Indian Journal of Economics and Development
Volume 18 No. 1, 2022, 148-155
DOI: https://doi.org/10.35716/IJED/21213
Indexed in Clarivate Analytics (ESCI) of WoS

Manuscript No. MS-21213
NAAS Score: 5.15
Indexed in Scopus

Crop Size Fixation Shields Price Volatility Syndrome: Analysis of Some Commercial Crops in India

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Received: September 13, 2021 *Revision Submitted: January 15, 2022* *Revision Accepted: February 28, 2022*

ABSTRACT

Prices of agricultural commodities like onion and chilli showed a high degree of volatility, which created a crisis like situation drawing attention from the policymakers, researchers, and farmers. An attempt was made to analyze the dynamics of production, price and export between regulated and unregulated crops. Results revealed that production variability was high in onion and chilli and low in FCV tobacco. The stability index for FCV tobacco price was high (0.90), while it was low for prices of onion (0.41) and chilli (0.59). The stability index for the export of FCV tobacco was high (0.81), while it was low for onion (0.31) and chilli (0.52). Thus, crop size fixation, a unique regulatory apparatus, is a potential instrument to shield the price volatility syndrome and stabilize exports.

Keywords
Crop size, exports, price, shield, syndrome, volatility.

JEL Codes
C40, Q13, Q18.

INTRODUCTION

Price volatility is a universal problem, indispensable to understanding its implications on the economy and devising strategies for its management. The nature of supply and demand creates instability in prices and income in the agricultural and non-agricultural sectors. The high levels of price and income volatility for farmers were correlated with the market fundamentals of demand and supply dynamics. Nevertheless, macro-economic variables could aggravate these variables, administrative and legislative environment for farmers, and hoarding and speculation in agricultural commodities. The phenomenon of price volatility in agricultural commodities assumes many financial implications since its associated uncertainty is one of the major factors affecting the income security of farmers and traders, adversely affecting the performance of agriculture and consumer welfare (World Bank, 1997; OECD/FAO, 2011).

In India, the major characteristic of agriculture is persistent high price volatility, which has an adverse effect on producers and consumers (Sendhil et al., 2014). Likewise, the price volatility syndromes are frequently hitting many countries, getting severe over the years. In the recent past, trending price volatility has emerged as the central issue as there is a strong link between production, trade and price of agricultural commodities. The agricultural price management falls under the purview of a number of ministries and multiple stakeholders with regard to production, processing, consumption, marketing, exports and imports of agricultural commodities in the country. Hence, a holistic approach is imperative at the macro level, as multiple stakeholders are involved in the agricultural supply chain

and supply-demand management of agricultural commodities.

Before considering regulatory apparatus to manage domestic price volatility in agricultural commodities, we must understand that some degree of price volatility is an inherent characteristic of agricultural commodity markets. In the short term, there is a mismatch between the timing of supply due to seasonal nature and timing of demand. However, the lack of accurate information on the demand and supply of particular commodities may reduce efficiency and accentuate price movements. For example, market glut and rapid fall in the price of particular crop continuously can inflict heavy losses on the farmers. It will reduce the farm income and diminish the spirit to cultivate the same crop in the future. Hence, the action is needed to bring about unplanned cropping patterns to the crop planning and crop size fixation in advance, systematic monitoring and implementation in the crops, which exhibit high price volatility to regulate the crop size.

In India, agricultural policies encompass several mandates such as production imperative for achieving food security, consumer imperative for maintaining low prices for a large chunk of the middle and low-income population, and farmer welfare imperative for augmenting farmers' income and export imperative for boosting agricultural exports. Moreover, recently, the Government of India has been introduced multiple reforms with a particular focus on the agriculture and allied sectors, agro-based industries to develop the entire agriculture sector and improve farmers' prosperity. The initiatives in the form of schemes and programmes like soil health card, per drop more crop, Param-paragat Krishi Vikash Yojana (intended towards promoting organic farming), DFI (doubling of farmers' income) by 2022-23, PMKISAN (supporting farmers through income support of ₹6000 per year), PMFBY (crop insurance scheme), digitization of land records, national agricultural market (E-NAM) to create common platform for agricultural marketing, agricultural export policy to boost agricultural exports, and agriculture infrastructure fund for strengthening of farm-gate infrastructure, etc. Similarly, the government should emphasize a long-term solution to correct a supply-demand imbalance in agricultural commodities and minimize price volatility. In this context, we argue that bringing regulation and its strict implementation in crop planning and crop size fixation in advance would result in a relatively more stable production system, minimize price volatility, augment farmers' income and stabilize agricultural exports, which is the more concern of the government.

In the FCV tobacco sector, the regulatory apparatus existed for several decades and practiced in consonance with the domestic demand and international demand, marketability of different tobacco types and other factors to ensure remunerative prices to farmers. The crop size fixation in FCV tobacco was governed by production policy and a regulatory mechanism developed for imparting production stability and minimizing price fluctuation in the last few decades. The main intention is to regulate the production and area under FCV tobacco in the country. However, it will also focus on the quality of product, curing, grading of the produce and control excess production than the quota allotted and unauthorized cultivation of tobacco by the farmers and organized marketing in the well-defined network of auction platforms in tobacco-producing regions. In this background, we argue that government intervention in the crop size fixation or cropping pattern would result in a relatively more stable production system, minimizing price volatility, promoting export stability, and enhancing farmers' income, which is the more concern of the government. Though the crop is criticized for negative externalities in terms of public health, environmental impact associated with tobacco production, the policy on crop size fixation centered on the regulatory mechanism remains a robust safety device for the farming community. Thus, price management in agricultural commodities is a policy priority, drawing greater attention from scientists, economists and policymakers. This research attempted to ensure supply-demand balance in agricultural commodities through policy intervention called crop size fixation with the specific objectives to relate the production variability between regulated and unregulated crops and to compare the price volatility and export instability between regulated and unregulated crops.

METHODOLOGY

The study was primarily based on secondary data published from various authentic sources. The relevant data on FCV tobacco, chilli and onion exports were collected from Agricultural and Processed Food Products Export Development Authority (APEDA, 2020), Office of the Economic Adviser (2020), and official website of Food and Agriculture Organization (FAOSTAT, 2021). Data on production of FCV tobacco, chilli and onion collected from the Ministry of Agriculture and Farmers Welfare (2020), Ministry of Agriculture and Farmers Welfare and Tobacco Board (2019-2020), Ministry of Commerce and Industry. Data on wholesale price indices

for tobacco, chilli and onion obtained from the Office of the Economic Adviser, Ministry of Commerce and Industry.

Analytical Tools

Different methods can measure variability, volatility and instability. Simple statistical measures like mean, range, standard deviation, and stability index were employed to analyze variability, volatility and instability in time series data for the selected variables.

Stability Index

The data on production, price and exports of FCV tobacco, onion and chilli for 2009-10 to 2018-19 were statistically analyzed and interpreted in terms of stability index. The following equation calculated the stability index of the variable for a particular crop.

$SI = X - SD/X_{max}$

Where SI is the Stability Index SD is the standard deviation

$\bar{X}$ is the mean

X_{max} is a maximum value

The value of a stability index of variable is high, which implies more stability and vice versa.

RESULTS AND DISCUSSION

Policy-led Crop Size Fixation for Demand-Supply Management in FCV Tobacco

The Tobacco Board formulates the production policy on crop size fixation and planning every year, which may be applied *per se* or with some modifications, based on the crop demand or need for imparting stability in other commercial crop production systems in the country. However, the implementation strategies should be crop and need specific targeting the production of different crops in different agro-climatic regions. The framework integrating different demand and supply components, institutions and policies to achieve targeted production, price stability, and augment farmers' income was illustrated and presented (Figure1).

Crop Size Fixation Process

Tobacco Board laid down a production policy for FCV tobacco every year for the states of Andhra Pradesh and Karnataka. Accordingly, it fixed crop size for different soil regions in Andhra Pradesh and Karnataka, considering specific factors, *viz.,* the domestic market demand and export demand, marketability of different styles of FCV tobacco and other factors. This target was achieved through crop planning and fixing crop sizes for Andhra Pradesh and Karnataka separately. Further, the Board also fixed the crop size in various production domains. For instance, the crop size fixed for 2019-20 in various soil regions of Andhra Pradesh *viz.*, NLS (Northern Light Soils) - 46 million kg, NBS (Northern Black Soils)-4 million kg, SLS (Southern Light Soils) - 46 million kg, and SBS (Southern Black Soils)-40 million kg. The declining demand due to the Covid-19 pandemic was likely to reduce tobacco production in the future. It was evident that the Tobacco Board in India had recently

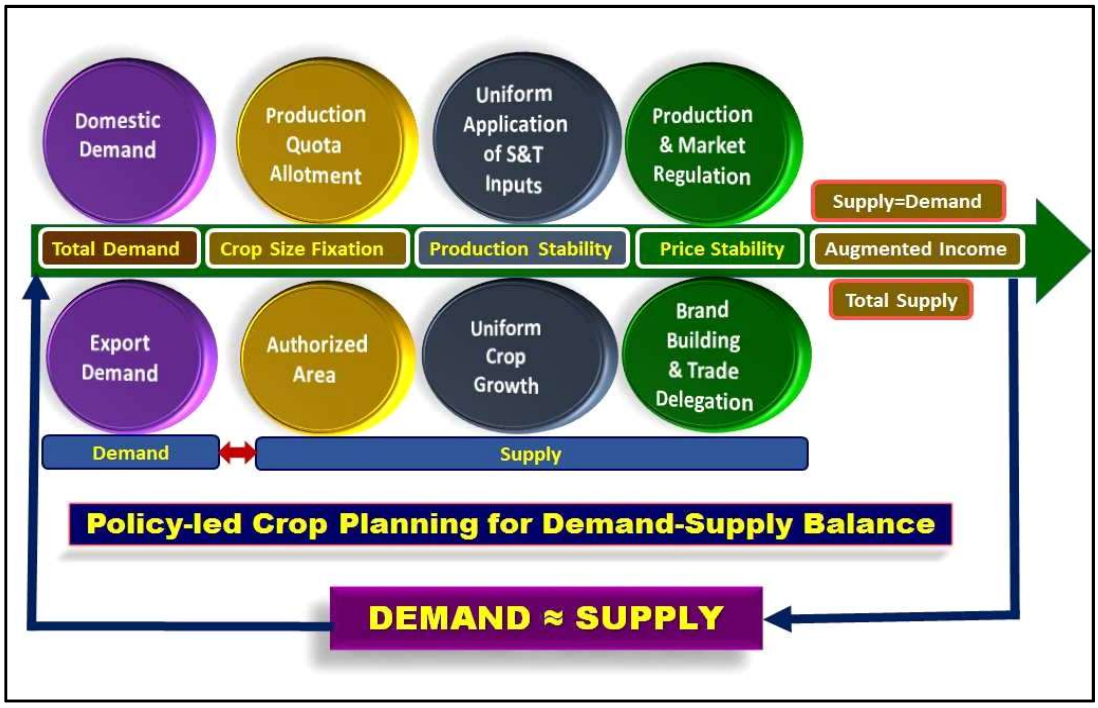


Figure 1. Crop size fixation and demand and supply management system in FCV tobacco

reduced FCV tobacco crop size by 12 per cent (from 100 million kg to 88 million kg) in Karnataka for the year 2020-21.

Nevertheless, the policy-driven approach regulated the crop size has one of the potential instruments to foster the transition from tobacco to other sustainable crops with their knowledge and practice and without looking into the formidable barriers that included issues of economic feasibility and institutional support as observed in tobacco-growing regions of Andhra Pradesh (Reddy, Reddy, Rao, Hema & Srinivas, 2017). For predicting the demand, the board ascertained the requirements of the manufacturers and the exporters by considering the global supply situation, the carryover stocks lying in the market from the previous year and the specific demand for tobaccos grown in different production zones of the country. Nevertheless, the farmers were directed to grow tobacco within the production quota allotted, and the excess production was held responsible for tobacco growers and additional charges were levied for the sale of excess crop produced by them.

Comparative Analysis of Commercial Crops with Crop Size Fixation and Without Crop Size Fixation

The three high-value commercial crops *viz.,* one crop (FCV tobacco) grown under the government regulation in the form of crop size fixation, which garners the institutional support from Tobacco Board and other two crops (onion and chilli), which were grown under unregulated condition, without any institutional support, were selected for the comparative analysis. Further, the influence of crop size fixation on the variables viz., production, prices and exports of these selected commercial crops was empirically assessed during the last decade.

Table 1. Crop size fixation of FCV tobacco during different crop seasons

(Million kg)

Crop season	Andhra Pradesh	Karnataka	India
2017-18	130	99	229
2018-19	136	100	236
2019-20	136	100	236
2020-21	115	88	203

Source: Tobacco Board, 2021.

Production Dynamics in FCV Tobacco Versus in Onion and Chilli

Production is an important variable that significantly influences the demand and supply of any commodity. The average production level of FCV tobacco (with crop size fixed) showed less variability over the years, whereas the other two crops-onion and chilli (without crop size fixed), depicted much variability with respect to their production levels. The range of production was very low (133 million kg) in the FCV tobacco, while it was very high in onion (11326 million kg) and chilli (1098 million kg) during the last decade. Further, the stability index for production was relatively low (0.68) in FCV tobacco, as the production levels were determined by crop size fixation annually, subsequently the area allocation for crop cultivation, which tends to vary from year to year based on the crop demand. The results revealed that the stability index for onion production was very high (0.84), while it was very low for chilli (0.53) during the last decade. It implied that production variability in FCV tobacco was induced by crop size fixation, therefore changing the targeted production every year.

FCV tobacco is an important high-value cash crop grown under government regulation in India. The trends in crop size fixed and actual production realized annually in Andhra Pradesh during 2009-10 to 2018-19 is presented in Figure 3. The crop size was fixed at 170 million kg for the crop seasons 2009-10 and 2013-14, but the realized crop production was 208 million kg and 214 million kg of production during corresponding years

Table 2. Production variability across the crops with crop size fixed and without crop size fixed

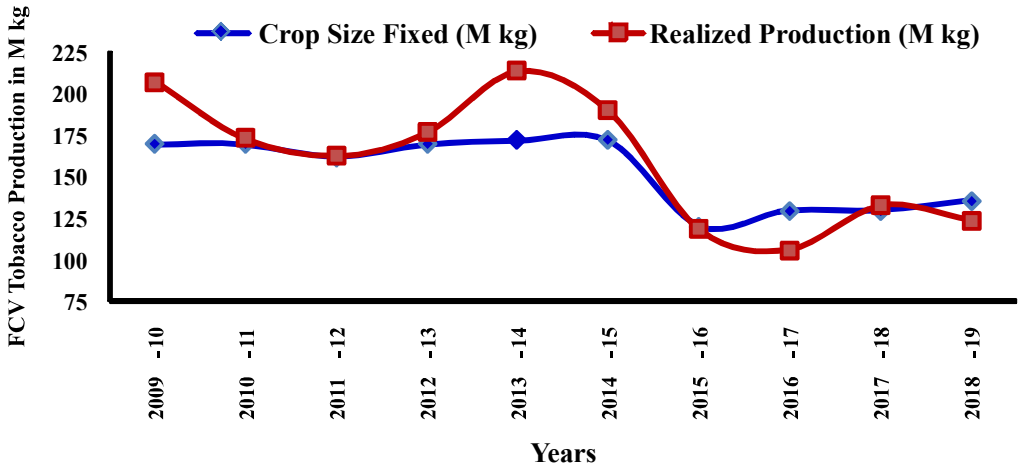
(Million kg)

Crop	Mean		Range			Stability Index		
	2009-14	2015-19	2009-19	2009-14	2015-19	2009-14	2015-19	2009-19
Crop size: Fixed								
FCV tobacco	296	233	264	267-323	190-293	0.96	0.84	0.68*
Crop size: Non fixed								
Onion	16201	21807	19004	12159-19402	18927-23485	0.71	0.80	0.84
Chilli	1300	1842	1571	1203-1492	1520-2301	0.67	0.80	0.53

**** Stability Index for the production of FCV tobacco is relatively low as the production levels are determined by crop size fixation annually, and it tends to vary from year to year.***

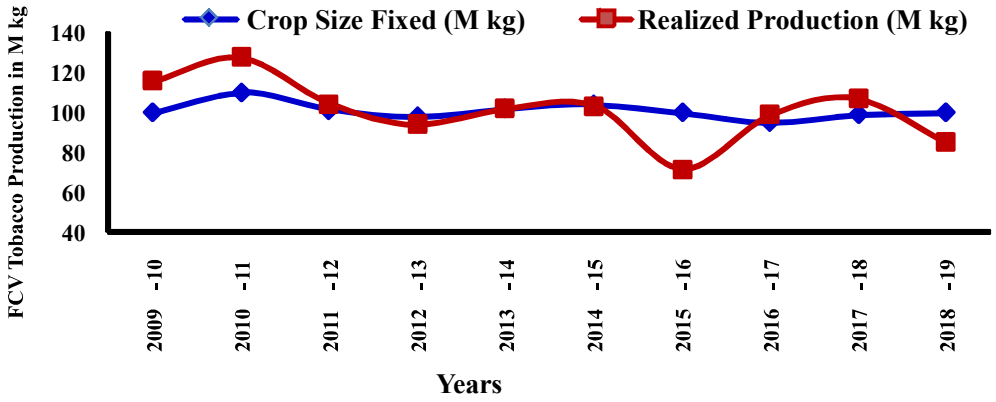
(about 22.35 per cent in 2009-10 and 25.88 per cent in 2014 higher than the crop size fixed). This difference in fixed and realized crop size might be attributed to bounties of weather or excess production. Nevertheless, the production in the remaining years has showed not much deviation between the crop size fixed and the actual production realized. Further, the difference between the average crop size fixed (153 million kg) and the average of actual production realized (161 million kg) in Andhra Pradesh during the last decade was very insignificant (8 million kg). It demonstrated the effectiveness of policy regulation in imparting production stability and ensuring the demand-supply balance of an agricultural commodity.

The trends in crop size fixed and actual production realized annually in Karnataka during 2009-10 to 2018-19 was presented in Figure 4. The crop size was fixed at 110 million kg for the crop seasons 2009-10, but the realized crop production was 128 and 100 million kg of production during 2015-16 (about 22.35 per cent in 2009-10 and 25.88 per cent in 2014 higher than the crop size fixed). This difference in fixed and realized crop size might be attributed to bounties of weather or excess production. Nonetheless, the production in the remaining years has showed not much deviation between the crop size fixed and the actual production realized. There was absolutely no difference between the annual average of crop size fixed (101 million kg), and an average of actual production realized (101 million kg) during the last decade in Karnataka. It demonstrated the effectiveness of policy regulation in imparting stability to the production



Source: Tobacco Board, 2020.

Figure 2. Trends in crop size fixed and production realized in FCV tobacco in Andhra Pradesh from 2009-10 to 2018-19



Source: Tobacco Board, 2020.

Figure 3. Trends in crop size fixed and production realized in FCV tobacco in Karnataka from 2009-10 to 2018-19

system and ensuring the demand-supply balance of an agricultural commodity.

Price Movements in FCV Tobacco Versus in Onion and Chilli

In agricultural commodities, price volatility assumes critical importance in the context of agricultural trade liberalization in India. The agricultural markets experience recurrent price volatility, which might be due to the factors such as seasonality of production, mismatch in demand and supply and weather aberrations, etc. On the one hand, consumers were affected adversely during high prices, and when the prices were very low, farmer producers were severely affected on the other. Historically, in FCV tobacco, the marketing system grew and developed an organized structure over the decades. The marketing system had gradually improved, visualized with high prices recording across different production zones. In other commercial crops such as onion and chilli, there was no organized marketing system in the country to minimize price volatility. The demand and supply of any commodity determine the price of the commodity. The average price level of FCV tobacco (with crop size fixed) showed relatively more stability over the years, whereas the other two crops, onion and chilli (without crop size fixed), depicted much deviation regarding their production levels. Further, the price stability index was very high (0.90) in the FCV tobacco, which implied more stable prices, whereas it was very low in onion (0.41) and chilli (0.59) during the last decade. It implied that the crop's production variability was very low, where crop size was fixed in contrast with the crops, where crop size fixation was not followed.

Export Stability in FCV Tobacco Versus in Onion and Chilli

In the recent past, agricultural exports were subjected to a high degree of instability in the world agricultural markets due to an imbalance in global demand and supply. However, in the case of FCV tobacco, the export demand was considered as an integral part of crop size fixation, whereas in other commercial crops such as onion and chilli, the export demand was not be assessed in advance, as the crop size fixation was not followed in these commercial crops. The comparative analysis between these crops revealed that the stability index was very high (0.81) in the FCV tobacco, which implied more stable exports over the years, whereas it was very low in case of onion (0.31) and chilli (0.52) during the last decade. The comparative analysis revealed that the export stability index of FCV tobacco showed relatively more stability over the years, whereas the other two crops-onion and chilli, had depicted relatively high instability in their exports during last decade. It implied that the export stability was very high in FCV tobacco, where crop size was fixed and low in the onion (0.31) and chilli (0.52).

Table 3. Degree of price volatility across crops with crop size fixed and without crop size fixed

Crop	Mean WPI*			Range		Stability index		
	2009-14	2015-19	2009-19	2009-14	2015-19	2009-14	2015-19	2009-19
Crop size: Fixed								
FCV tobacco	296	233	264	267-323	190-293	0.96	0.84	0.68*
Crop size: Non fixed								
Onion	16201	21807	19004	12159-19402	18927-23485	0.71	0.80	0.84
Chilli	1300	1842	1571	1203-1492	1520-2301	0.67	0.80	0.53

WPI-Wholesale price index.

Table 4. Degree of export stability across crops with crop size fixed and without crop size fixed

(M kg)

Crop	Mean			Range		Stability Index		
	2009-14	2015-19	2009-19	2009-14	2015-19	2009-14	2015-19	2009-19
Crop size: Fixed								
FCV tobacco	222	196	209	203-236	180-211	0.96	0.89	0.81
Crop size: Non-fixed								
Onion	1590	1901	1745	1341-1873	1086-3493	0.29	0.73	0.31
Chilly	275	379	327	234-332	274-469	0.64	0.72	0.52

It was imperative to assess the impact of the crop size fixation on imparting stability to the production system, realizing price stability and stabilizing exports. In this context, the effect of production policy in achieving production stability, minimizing price volatility, and ensuring remunerative prices to the FCV tobacco farmers in Andhra Pradesh and Karnataka during the last decade was analyzed. Price volatility of agricultural commodities assumed critical importance in the context of ongoing agricultural market reforms in India. The crop size fixation will primarily ensure the supply-demand balance of agricultural commodities. Moreover, volatility in agricultural commodity prices does not serve as an adequate guide to crop production plans and create an imbalance in price movements. However, the policy intervention in the FCV tobacco sector in India had established stability in crop production and minimized price volatility in prices over the past few decades. It is clearly witnessed that significant the impact of crop size regulation in terms of efficiency in imparting production and price stability of an FCV tobacco vis-a-vis other unregulated commercial crops like onion and chilli. Similarly, on the export front, it was evident that the stability in FCV tobacco over the years validated the effectiveness of crop size fixation in advance in contrast with other unregulated commercial crops grown in the country. However, the current study used annual time series data and significant changes regarding production, prices, and exports were obtained between regulated and non-regulated commercial crops.

The FCV tobacco is the only commercial crop in India under government regulation. Tobacco Board every year regulates the production and curing of FCV tobacco in the country. The main objective was to safeguard the smooth functioning of the vibrant farming system, ensure remunerative prices to tobacco growers and boost exports. It was sought to be achieved through crop planning and crop sizing of FCV Tobacco for the states of Andhra Pradesh and Karnataka separately. Conversely, other commercial crops had no such regulatory mechanism to control crop production size, resulting in wide production variability market and price volatility.

Reddy, Chakradhar, Kumar, and Santosh (2018) reported that the factors that affected the fast change in prices of vegetables *viz.* demand forecasting, demand-supply management, erroneous statistics of vegetables, storage facilities, and supply chain system, etc. Hence, there was no regulation on the production of horticultural and agricultural crops, every and now and then consequently results in under production and sometimes, the overproduction of these crops makes demand-supply management a tedious task. Hence, it was suggested that the demand forecasting and demand-supply management of vegetable crops to solve the price volatility, the major problem of farmers and consumers. A novel system was recommended which gets crop data from the farmer, demand forecasting daily, regulates crop acreages, generates accurate statistics, and ensures demand-supply management of crops. However, the current study used annual time series data and significant relations were obtained between production levels and price movements with regard to the crop with regulation and crops without regulation.

Chilli, an important commercial crop, India enjoys a pre-eminent position, played a significant role in the national economy in terms of livelihood security to millions of people at various levels, including farmers and farm labourers and bringing foreign exchange revenue to the country. In the recent past, Chilli farmers from the southern states of Andhra Pradesh and Telangana were demanding crop regulation on FCV tobacco lines. Accordingly, the farmers have submitted memorandums to the respective government in both the states and the central government. There is an immense need to regulate chilli crop size and area allocation and ensure remunerative prices in the wake of recurrent prices volatility due to wide fluctuation in cultivated areas. The chill farmers suffered due to fall exports demand on the back of devaluation of the currency and amplified incentives offered by competing countries for chilli exports. Thus, there is an urgent need for crop size regulation.

CONCLUSIONS

It was evident that regulatory mechanism FCV tobacco imparted stability in crop production over the years. Nevertheless, such a regulatory mechanism was not in place for other commercial crops, resulting in high price volatility. There was an immediate need for such crops to have similar regulatory apparatus in order to minimize price volatility. Hence, top priority should be accorded to supply-demand management in crop planning and crop sizing fixation in advance for onion and chilli crops. The policy intervention and its strict implementation would act as a coherent instrument to shield price volatility syndrome, stabilize export and augment farmers' income in unregulated crops. Thus, this unique regulatory apparatus creates an ecosystem that safeguards demand-supply balance, instills confidence in farmers, and protects consumers from violent price fluctuations.

NOTES

1. Production policy was first introduced in the mid-1970s and presently continuing for FCV tobacco in India to right-size the production every year in consonance with domestic demand and export demand
2. Other institutional support measures include the supply of farm inputs, crop advisory services during the crop growing season, providing farm loans to the farmers at a low rate of interest and grower's welfare measures
3. These measures mainly aim at improving productivity, quality and integrity of the crop, which imparts stability to the production system and ensures remunerative prices, consequently better income realization by the farmers
4. Keeping a constant watch on the FCV tobacco markets, within the country and aboard to ensure that the commodity is available consistently to meet domestic demand and export demand and minimize wide fluctuations in the price of the commodity

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