



Research Article

TRENDS IN AREA, PRODUCTION AND PRODUCTIVITY OF COFFEE ACROSS THE MAJOR COFFEE GROWING STATES IN INDIA

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Abstract: India has been ranking among top seven producers of coffee in the world, Karnataka, Kerala, Tamil Nadu being the major coffee producing states in the country. However, there has been a consistent fluctuation in the production in the recent years across the states due to changing climate conditions. The paper aims to examine the trends in planted area under coffee, bearing area under coffee, production and productivity of coffee in India by using compound growth rate analysis with the 18 years' time series data. It also analyses the area and productivity effect as preliminary determinants of coffee production. The major issues and challenges relating to production and productivity of coffee have also been dealt with. Concluding remarks includes some of the initiatives taken by the Coffee Board (a nodal agency for coffee sector in India) for augmenting the overall coffee production and its consistency.

Keywords: Compound Growth Rate, Coffee Production, Coffee Productivity, Area under Coffee, Coffee Board

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Introduction

Coffee is a highly traded tropical agricultural commodity in the World, about 97.16 lakh tonnes of coffee is consumed in the world during 2017-18 [6]. Coffee production (over 90%) takes place in the developing countries while 70 percent of it is consumed in developed countries [7]. The total world production of coffee stood at 163.51 million bags (98.11 lakh MT) in 2017-18 (International Coffee Organization). The coffee industry engages about 100 million people of which 20-25 million are small growers [2]. The reports of International Coffee organization detail that coffee is supporting millions of small farmers and creates enormous employment opportunities in rural areas. Botanically, coffee belongs to the family Rubiaceae. Two important economic species of coffee grown across the world are Arabica (Coffee Arabica) and Robusta (Coffee Robusta). Major Coffee growing countries have been distinguished under four regions: South America, Asia and Oceania, Mexico and Central America and Africa (ICO Report). Across these regions, across these regions, Brazil, Vietnam, Colombia, Indonesia, Honduras, Ethiopia, India, Uganda, Peru and Mexico are being recognized as top 10 coffee growing countries (ICO Report). Brazil and Vietnam are the world's biggest coffee growers, accounting for about half of the total production. South America & Asia dominated the coffee production worldwide, which accounts for about 76 percent of total world production [Fig-1].

Overview of the Indian coffee Industry

Introduction of Coffee in India dates back to 1600 A.D. It is said to have been introduced in the hills of Chikkamagaluru in Karnataka state by legendary pilgrim Baba Budan in the Chandradrona Parvatha by sowing seven seeds. Over the period, Coffee occupies a place of pride among plantation crops grown in India. Introduction of new economic policy during 1991-92 helped greater globalization by reducing restriction on exports and imports in Indian International trade policy. Coffee industry has taken full advantage and cheaper labor costs of production.

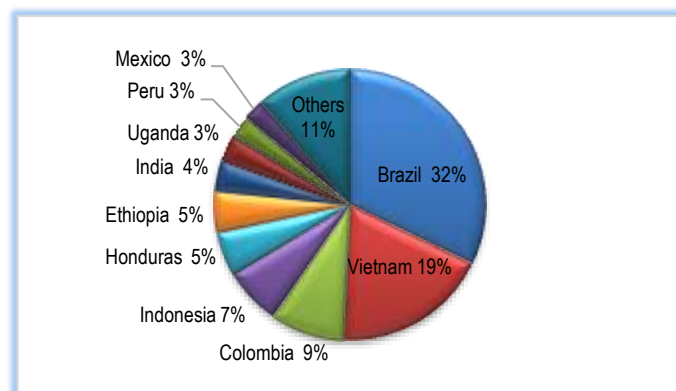


Fig-1 Top ten coffee producing countries in the world during 2017-18

Source: International Coffee Organization

In 1993, a monumental Internal Sales Quota (ISQ) made the first step in liberalizing the coffee industry by entitling coffee farmers to sell 30 percent of their production within India. This was further amended in 1994 when the Free Sale Quota (FSQ) permitted large- and small-scale growers to sell between 70% and 100% of their coffee either domestically or internationally. A final amendment in September 1996 directed all growers in the country, freedom to sell their produce wherever they wished [4] which resulted in changes in the area, production and productivity of coffee in India [1]. Coffee cultivation in India is confined to the Traditional Coffee growing areas comprising of the states of Karnataka, Kerala and Tamil Nadu, the Non-Traditional areas comprising of the States of Andhra Pradesh and Odisha and the North Eastern Region comprising of the states of Assam, Tripura, Mizoram, Meghalaya, Nagaland, Manipur and Arunachal Pradesh.

The contribution of coffee in India's gross domestic product (GDP) is about 0.05% percent in 2017-18 and the share of coffee sector in the country's exports during 2017-18 was 0.43% [5]. However, it is much more important for the economies of the states in which it is grown. Coffee sector provides employment to more than 20 lakh people directly or Indirectly in India [3]. It contributes 2.5 percent to the nation's primary sector export earnings, highlighting its economic importance. There are 3,66,242 coffee holdings in India, of which 99 percent are less than 10 hectares in size and falls under the category of small holdings. Small holders form about three-fourth of the total planted area of the country and accounts for 70% of the production [8]. Large holders form 25 percent of the total planted area and account for 30 percent of output, as their productivity levels are moderately higher. Keeping in view of the above issue having importance in coffee production, an attempt has been made to understand the trends in the area, production, productivity of coffee in major coffee growing states/region of the country.

Methodology

Time series secondary data on planted area, bearing area, production and productivity for a period of 18 years from 2000-01 to 2017-18 was obtained from Coffee Board database.

Exponential growth Model

In order to analyze the growth rates in planted area, bearing area, production and productivity of coffee in different states and the region as a whole, compound growth rates were computed for a period of 18 years from 2000-01 to 2017-18 by using the following using the exponential growth function of the form:

$$Y = a b^t e^{(1)}$$

Where

Y= Dependent variable (Area, Production, Productivity)

a= Intercept

b= Slope (represents the rate of change in dependent variable as a function of independent variable)

t= Time (independent variable)

e= Residual term or error term

The compound growth rate (CAGR) was derived from the logarithmic form of the equation (1) as below

$$\ln y = \ln a + t \ln b$$

The percent CAGR (g) was estimated using the following relationship

$$g = (\text{Anti log of } b - 1) \times 100$$

Results and Discussion

Planted Area under coffee in major coffee growing states of India during 2017-2018

In India, during 2017-18, coffee is cultivated over 4.55 lakh hectares of area, out of which 2.29 lakhs hectares under Arabica and 2.26 lakh hectares under Robusta. So, in India almost both the varieties are grown in equal areas. Karnataka is the leading coffee producer with the area of 2.45 lakh hectares, which accounts for about 54 percent of the total planted area under coffee, followed by Kerala (0.86 lakh hectares), accounts for about 19 percent of the total planted area under coffee. Overall, about 73 percent of the total planted area under coffee is from Karnataka and Kerala. Arabica and Robusta have equal share in the planted area under coffee at all India level. In Karnataka, Robusta has highest share of 56% in total planted area under coffee during 2017-18. About 95% of the planted area in Kerala is Robusta coffee whereas 83% of the planted area is Arabica in Tamil Nadu. In NTA's only Arabica coffee is grown while in case of NER 77% of the planted area is Arabica coffee [Fig-2].

Bearing Area under coffee in major coffee growing states of India during 2017-2018

Karnataka is having highest bearing area under coffee in India with about 55 percent share in total bearing area under coffee followed by Kerala (21%). About 76 percent of total bearing area under coffee is from these two states. At all India level, Robusta contributes about 52 percent of the total bearing area under coffee. Similar to the planted area, bearing area under Robusta has highest share in

Kerala (95%). While bearing area under Arabica dominated in NTA's, Tamil Nadu and NER [Fig-3]. In Karnataka Robusta contributes about 56 percent to the total bearing area rest is Arabica (44%).

Production of coffee in major coffee growing states of India during 2017-2018

Karnataka is the leading coffee producer accounting for about 70 percent of the total Indian coffee production, followed by Kerala with 20 percent and Tamil Nadu 5.5 percent during 2017-18. About 96 percent of total Indian coffee production is only from these three states. Other coffee producing regions of the country including Andhra Pradesh, Odisha and North eastern region contributes just 4 percent to the country's total coffee production. In Karnataka the production of Robusta occupies prime place with the lion share of 69 % of total coffee production in the state, while Arabica coffee constitutes about 31 percent. Almost all the coffee grown in Kerala is Robusta (97%). Whereas, in Tamil Nadu production of Arabica coffee (74%) is more than that of the Robusta (26%). In Andhra Pradesh, Orissa, only Arabica coffee is produced [Fig-4].

Productivity of coffee in major coffee growing states of India during 2017-2018

Among all the states, both Arabica and Robusta registered highest yield in Karnataka (692 kg/ha and 1211 kg/ha respectively). At all India level Arabica coffee productivity is 478 kg/ha while in case of Robusta 1031 Kg/ha. Overall coffee productivity in India during 2017-18 is about 765 Kg/ha [Fig-5].

Trends in Area, Production and Productivity of Coffee in India

Planted area & bearing area under Coffee in India during 2000-01 to 2017-18

The data shows that, the planted area under coffee in India has shown an upward trend, from 3.47 lakh hectares in 2000-01 to 4.55 lakh hectares in 2017-18 with the compound annual growth rate (CAGR) of 1.57 percent, this increase is inclined by new Indian economic policies and the expansion of coffee cultivation in Non-Traditional Areas (NTA's) and North Eastern States (Coffee Board). The planted area under Arabica cultivation is increased from 1.68 lakh hectares in 2000-01 to 2.29 lakh hectares in 2017-18 with CAGR of 1.91 percent, whereas, in case of Robusta, planted area under cultivation increased from 1.79 lakh hectares to 2.26 lakh hectares for the same period with the CAGR of 1.25 percent. The results of the compound growth rate analysis state wise/region wise reveals that, highest growth rate of about 9.24 percent in planted area under coffee was registered by Non-Traditional Areas (Andhra Pradesh and Odisha), a relatively small coffee growing region in the country, followed by Karnataka (1.13%), Tamil Nadu (0.75) and Kerala (0.09). Planted area under Arabica is increased significantly in Non-Traditional Areas (NTA's). North Eastern Region registered a negative annual growth rate of 4.49 percent indicating decrease in planted area under coffee by 4.49 percent per annum during the review period. In case of planted area under Arabica coffee, NTA's registered a highest CAGR of 9.32 percent, the planted area under coffee is increasing in the tribal areas of Andhra Pradesh, most of the coffee produced in this region is Arabica coffee and organic by default. While in case of Robusta, Karnataka registered a highest CAGR of 2.33 percent but planted area under Arabica in Karnataka registered a negative compound annual growth rate of 0.05 indicating shift in the planting area from Arabica to Robusta in Karnataka [Table-1]. Similarly, bearing area under coffee is increased from 3.11 lakh hectares in 2000-01 to 4.13 lakh hectares during 2017-18 with the CAGR of 1.61 percent. Bearing area under Robusta increased from 1.67 lakh hectares in 2000-01 to 2.14 lakh hectares during 2017-18, while Arabica bearing area increased considerably from 1.44 lakh hectares to 1.99 lakh hectares for the study period. Highest annual growth rate in bearing area under coffee was recorded in Non-Traditional Areas (8.26%) followed by Karnataka (1.04%), Tamil Nadu (0.60%) and Kerala (0.14%). Bearing area under coffee is significantly increased in NTA's comprising of Andhra Pradesh and Odisha. Growth in bearing area under Arabica was highest in Non-Traditional Areas (12.32%) followed by Tamil Nadu (0.70%) and Kerala (0.37%). But, bearing area under Arabica decreased annually by 0.25 percent in Karnataka indicating shift from Arabica production to Robusta production in Karnataka, it is evident that, growth rate in bearing area under

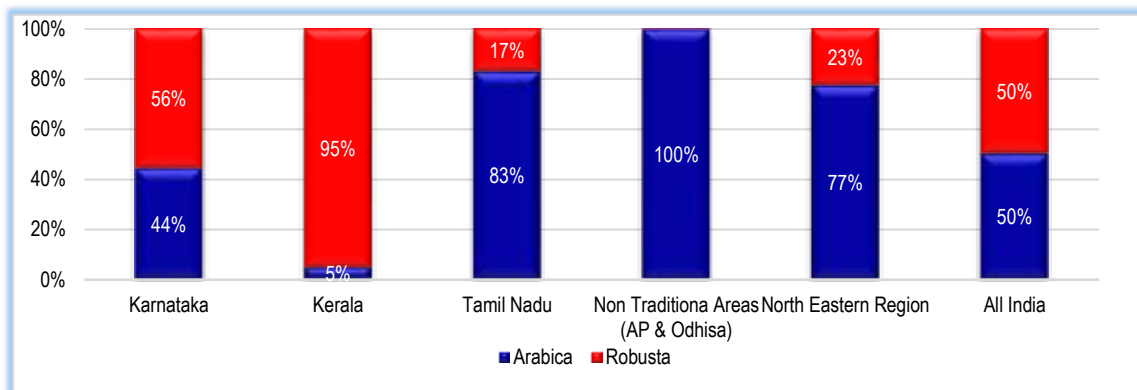


Fig-2 Percentage share of planted area under Arabica and Robusta across coffee growing states of India during 2017-2018

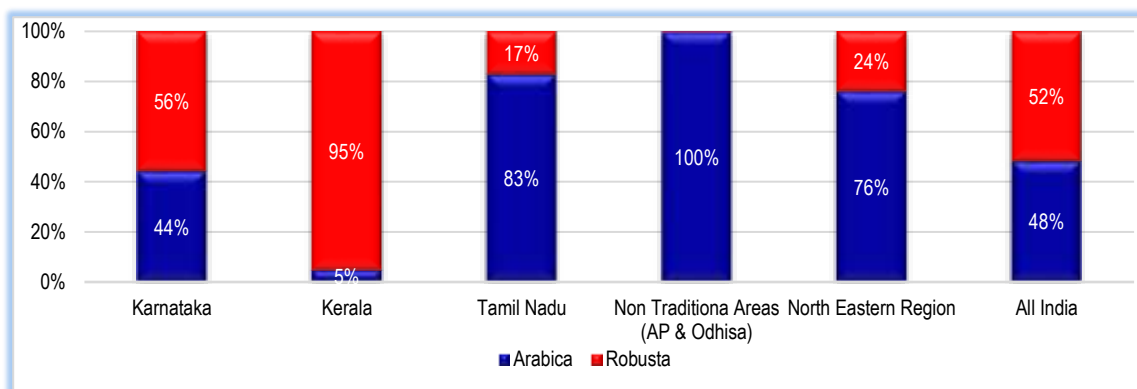


Fig-3 Percentage share of bearing area under Arabica and Robusta across coffee growing states of India during 2017-2018

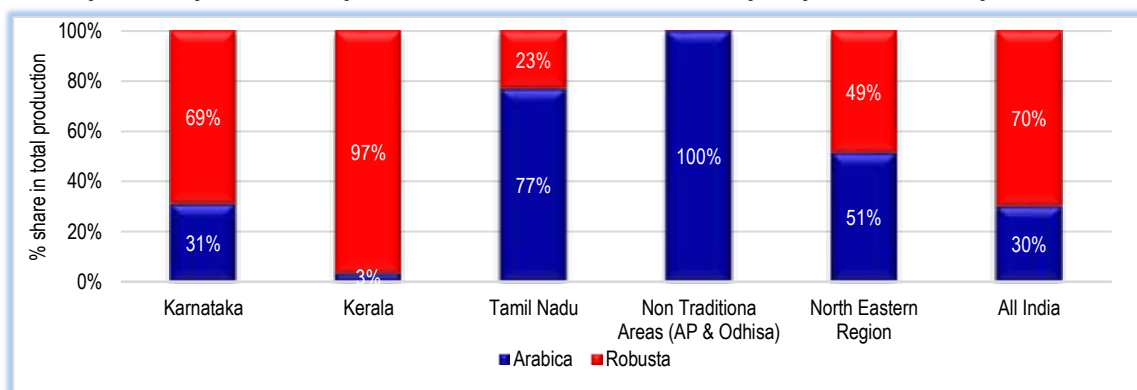


Fig-4 Percentage share of Arabica and Robusta in total coffee production across coffee growing states of India during 2017-2018

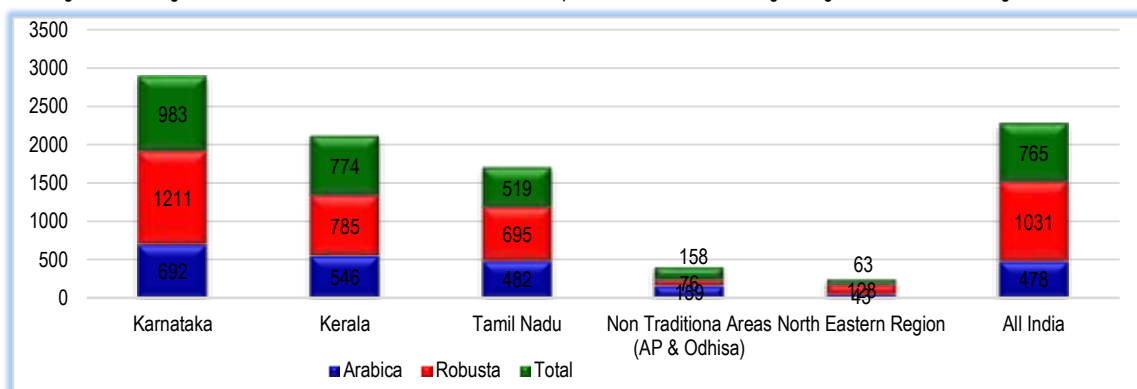


Fig-5 Productivity of coffee in major coffee growing states of India during 2017-2018

Robusta is highest in Karnataka (2.35%). At all India level, growth in the bearing area under Arabica and Robusta were found 1.97 percent and 1.29 percent per annum, respectively. Overall, bearing area under coffee in the country is increasing annually by 1.61 percent [Table-1].

Coffee Production in India during 2000-01 to 2017-18

In absolute terms production of coffee increased from 3.01 metric tonnes (MT) in 2000-01 to 3.16 MT during 2017-18 with the CAGR of 1.07%. In case of Arabica, production was 1.04 MT in 2000-01 which decreased to 1.21 MT in the

Table-1 Compound Growth rate of planted area, bearing area, production and productivity of Coffee in India during 2000-01 to 2017-18

States /Region	Arabica (%)				Robusta (%)				Total (%)			
	P. Area	B. Area	Production	Productivity	P. Area	B. Area	Production	Productivity	P. Area	B. Area	Production	Productivity
Karnataka	-0.05	-0.25	-1.20	-0.95	2.33	2.35	2.49	0.14	1.13	1.04	1.07	0.03
Kerala	0.18	0.37	3.61	3.23	0.08	0.13	0.32	0.19	0.09	0.14	0.35	0.26
Tamil Nadu	0.84	0.70	-0.54	-1.24	0.32	0.15	0.81	0.66	0.75	0.60	-0.24	-0.83
NTA's	9.32	12.32	9.38	-2.61	-0.33	-0.28	-5.91	-5.84	9.24	8.26	9.40	-2.48
NER	-3.97	-3.81	-3.45	0.41	-6.10	-5.14	-3.35	1.89	-4.49	-4.21	-4.46	0.75
All India	1.91	1.97	-0.53	-2.44	1.25	1.29	1.91	0.45	1.57	1.61	1.07	-0.62

NTA-Non-Traditional Area's includes Andhra Pradesh and Odisha, NER- North Eastern Region

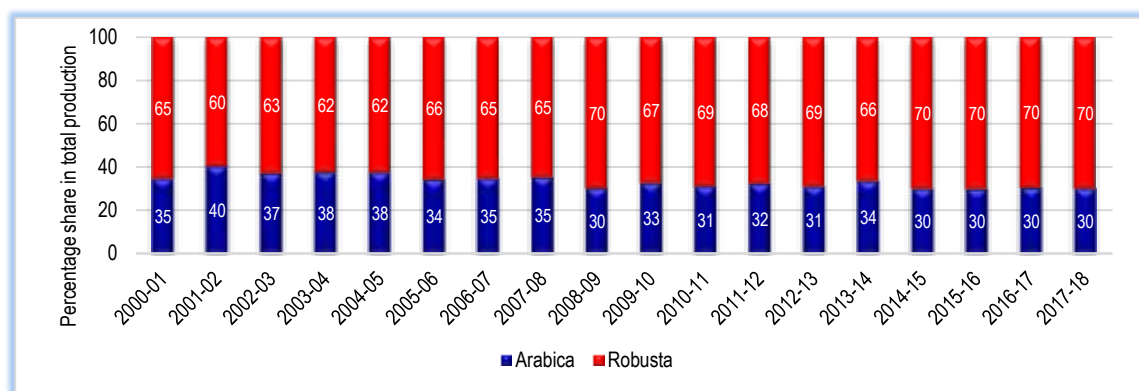


Fig-6 Percentage share of Arabica and Robusta in total coffee production during 2000-01 to 2017-18

subsequent year 2001-02 thereafter, Arabica production decreased continuously and reached to the level of 0.95 lakh MT during 2017-18 with the negative CAGR of 0.54% which is mainly because of high incidence of white stem borer insect, which affected Arabica coffee productivity. Robusta coffee has been grown at CAGR of 1.91% during 2000-01 to 2017-18, the production of Robusta coffee increased from 1.97 lakh MT to 2.21 lakh metric tonnes in 2017-18 indicates tremendous growth in production. The share of Robusta coffee in total production is increased from 65 percent in 2000-01 to 70 percent during 2017-2018, while Arabica share decreased from 35 percent in 2000-01 to 30 percent during 2017-19. The growth in coffee production in the country was highest for Non-Traditional Areas (9.40%) followed by Karnataka (1.07%) and Kerala (0.35%). Whereas, Tamil Nadu (-0.24%) and North Eastern Region (-4.46%) witnessed decline in production. At all India level, Arabica production registered a negative annual growth rate of 0.53, while production of Robusta coffee has been increased by 1.91 percent per year during 2000-01 to 2017-18 [Table-1].

Coffee Productivity in India during 2000-01 to 2017-18

Changes in the yield of coffee from 2000-01 to 2017-18 is analyzed, among two types of coffee, Robusta registered highest yield of 1211 Kg/hectare in 2017-2018 in Karnataka. At all India level, growth in Arabica productivity is negative (-2.44%) while growth in Robusta productivity is not significant (0.45%) during 2000-01 to 2017-2018. Robusta productivity increased with the CAGR of 0.45%, whereas, Yield of Arabica decreased annually by 2.44% during 2000-01 to 2017-18, which clearly indicates Robusta productivity is stagnant and Arabica productivity is declining. Further, at the all India level overall coffee productivity growth is negative (-0.62%). In NTA's, though there is significant increase in area under coffee, productivity registered negative growth rate (-2.48%) which is mainly due to lower yield in tribal coffee growing areas. Therefore, increase in overall coffee production in the country is mainly attributed to increase in area under coffee. The results of the productivity analysis reveal that, overall coffee productivity in the country is stagnated which is mainly due to erratic rainfall coupled with high temperatures in the coffee growing regions and white stem borer menace in Arabica plantations. Age of the coffee plantations is also one of the reasons for declining coffee productivity [Table-1].

Changing Pattern of Coffee Production in India: Moving from Arabica to Robusta

The percentage share of Arabica production has decreased from 35 percent during 2000-01, to 30 percent in 2017-18. It is important to note that the productivity of Arabica coffee declined from 727 kg/ha in 2000-01 to 478 kg/ha in 2017-18 (a decline at the rate of -2.44 percent per annum). The decline in productivity is the major reason for the decreasing share of Arabica in total coffee production. The share of Robusta coffee in total coffee production has increased over the years in India [Fig-6].

Conclusion

In a nut shell, the analysis shows production growth in coffee is area led rather than productivity led. The analysis shows a structural change in Indian coffee production from Arabica coffee to Robusta coffee. Both planting and bearing area under coffee is increasing at higher rate in NTA's where the productivity levels are very low. Overall, productivity levels have been fluctuating due to erratic rainfall, increased temperatures and extreme weather events. The Coffee Board of India, a nodal agency for the coffee sector in the country bringing out new interventions using emerging technologies for increasing the coffee production in the country. Applying the right quantity of plant nutrients at right time is very important for increasing the coffee productivity. In this context, the Coffee Board launched Kaapi Soil Health Monitoring and Management (KSHEMAM) website for coffee plantations and distributed soil health cards to the coffee growers. The Coffee Board also launched Coffee Krishi Tharanga is an IVR based digital mobile extension service with the aim to provide timely customized technical information pertaining to coffee production practices to increase coffee productivity and production. Further, Coffee Board in collaboration with EKA Analytics - a global leader in data analytics has initiated the pilot project for testing an application for identifying white stem borer pest in coffee plantations. Besides this, the Board is providing financial incentives to facilitate water augmentation that will improve production/productivity and the Board is also extending incentives for re-plantation of existing old/senile un economical coffee plantations with the suitable varieties.

Application of research: The Central Coffee Research Institute (CCRI) of Coffee Board is releasing high yielding and disease resistant varieties of Arabica and high yielding and drought resistant varieties of Robusta time to time. CCRI also developed and refined the clonal propagation techniques and supplied rooted clones of Robusta to coffee growers.

Research Category: Coffee research

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Author Contributions: All authors equally contributed

Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: Coffee Board, Bengaluru, 560001, Karnataka

Cultivar / Variety name: Coffee

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

Ethical Committee Approval Number: Nil

References

- [1] Babu Reddy D.R. (2001) *J. Plant. Crops*, 29(3), 22-26.
- [2] Coffee Barometer (2018) Available online: <https://www.hivos.org/assets/2018/06/Coffee-Barometer-2018.pdf>
- [3] Coffee Board of India (2018) *Database on Coffee*, Coffee Board of May 2018. <https://www.indiacoffee.org/database-coffee.html>.
- [4] Chattopadhyay S., John P. (2007) *Bitter Beans: An analysis of Coffee Crisis in India, Partners in change*, First edition. Available online: www.picindia.org
- [5] Economic Survey (2018) *Ministry of Finance, Government of India*
- [6] ICO (2018) http://www.ico.org/new_historical.asp?section=Statistics
- [7] Ponte S. (2004) *Standards and Sustainability in the Coffee Sector. A Global Value Chain Approach*. United Nations Conference on Trade and Development and the International Institute for Sustainable
- [8] Upendranadh C. and Subbaiah C. (2012) *Small Growers and Coffee Marketing-Issues and Perspective from the field*. Discussion Paper 15, NRPPD, Centre for Development Studies, Thiruvananthapuram.