DON BOSCO INSTITUTE OF TECHNOLOGY, KURLA, MUMBAI – 400070

SUBJECT: - ENGINEERING MATHEMATICS – III

TITLE: - Statistical analysis on distribution of Agricultural Production

ACADEMIC YEAR: - 2023-24

Group Members: -

- Sanffred Cheruvathur - 09 (Leader)
- Tejas Budhe – 06
- Onkar Lambade - 32
- Joel Jose – 25
- Samuel D’souza - 15
- Chris Rodricks – 48

❖ Acknowledgement

We are truly humbled and deeply appreciative of the remarkable teamwork and dedication exhibited by our exceptional group members: Sanffred, Joel, Onkar, Tejas, Samuel, and Chris. Their unwavering commitment and collaborative spirit played a pivotal role in the successful completion of this math mini project, and it's no exaggeration to say that without their collective hard work, this project would not have reached its successful conclusion.

In addition, we extend our heartfelt gratitude to our esteemed mathematics teacher, Mrs. Manisha. Her guidance, expertise, and unwavering support have been the guiding light that illuminated our path throughout this project. Mrs. Manisha's mentorship has not only enriched our academic experience but has also significantly contributed to the success of this endeavor. In closing, we want to express our profound appreciation to everyone involved in this project. We are grateful for the opportunity to work together and for the invaluable lessons we have learned along the way. Thank you all for your unwavering contributions and support; it has truly been a remarkable journey

❖ Abstract:

This mini project presents a statistical analysis of agricultural production, focusing on sweet potatoes and Peas and beans (pulses) in Uttar Pradesh and Meghalaya over several years. It examines production trends, variations, and key factors influencing crop yields. By comparing the two states, the study highlights regional disparities and offers insights for informed decision-making in agriculture policy and practices.

❖ Introduction:

This project entails an extensive statistical examination of crop production and distribution within the Indian states of Uttar Pradesh (UP) and Meghalaya. Its primary objective is to gain comprehensive insights into the historical trends, regional dynamics, prevailing challenges, and potential opportunities within their respective agricultural sectors. The ultimate aim is to furnish policymakers and stakeholders with valuable insights that can contribute to the advancement of agricultural sustainability and productivity in these states.

- **What is the project about:**

Our project focuses on the comprehensive analysis of crop production in the regions of Uttar Pradesh and Meghalaya. Employing a combination of tabular and graphical techniques, our aim is to extract valuable insights from a substantial dataset. Our analytical approach encompasses statistical methodologies, including mean, mode, median, and standard deviation, rooted in fundamental probability formulas. Ultimately, our objective is to arrive at a conclusive understanding of crop production dynamics in these regions.

- **What problems were tackled:**

- Data Management: The project initiated with the formidable challenge of handling and organizing an extensive dataset. Efficient data distribution and organization were paramount to enhance the overall accessibility and utility of the information.

- Categorizing Crops Production: A significant aspect of our analysis involved meticulously categorizing and cataloging annual Peas and beans (pulses) production and sweet potato production data based on geographical regions. This meticulous process formed the bedrock of our subsequent analyses.

- Visual Representation: To enhance comprehension and communication, we meticulously designed graphical representations illustrating the temporal relationship between years and total crops production (sweet potato and Peas and beans (pulses)), as well as the spatial relationship between geographical area and total crops production.

- Statistical Analysis: Leveraging foundational probability formulas, we conducted rigorous statistical analyses encompassing mean, mode, median, and standard deviation. These analyses were pivotal in unearthing nuances within the dataset.
- Regression Modeling: Beyond descriptive statistics, we employed regression analysis to derive a regression line, facilitating the prediction of trends and offering a deeper understanding of the interplay between time and total production.

- List Of Crops :

Uttar Pradesh :-

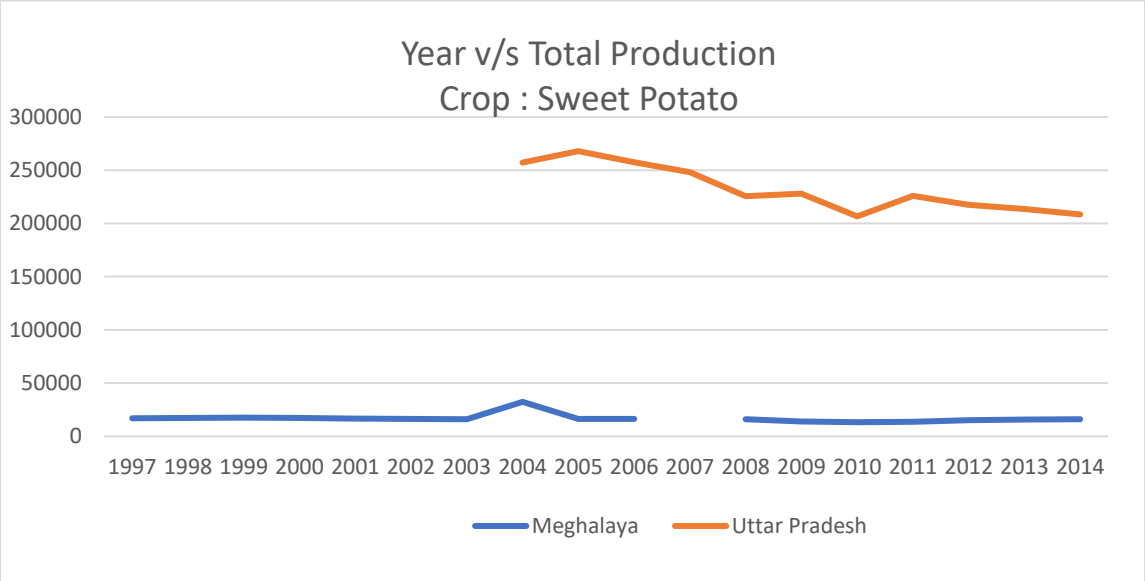
Arhar/Tur	Oilseeds total
Bajra	Onion
Banana	Other Rabi pulses
Barley	Other Kharif pulses
Castor seed	Peas & beans (Pulses)
Coriander	Potato
Cotton(lint)	Ragi
Dry chillies	Rapeseed &Mustard
Dry ginger	Rice
Garlic	Sannhamp
Ginger	Sesamum
Gram	Small millets
Groundnut	Soyabean
Guar seed	Sugarcane
Jowar	Sunflower
Jute	Sweet potato
Linseed	Tobacco
Maize	Total foodgrain
Masoor	Turmeric
Moong(GreenGram)	Urad
Moth	Wheat

Meghalaya :-

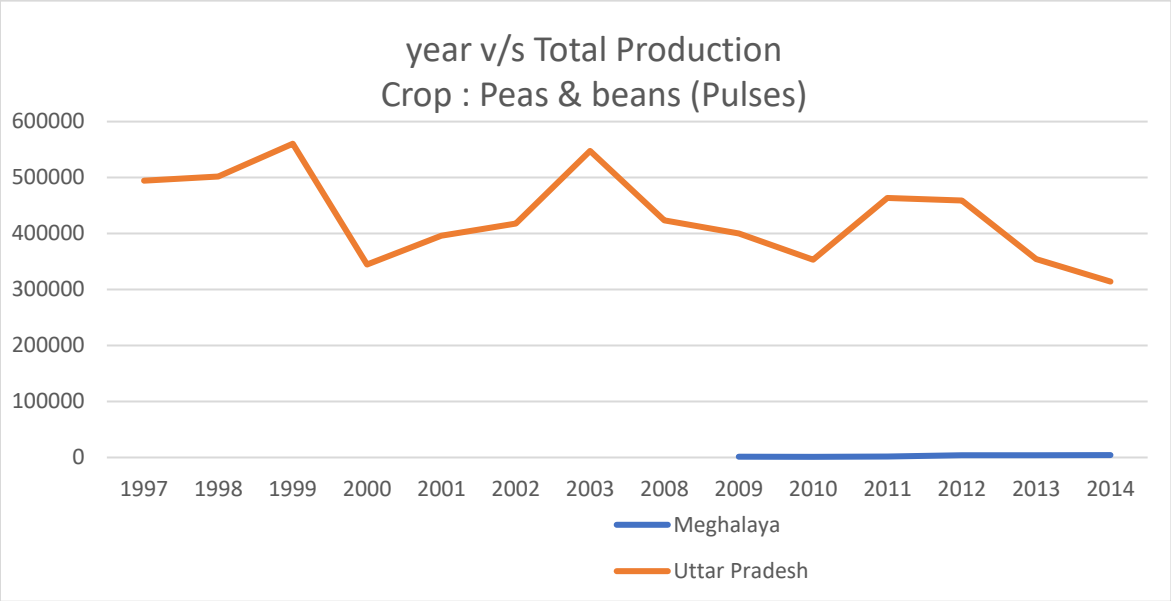
Arecanut	Pineapple
Arhar/Tur	Potato
Banana	Pulses total
Black pepper	Rapeseed &Mustard
Cashewnut	Rice
Castor seed	Sesamum
Citrus Fruit	Small millets
Coriander	Soyabean
Cotton(lint)	Sugarcane
Cowpea(Lobia)	Sweet potato
Dry chillies	Tapioca
Dry ginger	Tobacco
Garlic	Total foodgrain
Gram	Turmeric
Jute	Wheat
Kapas	Oilseeds total
Linseed	Other Rabi pulses
Maize	Papaya
Masoor	Peas & beans (Pulses)
Mesta	

- Total Production Of crops over the years in Uttar Pradesh and Meghalaya :

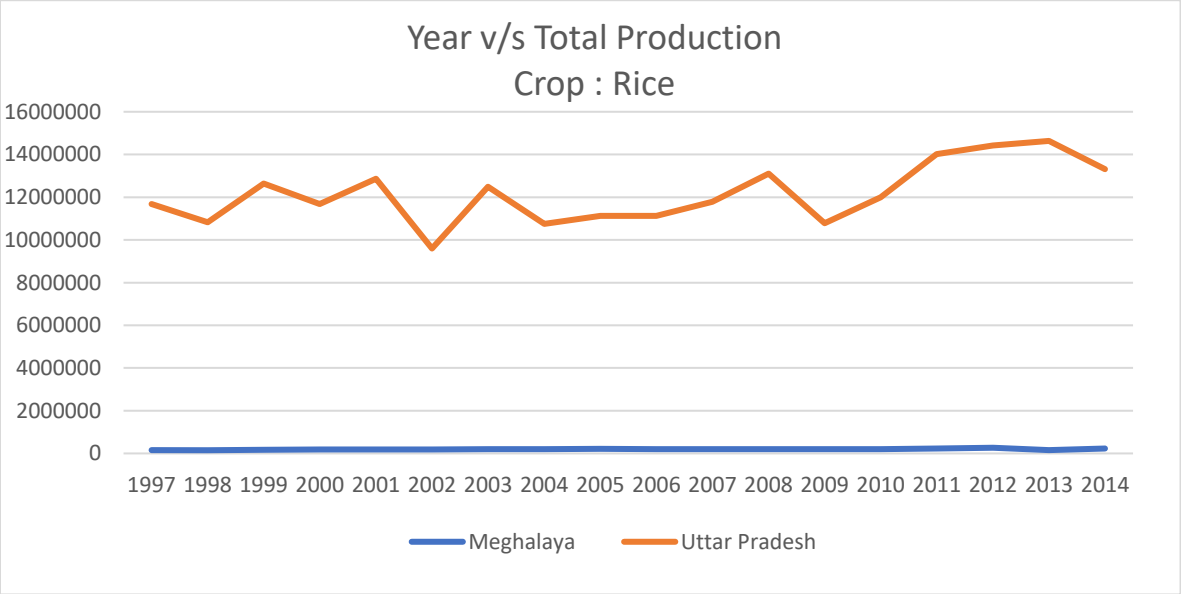
Sweet Potato :



Peas and beans (Pulses):



Rice:



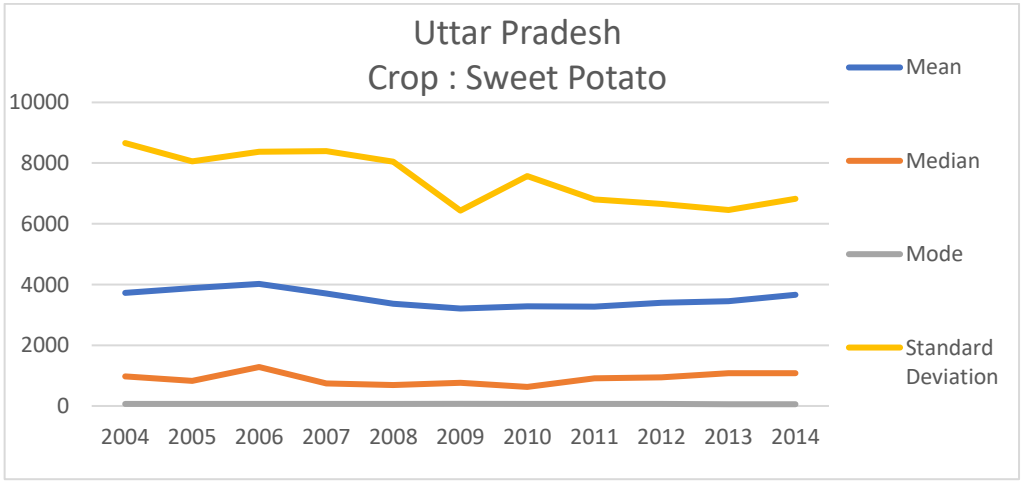
Inference :

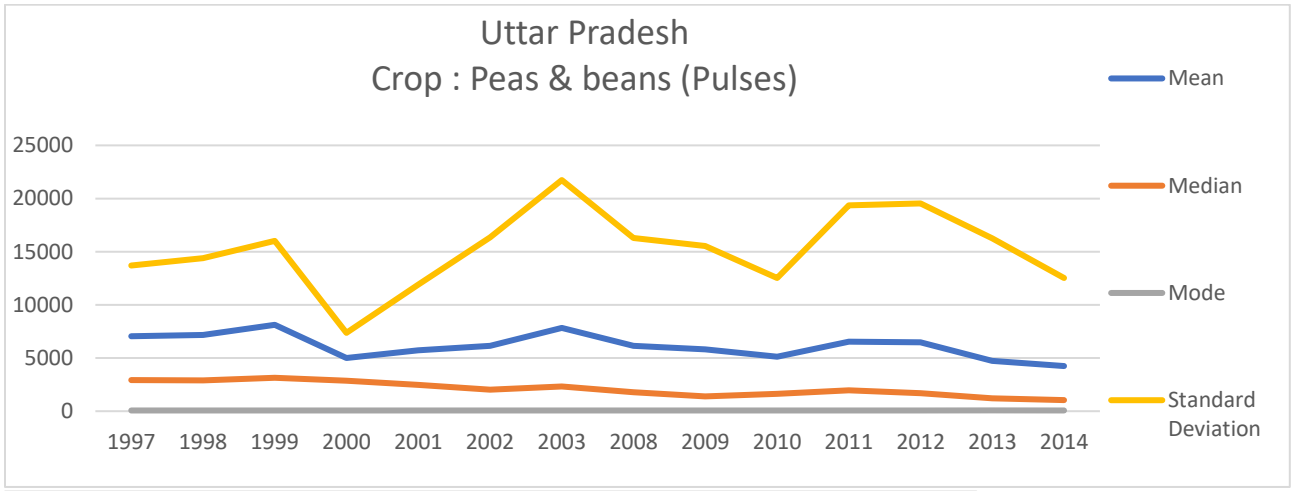
- Sweet potato production is higher in Uttar Pradesh compared to Meghalaya, driven by climatic factors like rainfall and irrigation practices. Uttar Pradesh's sandier soil, due to lower rainfall, is better suited for sweet potato cultivation, whereas Meghalaya's high annual rainfall limits its production.

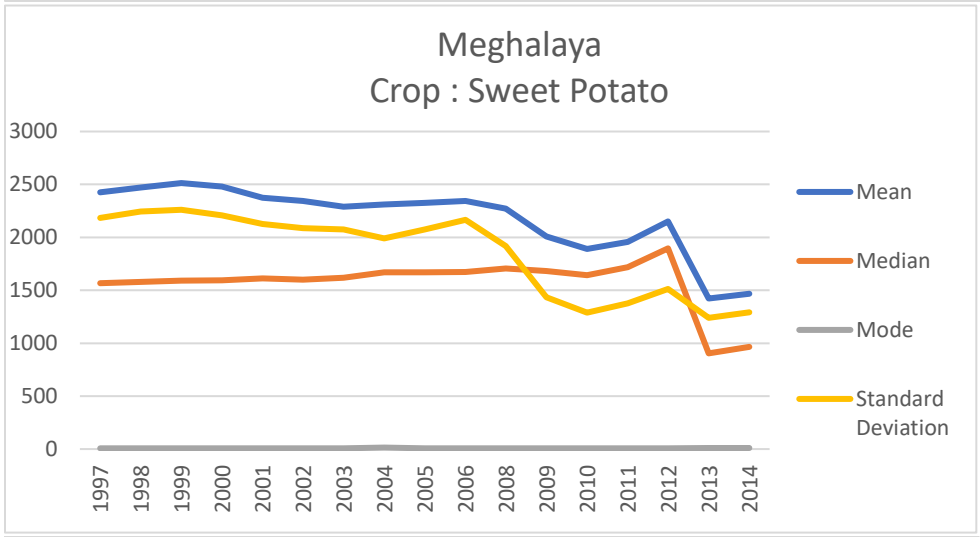
- The cultivation of crops reflects regional farming practices. In Meghalaya, low productivity of peas and beans results from inadequate cropping methods, poor-quality seeds, and water stress during dry winters, as identified by scientists.

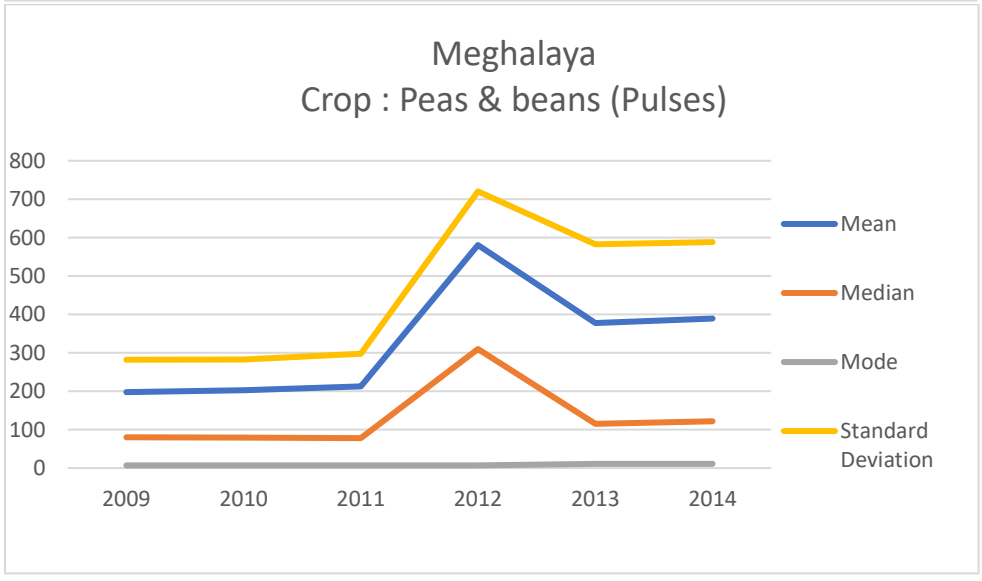
- Uttar Pradesh is a significant rice-producing state in India, while in Meghalaya, rice is a staple crop intricately linked to monsoon patterns and sustainable power sources.

- <u>Mean, Median, Mode and Standard Deviation of the crops in both the states :</u>




Uttar Pradesh
Crop : Peas & beans (Pulses)
25000
20000
15000
10000
5000
0
1997 1998 1999 2000 2001 2002 2003 2008 2009 2010 2011 2012 2013 2014
Mean
Median
Mode
Standard Deviation


Meghalaya
Crop : Sweet Potato
3000
2500
2000
1500
1000
500
0
1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2008 2009 2010 2011 2012 2013 2014
Mean
Median
Mode
Standard Deviation


Meghalaya
Crop : Peas & beans (Pulses)
800
700
600
500
400
300
200
100
0
2009 2010 2011 2012 2013 2014
Mean
Median
Mode
Standard Deviation

Inference:

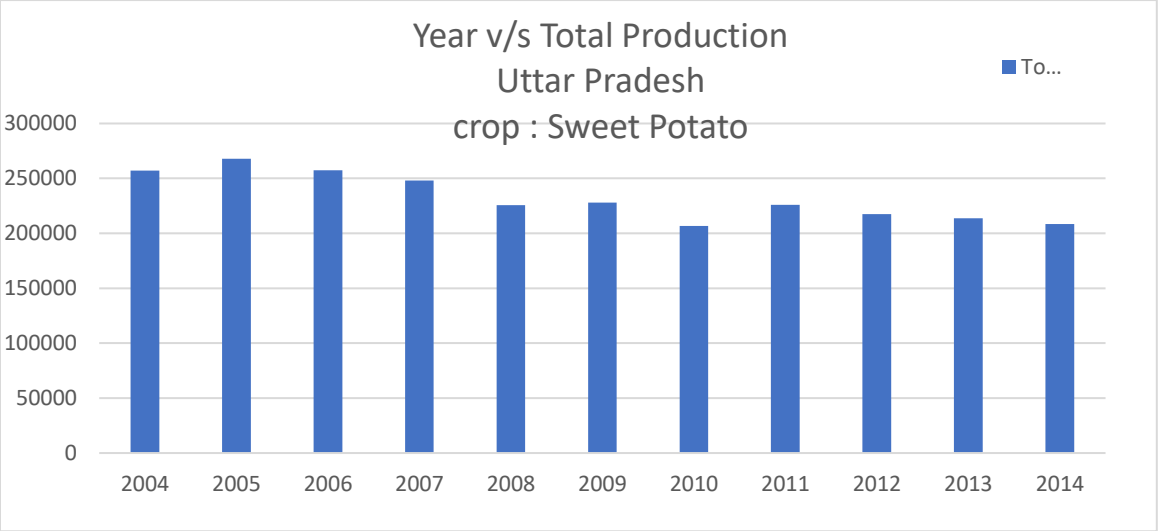
- The average production of sweet potatoes and peas and beans (pulses) in Uttar Pradesh has remained relatively constant over the years, with the exception of a noticeable decline in the average production of peas and beans between 1999 and 2000. This dip in productivity may be attributed to climate change and reduced rainfall during that period.

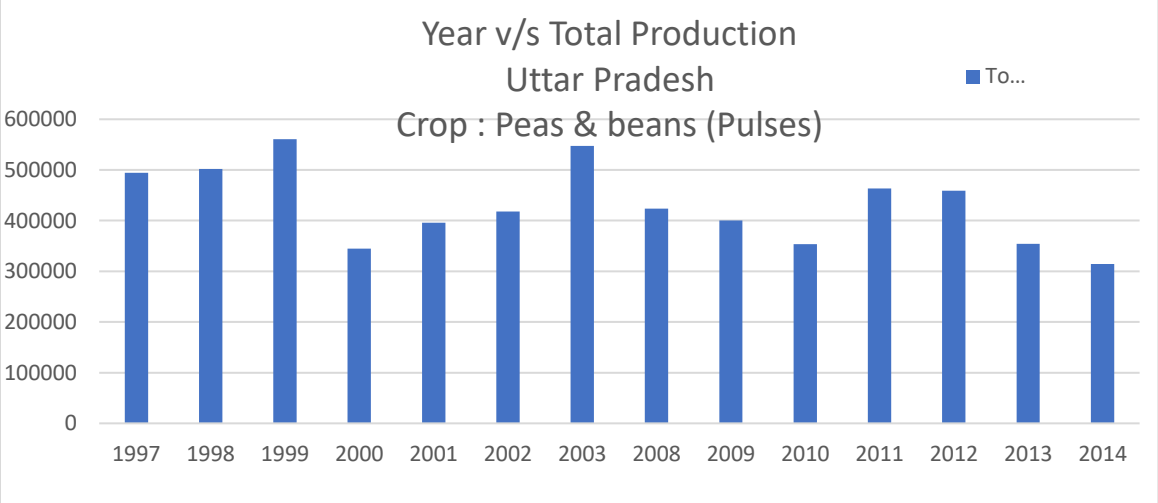
- In contrast, the average production of sweet potatoes in Meghalaya exhibited stability from 1997 to 2008, but a subsequent decline in production emerged after 2008. This decline could potentially be attributed to an increase in annual rainfall in the region during those years, impacting crop yields adversely.

- Similarly, the average production of peas and beans (pulses) in Meghalaya remained consistent from 2009 to 2011, followed by a significant upswing in production in 2011 and 2012. However, this was followed by a substantial decrease in average production from 2012 to 2013. On the whole, there has been an overall increase in the average production of peas and beans (pulses) in the state of Meghalaya, despite these fluctuations.

- These patterns in crop production underscore the influence of climate and environmental factors on agricultural outcomes, highlighting the need for adaptive strategies in response to changing conditions.

- Year v/s Production (Uttar Pradesh)



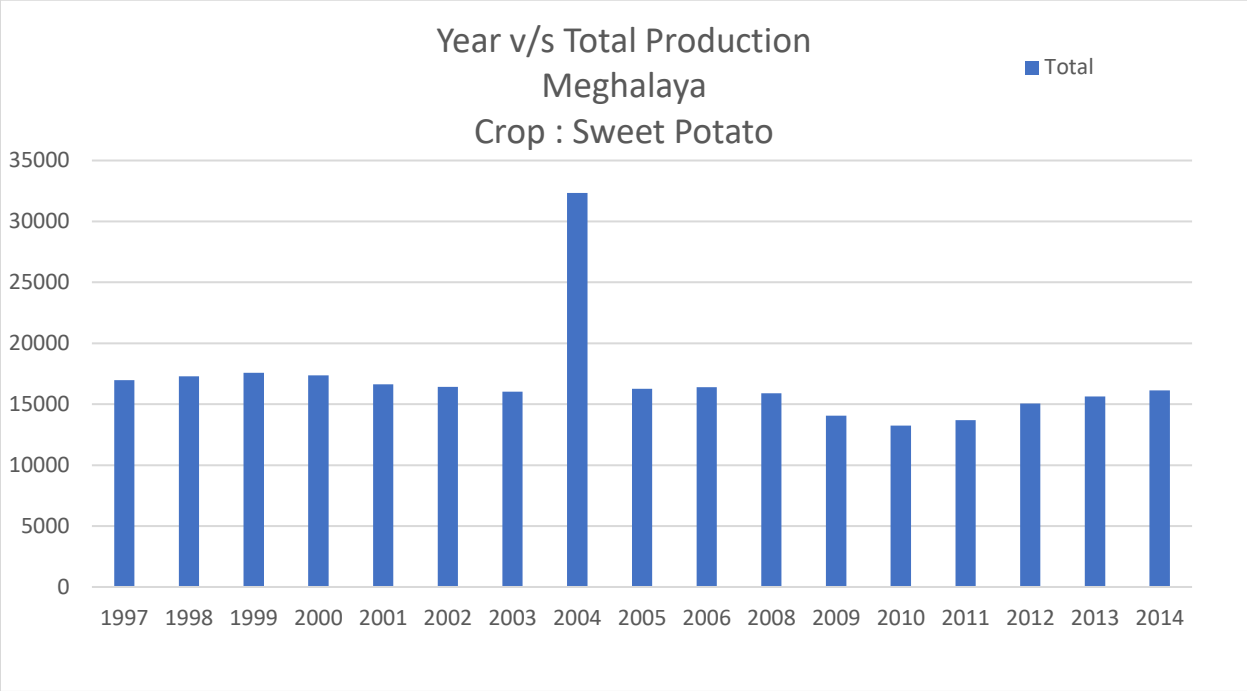


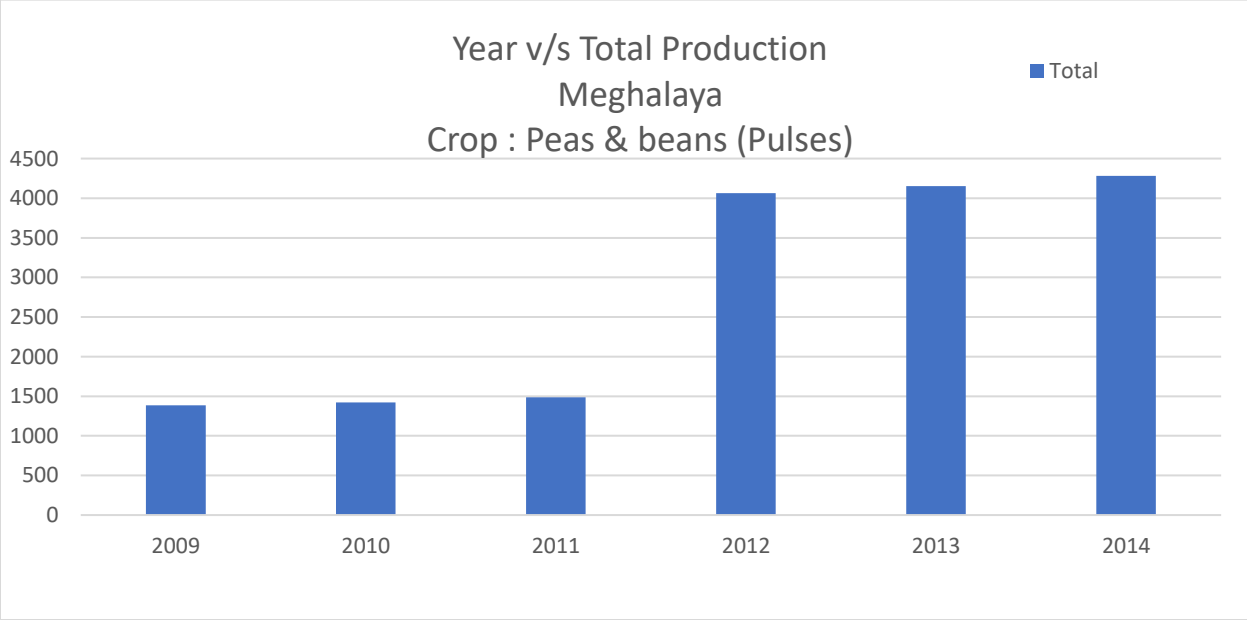
Inference:

- The government of Uttar Pradesh has actively promoted sweet potato production due to its high nutritional value and suitability for the region's sandy soil. This concerted effort resulted in increased sweet potato production from 2004 to 2014, as indicated in the graph.

- Conversely, the production of peas and beans (pulses) in the period 1997 to 2014 experienced a slight decline, possibly due to factors like low rainfall, poor seed quality, and suboptimal farming practices.

- Year v/s Production (Meghalaya)





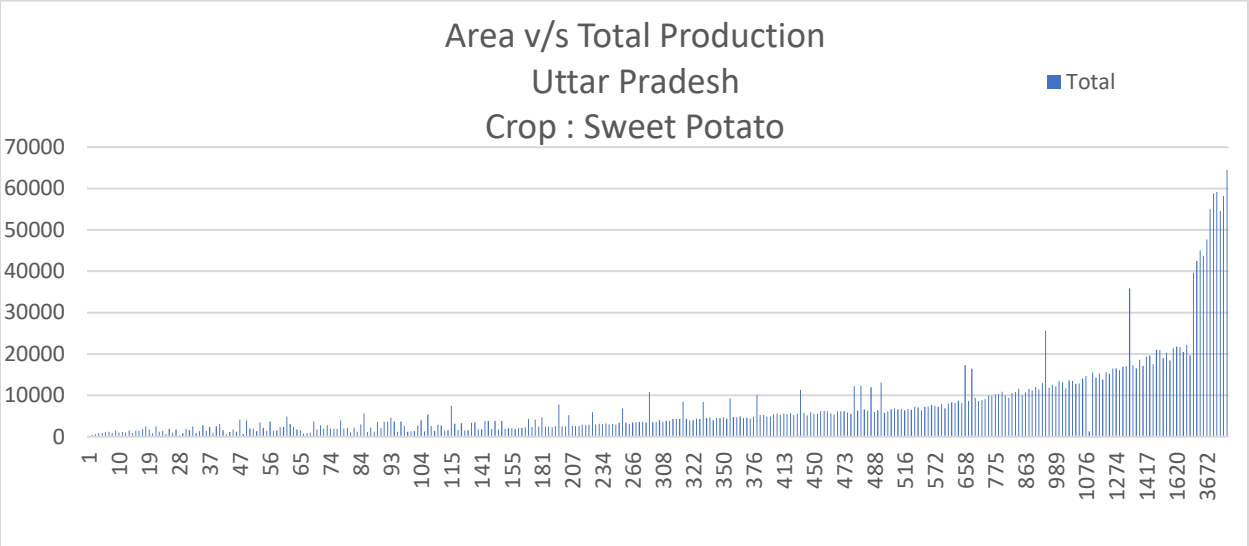
Inference:

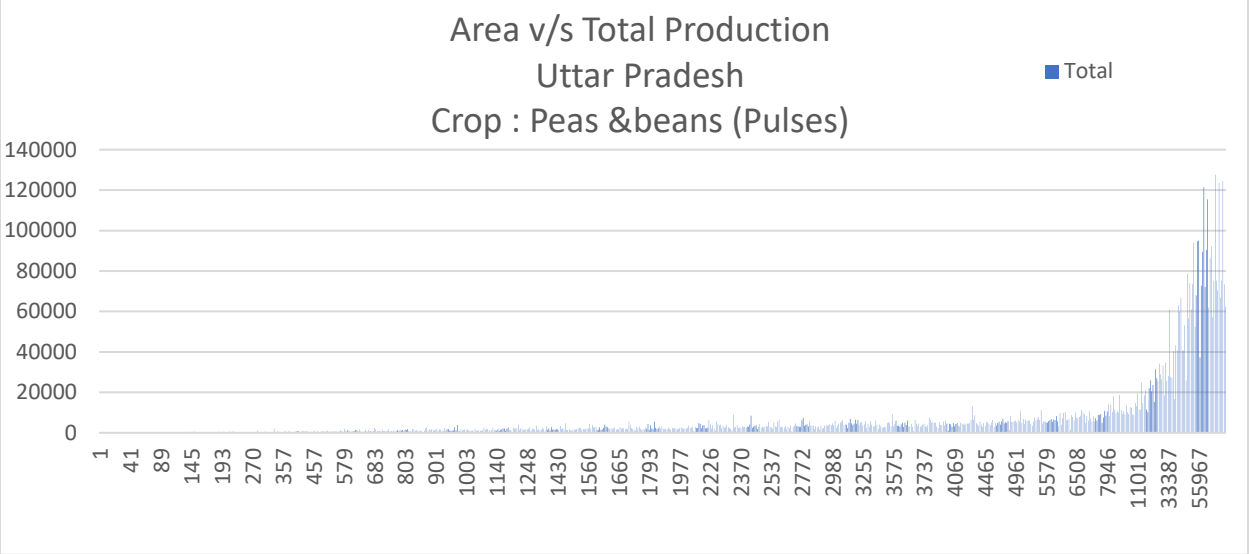
- The production of sweet potatoes remained relatively stable over the years from 1997 to 2014, with a notable peak in the year 2004 when the total production exceeded 30,000 units. This significant increase in sweet potato production in 2004 could potentially be attributed to shifts in climate and rainfall patterns, which can significantly impact crop yields. Conversely, the lowest production, as depicted in the graph, was observed in the year 2010, signifying potential fluctuations in environmental conditions during that period.

- In contrast, the production of peas and beans (pulses) displayed a gradual upward trajectory, commencing in the year 2009 and culminating in peak production in 2014. This progressive increase in pulse production may be indicative of improved agricultural practices, better seed quality, or possibly more favorable climatic conditions during those years. Such trends highlight the intricate interplay of environmental factors and agricultural practices in shaping crop production outcomes.

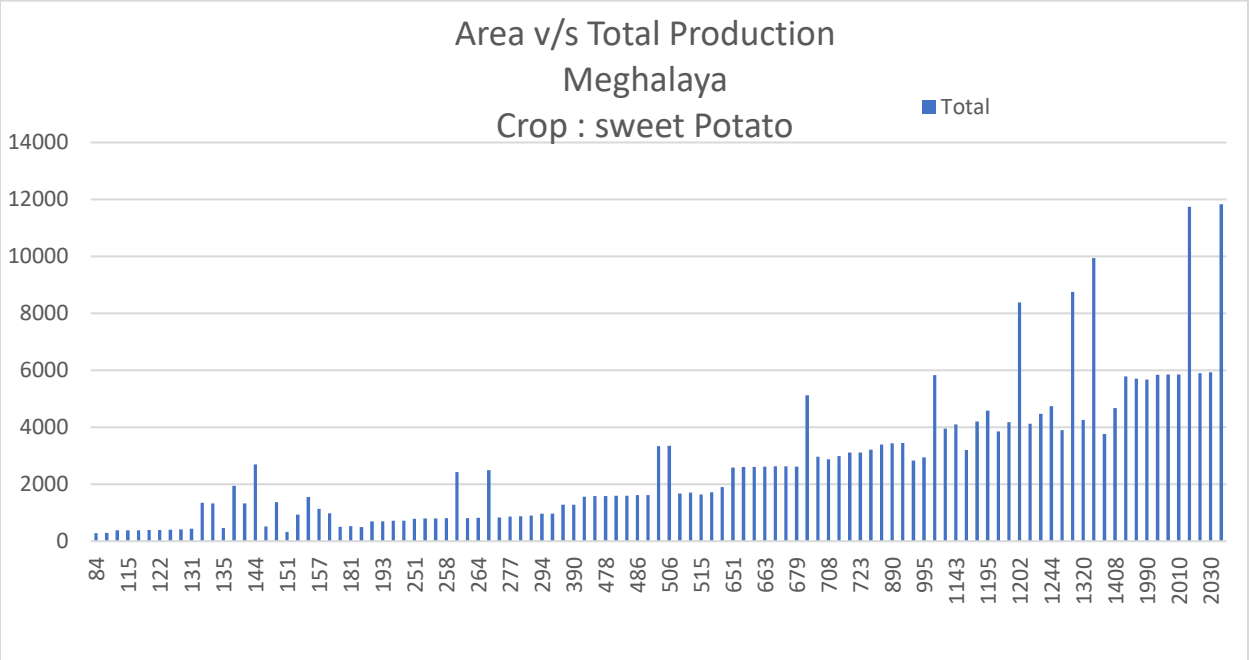
- Area v/s Production

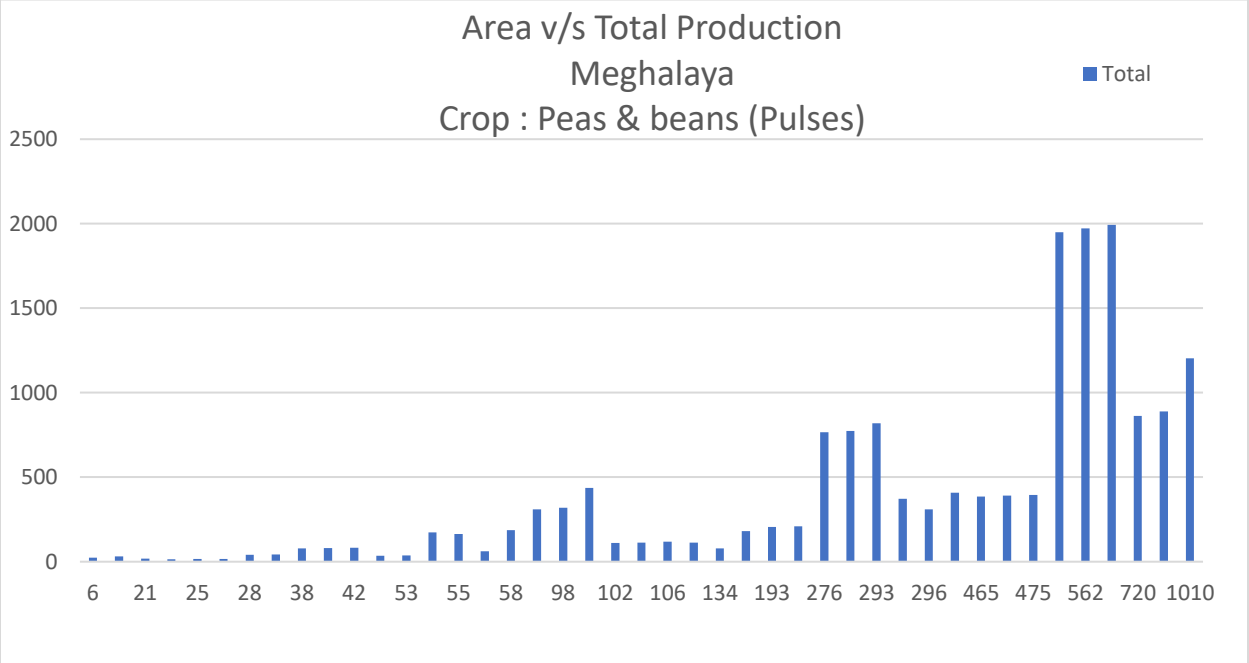
Uttar Pradesh :


Area v/s Total Production
Uttar Pradesh
Crop : Sweet Potato
Total
70000
60000
50000
40000
30000
20000
10000
0
1
10
19
28
37
47
56
65
74
84
93
104
115
141
155
181
207
234
266
308
322
350
376
413
450
473
488
516
572
658
775
863
989
1076
1274
1417
1620
3672


Area v/s Total Production
Uttar Pradesh
Crop : Peas &beans (Pulses)
Total
140000
120000
100000
80000
60000
40000
20000
0
1
41
89
145
193
270
357
457
579
683
803
901
1003
1140
1248
1430
1560
1665
1793
1977
2226
2370
2537
2772
2988
3255
3575
3737
4069
4465
4961
5579
6508
7946
11018
33387
55967

Meghalaya :



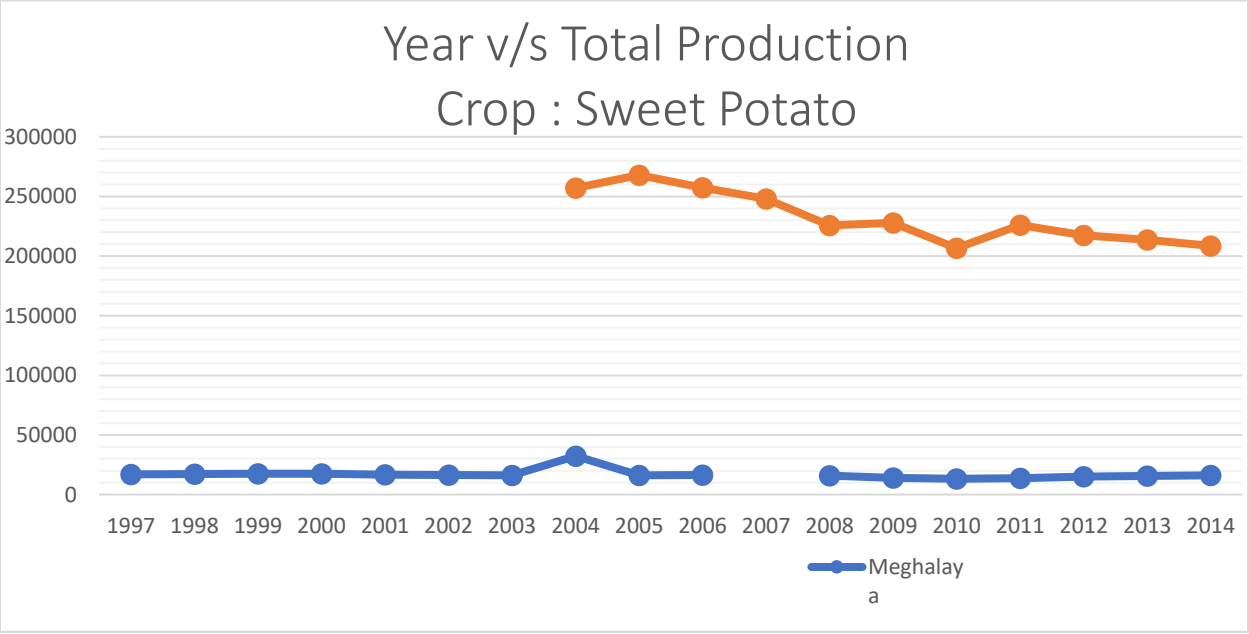


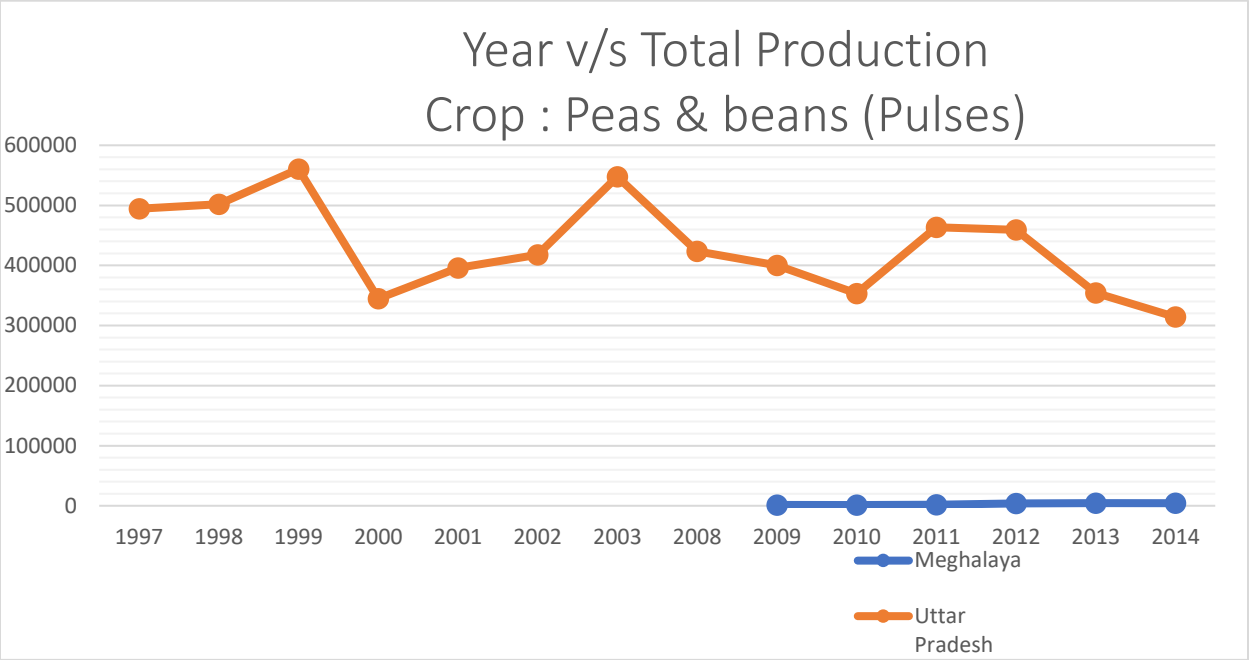
Inference:

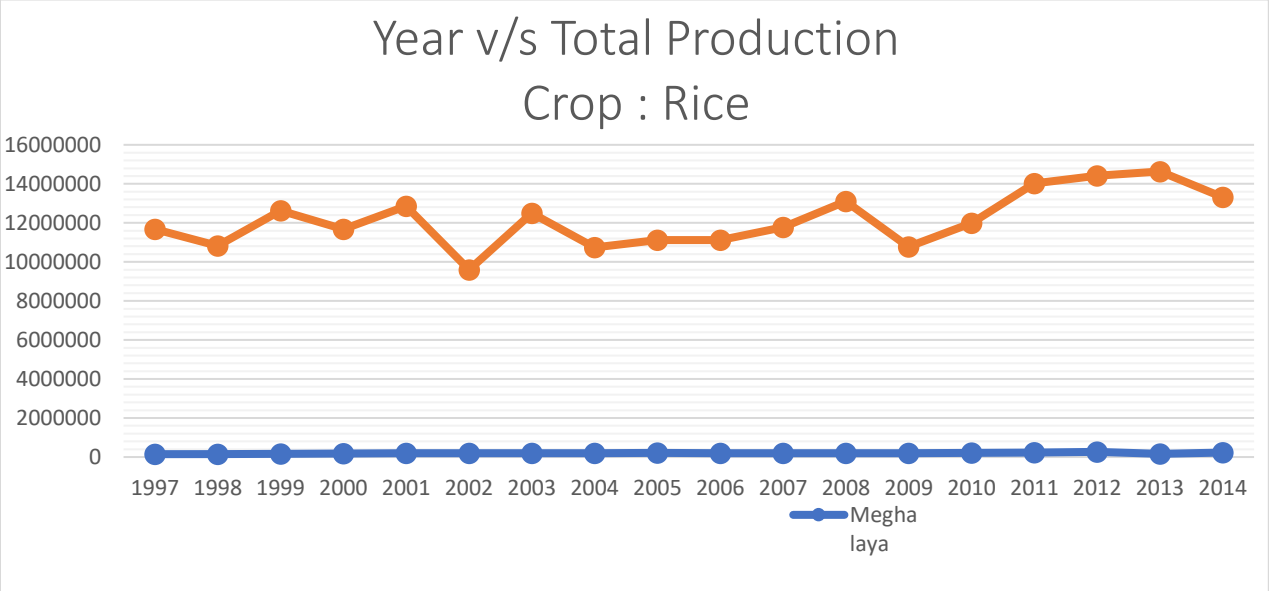
- An analysis of the Area vs. Production charts for both Uttar Pradesh and Meghalaya reveals distinct trends in crop cultivation. In Uttar Pradesh, crops like Peas and beans (Pulses) and sweet potatoes in both states demand a significant amount of cultivation area, reflecting their importance in the agricultural landscape.

- Conversely, in Meghalaya, the cultivation area allocated to Peas and beans (Pulses) is comparatively smaller. This deviation can be attributed to factors such as lower demand, challenges associated with poor seed quality, suboptimal farming practices, and less favorable climatic conditions, which collectively contribute to the reduced land usage for pulse cultivation in Meghalaya.

- <u>Comparative Study of the common in both the States :</u>







Inference:

- The substantial disparity in sweet potato production between Uttar Pradesh and Meghalaya can be attributed to a combination of factors, including government policies, climate suitability, and effective irrigation techniques. While Uttar Pradesh boasts high sweet potato production, Meghalaya maintains a consistent albeit lower production rate.

- In the case of Peas and beans (Pulses), Uttar Pradesh exhibits significantly higher production levels compared to Meghalaya, despite experiencing fluctuations as indicated by the graph. Conversely, Meghalaya's lower production of Peas and beans (Pulses) suggests that it is not a staple dietary component for the local population.

- Regarding rice production, both states demonstrate a relatively constant trend, with fluctuations in Uttar Pradesh. The inclusion of rice in the staple diet of residents in both Uttar Pradesh and Meghalaya is evident. It's worth noting that the lower rice production in Meghalaya, as depicted in the graph, could be influenced by the higher population and larger farming area in Uttar Pradesh, underscoring the intricate dynamics of agriculture in these regions.

- <u>Regression Line and Prediction of total Production of the years 2016 to 2022 :</u>

  The following graphs display regression lines representing the production trends of sweet potatoes, Peas and beans (Pulses), and rice in both Uttar Pradesh and Meghalaya. Additionally, these graphs provide projections for crop production spanning the years 2016 to 2022.

Uttar Pradesh :

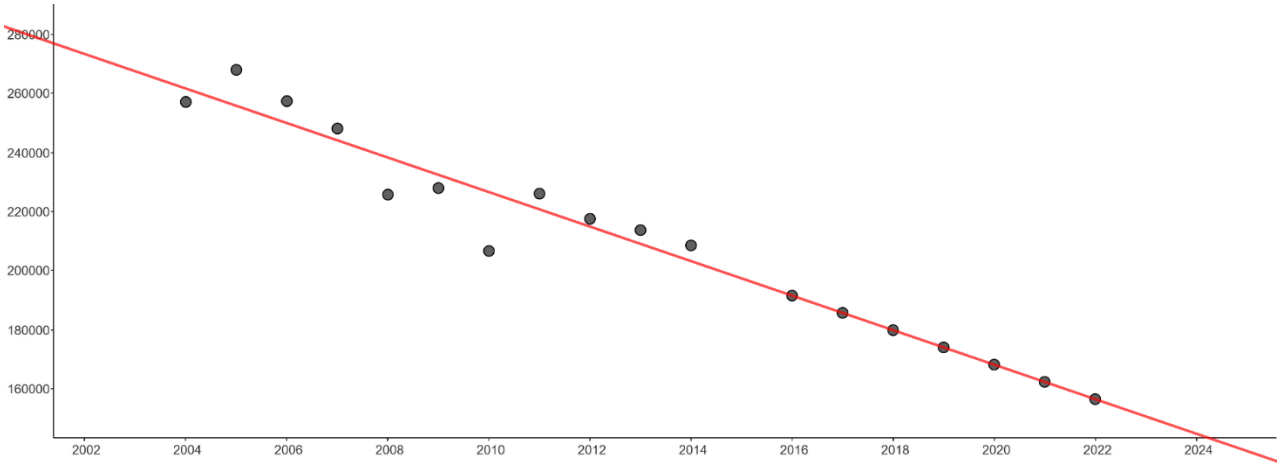
1. Sweet Potato

.

Year	Production
2004	257051
2005	267901
2006	257323
2007	248042
2008	225694
2009	227909
2010	206633
2011	226031
2012	217506
2013	213687
2014	208515

Predictions of the years 2016 to 2022 using GeoGebra

year	production
2016	191531.18
2017	185694.18
2018	179857.18
2019	174020.18
2020	168183.18
2021	162346.18
2022	156509.18



2. Peas and beans (Pulses)

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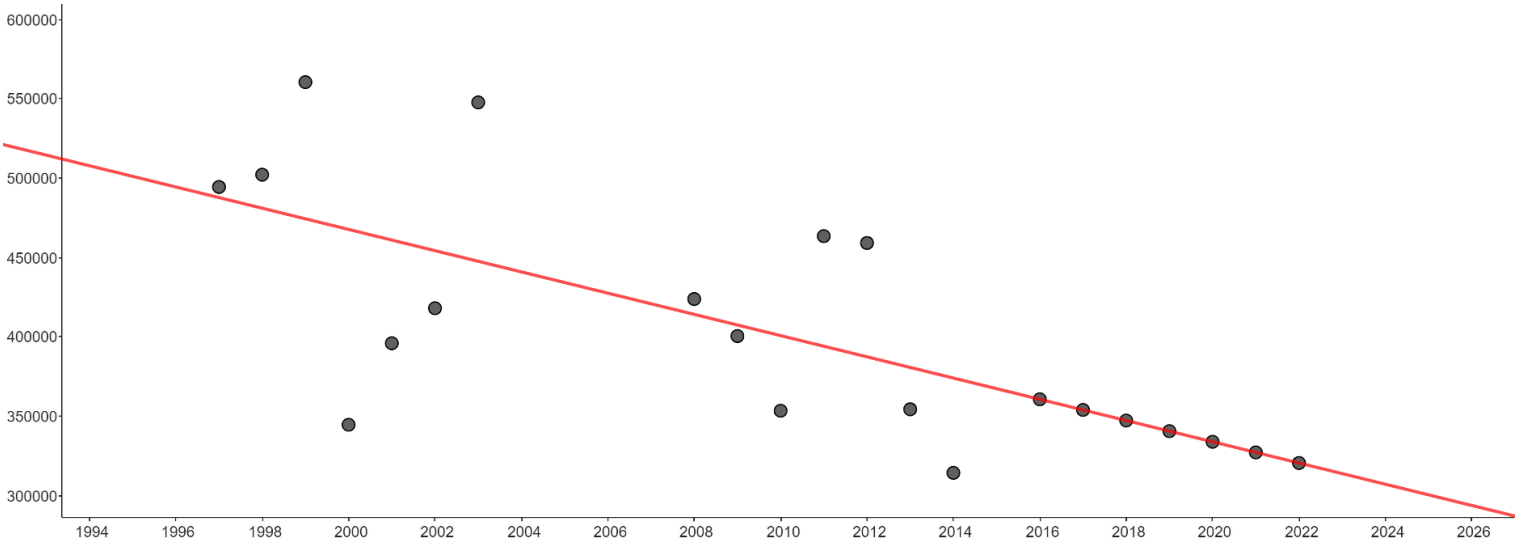
Year	Production
1997	494378
1998	502108
1999	560444
2000	344524
2001	395889
2002	417961
2003	547690
2008	423753
2009	400401
2010	353322
2011	463374
2012	459077
2013	354267
2014	314196

Predictions of the years 2016 to 2022 using GeoGebra

year	Production
2016	360555.79
2017	353864.62
2018	347173.44
2019	340482.26
2020	333791.09
2021	327099.91
2022	320408.74



3. Rice

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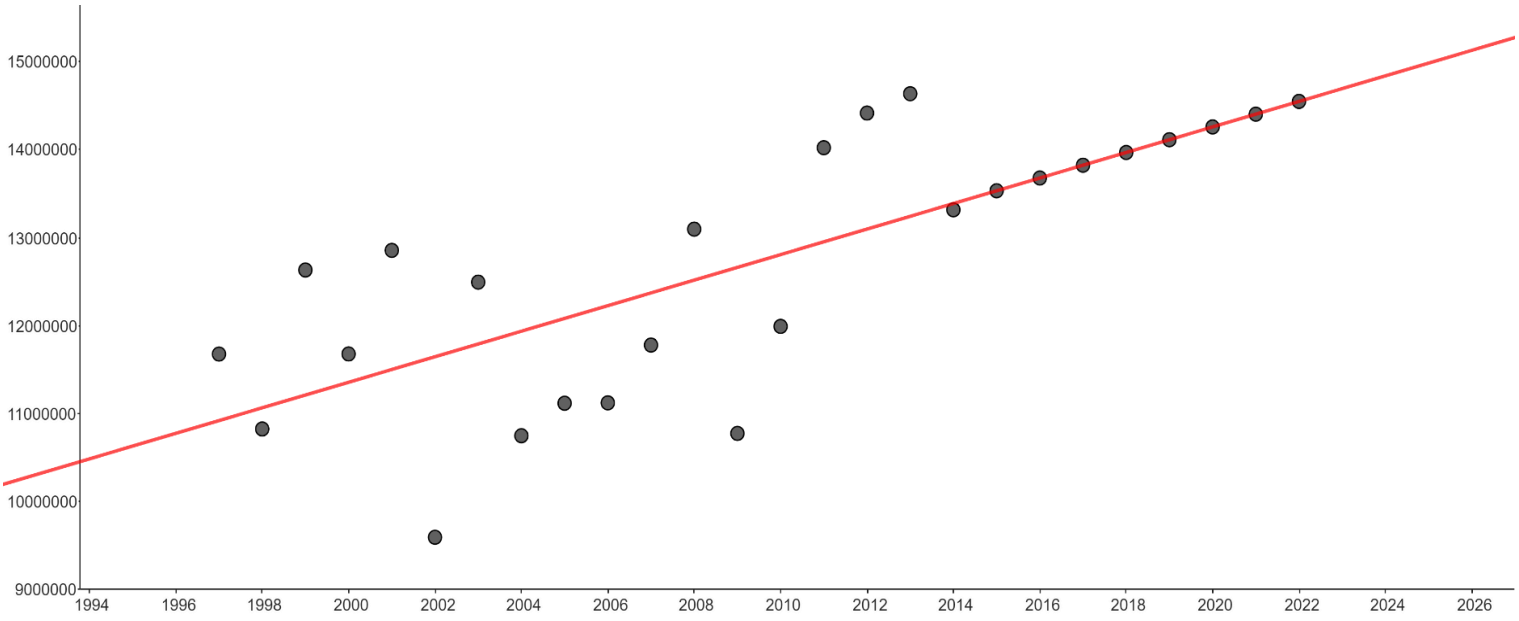
Year	Production
1997	11677947
1998	10826635
1999	12632709
2000	11679149
2001	12855857
2002	9596346
2003	12494939
2004	10749989
2005	11119095
2006	11123613
2007	11780112
2008	13097031
2009	10776504
2010	11992299
2011	14022392
2012	14415939
2013	14635836
2014	13316967

Predictions of the years 2016 to 2022 using GeoGebra

year	Production
2015	13533161.6
2016	13678211.6
2017	13823261.6
2018	13968311.6
2019	14113361.6
2020	14258411.6
2021	14403461.6
2022	14548511.59



Inference :

- As depicted in the graph, there is a projected decrease in sweet potato and Peas and beans (Pulses) production in Uttar Pradesh. These declines may be attributed to multiple factors, including weather patterns, soil conditions, and cultivation practices.

- Conversely, the graph suggests an anticipated increase in rice production in Uttar Pradesh, a prediction made through the use of GeoGebra software. This underscores the value of predictive tools in agriculture, aiding in informed decision-making to meet evolving agricultural needs.

Meghalaya:

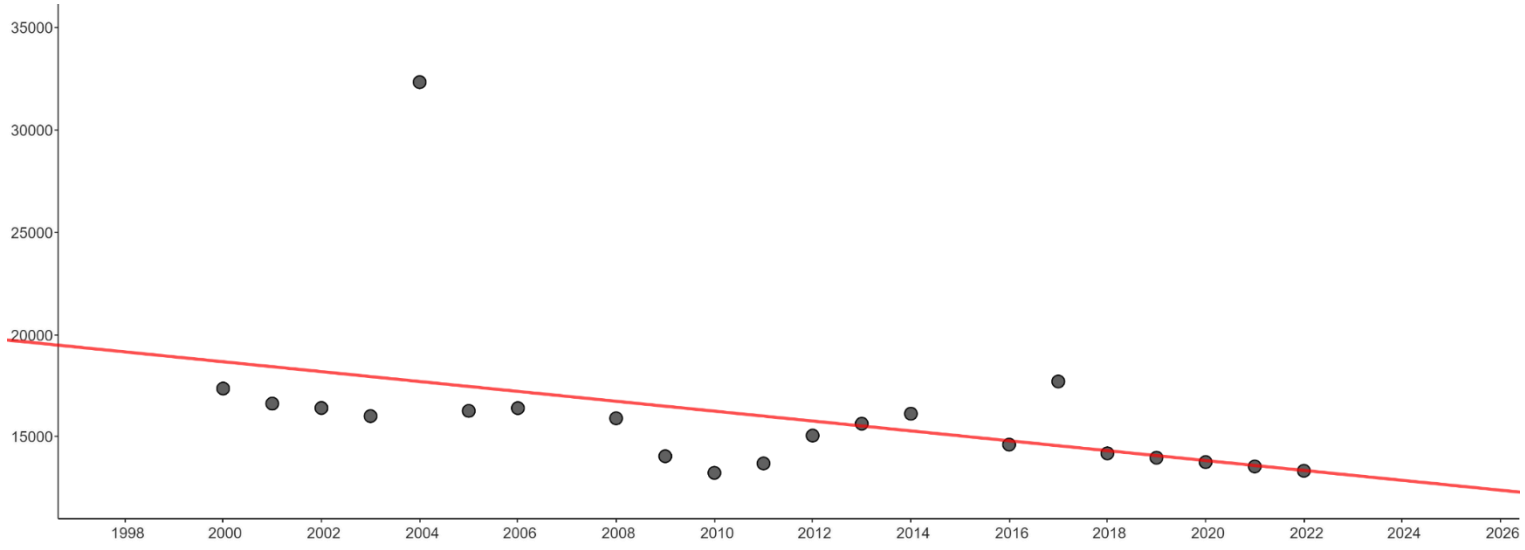
1. Sweet Potato

.

Predictions of the years 2016 to 2022 using GeoGebra

Year	Production
1997	16978
1998	17291
1999	17591
2000	17363
2001	16627
2002	16412
2003	16016
2004	32344
2005	16270
2006	16406
2008	15909
2009	14053
2010	13241
2011	13701
2012	15063
2013	15644
2014	16133

Year	Production
2016	14622.9
2017	17709.35
2018	14195.73
2019	13982.11
2020	13768.49
2021	13554.87
2022	13341.25

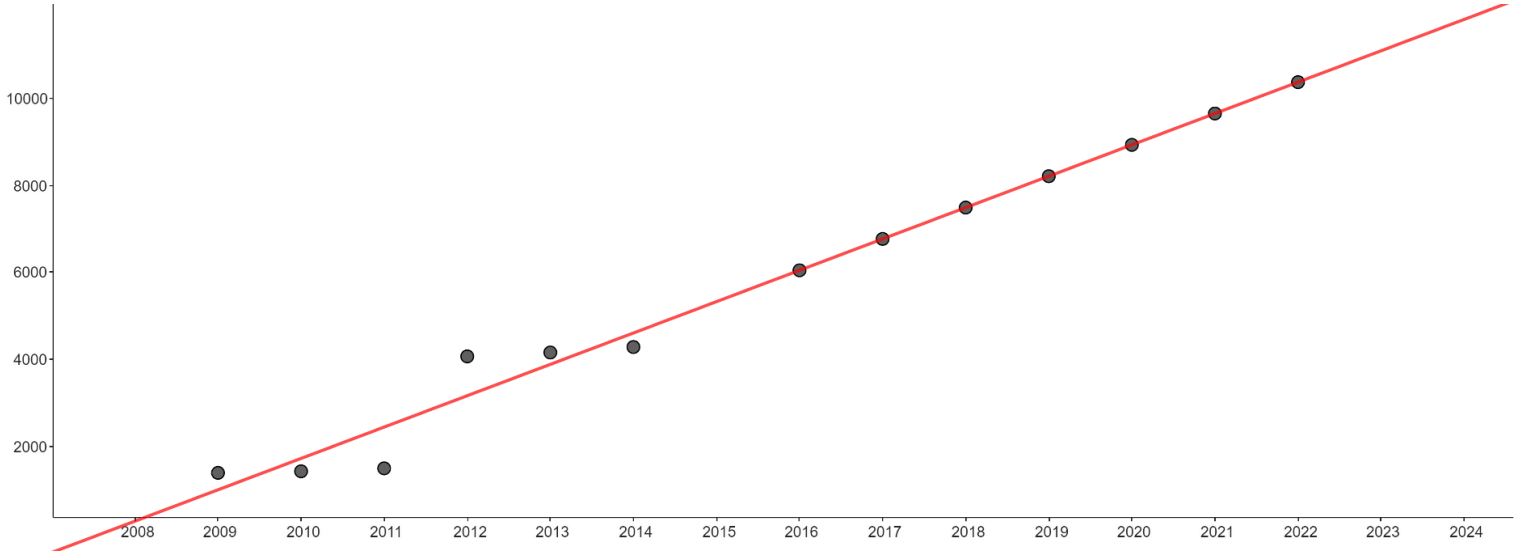


2. Peas & beans (Pulses)

. Predictions of the years 2016 to 2022 using GeoGebra

Year	Production
2009	1384
2010	1420
2011	1488
2012	4064
2013	4154
2014	4280

Year	Production
2016	6045.79
2017	6767.45
2018	7489.1
2019	8210.76
2020	8932.42
2021	9654.08
2022	10375.73



3. Rice

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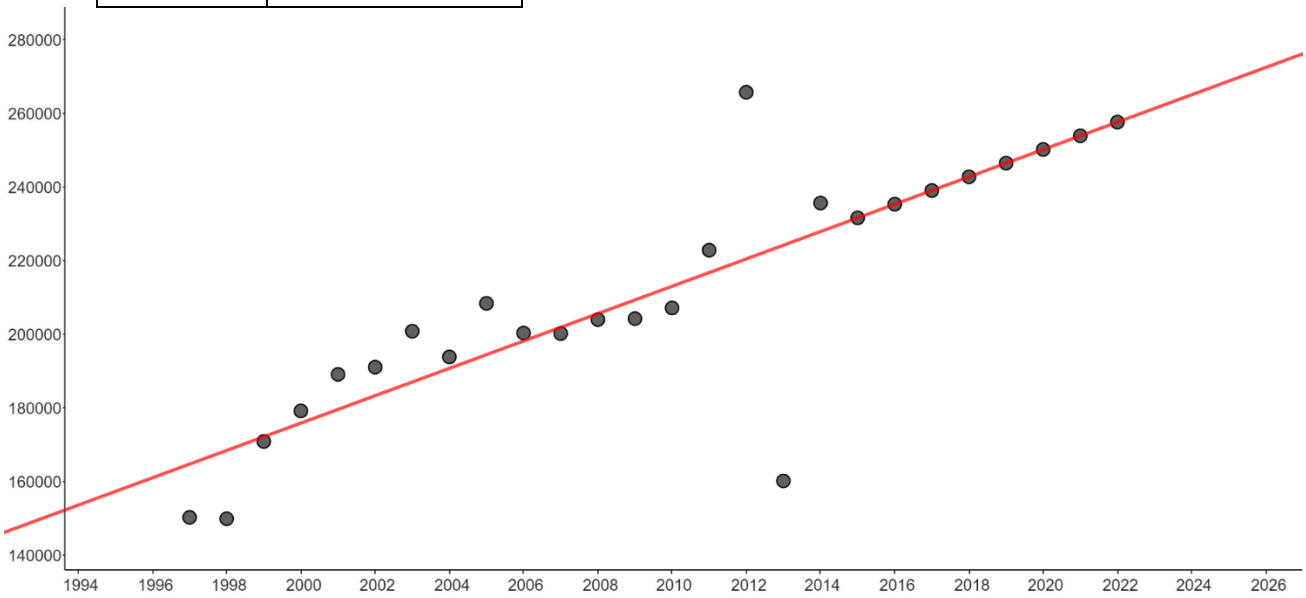
Predictions of the years 2016 to 2022 using GeoGebra

Year	Production
1997	150101
1998	149742
1999	170733
2000	179042
2001	188971
2002	190937
2003	200703
2004	193719
2005	208277
2006	200209
2007	200077
2008	203862
2009	204129
2010	207021
2011	222731
2012	265653
2013	160016
2014	235551

Year	Production
2015	231515.4902
2016	235233.6471
2017	238951.8039
2018	242669.9608
2019	246388.1176
2020	250106.2745
2021	253824.4314
2022	257542.5882



Inference:

- As indicated in the graph above, there is an anticipated decline in sweet potato production in Meghalaya. This decline could be attributed to multiple factors, including weather conditions and soil cultivation practices.

- Conversely, the graph suggests an expected increase in Peas and Beans (Pulses) production in Meghalaya, likely influenced by the region's favorable climate for pulse cultivation and other contributing factors.

- Similarly, the projection using GeoGebra software indicates a forthcoming rise in rice production in Meghalaya from 2016 to 2022. This highlights the utility of technology in predicting agricultural trends.

- Conclusion :

To sum up, the data and analysis provide important insights into farming in Uttar Pradesh and Meghalaya:

1. **Production Patterns:** The production of various crops, like sweet potatoes, peas and beans (pulses), and rice, is shaped by a mix of factors such as climate, government policies, and farming methods.

2. **Steadiness and Changes:** Some crops, such as sweet potatoes and rice, stay relatively steady in production over time. Others, like peas and beans (pulses), see fluctuations, often linked to changes in weather and how farmers work.

3. **Different Land Use:** The two states allocate land differently. Uttar Pradesh dedicates more land to crops like sweet potatoes and pulses due to higher demand and government support. Meanwhile, Meghalaya faces unique challenges like tough weather and lower demand for certain crops.

4. **Forecasting with Technology:** Using tools like GeoGebra software helps predict future crop production, giving valuable insights for smart decisions in farming.

In a nutshell, farming involves many factors, and it's crucial to adapt to changing conditions in both states.