PROCEEDINGS OF THE SYMPOSIUM ON 'ASSESSMENT OF IMPACT OF DROUGHT AND FLOOD' HELD ON 29TH DECEMBER, 1981

Chairman : SHRI PRITAM SINGH
Conveners : SHRI H.L. CHAWLA
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It is well-known that drought and flood cause considerable damage to crops, livestock, building structures, household effects, public utilities and also result in disruption of normal economic activity of the affected people. Enormous losses from calamities are being reported every year. A correct assessment of these losses is very essential both from the short-term point of providing relief to the affected people and from the long-term view of policy planning with regard to disaster management. It was in this background that the Indian Society of Agricultural Statistics decided to organise a symposium on Assessment of Impact of drought and flood on the occasion of 35th Annual Conference of the Indian Society of Agricultural Statistics held at New Delhi. The symposium addressed itself to the task of identifying parameters required for assessment of loss, the adequacy of the existing agency responsible for collection of statistics of these losses and to suggest techniques and methodologies for assessing the losses with greater reliability and to study the correlations, if any, between depth and duration of flooding and the damage to crops, livestock and farm assets etc.

15 papers were received for presentation at the symposium of which 6 papers related to assessment of impact of flood, 6 to the assessment of impact of drought and 3 papers to both flood and drought. The following are the extended summaries of the papers presented at the symposium :

Assessment of Flood Damages

BY
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The paper gives an account of direct and indirect damages caused by floods. Direct losses include losses in the agricultural

sector, namely, standing and harvested crops, stored inputs, agricultural implements and livestock, damage to property and public utilities etc. Indirect damages result from cessation of normal economic and commercial activity resulting in loss of income to the affected people. While direct losses may be measurable in value terms, it may not be easy to measure the indirect losses.

Flood damage statistics are being collected and compiled by the Revenue Department of the State Governments mainly as a part of relief administration. The Central Water Commission of the Deptt. of Irrigation colates and coordinates these data to arrive at a national picture. Time series data on these various items from 1953 up-to-date are available with C.W.C. and statewise statements of flood damage information is prepared on a regular basis by the CWC. The paper presents an account of damages under various heads, both in units as well as in value terms. The paper also quotes extensively from the report of the National Flood Commission on the losses due to floods in different States and the recommendation made by the Commission with regard to methodology for flood damage assessment.

The possibility of application of remote sensing techniques such as the use of observational satellite like Bhaskara-II, which went into orbit recently for monitoring reliable data on the extent of area affected by floods has been suggested. The paper stresses the need for evolving a data collection technique for formulation of flood control and other irrigation schemes as also for formulating appropriate policies and suggests the need for conducting sample surveys for assessment of damages. Surveys in a few flood affected areas would be necessary every year to sort out methodological problems involved in such surveys and also to arrive at relevant norms for regular damage assessment. The sample surveys should also collect data on losses to cattle and livestock, household effects and other non-crop damages etc. The spade work necessary for the conduct of such sample surveys may be entrusted to the State Bureaus of Economics and Statistics. A national level Committee may also be formed to sort out the problems in this regard and enforce timely publication of survey results to enable their meaningful utilisation for purpose of planning and policy decisions.

Methodology for Collection and Assessment of Flood Damage Data in a River Basin

BY
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At present only direct flood damage data are being collected and assessed. The indirect damages are not being assessed. Of the direct damages, the one pertaining to crops, houses, public utilities, cattle and human lives is collected by enumeration method, by and large, by the Revenue Departments of the States through their village level functionaries. This is done as an additional item of work. The same staff during flood days are under pressure of relief operations besides their normal functions. No villagewise record of area flooded, damage to crops, houses and cattle lost is maintained.

The paper refers to views of several past committees such as High Level Committee on Floods (1957), Sub-Committee of River Commission (1959) and the Minister's Committee on Flood Control (1964) on the gaps in methodology of flood damage assessment and the recommendations made by these committees to improve the methodology.

The paper suggests a methodology for assessment of direct damages with river basin as unit of area for assessment. For assessing loss of crops, livestock and other rural losses, two-stage stratified sampling design has been suggested with blocks as first stage units and villages as second stage units, villages being selected with probability proportional to size with replacement, size being the area of the village. However, grouping of villages has been recommended according as whether they are protected or unprotected villages.

It is also suggested to collect and assess the indirect flood damages like loss of employment, transport-rail and road, trade and production from industries etc.

Evaluation of benefits of floods on subsequent crops, due to waterlogging and silt deposit etc., also needs to be assessed.

Collection of data of flood damage to Public Works like roads, railways, telegraphs etc. may continue to be done by respective departments as at present.

On Measuring the Impact of Flood

BY
D. TRIPATHI
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The assessment of the losses due to natural calamities like floods is primarily the responsibility of the State Governments which usually prepare the 'White Paper' or some such reports for presenting them to the visiting Central teams with a view to get financial assistance from the Centre. Except for the State of Andhra Pradesh, where these estimates are prepared by the Irrigation Department, all other States entrust the work to the revenue authority, the primary information being provided either by 'Patwari' or the 'Gram Sewak'. The assessment of the damage is done during the floods or immediately after.

This primary estimation is done through visual observation of the extent of crop damage and the area affected. This procedure is highly defective and deficient and has got an inherent upward bias right from the village level. National Commission on Floods reports that more often than not, the scrutiny of estimates at the primary stage is not done by the higher officials.

Several Committees set up in past have gone into the methodology of assessment of loss due to floods and have made recommendations by way of improvement.

The paper suggests the need of applying suitable sampling technique for collection of data of crop losses. The crop loss may be estimated over the entire crop-year taking into account the affects on both Kharif and Rabi crops rather than on the basis of Kharif crop alone.

Crop Damage by Floods in India

BY
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Ministry of Agriculture.

The available statistics on flood damages which, of course, suffer from certain limitations, indicate substantial increase in areas affected by floods in recent years over the estimated damage in earlier years.

Crops are affected by floods in the Kharif season. The period 1976 to 1978 is associated with severe floods when the average crop area affected by floods was put at 8.7 million hectares which formed 6.1 per cent of the net area sown or 9.5 per cent of the total area under crops in the Kharif season averaged over the 3 years ending 1978-79.

Floods in August provide good soil moisture for rabi crops. Water level in reservoirs which provide water and electricity for irrigation purposes in the rabi season, improves on account of excessive rains and floods in the Kharif season. Due to such favourable factors, the fall in production of Kharif crops on account of floods is made good to some extent by higher rabi production. Thus the overall loss in total foodgrains production due to floods in a normal year may not be very significant.

The paper suggests the need of early implementation of the recommendations of the National Commission on Floods for assessing flood damage on scientific lines.

Research Institutions like IASRI be entrusted with the task of developing appropriate statistical methodology for estimation of losses due to various natural calamities including floods.

Crop Planning Strategy for Drought and Flood Prone Areas of North West Plain Zone

BY

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Droughts and floods are recurring features not only in North West Plains Zone but through the length and breadth of the country. Though fore-warning systems have been developed to forecast their occurrence, it still appears difficult to predict their exact time, duration and intensity. Critical analysis of the meterological data gathered over decades, particularly rainfall, would indicate its behaviour. Weekly rainfall probability has been estimated using rainfall data collected over 50 years which serves as useful tool for crop planning. A series of experiments conducted during the last decade at the Indian Agricultural Research Institute, New Delhi have yielded results of great economic utility. A number of crop varieties have been evolved, which can withstand conditions of moisture deficiency in the soil as a result of drought. Similarly research efforts have also been directed to identify crops and crop varieties suitable for flood prone areas.

It has been observed that Castor (crop variety Aruna) is the most stable yielder in dryland areas (20. 6q/ha) as studied for a period of 8 years (1970−78). Pearlmillet and red gram are other stable and economically viable crops for moisture deficit areas. Amongst *rabi* crops, rapeseed (20q/ha) proved of outstanding stability and economic viability. It was followed by safflower, barley and wheat in the descending order. Seeding time of both *kharif* and *rabi* crops is to be so adjusted that critical growth stages do not concide with probable soil moisture deficit periods. In general, *Kharif* crops should be sown in the first half of July. Middle of October appeared optimum seeding time for most of the *rabi* season oilseeds. Besides soil moisture, fertilizer in dryland conditions also plays an important role. Fertilizers gave Rs. 800—1450/ha as the net profit. Intercropping of cereals/millets with legumes displayed great beneficial effects as guaged by total grain productivity and soil fertility. Use of transpiration-suppressants singly or in combination with different types of mulches, significantly augmented crop productivity, particularly during *rabi* season. Control of weeds through herebicides alone or in combination with one late hand weeding (at 5-6 weeks stage) improved upon efficiency of conserved soil moisture use and crop production and also eliminated aggressivity of weeds.

New varieties of Bengal gram, *viz.* M-109 and M-119 (mutant) have been found eminently suitable for late sowing and as such they hold high promise for flood prone areas. In *Diara* areas wheat cultivars *viz.*, HD-1553 and HD-2205 can be successfully grown. Phosphate fertilization of crops in flood prone areas has proved of distinct advantage.

Methodology for Assessment of Losses due to Floods

BY

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The flood damage assessment for the agricultural sector is primarily the responsibility of the Revenue Department as it emanates from the village official namely the Patwari and passing through various channels is coordinated at the district level. In almost all cases the figures relating to the damage to crops are obtained by eye estimation. The methodology followed by the revenue agency suffers from several deficiencies notable among them being;

(*i*) Lack of information from State to State and even within a State

(*ii*) Losses assessed in terms of potential output and therefore no allowance made for resowing/replanting,

(*iii*) Losses are generally over-estimated.

(*iv*) The reporting agency already over-burdened with usual routine work of the department.

(*v*) Higher officials have no time to check the estimates provided by the lower level functionaries.

(*vi*) Duplication of losses reported by different agencies.

(*vii*) Indirect losses not assessed.

The National Commission on floods had gone into entire problem of flood damage assessment and suggested that the methodology adopted for data collection should be periodically reviewed by a committee drawn up from the concerned departments in the States such as Revenue and Relief Commissioner, Bureau of Statistics, Flood Control Department, Director of Agriculture and also some academicians and experts from outside the Government.

The paper refers to the sample survey recently being conducted by IASRI in 1981 in two flood-prone districts of Uttar Pradesh to assess the losses caused by floods to crops, livestock and other capital assests and its subsequent impact on the *Rabi* crops. Some preliminary results of the Survey were presented.

Sample Surveys for Assessment of Impact of Drought and Flood

By

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Drought and flood are two of the many forms of natural disaster that occur from time to time all over the world. Speaking in the context of agricultural sector only, the immediate effect of drought or flood is loss of crops and livestock and damage to capital assets, the last item attributed mainly to flood. The benefit may accrue mainly in the form of residual effect of drought or flood. Therefore the total impact of drought and flood has to be assessed in terms of direct and indirect losses during the period in which it occurs and residual effect in the following season.

Direct losses due to flood and drought would be the aggregation of inputs used such as seeds, manures, fertilizer, irrigation, human and mechanical labour etc. and to livestock. Where sowing had been rendered impossible due to a long spell of drought or flood, the loss could be measured in terms of potential output.

Indirect losses may be caused in terms of interruption in normal economic activity of the people resulting in lack of job opportunities, distress sale of assets etc., which may also need to be assessed.

The paper refers to a sample survey conducted by the IASRI in Union Territory of Delhi during 1979-80 to study the impact of drought on crop production. Estimates have been provided of the crop losses and the growth stage at which the drought occurred for various crops grown in the *kharif* season. Estimates have also been provided of the various inputs used and crop yields harvested by cultivators having different holding sizes. It was found that small and marginal farmers suffered most of the losses. Among various crops maize, jowar, moong and lobia were the worst affected. Information was also collected on the impact of drought on subsequent *rabi* crops.

Gauges of Food Availability

By

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The problem of devising gauges of food availability in areas of partial or total crop failure has been with us for over a hundred years. During the British period, the need for such a guage was articulated by famine relief administrators. It was pointed out that the *annewari* or anna value of the crop, at best an indicator or inability to pay land revenue, was a poor guide even to levels of agricultural production. It was not very helpful to assess the presence of 'scarcity' or 'famine'. Further, a uniform formula of 'failure' (of crop values below four annas) put the proper tracts at a disadvantage. The more discerning administrators suggested that if the annewari were at all to be used to determine the levels of food availability, then it could only be used as a varying scale, 'scarcity' being declared at higher annewari values for the poorer tracts and lower ones for the 'better' areas.

During the last thirty years, the problem has been obscured. In 1961, the Joshi Committee of Maharashtra pointed out, though somewhat indirectly, the lacuna in the use of the aneswari as a guage for determining scarcity. It stated that the 'norms' against which the levels of production in a given year were measured should be determined carefully. If the norm was the production level of the three best years (in a ten years period) then the areas where annual fluctuations were high would not be at a disadvantage. Whereas if

the norm to be used was the *average* (whether of 10 years or a moving average that we use today is not of critical importance) then the areas where the fluctuations are low would be at an advantage. And in the poorer tracts distress will rarely be recognised by the Government.

However, the Dandekar Committee, which again reviewed the annewari formula in 1973, lost sight of this problem. The committee's report has since been accepted by the Maharashtra Government. However no attention seems to have been paid to the fact that the annewari offers a distorted picture of the levels of crop failure and consequent food availability in the tract, since it indicates only a relation between the high and low levels of productivity in the given tract, and offers no basis for comparison between distress in different tracts.

It may be asked whether the administrator should fall back on other indicators such as tribal or caste composition of the population of the affected tract, the proportion of landless and wage and purchasing power and so on. But that does not imply that a critical indicator such as the level of agricultural production and fall in such levels should not be accurately 'metered' and made available to him.

It may well be pointed out that the States of Maharashtra and Gujarat have atleast a crude indicator to fall back upon. Other States in the country, particularly the non-ryotwari areas, do not have any gauge to determine fall in production in areas affected by drought and flood. The task of agricultural statisticians, to device such a guage is therefore an urgent one.

Israel's Solution to the Problem of Irregular and Scanty Rainfall and Shortage of Water in General

By

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Israel is a country where water is an extremely scarc commodity. It is a semi-arid country, a large portion of its area being desert with less than 6 inches of rainfall per annum during the rainiest of years.

This paper explains how the available fresh water resources are optimally utilized for domestic consumption and irrigation in that country. The distribution losses have been kept at a minimum with 93 per cent of the annual water potential being exploited. Pumping is controlled and water is rationed as well as subsidised. 82 per cent of the available fresh water is used in agriculture and high efficiency irrigation systems like sprinkler, spray and drip systems are adopted.

Non-fresh water like sewage, swamp (brackish) and desclinated sea water are also utilised for agriculture.

Floods are a rarity in Israel but flash floods could occur and in the Negeve desert, systems devised more than 2000 years ago for harnessing flash floods are being studied by the scientists.

The cost of irrigation system in Israel is obviously very high. The total investment in agriculture and irrigation over the last 25 years has been only about twice the value of one year's agricultural production which speaks for the efficiency of the system.

The Israel system could be applied in parts of our country also. The author cites Punjab as a possible application of the Israel system.

Assessment of the Impact of Droughts

By

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This paper examines the impact of drought that occurred during 1972-73 in Maharashtra State, by comparing the rainfall data recorded at rain gauge stations in Drought Prone District (DPD) and non-drought Prone Districts (NDPD) for the pre-monsoon, monsoon and post monsoon periods. Broadly, the conclusion that emerges out of this comparative study is that the failure of the rainfall was equally wide-spread both over DPD as well as NDPD areas.

Given the rainfall pattern, the author then examines its impact on area, production and productivity of principal crops of the State, firstly at the State level and then by comparing for DPD and NDPD areas. The areas under cultivation of pulses, bajra, wheat and maize declined, while that under rice and jowar there was not much change, but the production and productivity loss of these two crops were heavier as compared to other crops. The area, production and productivity of all the crops declined considerably in the drought prone areas showing that the farmers being aware of the occurrence of impending drought tried to keep their lands follow to avoid investment by wage of inputs. However, the same kind of adjustment mechanism was not observed in the NDPD areas with the result that farmers suffered heavily by way of inputs in these areas. Finally, the author analyses the loss in production at district level for some major crops of the districts. The general pattern indicates that the losses in production were more than 25 per cent of a normal year's output for

most of the crops and for majority of the districts, although a few crops escaped the fury of drought in some of the districts.

Assessment of Impact of Drought

BY

T. A. GHARPURE,

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Drought results due to the interaction of several meteorological factors such as precipitation, temperature, wind velocity, sunshine etc. and occurs as a result of adverse balance between soil moisture and evaporation from soil, water surfaces and transpiration plants resulting in total or almost failure of crops.

The loss due to drought may be evaluated in terms of extent of area affected and extent of reduction in expected yield as compared to normal yield. The eye appraisal of the standing crops and ultimately data available from crop cutting experiments would provide some measure of the extent of likely yield. The extent of loss thus could be broadly estimated. Having thus ascertained the quantity of loss, its monetary evaluation would be possible on the basis of ruling prices of the commodities in particular areas.

A Hill Restoration Model for Drought Control

BY

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Due to increasing biotic pressure and heavy dependence of the people on hills the ecosystem of hilly environment is getting disturbed day by day. In a bid to carve out a living in foothills people keep a large number of cattle which graze in the hills, break the slopes for meeting food requirements and exploit every possible vegetation on the hills for warming their kitchen. This has led to vicious cycle of poverty, crop failures and hill denudation. A hill restoration model has been developed for reversal of the cycle in village Sukhemajri, District Ambala (Haryana). The model consists of storing excess rainwater from hills by construction of a dam, using stored water for supplemental irrigation coupled with improved agronomic practices in the command area, protecting the catchment area from grazing and establishing a new relationship between the people and hills.

The paper at hand discusses as to how the hill restoration model described above, served as a drought control model during *Kharif* 79 and *Rabi* 79-80 and attempts to qualify impact of the drought on wheat and maize yield with the adoption of the model in the village and without it out side the village.

An objective approach towards Assessment of drought and flood

BY

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The experience of drought and flood situations has become common on Indian scene every year in one or the other part. Also its effect on national economy in general and life of the region where it occurs in particular, is quite significant. Agriculture being the main stay of the country, any adverse effect on this sector would naturally be of great concern to policy-makers. In the paper, an attempt has been made as to how one can quantify the effect of rainfall situation and study the same in understanding agricultural situation prevailing in the region.

The total rainfall received alone is not enough to decide the prospects of agricultural situation, but its distribution is also quite important. The degree of severity of rainfall situation should be measured by knowing both actual quantity of rainfall and number of rainy days through which it occurs, in relation to normal rainfall and rainy days. Also, effect of rainfall on State agricultural prospects should be based upon talukawise data on rainfall and cropping pattern, rather than on district or State level aggregates. The paper tries to bring out such an objective methodology blended with subjective decisions.

Impact of Drought on Crop Production—A case study for Pearlmillet in the Arid Zone of Rajasthan

BY

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Drought is a climatic anomaly characterised by deficit supply of moisture. Droughts of varying intensities will have different impacts on crop production. In the arid regions of Rajasthan, Pearlmillet is the principal rainfed crop and the grain yield is badly affected with the incidence of droughts. An estimation of the impact

of droughts of various intensities viz., large, severe and disastrous on the pearlmillet crop was carried out for the 10 arid districts. It was found that on an average, the percentage loss in grain yield of pearlmillet due to large severe and disastrous droughts was 33, 70 and 88 respectively in the arid zone of Rajasthan.

Assessment of Impact of Flood in Assam

By
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Assam suffers from scourage of floods every year. There is need to develop suitable system for assessment of impact of floods in the State. Data of losses due to flood collected by the State revenue agency do not present an objective picture of the flood damages due to lack of supervision and over burdened revenue agencies. The paper makes a plea for correct assessment of these losses.

Some estimates of damages caused in terms of a area and population affected, crops and livestock lost during the last 5 years have been presented.

Recommendations

The following recommendations emerged from the deliberations at the symposium :

1. The existing method of complete enumeration followed by the State revenue agencies should be continued for obtaining estimates of losses for the immediate purpose of provision of relief to the affected people. However, there is need for better supervision by the higher officials.
2. The existing demarcation of flood affected areas into protected, unprotected and covered by embankment etc. should be kept into view and losses assessed separately for each area.
3. Losses should not be assessed only in terms of realisable output but where resowing or replanting had taken place, these should be assessed in terms of loss of inputs used.
4. Drought and flood are reported to have some beneficial effects also. For example, the silt deposited by flood, in the plains and rise in soil moisture and ground water level may improve prospects of a better crop in the following season. Similarly, a compulsory fallow as a result of drought may improve the soil fertility. Some soil-borne pests and diseases may also get eliminated. Therefore, the

total impact of drought or flood should be assessed on the basis of both Kharif and Rabi crop seasons.

5. Crop varieties/rotations/combinations and agronomic practices which help to minimise losses and maximise returns from the disaster-prone areas, should be identified and propagated.
6. For long term planning with regard to flood management it is necessary to have more reliable data on losses. For this purpose, sample surveys may be conducted in typical flood-prone areas which should help not only to verify estimates obtained by the revenue agency but also provide estimates of losses with higher degree of precision.
7. Research Institutions like the Indian Agricultural Statistics Research Institute should undertake/intensify studies, surveys and research for developing appropriate methodologies for the assessment of losses from different types of disasters They should try to provide the state and central governments and the planners with the tools for undertaking crop insurance over areas affected and prone to such disasters.
8. Studies may be undertaken to correlate crop losses with hydrological parameters such as depth and duration of flooding and relevant weather parameters.
9. Suitable cells may be created in the C.W.C./Ministry of Agriculture to monitor the arrangements on data collection and evolution of methodologies on assessment of crop losses.
10. Lack of funds was pointed out one of the constraints in taking up methodological studies on assessment of losses due to disasters like floods, drought and cyclones etc. It was suggested that agencies like the Central Board of Irrigation and Power may be approached to provide funds for research projects aimed at these aspects.