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Agricultural Research and Poverty Alleviation in India
Management Issues

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The findings, interpretations and conclusions expressed in this paper are entirely those of the authors and should not be attributed in any manner to their respective institutions

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Abstract: India hosts one-third of the world's poor, most of them in rural areas. This makes it imperative for all those involved in the rural sector, including agricultural researchers, to examine the extent to which they contribute to poverty alleviation. The purpose of this paper is to examine how the management of research can support this objective. The paper first reviews the past contributions of agricultural research to poverty alleviation, as seen through a variety of studies, including village studies, and the capacity of the Indian NARS to face the challenge of rural poverty. These studies show that Green Revolution technologies were effective in reducing poverty, but their impact on the poor was moderate and after a considerable time lag. This has implications for future research. Moreover, the analysis of scientists' attitudes toward poverty alleviation, and of the existing management practices, reveals some biases that impede the focusing of research on poverty alleviation. Multidisciplinary research, with a social science component, is required to better understand the conditions of the poor and to develop appropriate technologies. Management systems need to be supportive of this reorientation. Policy perspectives are provided.

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1. Introduction

There is no doubt that agricultural research contributes to poverty alleviation, but the mechanisms through which this occurs and the precise contribution of agricultural research are much less well known. The most widely accepted view is that it contributes to economic growth and economic growth is directly related to poverty alleviation. Econometric analysis of the Indian National Sample Survey shows that 86% of the decline in the head count index over the 1951-94 period is accounted for by economic growth.[1] The rest is explained by policies seeking to alter the distribution of income (World Bank, 1997:17). Agricultural innovations are often accompanied by a host of infrastructural and institutional changes whose contribution cannot be easily isolated from that of research. This is particularly the case with the Seed-Fertilizer-Irrigation technologies, popularly known as Green Revolution technologies, which incorporate advances from agricultural research and improvements in irrigation and marketing facilities. The macroeconomic link and the attribution problems described above have led many observers to conclude that agricultural research is too blunt a tool to address the problem of poverty alleviation. Its contribution to poverty alleviation cannot be ignored, but not much can be gained from improved targeting.

Poverty, like other macroeconomic variables such as unemployment, can be reduced by economic growth, but requires special programs. Agricultural research can make a contribution to this effort – a critical, albeit small, one. In this paper, we take the

yet unproven view that we cannot rely exclusively on the macroeconomic link to get the highest impact on poverty and that finer targeting of research could lead to increased benefits for the poor. Walker and Ryan (1990) explicitly reject this view, arguing that such targeting is neither desirable nor feasible. According to them, it is best to focus on the regions where the poor are found and on their crops. While it is not certain that improved focusing on the poor will have a greater impact on poverty alleviation, it clear that focusing on the crops of the poor should be supplemented by an analysis of their resource conditions. Improved targeting requires not only finer analytical tools, but also changes in the attitudes of scientists and managers toward the role of poverty alleviation research, and more sensitive management methods that would allow better access to the poor. The purpose of this paper is to examine some attitudes of scientists and management processes that create obstacles to a greater focus on poverty alleviation.

In the next two sections, we shall examine the evolution and nature of rural poverty in India, through evidence provided by the Indian National Sample Survey and the numerous village studies undertaken over the last 40 years, to identify possible linkages with agricultural research. The Indian agricultural research system will be reviewed in section 4 to assess its state of readiness to address poverty issues effectively. Evidence from a survey will be presented in section 5 to show the attitudinal gap that needs to be overcome to foster better focusing of research on poverty alleviation, and the changes in management process that would be required to support such a shift in focus. Section 6 is an exploration of possible institutional

and managerial changes to enhance the effectiveness of agricultural research in its fight against rural poverty.

2. Nature of Rural Poverty in India

The extent and evolution of poverty in India

On the basis of the poverty line as defined by India's Planning commission (1993),[2] more than three-quarters of the poor in India are in rural areas (Table 1) and the severity of poverty, as measured by poverty gap measures,[3] is much greater in rural areas. Moreover, progress in overcoming poverty in rural areas has been slower in recent years, as the focus of economic policy has been shifting toward increased liberalization of the economy (Table 2).

<Table 1>

It is clear from Table 2 that progress in reducing poverty has been greater in urban areas, and this suggests that special efforts are required to alleviate poverty in rural areas.

<Table 2>

Poverty alleviation has been a major policy goal since independence, and Table 3 shows the extent of progress, especially in reducing the severity of poverty.

<Table 3>

Characteristics of rural poverty

The incidence of rural poverty is much higher for those living in landless households; dependent on wage earnings; from scheduled castes or tribes; or living in households headed by women (NCAER, 1996).

Landlessness. In 1994, 37% of rural households were landless, but the incidence of poverty in that group was 52%. Not surprisingly, they represented the largest group of rural poor (49%). The landless households could be further divided on the basis of their source of income: those with work contracts remunerated on a fixed basis, and daily wage earners or those with casual employment. The former may be better-off than small farmers in a risky environment, particularly in areas with insufficient control of water. In the latter group, which represents about 20% of the rural households, the incidence of poverty is as high as 68%. They constitute the poorest of the poor. Female heads of household often fall in this category. It should be pointed out that the landless may still have access to land through various forms of tenancy contract. Moreover, they also own a sizeable amount of livestock, which can be mobilized for development with appropriate technological and institutional innovations. Evidence from village studies suggests that landlessness is not rising, contrary to the suggestions made by several critics of the Green Revolution (Jayaraman and Lanjouw, 1999). Agrarian reform may have also played a role in keeping landlessness from increasing.

Small and marginal farmers. Small farmers are defined as owning 1-2 ha, while holdings of marginal farmers are smaller than 1 ha (Government of India, 1987). The incidence of poverty among marginal and small farmers, who represent 32% and 19% of the rural population, respectively, is around 45% and 27%. Medium- and large-scale farmers, who represent only 16% of the rural households, face a much lower incidence of poverty – between 11% and 16%. Poverty is thus strongly related to land ownership. Yet, marginal and small farmers command 32.3% of the farmed area; this is not an insignificant land resource, and its mobilization for agricultural development may be challenging.

Social dimension. Poverty also has ethnic and social dimensions. One-half of the population of Scheduled Tribes and Castes fall below the poverty line, and these social groups constitute one-third of the rural population. While religion does not play a major role in poverty, literacy is a key factor: the incidence of poverty is 45% for households where adult males and females are illiterate, while it falls to 27% when both are literate. Finally, family size appears to be an important characteristic of the rural poor: the incidence of poverty is 43% for households of eight or more persons, while it is only 26% for households of fewer than four persons.

3. Linkages of Agricultural Research and Poverty Alleviation: Evidence from Past Studies

Several village studies have been conducted across India, some of which include revisits after a number of years and provide an opportunity for longitudinal

comparison. These were reviewed recently by Jayaraman and Lanjouw (1999) to trace the evolution of poverty over the period and to analyze the forces explaining this evolution. We have returned to these studies to examine the specific links to agricultural research.

The principal conclusion that emerges from these studies is that agricultural innovations finally reached the poor, but after a time lag that varied across the studies, placing the equity issue in research in a different perspective. Indeed, the poor have generally benefited over time, but in the short term they may have paid a price. Delays and the obstacles in the diffusion process should be of interest in understanding the link between research and the reduction of poverty.

The proportion of the rural population falling below the official poverty line ranged from 40% to 55% from the mid 1950s to the mid 1980s, even in the post-Green Revolution period (Ahluwalia, 1986). At the same time, many studies show that Green Revolution technologies raised regional disparities and increased the gap between rich and poor farmers. Areas endowed with favorable natural resources and well-developed physical and institutional infrastructure were the first to experience the spectacular gains (Bhalla and Alagh, 1979; Prahladachar, 1983). Even within well-endowed regions, new production techniques were primarily seized by and benefited the rural elite. The rural poor, who include near-landless cultivators, tenants and landless laborers, were bypassed (Beck, 1994; Dasgupta, 1977; Pearse, 1980; Griffin, 1989). The selective nature of the modern agricultural technology has exacerbated the situation in favor of the big farmers, contributing to an increased

marginalization of the landless and near-landless (Byres, 1981; Patnaik, 1987; Sanyal, 1988).

These conclusions are challenged, notably by studies focusing on the more recent period. They broadly conclude that the Green Revolution technologies, which had initially gone against the poor, have started benefiting them. These benefits stem either from the adoption of the Green Revolution technology by poor farmers in new areas as the irrigation infrastructure progresses or from second-generation effects.

The studies found that where infrastructure was available, small farmers exhibited a remarkable tendency to catch up to large farmers in the adoption of high-yield varieties (Chadha, 1979; Vyas, 1979) and small farms even became economically viable (Dantwala**,** 1973). Marginal farmers, with average holdings of less than 0.4 ha, who accounted for 58% of landholdings (Government of India, 1996), were less fortunate. The regional disparities were reduced in terms of average yield (Srivastavsa, 1997; Bhalla and Taygi, 1989; Etienne, 1988).

The second-generation effects have given rise to a wide range of non-crop and off-farm employment opportunities (Sharma and Poleman, 1994; Mellor, 1986), which have increased farm wages (Srivastava, 1997; Walker and Ryan, 1990) and have reduced income inequalities.

Two conclusions can be drawn at this point. First, the adoption of Green Revolution technologies was largely conditioned by resource availability at the farmer level and

was less suitable for resource-poor farmers. Secondly, the benefits to the rural poor that were tied to second-generation effects have come principally from off- farm opportunities. That such opportunities benefited the poor more is still debatable.

Finding unfound linkages

Along with infrastructure development, agrarian reforms and the development of the input supply network, agricultural research has been the major driving force in increasing agricultural performance. Yet, most evaluation studies, including village studies, have focused on factors of development and reforms, shedding little light on the linkage with reduction of poverty.

Studies comparing rich and poor farmers with respect to their adoption and rejection of technologies would cast some light on the research-poverty alleviation linkage. Such studies, conducted mostly by extension people, are more relevant than the village studies. They reveal clearly that the majority of technologies generated through current research were not suitable for the poor farmers and poor regions on four counts:

(i) The technologies are not adjusted to the resource endowment of poor farmers/agricultural laborers. They have high cash expenditure requirements for off-farm inputs, and they require access to water. Poor farmers in general have achieved a lower level of the potential yield of the modern technology. Moreover, the chances are that these technologies carry increased uncertainty and risk in poor farmers' fields.

(ii) The dryland technologies and the low-cost technologies are highly unreliable because of lack of research into development, assessment and refinement.

(iii) Physical resources are lacking and there is poor access to knowledge. According to Rahudkar (1962), agricultural information first reaches the large farmers through the mass media and extension agents, and they in turn inform the small farmers. The information on agricultural innovations often gets distorted during transmission (Haque and Singh, 1972). Poor farmers or those of low socioeconomic status (Mathur et al. 1974) rely mostly on information from informal sources (Dasgupta 1989), and their knowledge about technology can easily be distorted. Poor knowledge about an innovation acts as an important constraint to its adoption (Reddy and Reddy, 1972; Waghmare and Pandit, 1982). This is especially true among small farmers (Singh and Mathur, 1984).

(iv) Sometimes the technology reaches the poor farmer at the stage of declining product prices, when the early innovators' rents have eroded. Walker and Ryan (1990) confirmed that early adopters are predominantly large farmers who earn a sizable innovator's rent, and that early adoption by the few impedes diffusion to the majority.

Two conclusions can be drawn. First, to realize its full potential, the technology must effectively reach the poor. Secondly, to be useful to the poor, the technology should have an appropriate resource requirement.

Post-Green Revolution technologies

Since the early '80s, a considerable emphasis in agricultural research has been placed on crops such as oilseeds, pulses and millets. At the same time, research has increased in areas less endowed in natural resources (dryland and rainfed areas), on sustainable resource use (soil and water conservation) and on farming systems research, including watershed management. The change in research emphasis has generated a significant amount of knowledge as well as technologies.

However, most of the studies before and after the ’80s, including the village studies, continue measuring the impact of Green Revolution technologies on different regions and sections of society. Hardly any reference has been made to post-Green Revolution technologies in impact assessment studies of regions, and of sections of society including poor farmers. We strongly feel that the study of the impact of post-Green Revolution technologies could throw more light on the mechanisms linking agricultural research to poverty alleviation.

Issues in targeting research

The second-generation effects took a long time to mature, almost three decades in the present case. Under such circumstances, benefits of the technology accrue to second-generation households, and not to those immediately in the grip of poverty. Thus, in order to increase household income over the short term as well as for long-term development, it is necessary to target research at poor farmers.

Targeting research to meet the needs of the rural poor will mean designing technologies that are relevant not only to the commodities on which they depend, but also to the conditions under which they produce the commodities. Walker and Ryan (1990) suggested that research should focus on commodities of the poor, and on areas where the concentration of the poor is greatest – rainfed and dryland, semi-arid tropics and marginal lands. Generally, farmers in such areas are poor, irrespective of the size of their landholdings, and we need to look at all other resources available to the farmer to seek ways out of poverty.

Agricultural research targeted at poor farmers should help to raise their income with technologies requiring fewer resources or reduce their resource use. Higher productivity of their food crops will lower the amount of land required for low-value food crops, and it will free land for diversification and high-value crops.

Hazell (1999) argues that since there are few economies of scale in agricultural production in developing countries, targeting family farms is attractive on both equity and efficiency grounds. He further emphasizes that small and medium-sized farms must receive priority in publicly funded agricultural research and extension. The author further mentions that targeting rural women in agricultural extension and education is another way to focus research on poverty alleviation.

To ensure that agricultural research generates more technologies relevant to poor farmers, management of agricultural research has to be brought to bear on the issue. The attitudes of scientists and managers, and management mechanisms, also need to be oriented toward poverty alleviation. Lacking clear evidence of a linkage between agricultural research and poverty in literature, we have tried to determine whether the system and its management provide scientists with the prerequisites to work effectively toward poverty alleviation.

3. The National Agricultural Research System

The major components of the National Agricultural Research System (NARS) in India are the Indian Council of Agricultural Research (ICAR) and state agricultural universities (SAUs). In addition, several other agencies, like general universities, other scientific organizations, various departments and ministries at the national level, and private and voluntary organizations, also participate directly or indirectly in research activities related to agriculture (Raman et al, 1988).

The private sector accounts for 16% of the research carried out in India (Evenson et al., 1998) and its importance is growing in seed production, crop improvement, and input resources. These organizations are capable of conducting research in agro-climatically favorable areas and they meet the needs of rich farmers. Public research need not compete with private research in those areas. This trend provides an opportunity for public research to focus more on agro-climatically unfavorable areas and on resource-poor farmers who cannot afford the more costly innovations.

Mandate for poverty alleviation

The mandates of ICAR and the SAUs, the two principal components of the system, complement each other. ICAR institutions concentrate mainly on problems of national importance, with some focus on regional problems wherever the local research infrastructure is not yet fully developed (Balaguru and Raman, 1988). Regional problems are handled principally by SAUs. An essential feature of a state agricultural university is its philosophy of service to agriculture and the rural community, and its emphasis on programs that are directly and immediately related

to solving social and economic problems of the countryside (Singh, 1988). Thus, in principle, the SAUs are more oriented to dealing with rural poverty by virtue of their mandate and by the deep penetration of their station network into their respective hinterlands.

Extent of the system

Regional distribution. The state agricultural university system dominates the NARS through the importance of its human resources, which account for two-thirds of the scientific manpower and three-fourths of the permanent research sites. In addition to the main campus and constituent colleges, it conducts state-specific research through its network of research stations dispersed widely in each agro-ecological zone. The 45 ICAR institutions and 28 SAUs have an average of 4 and 21 research stations, respectively. The SAUs have more stations in regions of high rural poverty, but these cater to larger areas in comparison with those in low-poverty regions. The ICAR institutions are sparsely spread all over country and are located mainly at district or state headquarters. They have comparatively limited access to the rural poor.

Scattering of Human Resources. Approximately 40,000 scientific staff work in the NARS. Of these, 56% are in SAUs and 12 % in ICAR institutions. The rest are spread across general universities, NGOs, etc. The proportion of SAU and ICAR staff working at field research stations is 31% and 22%, respectively. However, the average number of scientists per research station in the regions of high poverty and

low agricultural productivity is less than the number in regions of low poverty and high agricultural productivity (Table 4).

<Table 4>

Trends toward station specialization. Research in ICAR institutes is highly specialized in terms of crops, animals and resources. SAU research stations are much less specialized because of their commitment to solving local problems. The specialization of some stations in crops and resources is likely to divert resources from research with a farmer perspective. Since funding of research in SAUs is largely coming from ICAR through nationally coordinated projects, which are predominantly commodity focused, commodity specialization is increasingly forced onto the SAUs.

Resources

Financial control. Several Government of India agencies provide about 60% of all funds for agricultural research, while state governments contribute about 20%, private companies about 12%, and foreign agencies the rest (World Bank, 1990). In addition to heading a network of research organizations, ICAR is a central funding body to the whole system and provides more than Rs 300 million annually to SAUs (Evenson et al., 1998). It also exercises considerable influence on the orientation of research in state agricultural universities through its monitoring and coordination role. In addition to the funds from state governments, the SAUs receive support from ICAR in the form of development grants and fellowships, and through nationally coordinated research projects, ad hoc research schemes, and the UNDP Center of

Advanced Studies. State governments barely cover the operating costs of their vast network of research stations; thus ICAR funds are crucial to SAU research.

Disciplinary mix of human resources. The social sciences have an important role to play in the research system. At the global level, they should play a key role in research policymaking, setting priorities, monitoring, and evaluation. They also have an essential contribution to make in identifying research issues at the farmer and community levels, and in evaluating the technologies being proposed to farmers. There are about 150 social scientists in ICAR, and not many more in the SAUs. They comprise less than 3% of the total number of scientists and are thus seriously underrepresented in the system. This particular disciplinary imbalance has made it difficult to focus research more on resource-poor farmers. If institutional innovations are to be important in helping poor farmers overcome some of their resource constraints, the weak social science base in the NARS may even be more disturbing.

Management of agricultural research

The strength of the NARS arises not only from its resources, but also from its ability to manage the resources effectively and efficiently. Such management should be responsive to the needs of its stakeholders and accountable for the resources entrusted to it (Raman, 1988). Scientific management and institutionalization of research management were deemed essential components in the World Bank-funded National Agricultural Technology Project (NATP). More than 20% of the resources are allocated to strengthening the organization and its management. The proposed

changes amount to a real difference in management culture. They also include the implementation of a priority-setting mechanism involving socioeconomic criteria (ICAR 1998) and a decentralization of decision-making powers. The design of these mechanisms and procedures will have important consequences for focusing research on poverty issues. The National Academy of Agricultural Research Management (NAARM), created 20 years ago in the ICAR system to strengthen management in the ICAR institutions, will also be called upon to help implement this ambitious program of change.

Research management is less focused in the SAUs, whose resources and management systems are strained by the dual mandate of research and education. Little effort has been made to improve the management of research in those institutions on the front line of the battle against poverty.

5. Poverty Alleviation in Agricultural Research As Seen by the Scientists

The attitudes of scientists and their perception of management biases toward greater research focus on poverty alleviation were analyzed through a survey that is part of an ongoing DFID-funded study.[4] The results presented here are still preliminary as the survey is still underway.

Questionnaires were distributed to full-time researchers at selected research stations of three state agricultural universities in southern India and one ICAR institute in the same region. The sample of 71 observations represents more than 10% of the targeted population of researchers engaged in full-time research activities (no

teaching or dissertation supervision duties). Outlying stations are underrepresented for the time being. This is a serious flaw as these stations are supposed to be better positioned to access the poorer farmers, and their views would have been very useful.

With these caveats, the results are presented below in two parts: a) a report on how scientists view the role of agricultural research in poverty alleviation, and b) a report on perceived management biases against an increased focus on poverty alleviation.

How scientists view the role of agricultural research in alleviating poverty

Measuring attitudes is difficult under the best of circumstances and depends very much on the nature of the attitude object. A complex object will provide fuzzy answers. One must recognize that the attitude of scientists toward the role of agricultural research in alleviating poverty is not a trivial attitude object. Attitudes are generally made up of three components: the cognitive aspect – what the subject knows about the subject; the affective aspect – whether he likes or dislikes the object; and the propensity to action (Sudman and Bradburn, 1986). Our survey focused essentially on the last two components and the results are reported under those headings. We relied heavily on Chambers (1983) in drafting most of our questions.

How do scientists feel about research and poverty alleviation?

Poverty alleviation is an important goal for agricultural research. There is obviously a strong sympathy toward poverty alleviation among agricultural scientists, with over 90% recognizing it as a valid goal for agricultural research (105).[5] There may well be an element of political correctness in this strong response, especially in a country where the issue is a matter of public debate. A significant minority (17%) views it as a foreign concern, and this skepticism is principally located on main campuses of SAUs (101). Opinions are divided equally on question number 103 regarding poverty alleviation as an explicit goal of ICAR. In fact, India does not have an explicit agricultural research policy, and the commitment to poverty alleviation in ICAR stems more from adherence to national policy goals than an explicit espousal of poverty alleviation as a goal of the system. Poverty alleviation does not appear in the goals of ICAR as stated in the most recent version of the draft perspective plan, and only a passing reference to sustainable agricultural development is found in the vision for 2020 (ICAR, 1999).

<insert table 5>

Poverty alleviation is an obvious goal, but targeting the poor arouses more conflict. An overwhelming majority of scientists feel that any good research will lead to poverty alleviation (1010) and that all of their research deals with the issue in one way or the other (102). This is consistent with the fact that poverty is an important goal, and it is a convenient cop-out for those who feel that research cannot be targeted more specifically at poverty. Indeed, when it comes to increasing the focus of research on poverty, opinions are much more divided. A majority of scientists agree that agricultural research is powerless to reduce the burdens of the landless poor(1011). One third feel that the needs of the poor are no different from

those of other farmers, thus requiring no special targeting efforts (1013). Nearly one-half of the scientists feel that agricultural research cannot be targeted at any specific group of farmers (109).

It is the view of a significant group of scientists (32%) that there is little point in consulting the poor in setting research priorities, as they are not aware of their technology needs (106). Contrary to expectations, this view was shared by scientists in smaller isolated stations as well as those in larger zonal research stations and on main campuses. Proximity to rural poverty does not seem to raise awareness about the specific technology demands of the rural poor. On the other hand, nearly 80% of scientists recognize that poor farmers are more constrained in their technology choices, which should suggest that they recognize that they have special needs (1012).

What would scientists like to see done about it?

Attitudes toward action were measured through a series of questions designed to test what scientists would be prepared to do to improve the performance of research in alleviating poverty.

<Insert Table 6>

Skills development. Unless they were speaking for others, scientists overwhelmingly recognized the need to learn from the poor about how they cope with problems and develop strategies to escape from poverty (107). They also accepted the necessity to acquire certain techniques to improve their interaction with the poor (1023), and to develop the required skills to focus their research on poverty

alleviation (1018). In addition, they recognized the potential of participatory research methods to develop and test technologies for the poor (1026).

This rather strong willingness to act is in sharp contrast to the less-than-unanimous response regarding the ability to focus research on poverty alleviation, as seen in the preceding section.

Perceived research management biases toward poverty alleviation

Two aspects need to be emphasized in the discussion of the above results. First, we need to insist that they are perceptions and should not be confused with actual facts. Perceptions such as lack of transport need to be confirmed with objective quantification of the availability of transport in research stations. Such quantification could be undertaken in follow-up research. The second point is that identified biases are not necessarily intentional and do not constitute an indictment of present management practices. We have simply tried to identify those administrative practices that are not conducive to improved focus on poverty alleviation. It is principally through discussions with scientists at research stations that the portion of the questionnaire relating to management biases was devised.

<Insert table 7>

A need to engage poor farmers more directly in research approaches. Seven questions related to different aspects of research management, ranging from

interfacing with the poor in order to identify their technology needs and set priorities (119, 1016, 1110, 1113,1115, 1121), to actual conduct of research in collaboration with the poor (115). On all but three questions (1016, 1110 and 1121) there is a very wide consensus (above 80%) on the need to get closer to the poor and to develop approaches to bring them in the planning process. While a majority of respondents feel that Rapid Rural Appraisals are biased toward the more vocal farmers (1110), a minority, especially at field research stations, continues to have faith in these methods. There is no doubt that such methods have contributed to a better understanding of village development problems; the poor are indeed recognized in such studies, but documents examined so far fall short of an analysis of the technology needs of the poorest. Responses to question number 1121 are more puzzling and may cast some doubt on the wording of some of the questions. Indeed, after recognizing that focusing on the poor requires special approaches, a majority of respondents still feel that current targeting methods are adequate to meet the needs of the poor. More than one-quarter of the scientists refute the view that scientists and extension agents prefer exchanges with local influentials to those with poor farmers (1016). The minority that is willing to engage the poor may well provide a wealth of experience that could be tapped in future training programs.

The incentive structure may not support research focusing on the poor. Responses to three questions relating to the incentive structure (1111, 1114, and 1122) were less consensual. Indeed, more than one-quarter of respondents opposed the view that incentives were biased in favor of research focusing more on better-off

farmers. This minority view was well distributed across scientists on main campuses or in stations and substations.

Decentralization is necessary, but not a scattering of the human resources. Decentralization (1118) was recognized by a large majority of scientists as essential to allow units to respond effectively to the needs of their clients, especially the poor. An equally important majority felt that human resources should be allocated in multidisciplinary teams of some critical size (1119). Though size is not specified in our study, it is easy to recognize what scientists meant by critical size when one observes the current scattering of resources in the ICAR-SAU system. In a parallel research project still underway, covering more than one-quarter of the estimated one thousand publicly held research infrastructure sites in the country, we found that nearly two-thirds of the sites had five or fewer scientists. The situation is particularly severe in SAUs. Clearly the system has spread its wings very widely across the country. This scattering of resources has not been accompanied by the decentralization required by such a vast set of resources. The ICAR management, which is attempting to address this situation in the NATP referred to above, has recognized this last point.

A clear advantage of such an extensive system of stations and substations is its ability to reach deep into the hinterland and seek out pockets of poverty. In spite of this impressive dispersion of resources, scientists feel that sites for technology assessment and refinement are still chosen in more accessible villages (1022). We know too little about the spatial distribution of poverty yet to judge the wisdom of

locating such research sites close to research stations. It may lower research costs, but that might be at a significant cost in terms of relevance to poor farmers.

Related to the issue of size is that of the discipline mix of such research teams. The ICAR system has fewer than 150 social scientists, mostly economists. The SAU system fares little better in this respect and has even fewer social scientists in the field. Scientists are nearly unanimous in recognizing that the problems of the poor will require global approaches, which are generally provided by multidisciplinary teams rather than individuals (1025).

More resources may be required to focus on poverty alleviation. It seems that the poor are not as easily accessible as better-off farmers (114), that more transport assets may be required (118), and that developing technologies for the poor will in general be more costly (1024). It is likely that poverty-focused research conducted in collaboration with poor farmers may indeed be more costly in terms of transport and scientists' time; however, this may be offset by the lower cost of such research compared with on-station research. This cost comparison is required in India, which has a vast network of physical installations, the cost of which may well be quite crippling.

Administrative biases. The only administrative issues raised in the questionnaire were those reported to us in interviews with scientists. On those few issues, the survey found ambiguous responses. Working hours (111 and 117) do not prevent scientists from reaching the poor, but seem to be an obstacle in effectively

interacting with them. A majority find current administrative procedures not supporting scientists staying overnight in villages (1112) when interaction with poor farmers could be more congenial. Frequent transfers (1117) across institutions are seen as an impediment to acquiring a better understanding of the needs of the poor.

6. Policy perspectives for institutional and management change

The experience of the Indian NARS in poverty alleviation provides some clues regarding possible changes in research organizations and their management.

Research approaches yielding more targeted short-term benefits are required.

In the Indian context, **t**he Green Revolution technologies have shown their limitations in reaching the poor in a reasonable time frame. This would suggest that research methods of the past need to be complemented by additional ones that have a more effective interface with the farming communities, in particular the poor. Since 1995, ICAR has initiated a Technology Assessment and Refinement project focusing on key villages around selected research stations. Such projects are set up as units in existing stations. It is too early to assess the impact of this new approach, which incorporates Rapid Rural Appraisal methods and on-farm testing, but the initial results are encouraging in terms of their perception of the problems of the poor. A widening of the approach could include a search for alternative activities in addition to the promotion of the traditional crops proposed by the station, and a search for institutional innovations that foster a greater participation of the poor in the conduct of their economic affairs.

Indonesia has pioneered the testing of this model through separate institutions called technology assessment institutes rather than units within existing institutions. These new entities interface with farmers and link with upstream commodity institutes as well as with private sector entities. This model will need to be reviewed to see the extent to which it reaches its targets more effectively, and how the management mechanisms are holding in this situation.

More flexible organizations and management methods. Unless new organizations are created specifically to focus on such adaptive research, as was the case in Indonesia with the technology assessment institutes, current organizations will need to be given much more flexibility to deal with the challenge of these new research approaches. In particular, they should be able to support multidisciplinary teams operating outside their home base for extensive periods of time, often under difficult conditions. This will require proper incentives for scientists to accept the difficult field conditions and to choose a career path that may be less rewarding from a more traditional science perspective. Bureaucracies generally find it difficult to accommodate staff of similar experience and responsibilities operating under different sets of incentives.

The multidisciplinary teams should be able to link effectively with their colleagues at the station or at the upstream commodity or resource base institutes. The type of interaction required is one of direct contact among scientists, which should be unhindered by bureaucratic procedures governing communications between institutes. Possibly the new information technologies could support more active

dialogue between scientists operating upstream and downstream in the research continuum.

Costs. The expense of such research may compare favorably with that of on-station research if all costs are accounted for in both cases. The cost of station-based research is often underestimated by ignoring much of the overhead costs. A proper estimation of the real cost of station-based research may put off-station research in a more favorable light even with the increase in travel costs and daily allowances.

Mandate. Mission and mandate are often seen as modern management buzzwords that carry no real significance in the actual management of organizations. In fact, without a sharply defined mandate, organizations drift in many directions and lack focus in their activities; and, not surprisingly, in their performance. If poverty is to be central to some institutes at the farmer interface, it should appear in the mandate, and commitment to the mandate should be monitored by appropriate governance mechanisms at the system level.

Development of a strong capacity in the rural social sciences. The Indian NARS, like many other NARS, has to develop a sizeable capacity in the rural social sciences for the operation of contact teams with poor communities. A shortage of social scientists is a serious constraint to developing the necessary understanding of the conditions of poor rural households and finding proper solutions to their problems.

Conclusion

There is clear evidence that the Green Revolution technologies have had a significant impact on poverty alleviation, though such an impact, for a variety of reasons, may have taken considerable time to reach the poor. Equity considerations are then addressed over time, a less-than-satisfactory solution for those living in poverty. To complement the current research approaches, there is a need for a different kind of research focused on the farmer, in particular the poor farmer, which would fully recognize his resource constraints. To be effective, this new research approach will require a more multidisciplinary mix, including more rural social sciences; greater farmer participation; improved linkages with specialized commodity centers; and effective teamwork. These requirements constitute serious challenges to current organizational structures and management methods.

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Table 1. The Extent of Poverty in India, 1993-94

	Rural	Urban	Total
Head Count	36.70	30.50	35.00
Number of poor in millions	240.00	71.50	312.50
Poverty Gap	8.38	7.40	8.13
Squared Poverty Gap	2.79	2.42	2.69

Source: Datt (1997) Poverty in India and Indian States: An Update. IFPRI Washington DC

Table 2. Poverty Trends in India, 1977/78 to 1993/94

Region	Poverty (head count)			Growth rate (annual)	
	1977/78	1987/88	1993/94	1977/78-1987/88	1987/88-1993/94
	(percent)			(percent)	
Rural	50.60	39.23	36.66	-2.51	-1.12
Urban	40.50	36.20	30.51	-1.12	-2.81
All India	48.36	38.47	35.04	-2.26	-1.54

Table 3. The Evolution of Rural Poverty in India, 1951-94

Years of Observation	Head Count	Poverty Gap	Squared Poverty Gap
1951-52	47.37	16.00	7.53
1961-62	47.20	13.60	5.31
1972-73	55.36	17.34	7.32
1983	45.31	12.64	4.84
1991	36.43	8.28	2.68
1993-94	36.66	8.38	2.79
Trends 1951-94 in %	- 0.86	- 1.84	- 2.65

Source: World Bank (1997)

Table 4a. Resource Allocation in the Indian NARS across Regions of Agricultural Productivity and Rural Poverty

Particulars		Regions				Total
		HAP & LRP	HAP & LRP	LAP & LRP	LAP & HRP	
Agricultural Research Expenditure:						
Percentage share in real research expenditure	1965-68	27.14	17.98	17.09	22.76	100
	1989-92	26.50	21.87	17.59	25.64	100
Per ha research expenditure in Rs.	1991-92	4391	2000	3657	1917	
Gross irrigated area (%)		51.47	30.53	24.60	21.22	36.00
Fertilizer consumption per hectare in Kg.		125.00	80.00	51.00	45.00	
Institutional Network:						
No. of SAUs		4	8	7	10	29
Research stations	1991-92	121	102	171	209	603
Net cultivated areas per Research Station	1991-92	173.59	301.92	218.20	246.84	233.42
ICAR research stations		31	44	44	47	174
ICAR Institutions						
Human Resources						
Scientific manpower per research station in SAUs	1991-92	17.55	13.64	8.81	7.57	11.16
Scientific manpower per ICAR research station		3.58	7.00	6.38	5.21	5.84

Agricultural productivity is measured in terms of gross value of production per hectare of gross cropped area, taken from *District Profile 1995*. CMIE. (Bombay,). Rural poverty reflects the statewide head count ratio in percentage terms

HAP-LRP: High agricultural productivity- Low rural poverty. Agricultural productivity varies from Rs 4392 (Andhra Pradesh) to Rs 8034 (Kerala). Rural poverty varies from 25.2% to 29.10% in the same states. (Kerala, Punjab, Haryana and Andhra Pradesh)

HAP-HRP: High agricultural productivity- High rural poverty. Agricultural productivity varies from Rs 3875 in Assam to Rs 6622 in Tamil Nadu. Rural poverty varies from 48.30% (WB) to 39.35% (Assam). (Tamil Nadu, West Bengal, Uttar Pradesh and Assam)

LAP-LRP: Low agricultural productivity- Low rural poverty. Agricultural productivity varies from Rs 1559 (Rajasthan) to Rs 3495 (Karnataka). Rural poverty varies from 32.82% (Karnataka) to 16.28% (Himachal Pradesh). (Karnataka, Jammu & Kashmir, Himachal Pradesh, Gujarat and Rajasthan).

LAP-HRP: Low Agricultural productivity- High Rural Poverty. Agricultural productivity varies from Rs 2170 (Madhya Pradesh) to Rs 3498 (North-Eastern States). Rural poverty varies from. 57.64% (Orissa) to 39.35% (North Eastern States. (North-Eastern States, Maharastra, Madhya Pradesh, Bihar and Orissa)

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Table 5. Attitudes of Scientists Toward Poverty Alleviation Through Agricultural Research: What They Feel About the Issue (as % of total sample)

	Strongly agree	*Agree*	*Disagree*	*Strongly disagree*	*No opinion*
101. Poverty alleviation in agricultural research is a foreign concern.	4	13	39	34	10
102. All our research is concerned with poverty alleviation in one way or the other.	39	46	8	0	6
103. Poverty alleviation is not an explicit goal of agricultural research in India.	10	34	32	18	4
105. Poverty alleviation is a valid objective for agricultural research.	41	51	3	0	4
106. The poor do not know their technology needs, so there is little point in consulting them to set research priorities.	14	18	31	31	6
109. Agricultural research cannot be targeted at specific groups of users such as the poor.	8	32	41	13	11
1010. Any good agricultural research will contribute to poverty alleviation.	34	57	4	0	4
1011. A large number of the poor are landless, and agricultural research can do nothing to improve their lot.	7	33	47	11	3
1012. Poor people have little freedom and power and are therefore more constrained in their technology choices.	23	57	16	0	4
1013. Focusing technology development on the poor does not make sense because their technology needs are not different from those of other groups of farmers.	6	28	49	11	6

Table 6. Attitudes of Scientists Toward Poverty Alleviation Through Agricultural Research: What They Would Like to See Done About It (as % of total sample)

	Strongly Agree	***Agree***	***Disagree***	***Strongly Disagree***	***No Opinion***
107. Learning from the poorest about how to cope is essential to enabling them to improve their lot.	42	44	3	1	10
1018. Scientists would require special skills to focus their research on poverty alleviation.	35	52	10	1	1
1019. I would like to see poverty alleviation as a criterion for the approval of research projects	25	55	11	3	6
1023. There is much to learn from the poor but you need certain approaches to reach them and to enter a productive dialog with them.	25	66	3	0	6
1026. Participatory research approaches are essential to developing and testing technologies for poor farmers.	38	56	1	1	3

Table 7. Perceived Management Impediments Toward Greater Role of Research in Poverty Alleviation (as % of total sample)

	Strongly Agree	*Agree*	*Disagree*	*Strongly Disagree*	*No Opinion*
111. Our working hours do not allow us to reach the poor.	8	38	46	6	1
113. Developing technologies for the poor is less rewarding career wise because it will take much longer to reach publishable results.	13	34	43	4	6
114.Poor farmers are generally in more remote locations and will require higher transport costs for scientist to reach them.	16	73	8	0	1
115. Because the poor have less resources of their own, they are less likely to be able to participate in joint research efforts.	21	51	20	4	4
116. Extension staff and researchers have a marked tendency to visit progressive farmers.	13	34	44	7	3
117. Working hours in research stations are an obstacle to interaction with the poor.	38	49	8	4	0
118.There are too few vehicles on the station to enable scientists to reach the poor farmers.	24	56	11	3	6
119. Poor farmers cannot afford to participate in station-based research consultations with farmers and consequently are seldom represented in such consultations.	12	31	38	10	10
1016. Scientists and extension agents always find it more profitable and congenial to converse with local influentials than with the uncommunicative poor.	18	49	21	3	8
1022. The villages selected for Technology Assessment and Refinement tend to be more accessible villages close to research stations.	14	61	20	3	3
1024. Developing technologies for the poor is more costly in scientists' time, in transport costs, and in providing the necessary inputs to support the proposed technologies .	12	31	38	10	10
1025. The problems of the poor are generally multidimensional and require a more global approach that would require multidisciplinary teams.	38	54	4	1	1
1110. Rapid Rural Appraisals are biased toward the more accessible and more vocal farmers.	14	55	14	1	15
1111.There is a strong professional incentive (publications) to conduct research with more progressive farmers who have adequate resources and who can pick up more readily the proposed innovations.	12	56	25	3	4
1112. Current administrative procedures do not encourage staff to stay overnight in villages, when more discussions could take place with the poor farmers in a less-constrained framework.	15	39	35	4	6
1113. As the poor tend to be more difficult to find and less vocal when in the presence of officials, researchers need to develop new methods to reach and engage the poor.	22	62	8	1	6

1114. Publication requirements are heavily biased in favor of quantitative research approaches that may not be most appropriate to reach the poor.	16	52	21	4	6
1115.To develop appropriate technologies for poor farmers, it is essential that our research organizations develop new methods of collaboration between scientists and farmers to identify their needs, set priorities in work programs, test and refine the technologies, and evaluate the final results.	42	48	8	0	1
1117.Frequent transfer of staff across units and functions work against developing understanding of the poor and expertise in dealing with issues of relevance to the poor.	17	45	22	3	13
1118.Decentralization of our research organizations is required to enable the various units to respond more readily to the needs of their clients, particularly those of the poor.	20	59	12	3	6
1119. Scattering of human resources in remote stations does not allow for the minimum size of research team necessary to achieve the multidisciplinarity balance required to deal effectively with the problems of the poor farmers.	13	63	14	3	7
1120.There are neither guidelines nor directives from top management to focus on poor farmers.	12	31	48	4	6
1121.Present targeting mechanisms in my institution are sufficient to target research at the poor.	7	45	31	8	8
1122. The scientific pay-off (research papers and promotions) of developing technologies for the poor are much lower that for the better-off farmers.	12	45	28	3	13

[1] For a definition of Head Count Index and other poverty measures, refer to World Bank (1997, 2-3).
[2] The poverty line for a household of five members was estimated at Rs 6,400 per annum at 1984-85 prices.
[3] For a definition of these measures, refer to World Bank (1997, 2-3).
[4] In collaboration with ISNAR, the Commonwealth of Learning, and Wye College, NAARM is developing a strategy to provide in-service management training to research managers through the distance learning mode. This strategy will be tested with one training module. This module, yet to be developed, will provide background materials on Rapid Rural Appraisal and priority setting methods. It is also intended to sensitize scientists to the situation of the poor and managers to management approaches that could support the efforts of the scientists.
[5] Numbers in brackets refer to questions in the tables.