CHAPTER II : INDIAN COUNCIL OF AGRICULTURAL RESERCH

Management of projects relating to utilisation and conservation of soil and water undertaken by institutes of ICAR

Highlights

- ***NBSS&LUP, Nagpur could not achieve objectives of soil survey, mapping and land use planning in three projects involving an expenditure of Rs 6.63 crore. Soil Survey reports were not prepared even after lapse of five to 25 years.***
- ***IISS, Bhopal did not achieve the desired results in soil science research in two projects, despite expenditure of Rs 55.25 lakh.***
- ***CSSRI, Karnal could not solve effectively the issues relating to reclamation and management of alkaline and saline soils in two projects costing Rs 12.82 crore. Map of salt affected soils of India was also not prepared.***
- ***In water management research, WTCER, Bhubaneshwar failed to accomplish targeted results in three projects costing Rs 36.39 lakh resulting in non-achievement of the objective of sustainable agricultural production through management of canal water, rain water and waterlogged land.***
- ***CSWCR&TI, Dehradun did not achieve the objectives of research in soil and water conservation measures and land use systems for sustainable crop production in three projects costing Rs 37.90 lakh.***
- ***Technologies developed in 16 projects at a cost of Rs 2.44 crore were not transferred to end users***

2.1 Introduction

Natural Resource Management Division of Indian Council of Agricultural Research (ICAR) is responsible for research on conservation, improvement and efficient utilisation of soil and water. Five research institutes of ICAR are engaged in research in these areas. Areas of research undertaken by them are as under :

Sl. No.	Name of institute	Research areas
1.	National Bureau of Soil survey and Land Use Planning (NBSS&LUP), Nagpur	Soil survey and mapping the soils of the country to promote scientific and optimal land pedology, soil survey, land evaluation and land use planning.

Sl. No.	Name of institute	Research areas
2.	Indian Institute of Soil Science (IISS), Bhopal	Basic and strategic research on soils, especially physical, chemical and biological processes related to management of nutrients, water and energy and developing advanced technologies for sustainable systems of input management in soils.
3.	Central Soil Salinity Research Institute (CSSRI), Karnal	Basic and applied research for developing strategies for salinity control, reclamation and management of salt affected soils.
4.	Water Technology Centre for Eastern Region (WTCER), Bhubaneshwar	Basic and applied research for developing strategies for efficient utilisation of on-farm water resources to enhance agricultural productivity on sustainable basis.
5.	Central Soil & Water Conservation Research and Training Institute (CSWCR&TI), Dehradun	Research and development of strategies for controlling land degradation under all primary production systems, rehabilitation of degraded lands, updated technology in soil and water conservation, watershed development and its management and undertaking water harvesting measures

2.2 Scope and objectives of audit

The present review, covering the period 1999-2000 to 2003-04, includes observations on management of the projects undertaken to utilise and conserve soil and water through test check of in-house projects, sponsored projects and externally aided projects undertaken and completed by five institutes with reference to the milestones and achievements of objectives and benefits to be derived from them.

2.3 National Bureau of Soil survey and Land Use Planning (NBSS&LUP), Nagpur

NBSS&LUP, Nagpur completed 45 projects and terminated 15 projects before their completion during 1999-2004. Of the completed projects, research project files were available for 19 projects only which were examined in audit.

2.3.1 Improper maintenance of project files

In accordance with the byelaws, rules and regulations of ICAR and instructions issued by ICAR from time to time, research project files (RPFs) are required to be maintained in three parts. The research project proposal is to be kept in RPF-I, which is to be presented to Staff Research Council (SRC) for approval. Annual progress of each project is to be kept in RPF-II, for review by SRC to evaluate the implementation of the project. The final report in the form of RPF-III is required to be prepared and presented to SRC and Research Advisory Committee (RAC) for overall review and evaluation of the project. However, NBSS&LUP did not maintain the RPFs properly in respect of the

projects implemented during 1999-2004. In case of 15 projects, which were dropped midway, RPF-I only were available. As such reasons for termination of the projects before their completion were not ascertainable. Besides, no records were maintained for 10 completed projects. In 16 projects, RPFs were maintained intermittently. In the absence of proper maintenance of RPFs, effectiveness of monitoring of research activities by SRC/RAC cannot be ensured.

NBSS&LUP stated in August 2004 that in future proper maintenance of RPFs would be ensured.

2.3.2 Non-achievement of objectives

In three projects, partial achievements of objectives and delay in completion ranging from three months to seven years were noticed. These are discussed below:

(a) In collaboration with CSSRI, Karnal, NBSS&LUP undertook a project in May 1996 on "Preparation of soil resource inventory of coastal salt affected areas of West Bengal and Orissa using satellite imagery and characterization and classification of the soil to determine their potentialities, problems and management" at an outlay of Rs 16 lakh for a period of two years.

However, the project was continued even after the stipulated duration of two years. SRC recommended in November 2000 to complete the project by 2001. Ignoring the advice of SRC, the project was continued as of July 2004. The annual progress reports of the project were not prepared regularly. In the annual progress report for 2002-03, it was mentioned that due to pressure of other projects, the work of this project could not progress as per the schedule and the likely date of completion was determined as December 2005. ICAR stated in December 2004 that extension of the project up to December 2005 was accepted by SRC and added that the work was in progress and would be completed. ICAR did not, however, indicate the remedial measures instituted to address the delays.

(b) NBSS&LUP, Nagpur undertook a project on "Identification, characterization and delineation of agro-economic constraints of oilseed based production systems in rainfed eco system" from July 2000 to February 2003 at an estimated cost of Rs 55.41 lakh. The project was to facilitate identification of the appropriate sowing time for specified areas and suggest strategies for improving the productivity of rainfed oilseed crops. The rainfed oilseed based production zones were to be delineated using Geographical Information System (GIS).

The final report of the project revealed that studies were conducted for four crops in 16 districts as against the target of six crops in 19 districts. Further, data on area and production of oilseeds were collected only in six districts as

against 28 different districts targeted. Even in the 16 districts covered, no strategies for improving the productivity of rainfed oilseed crops were suggested. The rainfed oilseed-based production zones were also not delineated using GIS. Thus, the benefits of improving the productivity of rainfed oilseeds could not be derived.

ICAR stated in December 2004 that against the target of 19 districts for six crops, 16 districts for four crops were covered as suggested by the Scientific Advisory Panel and added that the data collected was processed to generate maps depicting the oil seed production potential and constraints and were presented in different thematic maps. However, it did not furnish the reasons for collection of data only in six districts as against 28 districts as per the project proposal.

(c) ICAR sanctioned a project on "Land use planning for management of agricultural resources" from January 2001 to December 2003 at a cost of Rs 9.32 crore. The project aimed at developing the strategies and options for rational and scientific land use plan at watershed level.

The project was extended up to December 2004. The progress reports of the project up to March 2004 revealed that due to delay in receipt of funds, activities like procurement of equipment, socio-economic survey, resource survey, different kinds of mapping and crop experiment could not be completed as planned. The economic analysis of alternate land uses to assess overall socio-economic aspect was not started as of July 2004. Linkages with various organizations like International Crop Research Institute for Semi Arid Tropics and CSSRI on various aspects such as fish varieties for coastal areas, animal component suitable for coastal eco-system and technologies for different crop components of land use models for coastal eco-system were yet to be developed. Further, field experiments for cereals and pulses crops, development of soil site suitability for different land use types, selection of suitable cropping system specific to each agro-ecological zone and monitoring of soil and water qualities were yet to be completed to achieve the aim of the project. Against the allocation of Rs 9.32 crore, only Rs 5.92 crore was spent as of March 2004.

ICAR stated in December 2004 that the work had already been started to conduct economic analysis and alternate land uses to assess overall socio-economic aspect and that activities were also simultaneously initiated to assess the data for horticultural validation, development of soil site suitability criteria, suggesting different crop/cropping sequence in specific agro-ecozone. However, the reply is silent about the linkages to be developed with other institutes as envisaged in the project.

2.3.3 Non-submission of survey reports

Conducting soil survey and publishing reports for land use planning was one of the mandates of NBSS&LUP. Twenty five field survey reports were pending for periods ranging from five to 25 years. It was observed that field surveys of the districts of Chittur, Mysore and Chitradurga were conducted partly in 1976 but were not completed fully. As such the soil survey reports were not submitted till August 2004. As a result, the objective of land use planning was not achieved fully.

ICAR, while accepting the facts, stated in December 2004 that the survey work undertaken before 1986 was suspended and complete manpower was put on national project on soil resource mapping work. It added that the pending soil survey reports would be completed by August 2005.

2.3.4 Costing of soil surveys

The cost of each survey was required to be worked out with reference to staff salaries, travelling cost, depreciation of vehicles and related overheads, cost of base maps, cost of laboratory analysis, cartography work and cost of map publication.

However, NBSS&LUP did not work out the cost of the surveys though it surveyed 25 states covering a total area of 2,90,577,440 hectare, five districts in the states of Bihar, Himachal Pradesh, Karnataka covering an area of 20,00,530 hectare, 11 research farms covering an area of 9800 hectare and 13 watershed command area covering the area of 2,90,125 hectare during 1997-98 to 2001-02.

ICAR stated in December 2004 that the costing of survey would be worked out for future projects.

2.3.5 Improper maintenance of national register of soil series

A national register was required to be maintained for identification of soil series along with their salient characteristics and classification. Indices according to states and crops raised on the soil series are also to be prepared for ready reference. However, the national register was not updated. NBSS&LUP did not furnish information on the year from which the register was to be updated. To complete this task, correlation of soil series identified so far was required to be completed. Quinquenniel Review Team (QRT) observed that there was a backlog of correlation of more than a thousand identified soil series.

ICAR stated in December 2004 that national register of soil series was temporarily suspended due to national mission project on soil resource mapping of different states on 1:2,50,000 scale and of the country on

1:1 million scale initiated in 1986. It added that state wise soil series had been registered and correlated for 13 states. For the remaining states the work was in progress. However, it did not furnish the timeframe for completion of the task.

2.4 Indian Institute of Soil Science, Bhopal

During the period 1999-2004, IISS Bhopal completed 36 projects, of which 19 projects were test checked. In two projects the objectives were achieved only partially. Apart from this, technologies developed in three projects at a total cost of Rs 1.18 crore were not transferred to the end-users as listed in ***Annexure***. ICAR did not furnish reasons for non-transfer of technologies to the end-users.

2.4.1 Non-achievement of objectives

(a) IISS undertook a project on "Organic pools and dynamics in relation to land use tillage and agronomic practices for maintenance of soil fertility" in May 2000 as lead centre with six co-operating centres at an estimated cost of Rs 1.08 crore to be completed by December 2003. The project was extended up to March 2004 with additional outlay of Rs 3.14 lakh. The project was aimed to quantify the changes in soil organic Carbon and Nitrogen pools to assess the mineralisation potential and C-sequestration in soils of semi-arid and sub humid regions and to fit experimental data in different models of C-sequestration. Rs 36.42 lakh was spent on this project by IISS till its completion.

Completion report of the project revealed that the project was implemented only in seven out of targeted eleven districts. Due to delay in procurement of Carbon Hydrogen Nitrogen Sulphur analyser and Furrier Transform Infrared Spectrophotometer, the chemical analysis of the project was hampered. Due to non-materialisation of training of two scientists in the USA in modelling of Soil Organic Matter (SOM) and recent technique in SOM dynamics and measurements, one of the objectives of fitting of experimental data in different models of C-sequestration could not be achieved

The contention of ICAR of December 2004 that the overall objectives of the project had been achieved is not tenable. The reply of ICAR contradicts the facts stated in the project completion report that chemical analysis of the project was hampered due to non-procurement of equipment and that fitting of data in different models of C-sequestration could not be achieved due to non-materialisation of training of two scientists. Further, ICAR itself had stated that the results could not be obtained for Bhubaneswar and Hyderabad due to discontinuance of long-term fertilizer experiments at those locations as well as inability to carry out solid sample analysis at Anantpur and Jorhat.

(b) IISS undertook a project on "Integrated Nutrient Management in major pulse based cropping system and identification of the most productive and remunerative systems" from May 2000 to March 2004 as lead centre. Against the total provision of Rs 30.66 lakh an expenditure of Rs 18.83 lakh was incurred.

The project involved six important cropping systems at different locations. The final report of the project revealed that experiments on three cropping systems were not conducted and experiments on another cropping system were not conducted in two out of four locations. Consequently, the objective of identifying the most productive and remunerative pulses based cropping system under different soil and nutrient management could not be achieved.

ICAR stated in December 2004 that since the project had to be executed under farmer's field condition in participatory mode after selecting the farmers and villages in the target districts, the cropping sequences were revised midway after considering the views of the farmers. The reply revealed that this project was undertaken without giving due consideration to the cropping sequences prevalent in the targeted districts resulting in revision of the technical programme after two years of starting the project.

2.5 Central Soil Salinity Research Institute, Karnal

CSSRI, Karnal completed 72 projects during 1999-2004, of which 40 were test checked. In two projects the objectives were achieved partially, which are discussed in the succeeding paragraphs. In three projects, technology developed at a cost of Rs 47.12 lakh was not transferred to the end users as listed in ***Annexure***.

2.5.1 Non achievement of objectives

(a) CSSRI undertook an externally aided Indo-United Kingdom collaborative research project on "Soil salinity and breeding of salt resistant crops (soil salinity and breeding for salt resistant crops – rice, Indian mustard and gram)" in March 1996 for five years at a total cost of Rs 5.63 crore. Scrutiny revealed that six scientists of CSSRI visited United Kingdom in the first year of the project and undertook studies on alkaline soil instead of both alkaline and saline soils. The progress report for 1996-97 revealed that two of the six scientists who were abroad in connection with the project did not contribute anything. The final report was not yet prepared as of June 2004.

ICAR while accepting that the projects include both saline and alkaline soils stated in December 2004 that all scientists contributed to achieve the project objectives and that the final report was being prepared. The reply has to be viewed in the light of the fact that the progress report clearly revealed non-contribution by the two scientists and the final report was yet to be prepared even after a lapse of three years from the completion of the project.

(b) All India coordinated research project on "Management of salt affected soils and use of saline water in agriculture" was implemented from 1972 at the coordinating unit at CSSRI, Karnal alongwith seven centres at SAUs and one at Agriculture College, Agra.

Rs 7.19 crore was spent on the project during 1999-2004. The benchmark survey for quality control of ground water was undertaken from 1972 only in Guntur district of Andhra Pradesh, but no strategy had been formulated as yet to solve the water problems of that area. Thus, one of the objectives of evaluating the effect of poor quality waters on soils and crops was limited to only one region. Apart from this, there was unspent balance of Rs 1.02 crore accumulated with the centres over the years due to non-adjustment of previous years' unspent balance while releasing further grants to them.

ICAR's reply of December 2004 was silent about the fact why no benchmark surveys were carried out at centres other than Guntur as well as on high accumulation of unspent balances at coordinating centres.

2.5.2 Non-preparation of maps of salt affected soils

RAC in its meeting held in February 2000 recommended preparation of maps for total salt affected areas of the country to know the latest position of the country's salt affected areas. It recommended that CSSRI should undertake this task of identification to have a final and authentic record. ICAR was to coordinate with different agencies to prepare this map upon a single figure. However, no time frame had been fixed to complete the task. The action taken report revealed that the map of salt affected soils on 1 : 2,50,000 scale for Bihar, Haryana, Orissa, Karnataka, Madhya Pradesh, Punjab, Uttar Pradesh and West Bengal had been prepared. But for the remaining states, no work was started as yet.

ICAR stated in December 2004 that the preparation of the maps was delayed since most of the maps were designated as restricted by Survey of India and it required considerable time to get clearance from the Ministry of Defence prior to their procurement from Survey of India. The contention is not a valid ground for delay, since the clearance issue is foreseeable and could be resolved in time.

2.5.3 Non-documentation of traditional wisdom

The RAC recommended in February 2000 to refine and update the traditional agricultural practices being followed in different parts of the country. Various traditional practices like soil-reclamation, land use, water management, nutrient management etc. were to be collected and documented. CSSRI did not take any action on this issue as of June 2004.

ICAR stated in December 2004 that due to constraints of non-availability of scientific personnel, documenting the traditional wisdom was not taken up in detail and the study would be conducted in future. It added that some information on traditional wisdom was colleted from the Gujarat region.

2.6 Water Technology Centre for Eastern Region, Bhubaneshwar

WTCER, Bhubaneshwar completed 28 projects during 1999-2004, of which 20 projects were test checked. In three projects, partial achievements of objectives were noticed and are discussed in the succeeding paragraphs. WTCER, Bhubaneshwar did not transfer to the end users the technology developed at a total cost of Rs 66.13 lakh in six projects as listed in ***Annexure.*** ICAR stated in December 2004 that efforts were being made to transfer the technology to the users.

2.6.1 Non-achievement of objectives

(a) In order to formulate an integrated water and nutrient management strategy for sustainable productivity of the eastern region by studying influence of water regimes on soil chemical environment and availability of nutrients, WTCER undertook a project on "Nutrient dynamics in soils under different water management practices" in November 1998 and completed in November 2001 after an expenditure of Rs 21.61 lakh.

The final report of the project revealed that soil samples were collected only from two districts of Orissa instead of major soil groups from different benchmark sites as envisaged in the project. WTCER did not undertake micronutrient studies (Zinc and Iron) as planned since the Atomic Absorption Spectrophotometer costing Rs 15.10 lakh was installed at the fag end of the project in August 2001 and was made operational only in March 2002 after completion of the project. Thus, achievement was limited to that extent.

ICAR stated in December 2004 that micronutrient studies could not be undertaken due to delay in receipt and installation of Atomic Absorption Spectrophotometers.

(b) WTCER undertook a project on "Mitigation of water logging from deltaic low land rice eco-system for enhancing agricultural productivity" in 1998. The duration of the project was five years at an estimated cost of Rs 19.29 lakh. The objectives of the project were *inter alia* to design and develop suitable technology for rice-fish integration and to study the socio economic feasibility of the prescribed technologies. The long-term objectives were to provide a sustainable technology package for the deltaic low land rice ecosystem for increase in agricultural productivity. This integrated package in combination with aquaculture was expected to be a viable alternative for utilisation of rainfed low land of 20.5 million ha which was prone to water logging.

The final report of the project revealed that after studying only one aspect of rice-fish integration and an expenditure of Rs 6.78 lakh, the project was prematurely closed in 2000. Thus, an integrated package as planned was not developed. WTCER stated in July 2004 that the principal investigator and one co-investigator were granted study leave and another investigator was transferred. It was decided to carry out the project with modified objectives as per the SRC's decision. Thus, an integrated package as a viable alternative for combating water logging in deltaic lowland rice ecosystem was not developed.

(c) WTCER undertook a project on "Studies on agro-meteorological parameters for evolving sustainable crop production strategies in selected location of eastern region" from January 1998 to January 2002. The objectives of the project were to compile agro-meteorological parameters to study the agro-climatic feasibility of crop production in West Bengal, Orissa, Bihar, eastern part of Uttar Pradesh, northern Madhya Pradesh, north Andhra Pradesh, Assam and the adjacent states, to analyse initial conditional probability of rainfall for evolving sustainable crop production strategy in those locations and to characterize drought periods and critical dry spell in respect of agricultural crop production on the basis of water balance and rainfall probability.

The final report of the project revealed that WTCER collected and compiled the data of selected zones of Orissa and West Bengal only. Since these two locations were not sufficient for evolving any strategy for crop production, the project was merged with another project titled "Appraisal of resources base and identification of land, water, climate and socio-economic constraints in managing water resources for agricultural development in eastern India" in July 2000. In spite of the merger, the earlier project started in January 1998 was continued without any activity and declared completed in January 2002 after an expenditure of Rs eight lakh. However, even after merging the project no work was undertaken for evolving crop production strategies for different agro-climatic zones of eastern India as envisaged.

ICAR stated in December 2004 that owing to the constraints in technical manpower, the project was planned to cover selected locations of eastern India that represented different agro-climatic zones of Orissa and West Bengal. The reply highlights weakness in management of human resources. As a result the crop production strategies for whole of eastern India could not be evolved.

2.7 Central Soil and Water Conservation Research and Training Institute, Dehradun

CSWCR&TI, Dehradun completed 86 projects during 1999-2000 to 2003-04, of which 16 projects, where project records were maintained, were test checked. Shortcomings noticed are detailed in succeeding paragraphs. CSWCR&TI, Dehradun did not transfer to the end-users the technology

developed in four projects at a total cost of Rs 12.31 lakh as listed in ***Annexure.***

2.7.1 Improper maintenance of project files

CSWCR&TI, Dehradun did not maintain research project files in respect of 70 projects. In the absence of such files, it is not clear how SRC/RAC evaluated and monitored the project.

2.7.2 Non –achievement of objectives

(a) CSWCR&TI undertook a project on "Appraisal/investigation of surface and sub-surface water harvesting systems in the Nilgiris and adjoining lower hills" from 1996 to 2000 at a total expenditure of Rs 4.10 lakh. The objectives of the project were *inter alia* to study the hydrologic response in terms of hydrologic process controls and channel flow across different spatial scales (size of watersheds) and land uses in Nilgiris, to suggest rainfall catchment area and pond capacity relationship and hydrologic budgeting of ponds.

The final report of the project revealed that hydrologic budgeting of ponds was not discussed, evidencing that no activity was undertaken in this area.

ICAR stated in December 2004 that the study was discontinued as the ponds had higher outflow than inflow which could not be correctly accounted for as these types of ponds were not only fed by surface runoff but also by spring (sub-surface). Therefore the hydrologic budgeting could not be carried out. The reply of ICAR has to be viewed in light of the fact that investigation was to be conducted both for surface and sub-surface water systems.

(b) CSWCR&TI, Dehradun undertook a project on "Methodologies for development and analysis of watersheds and decision support systems for interventions" from October 1999 to December 2003 at a total cost of Rs 5.13 lakh. The project aimed to collect data on nine watersheds in the Shiwaliks and to develop methodology for optimising land use patterns in the watersheds leading to sustainable development.

The final report of the project revealed that methodology for development and analysis of watershed could not be developed due to lack of interdisciplinary team. Thus, the aim of the project was not achieved.

ICAR accepted the audit observations.

(c) CSWCR&TI, Dehradun undertook a project on "Development and evaluation of soil and water conservation measures and land use systems for sustainable crop production in Western Ghats of coastal region" from June 2000 to September 2003 at an outlay of Rs 52.15 lakh. The project was taken up for evolving and testing different bio-engineering measures of soil and

water conservation, water harvesting system, water management alternatives and suitable land use systems prevalent in the region. The project was implemented at State Horticulture farm in Tamil Nadu, which represents the low elevation and high rainfall zone of the Western Ghats.

The final report of the project revealed that conclusions could not be drawn because the experiment was conducted with newly planted perennial crops like cardamom, pepper, mandarin orange, bush pepper and tea which would take at least four to five years for yielding. The project was, therefore, continued from October 2003 to March 2004 as in-house project. Thus, the benefit of evolving and testing different bioengineering measures of soil and water conservation could not be derived even after an expenditure of Rs 28.67 lakh.

ICAR stated in December 2004 that due to closure of the project in September 2003 by Agro-Eco Directorate (Coastal) of National Agricultural Technology Project, the project could run only for three years. Further, due to termination of senior research fellow and the experiment site being located at a faraway place from the research centre, the experiments could not be carried out and had to be conducted in its own farm. It added that had the project been continued up to August 2004, data for three years could have been collected and conclusions drawn on the initial establishment and growth of crops.