	1967	770	1077	1000	1180	842	1200	178.611
7	2013-14	1759	1127	1372	3053	809	1027	1000	1016	734	1095	601.626
8	2014-15	1833	1063	1380	3348	739	1030	800	1473	838	1095	508.427
9	2015-16	1685	1011	1402	3013	620	1063	789	1429	644	1136	700.68
10	2016-17	1436	1198	1495	1865	705	1094	1421	723	882	1108	504.4

11	2017-18	1653	1145	1367	3714	767	1277	896	994	972	1130	694.7
12	2018-19	1285	1164	1194	3257	690	1348	804	1071	805	895	562.396
	Total	20219	12726	16388	30932	8325	13531	10880	12123	8598	13299	5986
	Mean	1684.92	1060.50	1365.67	2577.67	693.75	1127.58	906.67	1010.25	716.50	1108.25	498.83
	Std	199.55	90.41	81.25	680.38	72.40	120.45	193.80	275.86	159.15	88.46	231.01
	CV	11.84	8.53	5.95	26.40	10.44	10.68	21.38	27.31	22.21	7.98	46.31
	CAGR(%)	-2.00*	1.92**	-0.20	5.11*	0.96	0.61	1.07	3.81	5.15**	-1.15	4.03
	R ²	0.59	0.82	0.71	0.54	0.41	0.76	0.35	0.65	0.90	0.63	0.80
	Instability	7.58	3.62	3.20	17.91	8.02	5.23	17.24	16.16	7.02	4.85	20.71

Source: Ministry of Agriculture & Farmers Welfare, Govt. of India

Note: ** Significant at 1 percentage

* Significant at 5 percentage

Table 5: Growth rate of area under ragi in major districts of Karnataka

Sl. No.	Year	('000 ha)										
		Bangalore Rural	Bangalore Urban	Chikkaballapur	Chitradurga	Hassan	Kolar	Mandya	Mysore	Ramanagara	Tumkur	Other districts
1	2007-08	48	28	38	59	76	61	68	81	74	197	104
2	2008-09	41	25	40	66	74	64	80	64	78	199	111
3	2009-10	42	24	46	50	70	51	66	65	77	180	95
4	2010-11	44	24	42	56	86	57	73	54	73	181	97
5	2011-12	43	25	39	41	72	60	56	45	71	151	77
6	2012-13	40	23	48	47	74	57	47	33	62	142	71
7	2013-14	41	23	48	47	76	55	50	37	70	154	69
8	2014-15	36	24	47	57	74	52	59	40	70	172	76
9	2015-16	39	20	47	48	70	58	61	51	70	162	79
10	2016-17	36	16	43	54	64	59	80	17	67	142	20
11	2017-18	37	14	49	50	95	66	84	56	74	145	109
12	2018-19	42	11	32	22	72	44	45	46	50	132	30
	Total	489	257	518	597	904	686	769	588	837	1956	938
	Mean	40.79	21.43	43.15	49.72	75.33	57.17	64.09	49.02	69.76	162.99	78.17
	Std	3.44	5.18	5.12	10.98	7.95	6.01	13.26	16.73	7.50	22.41	28.85
	CV	8.43	24.17	11.87	22.09	10.56	10.50	20.70	34.13	10.75	13.75	36.91
	CAGR(%)	-2.36*	-4.19**	1.86	-1.61	-1.17	-0.50	-1.28	-11.23	-1.50*	-3.11*	-11.07*
	R ²	0.92	0.98	0.74	0.87	0.38	0.82	0.90	0.68	0.85	0.89	0.55
	Instability	2.38	3.42	6.05	7.96	8.31	4.45	6.55	19.31	4.16	4.56	24.76

Source: Directorate of Economics and Statistics of India, Bengaluru

Note: ** Significant at 1 percentage

* Significant at 5 percentage

Table 6: Growth rate of production under ragi in major districts of Karnataka

Sl. No.	Year	('000 MT)										
		Bangalore Rural	Bangalore Urban	Chikkaballapur	Chitradurga	Hassan	Kolar	Mandya	Mysore	Ramanagara	Tumkur	Other districts
1	2007-08	111	70	53	78	98	73	128	142	165	310	269
2	2008-09	102	61	72	63	100	103	108	123	138	212	311
3	2009-10	92	54	50	68	107	69	100	121	139	252	259
4	2010-11	116	62	84	91	156	109	166	86	166	308	242
5	2011-12	101	71	73	39	94	119	96	76	166	229	210
6	2012-13	93	50	95	54	72	138	76	40	128	152	77
7	2013-14	104	73	105	60	135	124	97	62	177	234	10
8	2014-15	92	67	70	91	156	71	107	83	137	324	99
9	2015-16	79	44	85	76	110	66	112	97	130	272	116
10	2016-17	44	8	40	37	45	26	46	14	47	136	416
11	2017-18	93	27	111	95	242	182	141	87	182	227	101
12	2018-19	70	17	27	22	61	43	68	71	85	145	71
	Total	1098	604	866	773	1377	1122	1244	1000	1660	2802	2183
	Mean	91.48	50.36	72.18	64.40	114.73	93.54	103.68	83.33	138.36	233.49	181.89
	Std	19.62	22.13	25.86	23.58	52.74	43.80	32.18	35.67	39.41	64.74	120.46
	CV	21.45	43.94	35.83	36.62	45.97	46.83	31.04	42.80	28.49	27.73	66.23
	CAGR(%)	-6.18*	-11.78*	0.78	-2.91	-3.07	-6.95	-6.14	-14.68	-6.96	-3.35	-10.48
	R ²	0.63	0.82	0.63	0.28	0.24	0.76	0.23	0.64	0.41	0.41	0.68
	Instability	13.05	18.64	21.79	31.07	40.08	22.94	27.24	25.68	21.88	21.30	37.47

Source: Directorate of Economics and Statistics of India, Bengaluru

Note: ** Significant at 1 percentage

* Significant at 5 percentage

Table 7: Growth rate of productivity under ragi in major districts of Karnataka

Sl. No.	Year	(Kg/ha)										
		Bangalore Rural	Bangalore Urban	Chikkaballapur	Chitradurga	Hassan	Kolar	Mandya	Mysore	Ramanagara	Tumkur	Other districts
1	2007-08	2330	2470	1410	1320	1300	1210	1890	1760	2210	1570	2592
2	2008-09	2300	2450	1800	950	1360	1620	1360	1930	1760	1070	2804
3	2009-10	2220	2250	1090	1360	1520	1360	1520	1870	1820	1400	2721
4	2010-11	2620	2570	2030	1640	1810	1900	2260	1590	2260	1700	2504
5	2011-12	2350	2860	1870	940	1310	1970	1720	1660	2340	1510	2732
6	2012-13	2330	2200	1990	1140	970	2400	1610	1200	2060	1070	1094
7	2013-14	2570	3140	2200	1270	1760	2250	1950	1670	2510	1520	147
8	2014-15	2560	2790	1480	1590	2100	1350	1800	2080	1970	1890	1300
9	2015-16	2030	2250	1820	1590	1570	1130	1840	1900	1850	1680	1465
10	2016-17	1210	490	940	680	710	430	1210	830	700	960	2790
11	2017-18	2510	1840	2280	1900	2560	2740	1680	1560	2470	1570	929
12	2018-19	1640	1590	840	1000	840	980	1490	1530	1680	1090	2380
	Total	26670	26900	19750	15380	17810	19340	20330	19580	23630	17030	23458
	Mean	2222.50	2241.67	1645.83	1281.67	1484.17	1611.67	1694.17	1631.67	1969.17	1419.17	1954.83
	Std	418.03	697.37	487.97	356.34	529.66	662.93	283.24	341.62	486.76	300.89	915.89
	CV	18.81	31.11	29.65	27.80	35.69	41.13	16.72	20.94	24.72	21.20	46.85
	CAGR(%)	-3.64	-7.99	-1.05	-1.30	-1.92	-6.54	-0.94	-3.87	-5.55	-0.27	-9.78
	R ²	0.47	0.63	0.57	0.06	0.18	0.76	0.40	0.39	0.44	0.26	0.37
	Instability	13.69	18.92	19.44	26.95	32.32	20.15	12.95	16.35	18.50	18.24	37.19

Source: Directorate of Economics and Statistics of India, Bengaluru

Note: ** Significant at 1 percentage

* Significant at 5 percentage

Conclusion

This study has analysed the trend in area, production and productivity of finger millet and the instability by Cuddy Della Valle index. The growth rate of area of finger millet in India showed significant at 1 per cent but negative trend which is due to diversification of crops and production showed significant at 5 per cent but negative trend and productivity showed insignificant negative trend which is due adoption of traditional varieties. The growth rate of area and production of finger millet of Karnataka showed significant negative trend and productivity showed insignificant negative trend. Thus there is a need to take up productivity enhancing measures in finger millet like varietal improvement, improved cultural practices and irrigation facilities. The instability indices for area, production and productivity for finger millet is positive which indicates less risk in growing finger millet in future. Government intervention needs to focus on spreading finger millet as a wonder grain for dry lands and infant nutrition.

References

1. Anonymous. Agricultural Statistics at a Glance. Directorate of Economics and Statistics. Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India 2020.
2. Amin R, Kachroo J, Bhat A, Kachroo D, Singh SP, Isher AK. Status of Growth in Area, Production and Productivity of Major Crops in Jammu Province of J&K State. Indian Journal of Agricultural Research 2017;51(4):333-338.
3. Babu BNP, Rudragouda CS, Reddy YBV. Trends in Area, Production and Productivity of Coffee across the Major Coffee Growing States in India. International Journal of Agriculture Sciences 2019;11(4):7896-7900.
4. Bellundagi V, Umesh KB, Ravi SC. Growth Dynamics and Forecasting of Finger Millet (Ragi) Production in Karnataka. Economic Affairs 2016;61(2):195-201.
5. Cuddy JDA, Della Valle PA. Measuring the Instability of Time Series Data, Oxford Bulletin of Economics and Statistics 1978;40(10):79-84.
6. Danish F, Amin R. Status of Growth in Area, Production and Productivity of Major Crops in Jammu Province of J&K State. International Journal of Economics Commerce and Research 2017;7(3):1-12.
7. Dasyam R, Bhattacharyya B, Mishra P. Statistical Modeling to Area, Production and Yield of Potato in West Bengal. International Journal of Agriculture Sciences 2016;8(53):2782-2787.
8. Gopalan C, Rama Sastri BV, Balasubramanian SC. Nutritive value of Indian foods. National Institute of Nutrition (NIN) 2004, 59-67.
9. Kumawat DK, Kumawat RC, Jheeba SS. Growth Rates and Instability in Area, Production and Productivity of Fenugreek in the State of Rajasthan. Annals of Agricultural Research 2016;37(4):445-452.
10. Misra CM. Trends in area production and productivity of groundnut in India: Issues & challenges. Journal of Research in Agriculture and Animal Science 2017;4(7):1-6.
11. Misra CM. Trends in area production and productivity of groundnut in Uttar Pradesh: Future business implications. International Journal of Business and Management Invention 2017;6(2):65-70.
12. Panwar S, Kumar N, Kumar A, Paul R, Sarkar SK. Analysis of Trend in Area, Production and Productivity of Okra (*Abelmoschus Esculentus*) in India. Current Horticulture 2019;7(2):56-58.
13. Parthiban JJ, Rajesh R, Sundar GS. Trend Analysis of Area, Production and Productivity of Groundnut and Estimation of Cost of Production in Tiruchirappalli District. International Journal of Agriculture Sciences 2019;11(10):8488-8490.
14. Sivaramane N, Ganesh Kumar B, Ranjit Kumar, Arivelarasan T. Mapping of Diverse Production System of Finger Millet (*Eleusine Corocana* L.) in Tamil Nadu. An International Refereed, Peer Reviewed & Indexed Quarterly Journal in Science, Agriculture & Engineering 2018;8(A):361-367.