Jour. Ind. Soc. Ag. Statistics
51(2&3), 1998 : 235-244

System of Crop Forecasting-Status, Problems and Prospects

G.S. Ram
Ministry of Agriculture, Government of India,
Krishi Bhavan, New Delhi

SUMMARY

The effective mechanism of crop forecasts has immense utility in developing stable economic environment, reducing the risk in production, marketing and distribution operations and decisions for exports and imports. The advance forecasts are being framed periodically using inputs from various sources as discussed in the paper. Various measures are suggested to bring improvement in the existing system. The relationship between forecasts and actuals may be worked out over the last three years on a moving average basis and used as bases to prepare the advance estimates. Advantages of the FASAL project over existing procedure of crop forecasts have been discussed.

Keywords: TRS, ICS, GCES, FASAL, EARAS.

1. Introduction

India is credited with possessing one of the best agricultural statistics systems in the world. The collection of comprehensive statistics relating to various facets of farm economy is well established and time-tested over more than a century. The indispensable role of a sound statistical system to deliver the reliable statistics in desired format at right time has been affirmed by the dependence of planners and policy makers on statistics during their endeavour for social and economic development in the past five decades. If Indian agriculture has transformed itself from a stage of being vulnerable to vagaries of nature and susceptibility to recurring droughts leading to frequent food shortages faced in fifties and the sixties to a self-sufficient and food-secure country, the credit on the one hand goes to the pioneering work in the field of crop sciences and on the other hand to an effective policy mechanism and monitoring device, based on strong agricultural statistics system well founded on the pioneering work done by internationally renowned statistician Prof. P.V. Sukhatme.

This is not to suggest that nothing is wrong with the system. There are many pitfalls in terms of quality and timeliness of data. The system is also not attuned to cope with the requirements of data for newly emerging crop activities in the wake of commercialisation and globalisation of Indian agriculture. The constraints in environmental planning and possible under-estimation of cropped area and that of the national income due to the quality of land use statistics have invited the attention of various data users.

The system over the years has come under deeper scrutiny mainly on account of benefits derived and risks involved in the data based decision making process. There had been impediments in rational decisions due to the absence of authentic advance information on crop conditions, the mechanism for which has not been strengthened on scientific lines. In the recent past this issue has become extremely relevant because of difficulties faced in taking timely policy decision especially with regard to imports and exports.

2. The Existing System of Advance Forecasts and its Limitations

Though the existing system of crop statistics may be considered robust insofar as it relates to generation of 'final' estimates, it hardly serves the desired purpose of policy planning relating to pricing, procurement, distribution, transport, storage, import, export etc. The effective mechanism of crop forecasts has immense utility in developing stable economic environment, reducing the risk in production, marketing and distribution operations and decisions for exports and imports.

Forecasting is a scientific device involving systematic use of endogenous and exogenous parameters to foretell the future. The exercise becomes complex when the parameters having direct bearing on the event start behaving unpredictably. The crop condition during the period of sowing and harvesting depends significantly on the diverse weather conditions. An effective mechanism of crop forecasting may not be possible without evolving a design of collection and analysis of data relating to such volatile exogenous parameters.

The results of complete area enumeration through Girdawari and yields from General Crop Estimation Surveys (GCES) take a great deal of time. Even the Timely Reporting Scheme (TRS) and Improvement of Crop Statistics (ICS) do not throw up adequate data for timely forecasts. Therefore, the information based on the reports from the States on crop weather conditions, likely area to be covered, and inputs off-take are utilised for preparing advance estimates. These advance estimates are revised from time to time depending upon weather conditions, crop situation, prevalence of pests and diseases and abiotic factors

like flood, drought, etc. Presently, the advance crop forecasts are being framed periodically using inputs from various sources in the following way:

The *first* official forecast of area and production of kharif crops is prepared sometime in the middle of September when south-west monsoon season is about to be over and kharif crops are at advance stages. This is also the time when the National Conference for Rabi Campaign is organised and States bring their assessment of the kharif crops. Besides, the preliminary reports about area coverage and production supplied by State Agriculture Departments, Market Intelligence Units (MIU) of the Directorate of Economics and Statistics (DES) and Department of Space through their remote sensing techniques are also used to validate the forecast. The forecast is also aligned with the model based estimates of foodgrains by DES and that of rice by India Meteorological Department (IMD). The weekly meetings of multi-disciplinary crop and weather group in the Department of Agriculture & Cooperation (DAC) also help in assessing the crops prospects.

The *second* assessment of crop forecast is prepared sometime in the month of January when relatively firm estimates of kharif crops become available and also by making use of area estimates under TRS and yield estimates under the ICS Scheme, the latest remote sensing data, the revised yield forecast of rice by IMD and updated information received from SASAs and MIUs. As by this time the sowing of rabi crops is by and large complete, the indications about coverage and condition of crops in the season are also available. The estimates of likely rabi production are, therefore, also made on the basis of available information. Thus, the crop estimates are prepared for the entire 'agriculture year' covering kharif, rabi and summer crops. This assessment is used by the Ministry of Finance in their Economic Survey and the CSO in framing advance estimates of national income.

The *third* advance estimates of production is prepared towards the middle of April when the National Conference on Agriculture for Kharif Campaign is convened and the States come up with their assessments which indicate almost the final position of kharif crops and relatively much firmer estimates for rabi crops except those for summer season. The TRS and remote sensing data of rabi crops, the MIU reports as well as yield forecast of wheat made available by IMD based on their model are used to validate the States estimates.

The National Workshop of SASAs for Improvement of Agricultural Statistics which was started in 1995 has now become an annual feature. The workshop is generally organised in June. Since most of the rabi crops get harvested by the end of May, the SASAs attend the workshop along with

almost the final estimates of both kharif and rabi seasons as well as likely assessment of summer crops. Thus, by taking into consideration the figures supplied by SASAs, the *fourth* advance estimates or the provisional final estimates are brought out in the month of June.

Ultimately, the 'final estimates' are released during November- December when most of the States have received data from districts. However, as States still revised the estimates based on related information, the all-India crop statistics are brought out as 'fully revised' in the next crop year during November-December along with the 'final estimates' for that year. The final and fully revised estimates are generally very close. However, the various advance estimates are at large within them as also with the final estimates.

As may be seen from the above discussions, the present system of assimilation of vast data bases for delivering an effective forecasting mechanism leaves much to be desired. The efforts towards improvement in the system of forecasting based on research investigations using modern technological advancements in the field of remote sensing application, agro-meteorology and information technology, therefore, need to be viewed not only to modernise the system but to strengthen the decision making process in the long term perspective.

3. Measures for Improvement in the System

Though the advance estimates are mortals with a very short life span and they die soon with the availability of final estimates, their time utility in decision making is immensely recognised by the Government. The imprecise forecasts in the recent past have been the subject of grate concern. Accordingly, there is a dire need to completely revamp the system. The following measures hold promise for future prospects of advance estimates:

3.1 Injecting Objectivity in the Existing System

As already discussed, the present system of crop forecasting is highly descriptive and based on the common sense rather than any scientific statistical method. It is generally guided by the opinion and perceptions of various agencies. How the data flowing from different channels, viz., State Departments of Agriculture, the SASAs, the MIUs, Space Application Centre, etc., are assimilated and integrated into forecasts is not clearly spelt out. There is, hence, a necessity to improve upon the system of forecasting by injecting some scientific techniques to make it as objective as possible. Considering the exercise of forecasting as a tricky business, the past experiences have to be effectively

correlated with a view to establish the creditability of the estimates of various agencies. Such creditability coefficients i.e. the relationship between forecasts and actuals may be worked out over the last three years on a moving average basis and used as bases to prepare the advance estimates.

The results of the two schemes, namely, TRS and ICS, could also be effectively analysed to bear on the advance estimation. The TRS estimates of area at times differ with the final estimates on full Girdawari. The TRS results, therefore, have to be moderated in the light of their past behaviour. The ratio method which establishes a relationship between the TRS data and the final area figures may be used to generate area estimates at the time of forecasts.

The main source of variation in advance and final estimates of production is, indeed, the error associated with assessment of yields. The results of supervised crop cutting experiments jointly undertaken by NSSO and SASAs are at times used in framing the advance estimates of production. However, on the receipt of final results of all the crop cutting experiments it is observed that these are at times quite different from the ICS results earlier used in framing the estimates. It may, therefore, be advisable to utilise these ICS yield data after moderation using the correlation technique. Accordingly, a relationship between ICS results and final crop yields could be established by analysing data for preceding three years in respect of various crops in different States. This would definitely enhance the precision of the anticipated productivity estimates used in framing the forecasts.

3.2 Crop Simulation Method

The crop simulation method which attempts to analytically describe the physical and physiological effect of environment on crop conditions, perhaps, be the best method of crop yield forecasting. The method although complex, would be the most accurate and versatile in crop predictions.

Given our vast infrastructure and the presence of NICNET system throughout the country, a model for judging and assessing the real impact of rainfall and weather parameters is urgently called for. Under this set-up information on weather, namely, rainfall, temperature (maximum, minimum and range), humidity, rainy days, dry days, cloud etc., and biotic stresses on the crops, could be generated regularly.

For collecting the information, one has to establish a wider network spread all over the country so as to get the reasonably realistic feedbacks at some regular intervals, in time from all parts of the country. For this purpose, the

Ministry of Agriculture may be linked with its Crop Commodity Directorates, Central IPM Centres, NARP Centres of the State Agriculture Universities, few centres of ICAR and SAUs where the NARP Centres do not exist and also the headquarters of all the States/UTs. All these centres will be computer networked through NIC for sending the information to the Ministry of Agriculture. The staff in position at these centres/offices may be suitably trained in collection and transmission of the desired information.

The package/software could be developed to receive the information from all these centres and States for analysis and processing centrally. All the information received on day to day basis may be simulated for generating periodic forecasts. Besides, the information may be immensely useful in taking contingency measures and making necessary intervention.

3.3 Setting-up of an Expert Group

Toward improving the quality and timeliness of advance estimates of area and production of crops, the Government decided that the entire crop forecasting system including the methodology and assessment techniques should be reviewed by involving an independent expert body. Accordingly, an Expert Group under the Chairmanship of Director, IASRI, was set up in July, 1996, with a view to examine in depth the existing methodology and mechanism of crop forecasts and advance estimates and to suggest measurements and methods for improvements therein. The Expert Group submitted its report in January, 1997. The main recommendations of the Group related to the setting up of a Standing Technical Committee (STC) for reviewing and bringing improvements on regular basis in the system of crop statistics in India. The Group has also suggested to set up a National Centre for Crop Forecasting (NCCF) with strong infrastructure of trained manpower, necessary equipments and appropriate hardware and software configuration with two-fold functions,viz.,

(i) Periodic crop forecasting for major crops; and

(ii) Coordination and assimilation of various methodologies and technical advancement relating to crop forecasting

The Expert Group had specifically recommended for a "strong mechanism of crop forecasting" having a cohesion and coordination among DES, DAC, SASAs and other Central and State agencies associated with generating basic agricultural statistics. The Group has also suggested preparation of advance estimates of area and production of major crops by SASAs which may be based

on collective wisdom of various experts of agricultural extension, remote sensing, agro-meteorology, marketing, inputs, etc. in respective States.

3.4 Project on FASAL

The Department of Space have submitted a project proposal- Forecasting Agricultural Output Using Space, Agro-meteorology and Land Based Observations (FASAL) envisaging advance reliable assessment of crop acreage and production using remote sensing techniques and other data bases available. The FASAL project addresses all important issues related not only to improvement of forecast but also to providing more than one assessment during a crop season and having provision for alternate forecast methodology in case of non-availability of remotely sensed data due to cloud cover, especially in kharif season till the microwave missions become operational. It emerges that remote sensing, weather and field observations provide complementary and supplementary information for making crop forecasts. Thus, an approach which integrates inputs from the three types of observations is needed to make forecasts of desired coverage, accuracy and timeliness.

The concept of FASAL, thus, strengthens the current mechanism of early season crop estimation capabilities from econometric and weather based techniques with remote sensing applications. Mid-season assessments can be supplemented with multi-temporal coarse resolution data based analysis. In the latter half of crop growth period, direct contribution of remote sensing in the form of acreage estimates and yield forecasts is available. However, in this case also, the addition of more extensive field information and weather inputs would increase the forecast accuracy. The FASAL has the following distinctive features:

(a) *Interfacing with existing agricultural statistics system*

As already stated, India is bestowed with a well-established system of estimation of crop production. The TRS and the scheme for Establishment of an Agency for Reporting Area Statistics (EARAS) initiated in 1960s and 1970s respectively were oriented to provide area estimates in time. The estimates at the national level are prepared based upon the flow of information from SASAs. The yield estimation is arrived at on the basis of scientifically designed crop estimation surveys in which about 5 lakh crop cutting experiments are conducted on principal crops in the country. However, the need for the estimates of crop production before the harvest has been felt and it is in this context the focus of FASAL on generating advance estimates is envisaged to strengthen the crop forecasts.

Hence, the primary focus of the FASAL is to provide realistic advance estimates for major crops. However, the remote sensing application can be effectively dovetailed to meet the objectives of cropping system analysis and horticulture development as well.

The FASAL project has scope of providing district estimates in its National-State-District Forecast (NSDF) option. On stabilisation of the project, the same can be expanded to provide district-wise estimates. In addition to it, the estimates emanating from FASAL can be used to validate the final estimates of area and production. The National Remote Sensing Agency in 1988-89 had undertaken the land use and land cover surveys as well as the wasteland mapping. Such an exercise can be undertaken once in five or ten years for firming up the existing land use statistics where certain land utilisation may not have proper reflection due to the in-built limitation of land record system.

(b) *Advantages of the FASAL project over existing procedure of crop forecasts*

The FASAL project is seen to be bringing improvement in the existing system of crop forecasting on the following counts:-

(i) Though the existing system of agricultural statistics has a sound design and institutional operational framework to commit to the timeliness and quality of data through the schemes of TRS, EARAS and ICS and is enabling the final estimation of area and yield with consistency of aggregation over administrative and geographic hierarchy reasonably well, for advance estimation and forecasting of crop production, it relies more on conventional impressionistic approach. The FASAL envisages to induct the use of scientific approach and rational analysis of proper data bases in the forecasting mechanism.

(ii) The existing system of crop forecasting has weak assimilation and application of exogenous parameters and nominal scope of data exchange and networking. The absence of institutionalisation of crop forecasting system is a major hindrance. FASAL focuses on this felt need of the system of agricultural statistics with a concept and mandate of NCCF. In this process, FASAL also consolidates isolated developments taking place in the field of crop forecasting.

(iii) The existing system of crop forecasting is not adequately harmonised over the geo-space. Further, due to weak technological interface, the existing system has less scope of further development and

improvement. The FASAL being a technically oriented approach has development and advancement in methodology as its in-built component.

(iv) The FASAL project integrates itself with the existing system of agricultural statistics envisaging active involvement of SASAs. Hence, it provides a scope of down the line technology percolation.

3.5 Skill Upgradation of Field Functionaries

In order to take full advantage of the state-of-the-art technology, the development of human resources at various levels of functional hierarchy is inevitable. The conventional system operated through the joint efforts of Revenue Department, the State Directorates of Economics & Statistics and the Department of Agriculture would continue to provide basic agricultural statistics as per the existing constitutional provisions. All improvements in the system have therefore to be conceived on this premise. The system, hence, must keep contemporariness with the emerging needs and this would be possible only when the personnel operating the system are uptodate with the latest technology and techniques. A comprehensive training programme for skill upgradation upto the grassroot level that was started in 1995 by all the States/UTs at the behest of Centre has to be conducted periodically for which both Centre and the States must take abundant initiatives.

4. Concluding

Though the existing agricultural statistics system is well established and time-tested, it is ill-equipped to provide advance estimates of crop production consistently with any reasonable degree of precision. In recent years the weakness of the system has impinged on the policy decision making process of the Government. The measures indicated in this regard by setting up the Expert Group and the follow-up implementation of its recommendations would definitely effect an enduring improvement in the system. To begin with, the STC on Improvement of Crop Forecasts and establishment of NCCF must get highest priority. Besides, the project on FASAL would have great relevance in enhancing time utility of crop statistics in decisions relating to food security, imports and exports. Injecting objectivity in the existing system through analysis of past data periodically flowing from various channels vis-a-vis the final estimates is something which could be immediately attempted. The technique of crop simulation must also be employed to generate advance estimates. Ultimately, recognising the fact agricultural statistics is a State subject under

the federal constitutional set-up, the advance estimates must be perceived to bear on the official estimates of SASAs. In this context the technical competence and commitment of functionaries at various rung of administrative ladder would constitute the most crucial element in the system of scientific crop forecasts. Periodical skill upgradation programmes of every one involved in or associated with agricultural statistics in States and at Centre would be immensely useful.