

**BARD-ICAR-ICRISAT WORKSHOP ON WATERSHED BASED
DRYLAND FARMING IN BLACK AND RED SOILS
OF PENINSULAR INDIA**

3-4 October 1983
ICRISAT Center, Patancheru

PROGRAM

SUNDAY 2 OCT 1983

Arrival of participants

MONDAY 3 OCT 1983

0900	Registration - Main Lobby
0930	ICRISAT Field Tour
1030	Tea/Coffee - Academic Court

Venue : AUDITORIUM

SESSION I

Chairman : Dr. L.D. Swindale, Director General, ICRISAT

1050	Chairman's remarks
1110	Introduction to Workshop - Mr. Sant Dass, Managing Director NABARD
1130	Key-note Address - Mr. S.P. Mukerji, Secretary, Department of Agriculture and Cooperation, Government of India
1150	Presentation by ICAR on technology options and implications for red and related soils
1220	Presentation by ICRISAT on technology for black soils
1250	General Discussion
1330	Lunch (hosted by NABARD) - 204 Canteen

SESSION II

Chairman : Dr. J.S. Kanwar, Director of Research, ICRISAT

Rapporteurs : R.W. Willey / R.J. Hardiman

- 1430 Discussion on ICAR/ICRISAT presentations
1600 Tea/Coffee - Academic Court

SESSION III

Chairman : Mr. M. Gopalakrishnan, Agricultural
Production Commissioner, Govt. of Andhra
Pradesh

Rapporteurs : S.M. Virmani / N.A. Naidu

- 1620 Presentation by States of Andhra Pradesh, Karnataka,
Maharashtra and Madhya Pradesh on the adoption and
diffusion of dryland technologies
1720 Discussion on presentations
1900 Cocktail/Dinner at ICRISAT Center - 204 Snack Bar Area
(hosted by Dr. L.B. Swindale)

TUESDAY 4 OCT 1983

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SESSION IV

Chairman : Mr. S.P. Mukerji, Secretary
Department of Agriculture and Cooperation
Government of India

Rapporteurs : T.S. Walker / M. von Oppen

- 0900 Presentation by NABARD on credit support for development
of dryland agriculture
0930 Discussion on presentations
1030 Tea/Coffee - Academic Court
1100 Discussion on presentations
1330 Lunch - 204 Canteen

SESSION V

Chairman : Mr. S.P. Mukerji, Secretary
Department of Agriculture and Cooperation
Government of India

Rapporteurs : B. Venkata Rao / R.P. Singh

- 1430 Adoption of recommendations of the Workshop
1600 Closing remarks
1615 Tea/Coffee - Academic Court

NATIONAL BANK FOR AGRICULTURE AND RURAL DEVELOPMENT

NABARD-ICAR-ICRISAT WORKSHOP ON WATERS IED- BASED DRYLAND FARMING IN BLACK AND RED SOILS OF PENINSULAR INDIA

Introduction to Workshop by Shri Sant Dass,
Managing Director, NABARD

Chairman, Dr. Swindale, Chief Guest Shri S.P. Mukerji,
Colleagues and friends,

It was in the fitness of things that National Workshop on Dryland Farming convened by the Union Ministry of Agriculture under the Chairmanship of Secretary, Agriculture, Shri S.P. Mukerji, had recommended that NABARD, jointly with ICAR and ICRISAT should organise workshops on regional basis on credit support for dryland farming. We are glad to note that the proposed workshop is now a reality and a select audience of expert scientists, bankers and administrators is with us.

When we took the initiative, ICRISAT and ICAR readily and wholeheartedly extended their support to us, and we are beholden to both of them for preparing detailed papers on the technologies and economic aspects thereof. We are, in particular, grateful to ICRISAT for the readiness with which they have agreed and provided all the facilities for holding the Workshop in a setting in which the adoption of new technologies can be observed by us at first hand.

We are happy that the representatives of State Governments and Ministry of Agriculture, Ministry of Finance, Banks, AFC and other institutions have responded to the invitation.

I take this opportunity to welcome them all to the Workshop.

We are fortunate that Director General, ICRI&AT, Dr. Swindale, a well known agricultural scientist in his own right, has agreed to chair the session this morning.

We were a little disappointed when, initially, Shri S.P. Mukerji, Secretary, Agriculture informed us that he would not be able to come here on account of other pressing engagements. I need hardly say how happy we are that Shri Mukerji is with us today to deliver the Keynote Address and to guide the deliberations of the sessions on credit and recommendations of the Workshop tomorrow. His presence fully reflects his commitment to Dryland Farming.

The purpose of the workshop is clear : The financing institutions should understand the implications of the new strategy so that they can equip themselves suitably to respond to the emerging credit needs, and likewise Agricultural Scientists and administrators should understand the essential requirements to be taken care of so that maximum support would be available from the financing agencies.

'Dryland farming' is an area where very little has been done, both in terms of technologies as well as of providing financial assistance for the adoption of such technologies. Therefore, there is need to know more about what has been done by way of producing viable technologies. Secondly, while there is considerable scope for increasing productivity and production in dryland/rainfed areas, we also have to

understand how we can integrate with dryland farming, on a viable basis, agro-forestry, animal husbandry, etc. It is true we are now refinancing crop loans, as well as loans made for all these activities on a schematic basis, and model schemes have been developed for the purpose. We still want to know in what way the policies and procedures governing the sanction of loans/schemes need to be refined so that they are tailored to the needs of integrated watershed development. Thirdly, a ^{meaningful} ~~meaningful~~ exchange of views has become necessary between those developing new technologies, those implementing them and those required to extend financial support for their adoption on a wide front, so that a realistic appreciation of the different aspects of the technology/integrated watershed development and their implications for credit institutions would emerge.

Financing institutions are well spread out all over the country. Under the multi-agency approach a farm house-hold can seek financial assistance from one or the other agencies located in an area. But it is our responsibility to create conditions under which there would be smooth flow of credit for all legitimate purposes, especially dryland farming and micro-watershed development. This calls for finding ways to remove the various constraints experienced in regard to the spread of technology, acceptability of technology by farmers, viability of the programmes designed for the purpose, includ-

ing cost-effective methods for the adoption of the technologies, and the arrangements for formulation of the micro-watershed development projects.

While we look forward to constructive participation from the invitees on all these aspects, I would like to mention one or two points which, because of their somewhat controversial nature have not been covered in the paper to be presented on behalf of NABARD. One of the issues relates to subsidising interest on loans. Here I may mention that we are constrained by the fact that both GOI and NABARD had entered into certain Covenants with the World Bank. If we intend to continue to borrow from the World Bank - which currently appears to be the thinking - proposals involving interest subsidies on loans would be violative of these Covenants. If we allow interest subsidies for financing under dryland farming, we would not be able to avail of World Bank assistance for the purpose.

From the point of view of viability of the programmes taken up in the dryland/micro-watershed areas, the pricing policies for dryland/rainfed crops like pulses and oil seeds assume importance. So are the infrastructure facilities and arrangements for covering risks of farmers. These require immediate attention.

Some innovative approaches seem necessary for implementing the essential dryland works such as drainages, water harvesting structures etc. involving community action. An

integrated approach to micro-watershed development may also call for organizational innovations. In this respect we are looking to the States for initiatives for developing a few models for dryland farming in varying conditions.

I personally do not think that the dryland farming and watershed development programmes would immediately pose problem of resources. But as they gain momentum, we do have to consider how to fund NABARD, for providing refinance to LDBs/CBs/RRBs for investment loans. This problem arises especially if there is no assistance forthcoming from the World Bank under the NABARD-I project.

I would be failing in my duty if I do not mention, at this stage, the problems we are facing in recycling the available resources for promoting production on account of heavy overdues from farmers to the credit agencies. There is need for determined action to bring down overdues. I am sure we will have occasion to discuss, as we go along, the best way of repairing the damage done to our credit system and its credibility on account of the increasing overdues.

The Workshop may also consider whether one or two more Workshops of this or similar type, elsewhere, would be useful.

We are hoping that in the light of the observations of the Chief Guest and the discussion on the papers it would be possible for us to develop an action plan for the implementation of the programme, so that each of us know what he has

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to do in coordination with others in the achievement of the goals.

I once again welcome the Chief Guest and all of you to the Workshop, on my behalf and on behalf of NABARD, and look forward to fruitful discussions.

Thank you.

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PROBLEMS OF FINANCING DRYLANDS

BANK OF BARODA

Realising the importance of dryland agriculture which is practised over a vast area of 106 million hectares out of the net cultivated area of about 143 million hectares in the country, the Government has considered/recognised that development of dryland farming was most essential for ensuring National Food Security, narrowing down regional imbalances and creating rural employment, etc. It is against this background the need has been felt for taking long term development measures for lasting results and also immediate efforts to make an impact on the rural masses. For this purpose a two pronged strategy has been adopted viz. (i) extensive approach covering all dryland areas where all the on-going programmes and resources would be utilised optimally and the available technology disseminated for increasing the productivity of dryland agriculture and (ii) the intensive approach whereunder in selected blocks, micro-watersheds of 2000 to 3000 hectares each would be taken up for intensive development of dryland watersheds through multi-disciplinary approaches, including crop production, horticulture, social forestry, pasture development, water harvesting, pest control, use of modern implements like seed-cum-fertilizer drills, application of improved seeds, fertilizers, etc.

Government had decided to take up dryland farming programme in 3824 micro-watersheds covering a total area of 7 to 11 million hectares during 1982-83. Substantial areas of land in the country are affected by soil erosion or land degradation. The area so far covered by soil conservation measures is only 23.40 million hectares. Therefore there is a vast area yet to be covered. Small watersheds with an area of 2000 to 3000 hectares, treatment of which is practicable and manageable, have been proposed to be increasingly taken up during the Sixth Plan. The plan aims at a target of an additional 7.1 million hectares over the base level of 23.4 million hectares. It is intended that these micro-watersheds should serve as focal areas for demonstrating the beneficial effects of intensive watershed development programmes and provide models on the basis of which intensive development of other areas could be taken up in subsequent phases.

Effective implementation of this programme involving concept of microwatershed may perhaps be difficult, but not at all impossible, as it has to be planned carefully and scientifically through an efficient coordination mechanism. A good deal of research work on various aspects of dryland farming has been done in the problem areas where research centres under the aegis of All-India Coordinated Research and Development Project for Dryland Agriculture have been set up. Besides, pilot projects have also successfully demonstrated the beneficial effects of the research results to the farmers. Thus, field officers of the Banks,

Paper circulated for discussion and comments at the Workshop on Watershed Based Dryland Farming in Black and Red Soils of Peninsular India, NABARD/ICAR/ICRISAT, October 3-4, 1983, ICRISAT, Patancheru, India.

Government departments, Panchayat Administration should now lose no time in appreciating the developments and resolving the problems of smooth flow of credit under this programme.

Promising Technology

The use of straw mulches or deep ploughing are proven techniques for improving infiltration and available soil water, but are not practicable in present day Indian conditions, where nearly all crop residues are removed from the land and bullock power is generally inadequate to allow deep tillage. The solution is to use the small watershed as the basic farming unit, making use of its natural topography and drainage patterns. Contour farming or the use of ridges or broadbeds and furrows within the watershed greatly improve rainfall management and water availability to crops where the land has gentle slopes. Bench terracing is needed where slopes are greater.

The best crops and cultivators to use in any particular district depend upon climate, soils and agricultural and socio-economic traditions. With considerable efforts the All-India Coordinated Research Project for Dryland Agriculture has now determined the most appropriate crops for most of the rainfed regions of India. Inter-cropping and sequential cropping are common enough practices now in rainfed agriculture. They increase the efficiency in use of natural and capital resources and return two incomes a year from the farm instead of one. Many of the rainfed black soils traditionally cropped only in the post-rainy season can produce two crops a year without difficulty.

Combining improved seeds and fertilizers with improved management--raised beds and furrows--more careful placement of seed and fertilizer and more intensive weeding, that is, a full package of improved practices increased gross returns by Rs.3086. Average added costs were Rs.327 for a benefit-cost ratio of 9.4. The use of supplementary water increased profits by an additional Rs.570, equivalent to about five quintals per hectare of increased yield. In a similar set of experiments on the Alfisols, average gross returns rose from Rs.1403 per hectare under traditional practices to Rs.3823 using improved seed, fertilizer and management. Average gross profits rose from Rs.424 to Rs.2625. Improved seeds alone gave a benefit to cost ratio of Rs.10.7; improved fertilizer gave 2.38 and improved seeds plus fertilizer 3.9.

In Maharashtra State, hybrids now make up 35% of all sorghum planted in the rainy season and improved varieties make up more than 70% in the post-rainy season. Average yields in the state are 50% higher than they were 10 years ago. Perhaps the major reasons for the slow rate of adoption is that the introduction of new seeds alone does not represent a large enough change in the pattern of traditional agriculture to arouse the farmers interest. Small faults or problems either real or imagined associated with the new seeds dissuade him for trying them. They are simply not worth the trouble.

There is much evidence to show that fertilizer use is economical on the staple rainfed cereals. Several hundred experiments on cultivators' fields with sorghum, maize and pearl millet in rainfed areas of India

have given average gains of 14 kgs. of grains per kg of N and 7 Kg of grain per kg of P_2O_5 . Benefit-to-cost ratio are 2.5 or better. Responses to fertilisers by available varieties of rainy season sorghum and pearl millet are generally better than responses by rainy season maize or post rainy season sorghum. A combination of improved seeds and fertilisers yield an additional 1000 to 1500 kg/ha or more, gives positive and beneficial yields consistently, often exceeding Rs.2000/ha, can significantly improve the farmers income. The greater yields can significantly increase the production of foodgrains in the country.

Although the added benefits are substantial, the added cost ranging from about Rs.400 to Rs.1000 can be a problem for the small/marginal farmer who lacks access to institutional credit. For example the lack of well adapted fertiliser responsive cultivators for post-rainy season obviously prevents the use of combinations. Inadequate fertiliser distribution, inadequate extension and inadequate infrastructure in general are deterrents to the adoption of improved seeds plus fertilisers as they are to other improvements in agriculture. Timeliness of operations, particularly sowing and weeding and precision in the placement of seeds and fertilisers however have to be recognised as pillars of the modern dry farming technology.

Dry periods within the normal rainy season are typical of many monsoonal climates even when normal or above normal seasonal rainfall occurs. The result is usually a reduction in crop yield especially on soils that have relatively low water holding capacities. Having water available for supplemental irrigation is an important means of reducing the risk and improving production in rainfed agriculture. Many of the farmers in rainfed areas have access to water from wells, streams and tanks. One survey has estimated that 50 per cent of the farmers have some source of minor irrigation and that with the water available they can irrigate about four per cent of their land. The amount seems small but it probably can be more efficiently used for life saving irrigation on fertilized, high-yielding upland crops than on small areas of rice. One 5 cm irrigation strategically applied during a dry spell on a red Alfisol nearly doubled the yield of sorghum and maize. At product prices prevailing at the time of harvest, gross values were increased by Rs. 3120/hectare for maize and Rs. 2780 for sorghum. Significant opportunities exist for water harvesting in the rainfed areas. Runoff from heavy rains occur in all but the driest years providing opportunities for water harvesting.

Effective soil management practices in the rainfed areas produce a suitable seedbed, ensure the proper placement of seed and fertilisers, control weeds, conserve soil moisture and minimise runoff and erosion. Crust formation on the surface is a problem with many sandy textured soils. The power required to break the crust is low but the crust reforms after the rains, impedes seedling emergence and increases runoff and erosion. Incorporation of organic matter into the soil helps to decrease the strength of the crust-- probably by increasing soil moisture near the surface.

The research and demonstration efforts that have been made in recent years in the rainfed areas have identified a few items that are needed in addition to the normal technical and institutional services for

agriculture. Improved land management, increases the demand for bullock power compared with present utilisation patterns. Small farmers in particular find the lack of bullocks to be a major constraint. To effect the improved drainage that is needed during the periods of heavy rainfall requires the provision of community drains i.e. drains that serve several farmers or several villages. The farmers themselves quite naturally are unwilling to bear the cost of these community works, although they may be willing to provide the necessary labour. States soil conservation programmes are able presently to provide only part of the funds and services required. Improved technology at least as it has been available from ICRISAT requires some improvement in farm implements. Wheeled tool carriers, if heavy enough, improve seed and fertiliser placement and by reducing the bullock power and manpower needed for each operation increase the number and timeliness of the operations that can be performed. The tool carriers and implements that perform best are costly and are out of the reach of the individual small farmers. It is this area where farmers have to be assisted through custom services.

ICRISAT EXPERIENCE

In February 1981, after the traditional crop was harvested, ICRISAT and State Engineers surveyed the land and planned the watershed, leaving in place the property boundaries. The farmers did the land smoothing work with their own animals and equipment, but used the ICRISAT tool carrier behind their bullocks for most operations. The animals were rather weak and because the traditional crop was harvested late, the soils were already quite hard. It did not take long for the farmers to get used to the equipment, but the beds and furrows were not well made--but no worse than the first ones which ICRISAT scientists put at ICRISAT. Although the farmers were willing to install drainage ways on their own land, they were not willing to work collectively to install the necessary community drains to connect the water shed to the existing main drain system. In consequence, in the very heavy rains in the early part of the year the watershed did not work properly and the lower parts of some fields were flooded. When the farmers saw this and saw how this did not happen at ICRISAT, the scientists of ICRISAT were able to persuade them to undertake the construction of the community drains. The state department of Agriculture, through its existing soil conservation programme, paid for their labour to put the drains in place. Since then, in a year where the rainfall has been 70 percent above normal, there has been no further problems of waterlogging or drainage.

ICRISAT and the other research agencies recommended which crops would be best, but farmers made their own choices. In consequence, on this 15 hectares watershed with 14 farmers there were eight different crop combinations. With one exception, the crops have done well and far exceeded anything else for miles around. Not surprisingly, there have been some problems. The farmers are not used to growing crops during the rainy season, nor are they used to obtaining such high yields. Threshing and storage are new problems for them, accentuated in the very wet year because it has not been possible to dry the grain in the field. Average yields in the 23 separate fields-- some farmers divided their fields to try different crop combinations--have been 2000 kg/ha for sorghum grain, 7500 kg/ha for sorghum dry fodder, 1700 kg/ha for maize grain, 3600 kg/ha

for maize dry fodder and 490 kg/ha for mungbean. Based on the market prices, farmers have already covered their direct costs, including the cost of land smoothing and shaping and have made a profit. Besides, they could take up post-rainy season crops. Most of the adjoining farmers, having fallowed their land in accordance with traditional practice did not reap either food or income.

BANK FINANCE

Credit institutions do provide loan facilities in general for the development of agriculture which inter alia include production or/and investment loan for raising crops of economic importance, horticulture, social forestry, pasture development, water harvesting, pest control, purchase of modern implements like seed-cum-fertilizer drills, tractors, bund former, land leveller, buck scrapper, float, etc. The loan facilities are either provided in the form of short term with a repayment period of upto 18 months, medium and long term loans ranging from three years to 15 years depending upon the repaying capacity of the beneficiaries, viability of the scheme and productive life period of the assets, etc. While all these loan facilities are available for improving dryland farming, banking system has not been able to pay undivided attention to this very very important area. Perhaps, the experience of the field officers in this respect reveal that it is because of one or a combination of several of the following factors:

- lack of sufficient appreciation of the promising dry farming technology evolved by farm scientists and its potentialities to create significant impact in the vulnerable areas.
- lack of expertise at the branch/bank level to formulate bankable/viable schemes/projects to suit the specific area in which location specific technology can be introduced.
- inability to bring about effective coordination at the district/state level in pooling available technical expertise for developing soil and moisture conservation and other schemes on watershed basis. This is obviously reflected by its conspicuous absence in the district credit plan (1983-85) and Annual Action Plan (1983) prepared jointly by the Banks and State Government officials.
- Not only that most of the rural branches are either understaffed and/or inadequately trained but also the field officers are overburdened with only routine banking work. Compilation of statistics and collection of LAD consumes their time and energy.
- problem of cooperative defaulters, non-issuance of 'No-due Certificates' and otherwise ineligible borrowers has aggravated the situation most specifically in the chronically drought prone areas where banks have to pay specific attention.
- while each branch of the commercial banks in the rural areas has not adopted one dryland village for intensive development though it was suggested by the Union government, it is equally doubtful

whether these branches/banks are aware of the dryland farming programme being undertaken in over 3800 micro-watersheds and the progress it has made.

The problem of providing adequate and timely finance under dryland farming may have to be approached from the angle of transferring the available proven technology through provision of management input and marketing services. As the banks have no expertise in this field and have not done much in this area though they are enthusiastic to do so, there is all the while most urgent need to initiate following steps/measures.

identifying the micro-watershed and understanding the type and nature of activities which could be taken up there.

formulating the technologically feasible and economically viable schemes for undertaking these identified activities in the area. The scheme, say for instance--crop production or soil and moisture conservation-- should inter alia incorporate all the important/relevant information on the availability of needed infrastructure, backward and forward linkages, gaps in the existing infrastructure which have direct bearing on the failure of the implementation of the schemes. The scheme should also incorporate details of security requirements, rate of interest, subsidy available/margin to be provided, disbursement schedule; repayment period and instalments of loan yearwise, net incremental income, the role that each agency has to play and farmers obligation in the implementation of these schemes.

quantifying the requirements of physical units of each of the activities viz. horticulture, social forestry, pasture development, etc., and estimating the credit needs, subsidy/margin to be provided, financial outlay, refinance available, etc.

need based credit plan with full details of the activity-wise budget should be prepared and these funds should be sanctioned/committed by the participating banks in the respective micro-watershed area and incorporated into the Annual Action Plan as a part of District Credit Plan.

motivating the beneficiaries through organising frequent village level meetings and instilling in them 'the urge for development' rather than imposing anything on them. All details should be explained and their misconceptions/queries, doubts should be clarified through various communication media. A film on Sukho Manjri village would also prove to be of great use, specifically the activities which have potential in the area and their particulars in the form of credit schemes--rate of interest, security, subsidy/margin, loan amount, repayment instalments/period, etc., should be properly explained to them.

simplified lending policy, procedure and system should be evolved so that all loan proposals emanating from the micro-watershed area are sanctioned without any loss of time.

Like District Rural Development Agency, an organisational set up to provide management input and play effective role in the successful implementation of the schemes should be provided

Adoption of a full package of practices is more difficult. It requires the organisation of village level operational research and pilot projects. The key to success of such projects is the human factor, the interests and involvement, of the farmers and the constant and dedicated attention of trained, motivated and resourceful extension staff backed up by production and management specialists who are available when called for.

this organisation should be technically well qualified and experienced to formulate the development schemes which could be converted into credit schemes and to implement/monitor the working of the schemes. Wherever necessary, feed-back should be utilised to improve/modify the schemes to yield better results.

a time bound P E R T Chart should be prepared so as to ensure effective coordination amongst various agencies playing different role, complete the development task without losing the season and reducing the cost- escalation, etc.

now that the Union government has advised the State Governments and banks to set up block level Advisory Committee, this Committee should endeavour to resolve the grass-root problems through frequent discussion and involving people's participation in this programme.

Beneficiaries, Field Officers of the Banks, Extension workers of the Government and local leaders, voluntary associations should be adequately provided practice-oriented training.

training may preferably be organised in the area where these activities have already been successfully conducted as also at the Research and Training Institutes so that they can better appreciate the concept, programme and benefits and shed their wrong notions.

field level workers from the Government/Panchayats and Banks should work on lines of 'Training and Visit System' such that individual farm plan and farm budgeting system can be introduced and results are analysed.

'input supply and marketing system' should also be considered as a part of the development programme for which credit/loan facilities on liberalised terms and conditions should be provided and for which refinance facilities be extended.

CONCLUSION

At ICRISAT, a technology has been developed for deep black soils (Vertisols) with an assured rainfall of more than 750 mm per annum. The technology was tried on the farmers holdings in 1981-82 in village Tadanapally in Andhra Pradesh. Fourteen farmers with 15.42 hectares of land under the guidance of ICRISAT scientists have demonstrated that yields of crops and the gross income can be increased by six times. There is fairly good evidence to show that the technology developed by ICRISAT would prove to be profitable for about eight million hectares out of the total area of 22 million hectares of deep black soils in the country. It is, therefore, most urgent and necessary that this available proven technology should be transferred to the farmers fields through developing a PERT Chart and crystalising which agency should play what role and when.

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DRYLAND FARMING WORKSHOP AT PATANCHERU

3 AND 4 OCTOBER 1983

STATUS PAPER ON DRYLAND PROJECTS IN ANDHRA PRADESH

I. INTRODUCTION:

1.1 About 65% of the cropped land in Andhra Pradesh is under rainfed farming. Since rainfall varies widely from year to year, rainfed/ dry farming is vulnerable to the vagaries of monsoon. As a result, yields from dry lands show marked fluctuations, depending on the adequacy and the distribution of the rainfall over the crop season. The farmers, therefore, tend to regard dry land farming as risky and a gamble. They are reluctant to invest on costly inputs for production in these areas in the absence of appropriate and tested technology. Apart from weather aberrations, variability and drainability of the soil also contribute significantly to disparities in crop production.

1.2 In the dryland areas of A.P., the soils are black soils and red soils. The technology developed for the management of deep black soils (vertisols) at the ICRISAT has proved that with adoption of the recommended practices, the yields could be raised to 3000 - 4000 kgs per hectare with the required investment on inputs and necessary technical guidance. This technology was tried out in the years 1981-82 and 82-83 in farmers' fields in Medak District, in the proximity of ICRISAT. Based on this experience, it is being extended in 1983-84 to other districts for performance studies with farmer participants.

1.3 The ICAR has also evolved a package of practices for dryland farming in black soils as also in red soils.

1.4 Considering the availability of a large area under these soils there exists a great potential for achieving a breakthrough by popularising these technologies for achieving additional production under staple crops of cereals, pulses and oil seeds, etc., in a phased manner. While both the ICRISAT and ICAR vertisol technologies are being tried out in selected districts in Andhra Pradesh in 1983-84, so far as the red soils are concerned only the ICAR technology is being extended through the field trials in 1983-84.

II. CRITERIA FOR SELECTION OF WATERSHEDS IN 1983-84

2.1 In Andhra Pradesh such deep black soils are predominantly found in the districts of Medak, Nizambad, Karimnagar, Adilabad, Warangal and Khammam covering an area of about 25 lakhs hectares.

To introduce the ICRISAT/ICAR technologies for managing deep black soils in the fields of cultivators, micro watersheds have been selected in these 6 districts. In these districts micro watersheds in Red soils (alfisols) have also been selected, for

trying out the ICAR technology, keeping in view the following criteria;

- i. The soils should be vertisols/alfisols.
- ii. The average rainfall should not be less than 750 mm. per year.
- iii. The cultivators should be responsive and progressive
- iv. The percentage of small/marginal farmers should be substantial.
- v. There should be adequate credit facilities available in the area.
- vi. For vertisols, there should not be any irrigated areas in the village. In case villages without any irrigation facilities are not available, atleast the farmers in the selected watershed should not have any irrigated lands in any other watersheds in the village(s).
- vii. For alfisols, the irrigated area should not be more than 10% of the total area of the alfisol watershed.
- viii. The selected vertisol watersheds for the adoption of ICRISAT and ICAR technology should preferably be about 5-10 kms. from the alfisol watersheds in which the ICAR red soils technology is to be tried out.
- ix. The selected watershed should, as far as possible, be on the road side to produce a better demonstration effect.
- x. The slope of the land in selected watershed should be less than 3 per cent.
- xi. To the extent possible, the watersheds may be near to the research stations of ICRISAT/ICAR.

III. EXPERIENCE WITH ICRISAT TECHNOLOGY IN MEDAK DISTRICT IN 1981-82 AND 1982-83

3.1 The ICRISAT technology was adopted on field basis in Medak District where the ICRISAT station is located. The ICAR technology was not tried in black soils during that year or in 1982-83.

3.2 During the first year the ICRISAT technology was tried out in an area of 15.22 hectares in Tardanpally village with 13 participating farmers. The following cropping pattern was adopted:

ICRISAT TECHNOLOGY

Kharif

Rabi

TRADITIONAL

Sorghum+Pigeonpea	Pigeonpea continued	Sorghum, Pulses
Maize+Pigeonpea	Pigeonpea continued	Maize, Pulses
Pure Maize	Chickpea	Groundnut+ Pigeonpea
Mungbean	Sorghum/chickpea Sunflower/ Chillies	---

3.3 The performance of crops under the ICRISAT and traditional crop management, recorded during 1981-82 is as follows:

Watershed selected	Area in ha.	Cropping pattern	Yields obtained (kgs/hect)		Additional production	% of increased yields
			Project area	Neighbouring area		
Tardanpally	6.98	Sorghum+ Pigeonpea	2180+ 375	1400+ 220	935	58%
Tardanpally	1.92	Maize pure followed chickpea	2007	920	460	150%

3.4 During 1982-83, two more villages i.e., Sultanpur and Antawar in Medak District were also selected, increasing the area of operation to 48.94 hectares under ICRISAT technology with 29 beneficiaries. The cropping pattern followed and the performance of crops is given below:

Watershed selected	Area in hect.	Cropping pattern	Yields obtained (kgs/hect)		Additional production	% of increased yields
			Project area	Neighbouring area		
Tardanpally	3.45	Mungbean followed by Sorghum	454+ 519	245+ 395	640	52%
	2.03	Sorghum + Pigeonpea	2136+ 593	1353+ 230	1146	72%
Sultanpur	13.50	Sorghum+ Pigeonpea	1922+ 481	1268+ 215	920	62%
Anthwar	9.6	Sorghum+ Pigeonpea	2358+ 926	1408+ 385	1491	83%
	1.80	Mungbean followed by Rabi Sorghum	600+ 875	260+ 410	805	120%

IV. EVALUATION OF THE RESULTS OF ICRISAT TECHNOLOGY AND IMPRESSIONS OF FARMERS AND THE CONSTRAINTS.

4.1 It is rather early to evaluate the effects and impact of the programme, though the results for the last two years have been generally encouraging. The new technology did not find wide adoption as 85% of the farmers being poor with small and marginal holdings, having conservative outlook about the new technology for tackling which extensive education efforts are required.

4.2 The impressions of the farmers and the constraints are as follows:

- i. The soils should be thoroughly prepared, taking advantage of summer showers from February to May. If summer showers do not occur, thorough preparatory cultivation which is a prerequisite for the formation of broad beds and furrows and taking up dry seeding with the onset of the monsoon becomes very difficult.
- ii. The levelling should be done to near perfection: otherwise the germination in low lying patches will not be uniform if proper levelling is not done.

- iii. The cost of tropicultor with accessories is about Rs.10,000. This is beyond the reach of the average farmer. The tropicultor should be made available on custom service. The possibility of extending subsidies to such of the farmers who want to purchase tropicultors also needs to be considered.
- iv. Heavy draught animals are required for the preparation of land with the tropicultor. The small and marginal farmer cannot afford heavy draught animals: this becomes yet another constraint.
- v. Shallow cultivation in the early part of the season with application of fertilizers is increasing the weed growth, resulting in reduced yields, if timely weeding or intercultivation is not done. At times, intercultivation and weeding may not be possible if the rains are continuous.
- vi. An early kharif crop like mungbean or blackgram, comes to harvest in August when there are heavy rains. These rains spoil the quality of seed and hinder preparatory cultivation for Rabi crop in black soils.
- vii. There will be acute labour problem for weeding and intercultivation during August when paddy transplantation is at its peak.
- viii. In the selected watersheds the small and marginal farmers require liberal financial assistance for the purchase of inputs like seeds and fertilisers, without which expected returns will not be possible.

V. ICAR TECHNOLOGY

5.1 The ICAR technology was also implemented for the first time in red soil during 1981-82 in 3 villages of Medak District, namely Fazalwadi, Sultanpur and Mulug over an area of 37 hectares.

5.2 This was continued during 1982-83 and the area of operation was extended to Takapally village bringing the total coverage to 38.9 hectares. The rainfed crops grown in these villages with ICAR technology gave significant additional yields during 1981-82 and 1982-83. The farmers learnt that by observing the simple practices which can be easily adopted at their level, they can harvest sizeable yields from rainfed areas of red soils too.

5.3 Crop performance recorded under ICAR technology during 1981-82 and 1982-83:

Year	Village	Cropping Pattern	Yields obtained (kgs/hect)		Extra yield	% of increased yields
			Project area	Neighbouring area		
1981-82	Sultanpur	Pure Maize	1380	920	460	50%
	Mulug	Maize+ Pigeonpea	2380+ 135	1025	1490	145%
1982-83	Sultanpur	Pure Maize	2607	920	1797	194%
	Takapally	Pure Maize	2218	1250	968	16%

VI. EVALUATION OF ICAR TECHNOLOGY

6.1 It is premature to evaluate the results of the scheme. However, the following general observations can be made:

- i. It was noticed that pre-monsoon preparation of land has helped to advance sowings by 10 days with its fine tilth.
- ii. Use of hybrid varieties seed combined with application of fertilizers, not common with cultivators of chalka soils, has doubled their yields.
- iii. Application of fertilisers in Maize was practiced traditionally at the time of tasseling. As per ICAR recommendations, its application @ 25% as basal dose and remaining at 30 to 60th day alongwith basal application of $P_2 O_5$ at the time of sowing has doubled the yields.
- iv. Formation of key bunds has not only controlled erosion but also improved the water retention capacity of the soil in the watershed, supplying the much needed moisture to the crop at the initial stage of its growth period.

6.2 The impressions of the farmers are summarised below:

The ICAR technology can be easily adopted even by the small and marginal farmers. This technology does not involve a major shifting to agricultural machinery. It is found that 'A' frame for formation of keylines is not a complicated one and is within the understanding of the farmers. Adoption of high yielding varieties significantly increases the yields.

6.3 The constraints that have been noticed are as follows:

- i. Provision of adequate funds to meet the additional cost involved towards inputs such as improved seeds, fertilisers and implements like FESPO plough.
- ii. Formation of key bunds as guideline for contour cultivation.
- iii. Proper drainage system on watershed basis to dispose the runoff safely.

6.4 In this background, the following suggestions may be considered:

- i. Provision of adequate funds to meet the additional cost involved towards inputs, recurring and non-recurring aspects, is to be arranged on liberal terms to the participants by the financial institutions/Government besides providing incentives as subsidy on important practices.
- ii. Crop insurance to cover the risks in the event of failure or seasonal aberrations.
- iii. Provision of technical assistance for marking the key bunds and alignment of suitable drainage system to dispose the runoff on watershed basis.

VII. PROGRAMME FOR THE YEAR 1983-84

7.1 Convinced by the encouraging results of ICRISAT technology in deep black soils and ICAR technology in red soils, during 1983-84 the ICAR technology has been also introduced in red soils. The programme for 1983-84 is extended to (5) more districts, having similar climatic conditions.

7.2 The district-wise area programmed, area covered so far and the cropping pattern adopted under ICRISAT and ICAR technologies are given hereunder.

Sl. No.	District	ICRISAT technology (in ha.)		ICAR technology (in hectares)			
		T	A	Black soil		Red soils	
				Tx	A	T	A
1.	Medak	100	128	50	68	100	110
2.	Nizambad	100	100	50	50	100	100
3.	Khammam	100	100	50	50	100	100

4. Adilabad	100	90	50	32	100	78
5. Karimnagar,	100	100	50	50	100	96
6. Warangal	100	96	50	31	100	100

Cropping Pattern

Sl. No.	District	Cropping Pattern		
		ICRISAT Black soils	ICAR Black soils	ICAR Red soils
1.	Medak	Sorghum+P.Pea Maize+P.Pea Blackgram followed by rabi sorghum or chillies, Mungbean+P.pea	Blackgram followed by Rabi sorghum Mungbean followed by rabi sorghum	Maize+P.Pea Maize+Castor
2.	Nizambad	Mungbean, Blackgram, cotton, groundnut, chillies	Mungbean, blackgram, cotton, groundnut, chillies	CSH5 Sorghum+ Pigeonpea (2:1) Ratio
3.	Khammam	Mungbean, Mungbean+ Pigeonpea, Millet,maize, Maize+P.Pea and chillies	Mungbean Mungbean+ Pigeonpea Millet, Maize, Maize+P.Pea	Mungbean, Mungbean+ Pigeonpea Millet, Maize Groundnut, P.Pea, Sesam Chillies
4.	Adilabad	Sorghum+P.Pea Maize+P.Pea Cotton, Chillies	Sorghum+ P.Pea Maize+P.Pea Cotton	Sorghum+P.Pea Maize+P.Pea Cotton and P.Pea
5.	Karimnagar	Sorghum+P.Pea	Sorghum+P.Pea Maize, Mungbean, Chillies	Sorghum+P.Pea Maize+P.pea Maize, Mungbean P.Pea, Mungbean Groundnut+P.Pea Castor
6.	Warangal	Maize, Maize+ P.Pea, chillies	Maize, Maize+P.Pea Sesam+ P.Pea, Cotton	Mungbean, Maize Groundnut+P.Pea Sesam

7.3 The Government of Andhra Pradesh has provided an amount of Rs.5.00 lakhs towards the purchase of (52) tractors and for tractor ploughing in the watersheds selected in black soils of six Districts (which was resorted to because of the delay in the final decision to try these technologies over wider areas in 6 Districts). In addition to (12) tractors which were purchased during 1982-83 (40) tractors have been purchased in the current year from different agencies and supplied free of cost. The amount provided is not sufficient to meet the cost of tractors and the tractor ploughing charges, etc.

7.4 During kharif 1983-84 commercial and cooperative banks have advanced loans for purchase of inputs like seeds and fertilizers, etc., in addition to short term loans given by the Department of Agriculture.

7.5 Condition of crops: Dry seeding as proposed could not be taken up in all the districts and the sowings were completed late in the season. The condition of the standing crops during kharif 1983-84 is far from satisfactory due to heavy incessant rains. The early sown mungbean and blackgram crops are affected badly and very low yields are expected. The Sorghum and Maize crops were also affected by heavy continuous rains in the month of August.

VIII. DIFFICULTIES IN THE IMPLEMENTATION OF PROGRAMME DURING THE YEAR 1983-84.

8.1 The following difficulties were encountered in 1983-84:

- i. Due to drought conditions of 1982-83 inadequate soil moisture, made the tractor ploughing operation which was taken up in April-May, very difficult;
- ii. Pre-monsoon sowings could not be completed satisfactorily due to delay in tractor ploughing, late receipt of implements (Agricultors and Tractors) and for want of heavy draught animals.
- iii. Inadequate financial assistance to the small and marginal farmers for the purchase of inputs in time
- iv. The subsequent receipt of unprecedented rains, with high intensity resulted in the over-flow of water-ways and caused breaches, damaging the broad-beds and furrows.
- v. The heavy rains subjected the lands to ill-drained conditions, making the usage of bullock and manpower operationally difficult for pretty long periods. Despite the above difficulties the two technologies have evoked an enthusiastic response from the dry-land farmers. The departmental functionaries are therefore cautiously optimistic that over the next few years it should be possible to achieve a breakthrough in agricultural production in dry lands with the help of ICRIASAT and ICAR technology.

IX. OTHER DRYLAND FARMING SCHEMES IN OPERATION IN ANDHRA PRADESH

9.1 Dryland Farming Project:

- 9.1.1: To introduce the improved practices of dryland farming in the farmers' fields, based on the research findings of ICAR and APAU Research Station the Integrated Dryland Farming Project, Ibrahimpatnam, Rangareddy District was taken up with the Central Government assistance in the year 1969-70.

9.1.2: To extend the dry farming practices in another region of the State, one more project was started in Anantapur District during 1971-72.

9.1.3: Since 1979-80 both these projects are continued as State Non-plan Schemes. Every year an area of 800 hectares is selected on watershed basis under each project. The annual action plan of each project to conserve soil and moisture and to introduce the recommended practices of crop management such as use of improved seeds of high yielding varieties, timely preparatory and seeding operation, suitable cropping pattern, use of fertiliser, weed control, alternate cropping to suit the rainfall conditions and adoption of preventive and control measures of plant protection, is formulated in consultation with the scientists of ICAR and APAU. The annual action plan is implemented in the selected watershed with the approval of the Government. The credit requirements are met through the cooperative societies and scheduled banks. So far, an area of 18 200 hectares has been treated by these projects. The outlay for 1983-84 is Rs.10.496 lakhs for the two projects at Rs.5.248 lakhs per project.

9.2 River Valley Project:

9.2.1: The River Valley scheme is being implemented in the State since 1973-74 as a centrally sponsored scheme in the catchments of Sriramsagar, Nagarjunasagar and Nizamsagar on watershed basis with the objective of reducing the silt-flow into the reservoirs and prolonging their longevity.

9.2.2: Every year, management plans on micro watershed basis are prepared based on the detailed survey. According to the plans, works such as graded bunds gully control, retention dams, trenching and afforestation are taken up, with the prior approval of Government of India.

9.2.3: So far, an area of 25 431 hectares have been covered at a cost of Rs.159.57 lakhs on works and establishment.

9.2.4: During 1983-84, it is proposed to cover an area of 4631.50 hectares at an estimated cost of Rs.42.60 lakhs on works and establishment.

9.2.5: These works not only check the siltation of reservoirs

but also help in getting good rainfed crops by way of conserving soil moisture.

9.3: Drought-Prone-Area-Development-Programme:

9.3.1: This programme is being implemented since 1975-76 in seven districts of Andhra Pradesh viz., Anantapur, Chittoor, Cuddapah, Kurnool, Mahabubnagar, Nalgonda and Prakasam with 50% Central assistance. The objective of the scheme is to mitigate the effects of the drought through construction of permanent works, besides providing employment to rural labour during off season. Under agricultural sector the drylands are treated on watershed basis with graded bunds, gully control and water harvesting devices on priority basis. Upto end of 1982-83, an area of 2.94 lakh hectares have been treated at an expenditure of Rs.777.98 lakhs.

9.4 Integrated Dryland Project

9.4.1: It is proposed to cover 2000 hectares each in the districts of Kurnool and Anantapur on watershed basis under Integrated Dryland Development Project in collaboration with ICAR and DRDA. The preliminary steps that are to be taken up are being worked out.

9.5. Water Harvesting Technology Projects

9.5.1 It is proposed to take up dryland farming project during 1983-84 with emphasis on water harvesting technology in selected watersheds of Chavella, Pothalaboguda and Madikonda in Jogipet Taluk of Medak District with the financial assistance of Government of India. This selected area will be treated with soil and water conservation measures, improved crop husbandry, utility plantation of fruit and fuel plants and harvesting the surface runoff. An area of 702 hectares at a cost of Rs.25.00 lakhs is proposed to be covered. The project report is being finalised.

9.6. Development and Popularisation of Seed-cum-Fertiliser Drill

9.6.1: With the objective of popularising seed-cum-fertiliser drill for proper placement of fertiliser and seed, it is proposed to implement the scheme with 50% central assistance during 1983-84 to help the farmers in Medak District. Under this scheme 1600 demonstrations of 1/2 hectares each will be organised with the financial assistance of Rs.400/- per demonstration towards the cost of seeds and fertilisers. It is also proposed to supply 1000 seed-cum-fertiliser drills at subsidised rates.

9.6.2: In anticipation of release of funds from both State and Central Governments 300 demonstrations have been organised in the current kharif season with seed-cum-fertiliser drills and FESPO ploughs in the cultivators fields. The balance of demonstrations will be organised during the ensuing rabi season.

9.7. Development Micro Watersheds under New 20-
Point Programme of the Prime Minister

9.7.1: Under this programme it is proposed to develop micro watersheds by pooling the available funds of on-going schemes under different sectors. Under the scheme it is proposed to supply the Minikits of Oilseeds and Pulse crops, Development of Minor irrigation, Pasture Development and to raise fruit and fuel plantations. It is proposed to implement the scheme in 250 micro watersheds.

9.8 World Bank Aided Rainfed Farming Project

9.8.1: It is proposed to take up a World Bank Aided Rainfed Farming Project covering the villages of Maheshwaram and Ibrahimpatnam taluks of Rangareddy District on watershed basis in red soil area covering 25331 hectares of geophysical area with 10294 hectares of cultivated area. Under this project the watershed areas will be treated with soil and water management, forest and grass land development, improved crop husbandry and live-stock improvement in a phased manner over 7 year period at a total outlay of Rs.390 lakhs. This project is at the final stages of approval and is likely to be implemented from 1984-85.

C. SRINIVASA SASTRY
SECRETARY: FOOD & AGRICULTURE
GOVERNMENT OF ANDHRA PRADESH

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SOME NOTES ON WATERSHED BASED DRYLAND FARMING IN

BLACK SOIL REGIONS OF MADHYA PRADESH*

Madhya Pradesh, largest by area, the state occupies the centre of the country. By virtue of its size and geographical situation the state shares almost all features of agriculture in the country. It is bound by U.P. in the North, Bihar in North-East, Orissa in East, Maharashtra and Andhra Pradesh in the South, and Gujarat and Rajasthan in the West. With 87% of agriculture dependent on rain the state gets the largest share of Dryland Farming of the country. Area affected by water erosion under land use practices is also the largest in the state — 15.6% of such area of the country (India 132 m. ha., M.P. 20.6 m. ha.). This is as per "Manual of Soil and Water Conservation Practices in India - 1981".

Important Basic Information

Total area of the state : 44.2 m.ha.

Population : 52.1 m.ha.

This state shares 13.5% of the area and 7.6% of the population of the country.

Per capita- total land : 0.85 ha.

Per capita- cultivated land : 0.36 ha.

Per capita- forest Land : 0.27 ha.

Area under plough : 18.8 m.ha.

Area under forests : 14.0 m.ha. (This is 23% of the forest area of the country)

As much as 40% of the forest area is thin and poor.

Irrigation : 13%

Kharif cropping : 79%

Rabi cropping : 42%

Intensity of cropping : 121% (80-81 - 114.5%
(estimated 82-83))

*Paper prepared for NABARD-ICAR-ICRISAT Workshop on Watershed- based Dryland Farming in Black and Red Soils of Peninsular India, 3 and 4 October 1983 to be held at ICRISAT Center, Patancheru, Andhra Pradesh, India.

Major cereal crops:

Kharif	Rice, Sorghum, Maize, Pearl
Rabi	Millet, and Minor Millets Wheat and Barley

Major pulse crops:

Kharif	Pigeonpea, Urad, Moong
Rabi	Gram, Peas, Lentils, Lathyrus

Major oil seed crops:

Kharif	: Groundnut, Sesamum, Niger (recent introduction Soybean)
Rabi	: Linseed, Rape, Mustard

Major commercial crops : Cotton, Sugarcane

Fruit trees : Mango, Citrus, Guava, Pine
apple, Custard apple, Ber,
Papaya, Banana, Jack fruit
(used as vegetable) (Cashew
nuts introduced, coconuts
under trial)

Dryland Farming under various Soil Types:

1. Black soil areas. As much as 48.4% of the cultivated area in M.P. comprises of Black Soils. Most of this area has open fields which grow erosion permitting crops like sorghum, cotton, maize, pigeonpea and minor millets etc. during kharif season. These areas are constantly undergoing a process of depletion due to soil erosion by run off water. Malwa Plateau, Nimar Plains, Jhabua Hills, and Satpura Plateau part of Wainganga Valley and part of Vindhya Plateau present this situation.

The other big chunk of Black Soils is the monocrop rabi areas of Narmada Valley and Vindhya Plateau where the fields remain vacant during kharif season. The areas of discharge in this case, are eroded and subjected to drought and the areas of recharge, especially the bunder fields (typical example is the Haveli tract of Narmada Valley) seriously suffer from problems of drainage which stand in the way of kharif cropping.

Identification of problems of Black Soil and experience with soybean have provided very encouraging direction to the management of these regions.

Steps are under way as under:

- i. Soybean crop has caught up in most of the traditional rabi areas as an additional crop during kharif even under rainfed situation. In three out of five years the rainfall situation permits a normal rabi crop after soybean.

- ii. Use of Organic matter in black soils permits a short duration paddy crop during kharif in traditional rabi areas.
- iii. Program of drainage and simultaneously water harvesting is being tried on watershed basis to afford a stable base to the dryland farming technology.
- iv. Inter-cropping of erosion permitting crops like sorghum, pigeonpea, maize etc. with erosion resisting pulse/oil seed crops especially with soybean crop is gaining popularity.
- v. Use of improved Agriculture Implements especially the seed-cum-fertilizer drills has been found to be beneficial in moisture conservation and for better efficiency of applied nutrients.
- vi. ICRISAT technology for Vertisols with accent on Broad Beds and Furrow is under trial at two locations viz. Begumganj (Raisen district) and Phanda (Bhopal district) technology is obviously sound. Regarding large scale application it is too early to say anything.
- vii. The efforts are aimed at increasing productivity and intensity of cropping under all soil types in general and under Black Soils in particular.

The area under kharif fallow has declined during the last five years as under:

S.No.	Year	Kharif fallow Lakh/ha.	Rabi fallow Lakh/ha.
1.	1978-79	51.81	104.78
2.	1979-80	45.40	110.78
3.	1980-81	46.42	110.39
4.	1981-82	35.33	111.41
5.	1982-83	37.97	107.52

Decline in kharif fallow is much more than the corresponding increase in rabi fallow. Programs of minor irrigation and water harvesting will soon curb the increase in rabi fallow. Decline in kharif fallow is a technological break through.

2. Red and yellow soils. Chhatisgarh and allied area, which is the rice bown of the state covers about 29.5% of the area. These soils are more depleted than eroded. Levelling and bunding of paddy fields, increased

use of organic matter and programs of water harvesting on watershed basis are identified as foundation items for developing these areas.

3. Skeletal soils. About 9% of the cultivated area comes under skeletal soil where cultivation is practised on marginal and sub-marginal area like tribal belt of Mandla, Jhabua etc. Cultivation is no more economical in some of these areas. The areas are prone to water erosion and subsequently to drought. Besides protecting areas through soil conservation measures efforts are under way to encourage social forestry, horticulture, and pasture development in the undulating topography.

4. Mixed Red and Black Soils of Kymore plateau and Bundhelkhand cover about 8.10% of the agricultural land. Districts of Rewa Satnla, Panna, Tehsil Katni of Jabalpur, Chhatarpur, Tikamgarh Datia and part of Shivpuri district fall in this region.

Problems of these areas are also to be solved through soil conservations measures, by introducing soybean, by water harvesting and in general through dryfarming technology on watershed basis.

5. About 5% of the agricultural land comprises of Alluvial Soils half of which has already turned into Ravines in Chambal and Gwalior divisions. Special schemes for developing these areas, in view of dacoity menace, are under consideration.

Watershed Based Dryland Farming:

Significant efforts were started during 1982-83. About 620 Micro-watersheds were identified for planned development. Detailed project reports were prepared for more than half of the identified sites. During 1983-84 these areas are getting more pointed attention. Quality of effort will improve with experience. Development of watersheds has been taken up in three ways as under:

1. Land development work, development of minor-irrigation and water harvesting program. Such foundation work is the long-term development work. Since inception the state has treated about 37 lakh hectares of agriculture land with soil conservation measures. Such work has so far been scattered and isolated from improved agronomical practices for want of watershed approach.
2. Application of dry farming technology like use of improved seeds, introduction of additional crop like soybean to increase intensity of cropping, intercropping use of fertilizer, proper placement of seeds and fertilizers with improved seed-cum-fertilizer drills etc. in areas not treated by soil conservation measures.
3. Application of dryfarming technology as above, in areas developed by soil conservation measures -- old as well as newly developed areas.

Land development work is so far confined to private lands because the cost is recoverable in 20 years. However, Government is actively considering a proposal to permit 25 to 30% of the total expenditure on community works like providing drainage, protection of public lands against erosion development of pasture lands etc.

Multi-disciplinary approach:

The Additional Chief Secretary and the Agriculture Production Commissioner coordinate activities of various departments viz. Agriculture, Forest, Veterinary, Horticulture etc. at the state level so that all the departments share the program of development of selected watersheds with their resources.

At the district level the Collector is the Chairman of the Watershed Management Committee so that activities of various departments could be combined on watershed basis for generating a self supporting economy.

Agriculture Department is the Nodal department from state level to the project level. An Officer of the rank of Additional Director of Agriculture is the Nodal Officer at State Head-Quarters for monitoring the watershed-based dryfarming program. He is also the incharge of Soil Conservation Program of the state.

Long-term Soil and Water Management Program:

For every district of the state a Master Plan of Soil and Water Management is under preparation for a period of 6 years (last year of 6th Plan and the 7th Plan period). Guidelines for such a master plan were issued by the Secretary, Government of M.P. Agriculture Department a few months back. The plans are expected by the end of December 1983.

DRYLAND FARMING PROGRAMMES IN KARNATAKA

INTRODUCTION:

During the year 1982-83 development of dryland farming was taken up, in the State, in selected 85 watersheds covering an area of 42,500 hectares. The selection of these watersheds was based on the amount and the distribution of rainfall. The taluks receiving less than 850 mm rainfall were taken up for development. The objective was to increase unit area production by adopting dry land farming technologies, evolved by ICAR, UAS, ICRISAT, and the experiences of IDLAD Projects.

STRATEGIES ADOPTED:

The main strategies advocated were:

1. Proper soil and water conservation measures.
2. Suitable crops and cropping systems.
3. Judicious use of inputs.
4. Arrangements for Inputs and credits.
5. Use of improved dry Land Agricultural Implements.
6. Evolving contingent plans to suit aberrant seasonal conditions.
7. Farm Forestry

Under soil and water conservation measures, emphasis was given to:

- a. Contour bunding
- b. Graded bunding
- c. Inter bunded area management practices
- d. Compartment bunding
- e. Scooping
- f. Land smoothening

CROPPING SYSTEMS:

The cropping systems recommended for these dry land areas, were based on different agro-climatic locations, suiting the local conditions. The crops recommended were generally Drought resistant, High yielding, Photo-insensitive and of short duration.

OTHER STRATEGIES ADOPTED:

Planting of Pongamea, Glyrecidia and castor was taken up all along the bunds. As part of Farm Forestry Programme, Subabul was introduced on a massive scale so as to meet out fodder, fuel and timber requirements. To ensure high returns it was advocated to use, quality seeds, application of optimum doses of fertilisers and taking effective plant protection measures.

INPUTS CREDIT:

Timely availability of credits and inputs are a must for increasing the unit area production in dryland areas. To achieve this, Cooperative Institutions, Commercial Banks, KAICKSSC and KSCMF have been actively involved to open more number of sale points for timely supply of input requirements, including credit, to the dryland farmers.

IMPROVED IMPLEMENTS:

Another important programme taken up under the Dryland Agriculture Project was the distribution of improved implements. Since the farmers in these dryland areas happen to be economically weaker, implements were distributed to these farmers at subsidised rates.

ACHIEVEMENT DURING 1982-83:

The progress achieved under inter-bunded area management and other improved practices during 1982-83 is 43, 579 hectares as against the target of 42,500 hectares.

PROGRAMME FOR 1983-84:

Impressed by the progress achieved under dryland agriculture project during the year 1982-83, it is decided to extend this technology over all the 175 taluks in the State at the rate of 1000 hect. per taluk. The total area targetted for overall development during the year 1983-84 is 1,75,000 hectares. Against this an area of 1,19,720 hectares has been achieved upto end of August 1983. Dryland Agriculture technology is advocated in the (106 taluks) comprising North-Eastern, Northern, Central, Southern and Eastern dry zone areas receiving less than 750 mm rainfall and rainfed farming technology is advocated in (69 taluks) comprising Northern, Eastern transitional zone, Southern, Northern transitional zone, Hilly and coastal zones, receiving more than 750 mm rainfall.

DRYLAND DEVELOPMENT BOARDS:

It is further proposed for the formation of Dryland Development Boards covering dryland areas in the 4 Revenue Divisions in the State, to tackle the problems of the dryland farmers. In this connection, a

Seminar-cum-workshop is also going to be organised shortly wherein scientists from ICAR, UAS, ICRISAT, AICRP and the Resource personnel of the Department of Agriculture and allied subjects will be invited to actively participate, and chalk out the programmes, based on the latest technology for implementing and transferring to the farmers.

BROAD BED AND FURROW TECHNOLOGY (BBF) 1982-83

Another dryland agriculture technology for management of vertisols, evolved by the International Crops Research Institute for the Semi-Arid Tropics, Hyderabad was introduced in Farhatnabad watershed in Gulbarga district and in Andura watershed in Bidar district and an area of 16.8 hects. and 8 hects. were brought under BBF technology in each district during the year 1982-83. The "Wheeled tool carrier or the Tropiculator" was employed to layout these broad bed furrows. This technology helped in conserving the rain water and making efficient use of it, during crop growth period, besides improving drainage situations.

The important cropping system followed in this technology is as follows:

1. Hybrid Sorghum+Pigeonpea
2. Mungbean followed by rabi Sorghum/Safflower/chickpea

The performance of these sequences are given vide Annexure-I (Gulbarga district).

BBF TECHNOLOGY FOR 1983-84:

Encouraged by the results achieved during 1982-83 this technology has been extended to the districts of Raichur, Bellary, Belgaum and Dharwad in addition to Bidar and Gulbarga districts after studying rainfall probabilities, during 1983-84, wherein, it has been programmed to cover an area of 500 hects. in 50 taluks. So far, 277 hectares have been covered upto end of August 1983 during the current year under BBF technology, though survey and planning has been done covering an area of 1,354.48 hect.

DEPENDABLE RAINFALL REGIONS IN KARNATAKA:

Rainfall data of 27 rain gauge stations viz., Bidar (01), Bijapur (01), Bellary (02), Belgaum (06) Dharwad (09), Gulbarga (05) and Raichur (03) were analysed through the computer at ICRISAT, for working out the weekly, initial and conditional probabilities of 10 mm and more weekly rainfall.

Out of 27 rain gauge stations data analysed, (09) stations are identified as highly dependable (11) as dependable and (07) as low dependable areas.

As per the technology developed, the BBF method can be attempted only in the areas classified as dependable and highly dependable rainfall areas. The areas coming under low dependable rainfall may not be suitable unless the rainfall data is analysed and watched critically. As such, BBF technology has been introduced in dependable and highly dependable rainfall areas of Karnataka vide Annexure-II.

The review of progress achieved upto end of August 1983 is enclosed vide Annexure-III.

STATE SPONSORED PILOT PROJECT:

One pilot project on watershed management is being implemented in Managanahalli- Bettadur watershed in Mysore district, over an area of 866 hec. This scheme is financed by the State Government.

WATERSHED DEVELOPMENT UNDER WORLD BANK:

Another watershed in Kanakapura taluk of Bangalore district is programmed to be developed under World Bank Assistance. This is under final negotiations with the World Bank authorities. The total area to be covered is 29,803 hec. over a period of 7 years.

CENTRALLY SPONSORED PILOT PROJECT:

Another Centrally sponsored pilot project on water conservation/harvesting technology is taken up in Mysore district covering an area of 700 hec. in Bommenahalli-Huyilalu watershed. Similarly under DPAP it is proposed to develop one more watershed of 1000 hectares in Mitemari village, Bagepally taluk of Kolar district during the year 1983-84, which is being financed by Government of India.

WATERSHED DEVELOPMENT THROUGH NABARD:

One watershed each in Bellary and Bijapur districts have been programmed to be developed through NABARD assistance.

A N N E X U R E -I

PERFORMANCES OF BROAD BED AND FURROWS TECHNOLOGY IN THE STATE DURING 1982-83.

The BBF technology for management of vertisols was taken up in Bidar and Gulbarga districts on experimental basis. The area selected for this purpose was 16.8 hec. in Farhatabad village of Gulbarga district, and 8.0 hec. in Andura village of Bidar district. The major cropping systems followed in Farhatabad village was mungbean followed by sorghum and in Andura village sorghum/pigeonpea intercrop.

A comparative statement showing the yields obtained during 1982-83 under BBF in relation with Bench Mark yield of previous year and neighbouring cultivators of 1982-83 is given vide Annexure I.

A N N E X U R E - I (CONTD.)

TOTAL YIELD AND COST OF CULTIVATION AND NET PROFIT - UNDER B.B.F. TECHNOLOGY DURING 1982.83 IN
GULBURGA DIST.

Sl. No.	Crop	Area in Hects.	Yield in Kgs.	Gross income	Cost of cultivation	Net profit.	Loss	Remarks.
1.	Greengram	.. 6.15	3,100	9,300-00	3,852.40	5,447.60	-	The cost benefit ratio is 1 : 3.
2.	Blackgram	.. 0.50	52	182.00	108.15	74.85	-	
3.	Pigeon Pea	.. 0.85	1,088	3,916-80	1,024-10	2,892-70	-	
4.	G. Nut + Pigeon pea	.. 1.85	400 $\frac{1}{2}$ + 1657	1,40.00 + 5,965.20	2,893.35	4,611-85	-	
				7,505.20				
5.	Maize + Pigeon pea	.. 0.35	25 Kgs cobs & 3 cart load fodder + 280 Kgs.	1,358.00	453.40	904.60	-	
6.	Sesamum + Pigeon pea	.. 0.25	40 Kgs + 225 "	240.00 + 810.00	292.80	757.20	-	
				1,050.00				
7.	Rabi Jowar	.. 6.15	8,960 + 74 Cartload fodder.	19,920.00 + 1,110.00	6,046.00	12,984.00	-	
				19,030.00				
8.	Safflower	.. 0.50	627	2,194.50	562.50	1,632.00	-	
Total:		.. 9.95 + 6.62 Double crop area		44,536.50	15,231.70	29,304.80		

A N N E X U R E-I (Contd.)

COMPARATIVE STATEMENT SHOWING THE YIELDS OBTAINED DURING 1982.83 in RELATION WITH THE BENCH MARK OF PREVIOUS YEAR AND NEIGHBOURING CULTIVATED YIELDS OF 1982.83. GULBURGA DIST.

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Sl. No.	Crops	Bench Mark yield/ha. (in Kgs)	Cost of cultivation (in Rs.)	Neigh bouring plot yields per Ha. (Kgs.)	Cost of cultivation (in Rs.)	Yield of B.B.F. per Hect. (Kgs.)	Cost of cultivation	Increase over bench mark.		Increase over neighbouring Field	
								Yield per ha. (Kgs.)	% of increase.	Yield per Ha. (Kgs.)	% of increase.
1.	Greengram	295	225	290	258	504	626	209	70	214	72
2.	Pigeon Pea	550	850	500	810	1280	1226	730	130	780	156
3.	G. Nut + (*) Pigeon Pea	250 750	1240	190	1457	216	1603	40 146	26 18	26 89	14 11
4.	Maize + Pigeon Pea	-	-	-	-	142 800	1317	-	-	-	-
5.	Sesamum + Pigeon pea	150 350	860	25 600	855	160 900	1189	10 550	67 186	135 300	540 50
6.	R. Sorghum	700	450	1050	1250	1456	983	756	107	406	39
7.	Safflower	-	-	875	1325	1250	1125	-	-	375	43

(*) Due to the failure of the rains at the time of peg formation, the crop was worst affected and less yields were obtained during the year 1982.83 under B.B.F.

CONCLUSION:- B.B.F. method of cultivation has proved better than the existing traditional method of cultivation in vertisols even under scarcity conditions, but the cost of the implements and the cost of initial layout is too much to a farmer according to the Research Project Report taken at Farhatabad, Gulburga taluks during 1982.83.

ANNEXURE-II

LOCATIONS FOUND SUITABLE FOR BROAD BED & FURROW LAYOUT IN KARNATA.

Name of the district.	1	2	3	4	5	6	7
		Highly dependable (70% probability)	Probability of receiving highly dependable rainfall	Dependable (60% to 90%) probability	Probability of receiving dependable rainfall.	Low dependable (60% probability)	
Belgaum	1. Belgaum city	1st week of June	1. Bailhongal 2. Chikkodi 3. Rukkeri 1. Harapana halli. 2. Siruguppa 1. Bidar	4th week of June 4th week of June 4th week of June 4th week of June 2nd week of June	1. Raibag 2. Soun-fall datti. behaviour is erratic.		
Bellary							
Bidar							
Bijapur							
Dharwad	1. Dharwad 2. Hangal 3. Haveri 4. Hirekarur 5. Hubli 6. Kalghatgi 7. Shiggaon 7.a. Kundagol 1. Chincholli	2nd week of May & 4th week of June 1st week of June 3rd week of June 3rd week of June 4th week of April & 3rd week of June 3rd week of June 3rd week of June 1st week of June	1. Savanur	4th week of June 1. Rani-bennur.	1. Sindagi do 1. Rani-bennur.		
Gulbarga			1. Gulbarga 2. Aland (Cedam) 3. Yadgir 1. Manvi	4th week of June 2nd week of June 3rd week of June 3rd week of July	1. Shahapur do 1. Deodurg do 2. Raichur do		
Raichur			11				7 - 27 taluks

A N N E X U R E - III

A BRIEF NOTE ON THE PROGRAMME AND PROGRESS UNDER BROAD BED AND FURROW TECHNOLOGY IN SELECTED DISTRICTS OF KARNATAKA DURING THE YEAR 1983-84.

A special technology has been evolved by the International Crops Research Institute for the Semi-Arid Tropics, Hyderabad for management of vertisols, to harvest fairly encouraging yields by conserving whatever rainfall that is received.

To popularise this Broadbed and Furrow technology it was first introduced in the State during 1982-83 at Farhatabad in Gulbarga district and Andura in Bidar district. Programme and achievement is given vide Annexure I. Encouraged by the results achieved, this programme has been introduced in the districts of Bidar, Gulbarga, Belgaum, Dharwad, Bellary and Raichur during the current year 1983-84. It is programmed to bring an area of 500 hectares (50 blocks) under the Broadbed and Furrow technology. The area surveyed and plans prepared for layout of this technology is 1354.48 ha. so far. District-wise area selected, number of blocks taken up and the details of progress achieved upto end of August, 1983 is enclosed vide Annexure-II.

DISTRICT-WISE REVIEW OF PROGRESS ACHIEVED UNDER BBF TECHNOLOGY

Bidar District:

Out of the area of 441.43 hectares for which layout plans were prepared in 5 taluks for implementation of Broadbed and Furrow Technology, so far an area of 64 ha. has been laid out under BBF. The delay in the progress is, due to the late receipt of Tropicultors. All the area that has been laid out under BBF has been sown. The cropping system followed is sole crop of Mungbean-Blackgram and intercropping of Hybrid Sorghum+Pigeonpea. Dry seeding is done in almost all the blocks.

Gulbarga District

The area that has been planned to be brought under BBF technology is 436.90 ha. So far an area of 57.44 has been laid out under BBF besides 20.56 ha. done in seed farms. All the area that has been laid out under BBF has been sown except in one location i.e. at Kurikota. Cropping system followed is sole Mungbean/Blackgram, Hybrid-Millet+Pigeonpea, sole pigeonpea. Dry seeding is done in all the blocks.

Raichur and Bellary districts:

The area planned for Raichur and Bellary districts is 12 hect. and 19.12 hect. respectively. 4.00 hect. in Raichur district and 8 hect. in Bellary district have been laid out under BBF. The developed area has been sown with following cropping systems: 1. sole sunflower; 2. Mungbean+Chilli; 3. Hybrid Sorghum+ Pigeonpea. Dry seeding was possible in one block of Harapanahalli taluka.

Dharwad district:

The area that has been planned to be covered under BBF technology is 270 hectares. Due to limited number of Tropicultors available in this district so far only 63.5 ha. could be laid out under BBF. All these area has been sown with Groundnut+cotton, Hybrid sorghum+Pigeonpea and Potato. Dry seeding could not be possible due to late receipt of Tropicultors and land preparation itself.

Belgaum District

An area of 175 ha. is planned for introduction of BBF technology. Only 2 Tropicultors are available in the district, that too they were received late. As such, only 10 ha. is laid out under BBF and sowings done. The cropping system followed is mixed cropping of Hybrid sorghum+Pigeonpea and pure crop of Cowpea. Dry seeding was not possible due to delayed land preparation.

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DISTRICT-WISE PROGRAMME AND PROGRESS OF B.B.F. TECHNOLOGY IN THE STATE DURING THE YEAR 1983.84
(UPTO AUGUST, 1983)

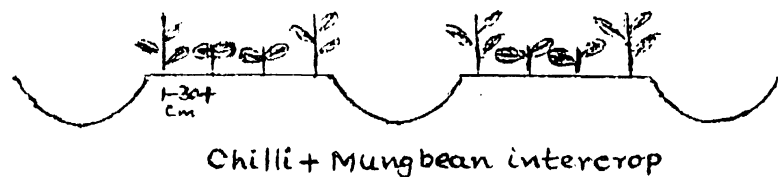
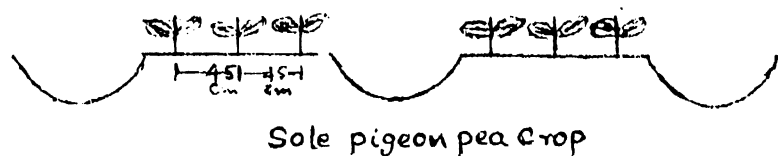
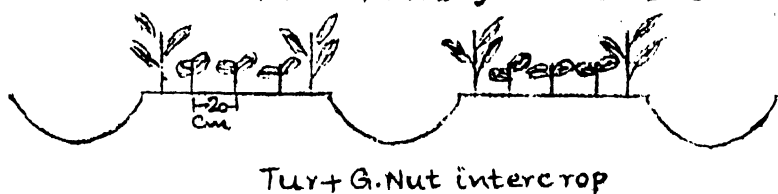
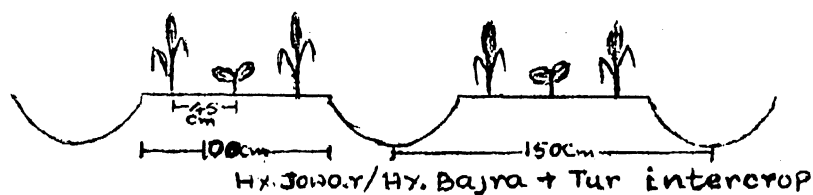
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Sl. No.	Particulars	Bidar	Gulbarga	Raichur	Bellary	Dharwad	Belgaum
1.	No. of taluks ..	5	4	1	2	9	4
2.	Field staff training prog..	25	32	14	18	36	42
3.	Area selected (Hects.) ..	441.43	436.90	12.00	19.12	270.00	175.03
4.	Surveying & Planning ..	Surveyed	Surveyed	Surveyed	Surveyed	Surveyed	Surveyed
5.	Land preparations (Ha) ..	64.00	78.00	4.00	8.00	63.50	10.00
6.	Opening of BBB (Ha.) ..	64.00	78.00	4.00	8.00	63.50	10.00
7.	Arrangements made for supply of inputs ..	Arrangements for supply of inputs has been made through local co.ope-ratives and K.A.I.C.					
8.	Area sown (Hects.) ..	64.00	78.00	4.00	8.00	63.50	10.00
9.	Crops and Cropping system..	Hy.Bajra+ Redgram, Hy.Jowar+ Redgram, Sunflower+ Redgram, Sole crop of Moong- bean	Sole Moong Bean Pigeonpea, G.Nut + Pigeonpea, Hy.Bajra + Pigeonpea	Sunflower Sole	Hy.Jowar+ Pigeonpea Moonbean + Chilli.	Hy.Jowar + Pigeonpea Groundnut + Cotton, Potato	Hy.Jowar+ Pigeonpea Cowpea sole
10.	No. of Tropicultors ..	20	49	1	1	10	2
11.	R e m a r k s ..	The progress achieved is in-sufficient which is due to late receipt of Tropicultors and unfavourable soil conditions for early layout of B.B.F.					

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AREA MANAGEMENT UNDER DRYLAND/ RAINFED FARMING

BROAD BEDS AND FURROWS ADAPTED FOR MANY ROW CROPS
AND CROPPING SYSTEMS ADVOCATED



TECHNOLOGY OPTIONS FOR INCREASING CROP PRODUCTION IN RED AND BLACK SOILS, CREDIT NEEDS AND POLICY ISSUES*

P R E A M B L E

The extent of red soils in our country is 59.6 m.ha., while that of black soils is 72.9 m.ha. The estimates of actual area under arable farming are not available for red soils. However, in black soils, arable farming is done on about 24 m.ha.

The black soils are more productive than red soils. They are deeper and have higher clay content (30-70%). They hold more water. They are heavy and tend to erode. The runoff could vary from 10-40 per cent depending on the rainfall and slope. The soils are poor in nitrogen and adequate in P at moderate levels of production. The reserves of K are adequate. Sometimes Zinc might be a problem, more so for higher production levels. The soil aeration might be a problem. Surface drainage is important. In shallow soils, kharif cropping alone is possible. In deep black soils with low rainfall only rabi cropping is to be attempted. In high rainfall areas double cropping is practised by farmers in large areas. However, in some flat lands only rabi cropping is practised. In the medium soils intercropping is suggested.

The red soils are more weathered. They are low in clay (10-20%). The nutrient and water holding capacity is low. The soils are shallow. The soils tend to crust. Runoff could be upto 20 per cent in these soils. These soils are poor in N and P. Sublethal deficiency of calcium and sulphur may occur. Potassium might become a problem in light soils under high levels of management. These soils are used primarily for kharif cropping. In high rainfall regions with deep soils (e.g. North Coastal Andhra Pradesh) two crops are taken. In medium rainfall regions, intercropping is a distinct possibility.

The agro-techniques developed by the All India Coordinated Research Project for Dryland Agriculture (AICRPDA) over the last 12 years, have clearly shown the vast scope of increasing crop production in these drylands. In the following paragraphs, the present setting, the techniques for increasing and stabilizing crop production in drylands, the implications, credit needs and policy issues are discussed.

The Setting

The average size of the holding is 2.00 ha. ranging from 0.49 ha. in Kerala to 4.65 ha. in Rajasthan. The holdings are unfortunately fragmented. Further, 72.6 per cent farmers are small and marginal having only about 23.5 per cent area under cultivation.

*ICAR Paper for the NABARD-ICAR-ICRISAT Workshop on Watershed-based Dryland Farming in Black and Red Soils of Peninsular India, 3-4 October 1983.

The drylands are more impoverished due to continuous leaching, erosion and consequent soil loss, poor crop management with relatively higher weed infestation and little or no addition of nutrients. The crop production is further affected by moisture stress. Timely operations, often times, become difficult due to lack of draft power. And thus with low risk bearing capacity, it would be a Herculean task to improve the lot of these dryland farmers.

Agro-techniques for Increasing Crop Production in Drylands

Among other things, the improved practices for increasing yield of dryland crops include:

- i. Early seedbed preparation,
- ii. Timely sowing,
- iii. Use of High Yielding Varieties (HYV) or Hybrid seed (HYB),
- iv. Achieving optimum plant stands,
- v. Use of moderate levels of fertilizers,
- vi. Timely and effective weed control,
- vii. Avoidance of pests and diseases through agronomic manipulations, and
- viii. Effective use of pesticides where necessary.

With the adoption of the above practices yield increases in cereal crops upto 200 per cent are possible in drylands. In the case of pulses and oilseeds, the increases would be 50-75 per cent.

It is, however, important to note that amongst the various practices suggested, the adoption of simple but improved agronomic practices which are fortunately of low monetary nature is the preamble for success in dryland farming. In other words, without efficient management at farm level, high cost inputs like fertilizers and HYB/HYV seed alone will not yield the necessary results.

The Components

a) Sowing: Early sowing of kharif crop is an important requirement to capitalize on the recuperated soil fertility and avoidance of pests and diseases. Similarly, in the south below 18° parallel, advancing the rabi sowings is a simple but effective means of increasing crop production. In red soils, early sowing is best done through off-season tillage and early seedbed preparation.

b) Seeds: The HYV/HYB seeds of crops generally yield more than local traditional varieties of crops.

c) Plant stands: Ideal plant stand is something like a good foundation to a building. It is necessary to obtain healthy good plant stands for good yields. Bullock drawn seed-cum-fertilizer drills are now available in different regions. Examples:

<u>Seed-cum-fertilizer drill</u> -----	<u>Region</u> -----
Shivaji Multipurpose farming Machine	Black soils of Deccan region
Eenatigorry	Red soils of Rayalaseema
Pora plough (FESP0)	Red soils of Telengana
Deep furrow seeders	Red soils of Chotanagpur
Ragi seed-cum-fertilizer drill	Red soils of south Karnataka

d) Fertilizer use: That fertilizers pay in drylands is now clearly established. However, it is necessary to apply moderate levels of fertilizers to dryland crops. It is also essential to avoid any possible deficiency either of other nutrients, or in management (e.g. weeding) or in pest control to obtain full benefits of the applied nutrient. Per se its use efficiency can be enhanced by placement. Split application of nitrogen for kharif crops and deep placement in rabi crops also are useful.

e) Weed control: Timely weed control is important. The first weeding has to be done by 3-4 weeks/5-6 weeks for short/long duration crops. To facilitate weeding, wide row planting with same population is found to be useful. Again sweeps, instead of blades, are found to be useful for interculturing operations.

f) Pests: As stated earlier, timely sowing helps in avoiding pests and diseases. For instance, shootfly in sorghum can be avoided with timely sowing. If a pesticide has to be used it must be used by early diagnosis of the malady. For instance, in sorghum the earhead bug needs early control.

Stability of Crop Production in Drylands

The main source of water for drylands is rain. The rains come through monsoons. Aberrations in monsoon are not uncommon. The most frequent aberrations are:

- i) Delayed onset of monsoon
- ii) 'Break' in monsoon
- iii) Early withdrawal of monsoon

Adoption of improved crop husbandry, itself, insulates the dryland crops against drought to a considerable extent.

For different agro-climatic regions, alternate crop strategies have been worked out. To meet the 'breaks' in monsoon, several mid-course corrections are now available. The HYB/HYV crops, being of shorter duration evade effects of early recession of monsoon. Inter-cropping is yet another way to meet weather aberrations.

Soil and Water Conservation

In tropics runoff is inevitable. But the soil loss, an associate problem reduces the root profile and removes the top fertile soil. To contain these problems, the following options are available.

- i) Mechanical structures to prevent soil erosion and enhance moisture conservation
- ii) Means to increase in-situ water harvesting
- iii) Dugouts for storing runoff water for recycling

i) Mechanical structures: Contour bunds for low rainfall light soils, graded bunds for all black soils and medium to high rainfall red soils are suggested.

ii) In-situ moisture conservation: The various means are:

Soil type	Rainfall	In-situ water harvesting measures
1 Red Soils	Low	Dead furrows at 3-6m intervals
	Medium	Sowing on flat and ridging later with eventual cultivation
	High	Graded border strips
Black Soils	Low	Contour cultivation
	Medium	Dead furrows at 3-6m intervals
	High	Graded open furrows (0.2-0.3m ²) at 10m interval across the slope

These systems resulted in not more than 15 per cent increase in yield of crops at any given level of productivity.

iii) Runoff recycling: Harvesting runoff into dugouts and recycling to the donor area is a recent approach. It is now agreed that the size of the dugout need be at least 250m³/ha catchment. The size should vary depending on the location, the acceptance of the farmers and physiography of the situation.

The pay-off for a critical irrigation is upto 20kg/ha/mm. But this story is not yet fully complete. The percolation losses in the dugouts of red soil region are high. Presently soil:cement (8:1); coal tar (Bitumen) and thick plastics overlaid with brick mortar layer are suggested. They are costly and have competitive uses. So a cheap sealant which would be available locally need be identified. Similarly, the lifting and conveying systems should be developed for optimised and efficient use of the runoff water collected in these dugouts.

Resource Management

As seen from above, there is an imperative need to more efficient use of the resources at farm level. The two important resources are, land and water (rainfall). Mechanical structures, where needed, be constructed on these lands to minimise soil loss. In-situ water harvesting should be encouraged. But permanent assets like the dugout ponds need be created in the farms so that there is stability in crop production in drylands.

To achieve these ends, farmers participation is very important as he is owner of the land. Most of the techniques of soil and water conservation practices can easily be adapted to a given local situation. Even contour survey can be simplified using a A-frame so that the farmer himself could participate in planning the soil conservation works on his field.

Alternate land use

Depending on the land use capability classes, the land should be treated with arable crops, agro-forestry, agro-horticulture, silvi-agriculture, silvi-pasture or farm forestry systems. This brings in ecological balance in the region and prosperity to the land owners.

Implications of the new technology

The new agro-techniques need more funds, i.e. credit. The credit needs and pay-off for crop production techniques are:

System	Credit needs (Rs/ha)	Pay off (Re/Re invested)
Sole crop	550-1000	1.30-2.37
Intercrop	600-1200	1.63-2.68
Double crop	800-3500	1.40-2.47

The costing of soil and water conservation need be considered on a separate footing since these are permanent assets and are needed for the benefit of the future generations as well. the various components and their costing are as follows:

Component -----	Cost ---	Pay-back from -----
1 Graded or contour bunds	Rs.500-600	20 years
2 Overall development of land on watershed basis	Rs.2000	10 years

The alternate land use systems are being evaluated. The cost-benefit ratio works out as follows:

Farming System	Annuity value (Rs.)	Benefit-cost ratio
1 Agro-forestry	1,117	1.73
2 Agro-horticulture	17,881	5.78
3 Silvi-agriculture	2,364	2.08
4 Silvi-pasture	1,115	2.56
5 Farm forestry		
a) Casurina	2,812	12.33
b) Eucalyptus	1,741	18.60

When the whole programme is taken up as an integrated system on watershed basis it is estimated that about Rs.3,500 per ha would be needed (this includes staffing) and the pay off is Rs.2.65/rupee invested over a period 5 years.

Some Policy Issues

While the crop production in drylands is to be enhanced for increasing total food production in our country to meet the growing demands of the increasing population, it is important to note that the technologies should be viable. They should be creditworthy and the investment capacity of the farmers enhanced. As an incentive, the farmers land need be developed in terms of water harvesting structures and mechanical structures. It should be our endeavour to utilise the farmers contribution as labour while creating these assets on his land. The costs towards sealants and lifting devices/systems should be borne by the Government or shared by the Government and the farmer.

Imparting skills to the farmer to improve his capabilities in dealing with the crop production in drylands is necessary.

Capital is a scarce resource. A strong credit support is a MUST. Another approach is revolving fund created and kept at the disposal of a cooperative where farmers are participants. The credit should be more in kind and repayment also need be in kind. Whenever weather is aberrant, the crop credit need be converted to medium term loans. Differential interests is another point for consideration in dryland farming.

To support the programme of rainfed farming there is a need to have specific infrastructure for the purpose. Quality seed supply, seed banks to meet weather aberrations and improvising fodder banks to mitigate unpredicted shortage of fodder are important.

Custom hire service for timely operations is very important in drylands.

Finally, it may be necessary to provide price-support to dryland crops along with adequate marketing and storage facilities. Similarly, crop loan insurance should be thought of for the dryland farmer.

**POLICY ISSUES IN THE GENERATION AND TRANSFER OF WATERSHED
BASED DRYLAND FARMING TECHNOLOGIES IN SOILS
BLACK SOILS OF PENINSULAR INDIA***

I C R I S A T

The Wet Deep Black Soil Region

One of the greatest challenges for agricultural researchers, extensionists, bankers, and policy makers is to develop, adapt, and transfer technologies to the wet deep black soil region which we believe is characterized by the widest gap between potential and actual crop production of any dryland farming region in India. On deep black soils, scientifically called Vertisols, farmers' traditional practice is to fallow land in kharif and crop on residual moisture in the rabi season. Because of kharif fallowing, three months of the cropping season are lost and soil erosion and runoff are increased. In much of this region, poor field drainage is an important reason why farmers fallow their fields during the monsoon.

The wet deep Vertisol region covers large areas in Madhya Pradesh and parts of Andhra Pradesh, Karanataka, and Maharashtra. By wet, we mean areas having dependable rainfall that averages from 750 to 1250 mm/year.

* Presented at the Workshop on Watershed Based Dryland Farming in Black and Red Soils of Peninsular India, NABARD/ICAR/ICRISAT, October 3-4, 1983, ICRISAT, Patancheru, Ind a.

Some Perspective Technological Options

Since 1974 research has been conducted at ICRISAT Center, Patancheru on operational-scale Vertisol watersheds and subwatersheds from one to five hectares to enable crops to be grown in the rainy and postrainy seasons. The main components of the technology are:

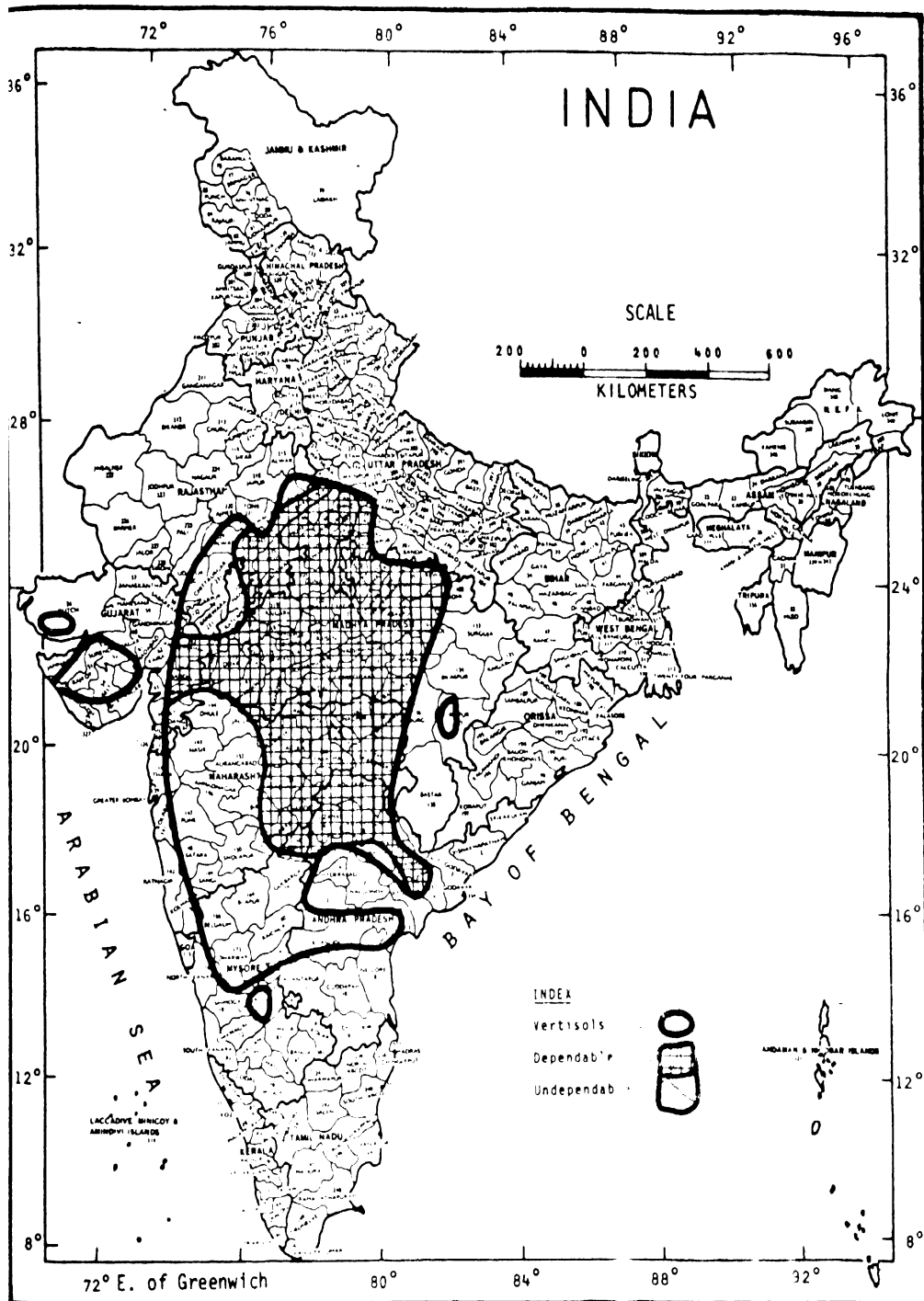
1. Cultivating the land immediately after the previous postrainy season crop has been harvested when the soil still contains some moisture and is not too hard,
2. land levelling and shaping, construction of field and community drains, and the use of graded broadbeds and furrows,
3. dry seeding before the monsoon,
4. use of improved seed and moderate amounts of fertilizer,
5. improved placement of seed and fertilizer, and
6. timely plant protection

Most of these practices are carried out with an animal drawn wheel tool carrier. For successful dry seeding, the early rains must be reliable. Moreover, soils should generally be at least one meter deep so that their water holding capacity is sufficient to produce two crops in a year without irrigation. The area for which this technology is suited is at least 5 and may be as much as 12 million hectares (Map I).

Technical and Economic Performance

Over the past eight years this technology has performed well at ICRISAT Center. Compared to farmer practices, the improved technology has

MAP 1



The Vertisol areas of India where rainfall is dependable and undependable

increased yields from 300-500%, has generated profits sufficient to give a 25% rate of return on additional investment, and has significantly reduced runoff and soil erosion.

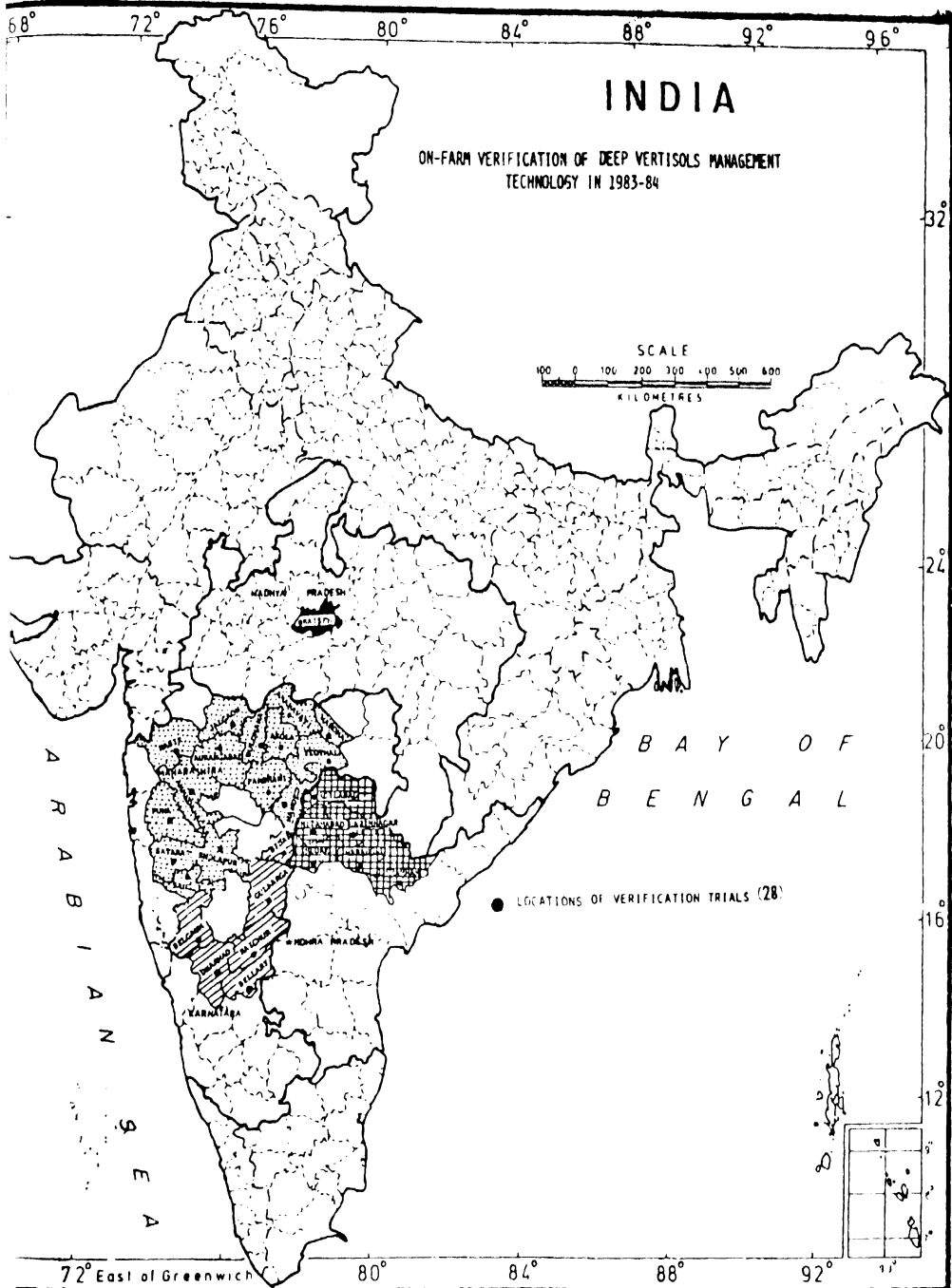
This promising agronomic and economic performance has held up in on-farm verification trials which were started in one location 1981-82, expanded to eight sites by State Departments of Agriculture in 1982-83, and are now carried out in several locations in 28 districts of Andhra Pradesh, Karnataka, Maharashtra, and Madhya Pradesh by State Departments of Agriculture (Map II). The most recent results in 1982-83 from the ICRISAT collaborative sites show that the rate of return on additional investment ranged from about 25 to 380%. The development cost of the on-farm watershed test sites varied from about Rs.200 to 1000 per hectare which is attractive when compared to an investment in irrigation.

More detailed information on the wet deep Vertisol production environment, on the improved technology, on its performance at ICRISAT Center and in on-farm verification trials, and on policy implications is contained in the papers listed in the references which will be distributed on request.

Policy Issues

There are a number of policy issues which have to be considered before the promise offered by the improved technology can be regarded as a real potential. Many of these issues are not new and were raised at the Second Policymakers' seminar on Improved Vertisol Management held at the ICRISAT Center 8-11 September 1982.

MAP II



Technological Policy

Results from the verification trials suggest the need for further research in the following areas: (1) adaptive research on cropping systems particularly in Madhya Pradesh to ensure a flexible package tailored to regional needs, (2) an evaluation of technical performance of cheaper alternatives to presently available models of the wheeled tool carrier, (3) an assessment of design modifications to the broad-bed and furrow systems for higher rainfall environments and for crops like wheat, (4) steps-in-technology experiments to measure the benefits from specific components of the package, (5) component research on improved weed management, pest resistant crop varieties, and chemical control of pests such as pod borer, and (6) an analysis of water harvesting and supplementary irrigation to ensure the establishment of the postrainy season crop in sequential cropping systems.

Marketing and Infrastructure

Several marketing problems have dampened the economic performance of the improved technology. The absence of markets for nontraditional kharif crops like maize represents a problem in the early diffusion of the technology. Transfer will also be impeded if fertilizer of the desired type is not physically available on a timely basis. Availability of soybean seed is critical to the expansion of kharif cropping in Madhya Pradesh. The most important input marketing bottleneck has been the lack of operating sprayers, effective insecticides and timely information to control *Heliothis* pod borer infestations in pigeonpea particularly in Andhra Pradesh. Building more all-weather access roads in the principal kharif-fallowing districts of Madhya Pradesh should stimulate diffusion of the improved technology.

Watershed Development

Watershed development requires grid surveying, land levelling/shaping, and constructing main and field drains. Technical assistance is provided by the State Departments of Agriculture through their soil conservation staff. These development activities confer differential benefits to farmer as individuals and to watershed participants as a group. How much of the development cost should be borne by farmers and financed with credit and how much should be subsidized by the State Departments of Agriculture? For example, a full subsidy may be required for community drains because it is difficult to apportion costs to beneficiaries. Those in the upper reaches where drains are smaller stand to gain less than those in the lower reaches where drains are larger and benefits to improved drainage are greater.

Credit

If development costs of the watershed are not totally subsidized by the State Departments of Agriculture, then expenses for land smoothing, constructing field drains, and forming broad beds and furrows will have to be financed through new lines of medium to long-term credit. Longer term credit is also needed for the purchase of the wheeled tool carrier, its attachments, and spraying equipment. New lines could also be opened to finance entrepreneurs to purchase tool carriers for custom hiring and to manufacture tool carriers and attachments.

For crop loans, flexibility in the scale of finance is required to meet the demands of different cropping systems in different Vertisol areas. In 1982-83, average out-of-pocket expenses of the watershed farmers in the verification sites ranged from about Rs.800 per hectare in Andhra Pradesh to Rs.2200 in Madhya Pradesh. We feel that Rs.1000 per

hectare for a cropping year should be the minimum scale of finance with this technology. The maximum scale depends on the cropping system. For example, Rs.600 per acre may be sufficient to finance a mung-rabi sorghum sequential crop in Andhra Pradesh, but it would not be enough to cover the cost of most cropping systems in Madhya Pradesh. Moreover, some cropping systems are particularly sensitive to a shortfall in late season credit. The failure to protect pigeonpea from pod borer in December because credit has been exhausted could have disastrous economic consequences with a loss of up to Rs.2300 per hectare.

Loans should be negotiated for both rainy and postrainy season crops together within the same agricultural year. One loan with two disbursements is preferable. Moreover, land development and preparation should start as soon as the rabi crop is harvested. Therefore, the disbursement for the kharif season should be much well in advance of the start of the monsoon. It may be preferable to restrict larger farmers' borrowing up to the limit where a registered mortgage is not required for collateral because obtaining non-encumbrance and other certificates may considerably delay loan processing and disbursement.

The agricultural field officers of banks who process loans in these dryland projects should be intimately involved at the field level in managing, processing, and monitoring so that non-interest rate borrowing costs to farmers are reduced and collection efforts correspond to what has actually happened in the farmers' fields.

With the watershed approach, overdues and lack of land titles present additional complications. Technically, it is desirable and in many cases essential that all farmers participate in the development of

the watershed in the first year when the main and field drains are constructed. Should State Departments of Agriculture provide credit to watershed farmers who are defaulters or who do not have clear titles to land and who therefore are not serviced by banks? Can lending procedures be designed to improve loan recovery among farmers who are poor credit risks?

Summing up, the demand for both investment and short term credit will increase in wet deep Vertisol regions particularly in the first year, new lines of credit are required, lending norms should be flexible, and repayment performance will have to be carefully monitored. The main source of risk for lending institutions involves extending the improved technology to regions and areas where poor drainage does not constrain kharif cropping and to areas within the wet deep Vertisol region where little adaptive cropping systems research has been undertaken. Bankers should play an active role in monitoring the verification test results to acquire a better understanding of their economic implications.

Selection of Project Sites

Criteria for selection of project sites were discussed at the Second Policymakers' seminar. Participants felt that the following criteria were important: (i) a regional research institution should be nearby to help design the project and to conduct adaptive research as required when local problems arise in the on-farm projects, (ii) sites should be accessible, (iii) a godown should be available or built at the village sites, (iv) work should begin at the lower end of the watershed and work back to the upland areas, (vi) little irrigated land should be in the village or nearby, (vii) as far as possible areas requiring large

cropping pattern shifts should be avoided, and (viii) farmers should be willing to participate in the project and not be coerced. Are these criteria still valid in the light of last year's experience? Are there other relevant considerations that have been overlooked.

Scheduling of development activities over time and space also merits discussion. In most project sites started this year, the drainage system has not been completed. Should watershed development be finished in existing sites before the project expands to new sites in the same state?

Need for a National Framework for Watershed Development Authority

The Ministry of Agriculture, GOI has drawn up plans to progressively initiate development of 105 watersheds across the country. Several of these would be located in the deep Vertisol areas of India. There is an urgent need to develop national and state watershed management authority/ies to properly plan, execute and conduct dryland farming related development work in the selected watersheds. A preliminary schematic flow chart is shown at Figure III.

Training and Stability of Project Staff

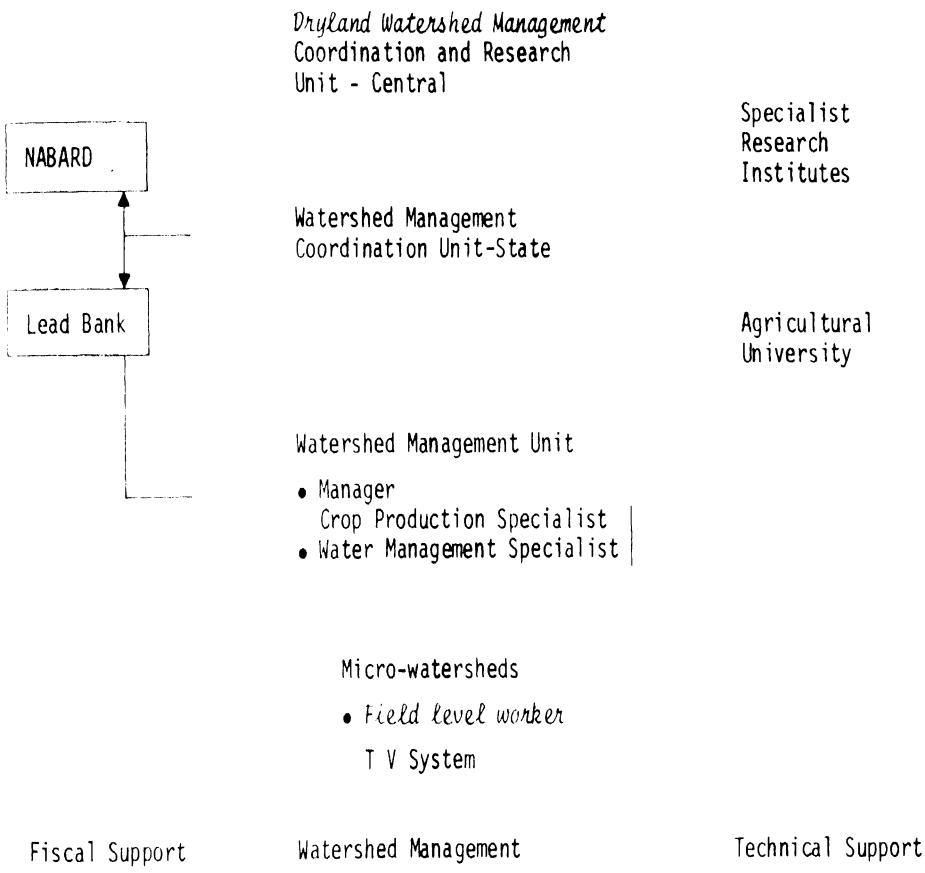
Soil conservation officers have the basic skills in watershed development, but they require training about land and water management specifications on the improved technology. Training of agricultural officers and farmers in the use of the wheeled tool carrier and its attachments is also essential.

The improved technology is intensive in its demand for timely and location specific information and skills. Transfer of the Vertisol technological options is especially vulnerable to the periodic transfer of extension and soil conservation staff. Transfer of staff also greatly diminishes returns to training.

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A Suggested Flow Chart for Administration and Support of Dryland Watershed Management.



AFC EXPERIENCE IN PROJECT FORMULATION
FOR WATERSHED DEVELOPMENT IN DRY ZONE - ISSUES

S U M M A R Y

Watershed is a technological unit of total development for economic upliftment of the inhabitants within an area. All resources are harnessed in a planned manner. Adequate management and mobilisation of resources are provided for sustained economic growth especially for those who are below the poverty line. AFC was entrusted by the Govt of Madhya Pradesh to prepare an outline for watershed development project in Dry Zone of Madhya Pradesh. The methodology adopted by AFC was to study the available resources and to identify issues for implementation of the project and also to prepare a schedule for implementation. Dry land farming technology has been developed by the Research Institutions in the recent past and 'lab to land' extension programme has also been incorporated by various research organisations, agricultural universities and Govt agencies. The complex development programmes envisage collection of agro-meteorological information, soil and land classification, inventory of resources, study of socio-economic conditions of the beneficiaries. A report on two identified project areas - Shajapur and Shahdol in Madhya Pradesh has been prepared. An agronomic plan has also been incorporated to suit the soil moisture conditions. Water harvesting sites have been located with a view to arresting runoff water. Small irrigation, besides soil and water conservation measures, horticulture development, forestry development and subsidiary activities have been identified.

Prepared by:

Agricultural Finance Corporation Ltd., Bombay,
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WATERSHED BASED DRYLAND FARMING IN
BLACK AND RED SOILS OF PENINSULAR
INDIA.

3-4 October 1983, ICRISAT Centre,
Patancheru, A.P. India.

The project outlay of Project Area-I Shajapur for a cropped area per year of 55,000 ha amounts to about Rs.195 million and in case of Shahdol Project Area-II the proposed cropped area is 23,800 ha and the financial involvement would be around Rs.71 million. The cost per ha. of cropped area in case of Project-I is Rs.3515 and in case of Project-II it is Rs.2970 respectively.

The credit requirements have been assessed, keeping in view the subsidy element that would be available from the Government. Organisational and Management requirements for implementation of such projects have been indicated. The analysis of benefits show the crop improvement and rise in productivity in both the areas. Several issues have been identified and listed for speedy implementation of the programme and for providing desired and varied benefits to all within a reasonable period. The cost-intensive project would have budgetary provisions to meet infrastructure development and institutional finance would supplement bankable schemes. It is felt that from the stand point of total development and to achieve desired benefits, integrated project approach would be effective rather than component wise approach.

INTRODUCTION

1. Watershed is a social, technological and economic unit for development while conserving soil and water and developing forest and related resources for economic growth. Protection of the resources, careful management through appropriate conservation measures and to provide economic development of the inhabitants within the watershed is imperative. Although river basin programmes have set forth desirable broad goals of resources utilisation, proper planning on micro-level watershed as a part of larger watershed have not been taken up in areas specially where rainfall is less and vagaries of rainfall cause havoc to the cultivators at times. "The Gap Situation" has led to the evaluation of watershed approach for effective use and development with a sense of common interest and mutual concern. AFC has assisted State Governments in different areas in preparation of Watershed Management Projects. In recent years, a sub-watershed project was taken up in Manipur and another project in Rangacherra in Tripura, both in the North-Eastern sector. Besides, Government of Madhya Pradesh had called upon AFC to prepare a project outline for two areas - Shadol and Shajapur - with a view to preparing norms for funding by multilateral agencies.

Importance of Dryland Farming

2. Agricultural production in the country fluctuates considerably year to year due to its dependance on rainfall and its distribution which are capricious and at times uncertain. About 71 percent (105 million hectares) of the present cultivated area is rainfed and vagaries of monsoon play a dominant role affecting agricultural production. About 70 percent of the Indian farming

community is involved in dryland/rainfed cultivation of such vast areas while producing only about 40 percent of the total food production. Development of dryland agriculture has been stressed in the previous 5 year plans. Even if all the resources are mobilised not more than 40 percent of the total cultivable land could be brought under irrigation in the foreseeable future. Therefore, about 60 percent of the cultivated area would still remain under rainfed. Co-ordinated research has developed appropriate dry farming technology with suitable crop planning and management by which productivity could be increased. Government of India have laid great emphasis on development of dryland farmers and called upon all research institutions for 'lab to land' transfer of technology and advised State Governments to give top priority for extension of programme. This is one of the most important components of 20 Point National Economic Programme.

Dryland Agriculture Research

3. With a view to increasing the production from dryland and rainfed agriculture, All India Co-ordinated Research Projects for Dryland Agriculture of ICAR, ICRISAT and Agricultural Universities have been engaged in research pertaining to development of dry farming technology for more than a decade. These institutions have already resulted in generating significant data/information on new HYV crops, short duration and drought resistant varieties, mid-season corrections in crop planning and suitable soil and water conservation measures. New agricultural implements have been developed and old ones modified suitably for efficient use in dryland cropping

sequence. Since water is the most limiting factor, a priority area of research has been instituted to develop the technique for water harvesting and recycling. Research has shown that in black cotton soil areas with moderate rainfall, there is positive scope for introduction of double cropping by sowing early kharif varieties. Agricultural scientists have recommended inter-cropping practices suitable to different dry zones to take advantage of residual soil-water.

Project Areas in Madhya Pradesh and Components:

4. At the instance of Government of Madhya Pradesh, AFC selected two watersheds in consultation with the Department of Agriculture. While selecting the project areas, the emphasis was that the area should be in the dry zone based on annual rainfall criteria (upto 1150 mm.) having a preponderance of weaker sections, scheduled caste and scheduled tribe population with no significant schemes being implemented at present nor had any developmental schemes or aided by and international agencies. Keeping these aspects in view, two project areas, viz., Chhoti Kali Sindh watershed in Barod and Agar blocks of Shajapur district (Project area-I) and Johilla watershed in Pushparajgarh block of Shahdol district (Project area-II) were selected. The maps showing location of Project areas are appended (Figures-1, 2 & 3).

5. Keeping the research findings in view, in consultation with research scientists/engineers of All India Co-ordinated Research Projects for Dryland Agriculture (at Indore for Malwa Regions, i.e., for Project Area-I and at Rewa for Vindhyan Region, i.e., for Project Area-II) and the concerned

M.P. DRYLAND AGRICULTURE PROJECT
MAP OF INDIA
SHOWING LOCATION OF
PROJECT AREAS

SCALE

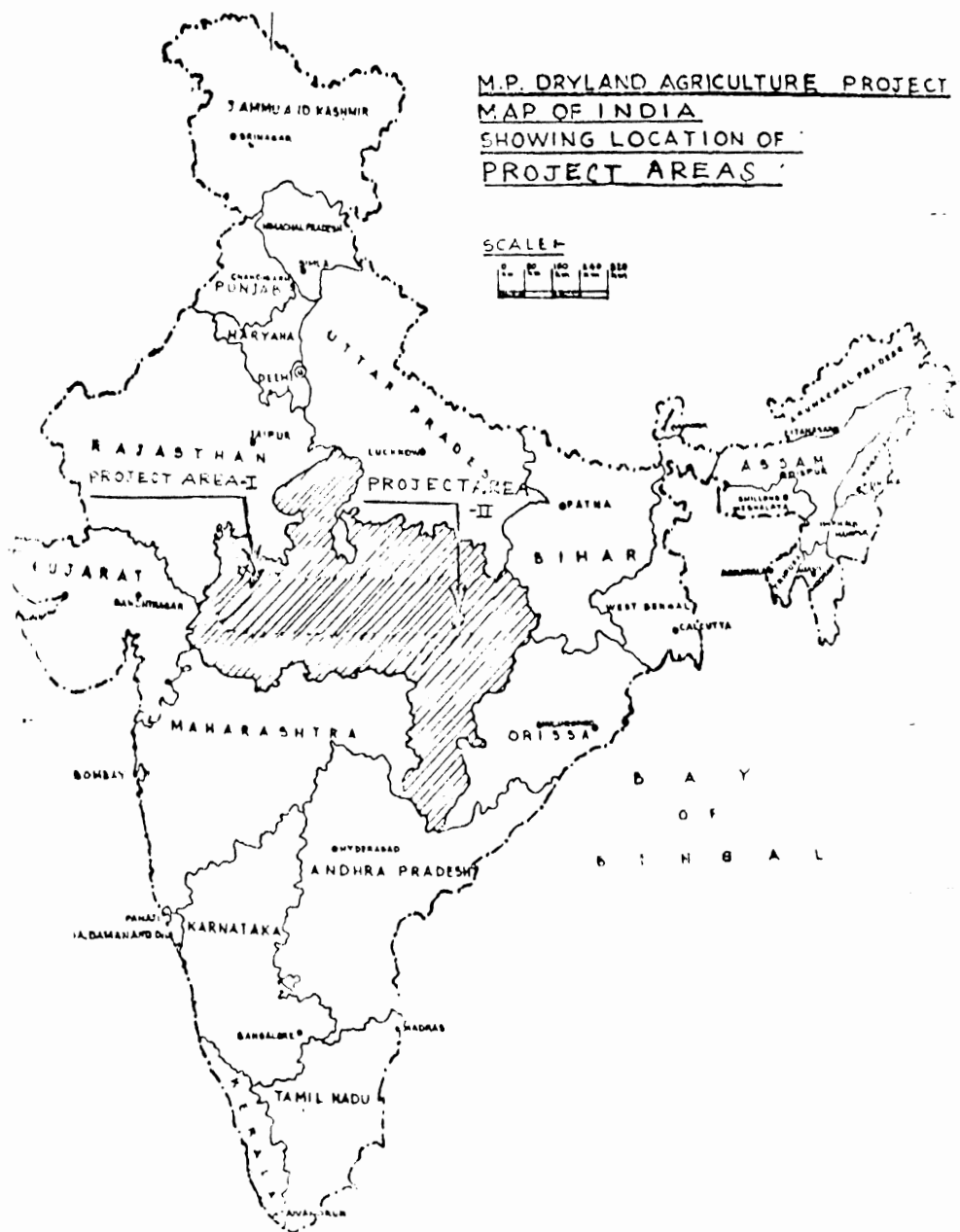
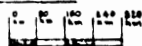
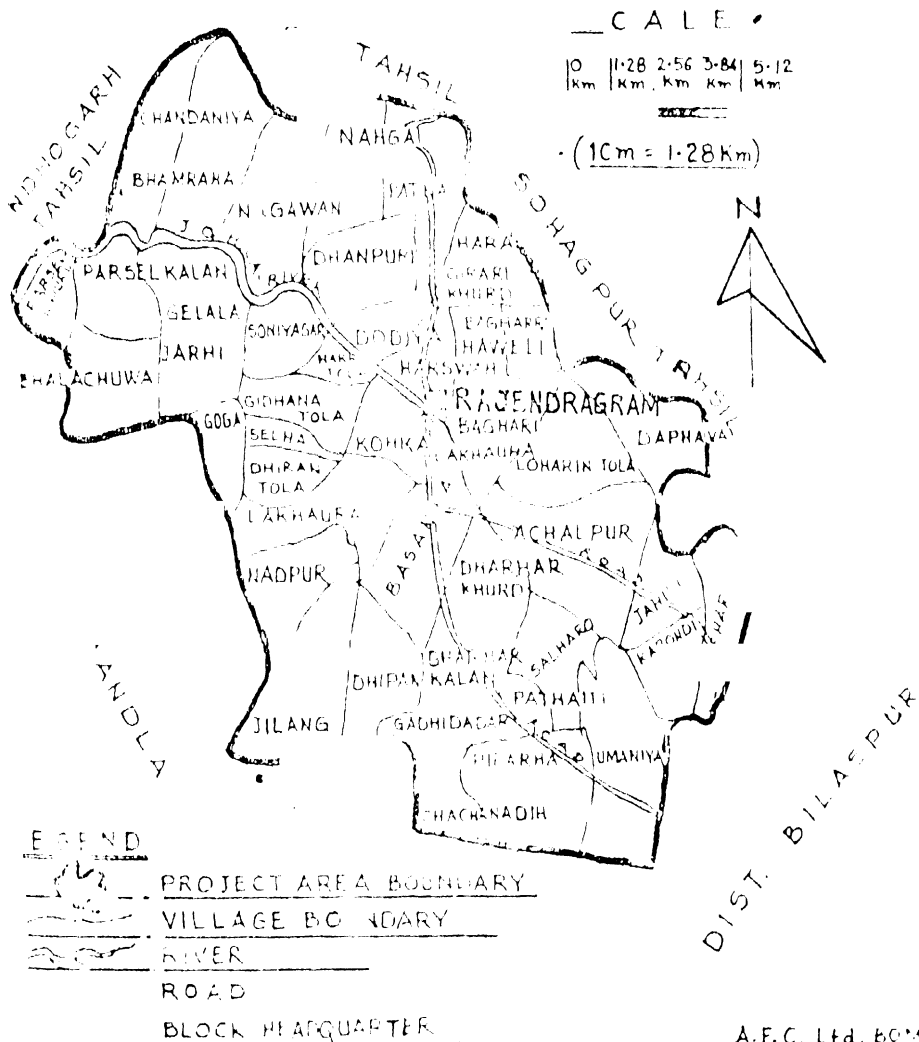


Figure-3

M.P. DRYLAND AGRICULTURE PROJECT
MAP OF PROJECT AREA II
(PART OF JOHILA WATERSHED IN
PUSHPARAJGARH BLOCK) SHOWING
LOCATION OF VILLAGES.
SHAHDOL DISTRICT.



experts of Departments of Agriculture, Soil Conservation, Horticulture and Forestry, Government of Madhya Pradesh, and based on agro-climatic, soil, rainfall and topographic conditions, the components most suitable for development of dryland agriculture in the project areas have been identified by AFC as given below:

- (i) Crop management with improved dry farming technology and use of suitable agricultural implements;
- (ii) Soil and water conservation/management measures and pasture development;
- (iii) Minor irrigation development;
- (iv) Horticulture development;
- (v) Forestry development; and
- (vi) Animal Husbandry.

6. In this paper, the approach, project components, agronomic review, project outlay and credit requirements and issues with references to the two project areas have been discussed. The methodology adopted for such a model watershed planning are:

- (i) Detail physical survey with a view to assessing all available resources - land, water and available manpower;
- (ii) Socio-economic and farm studies;
- (iii) Study of land tenure aspects;
- (iv) Survey/investigation with regard to infrastructure requirements and simple water harvesting schemes;
- (v) Land use and land capability classification;

- (vi) Subsidiary activities for employment;
- (vii) Suggesting appropriate management of the project;
- (viii) Preparation of implementation schedule; and
- (ix) Preparation of a banking plan.

SALIENT FEATURES OF PROJECT AREAS

7. The information on total geographical area, culturable command area, present cultivated area, topography, land use pattern, climate, population, classification farm size holdings, soils, irrigation, infrastructure facilities such as roads, communication, transport system, electrification, agro-processing facilities, credit institutions & status of agricultural credit, input supply, distribution network, marketing facilities, research/demonstration facilities, on-going schemes were collected through field visits and questionnaire/schedules from concerned govt. departments/agencies, financial institutions, etc., located in the project areas. The salient features of both the projects areas are given in Annexure-1.

8. Average annual rainfall of the Project Area-I is 297 mm having an average of 45 rainy days in a year, 94 percent of which occur in kharif season. Agriculture in the Project Area-I being dependent most on rainfed conditions is beset with risks and uncertainties. Inadequate rainfall and its uneven distribution along with frequent droughts in the area causes soil moisture stress to the crops grown which results in failure of crops at times. There are a few on-going schemes in district such as minor irrigation schemes for development of groundwater and lift irrigation scheme. About 81 percent of the population belonging mostly small and marginal farmers is engaged in agriculture of which 23 percent belongs to scheduled caste.

9. Average annual rainfall of the project Area-II is about 1193 mm. having an average of 92 rainy days in a year, 85 percent of which occurs in kharif season. Agriculture in the Project Area-II is totally dependent on rainfall in the absence of any irrigation facility. Sudden high intensity rain-storm at times cause flash floods resulting in severe soil erosion and damage to crops. Moisture stress due to uneven distribution of rainfall and long dry spells at times result in low production. About 84 percent of the total population is engaged in agriculture and 90 percent of population belongs to scheduled tribes. Small and marginal farmers constitute about 40 percent of the total farming community.

10. The farmers are still engaged in growing local varieties of crops with old farming practices. Mono-cropping is practised in both the areas. The present cropping intensities are 78 percent and 85 percent respectively in Project Areas-I & II . Average yields of various crops being 3 to 7 quintals and 2 to 6 quintals per hectare in Project Areas-I & II respectively.

SPECIFIC DEVELOPMENT REQUIREMENTS

Crop Planning

11. The present and proposed cropping patterns both in kharif and rabi seasons as well as perennial crops are given in Annexure-2.

Agricultural Implements

12. Farmers in both the project areas at present use only bullock drawn and manually operated traditional implements with very low field efficiency. Improved

bullock drawn and power operated agricultural implements/machinery for seed-bed preparation, sowing operation, interculture, plant protection equipments, harvesting and threshing equipments/machinery have been proposed. In Project Area-I, 22260 new implements/machinery and in Project Area-II, 3610 new implements/machinery have been proposed to be introduced by the farmers.

Soil and Water Conservation Measures

13. One of the most important components for increasing production in dryland agriculture is soil and water conservation/management. Suitable measures for moisture retention in the soil and storage of run-off water for recycling have been recommended for both the areas. In Project Area-I, at present, 1300 ha of land is covered under contour bunding. Recommended soil and water conservation/management and drainage measures are land shaping and smoothening, levelling and terracing, contour/graded bunding, construction of water harvesting-cum-minor irrigation tanks, construction of stop dams, pasture land development, construction and improvement of field and natural drains and suitable drop structures. Items such as construction of water harvesting tanks, stop dams, field drains, drop structures and pasture land development are proposed to be implemented as community items to be implemented by the Government. Rest of the items would be implemented on individual farmers' fields. Recommended measures for the Project Area-II are land shaping and smoothening, levelling and terracing, paddy & haveli bunding, construction of field drains, diversion and drop structures, construction of minor irrigation tanks, stop/check dams and pasture land development.

Minor Irrigation Development

14. Providing protective irrigation at critical stages during kharif season and pre-sowing and protective irrigations during rabi season, minor irrigation development in both the project areas has been proposed. Visits to the areas and examination of available groundwater data, water availability in the perennial streams/ rivers and discussions with State Government officials in the areas, have revealed that there is potential for development of both groundwater and lift irrigation. In Project Area-I, about 2470 dug wells irrigate about 2560 hectares at present. It is proposed to develop 1500 new open dug wells to irrigate about 2250 hectares, renovate 1000 old dugwells and convert/energise 1000 traditional lifting devices to irrigate additional area of 2000 hectares. It is proposed to install 11 community lift irrigation schemes in Chhoti Kali Sindh river for irrigating 450 hectares and 100 pumpsets to lift water by individual farmers for irrigating an area of 500 hectares. Besides these, proposed minor irrigation tanks, stop/check dams would irrigate about 520 hectares. Therefore, the total additional area that would be irrigated under the proposed programme would be 5720 hectares in Project Area-I. In Project Area-II, there is negligible irrigation facility at present. It is proposed to construct 300 new open dugwells with electric motor/diesel engine pumpsets to irrigate about 450 hectares and to install 50 diesel engine/electric motor pumpsets for lifting water from Johilla river to irrigate about 150 hectares. All these items are proposed to be implemented by individual farmers. Besides these, minor irrigation tanks, stop dams would irrigate about 260 hectares, thereby the total area under irrigation would be 360 hectares.

Horticulture Development

15. Research has shown that certain tropical and citrus fruit crops provide good yield and lucrative income in the dry areas. Even marginal and degraded lands can be suitably brought under horticultural crops. In Project Area-I, at present, a few farmers are growing Papaya, Guava, Mango and Lemon in small pieces of land and the area covered is 137 hectare. With a view to increasing horticultural production and income, 350 hectare is proposed to be brought under horticultural crops. In Project Area-II, no significant horticultural programme exists. Two hundred hectare is proposed to be brought under horticultural crops of Guava, Mango and Jackfruit.

Forestry Development

16. The Project Area-I is found to be partially denuded due to indiscriminate felling of trees and removal of vegetation. Out of 11400 hectare of fallow and pasture lands in the project area, 2500 hectares is proposed to be covered under farm forestry by means of bamboo plantation and introduction of fodder grass in individual farms. In Project Area-II, though some area (12.3 percent) is under forest, it is observed that some areas are denuded. Out of 3800 hectares of fallow and pasture lands in project area, 1000 hectare is proposed to be covered under farm forestry programme as in Project Area-I.

Subsidiary Activities Development Under Animal Husbandry Programme:

17. In dryland agriculture, use of locally available energy, ie., by bullock-power is more emphasised because of relatively low cropping intensity in the absence of assured irrigation facilities throughout the year. The

Project Area-I is located in the Malwa region, where traditional Malwi bulls/bullocks are good draught animals, on-going schemes such as, Operation Flood-2 and other State Government Cattle Improvement and Rearing Schemes in the district are concerned only with the improvement of female line for milk production. There is no significant scheme in the area for development and rearing of male line for draught purpose. There is a State Government Cattle Breeding Farm in the project area, which has the facility to produce good quality Malwi cattle, besides imparting training on improved animal husbandry management and production. Keeping these factors in view, a programme is proposed for rearing/development of male Malwi cattle in the project area by selected 600 farmers. Each farmer is proposed to be provided with two male calves for rearing from birth to normal working age of 3 years. Then these animals can either be used by the farmer or sold as draught animals.

18. There is demand in Project Area-II, for poultry eggs, meat, ham, pork-meat, draught animals etc. as the area has predominantly tribal population and there are various mining (coal, iron and steel) industries in the nearby region. In view of these development of poultry, piggery and cattle breeding/rearing are proposed in this area as subsidiary activities for supplementing income and employment opportunities to the farmers in the area. It is proposed to provide 50 individual farmers with units of 200 poultry birds (layers) each for production of eggs. Twentyfive units would be covered by one poultry co-operative society/estate, therefore, there would be two poultry co-operative societies. All inputs for rearing these layers will be provided at cost to farmers out of financial

assistance from financing institutions and subsidy from Government. One hundred piggery units of one boar and two sows of improved breed are proposed to be provided to 100 selected individuals/farmers under piggery development programme. Cattle breeding/rearing programme is proposed to be developed in two stages in the Project Area-II. First stage is by setting up a cattle breeding farm in the project area as a community item to be implemented by the State Government and second stage by providing two male calves to the farmers for rearing upto the working age. Cattle breeding farm will have 25 bulls for breeding of buffaloes. Necessary sheds, equipments, medicines etc. will be required. It is proposed to provide 350 selected farmers with 2 male calves each for rearing as draught animals.

PROJECT OUTLAY AND PHASING

19. The financial requirements for various components have been worked out on the basis of prevailing cost of inputs, materials, constructions, implementation, labour, machinery/equipments. The physical and financial outlay of all the components (component-wise) proposed for development for both the project areas are given in Annexure-3.

20. Total financial outlay for implementation of the proposed programme would be Rs.195 million and Rs.71 million for Project Area-I and Project Area-II respectively. The phasing of total investment cost is proposed to be 10 percent in first year, 15 percent in second year, 20 percent in third year, 25 percent in fourth year and 30 percent in the fifth year. In Project Area-II, all items components are proposed to be implemented as per above

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phases, except for setting up of cattle breeding farm by the State Government, which is proposed to be set up in the first year itself. The cost of the project works to be Rs.4330 per hectare of culturable command area or Rs.3515 per hectare of cropped area including horticulture for Project Area-I and Rs.3823 per hectare of culturable command area or Rs.2970 per hectare of cropped area including horticulture for the Project Area-II.

CREDIT REQUIREMENT

21. The component-wise credit requirements have been estimated for the project areas. For working out the credit needs for crop management with dry farming technology, the broad guidelines for assessment of credit as recommended by Reserve Bank of India have been followed. Since this is a special project for improvement of dryland agriculture for promoting productivity and production, 65 percent of the total cost of cultivation has been considered as credit requirement. Credit for agricultural implements has been estimated by subtracting subsidy available from Government and 10 percent margin to be provided by farmers from the total investment cost. In respect of soil and water conservation/management measures, about 75 percent of the cost has been taken as credit for individual items considering the composition of scheduled caste/tribe, small/marginal and other farmers in the project area and subsidy available to each category. In respect of community items, it is assumed that the State Government would spend 50 percent of the cost from budgetary resources and the remaining 50 percent would be credit. In respect of minor irrigation development, it is assumed that 25 percent of the scheduled caste/tribe farmers, 50 percent of the small farmers and 25 percent other farmers would avail loan. Considering the existing

subsidy pattern and margin requirements, it has been worked out that on the whole 75 percent of the cost of this development would be required as loan. For horticulture and forestry development, 75 percent of the cost would be credit and 25 percent would be margin contribution. For development of subsidiary activities under animal husbandry, 75 percent of cost would be credit. Thus, the total credit requirement has been estimated at Rs.132 million and Rs.48 million respectively for Project Area-I and Project Area-II. The credit would be required phased over a period of 5 years in the same proportion as described under financial outlay above.

ORGANISATION AND MANAGEMENT

22. The project would be implemented under the overall supervision, guidance and support of agriculture department of the Government of Madhya Pradesh. Assistance from concerned departments would be forthcoming. The collector of the district should be the Project Co-ordinator with the staff assistance of functional departments especially the Tribal Development Department. As the projects are located in backward areas lacking in many essential facilities such as accommodation, education etc., these would have to be suitably provided to the staff to avoid frequent transfer of development staff.

23. Success of such a project depends mainly on effective extension activities and education of the beneficiaries for adoption of improved technological practices. The majority of the beneficiaries in the project areas belongs to weaker sections and are not receptive to scientific methods of agriculture and livestock rearing. Vigorous extension work would have to be undertaken for them. Therefore, suitable extension machinery with adequate

staff and facilities would have to be provided in the project areas both at block and grass-root level for motivating the farmers for their effective participation in the project. The grass-root level extension workers would have to suitably identify themselves with the beneficiaries. Training programme for the development staff and financing institutions would have to be conducted for effective implementation.

24. The organisational structure in the project areas should be as per the actual requirements and work load. However, a suggestive pattern of organisation for each of the two project areas is given in Annexure-4.

25. For successful implementation of the project, it would be advisable to set up micro-watershed level committees. The exact composition of the committee would be decided by the Collector of the district, Project Executive and other relevant authorities.

MONITORING AND EVALUATION

26. A monitoring and evaluation cell would have to be set up in the Department of Agriculture at the State level for periodical appraisal and monitoring of the progress for implementation of the project.

BENEFITS AND CONCLUSIONS

27. The productivity and income would increase substantially when the project is successfully implemented. The cultivated area under oil seeds and pulses and their total production would also increase manifold. A weaker sections of the society, especially small/marginal farmers, scheduled castes and scheduled tribes would be benefitted

significantly. Details are summarised in Annexure-5. The total annual agricultural production from both the project areas would be about 103,355 tonnes after implementation of project as against present production of 36,005 tonnes. Total annual net income expected to be generated from the project would be Rs.88.69 million from all activities as against the present figure of Rs.14.15 million.

28. Implementation of the project would generate substantial additional employment potential in both the project areas and in the district in the field of distribution and supply of inputs, cultivation, harvesting, processing and marketing of agricultural produce, construction, operation and maintenance of irrigation/soil conservation measures, servicing and repair of pumpsets, engines, agricultural implements/machinery and allied activities.

PROJECT FORMULATION - ISSUES

29. Watershed Management has been accepted as an Integrated Area Development Programme to mobilise all resources, minimise erosion and ultimately to provide economic benefits in a specified area. Integrated Development signifies development of all resources for planning and implementation in a unit area. Planning increased agricultural production while utilising all land and water resources within a reasonable period would be the aim of the project. Components for integrated area development such as soil and water conservation measures, water-harvesting and re-cycling of stored water to raise agricultural productivity, grass land and pasture development, livestock and other activities for

subsidiary income - all these would form part of development programme. Research institutions have come out with new package of practices for dry land agriculture and, therefore, these are necessary to be incorporated. The State Government Agency would identify potential watersheds and codify them on the basis of state priority. It is felt that significant development and supervision of credit would be more harmonious in a compact area than scattered financing. It is also felt that formulation of schemes, implementation of the programme followed by proper management of the resources would provide desired benefits. In an area development programme, infrastructure development is considered essential and should be taken up as a priority item. This would facilitate participation by financial institutions. The development component of the project would be demarcated into community items and individual items. State budgetary resources would be utilised to develop infrastructure development and bank finance would be on the basis of individual and group scheme identified.

30. The major issues in planning and implementation of dryland agriculture project are:

- (i) non-availability of maps - cadastral and aerial;
- (ii) non-availability of adequate socio-economic data and also data pertaining to farms;
- (iii) inventory of resources - land and water not readily available;
- (iv) water harvesting structures for small storage of water for recycling;
- (v) allied activities related to agriculture especially, Cattle Development Programme and Poultry Development due to non-availability of infrastructure and suitable livestock;

- (vi) unit cost for implementation of the project is comparatively higher in dryland areas;
- (vii) officers experienced in land use management, soil conservation and agronomic planning are not readily available at the project level;
- (viii) village level workers are not exposed to take up similar work for total integrated development;
- (ix) motivation to take up watershed development programme with new package of practices;
- (x) timeliness and adequacies of supply of various inputs;
- (xi) appropriate network for marketing of additional produce;
- (xii) flow of credit inadequate;
- (xiii) documentation procedure and availability of land and revenue records cumbersome;
- (xiv) lack of trained supervisory personnel for implementation and management; and
- (xv) constant monitoring and evaluation of such integrated projects.

atg

DIFFERENT FEATURES OF THE PROJECT AREAS

Sl. No.	Particulars	Project Area-I	Project Area-II
1.	2.	3.	4.
1.	Name of Watershed & Location	Chhoti Kali Sindh in Agar & Barod Blocks of Shajapur District	Johilla Watershed in Pushparajgavla Block of Shahdol District
	Latitude	23°33' - 23°55' North	22°45' - 23°55' North
	Longitude	75°41' - 76°14' East	81°35' - 81°45' East
2.	No. of villages covered	115	45
3.	Geographical area	58,293 ha.	23,040 ha.
4.	Culturable command area	44,891 ha.	18,656 ha.
5.	Cultivated area	38,742 ha.	16,021 ha.
6.	Fallow land	6,149 ha.	2,635 ha.
7.	Forests	372 ha.	2,842 ha.
8.	Pastures	5,274 ha.	1,408 ha.
9.	Area covered under roads, villages etc. (unfit for cultivation)	7,756 ha.	334 ha.
10.	Average rainfall (annual)	827 mm.	1,193 mm.
	Average number of rainydays per year	45	92
11.	Population	66,076	10,357
	Population engaged in agriculture	55,258 (81%)	9,094 (84%)
	Scheduled caste/tribe population	15,722 (23%)	10,044 (93%)

1.	2.	3.	4.
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12. Classification of farm holdings (No.)

0 - 1 ha.	3,120	355
1 - 2 ha.	2,369	202
2 - 4 ha.	2,670	285
4 - 10 ha.	2,575	348
Above 10 ha.	1,011	218
Total:	<u>11,745</u>	<u>1,408</u>

13. Soils

Light soils with murrum & small pebbles - 20% of the area	Medium to deep black soils - 50% of the area
Sandy loam to light black cotton soils - 20% of the area	Clay loam soils - 17% of the area
Light black to medium black cotton soils - 60% of the area.	Sandy loam soils 23% of the area.
Depth of soil 30 cm. to 750 cm. (90% of the area has depth more than 90 cm.)	Light soils with murrum and pebbles - 10% of the area.
pH range 7.5 to 8.5	Depth of soil 1 to 4 metres.
	pH range 7 to 8

14. Topography

60% of the area has relatively flat to moderately sloping topography	25% of the area has less than 1% slope. 20% area has slope of 1 to 2 percent.
Foot hill zones - 20%. Intermountain valleys of elevated area - 20%	30% area has 2 to 3% slope. 25% area has slope of more than 3%.

Annex.1 (contd.)

1.	2.	3.	4.
15.	Status of irrigation	Number of irrigation wells (open dug) - 2407	Number of open dugwells - 9
		Electric pumpsets - 760	Number of irrigation tank - 1
		Diesel pumpsets - 345	Irrigated area .
		Traditional lifts - 1365	29 ha.
		Area irrigated - 2506 ha.	

PRESENT & PROPOSED CROPPING PATTERN

Season	Crops	Area in ha.	Crops	Area in ha.
1.	2.	3.	4.	5.

PROJECT AREA-I:

Kharif	Jowar, Bajra, Maize, Cotton, Paddy, Groundnut, Soyabean, Urad, Mung, Arhar, and Chillies	30,812	Jowar (hybrid, improved, local), Hybrid Bajra, Maize (hybrid & local), Cotton, Arhar, Mung, Urad (improved), Groundnut (impro- ved), Soyabean (improved) and Chillies. Intercropping of Jowar & Mung, Urad; Jowar & Soyabean & Arhar and Cotton & Arhar.	39,700
Rabi	Wheat (HYV), Hybrid Gram (irrigated & unirrigated) Linseed, Opium, Green Pea, Cowpea & other vegetables	4,254	Wheat (HYV & improved), Gram (improved), Safflower (improved), Opium Linseed, Onion vegetables	4,995
Perennial	Sugarcane	158	Sugarcane	
Total :	--	35,224		55,000
Cropping Intensity	--	78%		123%
Oilseeds	--	982		9,525
Pulses	--	3,155		9,675

Annex. 2 (contd.)

1.	2.	3.	4.	5.
<u>PROJECT AREA-II:</u>				
Kharif	Paddy, Kodo, Maize (improved), Ramtil, Millets	10,976	Paddy, Hybrid Maize, Kodo, Soyabean, Arhar and Ramtil	15,900
Rabi	Wheat, Gram, Rai/Mustard, Linseed & Barley	4,929	Wheat (HYV), Gram (improved), Linseed, Rai/ Mustard and Vegetables	7,900
Total :		15,905	--	23,800
Cropping Intensity		95%	--	127%
Oilseeds		3,100	--	5,625
Pulses		1,640	--	4,675

COMPONENTWISE PHYSICAL & FINANCIAL OUTLAY

Components	(Rs. in lakhs)			
	Project Area-I		Project Area-II	
	Physi- cal outlay	Finan- cial outlay	Physi- cal outlay	Finan- cial outlay
1.	2.	3.	4.	5.
1. Crop management with improved dry farming technology and use of agricultural implements:				
(a) Crop production (total) Cropped area per year after full development	55,000	756.60	23,800	276.00
(b) Agricultural implements (total number)	22,260	30.30	3,610	6.30
2. Soil and water conservation/management measures and pasture development:				
(a) Individual items (cumulative area proposed for treatment) under various measures	69,700	342.80	22,900	184.30
(b) Community items (cumulative area proposed for treatment)	45,700	253.60	18,400	99.30
3. Minor irrigation development:				
(a) Individual items (area proposed to be irrigated)	4,750	330.60	960	56.10
(b) Community items (area proposed to be irrigated)	450	19.80	--	--

Annex.3 (contd.)

1.	(Rs. in lakhs)			
	2.	3.	4.	5.
4. Horticultural development (total cropped area proposed)	350	47.60	200	25.10
5. Farm forestry development (total area proposed to be covered)	2,500	96.30	1,000	38.50
6. Subsidiary activities under animal husbandry programme:				
(a) Cattle breeding farm (25 bulls for servicing buffaloes (community item)	--	--	1	4.80
(b) Cattle rearing for draught animals (units of 2 male calves each)	600	16.50	350	9.60
(c) Poultry development (units of 200 layers each)	--	--	50	6.20
(d) Piggery development (units of 1 boar and 2 sows each)	--	--	100	7.10
Total:		1944.10		713.30

SUGGESTIVE ORGANISATION PATTERN

Sl. No.	Category/Staff	Number/Unit
1.	Project Manager (In the rank of Deputy Director of Agriculture with adequate accounts and establishment staff)	One
2.	Assistant Project Manager (In the rank of Assistant Director of Agriculture)	One
3.	Agronomist	One
4.	Agricultural Economist-cum-Statistician	One
5.	Soil conservation sub-divisions under the charge of Assistant Soil Conservation Officer	One unit for every Rs.20 lakhs expenditure
6.	Extension Officer	One for every 6 VLWs or 3 officers per block
7.	Village Level Workers	One for every 300 farmer families

PRESENT AND EXPECTED BENEFITS

Items of Benefit	<u>Project Area-I</u>		<u>Project Area-II</u>	
	Present	Proposed	Present	Proposed
Number of villages benefitted	115	115	45	45
Total cropped area (ha)	35,224	55,000	15,905	23,800
Cropping intensity (percent)	78	123	85	127
Total agricultural production (tonnes)	25,936	78,480	10,069	24,875
Productivity per hectare (tonnes)	0.73	1.43	0.63	1.05
Kharif season:				
- Area (ha.)	30,812	39,700	10,976	15,900
- Production (tonnes)	15,988	41,755	7,605	17,225
Rabi season:				
- Area (ha.)	4,254	14,950	4,929	7,900
- Production (tonnes)	5,208	22,725	2,463	7,650
Oilseeds:				
- Area (ha.)	982	9,525	3,100	5,625
- Production (tonnes)	552	8,830	730	3,550
Pulses:				
- Area (ha.)	3,155	9,675	1,640	4,795
- Production (tonnes)	1,753	6,930	820	3,180
Fruits:				
- Area (ha.)	137	350	--	200
- Production (tonnes)	599	2,330	--	2,150
Total Net Income (Rs. Lakhs)	89.10	612.00	52.40	272.49

NATIONAL BANK FOR AGRICULTURE AND RURAL DEVELOPMENT (NABARD)

Credit Support for Dryland Farming and Watershed Development*

Introduction

The National Workshop on Dryland Farming organized by the Department of Agriculture and Cooperation, Government of India in April 1983 called upon NABARD to organize Workshops jointly with ICAR and ICRISAT on regional basis on financing of dryland farming.

2. Certain recommendations have been made by the National Workshop relating to credit and cooperatives (see Annexure I). Since then, at a Seminar of Agricultural Economists organized jointly by the ISAF, ICRISAT, and the AICRPDA during August 22-24 at ICRISAT Center, the economic variability of dryland technologies and the broad credit aspects thereof were briefly discussed. Yesterday's presentations by the ICAR and ICRISAT and the discussions that followed have helped us greatly in understanding the technical and economic aspects of the new technologies. In this paper it is proposed to discuss the ways for removal of constraints to adoption of dryland technologies by, and their accessibility to, farmers, formulation of micro-watershed projects and schemes thereunder to form the basis of financing, viability aspects of the projects/ schemes for watershed-development, and the different aspects of ensuring credit support for the programmes.

3. Framework laid

The strategy for the implementation of a massic programme of dryland farming under the 20-point programme, spelt out by Government of India, provides for an intensive approach through micro-watershed development, and an extensive approach for spread of technologies. Funding and the organizational arrangements for implementation, and review thereof at the state, district and project levels have been indicated.

4. The intensive approach involves an integrated development of each selected micro-watershed covering, on an average, an area of about 1000 ha. It calls for a multi-disciplinary effort including crop production, soil and water management, agro-forestry, animal husbandry, horticulture, pasture development etc. About 4200 micro-watersheds are understood to have been identified by the states covering an area of about 4 m. ha. In the 4 states of Andhra Pradesh, Karnataka, Madhya Pradesh, and Maharashtra about 1100 micro-watersheds have been identified involving an

*Prepared by NABARD for NABARD-ICAR-ICRISAT Workshop on Watershed-based Dryland Farming in Black and Red Soils of Peninsular India.

Suggestions have been made in the paper to form the basis for discussion, in the light of which an official view will be taken.

area of about 10 lakh ha. Outside the selected watersheds, an area of one million ha. is to be covered under dryland farming technologies in the 4 states in 1983-84. Under this program, all know technologies of dryland farming covering the distribution of seed-cum-fertilizer drills and other improved implements, use of improved seeds and fertilizers, adoption of suitable cropping patterns, deepening/ renovation of tanks/ponds etc., promotion of intercropping, double cropping, agro-forestry etc. are to be disseminated amongst the farmers for adoption in all areas where agriculture is being practised under rainfed conditions.

5. In order to motivate farmers to adopt the improved cropping practices under dryland farming, Government is providing free of cost improved/drought resistant varieties of seed, fertilizer, seed mini-kits, seed-cum-fertilizer drills, and other small agricultural implements. Properly operated, the subsidy program can help create demand for inputs and credit in subsequent years. The extension arrangements proposed for the integrated development of the micro-watersheds and other dryland/rainfed areas play a crucial role in the process of developing motivation for a sustained effort.

6. Funds for carrying out the different programs in each micro-watershed are to be earmarked by the Government of India and the states concerned from the relevant on-going programs in the central and state sectors depending on the outlay worked out for each component. In respect of individual components, assistance provided for by way of subsidy and loan from institutional agencies varies from investment to investment. These involve water harvesting schemes, minor irrigation items, such as sprinklers, bore wells, shallow tube wells etc. lining of water conveyance systems, land shaping, levelling etc. In respect of investments undertaken by small/marginal farmers the level of subsidy is higher. Under the Centrally Sponsored Scheme for increasing agricultural production, small/marginal farmers will get a subsidy assistance (shared equally by Government of India, State) ranging from 25 to 50 per cent of the investments for minor irrigation and construction of water harvesting structures. In the case of community-based water harvesting structures and drainages, the recommendation of the National Workshop is that they should be done at Government cost.

7. Agro-forestry is an important component of dryland farming. The National Workshop recommended that agro-forestry should be taken up on field bunds along farm roads, and nullah sides affected by soil erosion and land patches of farmers where no cultivation is possible and on farms where protection by trees is desirable. Suitable species have been identified for the purpose and the need for setting up of nurseries in each micro-watershed, training of the beneficiaries in agro-forestry practices etc. have been stressed.

8. Another component is livestock development. Availability of fodder trees and pastures in the watershed areas would help livestock development. Among the activities suggested are sheep/goat rearing, dairy farming, poultry etc. depending on the silvo-pastoral systems suggested for each watershed. Under the centrally sponsored scheme Rs.0.5 lakh per block is available for providing subsidy for agro-forestry programs. Researches undertaken have shown that goat and

sheep rearing are feasible and economically viable in the arid zones.

9. The State Governments are to plan, implement and monitor the dryland programs. The National Workshop has recommended a phased program for the purpose. For implementation and review, certain organizational arrangements are visualized. These are: (i) setting up of a multi-disciplinary cell at the state level; (ii) setting up of a multi-disciplinary cell at the district level; (iii) setting up of a project implementation committee at the watershed level, under the charge of the Project Officer, and (iv) setting up of a district level coordination committee headed by the Collector to bring about effective coordination among all the participating departments, agencies, financing banks etc. Grass root level organizations are also proposed to take care of the community work like drainages, water-harvesting structures etc.

10. The success of the dryland farming program, in particular the micro-watershed development program depends, essentially, on its viability, and acceptability by farmers of the dryland farming technologies developed and on how, in practice, the concept of integrated development of micro-watersheds is translated into one or more viable, bankable programs.

11. Technology

In the last about 10 years, ICAR through its All-India Co-ordinated Research Project for Dryland Agriculture (AICRPDA) conducted valuable research work through its Research Centres located in various agroclimatic regions. Further, in pursuance of the recommendations of the National Workshop, ICAR is reported to have formulated a number of projects for watershed development on the basis of detailed surveys and prepared designs for water harvesting/soil conservation structures and improvement of crops on the basis of technologies developed for different areas. In addition, various other integrated dryfarming development projects have been taken up in different locations, with the support of international organizations like the Ford Foundation.

12. Simultaneously, ICRISAT, where we are now meeting, has also been doing valuable research work for stabilizing and increasing the productivity and production of 5 major crops grown in Semi-Arid Tropics of this country. The technologies developed by it have been widely tested in some areas of the 4 states represented here as discussed in the paper presented by ICRISAT yesterday.

13. A technology base is now available for (a) crop management, (b) soil and water management, and (c) equipments to be used in the dryland/rainfed farming areas (about 105 m. ha). Recognising that the watershed approach requires time to be given effect to on scientific lines, the improved dryland/ rainfed farming practices are proposed* to be propagated in the first instance so that farmers would stand to benefit immediately though not optimally from the technologies.

14. For the red soils (Alfisols) as in the case of deep black soils

*See Field Manual on Dryland Agriculture by MOA., GOI.

(Vertisols) farmers have choice of different cropping systems, each of which is associated with specified soil/water management practices and use of implements.

15. In respect of the deep black soils (Vertisols) the recommended technology is considered suitable for 80 m. ha. and involves, as brought out in the technical papers presented yesterday, construction of main and field drains, broad bed-and-furrow system and adoption of improved inter/double/sequential cropping systems, according to local situations. A specially designed equipment known as 'Tropicultor' drawn by bullocks is used for making the broad bed and furrows. It has been claimed that the system offers a base for achieving a quantum jump in the production of oilseeds.

16. As brought out in yesterday's presentations by the ICAR/ICRISAT, the application of technologies, though in limited areas, has resulted in increased yields and incomes to farmers and they have been found profitable. The benefits in terms of additional production and incomes especially to small/marginal farmers, and additional employment in the rural areas, are also evident. But studies* have also brought to light a number of constraints to their adoption some of which appear to be general, but many are specific to certain areas. Broadly speaking, the following types of constraints/limitations have been noticed:

- i. There is a general tendency among farmers to adopt those components/elements of the technology, which produced substantial immediate increases in incomes.
- ii. Adoption of improved technologies in the first instance appeared to be, due to the availability of heavy subsidies. Withdrawal of subsidies has led to declining interest in the continued use of technologies. It appears that the good points of the technologies have not been sufficiently emphasised to make them acceptable on their own merits.
- iii. There is also a tendency to adopt first those practices of the farming systems which do not require soil and water management measures, but which are easy of application.
- iv. Community action does not come forth where community water harvesting structures, drainage works etc. are involved and constitute the essential parts of the technology. Where these are done at Government costs there are problems of maintenance.
- v. Farmers generally preferred to use the traditional implements with some improvements, instead of going in for new implements which would cost more, and needed maintenance.
- vi. Fertilizer consumption improved substantially, but risk also likewise increased in the case of small farmers who do not have sufficient

*Presentations made at the Seminar on Technology Options organized by ISAE and ICRISAT In August 1983.

choices to reduce risks.

- vii. Arrangements for supply of inputs like fertilizer, seed, pesticide etc. in the dryland areas are not adequate.
- viii. Marketing and processing arrangements are not adequate in the dryland areas. This results in farmers not getting remunerative prices.
- ix. Price incentives are not adequate, especially for pulses and oilseeds, which are mainly grown in the dryland/rainfed areas. Farmers are not adequately motivated to grow these crops adopting new technologies.
- x. There is general reluctance to borrow funds from financing institutions for the purchase of costly equipments, e.g. Tropicultor. There are no agencies to hire out tropicultors or bullocks, or sprayers. There should be suitable arrangements to provide these on hire basis.
- xi. There are a number of defaulters of cooperatives on account of their earlier failure to repay loans when they were not given conversion facilities. They are ineligible for fresh loans if they want to adopt new technologies.
- xii. One of the major problems faced is low yields on account of failure to adopt timely pest control measures to prevent damage to crops. Sometimes this is due to lack of equipment for spraying. Another reason is lack of labour at the right time for weeding operations on account of shortage of labour. Where returns are not adequate to repay loans by the due dates, the burden of repayment should be spread over a longer period.
- xiii. Recovery of loans is low. In many areas, cooperatives are not able to extend loans on account of their overdues and commercial banks and RRBs have not extended their operations. Farmers also appear to be reluctant to approach financing agencies for assistance, on account of cumbersome and time consuming procedures.
- xiv. Often the recommendations for improved practices do not take into account the type of soil or resources and capability of the farmers to adopt the technology. This exposes farmers to risks.
- xv. On account of risks of failure of crops under the new technology, the farmer is not assured of even the income he was getting under traditional method of cultivation. Accordingly, in order to cover risks there should be crop insurance. Till such time as this is introduced, farmer should be assured of income he was getting under traditional farming. The burden of repayment should be spread over a longer period.
- xvi. In order to reduce risks, introduction of technology in stages i.e. 'tier system' of technology may be adopted.

- xvii. Banks are hesitant to finance dryland farming because of risk of default. (In addition to the fact that they do not have adequate technical staff). They should have suitable motivation.

17. While the basic soundness of the technologies and their profitability as observed in the operational research centers and in certain areas appear established, their adoption in larger areas has to be made feasible and economically viable. This calls for removal of the various constraints illustratively listed above, and the technologies being made more easily accessible to farmers, supported by effective extension service so that credit needs get more clearly orchestrated. How best the constraints illustratively listed above can be removed has to be discussed.

18. Micro-watershed approach

A watershed approach facilitates, as emphasized by the National Commission on Agriculture, focussed attention being paid to the various aspects of technology adoption discussed above. There seem to be three ways of translating watershed approach into programs. For adopting any of the three, the first requirement is a micro-watershed project report, which would set out the various alternatives available for introducing the technologies on a viable basis. It would cover components relevant to improved crop management practices, alternative land use systems, animal husbandry and infrastructure support consisting of extension, input supply, marketing and processing. This would be a multi-disciplinary effort to be undertaken by an agency which has already, perhaps, developed expertise in that regard. The watershed schemes prepared/being prepared by the ICAR for land-water management in the micro-watersheds adopted by it, can, perhaps, form the basis for such integrated projects. Identification of suitable agency for formulation of projects and funding for the purpose needs to be considered at this stage (AFC has prepared a few watershed development projects).

19. One way is to adopt a farmer-family approach under which each farmer would be given a program for his holding. The program, prepared jointly by the financing bank and project technical staff, would cover the dryland technology the family would adopt in terms of crop management practices, soil and water management measures and equipments, and the alternative land use systems (agro-forestry, agro-horticulture etc.) it would adopt. Where it is feasible and the family is interested, animal husbandry would also be included in the program. The program would be specific to his soil-water situation, and tailored to the family's resources position, and would take into account his willingness to exert himself to improve his incomes. The program for the family can be so designed (assuming the prescribed level of subsidy) that it would become viable, given the supporting arrangements.

20. Under this arrangement, small/marginal farmers would not be in a position to invest on costly equipments like the proposed tractor or on bullocks of the size suited for the purpose. In the red soil areas also, farmers do not appear to be inclined to invest funds on new equipments. This being the case, arrangements would have to be made to supply equipments and, where feasible bullocks also, either through the primary agricultural credit societies, if these are considered suitable

to undertake the task with appropriate financing and staffing support, or through unemployed educated youths trained under TRYSEM willing to set up custom hiring units for the purpose. If such units are set up, they would besides hiring equipments for land shaping, spraying etc. may also undertake spraying in the fields of farmers and do such other items of work like distribution of improved seed, fertilizer, pesticides etc. required within the watershed areas. These units also can be provided financial assistance. Community works like drainages and common water harvesting structures etc. would have to be got done by the project authorities at government cost as already provided for, and the maintenance thereof would be entrusted to a groups of farmers who would derive benefits from the structures.

21. The second alternative is to proceed component-wise in each micro-watershed. For the development of each micro-watershed under this approach, there would be 3 or 4 schemes. One scheme would cover all the farmers willing to undertake improved crop management systems, together with or independently of soil and water management measures and improved equipments. It could be for a group of farmers having similar soil conditions or receiving benefits from given community facility like common drainage or common water-harvesting structure. Likewise another scheme could be for adopting alternative land-use systems (i.e. agro-forestry, silvo-horticulture) and a third for animal husbandry etc. For the credit institutions this would be similar to the present schematic approach.

22. Under the third approach, an organisation at the grass root level would have to be given overall responsibility for executing the works, (including providing infrastructure) other than those that the farmers would themselves carry out. It would receive funds from banks/government for the work done for the farmer, and from the government for community items. It could be a panchayat or a cooperative or even a voluntary organization. The advantage in this arrangement is that banks would not deal with the individual farmers but with the organization set up for the farmers which would work jointly with Project Officer and his staff for executing the program and effecting recoveries. This method needs to be tried out on a pilot basis.

23. Depending on the allocation of districts in each state among the lead banks, the micro-watersheds can be allocated among the lead banks and the state cooperative banks and state LDBs, and a banking plan prepared for each state. The preparation of watershed projects may be entrusted to AFC/lead bank. They may undertake the task, jointly with the Department of Agriculture, Animal Husbandry and Forest Department etc. making use of watershed plans prepared by the ICAR/ICRISAT. The feasibility of this arrangement may also be discussed in the workshop.

24. Viability aspects

Among other things, viability of the technology and its accessibility to farmers are important for facilitating flow of institutional finance. In the presentations yesterday by the ICAR and ICRISAT, the technical and

economic aspects of the new technologies have been discussed. The claims about the economic viability of the technologies have been disputed by some agricultural economists based on their own studies.*

25. Their main contention is that the technologies have been tried out in limited areas under conditions when most of the capital expenditure was met by the Government or heavily subsidised and when the farmers in limited areas, received focused attention of Government extension machinery and research workers. High cost of inputs and labour, high interest on loans and lack of storage and marketing facilities and other infrastructure such as roads, and, above all, lack of attractive prices for the main produce of dryland areas, viz. pulses and oil seeds, have been cited as the factors which rendered technologies in some cases non-viable. Arising from this diagnosis, prescriptions have been suggested which range from subsidized inputs and loan assistance, more assured supplies of inputs and credit, risk cover, better storage and marketing arrangements, to higher support prices for dryland crops.

26. Price incentives as well as subsidized credit are matters for the Government to decide. However, it has to be recognized that unless the supporting arrangements are taken care of by the State Governments, which, perhaps, will be easier if a project approach for each watershed is adopted, other efforts towards ensuring viability of the technologies may be of little avail.

27. The second aspect is the adoption of a total approach to the programs undertaken by each beneficiary in a watershed, i.e. combining improved crop, soil-water management technologies with agro-forestry/horticulture/silvo-pastoral and animal husbandry programs. These alternative farming systems while promoting, eco-balance, provide fuel and fodder, and are reported to be profitable. These are more essential in the case of small/marginal farmers. In order that these can be tried out on a larger basis, expertise needs to be built up in the financing agencies and concerned Government Departments for formulation of area schemes, even as training programs/demonstrations are organized for the farmers. Depending on the gestation period of the tree crops and the mix of farming system, the repayment program can be worked out, after allowing for farmers' maintenance, saving for the rainy day etc. This is an aspect on which specific proposals should be made by those who will be called upon to prepare the project reports.

28. Subsidy and viability

Various levels of subsidy have been indicated for different items of investment, and even for current expenditure, in order to motivate farmers to adopt the technologies and minimize the loan burden, and in the process to improve the viability of the investment. A point has been made that most of the programs supported by subsidies tend to be discontinued once the subsidies are withdrawn. Subsidies of one type or another, therefore, may achieve far less spectacular results than originally expected; but in the long run may undermine the original

*Some of the presentations made at the Seminar organized by the ICAR/ICRISAT in August 1983 on "Technology Options for Dryland Agriculture - Potential and Challenge"

objectives. For instance, the association of institutional loans with subsidies has tended to blur the distinction between the two, to the disadvantage of financing institutions. In the dryland areas there is need for developing suitable procedure so that farmers understand the motivation offered by subsidies and the obligation associated with loans. The National Workshop's recommendation that there should be close linkage between subsidies and loan assistance, perhaps, need to be understood in this context. For instance, would it be feasible to work out all the subsidies that would become available to farmers and for the community works from different Government Departments like Agriculture and Soil Conservation, Minor Irrigation, NREP, Horticulture etc. in a micro-watershed on the basis of a project, and establish a loan limit in relation to that subsidy assistance and get the work done through an organization like Panchayat/Voluntary agency, involving all the beneficiary farmers, thereby delinking individual beneficiaries from the subsidy assistance?

29. Workshop may discuss various alternatives available to promote better arrangements for linking subsidy with loan, and use of subsidies for promoting (a) motivation for adoption of technologies, and (b) viability of investments in the context of dryland farming.

30. Unit cost

For ensuring the viability of technology costs have to be reasonable. The unit cost for various items of work in dryland/rainfed farming widely varies from place to place. There are large number of items of work which it would be difficult to prescribe any uniform cost other than indicating some range or guidelines. It would appear that a unit cost for any item of work/investment (e.g. equipments) that is far higher than the farmer is used to paying would shy away farmers from adopting the technologies. Even when farmers are willing, it would not be prudent to drive them into debt trap if alternative ways of carrying out the improvements at less cost can be introduced. For this purpose, while preparing the project report for each watershed, it has to be examined whether any cost effective methods of undertaking the works of soil and water management, spraying, drainage construction etc. and whether costs could be reduced if they are done on a community basis or by a panchayat or voluntary agencies or cooperative organizations. Government Corporations undertaking the work would be uneconomical, as experience has shown.

31. Risk and viability

Traditionally dryland farming has been found to be risky. With large investments that the technologies involve, the farmer runs greater risks if there is a failure of crops. Suggestions have been made that there should be crop insurance to safeguard the interests of farmers undertaking dryland technologies. This is an issue within the purview of Government of India. Till such time as a suitable crop insurance scheme is formulated, the need for providing some kind of risk cover to farmers adopting new technologies has been stressed at various forums. In the case of Cooperatives, the National Workshop had recommended that a scheme may be evolved to provide assistance to the Bad debt fund of the Cooperatives in the dryland areas where uncertainty of crop production is

likely to affect the repaying capacity of farmers. This is to be extended to areas not covered by crop insurance. In so far as banks are concerned, the schemes of DICGC are intended to protect their interests in respect of their financing of agriculture. The gaps in the existing arrangements to cover the risks of farmers and of institutions may be discussed.

32. Institutional credit support

Institutional credit support needs to be designed for dryland farming keeping in view not only the strategy adopted by the Government of India for dryland/rainfed farming, but also the possibility of a World Bank Project for the purpose, starting with a project for the 4 states, likely to materialise in the near future. For this purpose two aspects have to be taken care of; one is the organizational arrangements and other is the framework of policies and procedures.

33. Under the multi-agency system it would be possible to ensure that one or the other financing agency viz. cooperative, PACS/ PLDB, commercial bank branch or RRB branch takes care of each of the selected micro-watersheds. The agency mainly entrusted with the financing of a watershed should be suitably equipped to provide, either by itself or in coordination with other agency, all the types of credit and related services needed by farmers as far as possible at one place. A program needs to be prepared by the states by which the PACS which have the jurisdiction over the identified watershed areas are adequately strengthened and equipped and their functions suitably diversified so that in respect of their members they will be able to provide adequate credit and related support for dryland/rainfed farming. For developing PACS on the lines recommended by Sivaraman Committee (CRAFICARD) guidelines have been issued by NABARD to states. Preference will have to be given by states for developing PACS serving micro-watershed areas not only on the lines indicated but also to suit the specific needs of dryland farming. Simultaneously, the PACS have to be assisted to acquire storage accommodation to handle fertilizer, improve seed, insecticide, equipments etc. The DCCBs with jurisdiction over the watershed are expected to coordinate the activities of the cooperatives viz. PACS, marketing societies etc. in the selected watershed. The National Workshop recommended that the DCB concerned may earmark an officer for the purpose, and that GOI may consider meeting the cost from the Cadre Fund.

34. It has been pointed out repeatedly at the highest levels that the performance of cooperatives under the 20-Point Programme, IRDP etc. has not been commensurate with the widespread organizational network they have built up. Cooperative banks have to understand the implications of their participation in dryland farming in term of expertise and additional technical staffing required for formulation of schemes and supervision thereof, delegation of powers for sanction of schemes to branches and of simplification of procedures, and suitably equip themselves for the purpose.

35. Some of the PACs may also require additional staff/assistance in order to be able to prepare programs for each farm family for undertaking the improved crop management, soil-water management, agro-forestry,

animal husbandry programs and for supervision. This calls for State Government/Apex Bank/LDB providing assistance to selected PACs for strengthening their staff or otherwise. In respect of the term credit assistance to farmers under the programs so prepared, PACs may have to function as the agents of the LDB. This would call for suitable amendments to Bye-laws, if not already done, and coordination between the concerned SCB and LDB.

36. For providing credit assistance to non-members of cooperatives, it has to be ensured that the selected micro-watershed comes under the jurisdiction of a branch of CB or of RRB operating in the area. This has to be done at the District Coordination committee level. NABARD can assist RRBs for appointing technical personnel for formulation of schemes, supervision etc. Appropriate training programs also need to be organized for such staff for which sponsor banks may have to take the initiative. Requisite staffing arrangements at the concerned branches of the commercial banks would also be necessary to support the programs. Where finance is provided by CB/RRB, linkage with the cooperative/private retail outlet will have to be forged so that, to the extent feasible, credit is provided in kind.

37. Policy and procedure for financing

The policies currently followed by the financing institutions for providing credit assistance, with NABARD refinance, cover all the purposes for which either short-term credit or term credit would be required under dryland/rainfed farming and watershed development (see Annexure II). Short-term production credit is provided by PACs on the basis of scales of finance fixed for different crops from time to time. The loan representing inputs is generally advanced in kind.

38. From time to time, improvements/relaxations are being made by NABARD in the matter of sanction, disbursement etc. of credit for cooperatives so that flow of funds for production is not interrupted. Thus, small/marginal farmers having overdues upto 10% are treated eligible for fresh finance. Non-defaulting and new member of PACs not eligible for credit support are allowed to be financed. Rehabilitation programs have been approved to certain states which involved recovery of the overdues pertaining to the period of drought over a long period of time subject to state government taking certain measures, including provision of long-term assistance to cooperatives.

39. In the context of a dryland schemes sanctioned by NABARD in Medak district (A.P.) on the basis of ICRISAT technology, certain refinements have been made in the loan terms. Thus, production credit advanced in the first year is allowed to be capitalized and recovered over a longer period along with the term loans. Refinance assistance is provided upto 95 per cent of the loan amount covering the first year's expenditure, including on farm investment. Considering that the land records are not upto-date and title to the property cannot be easily established, the financing bank has been advised to give special consideration and not insist on the mortgage security. (Under the Reserve Bank's instructions, security may not be insisted upon for loans upto Rs.5,000/-).

40. Crop management practices that are being propagated under dryland

farming are location-specific and relate to the soil-and- water management measures contemplated and have to be considered technically feasible. They may involve, in the place of the traditional method of single crop, double, inter or sequential cropping, which would impose new demands on credit institutions, so far accustomed to traditional crop financing. It has been also mentioned that soil series in the same village may be different from place to place, which means that the recommendation as to farming systems may have to be similarly different for different soil series in the same village.

41. The technology associated with each of the farming systems involves new practices, observance of timing of operations, (the operations are generally to start well before the rains), placement of seed and fertilizer in a given manner, weeding operations and application of pest control measures at a particular point of time etc. While these call for greater skill and application on the part of the farmer, he also needs more timely, diversified, and more frequent and larger, support from the delivery system designed for inputs and credit, than under the traditional single crop farming. His need for technical guidance/extension support also would be much greater.

42. In the light of these needs, it has to be considered how best the present system of fixing a credit limit for each member can be improved to facilitate flexible operation on the credit limit by farmers to suit double cropping/inter/sequential cropping. It has to be considered whether a cash credit type of account (as recommended by various Committees) which can also take care of the ups and downs in crop yields, and the need for dryland farmer saving for the rainy day, would be more suitable. In the light of discussions and the requirements indicated in the suggested project reports, needed refinements may have to be introduced in the procedures.

43. In so far as term loans are concerned, they would be available from the financing agencies on scheme basis with refinance from NABARD for all purposes relevant for dryland technology according to the terms and conditions currently in force (see Annexure II). The purposes include minor irrigation, soil conservation water harvesting/moisture conservation, renovation/deepening of ponds, bunding, terracing of different types etc. NABARD has formulated model schemes for a variety of purposes including minor irrigation, animal husbandry, social/farm forestry, horticulture etc.

44. Financial assistance can be made available for family-based program, or component-wise schemes on the basis of the micro-watershed project, taking into account their viability and supporting arrangements. The question of bank providing bulk finance to any organization authorized to raise funds and entrusted with the task of executing the entire project and empowered to recover costs (recommended by the National Workshop) is also under consideration.

45. In the context of watershed development what is, however, immediately required is strengthening of the field staff of the financing agencies for the formulation of the schemes jointly with the government's technical departments. How best this can be done may be discussed.

46. Banks with NABARD refinance can also finance service centers which might be set up in the micro-watershed areas so that they can acquire equipments (tropicultor, spraying equipments etc.) and provide custom services to farmers. Such service centers may also undertake supply of fertilizers, pesticides etc.

47. The need for the states providing processing facilities for the produce grown in the micro-watershed areas was also stressed by the National Workshop. It has recommended that NCDC may prepare plans for organizing processing units in consultation with the states. Where agro-processing units are set up, especially where they are linked with production programs, NABARD would be in a position to assist them, if suitable schemes are formulated as part, or independently of, the watershed development projects in the dryland areas.

48. Stabilization arrangements

The Reserve Bank of India had introduced, following the recommendations of the Rural Credit Survey in 1954 a system of providing relief to the farmers affected by wide-spread crop failures under what is known as the stabilization arrangements. Since then, in pursuance of recommendations of various committees including the Overdues Committee of the Reserve Bank some refinements have been introduced in terms of which farmers affected by wide-spread and successive crop failures, as well as the institutions which were providing assistance to them, could be provided relief so that the channels of credit remained open and the farmers were enabled to continue their production activities. Over the years considerable assistance has been provided by RBI/NABARD under these arrangements especially in states affected by frequent crop failures. Under the NABARD Act now, loans can be extended up to a maximum period of 7 years in areas affected by crop failures. The deteriorating overdues position of the cooperatives (as well as of commercial banks) shows that all is not well with the existing arrangements. For instance, it has been observed that the institutions are not availing of these facilities to the full extent resulting in their showing an inflated picture of overdues. The present arrangements also need to be examined in the light of how they have been availed of, and whether all those who are in genuine difficulties in the repayment of loans, as, for instance, the farmers in the dryland/ rainfed areas, have been assisted. What supplementary arrangements are called for in the case of rainfed/dryland areas in order to ensure flow of credit are being examined in the light of experience gained so far.

49. A point has been raised that on account of their past overdues in respect of which they did not get any relief although the defaults were for genuine reasons, many farmers in dryland areas are not eligible for fresh loans for adopting new technologies. If there is adequate evidence to show that the earlier defaults were for genuine reasons and there was institutional failure to provide relief, perhaps, a rehabilitation scheme could be formulated by the concerned state government (as in Gujarat), under which the overdues are spread out for repayment over a period and the farmers are made eligible for fresh loans for cultivation. State government may have to make out a case for this purpose so that it can be examined.

50. Overdues

Once the watershed development projects are formulated, the dimension of different types of credit and the character of such needs would be known. This would be the basis for considering the need for a fresh approach. In so far as the massive program of minor irrigation development through small/marginal farmers is concerned, the credit dimensions are broadly known and banks have been duly advised about the liberalized procedure for obtaining refinance.

51. However, the major bottleneck coming in the way of extending credit support for dryland/watershed/minor irrigation etc. is the problem of overdues. In the 4 states represented here, the overdues have been quite high in recent years (see Annexure II) both in respect of short-term as well as long-term cooperative credit structures. The eligibility of the institutions, as a result, for refinance assistance from NABARD and for making fresh loans has been considerably reduced. Recovery position of commercial banks is no better.

52. In terms of the covenant entered into by the GOI and NABARD with the World Bank, certain eligibility criteria have been introduced and are now in force. In terms of these, branches of CBs/RRBs with recovery performance of 65 per cent and above (including state government's share capital contribution of upto 10 per cent of demand in the case of LDBs) can undertake unrestricted lending in their jurisdiction. However, those banks with recovery performance below this level of lending are required to regulate their loaning either with reference to the average lending level reached by them in the preceding 5 years or upto the amount of average recoveries in the preceding 3 years, whichever is higher. These criteria are applicable only to borrowings from the NABARD and there is no restriction to their making advances out of their own resources. Whatever eligibility is available, banks are expected to use it for financing weaker sections, IRDP, dryland farming etc.

53. While, broadly speaking, the immediate credit demand in the watershed areas for dryland farming/watershed development is not likely to be of such an order as to create credit bottlenecks, still the banks' eligibility will have to be stepped up in order that they can satisfy the emerging credit demand. On the other hand, in the case of the massive program of supporting minor irrigation investments through small/marginal farmers for which a subsidy of Rs.3.5 lakh is available for each block, there is an urgent need, on the part of the banks, to improve their recovery performance so that this program of national importance gets adequate support.

54. There is, therefore, need for ensuring prompt repayment of loans by farmers where the capacity exists, in order to promote larger flow of credit assistance for dryland agriculture. Towards this end, on the one hand, there is need for prompt action by the institutions, supported by the state authorities, in recovery of dues from wilful defaulters. Often, state interference in the recovery of banks loans. While part of the overdues may be due to institutional failures to respond to the needs of farmers in genuine difficulties, still a substantial part would be on account of wilful defaults.

55. There is need for determined action by the states to bring down such defaults. While attempt should be made to provide relief to farmers in genuine difficulties, there should also be an organized effort to arouse social consciousness in favour of prompt repayment, so as to obviate the need for coercive action, both for prompting institutional viability and community's prosperity.

This is what NABARD is trying to do through the Vikas Volunteer Vahini, launched by it in November last year. The object is to spread the principles of development through credit among farmers with the help of small/marginal farmers who have themselves benefited from proper use of credit. This method of conveying the message to farmers has already been tried out in two districts of Tamil Nadu with some success. In the micro-watershed areas where training of farmers in the new technologies will be taken up, the program of training may also cover education of farmers in the sound use of credit through adoption of the five principles of development through credit.

56. Conclusion

In the light of the foregoing, the workshop may deliberate and identify the actions to be taken by (a) state governments, (b) financing banks, (c) AFC, (d) NCDC, (e) ICAR/ICRISAT, (f) NABARD, and (g) Government of India in respect of the following:

1. Measures for improving dryland technology adoption by farmers.
2. Measures for quick preparation of micro-watershed development projects and on that basis formulation of bankable schemes/programs for various components/farm families.
3. Measures to improve viability of the technologies/schemes/programs formulated within the micro-watershed.
4. Measures to improve flow of institutional credit assistance for dryland farming and watershed development.

Annexure-I

National Workshop on Dryland Farming

Recommendation on Credit and Cooperative

Support to Dryland Farming

A National Level Standing Committee should be set up to review the program of credit, input distribution, marketing, processing and storage of agricultural produce for making them more effective and suggesting measures to simplify the procedures, wherever necessary. The Committee should consist of Senior Officers of the Union Department of Agriculture and Cooperation, Ministry of Rural Development, Ministry of Finance, NABARD, RBI, N.C.D.C. and NAFED and also about four representatives of the State Governments.

(Action: Addl. Secretary (K), Ministry of Agriculture)

. The existing pilot crop insurance scheme should be modified to ensure that institutional credit in the 42 model watersheds selected for integrated development, is covered by an effective insurance scheme. In dry farming areas, there may be need for re-sowing of the same crop or any other crops for which seed and other facilities are to be made available under the insurance scheme itself.

(Action: Addl. Secretary (K), Ministry of Agriculture)

3. The subsidy to be given under the new program of Assistance to Small and Marginal Farmers should be effectively tied up with institutional credit in dryland areas.

(Action: State Governments)

4. Where land/water management works are to be undertaken by a public sector organization for the benefit of individual farmers, institutional credit should be given to these organizations. For this purpose, the financing institutions may give loans to the individual beneficiaries who will get the work done through the public sector organizations. Alternatively, the financing institutions may directly finance the public sector organization on the guarantee of the State Governments and it will be the responsibility of these organizations not only to execute the work and ensure its maintenance but also to repay the loans.

(Action: NABARD)

5. Secretary, Agriculture and Cooperation, Ministry of Agriculture announced that with a view to expediting the sanction of the dryland farming schemes by NABARD, the Technical Committee set up in the Agriculture Ministry for examination and clearance of the schemes referred by NABARD, should be wound up with immediate effect. Instead,

NABARD itself may hereafter evaluate and sanction various dryland farming schemes.

(Action: NABARD)

6. In each watershed areas, the Central Cooperative Bank of the district should earmark an officer to coordinate the activities of the cooperatives in the selected watershed. The Government of India may consider whether the assistance made available under the Cadre Fund, could be extended to cover the cost of this officer in the selected watersheds.

(Action: State Govts./Addl. Secretary (K), Ministry of Agriculture)

7. For each watershed area, a suitable cropping pattern should be worked out and the scale of finance determined periodically for different crops. The Central Cooperative Banks covering these areas, should be given priority under the Central Sector scheme for assistance towards non-overdue cover.

(Action: State Govts./Addl. Secretary (K), Ministry of Agriculture)

8. At least one institutional retail outlet for distribution of fertilizers and seeds should be available within each watershed area or within a distance of 5 kms.

(Action: State Governments)

9. The primary cooperative marketing societies covering the watershed areas, should be strengthened with assistance from N.C.D.C. for distribution of inputs and marketing of agricultural produce.

(Action: State Governments and N.C.D.C.)

10. N.C.D.C. in consultation with the State Governments and State MARKFEDs, should prepare a plan for organizing processing units in the selected watersheds, wherever necessary.

(Action: N.C.D.C.)

11. Cooperative godowns in the selected watersheds should be utilized for grant of pledge loans, particularly to the small and marginal farmers.

(Action: State Governments)

12. The integrated system of production, processing and marketing of oilseeds, worked out by the NCDC and NDDB, needs to be extended to various dryland farming areas.

(Action: Addl. Secretary (K), Min. of Agriculture/N.C.D.C.)

13. The State Governments should utilize the assistance available under the NCDC's scheme for integrated development of pulses around Dal mills.

(Action: State Governments)

14. As in the case of the erstwhile SFDA/MFAL schemes, a scheme may be evolved to provide assistance for Bad Debt Fund of the primary societies and the central cooperative banks in the dryland farming areas where uncertainty of crop production is quite prominent, affecting the repayment capacity of individual farmers. This needs to be provided in areas not covered by the crop insurance scheme.

(Action: Addl. Secretary (K), Ministry of Agriculture)

15. NABARD should organize a Workshop on financing of dryland farming program on regional basis in collaboration with ICRISAT, ICAR etc.

(Action: NABARD)

Annexure-II

Credit requirements of farmers refinance facilities available from NABARD

The country has now adopted a multi-agency approach to agricultural lending comprising cooperatives, commercial banks and regional rural banks (RRBs). In the cooperative credit structure there are two separate wings for dispensing credit; short-term and medium-term, on the one hand, and long-term credit on the other. Short-term and medium-term structure is of three tier one with state cooperative banks (SCBs) at the apex level, the central cooperative banks (CCBs) at the intermediary or district level and primary agricultural credit societies (PACs) at the base level. The long-term cooperative credit structure is, however, a two tier one, comprising the state or central land development bank (SLDB) at the state level and primary land development banks (PLDBs) or branches of SLDB functioning at sub-division or taluka level. The commercial banks mostly provide loans direct to agriculturists. However, where the cooperative credit structure is weak these banks also provide loans through primary agricultural credit societies. The RRBs provide direct credit assistance to small and marginal farmers and rural artisans. Only in few cases do they route the loans through primary agricultural credit societies. Unlike the cooperative credit structure, both the commercial banks and RRBs provide all types of credit-short, medium and long-term.

Short-term loans for agricultural operations

Short-term loans for agricultural operations (crop loans) are granted to the cultivators to take care of the current outlay on raising crops and to assist them to switch over from the subsistence level of farming to commercial farming by adopting improved farm technology. The cultivators' requirements for crop loans are two fold, those for meeting miscellaneous cash outlays during the production period and additional cash expenditure necessitated by adoption of improved cultural practices and those which can be disbursed in kind such as improved seeds, chemical fertilizers, pesticides etc. As it is not possible to make an item-wise calculation of cash outlay likely to be incurred by the cultivators, the cash component is regarded, mainly as, 'a ways and means' accommodation to the cultivator intended to augment his resources for the purposes of cultivation. Crop-wise per hectare scales of finance for these two components are fixed by the financing banks in consultation with expert groups.

Short-term credit limits

With a view to supporting the lending operations of the short-term cooperative credit structure and of RRBs, the National Bank for Agriculture and Rural Development (NABARD) provides short-term credit limits to the state cooperative banks and to the RRBs at a concessional rate of interest of 3 per cent below the Bank Rate, on the basis of

certain norms prescribed by it. The accommodation sanctioned by NABARD is in the nature of cash credit accommodation. This means that the drawals and repayments under the sanctioned credit limits can be made as many times as required, provided the outstandings do not at any time exceed the sanctioned credit limit.

Credit limits are sanctioned by NABARD to the state cooperative banks on behalf of its affiliated central cooperative banks. The eligibility for credit limits from NABARD is based upon certain criteria. These are (i) level of overdues and (ii) eligibility on the basis of owned funds of CCBs. Limits are generally applied for and sanctioned before the close of the cooperative year ending 30 June in order to maintain continuity of operations from the next year commencing from 1 July. CCBs whose overdues as on 30 June of the year preceding the year when the application is submitted are 60 per cent or more of the total demand for the year are not eligible for a credit limit from NABARD. However, if the overdues as on 30 June are brought down, following the submission of application, sanction of credit limits to such banks are considered even in the following cooperative year. The maximum eligibility of a CCB is worked out with reference to its audit classification and owned funds.

The refinance facilities provided by NABARD to state cooperative banks for financing seasonal agricultural operations are subject to certain financial disciplines. These are (i) non-overdue cover; (ii) seasonality discipline relating to minimum level of recovery performance; (iii) sanction of separate limits for kharif and rabi seasons; (iv) minimum level of performance in regard to advances to small farmers; and (v) banks not maintaining unduly high call and short-term deposits with commercial banks while borrowings from NABARD are outstanding.

The seasonality discipline currently in force envisages that in order to be eligible for drawals from the credit limit sanctioned from 1 April (i.e. after the marketing season for Kharif crops is over) a CCB should have recovered and remitted to the apex bank at least 40 per cent of current demand under short-term agricultural loans or 30 per cent of the total demand (whichever is less). Similarly, a recovery performance of 40 per cent of total demand should be achieved for eligibility to operate on the limit sanctioned for the next cooperative year (1 July onwards). Earlier, banks which did not achieve the above recovery performance were prohibited from drawing on the credit limits. Relaxation has now been granted and the banks are allowed to operate on the credit limits from the date from which the discipline is complied with.

Short-term credit limits for financing seasonal agricultural operations are sanctioned separately for the two distinct agricultural seasons viz. kharif and rabi, in order to ensure that large funds to meet both the kharif and rabi requirements are not placed at the disposal of the banks from the beginning of the year. In some states such as Punjab and Haryana where rabi financing is more predominant than kharif financing and in states where there is multiple cropping throughout the year only one limit is sanctioned which is available throughout the year.

With a view to ensuring that at least a certain proportion of the short-term credit limits sanctioned by NABARD for seasonal agricultural operations are utilized by the CCBs for financing the weaker sections viz. small and marginal farmers, while sanctioning credit limits, a condition is stipulated that a certain specified portion of the limit (which varies from 10 to 50 per cent of the total advances issued, but in majority of cases has been fixed at 20 per cent of the limit) should be utilized for disbursing advances to small/marginal farmers.

NABARD provides refinance support upto 50 per cent of the eligible loans granted by RRBs for short-term agricultural purposes.

The lending rates prescribed to be charged to the beneficiaries are as under

- | | |
|--|-----------------------------|
| A. Small farmers
(loans upto Rs.5000) | Not exceeding 11.5 per cent |
| B. Others | Not exceeding 14 per cent |

Marketing of crops

NABARD provides refinance facility for marketing of crops to the cooperatives with the twin objective of (i) assuring a reasonable price to the grower for his produce by enabling him to hold on his produce for a better price and (ii) ensuring the linking of the recovery of the production credit with marketing. The expression 'marketing of crops' includes activities which are necessary in the process of marketing the agricultural produce and include the collecting, pooling, grading, storage, and processing prior to marketing for the purpose of selling it at reasonable prices. The scope of this accommodation covers (a) advances against pledge of agricultural produce belonging to members; and (b) outright purchase of agricultural produce of members. Credit limits from NABARD are available only in cases where cultivators availing of produce pledge loans from cooperative marketing societies, entrust the marketing of crops to the societies and the societies themselves agree to recover the production and other dues of the agricultural credit societies out of the marketing advances or the sale proceeds thereof.

Credit limits can also be utilized by banks to enable affiliated societies to make advances against outright purchases made by the latter from their members with the usual safeguards as regards margin, insurance etc. provided the production dues are also recovered out of the sale proceeds and remitted to the primary agricultural credit societies. This marketing finance is also available to the societies which combine marketing activity with processing activity to facilitate marketing operations on better terms subject of certain conditions.

Procurement, stocking and distribution of chemical fertilizers

Refinance is being provided by NABARD for purchasing, stocking and distribution of chemical fertilizers in respect of such of the cooperative marketing federations/societies which, due to certain special circumstances, are unable to secure necessary credit from the cooperative

banks from their own resources or from commercial banks including nationalized banks. The sanction and the quantum of credit limit depend, among other things, on the credit requirements of the unit, the unit's ability to maintain margins, its operational efficiency etc. The accommodation is charged interest at 1 per cent above the Bank Rate.

Marketing and processing activities of dairy cooperatives

Refinance facilities from NABARD are sanctioned for purposes such as (i) purchase of milk from affiliated societies; (ii) chilling, pasteurisation and bottling of milk including conversion of whole milk into standardized, toned and skimmed milk; (iii) processing of milk into milk powder and butter; and (iv) transportation and incidental charges such as octroi etc. incurred in collection and despatch of milk. State cooperative banks availing of refinance from NABARD for dairy cooperatives should ordinarily route it through the central cooperative banks. However, in exceptional cases where the CCBs are not in a position to channelise the funds, the state cooperative banks may directly finance district cooperative dairies and state/district federations of milk supply societies. The accommodation is being charged interest at Bank Rate.

Medium-term investment credit

While NABARD provides refinance facilities by way of medium-term or long-term loans to all eligible institutions which include state cooperative banks for financing project type investments, medium-term limits from the National Rural Credit (Long-term Operations) Fund are being provided to the state cooperative banks on behalf of the district central cooperative banks to enable them to provide finance for term investments in agriculture. Increasing emphasis is however, laid on schematic financing for agricultural investment purposes by submitting specific schemes for NABARD's approval. The various purposes which are deemed as approved under the relevant section of NABARD Act for obtaining medium-term limits are given below:

1. Sinking of surface wells and tubewells.
2. Surface wells/tube wells with pumping sets.
3. Pumping sets.
4. Repairs to/deepening/boring of wells.
5. Reclamation of land/land improvement.
6. Bunding of land.
7. Preparation of land for orchards and plantation crops.
8. Farm machinery such as tractors, power tillers, harvesters etc.

9. Agricultural implements, e.g. iron ploughs, trailers, carts etc.
10. Transport equipments.
11. Milch cattle.
12. Poultry farming.
13. Pig breeding.
14. Sheep as well as goat rearing.
15. Purchase of storage bins.
16. Purchase of rubber rollers.
17. Pump houses (upto Rs.1000).
18. Bullocks/bullock carts.
19. Camel/camel carts.
20. Dunlop carts.
21. Pisciculture.
22. Gobar gas plants.

The rate of interest charged on the medium-term credit limits sanctioned by NABARD to the state cooperative banks is 3 per cent below the Bank Rate. The rates to be charged to the ultimate borrowers have also been prescribed by NABARD, as under:

A. Minor irrigation and land development purposes (all types of borrowers)	10.25 per cent
B. Other purposes	
i) Small farmers (loans upto Rs.5000)	10.25 per cent
ii) Others	12.50 per cent

Medium-term (conversion) loans

Medium-term conversion facilities are allowed whenever conversion of short-term agricultural loans into medium-term loans becomes necessary on account of widespread drought in the area as a result of natural calamity. Medium-term conversion loans are available for converting short-term dues of agriculturists/societies from such areas only where the crop yield is declared by the State Government concerned at not exceeding 50 per cent of the normal crop yield i.e. where the annewari

is declared at 6 annas or less. The rate of interest charged on the medium-term conversion loans is 3 per cent below the Bank Rate.

Rephasement and rescheduling of medium-term conversion loans/instalments

NABARD provides facilities of rephasement and rescheduling of medium-term conversion loans in case of recurrence of natural calamities. If during the pendency of a medium-term conversion loan, natural calamity re-occurs and crops are affected to such an extent as to justify stabilization arrangements again, the period of the first conversion loan is extended by NABARD from 3 to 5 years. The instalment falling due for repayment in the year in which the calamity re-occurs is deferred and the balance amount of the outstanding conversion loan is suitably rephased to correspond to the extended period of rephasement i.e. 5 years. The maximum period upto which conversion can be granted is 7 years.

Long-term investment credit

Apart from providing short-term and medium-term refinance facilities to cooperative banks and short-term facilities to RRBs, NABARD supports through commercial banks, RRBs and cooperative banks long-term investment in agriculture and allied activities such as minor irrigation, land development, soil conservation, dairy, sheep, poultry, piggery, farm mechanisation, plantation/horticulture, forestry, fisheries storage and market yards, bio gas and other alternative sources of energy, sericulture, apiculture, animals and animal driven carts, agro-processing, agro-servicing centres, pumpsets and pumpset energisation etc. in the farm sector. Considerable efforts in identification of the activities for meeting new investment demands in agriculture are being made from year to year. Apart from the guidelines which have been circulated to all banks in respect of various types of investments mentioned above, guidelines/pilot projects have been prepared in respect of several innovative schemes relating to dryland farming, production of charcoal by using portable metal kilns, development of farm forestry, cattle breeding for production and rearing of high quality cross-bred cows, salvage of dry pregnant buffaloes from cities, cultivation of high yielding fodder crops, salvage of male and female buffalo calves from cities and metropolitan centres and rearing them for milk production and draft purposes respectively etc.

A beginning has been made by NABARD in regard to promotion of dryland agriculture through formulation and sanction of pilot projects. pilot projects were prepared in consultation with the All India Coordinated Research Project for Dryland Agriculture (AICRPDA) of ICAR or with ICRISAT. While a few pilot projects have been sanctioned some others are under consideration of the regional offices. In the scheme sanctioned by NABARD for dryland agriculture in Medak provision has been made for capitalising the production cost of the first year along with the investment cost so as to provide sufficient incentive to farmers to take up development in a planned manner. The cost of development of dryland agriculture has been estimated at around Rs.2000 per hectare in the scheme sanctioned in Doddaballapur taluk of Bangalore district as under:

<u>A. Capital cost</u>	<u>Rs. per ha</u>
Surveying	50
Land smoothening	9
Bed and furrow system	92
Private field drains	8
Rodent control	7
Main drain	88

	254

B. Initiation operation cost

(i) Material inputs

(a) Seeds 20 Kgs.	50
(b) Fertilizers 2 1/2 bags each of Urea and DAP	650
(c) Pesticides	25

(ii) Bullocks hire 180

Hire of tropicultor 260

(iii) Human labour

(a) Cultivation	400
(b) Harvesting expenses etc.	250

1815

A + E = 2069

Less margin of beneficiary/subsidy 69

Total requirement 2000

Lending terms

The rates of interest on refinance and the ultimate lending rate are fixed by NABARD from time to time. The rates at present are as follows:

Purpose	Rate of interest to financing banks p.a.	Rate of interest to ultimate borrowers p.a.
Minor irrigation and land development	6.5%	10.00%

Diversified purposes

(a) Small farmers	6.5%	10.00%
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(b) Others

8.0%

12.50%

Quantum of refinance

75 per cent to 95 per cent of bank loans.

Security

The financing banks may obtain such security as is prescribed by them in conformity with the guidelines issued by Reserve Bank of India/NABARD from time to time.

Assistance to small farmers

To ensure flow of medium-term and long-term credit to small farmers, NABARD has evolved land holding norms for defining such farmers based on income criteria and banks are required to ensure that at least 60 per cent of the total lendings under schemes refinanced by NABARD are advanced to such borrowers. While interest rate on short-term loans to small farmers (for loans upto Rs.5000/-) cannot exceed 11.5 per cent per annum, loans for medium-term and long-term purposes disbursed to small farmers are fixed at 10.25 per cent and 10 per cent respectively. Further, the banks have been permitted to ensure production finance to defaulter small/marginal farmers (those cultivating upto 1 hectare of irrigated and 2 hectares of dryland) by condoning such defaults provided these are upto 10 per cent of their eligibility under short-term production loans and which occurred on account of circumstances beyond their control. With a view to helping the small farmers, the ratio of share linking to borrowings has been relaxed from 10 per cent to 5 per cent. In the case of loans for investment purposes, small farmer borrowers are allowed to contribute to the share capital at 5 per cent of their borrowings in 4 instalments i.e. 2 per cent in the first year and 1 per cent in the subsequent 3 years. Further, the share capital so contributed is reckoned towards down payment requirements. With a view to facilitating borrowings by small farmers under NABARD refinanced schemes three concessions in lending terms are allowed to them. Firstly, a lower margin of 5 per cent towards the investment cost, which could be contributed in cash or in the form of labour has been stipulated. Secondly, small farmers are allowed longer loan maturities (upto 15 years). Thirdly, the rate of interest charged on loans to small farmers is lower than that applicable to other farmers.

Data relating to the cooperative credit structure in the four states of Andhra Pradesh, Karnataka, Madhya Pradesh, and Maharashtra, details of the short-term and medium-term credit limits sanctioned to state cooperative banks, short-term limits to RRBs and refinance for schematic lending made by NABARD as also the schemes for dryland farming sanctioned and/or under consideration of NABARD are given in the statements appended.

Appendix - I

Primary agricultural credit societies - 1981-82

(Amount in lakhs of rupees)

State	Total no. of societies	Of which viable	Total membership (- - - in	Of which		Loans issued during the year	Loans out- standing at the end of the year	Loans overdue	Percentage of overd to demand
				Borrowing members thousands	Scheduled Castes/Tribes - - -)				
Andhra Pradesh	7330	6531	5402	1554	694	10611	16902	7198	47.0
Karnataka	4871	4277	3684	690	652	10890	16853	8697	50.9
Madhya Pradesh	5575	4029	3819	1258	1402	13371	19124	9154	43.6
Maharashtra	18406	4920	5520	1450	1128	26200	41000	17000	45.7

Appendix - II

Central Co-operative Banks - 1981-82

(Amt. in lakhs of rupee

State	No. of banks	No. of offices	Membership societies	Loans issued	Loans recovered	Loans overdue	Percentage of overdues to demand
Andhra Pradesh	27	392	15445	20333	13681	8002	38.6
Karnataka	19	545	13216	20168	11718	7397	46.5
Madhya Pradesh	44	741	9916	22180	17580	7981	35.6
Maharashtra	26	1845	37911	101069	59959	15768	15.6

Appendix - III

State Land Development Banks - 1981-82

(Amt. in lakhs of rupees)

State	branches/ sub-offices	primary LDBs	advanced	outstand- ing	overdue	dues to demand	unrestricted eligibility	restricted eligibility
Andhra Pradesh	22	219	4811	28411	3237	36.9	70	148
Karnataka	19	177	1930	12114	1700	41.9	51	126
Madhya Pradesh	7	45	1796	11025	1970	50.3	4	41
Maharashtra	316	-	4125	24500	3670	46.5	76	229

Appendix - IV

Financial assistance provided by NABARD for agricultural production and investment purposes during the last 3 years to co-operatives/commercial banks

(Rs in lak)

State	Limits sanctioned during the year			Utilisation against limits sanctioned		
	1981-82	1982-83	1983-84	1981-82	1982-83	1983-84
A. Short-term credit						
Andhra Pradesh	97	128	112	63	103	91
Karnataka	3600	5175	5735	3312	4860	4710
Madhya Pradesh	9210	11240	10300	7536	8759	NA
Maharashtra	4250	9820	12445	NA	6766	7047
B. Medium-term credit						
Andhra Pradesh	3	4	4	2	2	NA
Karnataka	100	144	189	70	114	NA
Madhya Pradesh	2	2	2	1	2	1
Maharashtra	15500	9050	24600	9423	5547	NA

Appendix - IV Contd.

C. Refinance availed of under schematic lending

(Rs. in lakhs)

Purpose	Andhra Pradesh			Karnataka			Madhya Pradesh			Maharashtra		
	1980-	1981-	1982-	1980-	1981-	1982-	1980-	1981-	1982-	1980-	1981-	1982-
	81	82	83	81	82	83	81	82	83	81	82	83
Minor Irrigation	3828	1703	2830	497	724	782	3144	2430	2128	3555	3202	2771
REC	333	391	627	75	155	521	-	224	639	237	441	481
Land Development	76	82	26							-	35	65
Command Area Development	72	117	223			90	145	26	108	506	120	121
Farm Mechanisation	827	1256	1395	341	571	811	234	371	843	299	698	321
Plantation and Horticulture	155	243	143	258	579	640	-	-	8	83	56	46
Poultry Farming	492	254	165	40	99	35	9	11	12	119	173	38
Sheep Breeding	394	302	290	27	56	96	-	-	-	4	2	5
Fisheries	129	93	121	178	110	114	-	-	1	57	16	15
Dairy Development	267	158	142	48	88	122	1	3	12	117	158	189
Forestry	35	34	4	11	-	23	73	13	90	-	-	215
Gobar Gas Plants	-	1	28	18	3	26	-	-	-	17	5	25
Others	162	151	226	43	177	130				15	9	11
NSP	-	-	17									
IRDP	343	1869	1574	137	451	1060	-	36	194	38	431	101
Interim Finance	-	50	-	-	38					-	-	11
(MP)EB							-	916	248			
Bullocks							-	11	4			
Godowns Warehousing/ Markets/yards				103	-		148	119	143	96	26	69
ICDP (Integrated cotton Development Programme)										28	37	277
Piggery				-	4	-						
Total :	7113	6704	7811	1776	3055	4427	3754	4150	4430	5171	5409	4761

Appendix - V

Regional Rural Banks

State	No. of banks			Short-term limits sanctioned by NABARD			Maximum outstandings in the limit		
							(Rs in lakhs)		
	1981-82	1982-83	1983-84	1981-82	1982-83	1983-84	1981-82	1982-83	1983-84
Andhra Pradesh	10 (5)	12 (7)	12 (7)	2965	3182	2245	2464	2562	N.A.
Karnataka	6 (5)	8 (7)	8 (7)	2015	2672	2995	1854	2104	2108
Madhya Pradesh	14 (11)	17 (12)	18 (9)	874	1266	1090	793	1103	1139
Maharashtra	1 (1)	3 (1)	3 (-)	450	450	Nil	376	376	376

Figures in brackets indicate number of banks that availed of NABARD refinance.

N.A. = Not available.

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Appendix - VI

Schemes for dry land farming approved/under consideration

(Rs in lakhs)

State (1)	Taluk/ District (2)	Area covered (in hectares) (3)	Financial Assistance (4)	Refinance (5)	Financing Bank (6)
Andhra Pradesh	Medak	85	1.70 (for 1st year's programme)	1.61	State Bank of India
	Karimnagar and Khammam		Detail to be finalised		State Bank of Hyderabad
	Rangareddy		-do-		-do-
	Adilabad		-do-		Andhra Bank
	Nizamabad		-do-		Syndicate Bank
	Warangal		-do-		Central Bank of India and Canara Bank
Karnataka	Doddaballapur taluk Bangalore District	513	Financial outlay at the rate of Rs 2,000 per hectare.		Canara Bank.
	Udaleresi Village Bellary District.	100	Financial outlay on land deve- lopment Rs 820 per ha. Production cost ranges from Rs 690 to Rs 1125 depending on the crop.		Syndicate Bank
Madhya Pradesh	Rewa District	693	Financial outlay at the rate of Rs 2525 per hectare.		Not finalised
	Indore District	378	Financial outlay at the rate of Rs 1900 per hectare.		not finalised
Maharashtra	Akola District		Programme yet to be finalised		

DRYLAND FARMING IN MAHARASHTRA STATE*

It has been estimated by the National Commission on Agriculture that the gross cultivated area in Maharashtra State would be about 238 lakh hectares by the turn of 20th century. It is also estimated that the total irrigated area would not exceed 30% of the total cultivated area even after developing full irrigation potential from all the sources. This fact is also brought out by the State Irrigation Commission in its report. It is therefore, obvious that state will have to primarily depend on dryland agriculture in order to meet the full requirement of food of the State. Intensive efforts will, therefore, need to be made towards optimal land and water use, both from the stand point of increasing agricultural production and improving the economy of the dryland farmers.

Land and water are two very important natural resources not only for agriculture but for the existence of life. Unlike water which is a renewable resource, land is not renewable and therefore loss of soil when it occurs through misuse and neglect, amounts to a permanent loss of the most important means of production. Since 88.5% area of Maharashtra depends on natural precipitation, it is very essential that the two resources viz. soil and water are properly conserved for achieving sustained and optimal agricultural production.

In dryland farming it is imperative that every drop of water received from natural precipitation goes into the soil and is properly conserved with minimum runoff. Improved rainfed farming would, therefore, consist of conserving and optimising the use of water resource in such a manner that rain water stays in the soil profile for a longer duration and is slowly released through the drainage line in that area. This would also result in the streams in the area flowing for a longer duration and becoming perennial or semi-perennial. Water from such streams can then be used for irrigating crops whenever the soil profile gets emptied. Thus recycling of water would continue bringing in its wake a high productivity level. Since this is the principal means of improving rainfed farming, an integrated development and management of watersheds naturally becomes the prime solution to the problem.

Strategy for Dryland Farming

The strategy so far followed under Agriculture Development especially for food grain production was a single pronged activity of converting area under traditional crop varieties into hybrid and high yielding varieties. This conversion alone led to a quantum jump in agriculture production and has reflected an impressive growth in the foodgrain production. A stage has now reached when increase by the methods earlier adopted will prove more or less marginal as most of the potential areas have been brought under Hybrid and High yielding varieties.

* Note circulated by the Directorate of Agriculture, Maharashtra, at the NABARD/ICAR/ICRISAT Workshop on Watershed-based Dryland Farming in Black and Red Soils of Peninsular India.

The strategy for dryland farming now adopted broadly comprises of:

1. Provision of basic land development infrastructure for dryland farming on a watershed basis so as to enhance a capacity of soil profile to retain moisture (This may be called the hardware component) and
2. adoption by farmers themselves, with logistic and extension support from Government of appropriate cropping systems and agronomical practices based on soil type, use of seed of improved variety and use of improved implements, optimum use of fertilizers, plant protection, etc. in order to minimise the risk inherent in dryland farming (software items).

The three organizational streams of Agriculture Department viz. land and water management, T & V extension and Inputs Supply Wing provide the linkage between hardware and software components of technology.

Hardware Components

The practice so far followed in case of land development in dryland area comprised of programmes like contour bunding, graded bunding, nala bunding, land development-cum-horticulture, bench-terracing and reclamation of land drainage, etc. Annually an amount of Rs.20 crores were spent on these works. The various works done so far against potential till March 1983 were below:

Sl. No.	Name of activity	Unit	Poten- tial	Work done till March '83	Balance	Target for 1983-84
1.	Contour/Graded bunding	lakh ha.	125.71	87.23	38.48	2.17
2.	Terracing	"	8.67	1.85	6.82	0.11
3.	Nala bunding	Nos.	44941	36209	8732	3575
4.	Land Development-cum-Horticulture	Lakh ha.	5.34	0.95	4.39	0.03
5.	Reclamation of illdrained soil	"	0.68	0.18	0.50	0.02

These activities have definitely helped the soil and moisture conservation in the dry farming zone of Maharashtra and also helped increase in crop production to certain extent. These land development or soil conservation programmes in Maharashtra were carried out individually

in a scattered manner unrelated to each other, till last year. It was more a tool for providing employment for rural unemployed and underemployed and to people affected by scarcity rather than a meaningful programme for development of land for raising its productivity.

During the scarcity of 1982-83 in addition to above activities special programmes like (a) shaping and grading of drylands (b) on-farm dryland development (pasture development and afforestation) and (c) broadbeds and furrows programmes were introduced as a long term measure for mitigation of drought in future.

a. Land Shaping and Grading

The programme of land shaping and grading of drylands is taken as an interbund treatment where contour/graded bunding work has been carried out. The technology includes reducing the main slopes to 0.8 to 1.0% and Lateral slopes to 0.2 to 0.4%. This helps the conservation of moisture in situ and enables the soil profile to retain the same.

b. On Farm Dry Land Development (pasture development and afforestation):

This OFDL programme comprises of pasture-cum-tree cropping on shallow soils where arable crops cannot be grown. Leguminous grasses like stylo-Hamata and Stylo-Scabra with suitable tree crops are planted under this programme. This is mainly a treatment to lands in capability classes to V to VII.

c. Broadbeds and Furrows

This programme consists of laying the whole land alternately into beds of 150 cm to width and furrows of 15 cm width. The beds and furrows are laid out at a grade of 0.2% to 0.4% depending on the soil type. The technology evolved by ICRISAT Hyderabad is found particularly useful in deep black soils in assured rainfall zone in Maharashtra, where drainage become a problem and very often interferes with tillage operations.

Operations at (a) (b) & (c) supra are carried out in identified watersheds. Details are furnished in Statement-II attached. Soil conservation works were so far carried out independently due to which full potential of the area could not be exploited. With the introduction of above mentioned interbund treatments the State Government has now decided to implement soil conservation measures on a comprehensive watershed development basis (COWDEP) for dryland farming. Under this programme the soil conservation works are now being carried out on a watershed basis in an integrated manner to a saturation point which by an increase in moisture conservation in soil is effected. This combined with propagation of better agronomical practices through intensive extension will go a long way towards stabilising yield under rainfed farming of the state. The work is now in progress in several watersheds in the State. Statement-I attached to this note indicates the number of watersheds selected, districtwise, for the programme. Many of these watersheds are now under implementation.

Linkage with extension

Government have also drawn up a scheme for comprehensive linkage of land development work with professional extension. Extension staff would be useful for assessing the farmers' response to land development works, creating awareness amongst farmers and motivating them to go in for land development themselves and for ensuring optimum utilization of the infrastructure created in their fields by backing them with necessary extension support for adoption of improved agricultural practices.

Watershed development on these lines is already underway. So far more than a thousand watersheds have been delineated and their project profiles prepared after working out details of the land treatments needed to be implemented. Necessary arrangements for backing up the infrastructure of land development so created, with the extension support, have also been made by providing T & V Extension staff in the villages where programme is planned. It has also been ensured that one outlet for supply of critical inputs as far as possible is opened in the village itself or within a reasonable distance from the village.

The scheme is designed to take the farmers from the present level of technology in agricultural production to higher level of technology which would substantially increase their farm incomes. However, the entire success of the scheme will depend upon the involvement of small and marginal farmers who constitute a large number of farming population. While the farmers are being motivated to switch over to the use of improved and hybrid seeds and also fertilizer use initially even in small doses through the seeds and fertilizer minikit trials, the major constraint for adoption of software components on large scale would mainly be availability of short term credit.

As we see today most of the small and marginal farmers being defaulters are not eligible for any kind of fresh credit. The issue was therefore, taken up with the NABARD who have shown willingness to consider providing short term credit to small farmers defaulters, considering the high technological content of the programme.

The programme has created a lot of interest amongst farmers and it is expected to yield spectacular results over the next few years. More and more watersheds will be covered under the programme every year.

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STATEMENT I - LIST OF WATERSHEDS SELECTED FOR INTEGRATED DEVELOPMENT
FOR 1983/84 - 1986/87

Sl. No.	DISTRICT	No. of WATERSHEDS selected under				TOTAL
		COWDEP (Normal programme)	WGD	DPAP	KRISHI PANDHARI WATERSHEDS	
1.	Nashik	6	62	15	13	96
2.	Dhule	2	10	8	9	29
3.	Jalgaon	4	--	15	13	32
4.	Satara	1	68	10	11	90
5.	Sangli	2	4	8	8	22
6.	Kolhapur	4	44	--	12	60
7.	Nagpur	17	--	--	13	30
8.	Bhandara	18	--	--	13	31
9.	Chandrapur	18	--	--	10	28
10.	Gadchiroli	8	--	--	8	16
11.	Thane	4	11	--	13	28
12.	Raigad	2	28	--	14	44
13.	Ratnagiri	1	53	--	9	63
14.	Sindhudurg	1	103	--	7	111
15.	Ahmednagar	7	--	23	13	43
16.	Pune	6	12	14	13	45
17.	Solapur	14	--	30	11	55
18.	Amravati	3	--	--	13	16
19.	Buldhana	5	--	4	13	22
20.	Yeotmal	6	--	--	14	20
21.	Parbhani	21	--	--	7	28
22.	Wardha	2	--	--	7	9
23.	Aurangabad	--	--	14	8	22
24.	Osmanabad	--	--	6	6	12
25.	Beed	--	--	6	7	13
26.	Akola	14	--	--	13	27
27.	Jalna	--	--	--	5	5
28.	Nanded	--	--	--	8	8
29.	Latur	--	--	--	5	5
TOTAL:		166	395	153	96	1010

STATEMENT II - SHOWING WORK DONE UNDER SHAPING AND GRADING OF DRYLANDS,
PASTURE DEVELOPMENT AND AFFORESTATION ON PRIVATE LANDS
AND BROAD BEDS AND FURROWS IN IDENTIFIED WATERSHEDS DURING
1982 and 1983.

Sl. No.	District	Shaping & Grading of drylands (Ha)	Pasture development and afforestations on private lands (Ha)	Broad Beds and Furrows
1.	Ahmednagar	2568	393	6
2.	Pune	2239	389	--
3.	Solapur	1601	1226	--
4.	Nasik	6093	655	--
5.	Dhule	1262	84	19
6.	Jalgaon	566	143	11
7.	Satara	417	181	6
8.	Sangli	1213	99	6
9.	Aurangabad	520	69	25
10.	Jalana	88	17	1
11.	Beed	918	67	--
12.	Parbhani	-	-	107
13.	Latur I	714	54	--
14.	Osmanabad I	-	-	-
15.	Nanded	-	-	79
16.	Amravati	907	66	338
17.	Akola	268	170	161
18.	Buldhana	243	102	229
19.	Yeatmal	-	58	53
20.	Nagpur	207	43	--
21.	Bhandara	-	38	--
22.	Chandrapur	-	-	-
23.	Gadchiroli	-	-	-
24.	Wardha	-	-	117
Total:		19824	3854	1158

NABARD-ICAR-ICRISAT WORKSHOP ON WATERSHED BASED

DRYLAND FARMING IN BLACK AND RED SOILS

OF PENINSULAR INDIA

3-4 October 1983

ICRISAT Center, Patancheru

LIST OF PARTICIPANTS

GOVERNMENT OF INDIA

S P Mukherji
Secretary
Ministry of Agriculture
Department of Agriculture
Government of India
Krishi Bhavan
New Delhi 110 001

Somnath Som
Joint Secretary
Dryland Farming
Department of Agriculture &
Cooperation
Government of India
New Delhi

K Ardhanareeshwaran
Joint Secretary, Credit
Ministry of Agriculture
Government of India
Krishi Bhavan
New Delhi 110 001

B D Srivastav
Commissioner (Coordination)
Department of Agriculture &
Cooperation
Government of India
New Delhi

A C Garg
Joint Commissioner
Dryland Farming
Ministry of Agriculture
Department of Agriculture
Government of India
Krishi Bhavan
New Delhi 110 001

P P Sharma
Deputy Secretary (Agriculture Credit)
Department of Economic Affairs
(Banking Division)
Ministry of Finance
" Jeevan Deep "
Parliament Street
New Delhi 110 001

S S Chibber
Jt Commissioner
Department of Rural Development
Ministry of Agriculture
Government of India
Krishi Bhavan
New Delhi 110 001.

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

R P Singh
Project Director
All India Coordinated Research Project for
Dryland Agriculture
Santoshnagar Colony
Hyderabad 500 659

J Venkateswarlu
Project Coordinator (Research)
All India Coordinated Research Project for
Dryland Agriculture
Santoshnagar Colony
Hyderabad 500 659

K Vijayalakshmi
Senior Scientist (soils)
All India Coordinated Research Project for
Dryland Agriculture
Santoshnagar Colony
Hyderabad 500 659

N K Sanghi
Senior Scientist (Farming and Extension)
All India Coordinated Research Project for
Dryland Agriculture
Santoshnagar Colony
Hyderabad 500 659

T Vishnumurthy
Senior Scientist (ORP)
All India Coordinated Research Project for
Dryland Agriculture
Santoshnagar Colony
Hyderabad 500 659

Y V R Reddy
Scientist (Ag. Econ.)
All India Coordinated Research Project for
Dryland Agriculture
Santoshnagar Colony
Hyderabad 500 659

K P C Rao
Scientist (Ag Econ)
All India Coordinated Research Project for
Dryland Agriculture
Santoshnagar Colony
Hyderabad 500 659

NATIONAL BANK FOR AGRICULTURE AND RURAL DEVELOPMENT

Sant Dass
Managing Director
National Bank for Agriculture and
Rural Development
P.B. 6522
Worli
Bombay 400 018

B Venkata Rao
General Manager
National Bank for Agriculture and
Rural Development
P.B. 6522
Worli
Bombay 400 018

K N Saksena
General Manager
National Bank for Agriculture and
Rural Development
P B 6522
Worli
Bombay 400 018

M V Gadgil
General Manager
National Bank for Agriculture and
Rural Development
P B 6522
Worli
Bombay 400 018

R Sundaravaradhan
General Manager
National Bank for Agriculture and
Rural Development
P B 6522
Worli
Bombay 400 018

S K R Zaidi
General Manager
National Bank for Agriculture and
Rural Development
" Pioneer House " 5th Floor
6-3-653 Somagiguda
Hyderabad 500 004

R C Gupta
Deputy General Manager
National Bank for Agriculture and
Rural Development
P B 6522
Worli
Bombay 400 018

S E Aranha
Deputy General Manager
National Bank for Agriculture and
Rural Development
P B 6522
Worli
Bombay 400 018

R K Dutta
Deputy General Manager
National Bank for Agriculture and
Rural Development
P B 6522
Worli
Bombay 400 018

Vishwanadha Rao
Deputy General Manager
National Bank for Agriculture and
Rural Development
" Pioneer House " 5th Floor
6-3-653 Somajiguda
Hyderabad 500 004

Kashi Viswanath
Deputy General Manager
National Bank for Agriculture and
Rural Development
Indian Express Building
No 1 Queen's Road
Bangalore 560 001

R S Deshpande
Manager
National Bank for Agriculture and
Rural Development
Guru Nanak Complex
34 Molaviya Nagar
Bhopal 462 003

G S Kalra
Manager, Technical
National Bank for Agriculture and
Rural Development
P B 6522
Worli
Bombay 400 018

P B Singh
Development Officer
National Bank for Agriculture and
Rural Development
P B 6522
Worli
Bombay 400 018

INTERNATIONAL CROPS RESEARCH INSTITUTE FOR THE
SEMI-ARID TROPICS

L D Swindale
Director General
International Crops Research Institute for
the Semi-Arid Tropics
ICRISAT Patancheru P O
Andhra Pradesh 502 324 India

J S Kanwar
Director for Research
International Crops Research Institute for
the Semi-Arid Tropics
ICRISAT Patancheru P O
Andhra Pradesh 502 324 India

C R Jackson
Director for International Cooperation
International Crops Research Institute for
the Semi-Arid Tropics
ICRISAT Patancheru P O
Andhra Pradesh 502 324 India

S P Ambrose
Principal Government Liaison Officer
International Crops Research Institute for
the Semi-Arid Tropics
ICRISAT Patancheru P O
Andhra Pradesh 502 324 India

S M Virmani
Leader, Farming Systems Research Program
International Crops Research Institute for
the Semi-Arid Tropics
ICRISAT Patancheru P O
Andhra Pradesh 502 324 India

M von Oppen
Leader, Economics Program
International Crops Research Institute for
the Semi-Arid Tropics
ICRISAT Patancheru P O
Andhra Pradesh 502 324 India

T Walker
Principal Economist
International Crops Research Institute for
the Semi-Arid Tropics
ICRISAT Patancheru P O
Andhra Pradesh 502 324 India

E E Ahmed
Ministry of Planning and Economics
Government of Sudan
Khartoum
Sudan

GOVERNMENT OF ANDHRA PRADESH

M Gopalakrishnan
Agricultural Production Commissioner
Food & Agriculture Department
Government of Andhra Pradesh
Hyderabad 500 022

C S Sastry
Secretary
Food & Agriculture
Food & Agriculture Department
Government of Andhra Pradesh
Hyderabad 500 022

K Subrahmanyam
Secretary
Forests & Rural Development Department
Government of Andhra Pradesh
Hyderabad 500 001

V K Srinivasan
Director of Institutional Finance
Government of Andhra Pradesh
Hyderabad 500 001

J Ram Babu
Director of Agriculture
Government of Andhra Pradesh
(Opp L B Stadium)
Hyderabad 500 001

J Balaji
Jt Director of Agriculture
Government of Andhra Pradesh
(Opp L B Stadium)
Hyderabad 500 001

GOVERNMENT OF KARNATAKA

P R Nayak
Development Commissioner & APC and
Sepcial Secretary to
Government of Karnataka
Vidhana Soudha
Dr Ambedkar Veedhi
Bangalore 560 001

J K Arora
Secretary
Animal Hubandry & Agriculture
Government of Karnataka
Vidhana Soudha
Dr Ambedkar Veedhi
Bangalore 560 001

K P Surendranath
Secretary
Rural Development & Cooperation
Government of Karnataka
Vidhana Soudha
Dr Ambedkar Veedhi
Bangalore 560 001

M Jothi
Additional Director of Agriculture
(Soil Conservation)
Department of Agriculture
Seshadri Road
Bangalore 560 001

C Lingaraj Urs
Additional Director of Agriculture
(Development & Extension)
Department of Agriculture
Seshadri Road
Bangalore 560 001

V Govindraj
Deputy Secretary
Finance Department
(Institutional Finance)
Government of Karnataka
Vidhana Soudha
Dr Ambedkar Veedhi
Bangalore 560 001

GOVERNMENT OF MAHARASHTRA

K Rajan
Secretary
Agriculture & Cooperation Department
Government of Maharashtra
Mantralaya Annexe
Bombay 400 032

J S Patil
Advisor, Agriculture
Government of Maharashtra
Bombay

V Kolhatkar
Dy Secretary
Agriculture & Cooperation Department
Government of Maharashtra
Mantralaya Annexe
Bombay 400 032

D V Dixit
Addl Director of Agriculture (Eng)
Government of Maharashtra
Pune

GOVERNMENT OF MADHYA PRADESH

R C Jain
Secretary
Agriculture Department
Government of Madhya Pradesh
Bhopal

Munshi Goyal
Project Coordinator
Government of Madhya Pradesh
Bhopal

G S Sachdev
Additional Director of Agriculture
Government of Madhya Pradesh
Bhopal

B P Bhargava
Joint Director
Institutional Finance
Government of Madhya Pradesh
Bhopal

D G Sharma
Director of Forest
Government of Madhya Pradesh
Bhopal

Srivastava
Conservator of Forest
Government of Madhya Pradesh
Bhopal

AGRICULTURAL UNIVERSITIES

B Pratap Reddy
Vice Chencellor
Andhra Pradesh Agricultural University
Rajendranagar
Hyderabad 500 030

S N Rao
Director of Research
Andhra Pradesh Agricultural University
Rajendranagar
Hyderabad 500 030

K Venkata Raju
Chief Scientist
Agricultural Research Station
Andhra Pradesh Agricultural University
Anantapur

N R Pawar
Director of Research
Marathwada Agricultural University
Parbhani 431 402
Maharashtra

S N Dubey
Director of Research Services
Jawaharlal Nehru Krishi Vishwa Vidyalaya
Jabalpur 482 004
Madhya Pradesh

LEAD BANKS

M N Dandekar
Chief Officer
Agricultural Banking
State Bank of India
Central Office
Post Box No 12
Bombay 400 021

N S Parulekar
General Manager (Operations)
Bank of India
Express Towers
Nariman Point
Bombay 400 021

B P Gokhale
General Manager (Operations)
Bank of Maharashtra
Lok Managal
Post Box No 919
Pune 411 022

M Gopalakrishnaiah
General Manager
Andhra Bank
Andhra Bank Building
Sultan Bazar
Post Box No 161
Hyderabad 500 001

G P Prabhu
Manager
Agricultural Finance Department
Canara Bank
112 Jayachamarajendra Road
Post Box No 6648
Bangalore 560 002

A R Patel
Manager
Agricultural Finance Department &
Project monitoring & Evaluation Cell
Bank of Baroda
Post Bag No 10046
3 Walchand Hirachand Marg
Ballard Pier
Bombay 400 038

K M Udupa
Divisional Manager
Rural Development Division
Syndicate Bank
Post Box No 1
Manipal 576 119 (S K)
Karnataka State

STATE CO-OPERATIVE BANKS

A Valliappan
Managing Director
Andhra Pradesh State Co-operative Bank Ltd
P B No 142
Troop Bazar
Hyderabad 500 001

K R Sahu
Manager
Maharashtra State Co-operative Bank Ltd
9 Bake House Lane
Fort
Bombay 400 023

LAND DEVELOPMENT BANKS

Vittal Rai
Managing Director
Karnataka State Co-operative Land
Development Bank Ltd
Tippu Sultan Palace Road
Post Box 1811
Fort
Bangalore 560 018

M Surendra Sastry
Managing Director
AP Central Cooperative Agricultural
Development Bank Ltd
Sahakara Bhavan
Barkatpura
Hyderabad 500 027

S P Mishra
Manager
Planning and Development
Madhya Pradesh Rajya Sahakari
Bhumi Vikas Bank Ltd
Sultania Road
Bhopal 462 001

RESERVE BANK OF INDIA

Kum D R Hiranandani
Deputy Chief Officer
Rural Planning & Credit Department
Reserve Bank of India
New Central Office Building
Shahid Bhagat Singh Road
Bombay 400 023

AGRICULTURAL FINANCE CORPORATION

K Roy
Director (Projects)
Agricultural Finance Corporation Ltd
Dhanraj Mahal
Shivaji Marg
Bombay 400 039

P S Kundu
Project
Agricultural Finance Corporation Ltd
Dhanraj Mahal
Shivaji Marg
Bombay 400 039

V Kamaraju
Project Executive
Agricultural Finance Corporation Ltd
Hyderabad 500 004

NATIONAL COOPERATIVE DEVELOPMENT CORPORATION

N L N Murthy
Director (Marketing)
National Cooperative Development Corporation
4 Siri Institutional Area
Hauz Khas
New Delhi 110 016

WORLD BANK

A Appa Rao
Agriculturist
World Bank
21 Jorbagh
New Delhi 110 003

NABARD-ICAR-ICRISAT WORKSHOP

3-4 OCTOBER 1983

PARTICIPANTS' ARRIVAL INFORMATION

Sl No	N A M E	A FROM	R DATE	R TIME	I V A L	PLACE OF STAY
					Flt.No./ TRAIN	
1	B VENKATA RAO	BOMBAY	1/10	1835	IC-117	DORMITORY
2	S E ARANHA	BOMBAY	1/10	1835	IC-117	DORMITORY
3	M JOTHI	BANGALORE	1/10	1930	IC-404	DORMITORY
4	C LINGARAJ URS	BANGALORE	1/10	1930	IC-404	DORMITORY
5	S N DUBEY	JABALPUR	2/10	0520	Dakshin Express Sec'bad	DORMITORY
6	P B SANGLE	BOMBAY	2/10	0550	Bombay Express Nampally	DORMITORY
7	B P GOKHALE	PUNE	2/10	0550	"	OWN ARRANGE- MENT - NO TRANSPORT
8	N R PAWAR	PARBHANI	2/10	0715	Manmad- Kachiguda Fast Pass enger Sec'bad	DORMITORY
9	N L N MURTHY	NEW DELHI	2/10	0815	IC-439	DORMITORY
10	A APPA RAO	NEW DELHI	2/10	0815	IC-439	HOTEL BANJARA
11	KUM HIRANANDANI	BOMBAY	2/10	0930	IC-127	DORMITORY
12	R C JAIN & WIFE	BHOPAL	2/10	1410	AP EXP SEC'BAD	IC GUEST HOUSE
13	D G SHARMA	BHOPAL	2/10	1410	"	HOTEL ASHOKA
14	SRIVASTAVA	BHOPAL	2/10	1410	"	HOTEL ASHOKA
15	G S SACHDEV	BHOPAL	2/10	1410	"	DORMITORY
16	S S CHIBBER	NEW DELHI	2/10	1745	IC-403	DORMITORY

NABARD-ICAR-ICRISAT WORKSHOP

3-4 OCTOBER 1983

PARTICIPANTS' ARRIVAL INFORMATION

Sl No	N A M E	A FROM	R DATE	R TIME	I V A L Flt.No./ TRAIN	PLACE OF STAY
17	M.V. GADGIL	BOMBAY	2/10	1835	IC-117	DORMITORY
18	M.N. DANDEKAR	BOMBAY	2/10	1835	IC-117	OWN ARRANGE- MENT - NO TRANSPORT
19	J K ARORA	BANGALORE	2/10	1930	IC-404	DILKUSHA - Room No. 5
20	V GOVINDARAJ	BANGALORE	2/10	1835	IC-404	DILKUSHA. " 6
21	P R NAYAK	BANGALORE	2/10	1835	IC-404	IC GUEST HOUSE
22	K P SURENDRANATH	BANGALORE	2/10	1930	IC-404	DILKUSHA Room No. 3
23	K ROY	BOMBAY	2/10	2020	IC-119	SAROVAR
24	P S KUNDU	BOMBAY	2/10	2020	IC-119	SAROVAR
25	R K DATTA	BOMBAY	2/10	2020	IC-119	DORMITORY
26	D V DIXIT	PUNE	2/10	2020	IC-119	DORMITORY
27	J S PATIL	BOMBAY	2/10	2020	IC-119	DORMITORY
28	G S KALRA	BOMBAY	2/10	2020	IC-119	DORMITORY
29	R C GUPTA	BOMBAY	2/10	2020	IC-119	DORMITORY
30	K N SAKSENA	BOMBAY	2/10	2020	IC-119	ASHOKA
31	S P MUKERJI	NEW DELHI	3/10	0815	IC-439	STATE GUEST- NO TRANSPORT
32	K N ARDHANAREESWARAN	NEW DELHI	3/10	0815	IC-439	IC GUEST HOUSE
33	A C GARG	NEW DELHI	3/10	0815	IC-439	DORMITORY
34	K RAJAN	AURANGABAD	3/10	0845	AJANTA EXP SEC'BAD	DILKUSHA Room No. 8
35	SANT DASS	BOMBAY	3/10	0930	IC-127	IC GUEST HOUSE
36	R SUNDARAVARADHAN	BOMBAY	3/10	1835	IC-117	ASHOKA
37	V K R KOLHATKAR	BOMBAY				DORMITORY
38	KASHI VISWANATH	BANGALORE				DORMITORY
39	MUNSHI GOYAL	BHOPAL				DORMITORY

NABARD-ICAR-ICRISAT WORKSHOP

3-4 OCTOBER 1983

PARTICIPANTS' ARRIVAL INFORMATION

Sl No	N A M E	A	R	R	I	V	A	L	PLACE OF STAY
		FROM	DATE	TIME	Flt.No./ TRAIN				
40	P P SHARMA	NEW DELHI							DORMITORY
41	VITTAL ROY	BANGALORE							DILKUSHA Room No. 9
42	A R PATEL	BOMBAY							SAROVAR
43	S P MISHRA	BHOPAL							SAROVAR
44	B P BHARGAVA	BHOPAL	2/10	0520	Dakshin Exp- Sec'nd				SAROVAR
45	R S DESHPANDE	BHOPAL							ASHOKA
46	K R SAHU	BOMBAY							ASHOKA
47.	SOMNATH SOM	NEW DELHI	3/10	0815	IC-439				DILKUSHA
48.	B.D. SRIVASTAV	"	"	"	"				"

NABARD-ICAR-ICRISAT WORKSHOP.

3-4 OCTOBER 1983

Sl. No.	Name of Participant	Affiliation	Arrival			Place of Stay	Departure			Food
			Date	Time hrs.	Flt.No./ Name of Train		Date	Time hrs.	Flt.No./ Name of Train	
1	V.K.R. KOLHATKAR	Deputy Secy. Animal Husbandry Bombay								
2	M. JOTHI	Dept. of Agr. Bangalore	1/10	1930	IC - 404	Dormitory	4/10	1830	IC - 403	NV
3	C. LINGARAJ URS	Dept. of Agr. Bangalore	1/10	1930	IC - 404	Dormitory	4/10	1830	IC - 403	NV
4	S.N. DUBEY	Director of Res. JNKVV Jabalpur	2/10	0520	Southern Express Sec'bad	Dormitory	4/10	2145	Southern Express Sec'bad	NV
5	N.L.N. MURTY	NCDC New Delhi	2/10	0815	IC - 439	Dormitory	4/10	2020	IC - 404	
6	A. APPA RAO	World Bank New Delhi	2/10	0815	IC - 439	Hotel Banjara	4/10	2020	IC - 404	NV
7	Kum. HIRANANDANI	RBI Bombay	2/10	0930	IC - 127	Dormitory	4/10	2100	IC - 120	V
8	B.P. GOKHALE	Bank of Maharastra Pune	2/10	0540	Bombay Express Nampally	Own arrangement (214)	5/10	2055	Bombay Express Nampally	NV

NABARD-ICAR-ICRISAT WORKSHOP

3-4 OCTOBER 1983

Sl. No.	Name of Participant	Affiliation	Arrival		Place of Stay	Departure		Food
			Date	Time hrs.		Date	Time hrs.	
9	R.C. JAIN	Secy. Agr. Bhopal	2/10	1410	A.P. Express Sec'bad	5/10		Accompanied by wife V
10	J.K. ARORA	Secy. AH&Agr. Bangalore	2/10	1930	IC - 404	4/10	1835	IC - 403
11	P.R. NAYAK	Dev. Commissioner, Bangalore	2/10	1930	IC - 404	4/10	1835	IC - 403 V
12	V. GOVINDARAJ	Dy Secy. Finance Bangalore	2/10	1930	IC - 404	6/10	1835	IC - 403 NV
13	L.N. DOSHI	Secy. Inst. Fin. : Bombay	2/10	2020	IC - 119			CANCELLED
14	K. ROY	AFC Bombay	2/10	2020	IC - 119	5/10	1540	IC - 118 NV
15	P.S. KUNDU	AFC Bombay	2/10	2020	IC - 119	5/10	1540	IC - 118 NV
16	R.K. DATTA	NABARD Bombay	2/10	2020	IC - 119	4/10	2120	IC - 120

NABARD-ICAR-ICRISAT WORKSHOP

3-4 OCTOBER 1983

Sl. No.	Name of Participant	Affiliation	Arrival		Place of Stay	Departure		Food
			Date	Time hrs.		Date	Time hrs.	
17	D.V. DIXIT	Addl. Dir. of Agrl. Pune	2/10	2020	Dormitory	4/10	2100	NV
18	S.P. MUKERJI	Secy. Agr. & Coop. New Delhi	3/10	0815	A.P. State Guest	6/10	2020	IC - 404
19	K.N. ARDHANARESWARAN	Jt. Secy. Credit New Delhi	3/10	0815	ICRISAT Guest House	4/10	2020	IC - 404
20	A.C. GARG	Joint Commissioner New Delhi	3/10	0815	Dormitory	4/10	2020	IC - 404
21	K. RAJAN	Secy. Agr. Bombay	3/10	0845	Dilkusha Guest House	4/10	2100	IC - 120
22	M.N. DANDEKAR	SBI Bombay	2/10	1835	Own arrangement	4/10	2100	IC - 120
23	N.S. PARULEKAR	Bank of India Bombay			Own arrangement			NV
24	G.P. PRABHU	Canara Bank Bangalore			Own arrangement			NV

NABARD-ICAR-ICRISAT WORKSHOP

3-4 OCTOBER 1983

Sl. No.	Name of Participant	Affiliation	Arrival		Place of Stay	Departure		Food
			Date	Time hrs.		Date	Time hrs.	
25	A.R. PATEL	Bank of Baroda Bombay			Hotel Sarovar			
26	K.M. UDUPA	Syndicate Bank Manipal			Own arrange- ment			V
27	VITTAL RAI	KSCLDB Ltd., Bangalore			Dilkusha Guest House			
(28)	P.G. KORANNE	MSLDB Ltd., Bombay			Own arrange- ment			CANCELLED
29	S.P. MISHRA	MPRSVB Ltd., Bhopal			Hotel Sarovar			
30	SANT DASS	NABARD Bombay	3/10	0930	ICRISAT Guest House			
(31)	G.P. BRAVE	NABARD Bombay			Bormitary			CANCELLED

NABARD-ICAR-ICRISAT WORKSHOP

3-4 OCTOBER 1983

Sl. No.	Name of Participant	Affiliation	Arrival			Place of Stay	Departure			Food
			Date	Time hrs.	Flt.No./ Name of Train		Date	Time hrs.	Flt.No./ Name of Train	
32	B. VENKATA RAO	NABARD Bombay	1/10	1835	IC - 117	Dormitory	5/10	2100	IC - 120	V
33	K.N. SAKSENA	NABARD Bombay	2/10	2020	IC - 119	Hotel Ashoka	5/10	2100	IC - 120	
34	S.E. ARANHA	NABARD Bombay	1/10	1835	IC - 117	Dormitory	4/10	2100	IC - 120	
35	R.K. DATTA	NABARD Bombay	2/10	2020	IC - 119	Dormitory	4/10	2100	IC - 120	See 16
36	G.S. KALRA	NABARD Bombay	2/10	2020	IC - 119	Dormitory	4/10	2100	IC - 120	
37	P.B. SANGLE	NABARD Bombay	2/10	0550	31 DN Bombay Exp Nampally	Dormitory	5/10	2105	32 UP Bombay Express Nampally	
38	R. SUNDARAVARADHAN	NABARD Bombay	3/10	1835	IC - 117	Hotel Ashoka	5/10	2100	IC - 120	V

NABARD-ICAR-ICRISAT WORKSHOP

3-4 OCTOBER 1983

Sl. No.	Name of Participant	Affiliation	Arrival			Place of Stay	Departure			Food
			Date	Time hrs.	Flt.No./ Name of Train		Date	Time hrs.	Flt.No./ Name of Train	
9	M.V. GADGIL	NABARD Bombay	2/10	1835	IC - 117	Dormitory	5/10	0635	IC - 128	
10	KASHI VISWANATH	NABARD Bangalore				Dormitory				
11	R.C. GUPTA	NABARD Bombay	2/10	2020	IC - 119	Dormitory	4/10	2100	IC - 120	
12	R.S. DESHPANDE	NABARD Bhopal				Hotel Ashoka .				
13	MUNSHI GOYAL	Project Coordinator Bhopal				Dormitory				
44	G.S. SACHDEV	Addl. Director of Agr Bhopal				Dormitory				
45	P.P. SHARMA	ISA New Delhi				Dormitory				

NABARD-ICAR-ICRISAT WORKSHOP

3-4 OCTOBER 1983

Sl. No.	Name of Participant	Affiliation	Arrival		Place of Stay	Departure		Food
			Date	Time hrs.		Date	Time hrs.	
46	N.P. ZAWAR	Director of Res. MAU Parbhani			Dormitory			
47	J.S. PATIL	Advisor, Agriculture Bombay	2/10	2020	Dormitory	4/10	2100	IC - 120
48	K. VENKATA RAJU	ARS Anantapur			Own arrange-ment			
49	HARBANS SINGH	Agr. Commissioner New Delhi			Dormitory			CANCELLED
50	C.T. BENJAMIN	Secy. F&F Bangalore			Birkusha Guest House			CANCELLED
51	K.K. SAKSENA	DI & CGC Bombay			Own arrange-ment			CANCELLED
52	N.S. RAWAT	MPRSB Ltd. Bhopal			Own arrange-ment			CANCELLED

NABARD-ICAR-ICRISAT WORKSHOP

3-4 OCTOBER 1983

Sl. No.	Name of Participant	Affiliation	Arrival			Place of Stay	Departure			Food
			Date	Time hrs.	Flt.No./ Name of Train		Date	Time hrs.	Flt.No./ Name of Train	
53	M. GOPALAKRISHNAN	Agr. Prod. Comm. Hyderabad				LOCAL				V
54	C.S. SASTRY	Secy. F&A Hyderabad				LOCAL				V
55	K. SUBRAHMANYAM	Secy. F&RD Dept. Hyderabad				LOCAL				
56	V.K. Srinivasan	Director Inst. Fin. Hyderabad				LOCAL				V
57	J. BALAJI	Jt. Dir. of Agr. Hyderabad				LOCAL				V
58	B. PRATAP REDDY	V.C. APAU Hyderabad				LOCAL				NV
59	S.N. RAO	APAU Hyderabad				LOCAL				

NABARD-ICAR-ICRISAT WORKSHOP

3-4 OCTOBER 1983

Sl. No.	Name of Participant	Affiliation	Arrival		Departure		Food
			Date	Time hrs.	Date	Time hrs.	
60	M. GOPALAKRISHNAIAH	Andhra Bank Hyderabad					
61	K. KAMARAJU	AFC Ltd Hyderabad					
62	R.P. SINGH	AICRPDA Hyderabad					V
63	J. VENKATESWARLU	AICRPDA Hyderabad					
64	K. VIJAYALAKSHMI	AICRPDA Hyderabad					
65	N.K. SANGHI	AICRPDA Hyderabad					
66	Y.V.R. REDDY	AICRPDA Hyderabad					

NABARD-ICAR-ICRISAT WORKSHOP

3-4 OCTOBER 1983

Sl. No.	Name of Participant	Affiliation	Arrival		Place of Stay	Departure		Food
			Date	Time hrs.		Date	Time hrs.	
67	T. VISHNUMURTHY	AICRPDA Hyderabad			LOCAL			
68	K.P.C. RAO	AICRPDA Hyderabad			LOCAL			V
69	A. VALLIAPPAN	APSCB Ltd Hyderabad			LOCAL			V
70	M. SURENDRA SASTRY	APCCADB Ltd Hyderabad			LOCAL			V
71	VISHWANADHA RAO, K	NABARD Hyderabad			LOCAL			
72	S.K.R. ZAIDI	NABARD Hyderabad			LOCAL			
73	L.D. SWINDALE	ICRISAT			LOCAL			NV
74	J.S. KANWAR	ICRISAT			LOCAL			V

NABARD-ICAR-ICRISAT WORKSHOP

3-4 OCTOBER 1983

Sl. No.	Name of Participant	Affiliation	Arrival		Departure		Food
			Date	Time hrs.	Date	Time hrs.	
75	C.R. JACKSON	ICRISAT					NV
76	S.M. VIRMANI	ICRISAT					NV
77	M. VON OPPEN	ICRISAT					NV
78	S.P. AMBROSE	ICRISAT					NV
79	T. WALKER	ICRISAT					
80	K.P. SURENDRANATH	Secy. Rural Dev. & Coop. Bangalore	2/10	1930			
81	B.P. BHARGAVA	Joint Director Institutional Finance Bhopal	2/10	0520	5/10	2055	V
82	K.R. SAHU	Manager SCB Bombay					

NABARD-ICAR-ICRISAT WORKSHOP

3-4 OCTOBER 1983

Sl. No.	Name of Participant	Affiliation	Arrival		Departure		Food
			Date	Time hrs.	Date	Time hrs.	
83	D. G. SHARMA	Director Forest Dept. Bhopal	2/10	1410	5/10		
84	SRIVASTAVA	Conservation of Forests Bhopal	2/10	1410	5/10		
85	S. S. CHIBBER	Joint Commissioner New Delhi	2/10	1745			
86	SOMNATH SOM	Jr. Secy Dryland Farming New Delhi	3/10	0815			
87	B. D. SRIVASTAV	Commissioner (Coordination) New Delhi	"	"			
88	E. E. AHMED	ICRISAT					
89	RAM BABU	Dir. of Agr. Hyderabad					