

## STATISTICAL STUDY AND ANALYSIS OF THE AGRICULTURAL PLAN\*

THE Chairman, Dr. Frank Yates, Rothamsted Experiment Station, England, said in his opening remarks that agricultural planning was not a short-term problem although politicians, by their very nature, have to look for immediate results. In view of the rapidly growing population of the country and the imperative need for raising the standard of nutrition of the people to as large an extent as possible it was essential that the agricultural production in the country should also increase correspondingly. Of course, each nation must evolve its own methods of achieving this objective with the help of its own resources. Consequently a proper and scientific study of the problems of agricultural production and of the present and future agricultural plans was one of the most important tasks before the country.

Dr. V. G. Panse, Indian Council of Agricultural Research, New Delhi, opening the symposium defined planning as a quantitative formulation of certain social aims that we wish to achieve in a specified time, and when the Plan is put into operation a quantitative assessment of the rate of achievement becomes an essential requirement for ensuring satisfactory working of the Plan. If this interpretation of planning be accepted the vital role that a statistician has to play in planning becomes obvious.

Planning in agriculture is far more difficult than in various other sectors, e.g., industry. In planning for the manufacture of textiles, for illustration, we know the capacity per loom for weaving cloth and the capacity per spindle for spinning yarn and all that is needed for achieving the target of production is to erect the necessary machinery involving the required number of spindles and looms. The check on the rate of production is also relatively simple, since the production is concentrated among a few well organised units. In agriculture, on the other hand, the technical information needed for planning is far less precise and the production is spread over millions of small and inefficiently organized units, with the consequent difficulty of executing the Plan and assessing the rate of progress. In the second agricultural plan, the production target has been raised recently from 15% to 30%.

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It needs a very careful examination as to whether this is a realistic target. Many questions arise in this connection for which statisticians must primarily seek an answer. The Indian Statistical Institute is making a systematic study of planning in its wider perspective under the leadership of Prof. Mahalanobis, but the speaker was not aware whether it is giving any special consideration to the peculiar problems of agricultural planning. He hoped that the discussion will lead to systematic work being taken up on this subject by agricultural statisticians.

He next considered planning in two stages: (1) formulation and (2) execution. The first stage may be represented as Social aims—Physical targets—Resources. The chief social aim of planning is to increase the standard of living all round. The broad contribution of agriculture to this aim would be to make available more food, more clothing and more rural employment. This contribution has to be translated into specific targets of additional production of foodgrains, cotton, etc., and of providing additional amount of work to the rural population. These targets in their turn must involve definite inputs of our resources like land, irrigation, fertilizers, human and animal labour, etc. The first and foremost problem in planning is to ensure mutual compatibility or consistency between these three aspects of planning. In the absence of this compatibility, the plan will be rendered inherently incapable of fulfilment. Consistency between physical targets and resources is even more important. These targets must be based on the results of technical research showing the productive capacity of various resources, singly and in combination, like irrigation, improved seed, fertilizers, etc. A critical assembly of such results from all possible sources is an important task for the statisticians and it is also his duty to point out gaps in our technical knowledge and press for initiation of research in those sectors where such gaps exist, since investment on such research is likely to pay greater dividends in the long run than ill-conceived production projects based on speculative information.

The bearing of technical data in the formulation of the Plan is two-fold: (1) to make the targets realistic, that is, capable of achievement by using given amounts of resources and (2) to enable us to choose between alternative projects or to give them proper weightage or priorities for optimum utilization of resources. As an illustration, if the effect of manuring is enhanced when used in conjunction with irrigation, as seems to be the case, it is very desirable to concentrate manuring in irrigated areas and not to dissipate our limited manurial resources by spreading them thinly on all kinds of areas for sentimental or political

reasons. For another example, it is necessary to decide what weightage we should give to projects for improvement of cattle nutrition and breeding, in order to achieve the targets for increased milk production. In seeking an answer, one must recognise that the beneficial effect from breeding can be secured only after a large number of years, and this time-factor also makes breeding projects very costly. Against this, improve nutrition would bring immediate returns, but these would be limited by the poor genetic quality of the animals. Careful statistical investigations are needed with the help of available data to answer such questions.

Turning to the second stage of planning, *viz.*, execution, some progress has already been made in demonstrating how modern developments in sampling and objective measurement can be utilized successfully for a quantitative assessment of the rate of progress, which alone provides an effective control on the working of the Plan. The main problem for the statistician here is to organize the quantitative appraisal on a sufficiently large scale on a continuing basis and to make the results available to the planners promptly for ensuring the achievement of the targets.

It is only by developments on these lines that the agricultural plan will become a really integrated effort aimed at the improvement of living of our people instead of a bunch of disjointed and unco-ordinated schemes. He finally stressed that the statistician must not work in isolation in tackling these problems, but in close co-operation with economists, administrators and the people themselves, who are to be effected by the success of otherwise of the Plan, in order that not only should his own work be facilitated, but also his contribution to the success of the Plan be truly effective.

Shri V. R. Rao (National Sample Survey, New Delhi) said that he should like to underscore the remarks of Dr. Panse about the role of the agricultural statistician in the formulation of the targets of agricultural production under the Plan, and in the continuing assessment of the results obtained. An analysis of the results of the First Plan *vis-a-vis* the proposed targets of food production during the Second Plan did not, according to him, indicate that the latter have been based upon any systematic statistical study. In fact, in the light of what had been achieved in the First Plan, the targets proposed during the Second Plan seemed somewhat unrealistic. He supported this thesis by presenting the targets and achievements of the First Plan under the several development measures as reported by the Ministry of Food and Agriculture, which showed that except in the case of improved

seed, where the production potential created was somewhat higher than the target prescribed, the achievement in all others was less than the target. The divergence was remarkably high in the case of irrigation, major and minor projects taken together. The additional area irrigated during the first four years was only 3.5 million acres and even if substantial additional area was brought under irrigation during the last year of the Plan, the gap between the target and achievement would still be significantly large. He also pointed out that most of the production potential created under the First Plan was in regard to the major foodgrains of rice and wheat, and even if one assumed that whatever increase in production of rice and wheat had been realised during the Plan period was the direct result of this effort, the substantial increase in the production of millets and other minor food crops, to the tune of 5 million tons, should be attributed mostly to a run of favourable crop seasons rather than anything else.

Analysing the category-wise breakup of the targets of additional production during the Second Plan, Shri Rao mentioned that irrigation once again accounted for a substantial part of the total additional production and going by the previous experience, one had to be rather cautious in one's expectation of the fulfilment of the target. The targets for improved seed were increased six-fold and for fertilisers and manures three-fold, as compared to the previous plan. It was again difficult to expect that with all the physical and organisational impediments in the way of the rapid expansion of area under improved seed and distribution of fertilisers, such high targets could be achieved.

Shri Rao also dealt with the concept of production potential and stressed the need for reliable and comprehensive yardsticks in the estimation of production potential, for which continuing surveys need to be carried out. He detailed the surveys carried out so far by the N.S.S. for this purpose on improved seed and fertilisers and remarked that they should be continued on a more comprehensive and systematic basis covering all fields of agricultural development. He also suggested that a comprehensive sample check should be carried out to verify the area benefited by major and minor irrigation projects and reconcile the discrepancies between several sets of estimates made available about them.

Shri S. Thotapali (Planning Commission, New Delhi) agreed with Dr. Panse on the importance of statistics in the formulation and execution of the Plan. He said that the Planning Commission was anxious to have as accurate statistics as possible. With this object in view,

the Commission convened a meeting in July 1956. As a result of the discussions a study group was formed to examine the following items:—

- (1) To examine data on yield of crops, benefits of developmental measures, and assessment of performance and benefits of irrigation projects.
- (2) To recommend changes which may be necessary in the scheme of crop-cutting experiments, to take account of irrigated and unirrigated areas and areas within and outside the National Extension Service.
- (3) To suggest intensive enquiries with a view to providing the necessary data for reviewing the yardsticks of additional production for different measures of development at present in use.

Shri Thotapali suggested that the statisticians may keep these points in mind in their statistical study of the Second Plan.

Shri Thotapali was of the view that the revised targets were not unrealistic when the various measures to realise them such as spreading of National Extension Service throughout the country, establishment of 3,800 seed farms and concerted drive to mobilize local manurial resources were taken into account.

Shri B. H. Joshi (Department of Economics, University of Bombay) said that planning involves fixation of internally consistent physical targets to achieve the social goals and also evaluation of adequacy and determination of optimal combination of resources available for realisation of the targets. In the sector of agriculture, targets have to be worked out in the light of future demand for agricultural products like food, raw materials for industries and an adequate surplus to counteract the threat of inflation and for exports to earn much needed foreign exchange. The obvious choice of simultaneous equation approach for a joint estimation of all these demands cannot be resorted to because of the short length of time series of the necessary available data and the various constraints of planning. Whereas the demand from the industrial sector for the agricultural raw materials can be gauged with necessary precision on the basis of the planned industrial growth and the input-output coefficients for the respective industries, the demand for food has been a subject of much academic controversy in absence of appropriate empirical studies on income distribution and income elasticity of food consumption. Until these are carefully designed studies on the patterns of rural production, consumption and

savings, the transitory and the final demand for food will remain a matter of speculation.

In striking contrast to the attention that is being recently given to estimating the demand for food because of rise in prices on the eve of initiation of the Second Five-Year Plan, the problems of measurement of production possibilities and marketable surplus have received scant attention. It seems that the upward revision of food targets from 15% to 25% increase has been undertaken only under the threat of inflation and not on the basis of reliable reappraisal of the production possibilities.

No attempts have so far been made for estimating productivities of various factors of production in agriculture. One does not know what increase in production can be expected if one invests in land improvements or in irrigation or uses better farm equipment or employs more labour. In the absence of any information on marginal productivities of various factors, it is not possible to say whether there is over-investment or under-investment on any specific factor of production. It is also equally impossible to determine an optimum investment programme for different agricultural regions.

A small experiment in fitting a production function to farm accounts data published by the Economic and Statistical Organisation of the Punjab Government has brought to light various problems in the construction of production functions applicable to Indian agriculture. Care has to be exercised in the measurement of inputs of family labour, bullock labour, manure and land. Unless both the quantity as well as quality of various inputs are taken into account, the marginal productivity figures are bound to be erroneous. The difficulties in measurement are aggravated by underemployment in agriculture and underdeveloped exchange economy. It is a well known fact that wages and other prices in agriculture follow a traditional pattern and bear only a remote relationship to the productivities of the respective factors. Hence in the incompletely monetised sector of agriculture, prices cannot serve as weights for aggregation of constituent factors into principal factors of production. One has to evolve suitable weightage on the basis of extensive and detailed studies on agricultural production. This would call for large-scale sample surveys in farm accounts. Large-scale sample surveys will also have other incidental advantages. The various factors of inputs are likely to be correlated and as such are expected to introduce some disturbance in the estimates of regression coefficients. A large sample will enable a test to be carried out for multicollinearity and thus

guard against the danger or erroneous estimates of regression coefficients.

Derivation of supply functions from production and cost functions presents some new problems such as estimation of marketable surplus. Proper regulation of marketable surplus by stabilizing production and prices and by suitably controlling the price parity ratio can facilitate migration of surplus agricultural population with the growth of industrial sector. A suitable study into factors influencing marketable surplus is of vital importance to developmental planning.

In addition to problems of measurement of production potential and marketable surplus, there are other problems which have a bearing upon the structure of Indian agriculture. But unfortunately the statisticians in the Government have been in past so much preoccupied with providing for the immediate administrative needs and the academicians on the other hand, with the abstruse problems in the design of experiments and sampling theory that research in applying statistical methods to economics of Indian agriculture has been almost neglected. Because of the dearth of necessary statistical material and virtual non-existence of empirical studies, we are at present experiencing many difficulties in formulating a suitable agricultural plan.

Shri Mahesh Chand (Reader in Econometrics, Lucknow University) said that at the centre the I.C.A.R., the state agricultural statisticians and the university economists should also be associated in planning. He remarked that in the study of production factors in economics simple logarithmic factors like those studied by Shri Joshi were not correct and that interactions of the various factors should also be taken into account.

Dr. G. D. Agrawal (Agricultural Economist, Kanpur) said that he agreed fully with Dr. Panse in his able analysis emphasising the need for greater attention to agricultural statistics in formulating agriculture plans and policies under the Five-Year Plans. A Plan can be considered scientific only when its targets have been arrived at after proper statistical appraisal of the resources and thorough shifting of the available evidence in respect of the potentiality of land and various other determinants of production.

It is, however, necessary to be clear about the role of statistics as one of the method sciences and the distinction between the physical and economic data for which also the term statistics is used. If the statistician by whom he meant a person trained in the method science of statistics devotes his attention to methodological problems involved

in collection of data, planning of investigations and analysis, his labour would have a higher marginal productivity values than when he himself attempts to take the entire charge of collection of statistics or various research projects and studies with major economic content. The point is of great topical importance in view of the fact that the supply of statisticians is far short of the suddenly increased demand for personnel trained in this discipline.

A thorough familiarity with the general problems of the topic chosen for investigation is essential to keep the non-sampling errors within reasonable limits, for correct formulation of hypothesis and finally for sound interpretation. Such knowledge is normally possessed by persons with training in the particular social or physical science to which the topic of study belongs.

He was critical of the opinion expressed that the targets in agriculture in the Second Plan are fixed at levels which are impossible of achievement because the past experience does not support such an optimistic view. He had conducted an investigation on a limited scale in an area where the farmers were already progressive and had taken to the use of improved seeds, and found that by proper guidance and planning of agricultural programme on each individual farm there was an increase of 25 to 30 per cent. in production. He had therefore no doubt that, so far as the potentialities of various input factors are concerned, our present level of production in agriculture is so low that it admits of quite appreciable increases in it.

Another factor to which attention needs to be drawn is that, so far, in preparing the estimates of production, factors like improved seeds, manure, irrigation, etc., have alone been taken into account while quite an important factor, namely, management, has been ignored completely. In the course of his survey of 600 holdings in Meerut and Muzaffarnagar Districts under the auspices of the Planning Commission, and in other investigations conducted by him, enough data have accumulated which show that variation in managerial ability is responsible for a large difference between the levels of production in farming. Although a method for objective measurement of managerial ability has not yet been perfected, it cannot be denied that the programmes of agricultural extension, community projects and education adopted under the Plan will make an appreciable change in the managerial ability of the existing and coming generation of farmers. He, therefore, had no doubts about the fulfilment of the targets fixed in agriculture provided the agricultural extension service is organised on right lines and the farmers are helped with the needed resources.



Shri D. Y. Lele (National Sample Survey, New Delhi) emphasised that as suggested by Dr. Panse, the role of assessment surveys was no less vital than experimental studies. In the first place, a study of the actuals provided a realistic appraisal of whether and how far the ideal recommended was being favourably received. The departures observed in practice from the recommendations would suggest the extent of revision called for in the expectations and the targets and thereby make these more realistic. Secondly, an analysis of the causes for such departure can help in reorientating the scope of the experimental studies themselves. Shri Lele then cited in support his experience of the assessment surveys undertaken in connection with the Grow More Food Campaign.

A somewhat different aspect which he wished to emphasise in connection with the formulation or interpretation of the Plan was the necessity for associating qualified and experienced statistical experts with decisions which are essentially quantitative in nature. There was a reference, for example, in the earlier discussions to the upward revision effected in the agricultural targets of the Second Five-Year Plan without the advice of statistical experts and evidence was presented by one of the earlier speakers to show how this upward revision of the targets was at variance with the experience of the actuals in the First Plan period. However, the very same figures could be rearranged and made to present a totally different picture, *viz.*, one in support of the revision. The point to be emphasised was that such a seemingly innocent rearrangement of figures would mean essentially a re-adjustment of the initial hypothesis in favour of another favouring a desired conclusion. As much if not most of the statistical work in Government finally boiled down to arithmetical calculations, the temptation was natural, indeed often irresistible for many to regard that such work could be done competently and without serious hazard without undue dependence upon experts. Precisely this sort of play with data, however, ultimately brings the science of statistics into periodic disrepute. The ability to formulate meaningful hypotheses having a solid foundation of cause-effect relationship, and the objectivity to adhere to such hypotheses against others more alluring, which could be made to fit a given body of data and yet favour a desired conclusion, generally develops only with professional training and practice and it is only fair that the advice of those who have this ability and objectivity should be valued and sought at the proper time if confusion is to be avoided in the public mind.

Dr. K. S. Rao (Ministry of Food and Agriculture, New Delhi) and Dr. P. V. Krishna Iyer (Defence Science Laboratory, New Delhi) also participated in the symposium,

In the concluding remarks, the Chairman emphasised the need for an operational research unit for agriculture, and pointed out that agricultural scientists in agriculture should be prepared to assess the value, in terms of increased production and economic returns, of new techniques and communicate this information to the planning economists. It was common assumption of the planners that as they had utilized the best figures available in framing the Plan the target must be achieved. Such an assumption often led to grave disappointment. The experience in Russia had shown how fraught with difficulty was the fulfilment of agricultural plans. He stressed the need for a running assessment from year to year both of actual production and of the rate of adoption of new techniques. Of course, whether irregularities could seriously affect actual production, and a determination of its influence would be of the greatest value in assessing real progress, since the annual figures could then be adjusted for variations in weather.

The place of experiments in planning was two-fold, *viz.*, the evaluation of provisional yardsticks by which the returns from improvements in techniques could be assessed and the determination of the best practices to recommend. Surveys were complementary to experiments since they gave measure of the actual improvements in techniques. The experiments on cultivators' fields and the surveys of agricultural practices, therefore, would both make a vital contribution to the formulation of the plan and to the assessment of its progress.

Finally, with regard to Dr. Panse's contention that better feeding of animals was more important than breeding in increasing the production of animal products, he remarked that in his view breeding and feeding were complementary. Without genetical improvement the response to better feeding would be poor, while without better feeding improvement of breed was likely to be of little value.