Statistical Analysis on Turmeric Production and Price Movement in Tamil Nadu

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Abstract:

Since ancient times, agriculture has been one of the chief factors in the advancement of many nations. Also, it has been a huge contributor to the GDP (Gross Domestic Product). But the farmers and the small-scale retailers are still unaware of the demand and supply of the commodities in mandis. Ultimately, they are compelled to use the repetitive pattern of crops. Through knowledge of the intra-mandi prices for seasonal crops is necessary to gain the desired profit. Price trends in several Tamilnadu markets were investigated for Turmeric in order to forecast price volatility and problems that produce mandi-level projections, enhancing its usefulness. Given that medicinal crops have various medical and culinary uses, boosting their productivity could increase farmers' profits in comparison to typical pattern crops. So, the aim of this study is to evaluate the optimum preferred crop conditions for Turmeric with respect to profit. A data from the past decade was screened to observe the variation in prices of the crops along with production analysis. Also, it was validated statistically by various statistical measures like Standard Deviation, Mean and Coefficient of Variation. We examined intra-mandi prices and found that prices fluctuate over the whole peak season, with notable fluctuations in modal prices among several mandis. To demonstrate the variations in pricing reported for certain mandis on specific days, we've given a few instances. A low standard deviation implies that the commodities price is clustered around the mean, whereas a large standard deviation shows that the commodities price is more dispersed. Price volatility is the discrepancy between what is anticipated and what occurs.

Keywords: Agriculture, Turmeric, Marginal farmers, Price Movement

Introduction

The art and science of cultivating the soil, growing crops, and raising livestock are known as agriculture. After China and the US, India has the third-largest economy in the world with a $2.1 trillion economy. In India, about 80% of the world's population utilizes traditional medicines and forest provides 90% of the herbs and medicinal plants. Our country is a rich repository of medicinal plants. Naturally occurring medicinal plants are very beneficial, either directly or as a component of medications used in our traditional Indian system of medicine or a foreign system of medicine. India is a second-largest producer of rice, wheat, sugarcane, groundnuts, veggies, and other naturally grown goods. History reveals that civilizations have always thrived in areas with excellent agricultural yields that are closer to rivers. A country will always struggle to maintain its economic progress without a solid agricultural foundation. This is mainly because it won't be able to satisfy the economy's demand for food. It not only meets the state's food needs but also provides a significant amount of jobs. Health-related research in agricultural and food systems covers a wide range of subjects. The development and quality of medicinal plants are preserved in some areas of the nation where monsoons occur frequently, rainfall is abundant, and a temperate climate is predominant. Farmers in state do not get desired profit cause of the erratic monsoon, rainfall, arid climate, and high temperatures. Farmers have used a variety of strategies to get beyond the limitations of traditional methods. They can increase their revenues by using technology-supported intelligent tactics for marketing their produce and yield planning. The State Forest Development Department and the Department of Indian Medicine and Homeopathy have created arrangements to gather various goods, including wild ones, although Ayurvedic pharmacies are located throughout the state. Nevertheless, the amount is still insufficient for the drug industry. Some therapeutic plants are going extinct or even facing extinction because of the ongoing and excessive gathering of valuable plants and the shrinking forest space. Such plants need to be preserved and protected or restored to their native, natural environments. Additionally, there is a

substantial disparity between the supply and demand of medicinal plants, which has an impact on the quality of the plants. It is crucial to make sure that pure and enough raw materials are available. In such cases, systematic cultivation techniques for some species must be established. Some of the state's innovative and forward-thinking farmers are considering growing therapeutic plants. Past years have seen a significant advancement in technology. With the use of contemporary digital devices and Artificial Intelligence to create solutions for smart agriculture, the explosion of digitized data and developments in Information and Communication Technology can play a critical role in achieving digital agriculture. The National Agriculture Market (eNAM) is a pan-Indian electronic trading site that connects the Agricultural Produce Market Committee (APMC) mandis in order to establish a unified national market for agricultural commodities, which enable rural businesses to provide value-added services, rural people to realize their full potential, and farmers to boost their profitability by having access to fair markets.

Major Cultivation: Districts of Tamilnadu

Many medical professionals have recommended increasing the body's immune system in the current situation where the entire world is trying to find a solution for the Covid-19 pandemic. This can assist to lessen the effects and speed recovery from the illness. The use of medicinal herbs has proven to be a lifesaver in this awful situation. In Tamil Nadu, Erode district is the largest district in turmeric cultivation by contributing 24.14 per cent of the total area and 33.37 per cent of the total production (Statistical Hand Book of Tamil Nadu, 2016, Government of Tamil Nadu).

For experimental analysis data was obtained from Ag mark net website which is manage by Indian government. Figure 1 represents major cultivation producing districts of Tamilnadu region for Raw Turmeric.

Issues that Impact Small Scale Farmer's Income

- Unfair market price
- Lack of supply chain between Producer and consumer
- Lack of linkage between producer and Consumer
- Lake of standardization of Medicinal plants
- Lake of awareness for medicinal crop and their production profit
- Limited resources for research (Research is limited to certain medicinal crops only)
- Lake of support from the government towards the production of medicinal plants
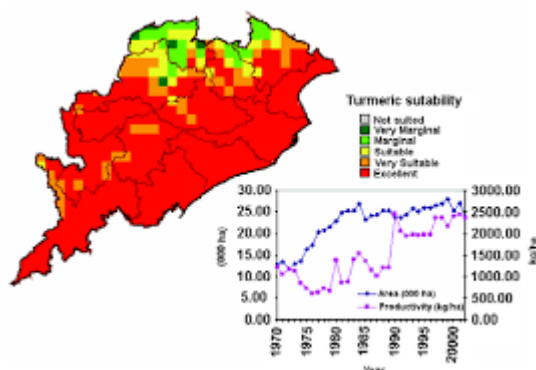- Lake of availability of marketplace for their produce

Fig. 1: Raw Turmeric Producing region of Tamilnadu

Factors Influencing Cultivation of Commodities:

Cultivation is performed to enhance root vital nutrients and moisture in the soil, to allow for improved root growth and consequently better tree anchorage, and to enhance the quality of planting. Plant growth is primarily influenced by four variables: light, water, temperature, and nutrients. These four components have an impact on the hormones that regulate plant growth, affecting how rapidly or slowly the plant grows. Plant stress can result from any one of the four alterations, which can either improve or inhibit growth. Altitude is the main factor influencing the cultivation of medicinal plants. As altitude increases, the temperature and air pressure decrease while the wind speed, relative humidity, and light intensity all increase. As a result of the shifting climate with height, the pattern of vegetation also changes. The most typical altitude for growing tea, cinchona, and eucalyptus is between 1000 and 2000 metres. Unlike cinnamon, cardamom, and other spices, which must be produced at elevations of 1,000 metres or above, senna can be grown at sea level. Another crucial element in the cultivation of the medicinal plant is temperature and humidity. Drought and desiccation eventually lead plants to perish.

Sudden drops in temperature led to the production of ice crystals in the intercellular spaces of the plants. Changes in temperature have an impact on how quickly photosynthesis occurs. With an increase in temperature, breathing becomes more rapid. Water vapors, a type of humidity, are present. Atmospheric humidity refers to this. Indicative of humidity are clouds and fog. In plants, humidity impacts transpiration, shape, and structure. Most plants, with the exception of xerophytes, require water, correct irrigation, and enough rainfall for growth. Rainwater is the primary source of water for the soil. The amount of precipitation and snowfall significantly influences the weather. Plants absorb the water-dissolved soil minerals after they have been dissolved. Water affects a plant's physiology and morphology. Since it helps all plants develop, soil is the most crucial natural resource. In addition to providing mechanical support and anchoring, soil also contains vital plant food components. Soil fertility is the ability of the soil to provide plants with the necessary amounts and ratios of nutrients as well as a favourable environment for plant growth give nutrients and a chemical foundation for growth. Generally, the soil is the loose, shallow upper layer in which plants can grow and get nutrients.

Factors affecting crop cultivation

- Water.
- Wind.
- Sunlight.
- Temperature.
- Rainfall.
- Photosynthesis.
- Microbes increase the fertility of the soil.
- Pollinating agents.

One of the most weathered parts of the soil is clay; it is made up of tiny particles that have cohesive and adhesive qualities and can contain nutrients for plant growth that have been lost to leaching. Minerals are responsible for the variation in soil formations, and soil is made up of mineral stuff, air, water, and organic material. Air and water combine to form pores; if half of the pores are filled with water and the other half with air, the result is good aeration for root nutrient absorption. Any form of soil that has less than 0.5 percent organic matter is referred to as poor soil. Organic matter is made up of cleansed and decomposed plant and animal parts. Rich soil is any sort of soil that contains between 1.5 and 5% organic matter. Any sort of soil that ranges in organic matter content from 0.5 to 1.5 percent is referred to as intermediate soil. pH between 6.5 and 7.5.

Alkaline soils can be reclaimed by gypsum, while acidic soils can be limed to produce neutral soil. Leguminous plants cannot grow in acidic soil because nodule bacteria cannot properly develop in these conditions.

Experimental Analysis and Discussion

Popular herb cultivation can turn out to be profitable. The cultivation of therapeutic plants

including Amala, Ajwain, turmeric, and raw turmeric is transforming the agrarian Ayurveda landscape of India and offering farmers exceptional opportunities to boost their revenues.
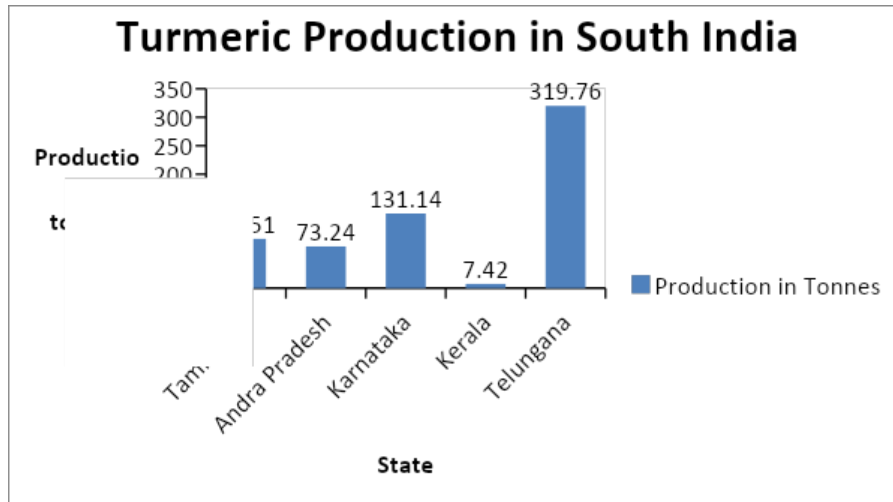

Fig. 2: Turmeric production from January 2010 to September 2020.

   Study of Medicinal Commodities Region and Need

Optimum conditions for various crops are depicted in Table 1–3. Many herbal industries sell turmeric seeds, and powder which helps to avoid flatulence and indigestion.

Table 1: Optimum conditions for Turmeric in South India

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State	Tamil Nadu, Karnataka, Andhra Pradesh, Telangana and Kerala
Weeding	Regular hoeing and weeding are necessary.
Climate	Requires humid climatic condition.
Temperature	The recommended temperature range for seed germination is 20 to 30^0 c
Propagation	The seeds germinate in 6-7 days when they are sown at a rate of 4–8 kg per hectare after being treated with any mercurial seed-dresser at a rate of 3g/kg of seed.
Irrigations	For good productivity [medium heavy soils], it required a total of 15-25 irrigations.
Post harvest technology	In January to March - April, the crop becomes ready for harvest
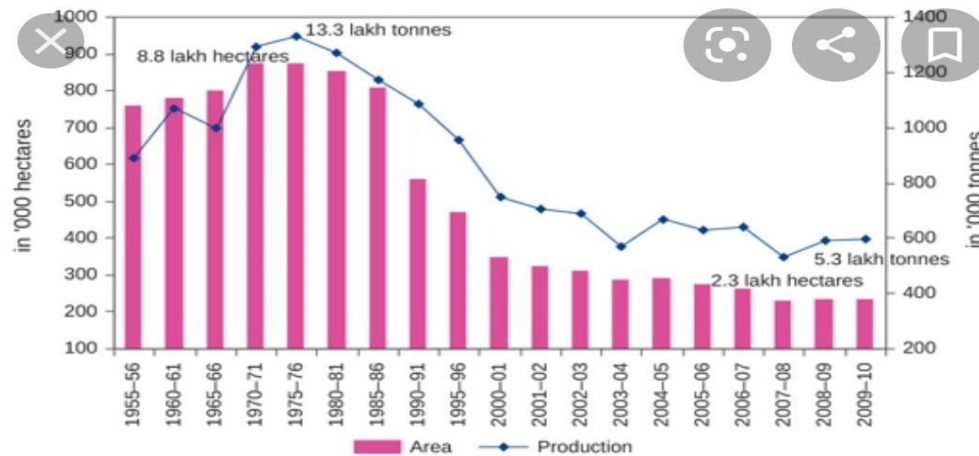
Fig.3:Price variation of Turmeric from 2010 -2020

Dataset for Experimental Analysis

Using historical data from the previous five years, the volatility for the chosen crops was examined for both the Kharif and the Rabi seasons. The volatility measurements foundations were the standard deviation and mean price changes

Analysis of Price Movement for the Past 5 Years

To compute Standard Deviation (1)

$$\text{Standard Deviation} = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} \qquad ...(1)$$

where,

x = value of ith point in the Agri-commodities dataset

$\bar{x}$ = The mean value of the Agri-commodities dataset

n = The number of data points in the Agri- commodities data

The ratio of the standard deviation to the mean is known as the coefficient of variation. With an increase in the coefficient of variation, the mean dispersion becomes more pronounced. Usually, it is expressed as a percentage. A Coefficient of Variation of 20 to 30 is considered appropriate, whereas a Coefficient of Variation of more than 30 is deemed unsatisfactory.

To compute Standard Deviation (2)

Coefficient of Variation = (Standard Deviation / Mean) * 100. ------------------(2)

Table 2: Volatility measures of RAW Turmeric.21

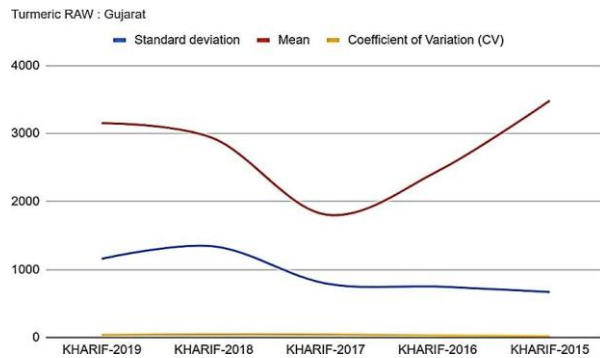| Season	Standard deviation	Mean	Co efficient of variation
KHARIF-2019	66.87	6331.5	1.05
KHARIF-2018	139.12	6556.25	2.121
KHARIF-2017	847.67	6853.25	12.36
KHARIF-2016	248.74	8375	2.97
KHARIF-2015	306.950	6937.5	4.424

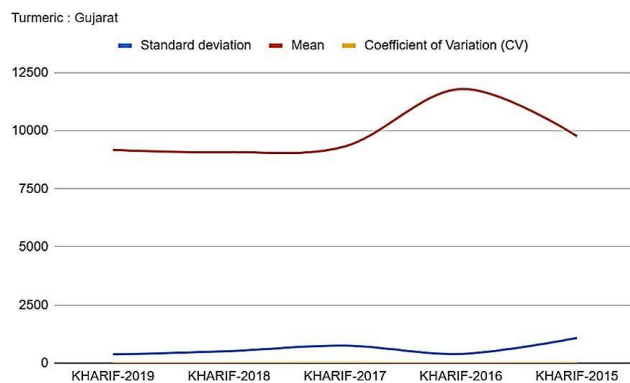Fig. 4: Turmeric RAW price trends during a five-year period.21

Fig. 5: Turmeric price trends for five-year

With increasing price volatility, the standard deviation increases. The standard deviation moves down as price movement becomes more stable. Increased standard deviation in price movements indicates strength or weakness over normal. Short-term spikes in volatility that precede market tops are signs of anxious and unsure traders. Long-term market tops that exhibit declining volatility signify a bull market that is reaching its maturity. Better risk/reward for the asset is indicated by a lower Coefficient of Variation. It doesn't necessarily indicate the return will be higher. It simply implies that it will yield higher return based on the level of risk you are willing to assume to obtain that return. The standard deviation is a measure of how typical or average a value is to the mean. When every number is the same, the standard deviation is 0. As with the mean, outliers have a significant impact on the standard deviation (it uses the mean in its calculation).

Farmers in South India make incredibly little profits. This may be a result of the farmers' low productivity or the low prices they receive for their crops. While the economic policy may be used to address wealth generated, which largely depends on the health of the agricultural sector, productivity generally refers to the technical aspects of farming. The website Agmark Net, which is operated by the Indian government, refers to the gathering of raw data. When intra-mandi pricing was analyzed, it became clear that prices were constantly fluctuating during the peak season, with considerable variations in modal prices among different mandis for the South Indian region. The interaction with marginal farmers led researchers to the conclusion that a variety of factors, including the presence of middlemen, a lack of market information, uneducated farmers, a lack of transportation, and selling produce to nearby markets rather than having to travel great distances to reach the main mandis markets, affect the mandi's price. It has also been suggested that these farmers may only be

receiving a marginal wage for the risk they take and the services they render. Given the persistently high level of price disparity, it is likely that information and transportation costs make only a small difference in the degree of spatial pricing variances. Overall price fluctuation is caused by region-specific, time-invariant characteristics, such as the quality and diversity of local crops, the strength of the neighborhood market, and the soil. Instead of following a routine, marginal farmers might make more money by growing therapeutic plants. As Nutrients in the soil are depleted when the same crop is planted repeatedly on the same plot of land. The excessive use of pesticides and fertilizers required for succeeding crop generations is harmful to the environment and the people who consume the crops.

Table 3:Price discrepancies for Turmeric Raw amongst different mandis

Date	Andhra Pradesh	Kerala	Tamilnadu
01-Jan-14	4790	100010000	9500
02-Jan-14	5069	11500	8200
08-Jan-15	6589	9500	9800
13-Nov-15	9137	12500	8800

Conclusion

Price volatility is one of the major risks that a farmer faces today. Yet, there are limited means available to the farmer to mitigate this risk. Within this context, reliable price predictions can help farmers anticipate price movements and plan their marketing strategy. There has been significant difference within the markets. Such as some of the mandis has always been reporting highest price in comparison to any other mandi in the given study. The consistency of agmarknet's data quality and dependability is still a concern. The validity of the data is impacted by instances where modal prices are not consistently updated, frequent portal outages, and significant intraday price fluctuations. With this study, current price crisis of crops can be resolved. The amount by which the fund return deviates from the anticipated average return is indicated by a wide dispersion. Increasing the yield of medicinal crops could raise farmers' profitability compared to raising relatively common pattern crops because they have a variety of medical and culinary benefits. Analysis of intra - mandi prices for seasonal crops and medicinal crops revealed that prices fluctuate with peak season and medicines get more attention, although they are influenced by a variety of factors and are always in demand. This data can aid to train a machine learning model for estimating the future price after consideration of market demand.

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