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Spline models for forecasting of cotton production

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ABSTRACT

The time series data on crop production often exhibit a discontinuity in the year to year variations. These disturbances are mainly due to several factors such as technological innovations in the production, socio-economic factors in addition to weather. The impact of these factors are often not of 'continuous' type and can be observed in the form of quantum jumps. To forecast the production of cotton, conventional trend models and Spline models were used. The conventional time trend models failed to provide efficient forecasts, as these models were based on the assumption of uniformity in the year to year variations. To deal with this situation, the applicability of Spline models have been explored in the context of forecasting the cotton production in Dharwad district of Karnataka and Karnataka State as a whole, by using 28 years of data (1978-2005). Spine model was developed and joined in pieces corresponding to the trend of the data; as discontinuity in the year to year variations is the fundamental assumption in these models. The results indicated that the Spline models provided efficient production forecasts (in terms of co-efficient of determination and bias).

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Key words : Cotton production, Forecasting, Spine models, Conventional models

Forecasting of agricultural production based on pre-historic (time series) data is a challenging task. It was observed that cotton production in Karnataka is fluctuating with the vagaries of rainfall. Over the years, it has witnessed several ups and downs in area, production and productivity. In addition to weather, the technological innovations and socio-economic factors can be also attributed to these fluctuations. These aberrations generally disturb the continuity in the year-to-year variations in the crop production data.

The time series data on production is affected by several factors that can be categorized as assignable and non-assignable or random factors. One of the major assignable factors that can be readily observed in the production data is the impact of technological innovations in the crop. Whenever a technology is released, its impact initially is in the form of sudden or quantal jump in the productivity and hence the level of production. Whenever a jump has occurred in the production (productivity) data its new and high level stabilizes over a period of time, *i.e.,* when a majority of farmers in the region adopt the technology. Due to these impacts of technology, not only there is a shift in the level of production over the earlier low level years, but the year to year variations also change its path. This results in the change of trend, which is otherwise uniform in the no-impact years. Thus, the production data exhibit a discontinuity in the year to year variations due to the disturbances arising out of technological impact. It is due to this behaviour of the production data, the conventional time trend models that are generally applied for forecasting purpose are inappropriate. The trend fitting approach assumes uniformity in the year to year variations (Kulkarni and Pandit, 1988).

Nonlinear regression models are recently being applied to study the dynamics of such data (Prajneshu and Kandala, 2003; Kulkarni and Narendranath, 2008). Application of these models is not straightforward. Several

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