

**SYMPOSIUM\***  
**ON**  
**YIELD GAP ANALYSIS**

*Chairman : DR. MAHATIM SINGH*  
*Professor of Agronomy,*  
*Banaras Hindu University, Varanasi*

*Convenor : DR. R. K. PANDEY*  
*Scientist,*  
*IASRI, New Delhi*

A symposium on yield gap was organised on 6th December, 1986 under the chairmanship of Dr. Mahatim Singh, Professor of Agronomy, BHU, Varanasi.

At the outset Prof. Prem Narain, Secretary, Indian Society of Agricultural statistics and Director, IASRI, New Delhi welcomed Dr. Mahatim Singh, who introduced the subject in brief and explained the importance of yield gap, its measurement, analysis and study of constraints. Five papers listed in the beginning were presented and discussed; but the last four papers could not be presented as the authors of these papers were not present. There was a good deal of discussion on the topic. Several speakers spoke about the problem of developing measurement techniques for yield gap. The Chairman invited Dr. Ambika Singh for his comments. Dr. Singh emphasized that the concept of potential yield and yield gap should be very well defined in the first instance. One has also to make sure whether yield is measured from breeder plot, national demonstration plot or from experiment-station plot. He suggested that there are 3 main components in improving the yield. These are: package of knowledge, package of services and package of government policy. He also emphasized that the yield gap and potential could be measured for smaller areas

\*Organised on 6th December 1986, during the 40th Annual Conference of the Society at Banaras Hindu University, Varanasi.

and regions. The average yield should be estimated for Taluka/regions. Various categories of farmers such as big, small and large should be covered. Dr. Daroga Singh also gave his views on the yield gap and variation in yield and emphasized that the potential yield and yield gap should be estimated for smaller areas.

Based on the papers presented and discussed, the recommendations emerged are as follows :

The research work should be speeded up for defining the concept of yield gap. Improvement in the methodology of measurement of yield gap should also be undertaken.

### 1. STUDY OF PRODUCTION POTENTIAL AND YIELD GAP IN FOODGRAINS PRODUCTION

R. K. PANDEY and SHANTI SARUP  
*I.A.S.R.I., New Delhi*

The potential farm yield can be estimated by conducting experiments on the farms. On the basis of knowledge and experience of the researchers, biological factors are identified which are the main causes of low yields. The accuracy of potential yield estimate largely depends upon the choice of factors.

Constraints to higher yields may be biological, physical, socio-economic, institutional etc. The yield gap and contribution of individual factors included in the experiments are computed from experimental data. The reasons for various biological and other constraints can be studied by conducting socio-economic surveys of farming households. The constraints in the realisation of potential yields can be studied through the following approaches:

- (1) Functional analysis by estimating production functions;
- (2) Programming techniques; and
- (3) Use of statistical technique such as discriminant function approach.

In a study the potential yield of rice and wheat and other foodgrains was computed using the results from the national demonstration trails. The average farm yields were obtained through various other publications for the period 1974-75 to 1977-78.

It was observed that the main rice growing states of Bihar, Orissa, Madhya Pradesh and Uttar Pradesh had the highest index of yield gap (around 73). Besides Punjab the states of Tamil Nadu, West Bengal, Maharashtra, Jammu and Kashmir were realising just half of the potential yields. In the states of Haryana, Kerala, Karnataka, H. P., Rajasthan and Andhra Pradesh the index of yield gap was around 50 to 65.

In the case of wheat, the states of Gujarat, and Haryana were tapping about one-half of the yield potentials. The index of yield gap in most of the states was around 70. Even in the state of Punjab only two-thirds of the wheat potential yield was being realised.

In respect of jowar and bajra, it was observed that the yield gap indices in most of the states were around 80 while for maize it was comparatively lower. Even the state of Tamil Nadu achieving the highest productivity of jowar and bajra was realizing only one-fourth of the existing production potential of these crops while in case of maize, the highest productivity state of Karnataka was tapping little more than half of the yield potential of maize crop.

The study showed that there is still an adequate untapped yield potential available for these crops in all the states. The analysis further revealed a wide difference in the actual and recommended level of input use and practices resulting in low productivity of these crops in the country.

Investigations are needed to examine whether the yield potential created due to technological innovations are economically viable. This is because farmers in general do not use the recommended dose of inputs. Instead they prefer the use of inputs at relatively lower levels. Thus, the question is whether, there is some-other potential such as 'economic potential yield' which is lower than the usual potential determined on agronomic considerations.

## 2. PRODUCTIVITY PROFILE OF AGRICULTURE

PADAM SINGH

*Planning Commission, New Delhi*

Indian agriculture during the three and half decades of planning has developed many fold. The growth rate of value added in agriculture during 1950-51 to 1984-85 has been over 2 percent per year. The productivity profile of agriculture with a view to identify regions as high, medium and low productivity and to analyse the details of reasons of this performance contrasts has been studied.

The criterion used for classifying district is the 'adjusted productivity level'. The productivity is measured in value terms per unit of net sown area. The crop considered are cereals pulses, oilseeds, fibre crops, sugarcane and tobacco.

351 Districts have been classified as very low, low, medium and high productivity districts. Distribution of number of districts belonging to various regions separately for each of the productivity class has been examined. Share of area and total value of output of different regions in India has also been studied.

### 3. YIELD GAP ANALYSES WITH REFERENCE TO ANIMAL HUSBANDRY

J. P. JAIN and SHIVTAR SINGH  
*I.A.S.R.I., New Delhi*

Yield gap—the difference between the potential yield and the actual yield in farmers' producing units is caused primarily by bio-physical and socio-economic constraints. The purpose of yield gap analysis essentially is to identify the major bio-physical constraints responsible for the yield gap and to determine the contribution of each factor to the gap, and to identify the possible socio-economic constraints impeding adoption of the improved technology. For achieving the objectives the two approaches: the survey approach and the experimental-cum-survey approach are presented. The latter approach has an edge over the former in assessing bio-physical constraints more precisely but is comparatively costlier and operationally more difficult to adopt in large animals. The analytical models for analysis of data may include parameteric and non-parameteric techniques.

For measuring the bio-physical constraints from the survey data the two complementary techniques: causal modelling (or the path coefficient analysis) and production function approach are delineated. The causal modelling technique in addition to providing direct effects of different factors permits estimation of indirect effects via other factors, thereby helping in identification of major causal factors affecting yield as well as their appropriate manipulation for increased yield. However, it does not permit estimation of the contribution of each factor to the yield gap.

In production function approach, two different decomposition analysis appropriate to two situations: when the producing units following old and new technologies are distinct and when they are not, are discussed. In the former situation two production functions are fitted, one for farmers adopting the new technology and one for those continuing with the old technology. These two functions are then manipulated into a single decomposition equation for apportioning the total gap due to technical change and due to the change in the input factors. In the latter situation instead of two production functions only one is fitted and contribution of each input factor to the yield gap accruing as a result of new technology assessed.

For evaluating socio-economic constraints there are three types of analyses: adoption analysis, descriptive analysis, and economic analysis. The statistical techniques in adoption analysis comprise use of multiple regression and the Mahalanobis'  $D^2$ -statistic. The variables that are not included in the regression model are tested for their influence on the

intensity of adoption of improved technology using rank correlation and or  $\chi^2$ -test. The relative economics of different input combinations are studied using the usual budgeting technique undereconomic analysis, whereas farmers' perception of input use and socio-economic condition in the area that may explain farmers' reluctance to adopt new technology are studied using simple tabulations as part of descriptive analysis.

In the experimental-cum-survey approach the statistical considerations involved in the conduct of experiments and analysis of data are discussed. These include choice of test factors, selection of experiment sites, experimental design, assessment of contribution of different factors to yield gap when interaction between factors is significant or absent.

Finally the use of foregoing techniques in yield gap analyses are illustrated with live data drawn from animal husbandry sector bringing out clearly their role and implications.

#### 4. ANALYSIS OF YIELD GAP FOR CROPS

D. V. SUBBA RAO and M. SUBRAHMANYAM  
*C.T.R.I., Rajahmundry (A. P.)*

The yield gap is the difference between the crop yields realised at the experiment stations and by farmers on their farms. This difference is attributable to environmental factors, socio-economic factors, non-adoption of recommended package of practices by the farmers, input risk, risk due to pests and diseases etc. yield gaps may be physical gap and economically recoverable gaps. The authors have studied the yield gap observed in FCV Tobacco crop production in different agro-climatic zones of the country. The demonstration trials at research stations indicated the yield levels varying from 1193 kg. per hectare to 2274 kg per hectare for various varieties. But the same on the farmers' field range between 832 kg. per hectare to 1975 kg. per hectare.

Identification of factors responsible for yield gap has been undertaken. The relative contribution of factors to yield gap has also been examined using production function approach.

#### 5. YIELD GAP ANALYSIS IN CHICKPEA

G. C. MISRA, O. N. SINGH and S. SINGH  
*Banaras Hindu University, Varanasi*

An experiment was conducted to see the trend of yield reduction in Chickpea by adopting different package of programmes at Banaras Hindu University during the years 1983-84 and 1984-85. The improved variety

T-3 obviously yielded more than the local one. The adoption of full package gave maximum yield (1491 kg/ha) and was significantly superior to the rest of the input treatment. The omission of weed control measures and fertilizer application caused maximum yield gap by reducing the yield 35.91 and 32.81 percent respectively and were emerged as most important inputs contributing towards yield. A serious reduction in yield was also found by adopting local variety interacting very poorly with local method. The improved variety widened the yield gap over the inputs suggesting, thereby, the input use with improved variety is must. The yield was not affected much by omitting inoculations, irrigation and plant protection measures.

## 6. YIELD GAP ANALYSIS OF FIELD CROPS—A ANALYTICAL APPROACH

R. I. SINGH

*C. S. Azad Univ. of Agric. & Tech., Kanpur*

The yield gap analysis under field conditions has assumed a special significance in the recent years with the innovation of new farm technologies and their adoption by the farmer. The objective of the paper is to present the analytical approach for yield gap for field crops in order to identify appropriate strategies of investigations and research to solve the limits to productivity and adoption of field crops.

The determination of actual and potential farm yields along with the experimental technique for gap analysis in farming system have been discussed.

## 7. YIELD GAP ANALYSIS IN PADDY

V. D. GALGALIKAR, B. D. BHOLE and P. N. BIDWAI

*Punjab Rao Krishi Vidyapeeth, Akola*

Present study pertains to the selected area of Bhandara district. About 70 per cent of the gross cropped area in this district is covered by paddy. Specific objectives of the study were (i) to work out the yield gap in paddy on cultivators fields, (ii) to identify the factors responsible for variation in yield and (iii) to suggest the ways for improvement in yield of paddy. In all 140 paddy plots from 5 randomly selected clusters of 3 villages each were studied. Data were collected by survey method. Data pertained to 1985-86 kharif season. For studying yield gap analysis plots were arranged in descending order of yield and were divided into three equal groups. These groups were named as high yield, medium yield and low

yield groups. In addition to this, variety wise input-output analysis was also made.

Present study leads to the following broad conclusions. Low coverage under High yielding varieties of paddy (28 per cent) is the major reason for low yields. Non-availability of HYVs seed was the main reason for low coverage of HYVs. The other reasons for low yields were the adoption of traditional (broadcasting) method of sowing, delay in transplanting, low level of fertilizers and non-adoption of plant protection measures. Suggestion that emerges from this study is that efforts need to be made to increase the coverage under HYVs of paddy by motivating the cultivators with adequate and timely supply of seed (may be on subsidised rate) and other key inputs.

#### 8. AN ECONOMIC ANALYSIS OF YIELD GAP IN FOODGRAIN IN EASTERN U. P.

J. P. MISRA and B. B. SINGH

*N. D. Univ. of Agril & Tech., Faizabad*

To meet the requirement of increased population we need 225 million tonnes of foodgrains by 2000 A. D. There is limited scope to bring uncultivated land under cultivation. Therefore, only alternative left is to increase the agricultural productivity per unit of area. It has been realised that average yield per hectare of foodgrains on farmers field is far below than their potential farm yield. In the present paper efforts have been made to quantify the gap and identify the constraints with the following objectives.

- (1) To estimate the trend and variability in the yield of foodgrain crops in eastern U. P.;
- (2) To determine the gap in the yield of and income from major food-grain crops;
- (3) To identify various constraints for foodgrain production in eastern U. P.

To estimate the trend and variability, time series data for the years 1965-66 to 1982-83 have been taken from Directorate of Agriculture, Lucknow. Data regarding input-output for the year 1984-85 have been taken from annual report on National Demonstration Scheme and M.Sc. (Ag) Agricultural Economics thesis of this university for the analysis of yield gap and constraints to high yield. It is evident from empirical results that the coefficient of wheat yield was positive and highest followed by Rice. There was wide fluctuations in the yield of major foodgrains. The

highest coefficient of variation (34.6%) was observed in Rice and lowest (12.80 percent) in case of Barley. The difference between potential farm yield and actual farm yield at farmers field (Gap II) was recorded maximum (36.11 qt/ha) in case of Paddy followed by Wheat (29.53 qt/ha) Maize (15.07 qt/ha) and Bajra (15.07 qt/ha).

However, the main constraints to high yield in the study area reported by the farmers were lack of adequate capital, costly inputs, non-availability of inputs, labour problems, irrigation, rainfall irregularly, and attack of pest and diseases.

## 9. SOME INVESTIGATIONS INTO YIELD GAPS FOR WHEAT CROP UNDER FIELD CONDITIONS

S. K. RAHEJA and P. C. MEHROTRA  
*I. A. S. R. I., New Delhi*

The total yield gap in productivity level of a crop viz. the difference between maximum yield possible under ideal management and average yield under field conditions (realized under farmers own management) has been studied into three components as (i) research gap, (ii) research cum-management gap and (iii) extension gap. In this paper the last component, namely, the extension gap has been further classified into two sub-groups (a) potential farm yield under National Demonstration Trials/progressive farmers average yield in an area is the average yield of the area and (b) the average yield level of the area versus the yield of the non-programme farmers in the area. These two components of the extension gap have been studied with respect to the input level and management practices as also the inter-district variability of this gap.