Economics and Technology of Soybean Cultivation in Central India, E. Revathi and B. Suresh Reddy, Academic Foundation, New Delhi in Association with Centre for Economic and Social Studies, Hyderabad, 2022, Pp. 223. Rs. 1295.00.

The authors comprehensively cover the key issues and challenges constraining the production of soybean in major soybean producing states of India. The study provides detailed quantitative and qualitative information derived from primary and secondary data. The authors also clearly identified the factors affecting the adoption of recommended package of practices to enhance productivity and address the challenges of promotion of soybean production, improving its economic viability, marketing and processing, consumer acceptability and to make it more competitive. In terms of challenges the study has addressed the trend in growth of area, production and yield; measure the TFP and its determinants; assess the level of adoption of technology and determinants of adoption of improved soybean production technologies; estimating technical, allocative and economic efficiency of soybean production and determinants thereof ; assess impact of public sector technology on economy and on producers and to suggest appropriate policy measures as a way forward using descriptive and multivariate analysis.

The primary data were collected from four states, viz., Madhya Pradesh, Rajasthan, Maharashtra and Telangana covering eight districts, sixteen blocks, 32 villages and 1500 soybean growers. The selected samples were stratified across four broad land holding categories of marginal, small, medium and large for assessing effect of scale. 46-48 soybean growers were selected from each of the selected villages. The primary survey was conducted during the year 2014-15 and fourteen villages were revisited to assess the recent changes in soybean production during 2018. The secondary data were collected for the period of 1992-93 to 2016-17 and were divided in two sub-periods (I-1991-92 to 2000-01 and II - 2001-02 to 2016-17). Stochastic Frontier production function was used to estimating technical efficiency across technology levels and cost function was estimated to assess the cost efficiency. Impact of soybean production technology also assessed using economic surplus model. The reason for a continued increase in soybean cropped area despite of stagnation and low productivity and increasing cost of production are suitability for cultivation in fallow land; yield and comparative profitability over other *kharif* crops due to price advantages; stable prices and organised markets; risk taking ability of farmers and facilitating government program like Technology Mission on Oilseeds. On account of higher comparative profitability from soybean mono cropping of soybean is dominating over inter and mixed cropping on sample holdings of the four states.

It was observed that traditional crops were replaced by soybean as long run change in the state of Madhya Pradesh and Rajasthan on account of relatively higher and stable returns, rainfed nature and short growing period. Also the growth in area was higher in the emerging states (Maharashtra and Telangana) as compared to traditionally soybean growing states (Madhya Pradesh and Rajasthan). The results of decomposition analysis of output growth of soybean in India and for selected states were predominantly due to area effect. In sample villages, the average area under soybean was higher in Maharashtra as compared to Madhya Pradesh while on the contrary, average yield was higher in sample villages of Madhya Pradesh. The yield of soybean was more stable in sample villages of Madhya Pradesh as compared to sample villages of three other selected states. Mono-cropping of soybean is dominant over inter and mixed cropping on the sample holdings of the four selected soybean growing states. The sample farmers expressed lack of awareness, not owing livestock, lack of adequate investment, improper extension support, more belief in the existing practices,

The major technological interventions were seed replacement rate as reported by 43 per cent of sample farmers of Madhya Pradesh, 100 per cent of Telangana and 66 per cent in Maharashtra replace seed every year. But according to recommendations

soybean being open pollinated crop, the required seed replacement is only 33 per cent. This means that after every three years the farmers should replace their seed. The high seed replacement rate might be due to release of advance soybean varieties which are resistant/tolerant to biotic and abiotic stress which compel farmers to replace seed almost every year or alternate year and this enhance their cost of production.

As reported by the authors, these sample farmers have express major constraint in soybean production as deficit rainfall, depleting ground water table and non-availability of seed on time. The constraint of non-availability of seed on times needs to be verified again because on the basis of information collected from sample farmers it is also reported that majority of farmers are replacing seed almost every year. It is also reported that the farming situation for the soybean crop is better in Madhya Pradesh, Rajasthan and Maharashtra in order of the states and thus it impacted the productivity, cost of cultivation and the economic viability of the farmers. But it is observed that authors did not carry out any situational analysis or comparative economics for determining efficiency in soybean production across the states. It is also mentioned by the authors that breeder seed of latest varieties of soybean at district level is provided by KVKs to the farmers, but generally breeder seed is not directly given to the farmers it is supplied to seed producer organizations for production of certified seed.

TFP analysis revealed that Madhya Pradesh state had high TFP index as compared to Maharashtra and Rajasthan along with positive and moderate growth in TFP. The output of Production Frontier Function indicates that all the inputs are under-utilised with the existing soybean production technology. Across the state high variation in technical efficiency observed. The average technical efficiency was the highest for state of Madhya Pradesh while it was the lowest for Telangana. Direct relationship between farm size and technical efficiency was observed and the allocative efficiency was better as compared to technical efficiency. The frontier cost function estimates shows that there is a scope of decrease in unit cost with increase in output. But it is observed that Cobb-Douglas specification allows only complementary inputs but Cobb-Douglas Stochastic Frontier Function has human as well as machine labour, irrigation, pesticides were missing from Stochastic Frontier estimation. That is the reason for large gamma value in the Stochastic Frontier. Significant determinants for technical and allocative efficiencies are score of adoption of practices and extension services. The study has analysed the adoption but did not estimate the yield gap due to adoption gap.

The analytical framework and textual description of this publication will be helpful to the academicians and research scholars for developing their knowledge and skill about econometric modelling. The study brings out the causal effects of economic inefficiency in soybean production. Because at present soybean tops in list of oilseeds crops of India and in this book that covers four important soybean producing states of the country accounting for more than 90 per cent of the national soybean production. High impact of soybean R&D efforts suggested that still there is a scope for increasing soybean output by bridging the yield gap of about 8 quintals per hectare through proper effective and efficient technological intervention. This will not only help in increasing output but also help in realising more profit through reduction in per unit cost of production (per quintal cost). This is an important crop from the point of view supply of edible oil in the country and pool of foreign exchange through export of DOC being Non-GMO. In this book R& D expenditure on soybean have been taken from Sharma and Dupare (2016) and this R&D figures only related to budget allocated by ICAR for AICRP for soybean and institutional budget for ICAR-Indian Institute of Soybean Research, Indore, Madhya Pradesh. Thus ignoring state support leads to under estimation of R&D support for soybean. Because many SAUs are having state funded projects on soybean and beside this Krishi Vigyan Kendras of Madhya Pradesh, Maharashtra and Rajasthan also spend part of their budget on demonstration of technologies. The benefit was also measured in terms of total output point only, thus it

is also under estimated. Because many value added products of the soybean are now available in the market along with edible oil and major portion of return is getting from the export of non-GMO DOC.

In the large context very good efforts were made by the authors to measure economic efficiency of soybean production in major soybean growing states and brought forward the need for improvement in productivity of soybean through development of varieties which are tolerant/resistant to biotic and abiotic stresses, location-specific solutions for location-specific problems like water management in black cotton soils, dissemination of knowledge from credible sources, linking farmers to backward and forward institutions and increasing R&D efforts for addressing emerging challenges due to climate change.

Jawaharlal Nehru Krishi Vishwa Vidyalaya S.B. Nahatkar
Jabalpur -482 004,
(Madhya Pradesh).