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CONSTRUCTION OF AGRICULTURAL INDEX NUMBERS IN INDIA

(Report of the Technical Committee)

DIRECTORATE OF ECONOMICS AND STATISTICS,
MINISTRY OF FOOD, AGRICULTURE,
COMMUNITY DEVELOPMENT AND COOPERATION.

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PREFACE

During recent years index numbers have assumed considerable importance for planning and policy making. A review of the scope and methodology of the various agricultural index numbers being constructed at various levels in India showed that in order that they might reflect faithfully the trends in area, production, productivity, prices, etc., over time and provide a firm basis for comparison of the performance of different regions in agricultural development, the existing series needed a number of improvements. Accordingly, a Technical Committee was set up in the Ministry of Food, Agriculture, C. D. and Cooperation, under the Chairmanship of Dr. V. G. Panse, to look into the scope, coverage, methodology, etc., of the various index numbers.

The Committee reviewed the technical details of the more important index number series in the sphere of agriculture and made far-reaching recommendations for improvements in the scope, coverage, and methodology of the existing series. The Committee further recommended the initiation of a number of new series of index number *e. g.* net area sown, cropping pattern, cropping intensity and productivity per hectare. Necessary action has already been initiated for the construction of all-India Series in the light of the recommendations of the Committee. In order that the series at lower levels *viz.*, State and Region, may provide a firm basis for assessment of the progress in agricultural development and for inter-State and inter-regional comparisons of the trends, the State and regional index numbers also need to be revised.

NEW DELHI;
July, 1966.

J. S. SARMA,
Economic and Statistical Adviser to the Government of India,
Ministry of Food, Agriculture, C. D. and Cooperation

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CHAPTER 1

INTRODUCTION

1.1. The Working Group on Agricultural Statistics set up by the Ministry of Food and Agriculture in connection with the preparatory work for formulation of the programme for the Fourth Five Year Plan in regard to the improvement of agricultural statistics reviewed *inter alia* the scope and methodology of the various index numbers relating to the agricultural economy being compiled by various Central and State Organisations. The Working Group felt that the existing series needed a number of improvements in order that they might reflect faithfully the trends in area, production, productivity, prices etc. over time and providea firm basis for comparison of the performance of different regions in agricultural development since the advent of planning in the country. In view of the importance of these index numbers for planning and policy making and the multiplicity of uses to which these are being put at the national and international levels, the Working Group felt that a deeper examination of the various problems involved in the construction of the different series of index numbers was necessary. Accordingly, a Technical Committee on Index Numbers relating to Agricultural Economy was set up to look into the scope, coverage, methodology, etc. of the various index numbers being constructed at different levels. The membership of the Technical Committee was as follows:

1. Dr. V. G. Panse, ***Chairman***
   Statistical Adviser, Indian Council of
   Agricultural Research.
2. Prof. M. L. Dantwala,
   Chairman, Agricultural Prices Commission.
3. Shri S. C. Chaudhri,
   Member-Secretary, Agricultural Prices Commission.
4. Shri J. S. Sarma,
   Economic and Statistical Adviser,
   Ministry of Food, Agriculture, C. D. and Cooperation.
5. Shri Ram Saran,
   Additional Economic and Statistical Adviser,
   Directorate of Economics and Statistics.
6. Dr. B. S. Minhas,
   Professor, Indian Statistical Institute.
7. Shri G. D. Mathur,
   Assistant Economic Adviser,
   Ministry of Industry.

8. Shri B. Sitaraman,
Officer on Special Duty,
Central Statistical Organisation.

9. Shri S. D. Bokil,
Institute of Agricultural Research Statistics.

10. Shri R. S. Chadha,
Asstt. Economic and Statistical Adviser, *Convenor*
Directorate of Economics and Statistics.

In addition to the above members, a number of persons from various Central organisations were associated with the deliberations of the Committee. A list of these persons is given in Appendix I.

1.2. The Committee held three meetings on 24th December, 1965, 17th January, 1966 and 22nd January, 1966 and discussed the detailed notes and memoranda prepared by the concerned officers and organisations and reviewed the scope, coverage, methodology etc. of the existing All-India and State series of index numbers relating to the agricultural economy. The Committee felt that there was an urgent need for introducing refinements and enlarging the scope of the various index numbers being constructed at present. A gist of the discussions held at the three meetings of the Committee alongwith the recommendations for the improvements in the various series of index numbers are given in the succeeding Chapters.

1.3. The report of the Committee has been divided into seven Chapters including the present introductory Chapter which deals with the setting up of the Committee, scope of its work, etc. The remaining six Chapters give a brief review of the technical details of the important index number series in the sphere of agriculture along with the improvements suggested by the Committee. Chapter II deals with the index numbers of area under crops, net area sown, cropping intensity, cropping pattern, crop yields, productivity per hectare and agricultural production. In Chapter III are discussed the problems involved in the improvement of the index number of harvest prices of principal crops in India. Chapter IV deals with the index numbers of parity between prices received and prices paid by the farmer. In Chapter V are discussed the details of the Indicators' Scheme of the Directorate of Economics and Statistics. Chapter VI contains suggestions for the construction of index numbers of cost of cultivation of crops, giving the example of sugarcane. A summary of the recommendations of the Technical Committee in regard to various index number series is given in Chapter VII.

1.4. Action on the various recommendations of the Committee has to be taken at various levels. In order to expedite the finalisation of the revised series in the light of the suggestions made, the Committee recommended that the Directorate of Economics and Statistics should under take the responsibility for implementation of the various suggestions of the Committee by convening meetings of the representatives of the State Governments, arranging training programmes for State staff,

publication of Manuals for the construction of various index numbers, etc. The Committee further recommended that if during the course of implementation of the suggestions any technical problems arose, these may be referred to the Committee again for its consideration.

1.5. *Acknowledgement.*—The Technical Committee wishes to record its high appreciation of the services rendered by the Convenor, Shri R. S. Chadha. He prepared comprehensive notes on various series of index numbers relating to the agricultural economy alongwith suggestions for improvements therein, for the consideration of the Technical Committee. He also prepared the draft report of the Committee.

CHAPTER II

INDEX NUMBERS OF AREA UNDER CROPS, NET AREA SOWN, CROPPING INTENSITY, CROPPING PATTERN, CROP YIELDS, PRODUCTIVITY PER HECTARE AND AGRICULTURAL PRODUCTION.

2.1. In India, index numbers of area under crops, agricultural production and agricultural productivity (yield) are being compiled at the country and State levels. The basic purpose of these index numbers is to study trends over time, to assess the relative contribution of area and yield to the increase in over-all agricultural production over a period of time and to compare the performance of different regions in agricultural development in a given period. In the context of the increased emphasis on agricultural development during the Fourth Five Year Plan, it is necessary that a clear picture of the performance of agriculture in the past should be available, by crops and regions, to throw light on the weaknesses in the existing policies and to help in the formulation of policies that will foster more rapid economic growth in future. The Committee felt that the existing series needed a number of improvements. For example, it is observed that besides area and yield, changes in cropping patterns also have an important bearing on the growth of production, particularly in those States where, over time, there have been significant shifts from one group of crops to another. Further, assessment of trends in net area sown, cropping intensity and productivity per net hectare are important for policy formulation. The base periods of the existing series are also pretty old and need revision. Broad details of the existing series alongwith the improvements needed are discussed below briefly.

Historical Background

2.2. The first series of all-India Index Numbers of Agricultural Production war compiled in the year 1949, with quinquennium ending 1938-39 as the base, the coverage being limited to 19 principal crops for which reliable estimates were then available. With the extension of coverage of crop estimates to more crops and the improvements in the reliability of the estimates, a revised series with the agricultural year 1949-50 as the base and the coverage extending to 28 principal crops, was issued in 1954. In 1955, the States were asked to undertake construction of similar index numbers following essentially the same concepts, definitions and methodology as adopted in the all-India series. It was observed in 1960 that while the States generally followed the concepts and methodology as adopted by the Ministry of Food and Agriculture for the all-India series, there were a number of variations in regard to the choice of the base period, coverage, method of construction etc., which vitiated inter-State comparability of the indices. Accordingly, broad criteria governing the selection of crops for inclusion in the index, base period, method of construction and weighting diagram, were supplied to the States in June 1961 for their guidance. In the light of these criteria, the States started revising their series of index numbers of agricultural production gradually.

2.3. For study of trends in area under crops and agricultural productivity over time, all-India index numbers of area under crops and agricultural productivity were issued in August 1962 with the same base and coverage as for the index of agricultural production. The States were also asked to construct similar index numbers. In connection with the study of Growth Rates, a review was again made of the State index numbers in 1963, which showed that from the point of view of inter-State comparability, the State series needed a number of improvements. A programme of training of State Officers in the construction of index numbers was accordingly organised by the Directorate in April-May 1964.

Base Period

2.4. The base period of the existing all-India series is the agricultural year 1949-50 All the States except Rajasthan, Orissa and West Bengal have the agricultural year 1956-57 as the base for their series. Rajasthan has the quadrennium ending 1955-56 as the base. Orissa and West Bengal have 1952-53 and 1949-50 respectively as base periods.

2.5. In the selection of the base period for the series under discussion, certain basic criteria are kept in view. Some of these criteria are :

(i) Base period should be recent enough so that the comparisons are meaningful. It is recognised that longer the time difference between current and comparison base period, more difficult it will be to interpret the index number series as satisfactory indicators of area/volume/productivity changes.

(ii) It should be reasonably normal or average from the point of view of weather, agricultural production and agricultural prices.

(iii) It should be a period by which most of the changes in State boundaries had already taken place and collection of reliable data on area, yield and production of most of the agricultural commodities had been initiated on a regular basis.

(iv) It should be a period by which the geographical coverage of the estimates of prouction of most of the crops had been completed and the methods of estimation fairly standardised in a major part of the country, so as to eliminate the effect of changes due to increase in coverage or differences in the methods of estimation.

(v) To ensure inter-State comparability, a common base period should be adopted for all the State and all-India series, as far as possible.

(vi) The base period should preferably be one which is used for other allied series of index numbers so that comparisons with other series/sectors of the economy or their joint use in economic analysis and economic planning and policy making might be facilitated.

(vii) In order that the series might serve the need for assessment of the progress of programmes of agricultural development under the Five Year Plans, the base period should preferably be a land-mark in the planning stages, such as the base of a plan.

2.6. Agricultural production is generally affected by uncertain factors like rainfall, floods, sunshine, temperature, etc. and is, therefore, subject to large fluctuations from year to year. As such, for study of trends in area, production and productivity, the base period should generally be more broad-based by taking an average of a number of years coinciding with the agricultural cycle at the all-India or State levels. There has been considerable discussion regarding the use of a single year or the average of a number of years as the base period. In view, however, of the large size of the country with differing seasons and crop complexes in different regions, it has not been possible to select a particular number of years to represent an agricultural cycle in respect of all the States and Crops. It is, however, felt that a period of 3-5 years would be quite appropriate. The Central Advisory Council on Statistics at its meeting held in December, 1961, recommended that the last year of the Second Plan or if that was not considered suitable in any particular case, some other year as close as possible to the last year of the Second Plan might be adopted as the base of each index. If no single year was considered suitable as the base for any index, a three year average including the last year of the Second Plan period might be considered for adoption.

2.7. The year 1960-61 was characterised by generally favourable weather conditions and well-distributed rainfall over large parts of the country, though, like all other years, it also did have its share of floods and droughts. As a result, a significant advance in agricultural production was achieved during this year. The previous year *viz.*, 1959-60 was characterised by unprecedented heavy rains and floods in various parts of the country during the monsoon season, a spell of drought in Sub-Himalayan West Bengal, Bihar Plains and East U. P. during August, 1959 and another spell of drought during February, 1960 in the north eastern and north-western regions. These adverse weather conditions had their impact on agricultural production during the year. The first year of the Third Plan, *viz.*, 1961-62, was also characterised by an uneven distribution of rainfall over large parts of the country, particularly in the western and north eastern States. From a study of the data on area and production of various crops, in different States, the Technical Committee felt that in the recent past an average of the three years ending 1961-62 would represent a normal period from the point of view of agricultural production. The Committee, therefore, recommended that the triennium ending1961-62 may be adopted as the common base period for all-India and State series of index numbers of area under crops, net area sown, agricultural production etc. This period statisfies all the criteria given in para 2.5 above and is in line with the recommendations of the Central Technical Advisory Council on Statistics. The F. A. O. has also recommended a base period centering around the year 1960 and extending where necessary over a period of three or five consecutive years, for national index numbers of agricultural production.

2.8. The Committee further recommended that to ensure inter-State comparability all efforts should be made by the Directorate of Economies and Statistics to persuade the States to adopt the triennium ending 1961-62 as the base for their series.

2.9. In view of the rapid changes in cropping patterns etc. in some regions, the base period selected should be revised once every five or at the most ten years.

Coverage and Grouping

2.10. *Coverage.*—In principle, the index of agricultural production should cover besides the agricultural crops grown in the State/country, animal products and fish catches. But in the absence of reliable annual production estimates of fish and animal products, the coverage of the series has to be limited to crops only. The Committee, however recommended that steps should be taken to conduct suitable surveys for estimation of production of important animal products and fish on annual basis.

2.11. Even among crops, reliable annual estimates are not available for a number of crops. The coverage of the series has, therefore, to be limited to the crops for which such estimates are available. The coverge of the existing all-India is limited to the following 28 crops :

I. *Foodgrains :*

(i) *Cereals*—Rice, Jowar, Bajra, Maize, Ragi, Wheat, Barley and Small Millets

(ii) *Pulses*—Gram, Tur and Other Pulses.

II. *Non-Foodgrains :*

(i) *Oilseeds*—Groundnut, Sesamum, Rapeseed and Mustard, Linseed and Castorseed.

(ii) *Fibres*—Cotton, Jute and Mesta.

(iii) *Plantation Crops*—Tea, Coffee and Rubber.

(iv) *Miscellaneous Crops*—Sugarcane, Pepper, Tobacco, Potatoes, Ginger and Chillies.

These crops accounted for 92 percent of the gross area sown in the country. The crop coverage of the individual State series varies from State to State. Some of the crops covered by the all-India series are not included in the series of some States where these are not grown to any appreciable extent. Similarly, certain crops not included in the all-India series are included in some of the State series, because of their local importance and availability of data in those States. The selection of a crop is generally done on the joint consideration of (i) value of production of the crop and (ii) extent of area covered by it. This joint consideration is considered essential as any one of these two criteria by itself is considered inadequate for arriving at a proper representation of crops to be included in the index. The crops covered in different State series account for between 80 per cent and 97 per cent of the gross cropped area.

2.12. During recent years, a number of additional crops have been covered under the system of crop estimation. For example, estimates of area and production of Sann-Hemp crop are regularly available since 1957-58. Turmeric has been brought on forecasting basis from 1964-65. Similarly, proposals for issue of forecasts of safflower nigerseed, coconut, arecanut, banana and guarseed have been finalised in consultation with the State Governments. Estimates of production of cottonseed are also available on a regular basis. Thus, to make the all-India and State series

more representative, their coverage needs to be enlarged by inclusion of the above mentioned crops. The States should make efforts to extend the system of crop estimation to more crops especially fruits and vegetables for some of which the necessary methodology for estimation of area and production has already been evolved by the Institute of Agricultural Research Statistics. With the availability of estimates for more crops in future, the coverage of the series can be further enlarged at the time of next revision of the base period.

2.13. *Grouping of Crops.*—There are several ways of grouping of crops for purposes of construction of index numbers of area, production and productivity. These may be grouped according to the biological species of the commodities or according to the utilisation of these commodities. It will be seen from para 2.11 above that the existing grouping of crops in the all-India series is from the utilisation point of view. Similar grouping is adopted in most of the State series. In view of the need for study of trends in domestic production of foodgrains and industrial crops, the existing classification of crops into 'foodgrains' and 'non-foodgrains' is in order. However, with the extension in the coverage of the series by inclusion of more crops, the sub-groups under 'non-foodgrains' will have to be further enlarged. The revised grouping of crops for the enlarged coverage of the all-India series, as suggested above, should be as follows :—

I. *Foodgrains :*

(i) *Cereals*— Rice, jowar, bajra, maize, ragi, wheat, barley and small millets.

(ii) *Pulses*—Gram, tur and other pulses.

II. *Non-Foodgrains :*

(i) *Oilseeds*—Groundnut, sesamum, rapeseed and mustard, linseed, castorseed, cottonseed, safflower, niger and cocount.

(ii) *Fibres*—Cotton, jute, mesta and sann-hemp.

(iii) *Plantation Crops*—Tea, coffee and rubber.

(iv) *Condiments and Spices*—Pepper, chillies, ginger, turmeric and arecanut.

(v) *Fruits and Vegetables*—Potatoes, bananas and cashewnuts.

(vi) *Miscellaneous Crops*—Sugarcane, tobacco and guar.

The above crops taken together account for nearly 94 per cent of the gross cropped area.

Concepts

2.14. *Concept of Area.*—In the existing series of index numbers of area under crops, the overall index for all crops is computed on the concept of gross area. However, for study of trends in productivity of cultivated area it would be useful to have an index of 'net area sown'. It was brought to the notice of the Committee that there was a time lag of 2-3 years in the availability of basic data on 'net area

sown' and as such there would be corresponding time lag in the availability of these index numbers. But, in view of the usefulness of the proposed indices, the Committee recommended that while efforts may be made to minimise the time lag in the availability of land utilisation statistics, construction of index numbers of 'net area sown' should be initiated immediately. An attempt has been made to construct all-India index numbers of 'net area sown' for the years 1949-50 to 1961-62 by making due allowances for the increase in coverage from year to year in different States. These index numbers are given in Appendix II. State-wise index numbers of 'net area sown' should also be computed by the State Governments.

2.15. *Concept of Production.*—The index of agricultural production aims at summarising trends in volume of agricultural production as a whole and important segments thereof. It has to be decided as to what type of production should be taken for purposes of index number construction. For example, output of a crop can be taken as the biological output without deducting the losses in the field. However, for most of the crops our method of estimation of yield takes care of the losses in the field and what we get is the estimate of the crop collected by the farmer. Thus, one concept of production can be gross production (excluding losses in the field). The F.A.O. has been constructing index numbers of total output after deduction of waste and that portion of output which is utilised for further production *viz.* seed and feed. In our case, however, the scope of the index is limited to crops only. Further, data on quantities of different commodities used for seed are not available. As such, the concept of gross output excluding losses in the field should be adopted, as in the existing series

2.16. Another concept of output can be the concept of value added in agriculture. In view, however, of paucity of information on a number of items especially on inputs, it may be difficult in the present circumstances to build up a strictly comparable series of value added in agriculture over a sufficiently long period of time. Construction of an index of this type should, therefore, be kept in abeyance till more reliable data start flowing.

2.17. Another point to be considered is the stage of the production process of various commodities which should be taken for the index of agricultural production. In the existing series, production of some crops was considered after the raw product has been processed, *e.g.*, rice instead of paddy. With the improvements in the efficiency of processing, the quantity of processed product would be more for a given production of the raw product than what is currently assumed. The Committee felt that as our primary concern was with the availability of a product, the accounting of the increase in the processed product due to improvement in the efficiency of processing as increased production would be in order. The Committee, therefore, recommended that the existing practice of constructing index numbers on the basis of raw or processed products, as the case may be, should continue. The Directorate of Economics and Statistics should, however, publish State-wise conversion factors of crops for which production data are available in terms of processed product. A study should also be made to assess the effect of the change in the form *i.e.* raw or processed, on the overall index of agricultural production.

2.18. *Concept of Productivity.*—Productivity is defined as the ratio between output and input. Although a number of factors combine to effect changes in productivity, it is necessary that a particular 'yardstick' of input factor may be chosen. For example, if we want to measure productivity of labour it will take the following form :

$$\text{Labour Productivity} = \frac{\text{Output}}{\text{Number of Workers or Number of Man-hours}}$$

Labour productivity computed in this manner reflects the magnitude of output per unit of labour input. Unfortunately, reliable data on number of workers in agriculture are not available over a long period of time and as such it is difficult to attempt construction of index of labour productivity in agriculture.

2.19. Land being one of the factors of production, land productivity can be measured as follows :

$$\text{Land productivity} = \frac{\text{Output}}{\text{Number of hectare of Land}}$$

As areas under individual crops are available on gross basis only, the existing indices of productivity are on gross basis and are, therefore, indices of yield per hectare. As suggested in para 2.14 above, it would be worthwhile considering 'net area' also for working out measures of changes in land productivity. Such index numbers would reflect not only the changes in yield per hectare but would also take into account the increases in productivity of land due to increase in double/multiple cropping over a period of time. The Committee, therefore, recommended that the index of productivity on gross area basis may be designated as the "Index of Crop Yields". Another Index of Productivity per Hectare should also be constructed.

Weights

2.20. *Area under Crops.*—As areas under crops can be added acre by acre, in the existing series in pooling together the indices of area under different crops for computation of indices for sub-group, group and all-crops, no explicit weightage has been given. The sub-group, group and all-crop indices have been worked out directly from the area under them in different years. There is thus implicit weighting in proportion to the area under individual crops to the total area under all-crops in the base year. In this way, equal weightage is given to areas growing different crops with divergent yields and incomes per acre of growers. Further, the overall index of area under crops does not take into account the changes in cropping patterns. To provide a basis for assessment of chages in cropping patterns over time, it would be useful to develop an index of cropping pattern. For this purpose weights will have to be assigned to different crops in proportion to gross value of production per acre in the base year. The index of cropping pattern would be as under :—

$$\text{Index of Cropping Pattern} = \frac{\Sigma c_{ij} y_{io} p_{io}}{\Sigma c_{io} y_{io} p_{io}} \times 100$$

Where, c_{ij} = Proportion of area under the ith crop in the jth year

$$\text{or } \frac{a_{ij}}{\Sigma a_{ij}}$$

c_{io} = Proportion of area under the ith crop in the base period

$$\text{or } \frac{a_{io}}{\Sigma a_{io}}$$

a_{ij} = Area under the ith crop in the jth year.

a_{io} = Area under the ith crop in the base period.

y_{io} = Yield per hectare of the ith crop in the base period.

p_{io} = Price per unit of the ith crop in the base period.

2.21. *Agricultural Production.*—In the existing all-India and State series, weights are assigned to the different crops in proportion to the total value of production of each crop during the base period. According to the method of construction of group and all-crop indices, value weights applied mean price weights in the Laspeyres' Aggregative formula as would be clear from the discussion on methodology. The prices used for evaluation of production in the existing series are State annual harvest prices during the base year for State series and all-India weighted average harvest prices for the all-India series. In cases where harvest prices were not available, wholesale prices during the post-harvest period were utilised with appropriate allowances. There are a number of problems that need to be considered in this connection. These are : (a) period to which the prices should relate; (b) type of prices to be used; and (c) use of uniform price weights for State series as against differential weights being used at present.

2.22. It is generally recognised that in the aggregative formula of Laspeyres' type, average prices over the comparison base period should be used as weight coefficients. However, when a single year is taken as the base, the weighting diagram may become out of date with appreciable and perhaps permanent changes in the price structure of agricultural commodities. Thus, as far as possible, price weights for the index of agricultural production (and also for index of crop yields, productivity, etc.) should relate to an average of three years ending 1961-62 *i.e.* the period recommended as the base for the all-India and State series of index numbers.

2.23. The prices used in determining the weights for the index of agricultural production should reflect the effective prices received by the producers at the farm/village. However, in cases where village prices are not available, wholesale prices at the primary markets where the farmers generally bring their produce for disposal may be made use of. At present, prices for a number of varieties of each commodity are collected for various purposes. From the point of view of weights for the index of agricultural production, etc., the prices should generally relate to the most common variety grown in the region/centre, accounting for the bulk of the production of the commodity. In cases where variety-wise figures of production of a commodity are available, the price should be the weighted average price of the different varieties with their production as weights.

2.24. Another important problem is the choice of weights for State/regional/district index numbers of agricultural production. It is recognised that for purposes of inter-State/regional comparisons, uniform price weights would be preferable to differential weights. A certain amount of artificiality would be there in the all-India prices but for purposes of planning at the national level, uniform price weights would be better. The Technical Committee discussed the question in detail and recommended that :

(i) the official State series of index numbers to be published by the States, should be based on differential weights relating to the respective States;

(ii) For analytical studies involving inter-State comparisons, the Directorate of Economics and Statistics should compile a series of State Indiex Numbers using all-India price weights. To avoid confusion, the limited purpose of the latter series should be suitably explained while publishing the same.

2.25. In the existing series, value weights have been computed on the basis of published production data for the base year without any adjustments. In view of the gradual changes in methods and coverage, adjusted estimates of production of crops for the base year, should be used for the weighting diagrams.

2.26. *Yield and Productivity.*—In the existing series, the crop, sub-group, group and all crop indices of productivity are computed by dividing the index of production by the corresponding index of area. This boils down to the following :—

$$\text{Index of Productivity (yield)} = \frac{\Sigma a_{ij}\ y_{ij}\ p_{io}}{\Sigma a_{io}\ y_{io}\ p_{io}} \times 100 \div \frac{\Sigma a_{ij}}{\Sigma a_{io}}$$

$$= \frac{\Sigma a_{ij}\ y_{ij}\ p_{io}}{\Sigma a_{io}\ y_{io}\ p_{io}} \Big/ \frac{\Sigma a_{ij}}{\Sigma a_{iq}} \times 100$$

where, a_{ij} = Area under the ith crop in the jth year.

y_{ij} = Yield per hectare of the ith crop in the jth year.

a_{io} = Area under the ith crop in the base period.

y_{io} = Yield per hectare of the ith crop in the base period.

p_{io} = Price per unit of the ith crop in the base period.

Thus, productivity index represents the ratio of value of production per hectare of gross area with base period prices in the jth year to the value per hectare of production in the base period.

Another approach could be to weight the yields (in value terms using base period prices) with areas under crops during the current year. The formula for this type of index would be as under :—

$$\text{Index of Crop Yield} = \frac{\Sigma y_{ij} \; p_{io} \; a_{ij}}{\Sigma y_{io} \; p_{io} \; a_{ij}} \times 100$$

Where y_{ij} = Yield per hectare of the ith crop in the jth year.

y_{io} = Yield per hectare of the ith crop in the base period.

a_{ij} = Area under the ith crop in the jth year.

p_{io} = Price per unit of the ith crop in the base period.

The above index of yield would represent the ratio of the value of production in the current year to that in the base period due to changes in yield per hectare of crop with the current year's cropping pattern and base prices. This index when multiplied by the indices of area under crops and cropping pattern would give the index of agricultural production. The Committee recommended that the index of yield should be constructed by weighting the yields with areas under crops during the current year.

2.27. If as suggested in paras 2.14 and 2.19, productivity is measured on net area basis, the index will take the following form :

$$\text{Index of Productivity per Hectare} = \frac{\Sigma a_{ij} \; y_{ij} \; p_{io} \; / \; N_j}{\Sigma a_{io} \; y_{io} \; p_{io} \; / \; N_o} \times 100$$

Where, a_{ij} = Area under the ith crop in the jth year.

a_{io} = Area under the ith crop in the base period.

y_{ij} = Yield per hectare of the ith crop in the jth year.

y_{io} = Yield per hectare of the ith crop in the base period.

N_j = Net area sown in the jth year.

N_o = Net area sown in the base period.

p_{io} = Price per unit of the ith crop in the base period.

This index, when multiplied by the index of net area sown would give the index of agricultural production.

2.28. In their paper on Analysis of Crop Output Growth, November, 1964 Dr. B. S. Minhas and Shri A. Vaidyanathan used an additive scheme of decomposition of the increase in crop production over a period of time due to the following component elements :—

(i) increase in area in the absence of any changes in per acre yields and cropping patterns;

(ii) changes in yields of crops for a constant crop pattern ;

(iii) changes in cropping patterns in the absence of any changes in per acre yields, and

(iv) interaction between changes in per acre yields and cropping patterns.

The scheme of decomposition used is as under :—

$$P_t - P_o = (A_t - A_o)\,\Sigma W_i\, C_{io}\, Y_{io} + A_t \Sigma W_i\, C_{io}\,(Y_{it} - Y_{io}) + A_t \Sigma W_i\, Y_{io}\,(C_{it} - C_{io}) + A_t \Sigma W_i (Y_{it} - Y_{io})\,(C_{it} - C_{io})$$

Where P_t = Crop output in year t.

P_o = Crop output in year o.

A_t = Gross crop area in year t.

A_o = Gross crop area in year o.

Y_{it} = Yield of crop i in year t.

Y_{io} = Yield of crop i in year o.

C_{it} = Proportion of area under the crop i to gross crop area in year 't'.

C_{io} = Proportion of area under the crop i to gross crop area in year o.

W_i = Constant price weights representing 3-year average all-India wholesale prices.

A multiplicative scheme of decomposition of the increase in crop output has also been formulated by Dr. Minhas and Shri Vaidyanathan. This scheme was discussed in a symposium in February, 1965 at the Institute of Agricultural Research Statistics and is as under :—

$$\text{Area} = \frac{A_t}{A_o}$$

$$\text{Yield} = \frac{\Sigma W_i\, C_{io}\, Y_{it}}{\Sigma W_i\, C_{io}\, Y_{io}}$$

$$\text{Cropping Pattern} = \frac{\Sigma W_i\, C_{it}\, Y_{io}}{\Sigma W_i\, C_{io}\, Y_{io}}$$

$$\text{Inter-action} = \Sigma W_i\, C_{it}\, Y_{it}\, \Sigma W_i\, C_{io}\, Y_{io} / \Sigma W_i\, C_{io}\, Y_{it}\, \Sigma W_i\, C_{it}\, Y_{io}$$

Methodology

2.29. The changeover during the last decade or so from the traditional method of reporting area and production of crops to the method of complete enumeration in the case of area and to crop-cutting survey method for estimation of yield, and, also the increase in reporting area have taken place progressively in respect of different crops in different States. To provide for these changes in coverage and methods of estimation, the existing index numbers of area under crops and agricultural production are constructed by the chain-base method under which the area/production of a crop during a year is expressed as a relative of the corresponding area/production in the preceding year, based on the same coverage and methods of estimation. These relatives for each crop are linked to the base year through the intervening chain relatives to give the area/production index for the crop.

2.30. The application of chain-base method involves two basic assumptions which are :

(i) the variation in production/area in the non-reporting areas is the same as that in the reporting areas in the aggregate; and

(ii) the relative variation in the figures of production based on crop-estimation surveys is the same as that based on the traditional method of crop estimation employing eye-appraisal and normal yield figures.

The practical implications of (ii) above are that for the transitional year, that is, when the method of estimation undergoes a change, the estimates of production should be available on the basis of both the traditional method and the crop-estimation surveys. In certain cases where these were not available, no adjustments were made in the existing series. To ensure comparability, it is suggested that in such cases allowance may be made for change in methods of estimation etc. by estimating the transitional years' figure, based on the old method, by extrapolation.

2.31. *Indices of Area under Crops and Net Area Sown.*—As already mentioned no explicit weightage is given to different crops for calculation of the composite subgroup, group and all-crop indices. The formula adopted is as under :—

$$\text{Index of Area under crops} = \frac{\Sigma a_{ij}}{\Sigma a_{io}} \times 100$$

Where, a_{ij} = Area under the ith crop in the jth year.
a_{io} = Area under the ith crop in the base period.

As already discussed in para 2.14 index numbers of area should also be constructed on "net area" also. The formula for the index would be as under :—

$$\text{Index of Net Area Sown} = \frac{N_j}{N_o} \times 100$$

Where N_j = Net area sown in the jth year.
N_o = Net area sown in the base period.

All-India Index Numbers of 'Net Area Sown', after making due allowances for changes in coverage etc., are given in Appendix II.

2.32. *Index of Cropping Intensity.*—During recent years, with the development of irrigation and other measures for intensification of agriculture, there has been a considerable increase in the double or multiple cropped area in the country. To provide a precise measure for assessment of trends in intensity of cropping over a period of time, the Technical Committee recommended that an index of cropping intensity should be compiled on a regular basis. The formula for such an index should be as under :—

$$\text{Index of Cropping Intensity} = \frac{\Sigma a_{ij} \;/\; N_j}{\Sigma a_{io} \;/\; N_o} \times 100$$

$$= \frac{\Sigma a_{ij}}{\Sigma a_{io}} \times \frac{N_o}{N_j} \times 100$$

$$\text{or} \quad \frac{\text{Index of Area under Crops}}{\text{Index of Net Area Sown}} \times 100$$

Where a_{ij} = Area under the ith crop in the jth year.
a_{io} = Area under the ith crop in the base period.
N_j = Net area sown in the jth year.
N_o = Net area sown in the base period.

As in the case of the other index numbers, due allowances should be made for changes in coverage, etc., by adopting the chain-base method.

2.33. *Index of Cropping Pattern.*— As already discussed in para 2.20 above, the index of cropping pattern for all crops taken together would take the following form :—

$$\text{Index of Cropping Pattern} \quad \frac{\Sigma C_{ij}\, Y_{io}\, P_{io}}{\Sigma C_{io}\, Y_{io}\, P_{io}} \times 100$$

(For notations reference may be made to para 2.20)

All-India index numbers of cropping pattern with 1949-50 as base have been constructed for 1949-50 to 1963-64 to give an idea of changes in cropping pattern during recent years. These index numbers are given in Appendix III.

2.34. *Index of Crop Yields.*—The existing formula for computation of index of productivity (or yield) is given by

$$\frac{\text{Index of Production}}{\text{Index of Area}} \times 100$$

It has been observed that while calculating the composite sub-groups/group/all-crop indices sometimes anamolies arise in as much as the composite index works out to above or below the constituent index numbers. Further, with the introduction of the index of cropping pattern, the existing index will not, when multiplied by the indices of area and cropping pattern, give the index of agricultural production. As already discussed in para 2.26, index of yield should take the following form :—

Index of Crop Yields

$$= \frac{\Sigma y_{ij}\ p_{io}\ a_{ij}}{\Sigma y_{io}\ p_{io}\ a_{ij}} \times 100$$

$$= \frac{\Sigma \frac{y_{ij}}{y_{io}}\ a_{ij}\ y_{io}\ p_{io}}{\Sigma a_{ij}\ y_{io}\ p_{io}} \times 100$$

$$= \frac{\Sigma I_{ij}\ a_{ij}\ y_{io}\ p_{io}}{\Sigma a_{ij}\ y_{io}\ p_{io}} \times 100$$

Where I_{ij} = Index of yield per hectare of the ith crop in the jth year.

a_{jj} = area under the ith crop in the jth year.

y_{ij} = Yield per hectare of the ith crop in the jth year.

y_{io} = Yield per hectare of the ith crop in the base period.

p_{io} = Price per unit of the ith crop in the base period.

A statement comparing the composite all-India index numbers of yield for food grains, non-foodgrains and all crops on the basis of the above formula with the existing series is given in Appendix IV.

2.35. *Index of Agricultural Productivity per Hectare.*—As discussed in para 2.27, productivity indices can also be worked out on net area basis. Index of productivity per net hectare will take the following form :—

$$\text{Index of Productivity} = \frac{\Sigma a_{ij}\ y_{ij}\ P_{io}/N_j}{\Sigma a_{io}\ y_{io}\ p_{io}/N_o} \times 100$$

$$= \frac{\text{Index of Agricultural Production}}{\text{Index of Net Area Sown}} \times 100$$

(For notations please refer to para 2.27)

All-India index numbers of productivity per net hectare are given in Appendix EI, alongwith the existing indices of productivity (on gross area basis).

2.36. *Index of Agricultural Production.*—It will be seen from the above that the following formula is followed for construction of index of agricultural production :

$$\text{Index of Agricultural Production } \frac{\Sigma \frac{P_{ij}}{P_{io}} \times P_{io}\ p_{io}}{\Sigma P_{io}\ p_{io}} \times 100$$

$$= \frac{\Sigma P_{ij}\ p_{io}}{\Sigma P_{io}\ p_{io}} \times 100$$

Where, P_{ij} = Production of the ith crop in the jth year.

P_{io} = Production of the ith crop in the base period.

p_{io} = Price per unit of the ith crop in the base period.

Thus, value weigthts employed in the existing method really mean price weights in the Laspeyres' type aggregative formula. To make allowances for changes in coverage and methods of estimation, chain-base mehod is used by comparing the estimates for every two successive years based on the same coverage and methods of estimation and then linking through successive chain-relatives with the base period.

Instead of constructing the index of agricultural production directly, it can be derived in the following manner also :

Index of Agricultural Production

$$= \frac{\text{Index of Area under Crops} \times \text{Index of Cropping Pattern} \times \text{Index of Crop Yields}}{100 \times 100}$$

or $$\frac{\text{Index of Net Area sown} \times \text{Index of Productivity per Net Hectare}}{100}$$

or $$\frac{\text{Index of Net Area Sown} \times \text{Index of Cropping Intensity} \times \text{Index of Cropping Pattern} \times \text{Index of Crop Yields}}{100 \times 100 \times 100}$$

Thus, the different index numbers as recommended above would provide a sound basis for checking their internal consistency.

2.37. *All India Indices to Flow from State Indices.*—All-India and State Index numbers of area under crops, agricultural production and productivity are at present computed independently. If the basic data used for the two sets of indices are the same, the all-India and State indices should be consistent, in principle. Occasionally, however, the adjustments made for changes in coverage and methods of estimation

are not the same in the existing all-India and State series. In some cases even the estimates of area/production utilised for the two series are different. To bring about consistency in the State and All-India series, another approach could be to get the all-India index from the State Indices. The method for combining individual crop indices for different States would be as under:

$$\text{All-India Index of Area of a crop} = \frac{\Sigma S_{ij} \times {}^{a}_{io}}{\Sigma {}^{a}_{io}}$$

Where, S_{ij} = Index of area under the crop in the ith State for the jth year.

${}^{a}_{io}$ = Area under the crop in the ith State in the base period.

Similarly,

$$\text{All-India Index of Production of a crop} = \frac{\Sigma \bar{S}_{ij} \times {}^{P}_{io}}{\Sigma {}^{P}_{io}}$$

Where, $\bar{S}_{ij}$ = Index of Production of the Crop in the ith State for the jth year.

${}^{P}_{io}$ = Production of the crop in the ith State in the base period.

As the crop coverage of the all-India and State series is not identical, there will be some difficulty in cases when a crop is included in the all-India series but not in a State series. In such cases the State index for the crop can also be constructed first to arrive at the all-India index as suggested above. After computation of the individual crop indices these could be combined into sub-group, group and all-crop-indices by using appropriate weights as discussed earlier. While such a procedure would give all-India indices consistent with State indices, there are a number of operational difficulties. For example, the State index numbers at present become available with a considerable time-lag and as such the computation of all-India index would also be delayed. The Committee recommended the following operational procedure for adoption for the new series with the revised base.

2.38. *Time Schedule.*—For the earlier years, the all-India indices should be built up from the State indices. For the latest one or two years for which all the State series may not be available, all-India indices may be constructed independently on a provisional basis and replaced later by the indices built up from the State indices, when there become available. There was at present considerable time-lag in the availability of various types of agricultural statistics. The Technical Committee recommended that efforts should be made to expedite the finalisation of data at various levels and to publish them with minimum possible time-lag. To improve the usefulness of the all-India and State index numbers for policy and administration, the index numbers series should be published in August-September every year.

2.39. *Errors.*—Estimates of production of most of the crops are now arrived at on the basis of random sample crop-cutting surveys. As the margins of errors of these estimates are known it would be useful to give an idea of the margins of errors

of the index numbers. As the standard errors of all crops on which crop surveys are being conducted are not calculated annually in all the States, it may be worthwhile attempting to estimate the margin of error of the index numbers periodically, say once in five years or so.

2.40. *Linking the New Series with Old.*—When the base period of the series is shifted to the triennium ending 1961-62, the new series may be linked with the old series to provide a fairly long series of index numbers for purposes of assessment of long-term trends.

2.41. *Regional Indices.*—Regional index numbers of area, cropping pattern, yield, production, productivity, etc., should also be initiated by dividing the States into suitable agricultural regions. This would be helpful in assessing the trends in different agro-climatic regions within a State.

2.42. *Preparation of Manual.*—A comprehensive "Manual on Construction of all-India and State Index Numbers of Area under Crops, Net Area Sown, Cropping Intensity, Cropping Pattern, Crop Yield, Productivity Per Hectare and Agricultural Production" should be prepared giving practical examples for the guidance of the staff engaged on this work at the all-India and state levels.

2·43. A Brochure on the lines of the white paper on national income should be issued annually giving the latest series of index numbers of area under crops, etc., for the use of research workers, administrators, etc.

2.44. *Training.*—Training of State staff should also be organised at periodical intervals to acquaint them with the methods laid down for construction of index numbers and to explain to them the pit-falls involved and procedures for solving problems peculiar to different States.

CHAPTER III

INDEX NUMBERS OF HARVEST (PRODUCERS') PRICES OF PRINCIPAL CROPS IN INDIA

Introduction

3.1. In pursuance of the recommendations of the Inter-Departmental Committee on Official Statistics, 1946, the Directorate of Economics and Statistics, Ministry of Food and Agriculture undertook the compilation of Index Numbers of Harvest Prices of Principal Crops in India. The prices data forming the basis of these index numbers are the 'Harvest Season Prices' reported by the branches of the State Bank of India (formerly the Imperial Bank of India). For each crop, important marketing centres have been selected in different States covered by the Index and for each of these centres, weekly wholesale prices during the prescribed harvest period of 6—8 weeks are reported by the concerned branches of the State Bank of India. A simple average of the weekly quotations is taken to represent the 'Harvest Season Price' for that commodity at that centre. These prices are utilised in the construction of the existing series of index numbers of harvest prices.

Farm (Harvest) Prices

3.2. Another series of harvest prices is also available with the Directorate of Economics and Statistics. In this series, 'Farm (Harvest) Price' is defined as the average wholesale price at which the commodity is disposed of by the producer at the village site, during the specified harvesting period of six to eight weeks. These prices are collected every week during the specified harvest period of six to eight weeks in respect of each of the principal crops through the agency of State Governments from a number of villages, selected on a purposive basis.

3.3. Generally 10 villages are selected from each district. The weekly prices of a commodity at each village are averaged to give the farm (harvest) price for the village by taking a simple average of the weekly quotations. A simple average of the village prices for the villages in a tehsil (taluk) gives the harvest price for the tehsil (taluk). District averages are worked out by taking a simple average of the tehsil prices. The State average harvest price is worked out as a weighted average of the district prices with the production of the crop in the districts during the current year as weights. Thus, the State farm (harvest) price of a commodity can be represented as under :

$$\text{State Harvest Price during the jth year} = \frac{\Sigma p_{ij} P_{ij}}{\Sigma P_{ij}}$$

where p_{ij} = District harvest price for the ith district in the jth year.

P_{ij} = Production of the commodity in the ith district during the jth year.

3.4. It will be seen from the above that from the point of view of evaluation of agricultural production and assessment of the prices received by the farmer, the Farm (Harvest) Prices series is better than the Harvest (Season) Prices in as much as the former refers to the transactions at village site whereas the latter relates to market quotations some of which are not even primary markets. The question of issuing a new series of index numbers based on the farm harvest prices has been under the consideration of the Directorate of Economics and Statistics for some time but the revised series could not be issued as data on harvest prices were not available for all the States. The position has improved considerably now and the data from 1960-61 onwards are available for all States except Orissa. Even in the case of Orissa, data from alternative sources, *viz.*, wholesale prices in primary markets, are available and can be made use of by making due allowances for transport, market charges, etc. on the basis of data on price spreads available with the Directorate of Economics and Statistics and Directorate of Marketing and Inspection. As the Harvest Season Prices reported by the branches of the State Bank of India suffer from a number of defects such as non-representative character of the centres selected and lack of comparability of the data reported from year to year, it would be preferable to base the index of harvest prices on an alternative set of prices. This opportunity may also be utilised to effect other desired improvements in the coverage, method of construction, etc. to improve the usefulness of the index for various purposes.

Change in the Concept of Farm (Harvest) Price

3.5. In the case of the farm (harvest) prices some change in concept appears necessary to meet the needs of various users. For example, in connection with the estimation of income from agriculture it has been observed that the cultivator sells his produce at different points of time, to the wholesaler, retailer and directly to the consumer in varying quantities and at different places (at village site, in near about primary markets or in distant secondary markets) and within or outside the harvest period depending upon his marketable surplus, holding capacity, distance from adjoining markets, knowledge of ruling prices at different places and transport facilities available to him. Studies carried out by the National Income Division of the C. S. O. indicate that bulk of transactions actually take place during the peak-marketing periods rather than during the harvest periods, there being a time lag of 1-2 months during the two periods. Thus, the current farm (harvest) prices are relevant only for that part of production which is disposed of by the cultivator at the village site during the specified harvest periods. For proper evaluation of outturn it would be necessary to select such prices which provide the nearest approximation to the prices accruing to the producer at the first point of sale. For this purpose it may be necessary to select a period in which the major part of the production of a crop in a region/district is disposed of either at the village level or at the primary market by the producers. This period appears to be the peak-marketing period of a crop in a district. Information on sowing, harvesting and peak-marketing periods has already been collected from the States. From the point of view of utility of the data on harvest prices, the concept of producers' price may be defined as 'average wholesale price at which the commodity is disposed of by the producer at the village site or neighbouring

primary market during the specified peak-marketing period of the commodity'. These prices may be designated as 'Producers' Prices'. A circular letter to this effect has already been issued to the States. Some of the States have already started reporting farm prices during the peak marketing periods. The response from the States has not, however, been very encouraging. A statement showing the present position regarding the switch-over to the new concept of reporting farm prices is given in Appendix V. It will be seen that so far only the States of Andhra Pradesh and Mysore have adopted the new concept. The question of adoption of the new concept should be persuaded with the other States.

3.6. In the case of the States which have already adopted the new concept, the current data are not comparable with the past. Efforts will have, therefore, to be made to make suitable adjustments in the past data to provide a strictly comparable series over time. In the case of States which have not yet adopted the new concept of farm price, the States will have to be instructed to collect prices according to both the concepts for the transitional year. This would entail some extra labour and might involve some additional cost. To ensure uniformity, a suitable scheme may be formulated and included in the Fourth Plan as a centrally sponsored scheme so that some States may not lag behind due to lack of funds. When the new series of prices starts flowing in, the index number series may also be revised and re-designated as 'Index Numbers of Producers' Prices of Principal Crops in India.'

Market Prices vs. Harvest Prices

3.7. Even with improvements in the concept of Farm (Harvest) Prices, as suggested above, it was felt that these may not be quite suitable for purposes of a trend study. Some doubt was expressed about the suitability of the revenue agency for purposes of price reporting. It was felt that market prices, for which a regular market intelligence agency familiar with the technique of reporting of prices data already existed, were best suited for construction of index numbers and trend studies. It was brought to the notice of the Technical Committee that during recent years a number of improvements had been effected in the quality and content of harvest prices data. Further, this was the only series which provided district and State prices and, as such, was quite useful for study of long-term trends. To enable an assessment of the reliability of harvest prices data in comparison with market prices, the Technical Committee recommended that a study of the basic data from village level upwards may be undertaken for a few selected States such as Rajasthan, Andhra Pradesh and Uttar Pradesh. This should be in the nature of a case study and its results placed before the Committee within three months to enable a decision on the nature of prices which should form the basis of the index of harvest (producers') prices. The farm (harvest) prices should, however, continue to be collected as these would be of considerable use for various other purposes *e.g.* evaluation of the part of the produce sold by the producers at the village level.

3.8. A brief review of the existing series is given in the succeeding paras alongwith suggestions for improvements.

Base Period

3.9. The base period of the existing series is the agricultural year 1938-39. This year is too remote and in view of the changes in the price structure of commodities it is imperative that a new post-independence period should be selected as the base. Some of the criteria which need to be kept in view in deciding the new base period are as under :

(i) Base period should be recent enough so that comparisons are meaningful for it is recognised that longer the time difference between the current and comparison periods, the more difficult it is to interpret the index number series as indicators of price changes.

(ii) It should be reasonably average or normal from the point of view of agricultural production and prices.

(iii) It should be a landmark in the planning stages, such as, the base of a plan.

(iv) It should preferably be one which is used for other allied series of index numbers so that comparisons with other series or their joint use in economic analysis and economic planning and policy might be facilitated.

3.10. The Central Advisory Council on Statistics at its meeting held in December 1961, recommended that the last year of the Second Plan or if that was not considered suitable in any particular case, some other year as close as possible to the last year of the Second Plan might be adopted as the base of each index. If no single year was considered suitable as the base for any index, a three year average including the last year of the Second Plan period might be considered for adoption.

3.11. In the case of the Index Numbers of Area, Cropping Pattern, Agricultural Production, Crop yields, Productivity, etc. triennium ending 1961-62 has been recommended for adoption as the common base period for all-India and State series. In the case of the Economic Advisor's Index Number of Wholesale Prices in India, it has been decided in a meeting of the representatives of Ministry of Finance, the Central Statistical Organisation, Planning Commission and the Ministry of Industry to adopt the year 1961-62 as the base for the 'New Series' proposed to be issued shortly. In view of the large fluctuations in the relative prices of agricultural commodiiies, it may be desirable to broad-base the base period of the index of harvest prices as in the case of the index numbers of area, yield, agricultural production, productivity, etc. From the point of view of agricultural production, the triennium ending 1961-62 represents a normal period. Even from the point of view of prices, this period is fairly normal as will be seen from the index numbers of harvest prices (existing series) given in Appendix VI. Thus, as in the case of index numbers of area under crops, cropping pattern, crop yields, agricultural production, productivity, etc. triennium ending 1961-62 should be adopted as the base for the Index of Harvest (Producers') Prices of Principal Crops in India, as well.

Coverage of States and Crops

3.12. The geographical coverage of the existing series is limited to about 60 per cent of the total geographical area of the country. The crop coverage of the series is limited to the following 15 crops divided into three groups :—

(a) *Foodgrains :*

Rice, jowar, bajra, maize, wheat, barley and gram.

(b) *Oilseeds :*

Groundnut, sesamum, rapeseed, & mustard and linseed.

(c) *Miscellaneous :*

Sugar (raw), tobacco, cotton &, jute.

3.13. The area under these 15 crops in the States covered by the series on an average accounted for about 75 per cent of the total cultivated area in these States and about 54 per cent of the total cultivated area in the country as a whole during the quinquennium ending 1953-54.

3.14. To improve the geographical coverage of the series it should be extended to all the States and Union Territories.

3.15. The crop coverage of the series may be extended to the following principal crops :—

I. *Foodgrains :*

(i) Cereals—Paddy (Rice), jowar, bajra, maize, ragi, wheat, barley.

(ii) Pulses—gram and tur.

II. *Non-Foodgrains :*

(i) Oilseeds—Groundnut, sesamum, rapeseed and mustard, linseed and castor-seed

(ii) Fibres—Cotton, jute, mesta and sann-hemp.

(iii) Plantation Crops—Tea, coffee and rubber

(iv) Miscellaneous crops—Sugarcane (Gur), pepper, tobacco, potatoes, ginger and chillies (Dry).

The above crops account for about 92 per cent of the gross area sown in the country.

Selection of Centres

3.16. A statement giving the number of centres reporting for each crop from different States is given in Appendix VII. It will be seen that the allocation of centres to the different States for a crop is not strictly in proportion to their contribution to all-India production of the crop. Further, in many cases the number of centres selected for a crop in a State is inadequate.

Weights

3.17. A system of double weighting is adopted in the existing series. In the first instance to work out a commodity index, moving weights in proportion to the current year's production of the crop in different States are used for combining the price relatives for different States into the commodity price relative taking their geometric mean. Subsequently, to work out the all-commodity index, weights are assigned to the different crops in proportion to the average value of production of each crop in the States covered by the series during the three years ending 1938-39. The production has been evaluated at harvest prices prevailing in the different States during the period under reference.

Thus, the price relative of a crop would be computed as under :—

$$R_j = \left[\pi \left\{ \frac{p_{ij}}{(p_i)(j-1)} \right\}^{P_{ij}} \right]^{\frac{1}{\Sigma P_{ij}}}$$

where R_j = All-India price relative of the commodity for jth year as compared to the previous year.

p_{ij} = Price of the commodity in the ith State in the jth year.

$p_i\,(j-1)$ = Price of the commodity in the ith State in the (j-1) th year.

P_{ij} = Production of the commodity in the ith State in the jth year.

$$R(j-1) = \left[\pi \left\{ \frac{p_i\,(j-1)}{p_i\,(j-2)} \right\}^{P_i(j-1)} \right]^{\frac{1}{\Sigma P_i(j-1)}}$$

While linking the price relatives for different years to the base period the denominator of Rj does not cancel with the numerator of R(j-1.) A better alternative would, therefore, be to weight the current year's prices (and not relatives) with current, year's production. Further. in accordance with the current thinking on the subject, we may use arithmetic average in place of geometric average. In that case the price relative for the current year over the previous year would be as under :

$$R_j = \frac{\Sigma p_{ij}\, P_{ij}}{\Sigma P_{ij}} \qquad \frac{\Sigma p_i\,(j-1)\, P_i\,(j-1)}{\Sigma P_i(j-1)}$$

Relative for the (j-1)th year would be as follows :

$$R(j-1) = \frac{\Sigma p_i(j-1)\ P_i(j-1)}{\Sigma P_i\,(j-1)} \qquad \frac{\Sigma p_i(j-2)\, P_i(j-2)}{\Sigma P_i(j-2)}$$

Where

R_j = All-India price relative of the commodity for the jth year as compared to the previous year.

p_{ij} = Price of the commodity in the ith State in the jth year.

$P_i(j-1)$ = Price of the commodity in the ith State in the (j-1)th year.

P_{ij} = Production of the commodity in the ith State during the jth year.

$P_i(j-1)$ = Production of the commodity in the ith State during the (j-1)th year.

When these relatives are linked to the base period, the denominator of R_j will cancel with the numerator of R(j-1) and so on. Chain base method may however still be necessary as the price for (j-1) th year comparable to jth year may in some cases be different from that comparable to the (j-2) th year due to changes in concepts varieties, etc. from year to year.

3.18. For combining the commodity indices into sub-group, group and all commodity index numbers, the weighting patterns would depend upon what it is expected to measure. For example, if the aim is to measure changes in prices received by the producers, the weights should represent the sales by producers. The quantities kept for home consumption will not enter the weights. On the other hand, if the index is expected to serve as a deflator of gross agricultural output, the weights should represent the total production of agricultural commodities and the quantities retained for home consumption can no longer be ignored. The aim of the present index is primarily to measure changes in the level of wholesale prices received by the producers but in the absence of reliable data on the quantities marketed by the producers total production has to be taken into account. Thus, as in the present series weights in proportion to the value of production of each crop during the base period may be made use of in the revised series.

Method of Construction

3.19. In the existing series, chain-base method is used in the construction of the index in view of the fact that price quotations are not uniformly available for all years. The current year's price relatives are computed in relation to the previous year and are linked to the base year through intervening chain-relatives. The detailed method of computing the price relatives and averaging is as under :

A. *Computation of State Price Relative for each crop*

(i) For each year, the price relative for each variety of crop at each centre is computed in relation to the corresponding price for the previous year.

(ii) A simple geometric average for such price relatives for the different varieties of the crop at each centre gives the price relatives at that centre.

(iii) A simple geometric average of the price relatives at the different centres gives the single price relative for the State for the crop.

B. *Computation of All-India Price Relative for each crop*

The price relatives for the different States are combined into the commodity price relative taking their weighted geometric mean, figures of the current year's production in the different States covered being used as weights. As the price relative in each year is computed with the previous year as the base, the system of moving weights has been adopted.

C. *Linking with base year*

After compiling the price indices for each year relative to the previous year, these are linked through the successive intermediate years with the base year (i.e. Agricultural year 1938-39) to get the Index Numbers for each of the crops.

D. *Group and All-Crop Indices*

The weighted arithmetic mean of the index numbers for the individual crops with the average value of their production during the three years ending 1938-39 as weights give the all-India Index Number of Harvest Prices for "Groups" and "All-Crops".

3.20. It will be seen that for computation of State and all-India price relatives for each crop geometric average is used, while for computation of "group" and "All-Commodities" indices arithmetic average is used. Since in the averaging of farm (harvest) prices at different levels, arithmetic mean is made use of, it would be advantageous to switch over to arithmetic average for construction of index of harvest (producer's) prices. The method of construction would be as follows :

A. *Computation of All-India Price Relative for each crop for a year*

(i) The all-India average price for each crop for a year 'j' may be computed as the weighted average of State prices of the crop with current year's production as weights. This can be represented symbolically as follows :—

$$P_j = \frac{\Sigma p_{ij} P_{ij}}{\Sigma P_{ij}}$$

where P_j = All-India average price for year 'j'.

p_{ij} = Price of the commodity in the ith State in the jth year.

P_{ij} = Production of commodity in the ith State in the jth year.

(ii) The all-India average price for the previous year, *viz* (j-1), comparable to P_j may be computed from State prices comparable with those of the current year in coverage and, concepts etc. but with production in (j-1)th year as weights. This can be represented symbolically as under :—

$$P_{(j-1)} = \frac{\Sigma p_i \ (j-1) P_{i(j-1)}}{\Sigma P_{i(j-1)}}$$

It may be mentioned that in some cases all-India average prices for (j-1)th year comparable to P_j would be different from that comparable to the all-India prices for (j-2)th year.

(iii) All-India price relatives for the crop would be ratio of P_j and $p(^{j}-1)$ which are comparable to each other. Thus,

$$R_j = \frac{P_j}{P(^{i}-1)} = \frac{\Sigma p_{ij}\ P_{ij}}{\Sigma P_{ij}} \Big/ \frac{\Sigma p_i\ (^{j}-1)P_i(^{j}-1)}{\Sigma P_i(^{j}-1)}$$

B. After computing the All-India price relatives for each year over the previous year, these relatives may be linked through the successive chain relatives to the base period to get the index numbers for each crop.

C. Sub-Group, Group, and All Commodities Indices

The index numbers for individual crops may be combined into Sub-Group, Group and All Commodities indices by taking their arithmetic mean with the average value of production of the crops during the base period as weights.

Linking of New Series with Old

3.21. When the new series as suggested above is issued, it may be linked with the old series to provide a fairly long series of index numbers of harvest prices for assessment of long-term trends.

CHAPTER IV

INDEX NUMBERS OF PARITY BETWEEN PRICES RECEIVED AND PRICES PAID BY THE FARMER

4.1. Index numbers of parity between prices received and prices paid by the farmer are available for the States of Assam, Kerala, Orissa, Punjab and West Bengal. Details regarding the base periods coverage, weighting diagrams and methods of construction of index numbers of prices received, index numbers of cost of living, index numbers of cost of cultivation, index numbers of prices paid and index numbers of parity are given in Appendix VIII.

4.2. It will be seen that these index numbers are issued by a very few States and suffer from a number of limitations. The base periods are different for different States. This vitiates inter-State comparability of index numbers. The crop coverage of the indices of prices received is inadequate in a number of cases and may not be fully representative of the movements in prices received by the farmer. The basis for assignment of weights for the different commodities in the index of prices received also differs from State to State. In some cases, the weights are in proportion to the value of marketable surplus while in others they are in proportion to the value of production during the base period. Similarly, in the index of domestic expenditure, the weights in most cases are based on family budgets of alimited number of rural families, which cannot be considered representative for the a entire State. The retail prices utilised for the index of domestic expenditure are in many cases urban prices of a few markets only. The items included in the index of cost of cultivation and their weights are generally approximate, being based on data from a few farms.

4.3. The index numbers are generally constructed on a monthly basis and annual average index is calculated from these monthly index numbers. The period for which the index numbers are available for different States are indicated below :

Assam	December, 1958 to June, 1965.
Kerala	July, 1953 to October, 1965.
Orissa	January, 1952 to May, 1959
Punjab	August, 1939 to July, 1964.
West Bengal	January, 1954 to December, 1963.

4.4. With a view to effecting improvements in the existing series of index numbers and to enable other States to initiate these index numbers, a scheme on index numbers relating to agricultural economy was included in the Second Five Year Plan. Under this scheme the States were entitled to 50 per cent financial assistance for the conduct of surveys for determination of weights for the various indices and for

staff required for the construction of index numbers. So far, the States of Punjab, Mysore and Madhya Pradesh have initiated the scheme by conducting suitable surveys. Punjab has already finalised the report of its survey and is proposing to issue a fresh series of index numbers of prices received and prices paid by the farmer using the new weights based on the above-mentioned survey. The States of Madhya Pradesh and Mysore have not yet completed their surveys. These are being conducted in a phased manner spread over a number of years. Other States are being persuaded to initiate suitable enquiries for determination of weights of the various constituent index numbers and to initiate the construction of their series. The question of utilisation of the data collected during the Farm Management Surveys for determining the weighting diagrams of the index of cost of cultivation in some States is also being examined. After the initiation of the series by the States it is proposed to build up all-India index numbers on the basis of the State series.

Extension to all States

4.5. All the States should initiate the compilation of the index of parity between prices received and prices paid by the farmer.

Base Period

4.6. As already mentioned in para 4·2 above, the base periods of the State series differ from State to State. To ensure inter-State comparability, triennium ending 1961-62 should be adopted as the common base period for all the State series.

Periodicity of Indices

4.7. At present, the indices are computed on a monthly basis. It was observed that in view of the seasonal nature of agricultural operations, the weights for the various constituents index numbers are not strictly valid for being applied to monthly basis. The Technical Committee, therefore, recommended that in order that the indices may be meaningful, these should be constructed on annual basis and not monthly, as at present.

Index of Prices Received

4.8. (a) *Commodity Coverage.*—The coverage of most of the existing series is limited to a few principal crops only. In order that the index may represent the trends correctly, the coverage should be enlarged to cover all the important crops grown in a State on a joint consideration of their marketable surplus and availability of prices data. Efforts may also be made to cover the important animal husbandry products of each State. For determining the weighting diagrams, surveys involving physical measurement should be initiated where reliable estimates of production are not available.

(b) *Basis of assignment of weights.*—As mentioned in para 2 above, the basis of assignment of weights for the different commodities differs from State to State. In order that the index might reflect income terms of trade, the weights should be proportional to the value of production of the commodities rather than their marketable or marketed surpluses.

(c) *Prices.*—At present wholesale prices are used for the construction of the index of prices received. The markets selected are not, however, adequate in some cases and include even the secondary markets. The Technical Committee recommended that the prices forming the basis of the index should be wholesale prices during the peak marketing periods of different crops in primary markets. It further recommended that a fairly large number of representative primary markets should be selected for reporting of wholesale prices for each crop. The quotations should generally relate to the varieties grown in the region concerned. In view of the various purposes for which data on wholesale prices are needed, the Committee recommended the strengthening and streamlining the system of reporting prices from primary markets.

(d) *Method of Construction.*—The formula used for the construction of the indices of prices received by the farmer in the case of most of the States is as under :—

$$\text{Index} = \text{Antilog} \frac{(\Sigma W_r \times \text{Log } P_r)}{\Sigma W_r} \times 100$$

where W_r = Weight of the commodity 'r'.

P_r = Price relative of the Commodity 'r'.

Σ = Summation over all the commodities.

Thus, weighted geometric average is used in the computation of the index. Current thinking in regard to the construction of index numbers in different sector is in favour of the use of weighted arithmetic average, as in the use of geometrical average, computations involved are quite heavy and there is no specific improvement in the index. The Committee, therefore, recommended the following formula for the index of prices received :

$$\text{Index} = \frac{\Sigma W_r \times P_{tr}}{\Sigma W_r} \times 100$$

$$= \frac{\Sigma Q_r \, p_{or} \frac{p_{tr}}{p_{or}}}{\Sigma Q_r \, P_{or}} \times 100 = \frac{\Sigma Q_r \, p_{tr}}{\Sigma Q_r \, p_{or}} \times 100$$

where

W_r = Value of production of the commodity 'r' during the base period.

P_{tr} = Price relative of the commodity 'r' during the year 't' over the base period.

p_{tr} = Price per unit of the commodity 'r' during the year 't'.

p_{or} = Price per unit of the commodity 'r' during the base period.

Q_r = Production of the Commodity 'r' during the base period.

The above formula is the usual Laspeyre's Formula which is widely used for construction of various types of index numbers.

Index of Domestic Expenditure

4.9. (a) *Commodity Coverage.*—The coverage of the existing series is limited to 70-80 per cent of the total domestic expenditure. This was mainly due to non-availability of price data for all the commodities entering a farmers' budget. During recent years the scope of prices data has been improved considerably. As such, it should now be possible for the States to enlarge the commodity coverage of the index of domestic expenditure to make it more representative. On the basis of various surveys on family budgets, a standard list of commodities to be included in the State series should be drawn up and recommended to the State Governments.

(b) *Basis of assignment of weights.*—In most cases the weights are not based on family budget surveys of farmers. As such these cannot be considered representative. However, as fresh surveys on family budgets of farmers would be time consuming and expensive, the feasibility of using the data already collected by the N.S.S., N.C.A.E.R. and other organisations should be examined. The question of tabulation of the N.S.S. data on family budgets of farmers, for both the Central and State samples for 15th, 16th and 17th rounds at the State level on a high priority basis should be taken up with the Central Statistical Organisation. The Chairman, Agricultural Prices Commission should be requested to secure the necessary priority for the tabulation of N.S.S. data from the Government. Data on family budgets available from other sources should be collected by the Directorate of Economics and Statistics. After the data from different sources become available, the Directorate should arrange discussions with the State Governments for the finalisation of the weighting diagrams.

(c) *Prices.*—At present weekly or month-end retail prices at urban centres are utilised for the index on the assumption that the price fluctuations and relative variations affect both the urban and rural prices alike. The centres selected are, however, in most cases inadequate. The Technical Committee, therefore, recommended that data on retail prices of the items included in the index should be collected from a fairly large number of primary markets through the marketing or price reporting agencies of the States, with a view to representing more faithfully the trends in prices paid by the farmers. In regard to the question of controlled prices vs. black market prices it was felt that the instructions to the price reporter should be very clear so that he is left with no discretion in the matter of reporting of prices. Further, for an index, there should be built in objectivity in the matter of price collection. It was, therefore, recommended that wherever there were price controls on different commodities, it is the controlled prices which should be reported.

(d) *Method of Construction.*—Weighted geometric average is used in the computation of the index by all the States. As in the case of the index of prices received, it is suggested that in future weighted arithmetic average may be used in place of the geometric average.

Index of Cost of Cultivation

4·10. (a) *Item Coverage.*—For the index of farm cultivation, cash expenditure actually incurred by the farmer has to be taken into account. This includes remuneration paid to hired labour, cost of seed, chemical fertilisers and other manures, agricultural implements and machinery, payment to artisans, cost of bullock labour, rent

of land taken on lease, land revenue and irrigation charges but excludes cost of family labour, land or capital and farm-yard manure produced on the farm. In most of the existing series the item coverage is limited due to non-availability of data on prices and weights. For example, in the case of Orissa the items included are bullock labour and wages of agricultural labour. Even in the case of bullock labour, the cost of upkeep of bullocks has been neglected on the assumption that most of the feeds are obtained from the farm. Interest on capital invested for bullock labour is taken into account by considering the price of a pair of bullocks. Expenditure on seeds has been omitted on the assumption that the bulk of the seeds are obtained from the farm itself. Thus, the item coverage is far from satisfactory. It is suggested that the selection of items should be based on recent surveys on cost of cultivation and farm management with a view to covering the bulk of the cash expenditure of the farmer on cultivation to ensure representativeness of the index.

(b) *Basis af assignment of weights.*—Except in the case of Punjab which has already conducted a State-wide survey, the basis of assignment of weights leaves much to be desired. Farm Management Surveys have already been conducted in 24 districts. Another 5 districts were proposed to be covered during the next few years. In the absence of any other reliable data, the Committee felt that farm management data should be made use for determining the weighting diagrams for the index. In this connection the consensus was in favour of the Cost 'B' concept for determination of weights. For each State, the Directorate of Economics and Statistics should collect all the data on cost of cultivation available from different sources and then in consultation with the State Governments decide upon the best source or combination of sources that could be used for finalising the item coverage and weighting diagrams. In the case of States for which no dependable data were available, suitable surveys should be conducted. For this purpose, the States should be divided into agro-climatic regions and from each region one district should be selected for survey. The States may be asked to make use of the data thrown up by the Farm Management Surveys or to initiate fresh surveys on State-wise basis to determine the weighting diagrams of the index of cost of cultivation.

(c) *Prices and Wages.*—Arrangements should be made to collect regular data on prices of items purchased by the farmers and on agricultural wages. Due weight should be given to the purchases made from Government and semi-Government sources especially for items like improved seeds and fertilisers.

(d) *Methodology.*—As in the case of other constituent indices, weighted arithmetic average may be used instead of the weighted geometric average.

Index of Prices Paid

4.11. The indices of cost of living and cost of cultivation are combined into a composite index of prices paid by the farmer. For this purpose, weights in proportion to the cash expenditure on the two heads are needed. In the existing series the weights used are generally rough, as no scientific enquiries had been conducted in the different States. In order that the index may faithfully represent the changes in prices paid by the farmer, the relative proportion of expenditure on cost of living

and cultivation should be determined on the basis of data available from the Farm Management or other scientific surveys. Weighted arithmetic average of the two indices may be used for arriving at the composite index of prices paid in place of the geometric average used at present.

Index of Parity

4.12. Index of parity between prices received and prices paid by the farmer is computed as the ratio of the two indices.

Time Schedule

4.13. At present there is considerable time-lag in the availability of the index numbers. To improve the usefulness of the index numbers, these should be available with the minimum of time-lag. Efforts should be made by the State Governments to publish annual indices within two months of the close of the year.

CHAPTER V

INDICATORS' SCHEME OF THE DIRECTORATE OF ECONOMICS AND STATISTICS

5.1. Information on trends in cost of production is very often required in connection with the implementation of the price policies. The cost of cultivation enquiries on a comprehensive basis tend to become costly, and hence these could be conducted only periodically. The valuable information yielded by these enquiries could, however, be projected in future through the collection of some additional information on a few key items in the subsequent years. The approach broadly consists of working out an index of cost on the basis of stable input-output estimates from the comprehensive enquiry and the representative data in respect of wages, prices and production collected subsequently on a regular basis.

The Scheme

5.2. The investigations into the economics of farm management conducted by the Directorate of Economics & Statistics since 1954-55 yielded valuable base line data necessary for measuring changes in certain important aspects of rural economy in the subsequent years with collection of some additional information on key items. It was with this end in view, that the Indicators' scheme was initiated. The scheme is now in operation in nine centres; six centres covered by the first series of farm management investigations *viz.* in U.P., Punjab, West Bengal, Maharashtra (two centres), Madras and three centres covered by the second series of farm management investigations *i.e.* in Andhra Pradesh, Bihar and Orissa. The details regarding the design and coverage, periodicity of the data collected and proforma used, methodology adopted in the construction of index numbers and the efficiency of index numbers are given in the succeeding paras.

Design and Coverage of the Scheme

5.3. Out of the five cost accounting villages in each zone of the 1st series of farm management centres, where the investigations were carried out in two contiguous districts, the biggest and the smallest villages were excluded. Out of the remaining three villages the common village representing the zone was selected. In case, the common village selected was not considered satisfactory, another village out of the three representing the zone was selected. Thus, in all, four villages were selected in each region from the 20 villages covered in the original study. In the case of the second series of farm management centres also, where the investigations were carried out in only one district, equal number of representative villages *i.e.*, four, were selected from 10 villages covered in the original study. The same holdings which were covered under farm management investigations were also taken up for this scheme.

Proforma for the collection of data

5.4. The information to be collected under the scheme has been divided into three categories *viz.* (a) weekly, (b) monthly, and (c) annual. Under the weekly information two sets of proformae—one for thevillage and the other for the selected cultivators—have been prepared. The village proforma gives information on prices, wages and hire charges of bullocks. The proforma for the selected cultivators gives information on employment and quantities marketed. The monthly proforma gives information on stocks of farm produce, quantities sold, quantities produced, quantity purchased and quantity consumed for selected cultivators. In the annual proforma, the information on rent per acre, land revenue, irrigation charges and other cesses, wage rate for annual farm servants, inventory of property and livestocks are collected.

The reference period for the collection of data on farm prices is the day in each week on which major wholesale transactions take place. In the case of wages and quantities marketed, the reference period is Friday while in case of employment of family labour, the data are collected on the 7th, 15th, 23rd and the last day of the month.

The base period

5.5. The base period for each centre is the same as the period of farm management enquiry in the centres *viz.* 1954-55 to 1956-57 for Punjab, U.P. Madras, West Bengal and Maharashtra (Ahmednagar and Nasik districts), 1955-56 to 1956-57 for Maharashtra (Akola-Amraoti) and 1957-58 to 1959-60 for Andhra Pradesh, Orissa and Bihar.

Index Numbers constructed

5.6. The following index numbers are being constructed in the Directorate :—

(i) Index numbers of wages of field labourers.
(ii) Index numbers of farm prices.
(iii) Index numbers of bullock labour cost.
(iv) Index numbers of prices received.
(v) Index numbers of farm cost.
(vi) Index numbers of cost of cultivation—major crops.
(vii) Index numbers of cost of production—major crops.
(viii) Index numbers of gross value of farm produce.
(ix) Index numbers of quantity marketed—major crops.
(x) Index numbers of stocks at the end of the month.
(xi) Index numbers of farm employment.
(xii) Index numbers of non-farm employment.
(xiii) Index numbers of total employment.

Method of construction of index numbers and the problems involved

5.7.(i) *Index numbers of wages of field labourers.*—The index numbers of wages of field labourers (male adults) are being used in the construction of cost of cultivation index numbers, representing the variation in the cost of human labour which is a major constituent of index of cost of cultivation. As such, the index of wages is constructed to assess changes in the cost of cultivation on account of changes in the wages.

Method.—The index is constructed by averaging the wage rates of male casual labour for the major operations for the month on the basis of 8 hours a day and dividing this by the annual average wage for the base period as provided by the farm management sample.

Difficulties and limitations.—This method of construction may give an idea of the changes in the level of wages over the year as a whole, but it may not give any indication of changes in wages from month to month due to seasonal or other factors, unless this series of monthly indices is constructed with the corresponding months of base year as base.

In the base period, family labour for the sample farms has been evaluated on the basis of wages of annual farm servants while the hired labour, both attached and casual, has been charged at the actual rates. But, in the case of hired labour, the physical quantities (as well as costs) are given together for permanent and casual labour in the case of most of the centres. As such, the wages per day of casual labour of the sample farms cannot be worked out separately. However, a general idea of the average wage rates of casual field labourers employed on a temporary basis in the sample villages (and not sample farms only) are available for all the centres. These latter data have been utilised for the construction of index numbers.

A better way would perhaps have been to construct the index on the basis of weighted average wage rates for the year with the labour input on different operations such as preparatory tillage, sowing and growth and harvesting as weights. This could, however, be used only for the Index of Cost of cultivation of individual crops and not for the index of Farm Costs as a whole. Further, the data on labour inputs for different operation in respect of a crop are not available for some centres, and when such data are available the corresponding wages data for the sample farms for the base period are not available. As a result, it is not possible to work out weighted wage rates on the above basis.

There is also a practical difficulty in collecting precise data on wages in cases where wages are either paid wholly in kind or partly in cash and partly in kind. Evaluation of wages paid in kind and value of perquisites given sometimes become difficult. Specially, in cases where kind payments are made in the form of fodder, etc. for which there may not be many transactions in the villages during the period under reference, its evaluation will depend, more or less, on the subjective evaluation of the reporting agency.

(ii) *Index Numbers of bullock labour cost.*—The index of bullock labour cost is being used in the construction of cost of cultivation index representing the variations in the cost of bullock labour. The index is constructed by averaging the hiring charges for major operations for the month on the basis of 8 hours a day and dividing this by the annual average. In case of U.P., Punjab and Maharashtra, where hiring of bullocks is not common, the index is based on the feed grains prices, *e.g.* wheat gram, etc., fed to cattle.

A better method would be to construct tae index on the basis of cost of maintenance of bullock, since a major portion of the bullock labour input comes from owned bullock labour. This could not be done since, in the base year, information relating to quantities of different types of fodder and feed fed to cattle are not available. The information is given in value terms only. In the case of certain centres, even the break up of maintenance cost is not available. Moreover, information on the quantities of different types of fodder and feed fed to cattle during each month or quarter and the prices used for working out value thereof should also be available if indices of cost of maintenance are to be worked out.

(iii) *Index numbers of farm prices.*—Farm prices are the prices at which farmers sell their farm produce during the week. The index numbers indicate the changes in the farm prices from month to month and may help in watching the behaviour of the prices of these commodities. These indices are also used as components of cost of cultivation index numbers representing the variation in the value of seeds. These are also used to construct the index numbers of prices received.

Method of construction.—The index numbers for the current month are constructed by dividing the average current month information by the average monthly farm prices of the base period. The index is based on a simple average of major varieties of the commodities.

Difficulties & limitations.—There are certain problems pertaining to the collection of farm prices data. Firstly, for the major crops more than one variety may be grown and the prices of different varieties may vary widely depending on the nature of the crop and the quantity produced. The difficulty may, however, be overcome either by considering the common variety or by averaging the different varieties by the application of suitable weights, if available.

Secondly, the produce may be sold by cultivators during the three or four months immediately following the harvest due to the absence of storage facilities and the lack of holding power. As such, the prices quoted during that period will naturally be the wholesale prices. During the remaining period there may either be no transaction or only a few transactions for the commodity. In such a case, some splicing may have to be done for arriving at the actual price quotation for the month or months.

Finally, there may be well developed markets near the villages selected for the study. In such cases, most of the produce may be sold in the market by the cultivators and the village prices may not be available. The prices may have to be worked backwards by deducting transport charges, marketing charges, etc.

(iv) *Index numbers of prices received.*—The monthly index numbers of prices received have been constructed to indicate the impact of changes in the prices of farm produce on the incomes of the agriculturists assuming that the level and structure of the quantities marketed in the current year remains the same as in base year. It also indicates how far the agricultural prices keep in step with the general price structure, costs, etc. and thus will help in the formulation of price policy.

Method of construction.—This index is a composite index. It is constructed from the indices of farm prices of major crops. The index of farm price of each commodity is weighted according to the contribution of that commodity to the total value of all the commodities marketed during the base period. As such, according to the method adopted, price relatives are weighted by the value of quantities. Values are obtained by multiplying quantities with their respective prices. The sum of the products of price relatives of the current year and value proportions of the base year divided by the sum of weights gives the weighted arithmetic average of relatives which is the required index number for the current year. Symbolically,

Index for the current year=$\Sigma IV/\Sigma V$

Where I stands for price-relatives and V for values.

Difficulties and Limitations.—It is noteworthy in this connection that this method of construction does not take into account the glut of supplies in some months and the lean supply in others and thus gives equal weights to all months. The variable weights for different months may be relevant in view of the fact that most of the farm produce is sold by cultivators in the short period immediately after the beginning of the harvesting of crops due to meagre resources at their disposal and lack of storage facilities.

(v) *Index Numbers of Farm Cost.*—The index numbers of farm cost have been constructed to assess the changes in the cost of cultivation for the farm as a whole and to know how far these variations keep in step with the general trends in the economy, specially the trend in the prices of the commodities produced by the cultivators.

Method of construction.—This is also a composite index number. The different values entering the index are represented by the following Indices :—

(a) Human labour is represented by the Index of wage rates of field labourers (adult male).

(b) Bullock labour is represented by the Index of hiring charges of bullocks. In the centres where hiring of bullocks is not common, for example, Punjab, Uttar Pradesh, etc. the cost of bullock labour is represented by the Index of farm prices of the major feed grains.

(c) Seed is represented by the Index number of farm prices during the sowing period of the crops.

(d) Fertilisers and manures are represented by the Index of prices of ammonium sulphate.

The weights used for the construction of farm cost indices are the percentage value of the different items of inputs to total inputs during the three years of Farm Management Investigations. The sum of the product of relatives of the current year and the value propertion of the base year, divided by the sum of weights gives the weighted arithmatic average of the relatives which is the required index number for the current period. Symbolically,

$$I = \Sigma(I_1W_1+I_2W_2+I_3W_3)/\Sigma(W_1+W_2+W_3)$$

Where, I_1 I_2 and I_3 represent the relatives and W_1, W_2 and W_3 value proportion of each item of input to the total inputs.

Difficulties & Limitations.—It is noteworthy in this connection that the four items on the basis of which the Index Nos. are being constructed cover as much as 58 per cent and 56 per cent in Madras and Punjab, 66 per cent and 83 per cent in West Bengal and Uttar Pradesh and 60-70 per cent in Maharashtra respectively of the total cost. They cover about 45,70 and 77per cent of the total cost in the case of Andhra Pradesh, Bihar and Orissa respectively. If the rental value of owned land and rent paid for the rented-in-land are not taken into account, keeping in view the recent land reforms, the percentage formed by these 4 items of cost is further increased to 80-90 per cent in the case of all the centres.

In view of this, it would introduce great simplification in the calculation of the Index numbers to assume the minor components to remain at the same absolute level as in the base period *i.e.*, to assume the relatives for these items to be 100 throughout a series of years. This will not affect the utility or accuracy of the calculated index numbers in any significant manner since the contribution of these components to the index is relatively small.

The expenditure on most of the items in the cost of cultivation are of annual nature, notwithstanding the fact that these items may be used over a period of time. As such, the annual index number is more relevant to indicate the changes in the cost of cultivation than the monthly index numbers. The construction of monthly index numbers, however, has the advantage of broadly indicating the changes in the cost of cultivation and thus help in the prediction of cost earlier which may perhaps be of some use to cultivators in planning their production and to policy makers and administrators in adjusting the policy. For some items such as land revenue and cesses, irrigation charges etc. the payments are made at a particular time. These expenses strictly pertain to the year as a whole or for a specific period. The adjustments in the annual index numbers of cost of cultivation for the changes in these items may also be relevant in the changing conditions. At present, the annual index numbers are being worked out by taking the arithmetic average of the monthly index numbers only.

There is one important limitation in the construction of index numbers by this method. The assumption involved in using the farm management input proportions

as weights is that the structure of inputs remain the same in the subsequent years. If the structure of inputs changes in the subsequent years, necessary adjustment may have to be made in the weighting diagram.

(vi) *Index Numbers of cost of Cultivation—Crop-wise.*—The index numbers of cost of cultivation crop-wise are worked out in the same way as the index of farm cost. This index is constructed for the relevant period of the diffierent crops *i.e.* from the preparatory tillage period to the harvesting of crops. Two sets of index numbers for the major crops are being worked out, one for the relevant periods of crop season *viz.* preparatory tillage, sowing and growth and harvesting and the other showing total expenses incurred till the end of the harvesting period based on the average of monthly indices for the crop season as a whole.

(vii) *Index Numbers of Cost of Production-Crop-wise.*—The index numbers of cost of production crop-wise has been constructed by dividing the index numbers of cost of cultivation per acre by the index numbers of yield per acre. The method of construction of cost of cultivation index numbers has already been discussed. The index of yield per acre of the main product is worked out on the basis of district figures of area and production available from the crop-cutting experiments in respect of the districts covered under the scheme.

Difficulties & Limitations.—The main assumption involved in the method of construction of the index of cost of production is that the percentage contribution of the bye-products to the total product remains the same from year to year. This proportion may, however, change with a change in the ratio of the quantities of bye-products to the main product on account of introduction of new varieties, weather conditions etc. Under normal conditions, however, these changes in the ratio of bye-products to the main product will not affect much the trend of the index numbers in any significant manner.

(viii) *Index Numbers of gross value of farm produce.*—It is a composite index based on the index numbers of prices received and the index numbers of yield per acre. The method of construction of prices received index has been discussed earlier. The yield per acre index number is constructed by first constructing the yield relatives for the major crops covered under the scheme for constructing prices received indices and thereafter combining these relatives on the basis of weights represented by the value proportion of each commodity to the total value of quantities marketed. The index number of gross value of farm produce is worked out by combining the Index of prices received and index of yield per acre.

(ix) *Index Numbers of quantities marketed.*—Quantities marketed pertain to the quantities of different crops sold by the cultivators during the period under reference. In constructing the Index numbers, the base year and the current year quantities marketed are reduced on a per holding basis. On the basis of these data three types of index numbers can be worked out.

(a) *Index Numbers of quantities marketed taking corresponding months in the base period as base :*

The index will give an idea as to how the quantities marketed in the current month compare with the quantities marketed in the corresponding month of the base year.

(b) *Index Numbers of quantities marketed upto the month under reference :* This index can be worked out by dividing the quantities marketed upto a certain period by the corresponding information for the base year. This will give an idea to some extent of the changes in the sales pattern of the commodities marketed.

(c) *Sales Pattern.*—The quantities marketed during each month of a crop from the harvesting period to the pre-harvesting period as percentage to total quantities marketed gives the sales pattern for the crop. The year may also be divided into 3-4 periods representing (i) the glut of supplies period immediately following the harvesting of crops, (ii) the medium supplies period following the glut of supplies period; and (iii) the lean months of supplies preceding the next harvesting period. Apart from the above indices, the following index numbers can also be worked out ;

(d) *Index Numbers of ratio of quantities marketed to quantities produced :* The Index is constructed by first working out the ratio of quantities marketed in each month to total production and thereafter dividing the current period ratio by the base year ratio.

(e) *Index Numbers of ratio of cumulative quantities marketed to production :* The method of constructing the index number is the same as in (d) above. In this case, however, we have cumulative quantities in place of quantities marketed during different months.

(f) *Index Numbers of ratio of quantities marketed to stocks at the end of the month :* The Index number is constructed by first working out the ratio of quantities marketed to stocks at the end of the month and then dividing the current year information by the corresponding base year information.

At present the index numbers at (a),(c) and (f) are constructed on a regular basis. The index numbers at (b), (d), & (e) have been constructed experimentally from time to time.

(x) *Index Numbers of stocks at the end of the month :*

Method of construction.—The Index Numbers of quantities in stock are constructed by dividing the quantities in stock of a particular crop at the end of the month in the current period by the quantities in stock during the same period in the base year.

Difficulties & Limitations.—The Index Numbers of quantities marketed and quantities in stocks at the end of the month are, however, limited in scope in view of the fact that a sample size of 40 holdings is not adequate to give a sensitive index number for measuring the changes in the quantities marketed and the quantities in stocks. Moreover, the quality of the investigating staff is an important factor in collecting this type of information. It has been the experience of a good many field workers that the cultivators are not always very cooperative in giving out information of this kind.

(xi) *Index Numbers of Farm Employment.*—The Index Numbers of Farm Employment indicate the changes in the employment opportunities of the members of the cultivating families on the farm with reference to the base period. The index is constructed on the basis of 8 hours 'work-day' by dividing the current month information by the monthly average for the base period.

(xii) *Index Numbers of Non-Farm Employment.*—The index is constructed to indicate the changes in the employment opportunities outside the farm. The method of construction of the index numbers, of non-farm employment is similar to the construction of index numbers, of employment inside the farm. But since the employment opportunities outside the farm are small in most of the regions, the index numbers for the sample under study may not give an accurate idea of the employment opportunities outside the farm.

(xiii) *Index Numbers of Total Employment.*—The Index number is constructed in the same way as the index of farm and non-farm employment. Apart from employment on the farm and outside the farm, it also includes employment on social and family affairs.

Difficulties and Limitations.—It is not always possible to make a clear cut distinction between different types of work. This is specially so in the case of social and family affairs. There is hardly any line between employment on social and family affairs and unemployment. Moreover, the data on employment position is only collected once in a week. Thus, there is liklihood of under reporting as well as over reporting of estimates.

Representativeness of Sample and the Quality of the Reporting Agency :

5.8 As indicated earlier, the data to be sufficiently reliable has to be based on a representative sample of adequate size and collected through a dependable method by a dependable agency. Under the Indicator's Scheme the data are collected from a set of four villages (a Sub-sample of villages investigated during the Farm Management Enquiry) by the cost accounting method through the agency of village reporters, one in each village, who are mostly educated upto the matriculation standard or are otherwise suitable for the post. The work of the village reporters is supervised by the supervisor of the centre who visits the villages once in every month.

5.9 The first series of Farm Mangement Investigations were carried out in 20 villages and covered 200 holdings in each region covered under the study. The indicator's scheme sample, represented by four villages and forty holdings, cannot be regarded as fully representative, specially in view of the fact that the districts covered under Farm Management Investigations were not always homogenous. This defect in respect of the sub-sample for the indicators' enquiry is somewhat overcome in case of villages selected for the second series of Farm Management Investigations. In the second series, investigations' were conducted in one district and covered one hundred cultivators only. To improve the usefulness of the scheme, the Technical Committee recommended that the sample of villages, from which the basic data on prices and wages were collected, should be enlarged to cover all the villages of the original enquiry.

5.10 As regards the agency for the collection of field data, it is not always possible to find out suitable personnel for the collection of data at the village site. Due to this single factor, work could not be started in the Orissa and Bihar centres under the scheme till recently. Not only that suitable talents are not available in the village but the remuneration offered is also not very attractive. Apart from these factors, the nature and quantity of the data that the village reporters are required to collect from the villages are sometimes too cumbersome for them to collect easily. The Technical Committee recommended that the possibility of using some other suitable agency, either in addition to or in substitution of village reporters presently employed under the scheme,may be explored. It was, however, felt that the revenue agency would not be suitable for collection of the required information. It was further recommended that the same farmers should not be approached all the time for securing the required data; but a representative sample should be canvassed every year.

5.11 The indices suffer from the usual limitation of assuming the constancy in weights *i.e.*, to assume that the relative weights of different inputs remain the same in the subsequent years. This assumption may not hold good specially when the economy is being increasingly subjected to measures aimed at transforming traditional agriculture into a modern one. In the case of 6 regions out of 9, for which the indices are being constructed, the weights have become as old as about a decade. This period of 10 years is long enough, by itself, to bring about changes in the relative importance of different inputs in farming and, secondly, new inputs like fertilizers, irrigation, better seeds, pesticides etc. have gained in importance during this period. This period is, therefore, expected to witness changes in the relative weights of different farm inputs. The question of assignment of new weights should be examined.

5.12 It was generally felt that, under the scheme, too much was being attempted with too little data. It would be worthwhile to confine the scope of the scheme to the construction of annual index numbers in respect of Farm Business Cost and Cost of Cultivation of major crops. It was generally felt that the sample was too small for collection of representative data on quantity marketed, stocks, etc. A view was also expressed that the measurement of employment bristled with a number of conceptual problems and it would, therefore, not be very useful to construct any index number for the purpose of measuring changes in employment on the basis of limited data collected under this scheme.

CHAPTER VI

INDEX NUMBERS OF COST OF CULTIVATION OF SUGARCANE

6.1 The underlying principles and details regarding working out indices of cost of cultivation of field crops have been given in Chapter V. These are illustrated on sugarcane here following the approach developetd by I.A.R.S. and embodied in a scheme taken up recently by the erstwhile Indian Central Sugarcane Committee. With the reorganization of the commodity committees and consequent abolition of Indian Central Sugarcane Committee, the scheme is expected to be continued under the control of the I.A.R.S.

6.2 Under the scheme information regarding wages and prices of inputs involved in sugarcane cultivation are reported monthly in the proforma given in Appendix IX by sugarcane development staff of the States in which the scheme is currently functioning namely Uttar Pradesh and Andhra Pradesh. The information is collected in the same sample of villages in which the earlier comprehensive inquiry on cost of cultivation of sugarcane was conducted and the development staff are expected to visit these villages in the normal course of their duties for purposes of sugarcane development work. Hence it is not inconvenient for them to send the reports monthly. This arrangement makes for economy as the field staff are paid only a token of honorarium of Rupees 5 per month. The information collected is also expected to be of satisfactory reliability as the development staff are familiar with the cultivation practices prevailing in the respective regions. It will be observed from the proforma (Appendix IX) that the wages of hired labour are to be reported in various months for operations which are commonly undertaken in these months in relation to sugarcane. A weighted average of these wage rates using the estimates of labour input for various operations obtained in the basic inquiry provides the wage relative. Similarly information on prices on manures and fertilizers and feed stuffs are recorded in subsequent sections of the form. Information on price of seed is not asked for as the statutory price of sugarcane is taken as the basis for calculating the price relative for seed. However, if a similar inquiry is to be conducted for other crops, information on prices of seeds have also to be recorded. The calculation of index of cost of cultivation on the basis of such data is illustrated in the succeeding paragraphs.

6.3 The following are the principal components in constructing the cost of cultivation index.

1. Human Labour.
2. Bullock Labour.
3. Seed.
4. Manure.

5. Charges for irrigation water.

6. Depreciation of and repairs to implements and farm structures.

7. Taxes on land.

The various components contribute very differently to the total cost and the importance of the various components in the composition of the total cost depends on the crop as well as the region. While human and bullock labour account for a major share of the cost almost for all crops in all regions, the importance of other factors varies considerably from crop to crop and region to region. Thus expenditure on seed might constitute as much as 15-20 per cent of the total cost as in plant sugarcane or be less than 2 per cent as in Jowar. Similarly, some crops are manured heavily while others are almost wholly unmanured and the intensity of irrigation varies from crop to crop and region to region. It is observed that 3 or 4 of the components enumerated above frequently account for over 80 or 90 per cent of the cost of cultivation of certain crops. In such cases it would introduce great simplification in the calculation of the index to assume the minor components to remain at the same absolute level as in the base period *i.e.*, to assume the price and wage relatives for these items to be 100 throughout a series of years. This will not affect the accuracy or the utility of the calculated index in any significant manner since the contribution of these components to the index is very small.

6.4 For illustration, we may consider the results for plant sugarcane obtained for the crop season 1955-56 in the region of Western U.P. Figures of expenditure in rupees per acre on the various components of the cost of cultivation as well as the same expressed as per cent of total cost are given below for the crop :—

Costs of Cultivation—Western Uttar Pradesh

Item of Cost	Rs./acre	%
Man Labour	141·3	35·0
Woman Labour	1·7	0·4
Bullock Labour	108·0	26·7
Seed	65·5	16·2
Manure	40·6	10·1
Irrigation	23·3	5·8
Other Costs	23·4	5·8
	403·8	100·0

The index of cost of cultivation of plant sugracane based on the data for the 1955-56 crop season is expressed as :

$$\text{Index}=\frac{1}{100}\left\{35\cdot0R_1+26\cdot7R_3+16\cdot2R_4+10\cdot1R_5+5.8R_6+6\cdot2(100)\right\}$$

$$=(0\cdot350R_1+0\cdot267R_3+0\cdot162R_4+0\cdot101R_5+0\cdot058R_6+6\cdot2)$$

The expression for index contains the relatives for man labour (R_1), bullock labour (R_3), seed (R_4), manure (R_5) and irrigation (R_6). The price of seed and irrigation rates are reported to be constant. Consequently R_4 and R_6 would each be 100. Other relatives *viz.*, R_1, R_3 and R_5 have to be calculated.

For calculation of R_1 we have the following data

Category of operations	Seasonal Av. wage rates in 1956-57 Rs./hour	Weights Man labour, Hrs./ acre in 1955-56
(1)	(2)	(3)
Preparatory cultivation	0·1572	121·8
Manuring	0·1433	31·4
Planting	0·1553	80·2
Irrigation	0·1767	80·2
Interculture	0·1554	186·2
Misc. Operations	0·1664	29·5
Harvesting	0·1682	304·6
		833·9

The weighted average of wage rates in Col. 2 above, weighting by figures in Col. 3 comes to Re. 0.1623 per hour. Similar average for 1955-56 was Re. 0.1694 per hour. Hence the wage relative :—

$$R_1=\frac{0.1623}{0.1694}\times100=95.8$$

For the calculation of R_3 we have the following data

Item of expenditure	Quantity per bullock pair per year	Prices 1955-56	Prices 1956-57
Dry fodder	48·3 md.	2·289 (Re./md.)	2·807 (Re./md)
Green fodder	303·9 md.	0·897 „	1·161 „
Concentrates	6·1	8·354 „	11·748 „
Labour of Upkeep	252·9 hr	0·1694 (Re./hr)	0·1623 (Re./hr)
Depreciation	..	133·1 (Rs./year)	133·1 (Rs./year)
Misc. Costs	..	11·8 „	11·8 „

On the basis of the above data the cost of maintenance per bullock pair per year calculated for 1956-57 comes to Rs. 746.0 as against Rs. 621.9 for 1955-56. Hence the price relative :—

$$R_3 = \frac{746.0}{621.9} \times 100 = 120{\cdot}0$$

Similarly for manures we have the data given below

Manure	Quantity used Md/Acre	Price Rs./Md. 1955-56	Price Rs./Md. 1956-57
Farm Yard Manure	142	0·30	0·30
Ammonium Sulphate	1·07	13·00	14·00

The cost of manuring per acre is Rs. 56.51 and Rs. 57.58 in seasons 1955-56 and 1956-57 respectively. Hence price relative :—

$$R_5 = \frac{57.58}{56.57} \times 100 = 101.9$$

Substituting the various values of wage and price relatives calculated above in the expression for index of cost of cultivation per acre the numerical value of the index for 1956-57 is calculated thus :

Index for 1956-57=0.350 (95.8)+0.267 (120.0)+0.162 (100.0)+0.101 (101.9) +0.058 (100.0)+ 6.2=104.1

The index of cost of cultivation per acre thus comes out to be 104.1. The yield estimates for the years 1955-56 and 1956-57 were 397.6 and 372.4 md. per acre respectively. The index for cost of production per maund for 1956-57 would, therefore be :

$$\frac{104.1 \times 397.6}{372.4} = 111.1$$

6.5 The proforma given in Appendix IX shows the manner of field collection of data required for the index. The proforma could of course be modified to suit requirements of special crops or regions or elaborated for collecting information relating to any significant changes in the methods of cultivation, for example, increased use of artificial fertiliser, greater use of irrigation etc., which might have taken place since the conduct of the comprehensive inquiry. The Committee recommended that cost of cultivation surveys should be followed by collection and compilation of data in these lines to enable construction of an index of cost of cultivation of the concerned crops for the area of survey.

CHAPTER VII

SUMMARY OF RECOMMENDATIONS

7.1 *General.*—In order to expedite the finalisation of the revised series of index numbers relating to agricultural economy in the light of the suggestions of Technical Committee, the Diretorate of Economics and Statistics should undertake the responsibility for implementation of the recommendations of the Committee by convening meetings of the representatives of the State Governments, arranging training programmes for State staff, publication of Manuals for construction of various index numbers, etc. If during the course of implementation any technical problems arise, these may be referred to the Committee again for its consideration. (Para 1.4)

7.2 *Index Numbers of Area under Crops, Net Area Sown, Cropping Intensity, Cropping Pattern, Crop Yields, Productivity per Net Hectare and Agricultural Production :*

7.2.1 *Base Period.*—The average of three years ending 1961-62 should be adopted as the common base period for all-India and State series of index numbers of area under crops, net area sown, cropping intensity, cropping pattern, crop yields, productivity per net hectare and agricultural production. (Para 2.7)

7.2.2 To ensure inter-State comparability all efforts should be made by the Directorate of Economics and Statistics to persuade the States to adopt the triennium ending 1961-62 as the base for their series. (Para 2.8)

7.2.3 In view of the rapid changes in cropping patterns, etc. in some regions, the base period selected should be revised once every five or at most ten years. (Para 2.9)

7.2.4 *Coverage and Grouping.*—Steps should be taken to conduct suitable surveys for estimation of production of important animal products and fish to enable their inclusion in the coverage of the series of agricultural production. (Para 2.10)

7.2.5 With extension in the coverage of crops for which regular estimates are framed, the crop coverage of the index number series should be enlarged as under :—

I. *Foodgrains :*

(i) *Cereals*—Rice, Jowar, Bajra, Maize, Ragi, Wheat, Barley and Small Millets.

(ii) *Pulses*—Gram, Tur and other pulses.

II. *Non-Foodgrains :*

(i) *Oilseeds*—Groundnut, Sesamum, Rapeseed & Mustard, Linseed, Castorseed, Cottonseed, Safflower, Niger and Coconut.

(ii) *Fibres*—Cotton, Jute, Mesta and Sann-hemp.

(iii) *Plantation Crops*—Tea, Coffee and Rubber.

(iv) *Condiments and Spices*—Pepper, Chillies, Ginger, Turmeric and Arecanut.

(v) *Fruits and Vegetables*—Potatoes, Bananas and Cashewnuts.

(vi) *Miscellaneous Crops.*—Sugarcane, Tobacco and Guar.

The above crops taken together account for nearly 94 per cent of the gross cropped area. (Para 2.13)

7.2.6 *Index of Net Area Sown.*—Construction of an index of 'net area sown' should be initiated immediately. (Para 2.14)

7.2.7 *Land Utilisation Statistics.*—Efforts should be made to minimise the time-lag in the availability of land utilisation statistics. (Para 2.14)

7.2.8 *Concept of Production.*—For the purpose of the index of agricultural production, the concept of production should be that of gross output excluding losses in the field, as in the existing series. (Para 2.15)

7.2.9 *Conversion Factors from Raw to Processed Form.*—The Directorate of Economics and Statistics should publish State-wise conversion factors of crops for which production is at present available in terms of processed products. A study should also be made to assess the effect of the change in the form, raw or processed, on the overall index of agricultural production. (Para 2.17)

7.2.10 *Index of Crop Yields.*—As areas under individual crops are available on gross area basis only, the existing indices of productivity are on gross basis and should, therefore, be designated as "Index of Crop Yields". (Para 2.19)

7.2.11 *Index of Productivity per Net Hectare.*—For measuring changes in land productivity, a new 'Index of Productivity per Net Hectare' should be initiated. (Para 2.19)

7.2.12 *Index of Cropping Pattern.*—To provide a basis for assessment of changes in cropping patterns over time, an index of cropping pattern should be initiated. (Para 2.20)

7.2.13 *Weights.*—Price weights for the index numbers of agricultural production, crop yields, productivity, etc. should relate to an average of three years ending 1961-61 *i.e.* the period recommended as the base for the all-India and State series. (Para 2.22)

7.2.14 The prices should generally relate to the most common variety grown in the region/Centre, accounting for the bulk of the production of the commodity. In cases where variety-wise figures of production/yield of a commodity are available, the price should be the weighted average price of the different varieties with their production as weights. (Para 2.23)

7.2.15 In view of the gradual changes in methods and coverage, adjusted estimates of production of crops for the base year, should be used for the weighting diagrams. (Para 2.25)

7.2.16 *Official State Series.*—The official State series of index numbers to be published by the State Governments, should be based on differential weights relating to the respective States. (Para 2.24)

7.2.17 *State Series with Uniform Weights.*—For analytical studies involving inter-State comparisons, the Directorate of Economics and Statistics should compile a series of State index numbers using all-India price weights. To avoid confusion, the limited purpose of this series should be suitably explained while publishing the same. (Para 2.24)

7.2.18 *Index of Crop Yields.*—The index of crop yields should be constructed by weighting the yields of individual crops, the areas under crops during the current year.

7.2.19 *Methodology.*—With a view to having a more complete analysis of the trends in agriculture, the following scheme for construction of index numbers of area under crops, net area sown, cropping intensity, cropping patterns, crop, yields, productivity per net hectare and agricultural production should be adopted :

$$\text{Index of Area under Crops} = \frac{\Sigma a_{ij}}{\Sigma a_{io}} \times 100 \quad . \quad . \quad . \quad (1)$$

$$\text{Index of Net Area Sown} = \frac{N_j}{N_o} \times 100 \quad . \quad . \quad . \quad . \quad (2)$$

$$\text{Index of Cropping Intensity} = \frac{\Sigma a_{ij}/N_j}{\Sigma a_{io}/N_o} \times 100 = \frac{\Sigma a_{ij}}{\Sigma a_{io}} \times \frac{N_o}{N_j} \times 100 \quad (3)$$

or $[\,(1) \div (2)\,] \times 100$

$$\text{Index of Cropping Pattern} = \frac{\Sigma c_{ij}\ y_{io}\ p_{io}}{\Sigma c_{io}\ y_{io}\ p_{io}} \times 100$$

$$= \frac{\Sigma \frac{a_{ij}}{\Sigma a_{ij}}\ y_{io}\ p_{io}}{\Sigma \frac{a_{io}}{\Sigma a_{io}}\ y_{io}\ p_{io}} \times 100$$

$$= \frac{\Sigma a_{ij}\ y_{io}\ p_{io}}{\Sigma a_{io}\ y_{io}\ p_{io}} \times \frac{\Sigma a_{io}}{\Sigma a_{ij}} \times 100 \quad . \quad . \quad . \quad (4)$$

$$\text{Index of Yield} = \frac{\Sigma a_{ij}\ y_{ij}\ p_{io}}{\Sigma a_{ij}\ y_{io}\ p_{io}} \times 100 \quad . \quad . \quad . \quad . \quad (5)$$

$$\text{Index of Productivity per Hectare of Net Area} = \frac{\Sigma a_{ij}\ y_{ij}\ p_{io}/N_j}{\Sigma a_{io}\ y_{io}\ p_{io}/N_o} \times 100$$

$$\text{or} \quad \frac{(3) \times (4) \times (5)}{100 \times 100} \quad . \quad . \quad . \quad . \quad . \quad (6)$$

$$\text{Index of Agricultural Production} = \frac{\Sigma a_{ij}\ y_{ij}\ p_{io}}{\Sigma a_{io}\ y_{io}\ p_{io}} \times 100 \quad . \quad . \quad . \quad (7)$$

$$\text{or} \quad \frac{(2) \times (6)}{100} \quad \text{or} \quad \frac{\text{Index of Net Area Sown} \times \text{Index of productivity per hectare of net Area}}{100}$$

$$\text{or} \quad \frac{(1) \times (4) \times (5)}{100 \times 100}$$

$$\text{or} \quad \frac{\text{Index of Area under Crops} \times \text{Index of Cropping Pattern} \times \text{Index of Yield}}{100 \times 100}$$

where, a_{io} = Area under the ith crop in the base period.

a_{ij} = Area under the ith crop in the jth year.

N_o = Net area sown in the base period.

N_j = Net area sown in the jth year.

$$c_{io} = \frac{a_{io}}{\Sigma a_{io}}$$

$$c_{ij} = \frac{a_{ij}}{\Sigma a_{ij}}$$

y_{io} = Yield per hectare of the ith crop in the base period.

y_{ij} = Yield per hectare of the ith crop in the jth year.

p_{io} = Price per unit of the ith crop in the base period.

(Paras 2.29 to 2.36)

7.2.20 *All-India Indices to flow from State Indices.*—To bring consistency between the State and all-India series, all-India indices may be built up from the State index numbers. (Para 2.37)

7.2.21 *Time Schedule.*—Efforts should be made to expedite the finalisation of agricultural statistics at various levels and to publish them with the minimum possible time-lag. To improve the usefulness of the all-India and State Index numbers for policy and administration, these should be published in August-September, every year. (Para 2.38)

7.2.22 *Errors.*—Margins of error of the index numbers should be worked out periodically, say once in five years or so. (Para 2.39)

7.2.23 *Linking of New Series with Old.*—When the base period of the index numbers series is shifted to the triennium ending 1961-62, the new series may be linked to the old to provide fairly long series of index numbers for purposes of assessment of long term trends. (Para 2.40)

7.2.24 *Regional Indices.*—Regional index numbers of area, cropping pattern, crop yields, etc. should also be initiated by dividing the State into suitable agricultural regions. (Para 2.41)

7.2.25 *Preparation of Manual.*—A comprehensive manual on construction of all-India and State index numbers, area under crops, net area sown, cropping intensity, cropping patterns, crop yields, productivity per net hectare and agricultural production should be prepared giving practical examples for the guidance of the staff engaged on this work at the all-India and State levels. (Para 2.42)

7.2.26 *Annual Publication.*—A brochure on the lines of the White Paper on national income should be issued annually giving the latest series of index numbers of area under crops etc. for the use of research workers, administrators, etc. (Para 2.43)

7.2.27 *Training.*—Training of State staff should be organised at periodical intervals to acquaint them with the methods laid down for construction of index numbers and to explain to them the pitfalls involved and the procedures for solving problems peculiar to different States. (Para 2.44)

7.3 *Index Numbers of Harvest (Producers') Prices of Principal Crops in India* :

7.3.1 *Concept of Farm (Producers') Price.*—From the point of view of utility of the data on harvest prices, the concept of Farm Price, should be changed to "Average wholesale price" at which the commodity is disposed of by the producer at the village site or the neighbouring primary market during the specified peak marketing period of the commodity", wherever this has not already been done. (Para 3.5)

7.3.2 *Adoption of the New Concept.*—Question of adoption of the new concept should be persuade with the States. In the case of States which have not yet adopted the new concept, arrangement should be made to collect data according to both, old and new, concepts for the transitional year. (Para 3.5 and 3.6)

7.3.3 *Harvest Prices* vs. *Market Prices.*—To enable an assessment of the reliability of harvest prices data in comparison with market prices, a study of the basic data from village level upwards should be undertaken for a few selected States such as Rajasthan, Andhra Pradesh and Uttar Pradesh. This should be in the nature of a case study and its results placed before the Committee within three months to enable a decision on the nature of prices which should form the basis of the index of harvest (Producers') prices. (Para 3.7)

7.3.4 *Base Period.*—Triennium ending 1961-62 should be adopted as the base of the index of harvest (Producers') prices. (Para 3.11)

7.3.5 *Geographical Coverage.*—The coverage of the series should be extended to all the States and Union Territories. (Para 3.14)

7.3.6 *Crop Coverage.*—The crop coverage of the series should be extended to the following principal crops :—

I. *Foodgrains :*

(i) Cereals—Paddy (Rice), Jowar, Bajra, Maize, Ragi, Wheat and Barley.

(ii) Pulses—Gram and Tur.

II. *Non-Foodgrains :*

(i) Oilseeds—Groundnut, Sesamum, Rape & Mustard, Linseed and Castorseed.

(ii) Fibres—Cotton, Jute, Mesta and Sannhemp.

(iii) Plantation Crops—Tea, Coffee and Rubber.

(iv) Miscellaneous Crops—Sugarcane (Gur), Pepper, Tobacco, Potatoes Ginger and Chillies (Dry).

(Para 3.15)

7.3.7 *Weights.*—For combining the State prices into an all-India price, current year's production should be used as weights. (Para 3.17)

7.3.8 *Methodology.*—Weighted arithmetic average should be used in place of the geometric average. (Para 3.20)

7.3.9 *Linking of New Series with Old.*—When the new series is issued, it may be linked with the old series to provide a fairly long series of index numbers of harvest prices for assessment of long-term trends. (Para 3.21)

7.4 *Index Numbers of Parity between Prices Received and Prices Paid by the Farmer :*

7.4.1 *Extension to All States.*—All the States should initiate the compilation of the index of parity between prices received and prices paid by the farmer. (Para 4.5)

7.4.2 *Base Period.*—To ensure inter-State comparability, triennium ending 1961-62 should be adopted as the common base period for all the State series. (Para 4.6)

7.4.3 *Periodicity.*—In order that the indices may be meaningful, these should be constructed on annual basis and not monthly, as at present. (Para 4.7)

7.4.4 *Index of Prices Received :* (a) *Commodity Coverage.*—The coverage of the index should be enlarged to cover all the important crops grown in a State. Efforts should also be made to cover the important animal husbandry products of each State. Where reliable estimates of production of animal husbandry products are not available, surveys involving physical measurement should be initiated. (Para 4.8)

(b) *Weights.*—In order that the index might reflect income terms of trade, the weights should be proportional to the production of the commodities rather than their marketable surpluses. (Para 4.8)

(c) *Prices.*—The prices forming the basis of the index should be peak-marketing period prices in representative primary markets. The system of reporting prices from primary markets should be strengthened and streamlined. (Para 4.8)

(d) *Methodology.*—Instead of the weighted geometric average, use should be made of weighted arithmetic average, for the computation of the index. (Para 4.8)

7.4.5 *Index of Domestic Expenditure :* (a) *Commodity Coverage.*—With the improvement in the scope of the prices data during recent years, the coverage of the series should be enlarged to make it more representative. On the basis of the results of various surveys on family budget a standard list of commodities to be included in the State series should be drawn up and recommended to the State Governments. (Para 4.9)

(b) *Weights.*—The feasibility of using the data already collected by the N.S.S., N.C.A.E.R. and other organisations should be examined. (Para 4.9)

(c) *Prices.*—Data on retail prices of the items included in the index should be collected from a fairly large number of primary markets through the marketing or price reporting agencies of the States. For an index there should be built in objectivity in the matter of price collection. So, wherever there are price controls on different commodities, it is the controlled price which should be reported. (Para 4.9)

(d) *Methodology.*—As in the case of the index of prices received, weighted arithmetic average should be used for the construction of the index in place of the geometric average. (Para 4.9)

7.4.6 *Index of Cost of Cultivation.*— (a) *Item Coverage.*—Selection of items should be based on recent surveys on cost of cultivation with a view to covering the bulk of the cash expenditure of the farmer on cultivation to ensure representativeness of the index. (Para 4.10)

(b) *Weights.*—For each State, the Directorate of Economics and Statistics should collect all the data on cost of cultivation available from different sources and in consultation with the State Governments decide upon the best source or combination of sources that could be used for finalising the item coverage and weighting diagrams. In the case of States for which no dependable data were available, suitable surveys should be conducted. For this purpose, the States should be divided into agro-climatic regions and from each region one district should be selected for survey. (Para 4.10)

(c) *Prices and Wages.*—Arrangements should be made for regular collection of data on prices and wages. (Para 4.10)

(d) *Methodology.*—As in the case of the other constituent indices weighted arithmetic average should be used instead of the weighted geometric averages. (Para 4.10)

7.4.7 *Index of Prices Paid.*—Relative proportion of costs of cultivation and living should be determined on the basis of data collected in the Farm Management or other scientific surveys. Weighted arithmetic average should be used for the construction of the composite index of prices paid in place of the geometric average. (Para 4.11)

7.4.8 *Time Schedule.*—To improve the usefulness of the index numbers, these should be published within two months of the close of the agricultural year. (Para 4.13)

7.5 *Indicators' Scheme of the Directorate of Economics and Statistics* :

7.5.1 *Enlargement of the Sample.*—To improve the usefulness of the scheme, the sample of villages, from which the basic data on prices and wages are collected, should be enlarged to cover all the villages of the original enquiry. (Para 5.9)

7.5.2 *Agency.*—The possibility of using some other suitable agency, either in addition to or in substitution of village reporters presently employed under the scheme should be explored. The revenue agency would not be suitable for collection of the required information. (Para 5.10)

7.5.3 *Respondents.*—The same farmers should not be approached all the time for securing the required data, but a representative sample should be canvassed every year. (Para 5.10)

7.5.4 *Weighing diagram.*—In view of the changes in the relative importance of different inputs since the base period, the question of assignment of new weights should be examined. (Para 5.11)

7.5.5 *General.*—The scope of the scheme should be confined to the construction of annual index numbers in respect of Farm Business Cost and Cost of Cultivation of major crops. (Para 5.12)

7.6 *Index Numbers of Cost of Cultivation of Crops:*

Cost of cultivation surveys should be followed by collection and compilation of data in the lines indicated in Chapter VI to enable construction of an index of cost of cultivation of the concerned crops for the area of survey. (Para 6.5)

5—1 Dte. E. & S./66

APPENDIX I

List of persons who were associated with the Deliberations of the Technical Committee on Index Numbers Relating to Agricultural Economy

Agricultural Prices Commission

1. Dr. B. P. Dutia.
2. Dr. Jai Krishna.
3. Dr. L. S. Venkataraman.

Central Statistical Organisation

4. Dr. S. G. Tiwari.
5. Shri R. Calla.
6. Shri M. S. Singhal.

Directorate of Economics and Statistics

7. Dr. W. B. Donde.
8. Shri R. Giri.
9. Shri Harpal Singh.
10. Shri S. L. Sharma.
11. Shri C. Ramalingam.

APPENDIX II

Index Numbers of Area and Agricultural Productivity on Gross Area and Net Area Basis

(Base : Agricultural Year 1949-50=100)

Years	Index Numbers of			
	Area under Crops on Gross Area Basis (Existing Series)	Net Area Sown	Agricultural Productivity on Gross Area Basis (Existing Series)	Agricultural Productivity per Hectare
1949-50	100·0	100·0	100·0	100·0
1950-51	99·9	100·8	95·7	94·8
1951-52	101·7	101·0	95·9	96·5
1952-53	105·3	103·0	96·9	99·0
1953-54	111·2	105·8	102·8	108·0
1954-55	112·3	106·6	104·2	109·8
1955-56	115·0	107·7	101·6	108·4
1956-57	116·0	109·1	107·2	113·9
1957-58	114·7	107·6	101·0	107·7
1958-59	119·4	109·8	111·8	121·6
1959-60	120·7	110·7	108·0	117·7
1960-61	118·5	110·9	117·9	126·0
1961-62	121·4	112·8	116·5	125·4

APPENDIX III

All-India Index Numbers of Area under Crops and Cropping Pattern—All Crops

(Base : Agricultural Year 1949-50=100)

Year	Index Numbers of Area under all-Crops *	Index Numbers of Cropping Pattern@
1949-50	100·0	100·0
1950-51	99·9	102·8
1951-52	101·7	103·3
1952-53	105·3	100·2
1953-54	111·2	96·0
1954-55	112·3	8·1
1955-56	115·0	99·5
1956-57	116·0	101·7
1957-58	114·7	102·4
1958-59	119·4	100·6
1959-60	120·7	102·3
1960-61	118·5	103·6
1961-62	121·4	104·6
1962-63	122·5	104·2
1963-64	122·2	104.1

* Index of Area under Crops $= \frac{\Sigma a_{ij}}{\Sigma a_{io}} \times 100$

@ Index of cropping Pattern $= \frac{\Sigma c_{ij}\ y_{io}\ p_{io}}{\Sigma c_{io}\ y_{io}\ p_{io}} \times 100$

$= \frac{\Sigma a_{ij}\ y_{io}\ p_{io}}{\Sigma a_{io}\ y_{io}\ p_{io}} \times \frac{\Sigma a_{io}}{\Sigma a_{ij}} \times 100$

(For notations please see para 2·20)

APPENDIX IV

All-India Index Numbers of Crop Yields

(Base : Agricultural Year 1949-50=100)

Year	Foodgrains		Non-Foodgrains		All-Crops	
	Existing series*	Revised series@	Existing series*	Revised series@	Existing series*	Revised series@
1950-51	92·4	91·4	95·6	96·3	95·7	93·1
1951-52	93·0	93·3	91·1	92·2	95·9	92·8
1952-53	98·0	100·3	89·3	90·9	96·9	96·7
1953-54	103·1	111·3	90·3	98·5	102·8	107·1
1954-55	105·2	108·3	94·9	102·1	104·2	106·2
1955-56	103·0	105·4	91·7	96·1	101·6	102·1
1956-57	107·4	108·2	97·8	100·4	107·2	105·4
1957-58	98·6	99·9	95·8	96·8	101·0	98·7
1958-59	112·5	114·5	102·0	105·5	111·8	111·2
1959-60	109·1	110·1	97·1	97·8	108·0	105·5
1960-61	118·3	119·1	106·3	105·3	117·9	113·8
1961-62	117·8	118·0	102·2	101·1	116·5	111·4
1962-63	111·0	110·8	101·5	102·5	112·0	107·5
1963-64	115·0	114·1	102·8	104·4	115·0	110·5

*—Index of Productivity = $\frac{\text{Index of Production}}{\text{Index of Area}} \times 100$

@—Index of Productivity = $\frac{\Sigma a_{ij}\ y_{ij}\ p_{io}}{\Sigma a_{ij}\ y_{io}\ p_{io}} \times 100$

(For notations please refer to para 2·26)

6—1 Dte. E. & S.166

APPENDIX V

Position Regarding Switch over to the New Concept of Farm (Harvest) Price in Different States as on 15 th June, 1965

State	Position	Remarks
Andhra Pradesh . .	Instructions to the primary reporters to report peak-marketing prices issued after June, 1964. Data according to the new concept not yet received.	Letter No. 32064-AE/63 dated 3-6-1964 from Director, Bureau of Economics and Statistics, Andhra Pradesh.
Assam . . .	Information on Peak-Marketing Periods of different crops for the State as a whole has been supplied. It is, however, not clear whether the new concept of the farm prices has been adopted or not.	Letter No. ESPI 125/58/63 dated 20-1-1964 from Director of Statistics, Assam.
Bihar	Collection period of harvest prices during 6-8 weeks of the peak-marketing period will be too late as this will mean some two months after the harvesting is completed. During this period the bulk of the marketable crop goes to the hands of the wholesale traders and it is *feared* that the prices from the producers will be rarely available and the prices collected will reflect not actual farm prices but 'wholesale prices'.	Letter No. 617 dated 24-7-64 from the Directorate of Statistics, Bihar.
Gujarat . . .	Information regarding the periods for collecting farm prices has been given. It is, however, not clear whether (i) if periods now furnished are really the peak-marketing periods and (ii) these periods are the same as those followed in the past for collection of farm harvest prices.	Letter No. Stat/I/WRR/26/63 dated 25-3-1964 from Directorate of Agriculture, Gujarat.
Kerala . . .	District-wise information of harvesting and peak-marketing periods has been furnished but it is not clear whether the farm prices are collected during the harvesting periods or peak-marketing periods (A clarification may perhaps be sought from the State Government).	Letter No. 10319/61/ESP dated 3-10-1964 from Bureau of Economics and Statistics, Kerala.

APPENDIX V—*concld.*

Position Regarding Switch over to the New Concept of Farm Harvest (Price) in Different States as on 15 th June, 1965

State	Position	Remarks
Madhya Pradesh . .	Information on peak-marketing periods has been furnished for the State as a whole. It is, however, not clear whether the farm prices are collected during these periods or during harvesting periods of crops (A clarification may be sought from the State Government).	Letter No. Q/V-B/64 dated 16-4-1964 from Director of Land Records, Madhya Pradesh.
Madras . . .	District-wise information on peak-marketing periods of different crops has been furnished. It is, however, not clear whether the farm prices are collected during these periods or during the harvesting periods. (A clarification may be sought from the State Government).	Letter No. 691/H/63-24 dated 25-7-1964 from Department of Statistics, Madras.
Maharashtra . .	Ditto.	Letter No. Stat/I/3321 dated 29-7-1964 from Deptt. of Agriculture, Maharashtra, Poona.
Mysore . . .	Peak-marketing periods adopted for collection of Harvest Prices from 1963-64.	Letter No. 11169/63-64 dated 19-12-1963 from Director of Statistics, Mysore.
Orissa . . .	No reply received.	
Punjab . . .	District-wise information on harvesting and peak-marketing periods received from the State Director of Land Records. The State Government has not issued any instructions for change in the period of collection of harvest prices.	Letter No. S/93-37/28922 dated 31-12-1964 from Director of Land Records, Punjab.
Rajasthan . . .	District-wise information on period of collection of harvest prices and harvesting periods of different crops has been received. The State Government has not adopted peak-marketing periods for collection of harvest prices.	Letter No. F39(iii)Agri/62/47924 dated 22-12-1964 from Director of Economics and Statistics, Rajasthan.
Uttar Pradesh . .	In the case of rabi crops the periods of reporting of harvest prices has been extended for some districts to cover peak-marketing periods. It is, however, not clear whether periods for other districts also relate to peak-marketing periods or not. Information about kharif crops is not known.	Letter No. 8520/39(ii)/62 dated 20-2-1965 from Joint Director of Agriculture, Uttar Pradesh.
West Bengal . .	No reply received.	
Jammu & Kashmir .	No reply received.	

APPENDIX VI

Index Numbers of Harvest Prices of selected Crops in India

(Agricultural Year 1938-39=100)

Year	Rice	Wheat	Total Food-grains	Ground-nut	Sugar (Raw)	Cotton	All com-modities
1949–50	479	603	485	666	364	373	474
1950–51	549	640	534	784	317	384	511
1951–52	579	605	538	669	207	337	476
1952–53	553	515	535	584	214	307	461
1953–54	515	547	486	360	239	339	440
1954–55	436	407	376	370	160	289	333
1955–56	472	531	437	444	181	316	389
1956–57	581	604	546	585	184	367	471
1957–58	623	579	554	556	204	351	475
1958–59	613	622	564	599	259	338	495
1959–60	626	561	560	639	280	400	503
1960–61	623	545	556	720	238	403	509
1961–62	635	583	561	786	215	400	501
1962–63	641	570	588	780	293	425	509

APPENDIX VII

Index Numbers of Harvest Prices of Principal Crops in India (Existing Series)—Number of Centres selected for Different Crops in the States covered

State	Rice	Jowar	Bajra	Maize	Wheat	Barley	Gram	Groundnut	Sesamum	Rapeseed & Mustard	Linseed	Sugar (Raw)	Tobacco	Cotton	Jute
Andhra Pradesh	5	5	5	..	..	..	..	5	2	..	..	1	2	3	..
Assam	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1
Bihar	9	..	..	5	..	3	3	..	..	1	5	2	1	..	3
Gujarat	2	1	1	2	1	..	1	..	2	..	..	..	1	2	..
Kerala	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Madhya Pradesh	2	..	..	..	3	..	3	..	4	..	2	..	..	1	..
Madras	6	4	4	..	..	..	..	5	4	..	..	3	1	5	..
Maharashtra	2	7	2	..	3	..	1	4	1	1	1	2	..	8	..
Mysore	1	3	1	..	1	..	..	3	..	..	..	2	1	3	..
Orissa	3	..	..	..	1	..	..	1	1	..	..	..	..	..	1
Punjab	1	..	1	2	6	2	3	..	..	1	..	1	..	2	..
Rajasthan	..	..	..	1	1	1	..	..	..	..	..	..	..	..	..
Uttar Pradesh	4	3	2	5	11	6	6	..	4	4	3	10	1	2	..
West Bengal	3	..	..	..	1	..	1	..	..	1	..	1	..	..	4
Delhi	..	1	1	1	1	1	1	..	..	..	..	..	..	..	..
TOTAL	39	24	17	16	29	13	19	18	18	8	11	22	7	26	9

APPENDIX VIII

Details of State Series of Index Numbers of Parity between Prices received and Prices paid by the Farmer

	Assam	Kerala	Orissa	Punjab	West Bengal
1	2	3	4	5	6
I. *Base period* .	1944	1952-53 (Agricultural year)	August, 1939	1938-39 (August to July)	1939. In addition, indices are also being constructed with base as 1948, previous year and previous month.
II. *Index Number of Prices Received*					
	Commodity Weight	*Commodity Weight*	*Commodity Weight*	*Commodity Weight*	*Commodity Weight*
(i) Commodities included and weights assigned	(a) Paddy 58·48 (b) Pulses (Matikalai, Mung & Khesari) 4·17 (c) Mustard 9·75 (d) Potato 3·70 (e) Sugarcane 2·87 (f) Jute 21·01 (g) Tobacco 0·02	(a) Paddy 24 (b) Coconut 34 (c) Arecanut 5 (d) Cashewnut 3 (e) Tapioca 11 (f) Ginger 1 (g) Pepper 15 (h) Banana 6 (i) Sugarcane 1	(a) Rice 68 (b) Pulses 7 (c) Sugarane 10 (d) Tobacco 5 (e) Mustard 1 (f) Jute 9	(a) Rice 4 (b) Jowar 1 (c) Bajra 2 (d) Maize 1 (e) Wheat 51 (f) Barley 3 (g) Gram 16 (h) Sugarcane 4 (i) Tobacco 3 (j) Rapeseed 3 (k) Mustard 2 (l) Cotton (Desi) 10	(a) Rice 69·7 (b) Wheat 0·6 (c) Barley 0·2 (d) Pulses 7·1 (e) Potato 5·0 (f) Sugarcane 2·9 (g) Tobacco 1·2 (h) Rape & Mustard 1·6 (i) Jute 11·7
	Total 100·00	Total 100	Total 100	Total 100	Total 100·00
	The above commodities are selected on a joint consideration of their marketable surplus and availability of prices data.				

(ii) Basis of assignment of weights.	In proportion to the value of marketable surplus of the agricultural commodities based on the Rural Economic Surveys conducted in 1948-50 in the plains districts of the State.	Weights assigned in proportion to the value of production during the base period.	Weights assigned in proportion to the average value of the marketable surpluses during 1936-37 to 1938-39.	Weights assigned in proportion to the value of marketable surpluses of the commodities during 1938-39. (In the case of Rape and Mustard, value of total production has been taken in the absence of data regarding marketable surpluses).	Weights assigned in proportion to the average value of marketable surpluses of the commodities during the period 1947-48 to 1950-51.
(iii) Prices used for the index.	Fortnightly wholesale prices for the following centres Tinsukia, Jorhat, Tihu, Hojari, Khoirabari, Khowang, Dargaon, Gauhati, Nowgong, Doom Dooma, Duhenhengra, Salonah and Lakhipur.	Wholesale prices of the selected commodities on a weekly basis are collected from 55 taluk centres.	Wholesale prices of the selected commodities published in prices current returns for Cuttack market.	Fortnightly wholesale prices of the selected commodities for the ten marketing centres of Palwal, Ambala, Jagadhari, Jullundur, Ludhiana, Ferozepur, Abohar, Amritsar, Gurdaspur and Pathankot, spread all over the State.	Monthly indices are based on the monthly wholesale prices; Annual indices are based on the farm harvest prices published in the Season and Crop Reports of the State.
(iv) Method of construction.	Weighted geometric average of the monthly price relatives for individual commodities.	A simple arithmetic mean of the prices for the different centres in a district gives the district price. The district prices are weighted with district production figures in 1956-57 to obtain the State average price. Weighted geometric	Weighted geometric average of the price relatives for the individual commodities.	A simple average of the fortnightly prices gives the monthly price of a commodity. A weighted geometric average of the monthly price relatives gives the index.	Weighted geometric average of the price relatives.

1	2	3	4	5	6
II. Index Number of Prices Received—contd.		mean of the price relatives for different commodities gives the index.			
(iv) Metohd of construction—*contd.*					
III. *Index Number of Prices Paid*					
A. Index Number of Domestic Expenditure					
(i) Commodities included and weights assigned.	*Commodity Weight* (a) Rice 24·44 (b) Pulses 4·44 (c) Vegetables (Cabbage, Brinjal & Tomato) 3·71 (d) Fish etc. 4·80 (e) Salt & spices 5·88 (f) Gur & Sugar 4·90 (g) Mustard oil 8·00 (h) Milk 1·26 (i) Clothing (Dhoti, Sari, Shirts, etc.) 22·55 (j) Fuel & lighting (Kerosene & matches) 4·44 (k) Tea 4·37 (l) Tobacco 6·46 (m) Betelnut & leaf 4·75	Average cost of living index for 12 centres, already being published, with base changed to 1952-53, is taken to represent the index of domestic expenditure.	*Commodity Weight* (a) Rice (b) Ragi (c) Gram (d) Black Gram (e) Green Gram (f) Arhar (g) Sugar } 62 (h) Clothing 25 (i) Lighting (Kerosene & Matches) 4 (j) Luxuries (Pan, supari & tobacco). 9 Total 100 The above items account for about 70 per cent of the total cash expenditure.	*Commodity Weight* (a) Rice (b) Wheat (c) Wheat flour (d) Gram (e) Arhar (f) Massar (g) Urid (h) Mung (i) Sugar (raw) (j) Sugar (refined) (k) Salt (l) Meat (Goat) (m) Milk (n) Ghee (o) Sarson oil } 44 *Clothing* (p) Dhoti (q) Shirting (r) Muslin (Coarse) } 48	*Commodity Weight* (a) Rice 35 (b) Pulses 7 (c) Sugar (raw) 5 (d) Salt 2 (e) Meat (Goat), fish etc. 8 (f) Milk 12 (g) Spices (Haldi & Chillies) 1 (h) Mustard oil 9 (i) Vegetables (Onion & Potato) 3 (j) Other foodstuff 1 *Clothing* (k) Dhoti & Saree 8 *Lighting* (l) Domestic Cokes & Kerosene oil

			Lighting (s) Kerosene Oil (t) Matches } 3	*Luxuries* (m) Bidi, Betel 4
	Total 100·00		*Luxuries* (u) Tobacco 5 Total 100	Total 100
	The above items account for about 70% of the total cash expenditure and are fairly representative of the total domestic expenditure.		The above items account for about 80 per cent of the total domestic expenditure of the farmers.	
(ii) Basis of assignment of weights	Weights are based on the results of enquiry into domestic expenditure of 2,123 rural families conducted during the Rural Economic Surveys during 1948-50 in the plains districts of the State.	Weights are based on the tentative estimates of expenditure on different items of domestic expenditure of an average agricultural family.	Group weights are based on the study of the family budgets of the farmers in Punjab during 1938-39 and the Working Class Cost of Living Index Numbers published by the Director of Industries, Punjab.	Family budget analysis of 91 families in 6 villages in 1944-45.
(iii) Prices used for the index	Weekly retail prices of selected commodities are collected from the centres mentioned under II (iii) above.	Monthly retail prices ruling at 16 urban markets distributed throughout the State.	Monthly retail prices for Ludhiana & Rohtak Centres.	In the absence of retail price data for the rural areas, weekly retail prices of the commodities ruling at different markets of Calcutta published in the

1	2	3	4	5	6
I. *Index Number of Prices Paid—contd.*					
(iii) Prices used for the Index—*contd.*					Calcutta Municipal Gazette are utilized. The average prices of cheapest rice and salt are calculated from fortnightly prices current (retail) of common rice and salt published in the Calcutta Gazette.
(iv) Method of construction	Weighted geometric average of the monthly price relatives for individual commodities.		A simple average of prices prevailing at different centres gives the State price of a commodity. Weighted geometric average of the price relatives for individual commodities gives the index of domestic expenditure.	A simple average of the group indices for the two centres gives the group index for the State. A weighted geometric average of the group indices gives the index of domestic expenditure.	Weighted geometric average of the price relatives gives the index of domestic expenditure.
B. Index of Farm Cultivation Costs					
(i) Items included and weights assigned.	*Item* *Weight* (a) Seeds (Sali, Ahu, Matikalai, Khesari, Sugarcane, Mustard and Potato) 17·17	*Item* *Weight* (a) Agricultural wages 60 (b) Implements (Plough, pick Axe, Mammati, Country Basket, Bullock cart & Waterwheel) 10	*Item* *Weight* Bullock labour 65 Wages of agricultural labour. 35 100 Items like Seeds, which are obtained	*Item* *Weight* (a) Bran 22 (b) Cottonseed 10 (c) Depreciation of bullocks 30 (d) Human Labour (Wheat) 34	*Item* *Weight* *Bullock Labour* (a) Cattle 28 (b) Seed 7 (c) Manure (Mustard cake) 10 (d) Rent

(b) Agricultural Wages	21·91	(c) Manure (cow dung and wood ash)	15	(e) Implements (Iron bars, plates, etc.)	4
(c) Depreciation and maintenance of draught cattle	31·90	(d) Livestock and fodder (depreciation of bullocks, gingelly cake, coconut cake, ground nut cake, cottonseeds and tamarind seeds	15		100
(d) Rent and Land Revenue	27·31		100		
(e) Interest on agricultural loan	1·71				
Total	100·00				

Cash expenditure on cattle feed, fodder etc., consumed by bullocks is negligible as these are mostly obtained from the farm itself. Expenditure on depreciation and maintenance of draught cattle is represented by the cost of a pair of bullocks on the assumption that the variations there of reflect the variations in the expenditure on this item.

mostly from the farm have been omitted. In the absence of any data on the prices of implements this item has also been omitted. In the case of bullock labour, the cost of upkeep has been neglected as most of it is obtained from the farm. Interest on capital invested has been taken into account by considering the price of a pair of bullocks.

The farm cultivation cost consists of bullocks labour, human labour and implements. The expenditure on upkeep of bullocks is represented by the prices of cottonseed and bran, the concentrates fed to animals ; the depreciation of bullocks and the interest on capital invested are represented by the price of a pair of bullocks. The variations in the wages of human labour are taken to correspond to variations in the retail prices of wheat. The cost variations on account of implements are worked out on the basis of changes in steel prices. Expenditure on land revenue, water charges, etc. has been ignored.

Human Labour	
(e) Wages	49
	100

Rent, is, however, left out of account on the assumption that it remains constant in permanently settled areas over a sufficiently long period and will not affect the general trend of changes in other items of expenditure.

1	2	3	4	5	6
III. *Index Number of Prices Paid—contd.*					
(ii) Basis of assignment of weights	Weights are based on the enquiry into farm cultivation costs in respect of 2123 farms conducted during 1948-50.	No scientific enquiry was conducted to determine the items and weights for farm cultivation cost, the weights are therefore rough.	Weights are based on the estimate of farm cultivation costs made by the Director of Agriculture, Orissa.	Weights are based on the estimates of farm cultivation costs of a few selected farms during the pre-war period.	Weights are based on the data collected during the Economic Enquiry 1944-45.
(iii) Prices and Wages used for the index.	Rent and land revenue and interest are taken as constant. Fortnightly prices of other items are collected from the centres mentioned under II(iii) above. Agricultural Wages are collected monthly from sixteen sub-divisions of the State through the agency of Agricultural Inspectors.			Fortnightly wholesale prices for the first three items as published in the supplement to the Punjab Govt. Gazette.	
(iv) *Method of construction*	Weighted geometric average of the relatives for individual items.	Weighted geometric average of the relatives for wages, etc.	Weighted geometric average of the relatives for the two items.	Weighted geometric average of monthly price relatives.	Weighted geometric average of the price relatives.
C. *Consolidated Index of Prices Paid*	Weighted geometric average of the indices of Domestic Expenditure and Farm Cul-	Weighted geometric average of the indices of Domestic Expenditure and Farm Cultivation	Weighted geometric average of the indices of Domestic Expenditure and Farm Cultivation	Weighted geometric average of the indices of Domestic Expenditure and Farm Cultivation	Weighted geometric average of the indices of Domestic Expenditure and Farm Cul-

	tivation Costs, Weights being 67 and 33 respectively.	Costs Weights being equal. No scientific enquiry was conducted for determining the ratio of expenditure on the two heads.	Costs weights being 58 and 42 respectively. The weights are based on rough estimates of pattern of expenditure framed by the Director of Agriculture.	Costs weights being 64 and 36 respectively. The weights are based on a study of the pattern of expenditure of a few selected farms in the pre-war preriod.	tivation Costs, weights being 65·3 and 34·7 respectively.
IV. *Index Number of Parity between Prices Received and Prices Paid*	$\frac{\text{Index of Prices Received}}{\text{Index of Prices Paid}} \times 100$	$\frac{\text{Index of Prices Received}}{\text{Index of Prices Paid}} \times 100$	$\frac{\text{Index of Prices Received}}{\text{Index of Prices Paid}} \times 100$	$\frac{\text{Index of Prices Received}}{\text{Index of Prices Paid}} \times 100$	$\frac{\text{Index of Prices Received}}{\text{Index of Prices Paid}} \times 100$

APPENDIX IX

Indian Council of Agricultural Research

Index of Cost of Cultivation of Surgarcane—Proforma

Year 196 —196 State.....

Sample Village.....Tehsil.....District.....

Name of the Reporting Officer.....Designation.....Date of Enquiry.....

A. *Data regarding Wages.*

I. Agricultural Operations	Male		Female		Child (if any)		Month in which to be reported.
	Wage rate per day	Working hrs./day	Wage rate per day	Working hrs./day	Wage rate per day	Working hrs./day	
1. Ploughing (or any Preparatory tillage operation)							Jan.-Feb.
2. Sowing							March-April
3. Hoeing, Weeding & Earthing up .							July-Aug. & September.
4. Harvesting							Nov.-Dec.
5. Any agricultural operation generally.							Every Month
II. Wages paid to permanent servant for agriculture.							Annually in March.
III. (a) Grazier Fees							Every Month.
(b) Amount paid to permanent servant for looking after cattle if any such is available.							Annually in March.

NOTE FOR A.—Information should be given monthly for each type of labour usually employed for the particular operation and during the period indicated on the basis of enquiry from 4 to 6 cultivators chosen independently during each visit. The names of the cultivators contacted are to be given in section D of the form.

Data regarding Prices

Manures and fertilizers	Prices/unit	Conversion factor for local units	Source nearest the village	Distance from the village	Cost of Transport/ unit	To be reported in
1. F. Y. M.						Feb.-March
2. Compost						
3. Chemical fertilizers*						
(a) Ammonium Sulphate . .						
(b) Urea						
(c) Calcium Ammonium Nitrate						
(d) Super phosphate .						April—Sept.
Single .						
Double .						
(e) Any others . . .						
4. Oil Cakes**						
II. Cattle Feeds						Every Month.
1. Dry Fodder@						
2. Green Fodder @ . . .						
3. Concentrates@@						
(a) Cotton Seed . . .						
(b) Horse Gram . . .						
(c).....						
(d).....						

III. Price of draught animals—value per pair

NOTE FOR B.—Rates should be reported for manures and fertilizers generally applied to sugarcane in the village. Data for F. Y. M. and compost are to be collected from the selected cultivators by enquiry on the basis of actual sale or purchase that

the selected cultivators might have made. In case none of the cultivators has made such a sale or purchase a fresh cultivator who has undertaken such transactions may be contacted to ascertain these rates.

* Data regarding chemical fertilizers are to be taken from the depot set up by the Department of Agriculture or from cane co-operative stores as the case may be. Distance of the source and cost of transport are to be given in the columns provided for.

** Data to be taken from local (village) dealer/shop-keeper or from nearest town where purchases are made for this. In the latter case distance and cost of transport are to be reported.

@ To be taken from selected cultivators as well as from local dealers or from nearest market where such purchases are made. In the latter case cost of transporting and distance should also be reported.

@@ To be taken from village shop-keepers dealing in these articles or from nearest town where cultivators buy their requirements. In the latter case distance of the market and expenditure on transport should be reported.

Specify breed and age detail. Price of draught animals should be ascertained from weekly or fortnightly fairs (for sale or purchase of cattle) if any such are held in the vicinity and also from periodical cattle fairs where such purchases are made. The former is to be reported *every month* and latter whenever such fairs take place.

C. Taxes and Water Rates—to be reported annually by the end of April.

(a) Taxes (i) Land
(ii) Any other

(b) Water rates (state sourcewise)

(i) .....

(ii) .....

(iii) .....

D. 1. Source of Information collected. (i) (iv)
Name of cultivators contacted (ii) (v)
for A and B. (iii) (vi)

2. Government official notifications for C.

Signature of the Reporting Officer.....

Date.....

Place.....

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