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PADDY CULTIVATION IN KERALA: NAVIGATING TRENDS AND FORECASTINGPRODUCTION TOWARDS 2030

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This research examines current trends in paddy cultivation in Kerala. Analysis of available data reveals adecade-long variability in paddy cultivation area, marked by notable fluctuations. Recognizing thesignificance of rice in Kerala's diet, the study forecasted rice production up to 2030. The forecast suggestsa consistent trend for most districts until 2030. Notably, Kollam and Malappuram show increasing production, while Idukki and Kozhikode exhibit a decline.

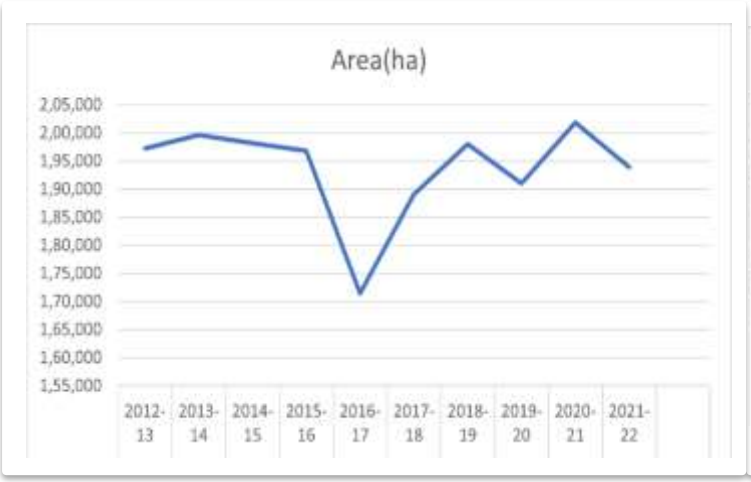
KEYWORDS: ***Paddy cultivation, Forecast, 2030.***

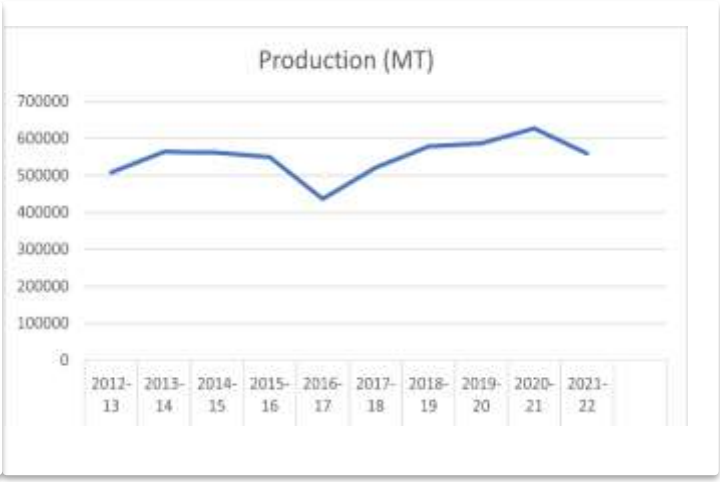
1. INTRODUCTION

1.1 Current trends of paddy cultivation in Kerala

As per the Economic review 2022 of the kerala state planning board, approximately 79% of the total land area dedicated to rice cultivation within the State can be attributed to four districts: Palakkad (39%), Alappuzha (18.8%), Thrissur (12%), and Kottayam (9.1%). Remarkably, these districts collectively contribute to 82% of the overall rice production in the State.[1] Based on the publicationsof Department of Economics and Statistics of the Kerala government, it is evident that over the past decade, the extent of land devoted to paddy cultivation within the state has demonstrated significant variability. Notably, the lowest recorded area for paddy cultivation was during the year 2016-17, whilethe highest was achieved in 2020-21, followed by a subsequent decrement. The production data also reflects a similar fluctuating pattern over this period.[2]

The contraction in cultivated land within the state of Kerala can be attributed to various factors such as the insufficiency of labour and the devaluation of paddy's market [3]. Moreover, the principal causative factor for the substantive reduction in cultivated acreage is the escalation in land prices, compelling agricultural practitioners to transition towards alternative crops such as coconut and rubberas a strategic response to prevailing economic pressures [4]. The consequences of climate change in the Kerala region further compound this issue, manifesting prominently in sectors pivotal to the agrarian landscape, namely crop production and horticulture [5]. In the face of these challenges, farmers exhibit proactive risk mitigation strategies, typified by their deliberate shift towards alternativeagricultural domains.





1.2 RESEARCH OBJECTIVES

Rice constitutes a fundamental component of Kerala's staple diet and represents a significant crop cultivated within the region. This research aims to establish a robust future forecast for rice productionin the state up to the year 2030. This holds significant importance for various stakeholders, including financial institutions like banks. Such forecasts provide valuable insights into the anticipated production trends across districts, enabling banks to make more informed decisions when considering loan applications from agricultural enterprises. By having a comprehensive understanding of which districts are expected to yield maximum production, banks can tailor their lending strategies and risk assessments, ensuring that loans are directed toward regions with favourable production prospects. Additionally, accurate production forecasts offer essential data for policymakers, aiding in the formulation of targeted agricultural policies and resource allocation. This information not only promotes efficient resource utilization but also contributes to the overall economic development of the state.

2. METHODOLOGY

A comprehensive secondary data analysis was conducted on the area and production data of 14 districtsof kerala based on the dataset published by Government of kerala, Department of Economics and statistics. This study employed various statistical tools, with a particular emphasis on the utilization of the Statistical Package for the Social Sciences (SPSS) software for the analytical processes. The analytical techniques encompassed in this study included descriptive statistics and time series modeling for the purpose of forecasting.

The primary objective of this research endeavor was to scrutinize and gain insight into the area and production patterns within the specified 14 districts. This was achieved through the rigorous application of statistical methodologies, which enabled a systematic examination of the dataset.The statistical analysis was initiated by employing descriptive statistics, which served to provide an initialoverview of the data. This involved the calculation of central tendencies, dispersions.

Subsequently, a time series modeling approach was adopted to facilitate forecasting of area and production trends. Time series modeling is a potent technique for predicting future values based on historical data, making it especially valuable for understanding patterns and fluctuations in agriculturaland production activities over time.

2.1 Data Analysis and Interpretation

Descriptive Statistics

Districts	N	Minimum	Maximum	Mean	Std. Deviation
Area (Trivandrum)(ha)	9	1751	2147	1963.40	147.161
Production (Trivandrum)(MT)	10	3069	5669	4787.43	811.035
Area (Pathanamthitta)(ha)	10	2280	3752	2959.38	521.104
Production (Pathanamthitta)(MT)	10	6041	11676	9000.22	1854.076
Area (Alappuzha)(ha)	10	31724	42273	37206.64	3612.340
Production (Alappuzha)(MT)	10	89335	128560	107305.79	12604.753
Area (Kannur)(ha)	10	4671	7046	5555.93	751.387
Production (Kannur)(MT)	10	10623	15066	11930.23	1478.250
Area (Malappuram)(ha)	10	6674	9814	8281.15	999.055
Production (Malappuram)(MT)	10	15377	31355	23907.89	5457.849
Area (Palakkad)(ha)	10	65513	82912	77455.87	4990.971

Production (Palakkad)(MT)	10	144275	248199	218957.59	33204.706
Area (Kozhikode)(ha)	10	1834	3511	2473.97	477.466
Production (Kozhikode)(MT)	10	2420	5326	3454.95	827.451
Area (Thrissur)(ha)	10	21100	24625	22929.37	1167.752
Production (Thrissur)(MT)	10	57478	87702	72203.11	8197.087
Area (Wayanad)(ha)	10	7326	11481	8774.89	1331.671
Production (Wayanad)(MT)	10	19513	30755	23886.81	3463.542
Area (Kasargod)(ha)	10	2096	4205	2980.01	700.647
Production (Kasargod)(MT)	10	4849	9439	6614.97	1609.852
Area (Kollam)(ha)	10	1302	2596	1792.46	464.597
Production (Kollam)(MT)	10	2396	5511	3779.72	924.440
Area (Ernakulam)(ha)	10	3940	5950	4791.01	591.822
Production (Ernakulam)(MT)	10	8533	12888	10732.59	1371.270
Area (Kottayam)(ha)	10	15746	22222	18076.86	1859.265
Production (Kottayam)(MT)	10	48030	61917	51854.57	4453.952
Area (Idukki)(ha)	10	488	1176	756.63	187.525
Production (Idukki)(MT)	10	919	3183	1879.39	600.346

Area - Descriptive Statistics

The district characterized by the smallest geographical expanse for paddy cultivation is Idukki, which consistently maintains the lower area measurement over the course of the decade, with a minimal area extent of 488 square units. Conversely, Palakkad emerges as the district having the most expansive geographical coverage, reporting a maximum area of 82,912 square units. In terms of the districts collectively, they exhibit an average area measurement of approximately 19,663.40 square units. Notably, the standard deviation of the district areas stands at 147.161 square units, indicating a relatively low degree of variability from the mean, signifying a relatively consistent distribution of areas across the districts.

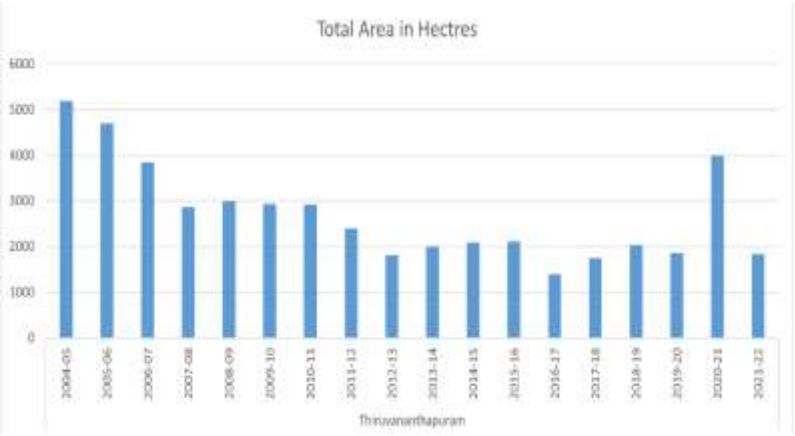
Production Descriptive Statistics

The district with the least production is Kozhikode, with a minimum production of 2420 MT, while the district with the largest production is Palakkad, with a maximum production of 248,199 MT. On average, the districts have a production of approximately 47,787.43 units. Thestandard deviation of the production values across the districts is 811.035 units, suggesting a moderate amount of variation in production levels.

2.2 Trends in Area Under Paddy Cultivation up to 2022

Trivandrum

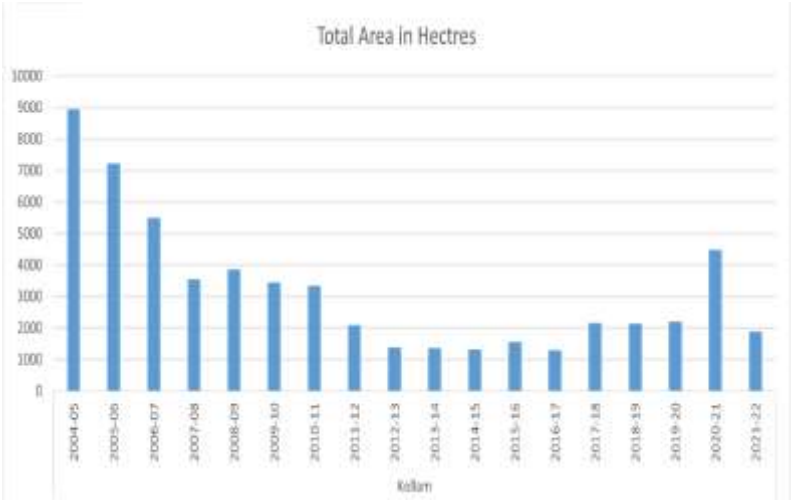
Year	Area (in ha)
2004-05	5196
2005-06	4705
2006-07	3849
2007-08	2867
2008-09	2995
2009-10	2940
2010-11	2919
2011-12	2395
2012-13	1816
2013-14	2001
2014-15	2093
2015-16	2119
2016-17	1392
2017-18	1751
2018-19	2038
2019-20	1864
2020-21	3988.6
2021-22	1841.6
Grand Total	**48770.2**



The data reveals a fluctuating pattern in the area over 18 years, with a notable decline from 5196 hectares in 2004-05 to a low of1392 hectares in 2016-17, followed by a gradual recovery. The most recent data for 2021-22 indicates a modest uptick to 1841.6hectares, cumulatively totalling 48770.2 hectares and highlighting the dynamic nature of the observed area**.**

Kollam

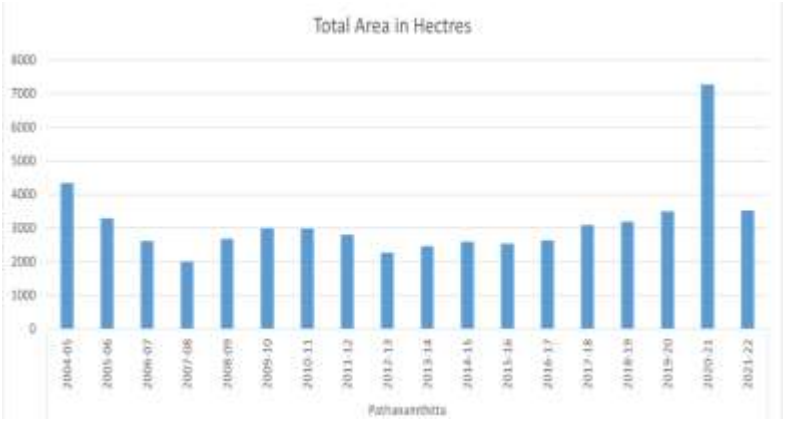
Year	Area (in ha)
2004-05	8949
2005-06	7218
2006-07	5497
2007-08	3538
2008-09	3859
2009-10	3453
2010-11	3342
2011-12	2097
2012-13	1387
2013-14	1363
2014-15	1327
2015-16	1555
2016-17	1302
2017-18	2166
2018-19	2134
2019-20	2203
2020-21	4487.6
2021-22	1891.6
Grand Total	**57769.2**



A discernible trend is evident, characterized by a notable decrease in area from 8949 hectares in 2004-05 to 1302 hectaresin 2016-17, followed by a subsequent resurgence. The cumulative area over the entire period amounts to 57769.2 hectares, reflecting the dynamic nature of the observed region and potential implications for environmental and agricultural dynamics.

Pathanamthitta

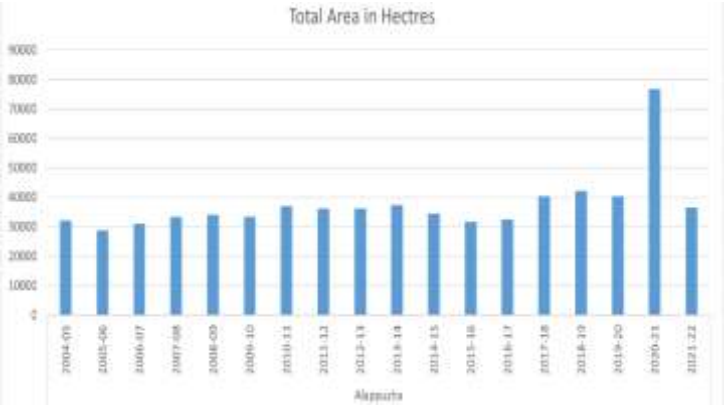
Year	Area (in ha)
2004-05	4339
2005-06	3291
2006-07	2616
2007-08	2001
2008-09	2681
2009-10	2996
2010-11	2986
2011-12	2802
2012-13	2280
2013-14	2467
2014-15	2592
2015-16	2534
2016-17	2640
2017-18	3101
2018-19	3199
2019-20	3504
2020-21	7276.8
2021-22	3524.8
Grand Total	56830.6



There is an upward trajectory in the area, with a marked increasefrom 4339 hectares in 2004-05 to a peak of 7276.8 hectares in 2020-21, followed by a marginal decline in the subsequent year.The cumulative area for the entire period amounts to 56830.6 hectares, underscoring the dynamic nature of the observed region and its potential implications for broader environmental and agricultural dynamics.

Alappuzha

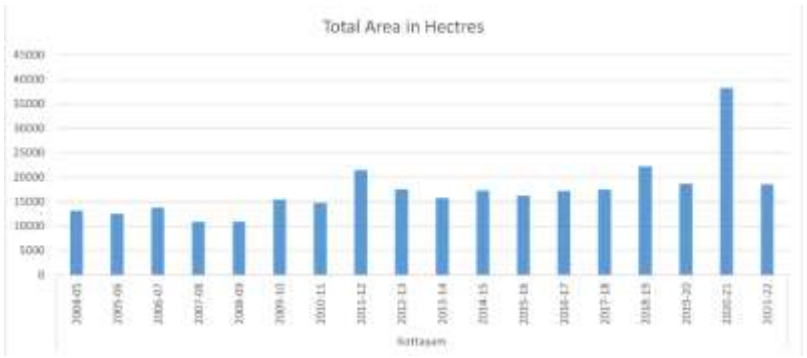
Year	Area (in ha)
2004-05	32158
2005-06	28768
2006-07	31060
2007-08	33335
2008-09	34143
2009-10	33440
2010-11	37060
2011-12	36251
2012-13	36195
2013-14	37403
2014-15	34415
2015-16	31724
2016-17	32453
2017-18	40393
2018-19	42273
2019-20	40338
2020-21	76872.4
2021-22	36528.4
Grand Total	674809.8



A discernible pattern emerges, showcasing a consistent growth in area from 32158 hectares in 2004-05 to a pinnacle of 76872.4 hectares in 2020-21, followed by a notable decrease in the subsequent year. The cumulative area over the entire period amounts to 674809.8 hectares, signifying the dynamic nature of theobserved region and its potential implications for environmental and agricultural dynamics.

Kottayam

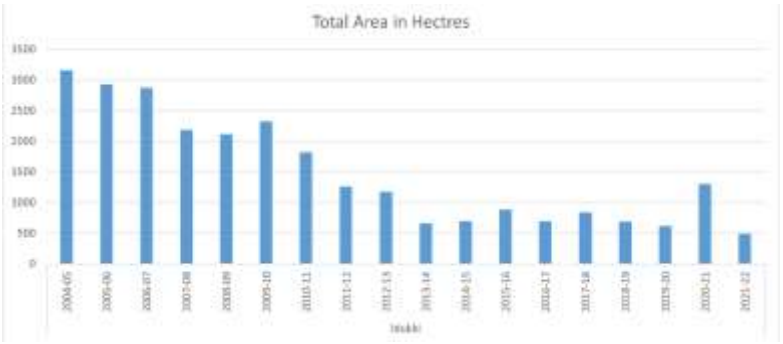
Year	Area (in ha)
2004-05	13161
2005-06	12557
2006-07	13814
2007-08	10969
2008-09	10951
2009-10	15474
2010-11	14775
2011-12	21410
2012-13	17571
2013-14	15746
2014-15	17295
2015-16	16272
2016-17	17216
2017-18	17470
2018-19	22222
2019-20	187.40
2020-21	38236.6
2021-22	18546.6
Grand Total	**312426.2**



The presented dataset delineates the annual variations in the observed area from 2004-05 to 2021-22. Notably, there is a discernible upward trend, with a substantial increase in area from13161 hectares in 2004-05 to a peak of 38236.6 hectares in 2020-21, followed by a notable decrease in the subsequent year. The cumulative area over the entire period amounts to 312426.2 hectares, emphasizing the dynamic nature of the observed region and its potential implications for environmental and agriculturaldynamics.

Idukki

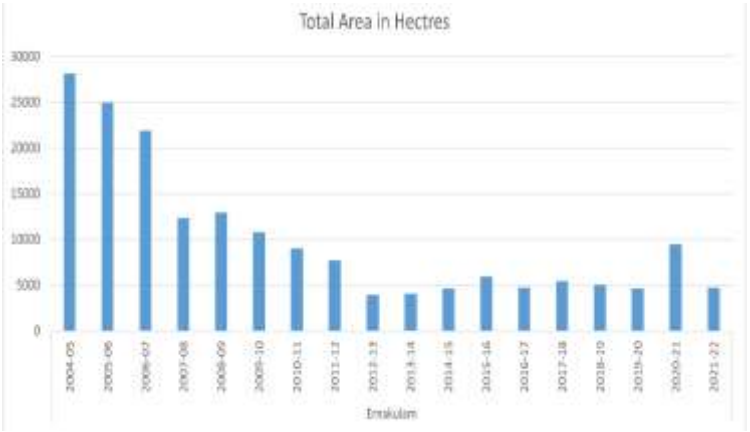
Year	Area (in ha)
2004-05	3166
2005-06	2932
2006-07	2878
2007-08	2190
2008-09	2115
2009-10	2328
2010-11	1819
2011-12	1264
2012-13	1176
2013-14	661
2014-15	697
2015-16	887
2016-17	695
2017-18	838
2018-19	688
2019-20	616
2020-21	1308.3
2021-22	488.3
Grand Total	**26746.6**



A discernible pattern emerges, illustrating a general decline in area over the years, with fluctuations ranging from 3166 hectaresin 2004-05 to a nadir of 488.3 hectares in 2021-22. The cumulative area over the entire period amounts to 26746.6 hectares, underscoring the dynamic nature of the observed regionand its potential implications for environmental and agricultural dynamics.

Ernakulam

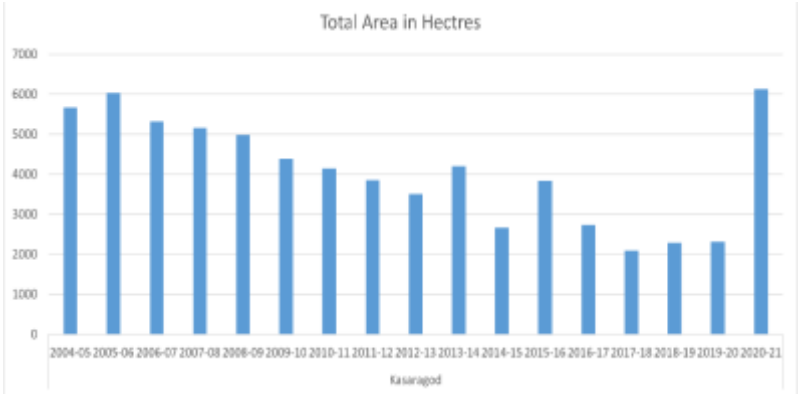
Year	Area (in ha)
2004-05	28145
2005-06	24934
2006-07	21895
2007-08	12343
2008-09	12966
2009-10	10787
2010-11	9016
2011-12	7731
2012-13	3940
2013-14	4052
2014-15	4644
2015-16	5950
2016-17	4730
2017-18	5440
2018-19	5044
2019-20	4646
2020-21	9464.1
2021-22	4723.1
Grand Total	**180450.2**



There is a noticeable fluctuation in the area, with a substantial increase from 28145 hectares in 2004-05 to a peak of 9464.1 hectares in 2020-21, followed by a decrease in the subsequent year. The cumulative area over the entire period amounts to 180450.2 hectares, underscoring the dynamic nature of the observed region and its potential implications for environmental and agricultural dynamics.

Kasargod

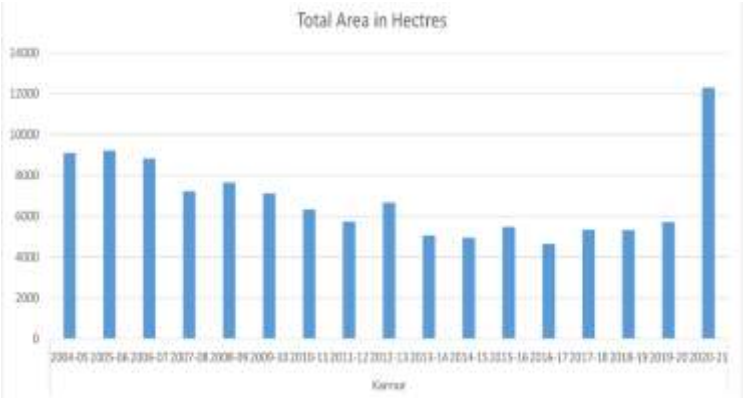
Year	Area (in ha)
2004-05	5675
2005-06	030
2006-07	5323
2007-08	5164
2008-09	4991
2009-10	4394
2010-11	4155
2011-12	3857
2012-13	3514
2013-14	4205
2014-15	2665
2015-16	3843
2016-17	2737
2017-18	2096
2018-19	2291
2019-20	2314
2020-21	6135.1
Grand Total	**69389.1**



A discernible pattern emerges, depicting fluctuations in area over theyears, with a notable increase from 5675 hectares in 2004-05 to a peak of 6135.1 hectares in 2020-21. The cumulative area over the entire period amounts to 69389.1 hectares, underscoring the dynamic nature of the observed region and its potential implicationsfor environmental and agricultural dynamics.

Kannur

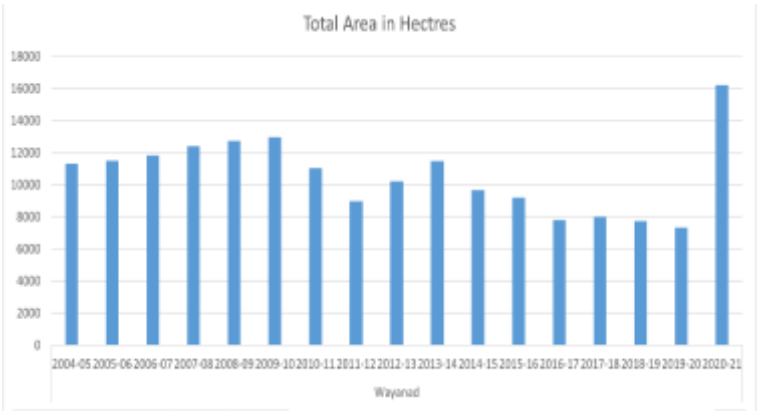
Year	Area (in ha)
2004-05	9102
2005-06	9223
2006-07	8842
2007-08	7232
2008-09	7649
2009-10	7130
2010-11	6339
2011-12	5740
2012-13	6684
2013-14	5080
2014-15	4955
2015-16	5478
2016-17	4671
2017-18	5347
2018-19	5330
2019-20	5715
2020-21	12299.3
Grand Total	**180450.2**



Notably, the data reveals a fluctuating pattern, with a significant increase in area from 9102 hectares in 2004-05 to a peak of 12299.3hectares in 2020-21. The cumulative area over the entire period amounts to 180450.2 hectares, underscoring the dynamic nature of the observed region and its potential implications for environmentaland agricultural dynamics**.**

Wayanad

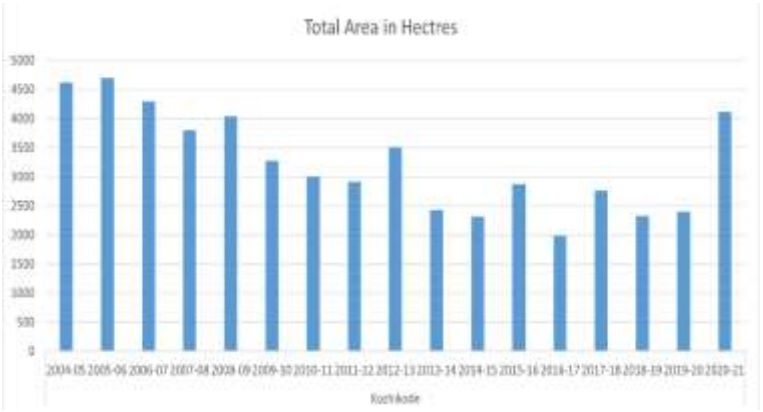
Year	Area (in ha)
2004-05	11331
2005-06	11503
2006-07	11832
2007-08	12408
2008-09	12746
2009-10	12995
2010-11	11054
2011-12	8995
2012-13	10230
2013-14	11481
2014-15	9690
2015-16	9204
2016-17	7822
2017-18	8026
2018-19	7761
2019-20	7326
2020-21	16208.9
Grand Total	**180612.9**



A discernible pattern emerges, illustrating fluctuations in area overthe years, with a significant increase from 11331 hectares in 2004-05 to a peak of 16208.9 hectares in 2020-21. The cumulative areaover the entire period amounts to 180612.9 hectares, emphasizingthe dynamic nature of the observed region and its potential implications for environmental and agricultural dynamics.

Kozhikode

Year	Area (in ha)
2004-05	4623
2005-06	4703
2006-07	4295
2007-08	3800
2008-09	4038
2009-10	3277
2010-11	3003
2011-12	2920
2012-13	3511
2013-14	2433
2014-15	2321
2015-16	2872
2016-17	1987
2017-18	2764
2018-19	2329
2019-20	2404
2020-21	4118.7
Grand Total	**55398.7**



A discernible trend is evident, showcasing fluctuations in area over the years, with a notable increase from 4623 hectares in 2004-05 to 4118.7 hectares in 2020-21. The cumulative area overthe entire period amounts to 55398.7 hectares, underscoring the dynamic nature of the observed region and its potential implications for environmental and agricultural dynamics.

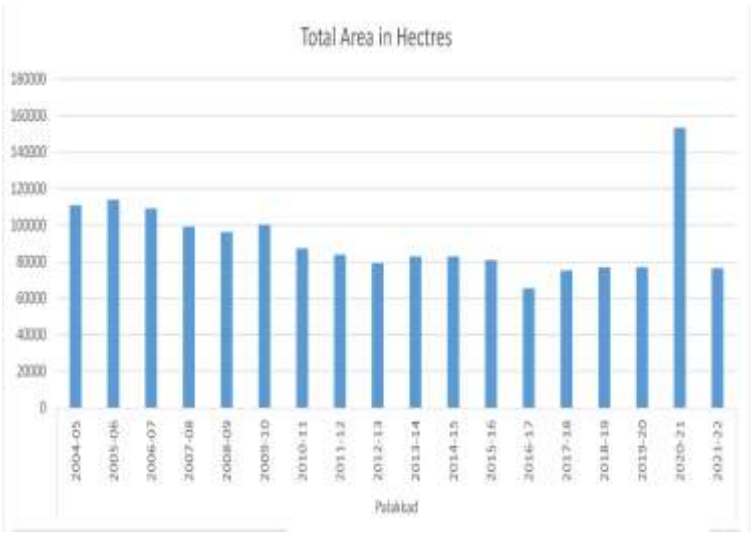
Malappuram

Year	Area (inha)
2004-05	16749
2005-06	14885
2006-07	15109
2007-08	9496
2008-	11013
2009-10	8838
2010-11	8949
2011-12	7528
2012-13	6674
2013-14	7549
2014-15	8402
2015-16	8687
2016-17	7140
2017-18	7864
2018-19	8339
2019-20	8803
2020-21	19353.5
2021-22	9813.5
Grand Total	**185192**

Notably, a discernible pattern emerges, illustrating fluctuations inarea over the years, with a substantial increase from 16749 hectares in 2004-05 to a peak of 19353.5 hectares in 2020-21, followed by a decrease in the subsequent year. The cumulative area over the entire period amounts to 185192 hectares,underscoring the dynamic nature of the observed region and its potential implications for environmental and agricultural dynamics.

Palakkad

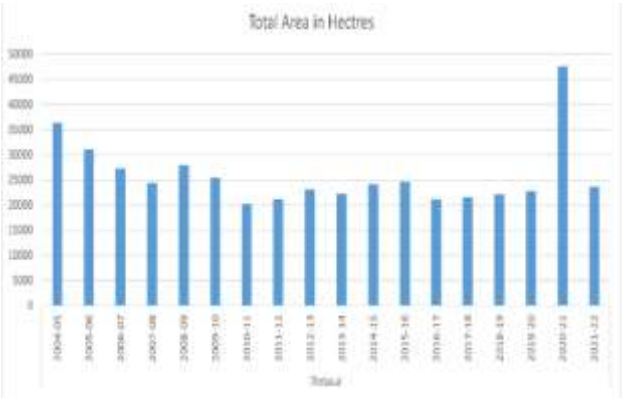
Year	Area (in ha)
2004-05	111029
2005-06	113919
2006-07	109208
2007-08	99173
2008-09	96190
2009-10	100522
2010-11	87511
2011-12	83998
2012-13	79201
2013-14	82896
2014-15	82912
2015-16	81120
2016-17	65513
2017-18	75415
2018-19	77121
2019-20	76961
2020-21	153419.7
2021-22	76503.7
Grand Total	**1652612.4**



A discernible trend is evident, showcasing fluctuations in area over the years, with a substantial increase from 111029 hectares in 2004-05 to a peak of 153419.7 hectares in 2020-21, followedby a slight decrease in the subsequent year. The cumulative areaover the entire period amounts to 1652612.4 hectares, emphasizing the dynamic nature of the observed region and its potential implications for environmental and agricultural dynamics.

Thrissur

Year	Area (in ha)
2004-05	36351
2005-06	31074
2006-07	27311
2007-08	24422
2008-09	27928
2009-10	25439
2010-11	20259
2011-12	21172
2013-14	22274
2014-15	24151
2015-16	24625
2016-17	21100
2017-18	21564
2018-19	22131
2019-20	22746
2020-21	47604.7
2021-22	23658.7
Grand Total	**466908.4**



A discernible trend is evident, showcasing fluctuations in areaover the years, with a notable increase from 36351 hectares in 2004-05 to a peak of 47604.7 hectares in 2020-21, followed by a decrease in the subsequent year. The cumulative area over the entire period amounts to 466908.4 hectares, underscoring the dynamic nature of the observed region and its potential implications for environmental and agricultural dynamics.

2.3 Forecast

Trivandrum

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Forecast(MT)	4787	4787	4787	4787	4787	4787	4787	4787	4787
UCL(MT)	6622	6622	6622	6622	6622	6622	6622	6622	6622
LCL(MT)	2953	2953	2953	2953	2953	2953	2953	2953	2953

UCL: upper control limit, LCL: lower control limit

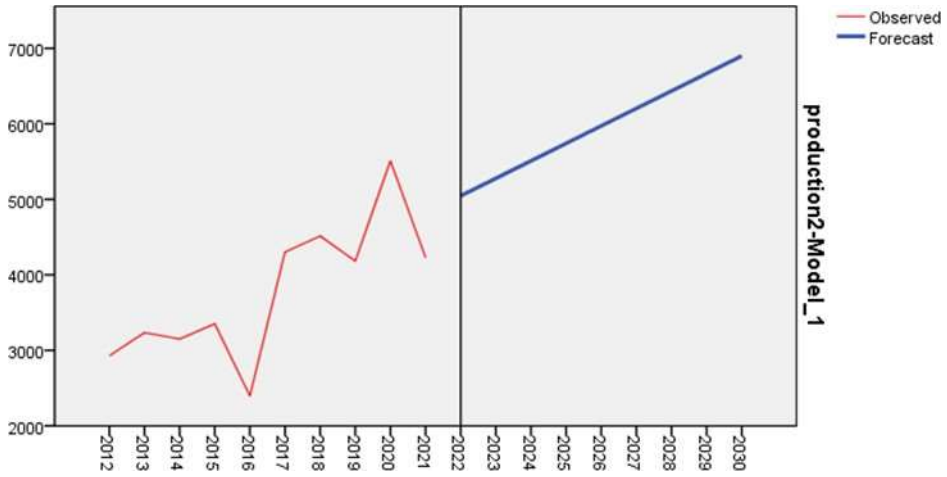
Interpretation:

The table illustrates that the forecasts for Trivandrum areexpected to remain at 4787 MTfor each year from 2022 to 2030.

Kollam

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Forecast(MT)	5047	5278	5510	5741	5973	6204	6436	6667	6899
UCL(MT)	6668	6929	7189	7449	7708	7967	8226	8484	8742
LCL(MT)	3425	3627	3830	4033	4237	4441	4645	4850	5056

UCL: upper control limit, LCL: lower control limit



Interpretation:

The table illustrates that the forecasts for Kollamare expected to increasefrom 5047 MT in 2022 to 6899 MT in 2030.

Pathanamthitta

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Forecast (MT)	8554	8554	8554	8554	8554	8554	8554	8554	8554
UCL(MT)	11757	13084	14102	14960	15716	16399	17028	17613	18162
LCL(MT)	5352	4025	3007	2149	1393	710	81	-504	-1053

UCL: upper control limit, LCL: lower control limit

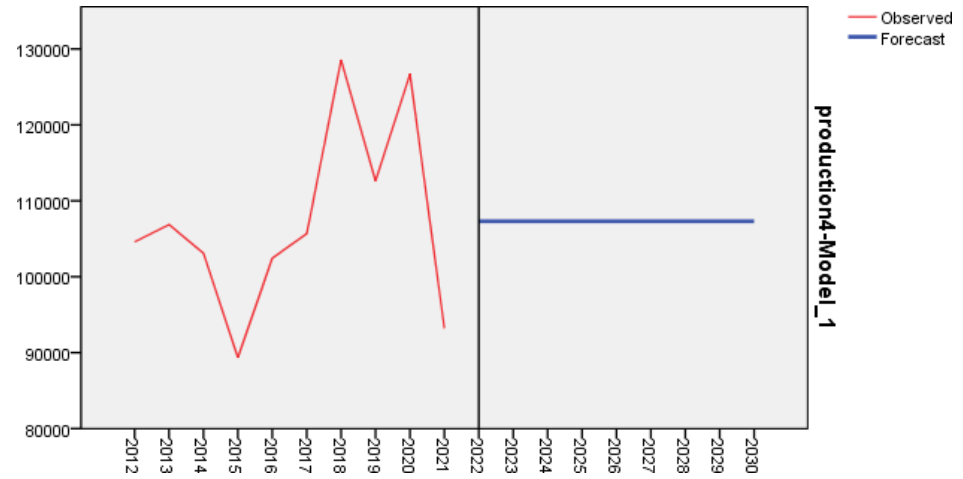
Interpretation:

The table illustrates that the forecasts for Pathanamthitta are expected to remain at 8554 MT for each year from 2022 to 2030.

Alappuzha

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Forecast(MT)	107306	107306	107306	107306	107306	107306	107306	107306	107306
UCL(MT)	135820	135820	135820	135820	135820	135820	135820	135820	135820
LCL(MT)	78792	78792	78792	78792	78792	78792	78792	78792	78792

UCL: upper control limit, LCL: lower control limit

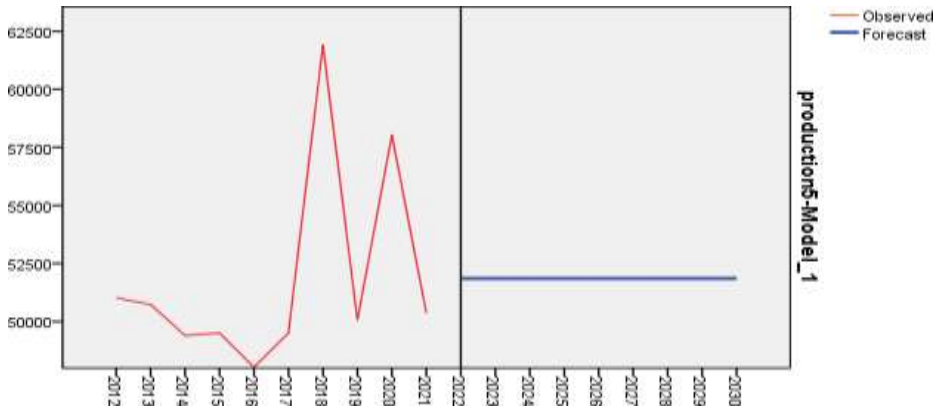


Interpretation:
The table illustrates that the forecasts for Alappuzha are expected to remain at 107306 MT for each year from 2022 to 2030.

Kottayam

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Forecast(MT)	51855	51855	51855	51855	51855	51855	51855	51855	51855
UCL(MT)	61930	61930	61930	61930	61930	61930	61930	61930	61930
LCL(MT)	41779	41779	41779	41779	41779	41779	41779	41779	41779

UCL: upper control limit, LCL: lower control limit

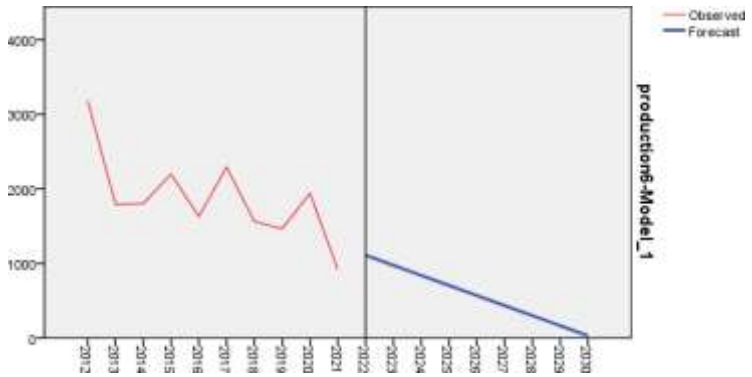


Interpretation:
The table illustrates that the forecasts for Kottayam are expected to remain at 51855 MT for each year from 2022 to 2030.

Idukki

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Forecast(MT)	1111	976	841	706	571	436	301	166	31
UCL(MT)	2248	2119	1989	1860	1730	1601	1471	1342	1212
LCL(MT)	-26	-167	-308	-448	-589	-729	-870	-1010	-1151

UCL: upper control limit, LCL: lower control limit

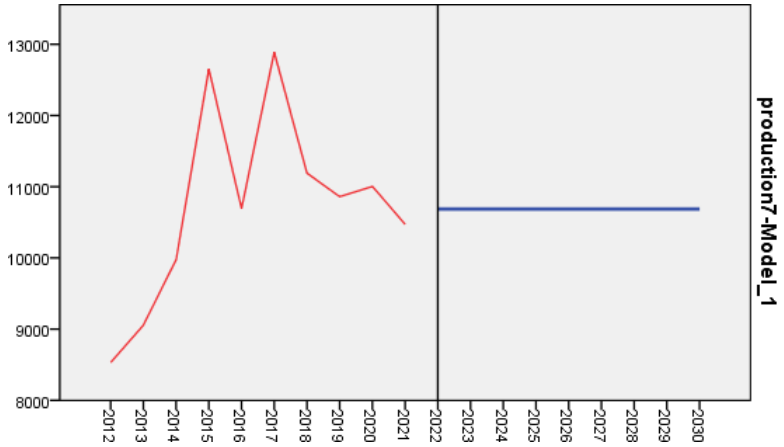


Interpretation:
The table illustrates that the forecasts forIdukki are expected to decrease from1111 MT in 2022 to 31 in 2030.

Ernakulam

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Forecast (MT)	10686	10686	10686	10686	10686	10686	10686	10686	10686
UCL(MT)	13787	14349	14835	15271	15668	16036	16380	16705	17012
LCL(MT)	7585	7023	6537	6102	5704	5336	4992	4667	4360

UCL: upper control limit, LCL: lower control limit



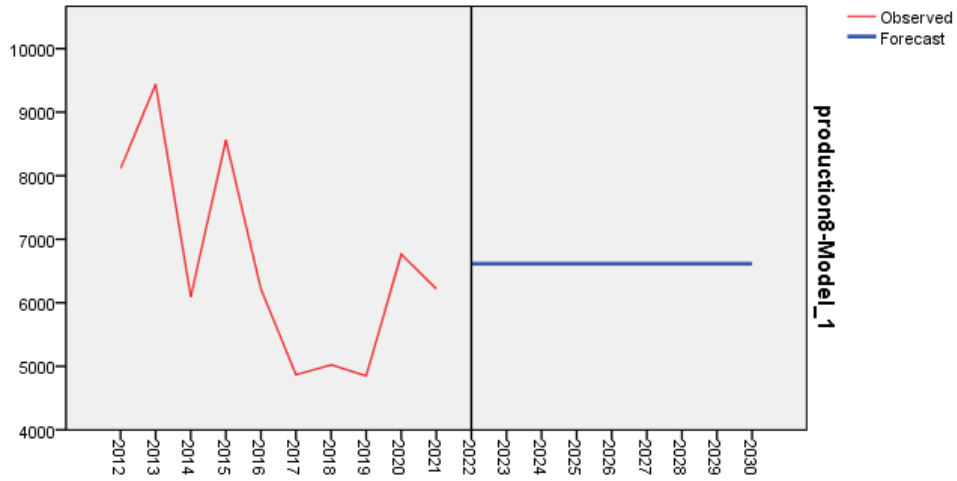
Interpretation:

The table illustrates that the forecasts for Ernakulam are expected to remain at 10686 MT for each year from 2022 to 2030.

Kasargod

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Forecast(MT)	6615	6615	6615	6615	6615	6615	6615	6615	6615
UCL(MT)	10257	10257	10257	10257	10257	10257	10257	10257	10257
LCL(MT)	2973	2973	2973	2973	2973	2973	2973	2973	2973

UCL: upper control limit, LCL: lower control limit



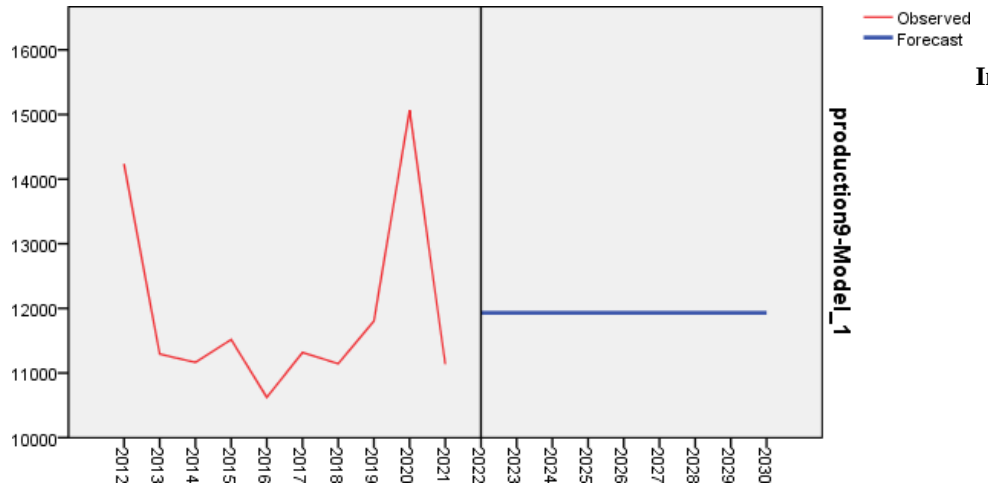
Interpretation:

The table illustrates that the forecasts for Kasargod are expected to remain at 6615 MT for each year from 2022 to 2030.

Kannur

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Forecast(MT)	11930	11930	11930	11930	11930	11930	11930	11930	11930
UCL(MT)	15274	15274	15274	15274	15274	15274	15274	15274	15274
LCL(MT)	8586	8586	8586	8586	8586	8586	8586	8586	8586

UCL: upper control limit, LCL: lower control limit



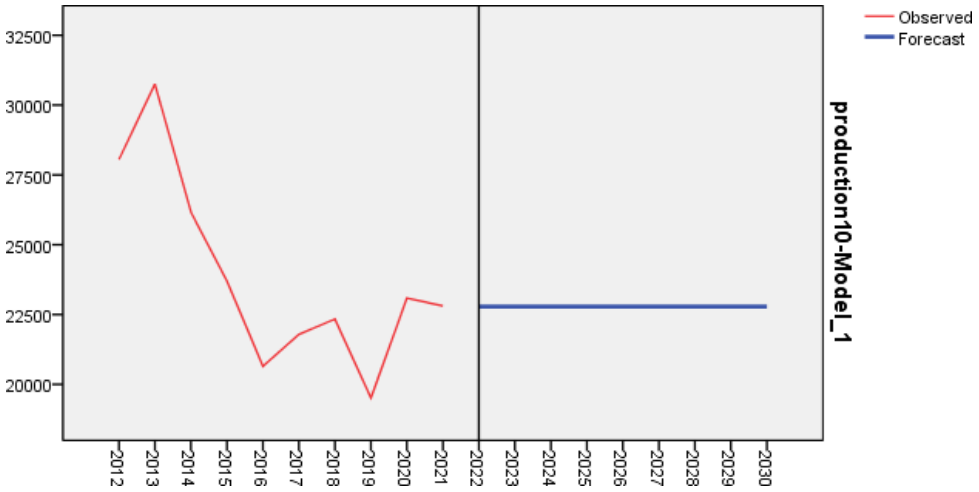
Interpretation:

The table illustratesthat the forecasts for Kannur are expectedto remain at 11930 MT for each year from2022 to 2030.

Wayanad

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Forecast(MT)	22787	22787	22787	22787	22787	22787	22787	22787	22787
UCL(MT)	28864	30810	32369	33708	34899	35984	36986	37921	38803
LCL(MT)	16710	14763	13204	11866	10674	9590	8588	7652	6771

UCL: upper control limit, LCL: lower control limit



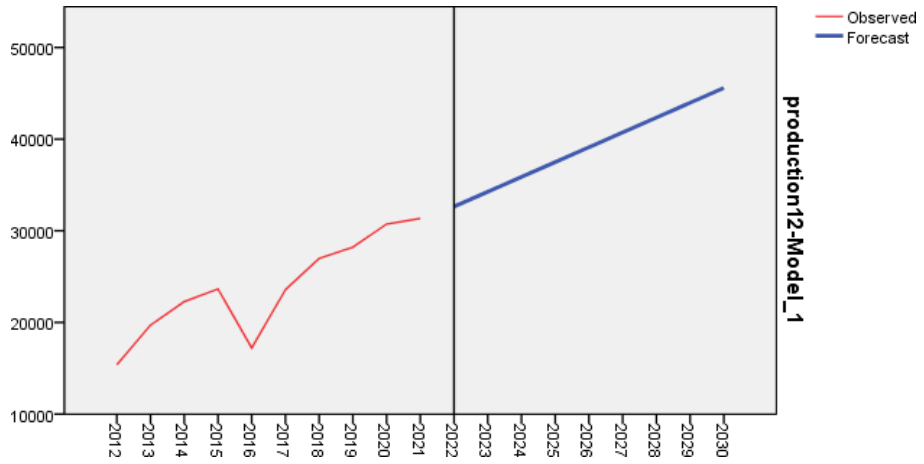
Interpretation:

The table illustrates that the forecasts for Wayanad are expected to remain at 22787 MTfor each year from 2022 to 2030.

Kozhikode

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Forecast (MT)	2270	2050	1830	1609	1389	1169	949	729	509
UCL(MT)	3532	3318	3105	2891	2677	2463	2249	2035	1821
LCL(MT)	1007	781	555	328	102	-124	-351	-577	-803

UCL: upper control limit, LCL: lower control limit

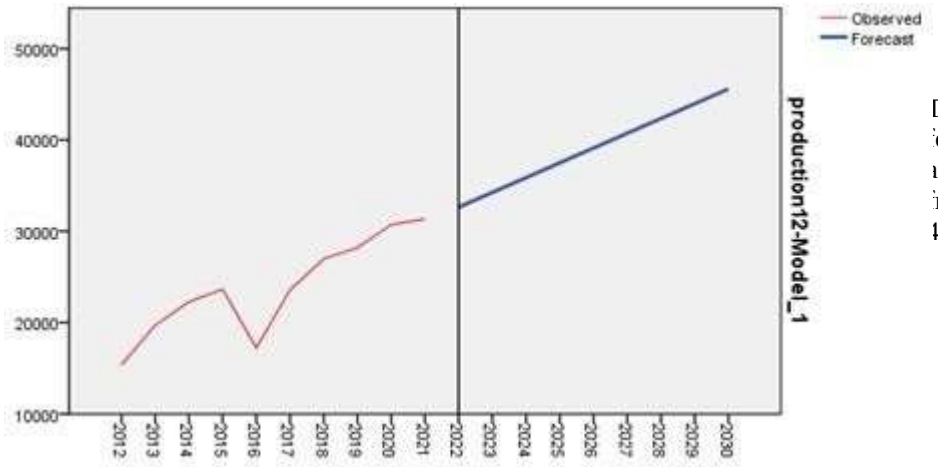


Interpretation:
The table illustrates that the forecasts for Kozhikode are expected to decrease from 2270 MT in 2022 to 509 MT in 2030.

Malappuram

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Forecast (MT)	32645	34263	35881	37499	39117	40735	42353	43971	45589
UCL(MT)	38884	40533	42182	43831	45479	47128	48776	50424	52072
LCL(MT)	26405	27992	29580	31167	32755	34343	35931	37519	39107

UCL: upper control limit, LCL: lower control limit

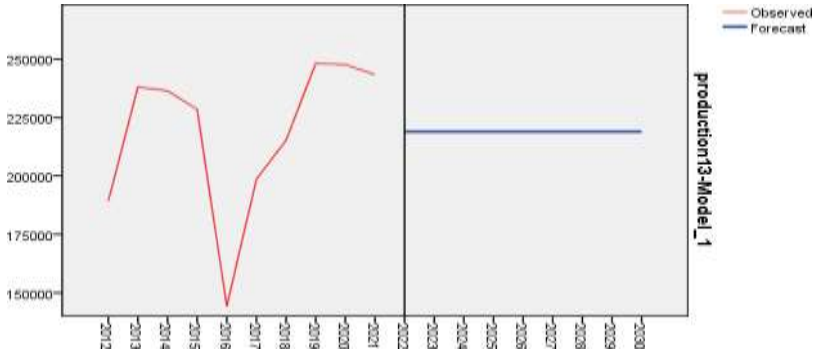


Interpretation:
The table illustrates that the forecasts for Malappuram are expected to increase from 32645 MT in 2022 to 45589MT in 2030.

Palakkad

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Forecast(MT)	218958	218958	218958	218958	218958	218958	218958	218958	218958
UCL(MT)	294072	294072	294072	294072	294072	294072	294072	294072	294072
LCL(MT)	143843	143843	143843	143843	143843	143843	143843	143843	143843

UCL: upper control limit, LCL: lower control limit

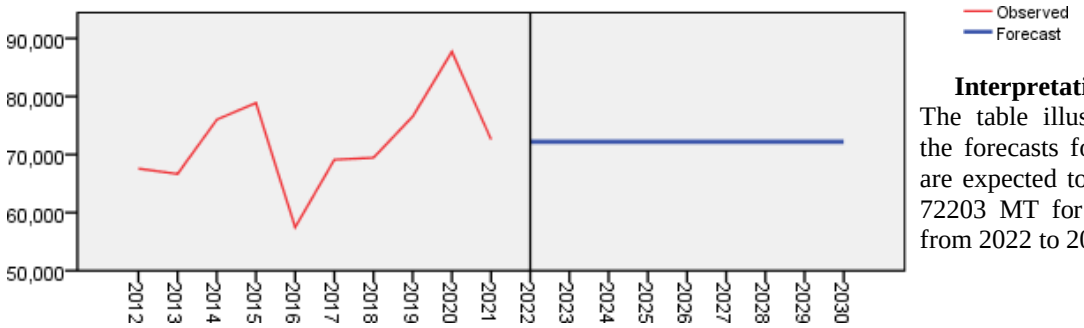


Interpretation:
The table illustrates that the forecasts for Palakkad are expected to remain at 218958 MT for each year from 2022 to 2030.

Thrissur

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Forecast (MT)	72203	72203	72203	72203	72203	72203	72203	72203	72203
UCL(MT)	90746	90746	90746	90746	90746	90746	90746	90746	90746
LCL(MT)	53660	53660	53660	53660	53660	53660	53660	53660	53660

UCL: upper control limit, LCL: lower control limit



Interpretation:
The table illustrates that the forecasts for Thrissur are expected to remain at 72203 MT for each year from 2022 to 2030.

Overall, The Malappuram district has consistently witnessed a notable increase in both the cultivationarea and production levels of paddy over the years. Similarly, in Kollam, there has been a significant uptrend in both the area devoted to paddy cultivation and the production figures, indicating a positive trajectory in the region. However, a contrasting picture emerges in the case of the Idukki and Kozhikode districts, which have exhibited a negative trend in terms of paddy cultivation and production over the years.

In contrast, other districts such as Ernakulam, Thrissur, Palakkad, Alappuzha, Kottayam, Wayanad, Kannur, Kasaragod, Pathanamthitta, and Trivandrum have demonstrated a relatively stable pattern in both paddy cultivation area and production. This observation suggests that these districts have managed to maintain consistent levels of paddy agriculture over the years.

3. DISCUSSION

In future, climate change will have a detrimental impact on the productivity of rice. [6] A practical investigation conducted with IR8 rice variety has shown that alterations in the environment can substantially reduce the productivity of the same rice variety over an extended period. [7] Two primary challenges in rice cultivation in the future involve achieving sustainable production by utilizing less land, water, labor, and minimizing the use of chemical inputs, as well as addressing the imperative ofreducing greenhouse gas emissions associated with rice cultivation.[8] Another significant challenge in rice production is to simultaneously enhance grain yield and conserve water. Various agricultural practices, including post-anthesis controlled soil drying, alternate wetting and drying irrigation, and non-flooded straw mulching cultivation, have the potential to significantly improve water use efficiency while preserving or even increasing the grain yield of rice. [9]

Effectively implementing rice-related schemes is a crucial component for mitigating future risks. Ensuring the success of government initiatives, such as the 'rice development scheme,' is vital. The rice development program aims to promote paddy cultivation in the state through area expansion programs, provide input assistance for sustainable rice development, support group farming activities, and offer royalties to paddy landowners. [10]

4. CONCLUSION

Most of the districts displayed similar trends in the extent of area devoted to paddy cultivation, showingan increase until 2020-21, which marks the peak, followed by a noticeable decline. Specifically, Trivandrum experienced a reduction in the area dedicated to paddy cultivation until 2016-17, followed by a gradual increase up to 2020-21, followed by a decline. In contrast, Idukki consistently witnessed a decline in the area allocated to paddy cultivation. The forecast for production levels suggests a constant trend for most districts until 2030. Notably, Kollam and Malappuram show an increase in production, while Idukki and Kozhikode exhibit a decline. Addressing the challenges through sustainable cultivation practices and the successful implementation of initiatives like the 'rice development scheme' is imperative. By prioritizing water use efficiency, minimizing environmental impact, and supporting comprehensive rice development programs, we can strive towards a resilient and productive future for rice cultivation despite the challenges posed by current scenarios.

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