POLICY BRIEF 3

FUNDING AGRICULTURAL RESEARCH

Why agricultural research ?

Agriculture the world over has changed from a resource-based to a science-based system. Technical change has accounted for half to more than four-fifth of agricultural output growth since the sixties in developed countries (Hayami, Yujiro and V.W Ruttan. 1985. Agricultural Development: An International Perspective. Johns Hopkins Univ. Press, Baltimore.). In India too, as land frontiers closed down rapidly, the contribution of technical change to output growth rose from about one-fourth in the fifties to more than half since then ((a) Boyce, J.K. and R.E. Evenson. 1975. National and International Agricultural Research and Extension Programs, ADC New York. (b) Evenson, R.E., K.P.C. Rao, and M.W. Rosegrant. 1993. "Determinants of Productivity Growth in Indian Agriculture" Paper for the National Workshop on Agricultural Research Evaluation: Methods and Applications, NAARM, Hyderabad (Unpublished).). This trend must be fostered and accelerated. This must accompany conservation of natural resources and maintenance of ecological integrity of the agricultural system.

Technology-led growth requires investments in technology generation (agricultural" research), extension, education, physical and institutional infrastructure. Empirical studies show that agricultural research has been the primary source of total factor productivity growth in India ((a) R.E. Evenson. and Rosegrant, M.W. 1993 "Determinants of Productivity Growth in Asian Agriculture" Paper for the 1993 American Agricultural Economics Association International Pre-Conference on Post-Green Revolution Agricultural Development Strategies in the Third World (Unpublished). (b) Kumar, P. and M.W. Rosegrant. 1995. "Productivity and Sources of Growth for Rice in India", Econ. and Pol. Weekly, XXIX (53): A 183-188. (c) Kumar, P. and Mruthyunjaya, 1992. "Measurement and Analysis of Total Factor Productivity in Wheat", Indian J. Agric. Eco. 47(3): 451-458. (d) Evenson, R.E. and J.W. Mckinsey. 1991. "Research, Extension, Infrastructure and Productivity Change in Indian Agriculture", in Research and Productivity in Asian Agriculture, R.E. Evenson and C.E. Pray (eds), Cornell Univ Press, Ithaca.). Public investment in agricultural research is, therefore, crucial.

A large and diverse country like India cannot depend on borrowing technologies from other countries. Agricultural production technologies are generally less transferable than others. Moreover, without adequate indigenous research capacity, benefits from international transfer are also minimal ((a) Boyce, J.K. and R.E. Evenson, 1975. op. cit. (b) Englander, A.S. 1991. " International Technology Transfer and Agricultural Productivity" R.E. Evenson and C.E. Pray (eds) op. cit.). Secondly Respite the current enthusiasm for privatization, private sector cannot meet these needs fully for several reasons. Research output is often a public good. Market failures are common and appropriability of benefits is restrictied, thus limiting incentives for private initiative. Also private sector is mainly driven by short-term profit considerations, longer term or sustainability concerns are rarely accorded priority. Therefore, even in highly developed countries, strong public research systems have to be supported (Ruttan, V.W. 1982 Agricultural Research Policy, Univ of Minnesota Press, Minneapolis.). Need for this kind of support to agriculture is recognised under WTO provisions also.

How much to invest ?

Use of conventional investment criteria to determine appropirate research investment levels is fraught with many conceptual and operational difficulties. Rates of return studies suggest substantial under-investment across the board. These typically show 40+ percent returns even in countries where research investment intensities are five times higher as compared to developing countries.

A norm of 2 percent of agricultural GDP for agricultural research has been suggested (a) World bank, 1981, Agricultural Research: Sector Policy Paper, Washington, D.C. (b) Technology Policy Statement

1993. Deptt. of Science and Technology, Govt. of India.). For India, Fig. 1 indicates that less than 0.5 percent of agricultural GDP is spent on research. At Independence, this was less than 0.1 percent, rising to 0.12 percent in 1960, and about 0.2 percent towards the end of sixties (Evenson. R.E. and Y. Kislev. 1975 Agricultural Research and Productivity, Yale Univ.). After a spurt through the seventies, it has hovered around 0.45-0.50 percent since early eighties (Randhawa, N.S., K.V. Raman and S.P. Ghosh. 1993. " Capital Requirements for the Modernization of Agriculture" in Proceedings of the First Agricultural Science Congress, P. Narain (ed). New Delhi.). This implies that research investments have barely kept pace with growth of agriculture; there has been no special accent on jacking up research investment intensity over the last 15 years.

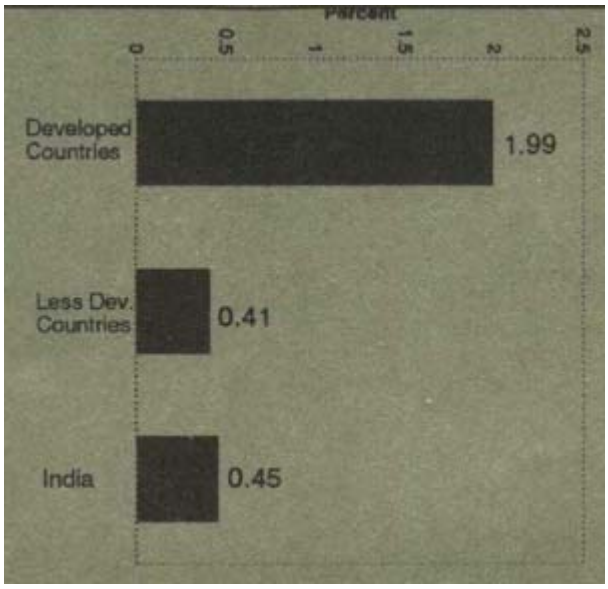

Fig. 1 agricultural research investment as percent of agricultural GDP

It has been estimated that in developing countries as a group, research .investments account for about 6-8 percent of total public spendings on agriculture (Pardey, P.O., J. Roseboom and J.R. Anderson. 1991. Agricultural Research Policy .-International Quantitative Perspectives, Cambridge Univ. Press, New York.). Fig. 2 illustrates the situation with regard to allocation of plan funds in India since the Fourth Five Year Plan.

The figure shows quite clearly that except during the Eighth Plan which sought to initiate a correction, agricultural research has not been accorded due priority. Since the centre accounts for nearly 60 percent of total public spending on agricultural research, signals on low priority filter down to states also (Mruthyanjaya, P. Ranjitha, and S. Selvarajan. 1995. "Congruence Analysis of Resource Allocation in Indian Agricultural Research System" Div. of Agric. Econ, IARI, New Delhi (Unpublished).).

Analysis of trends in developed countries which spend close to 2 percent or more showed that between 1965 and 1985, there was positive growth in real expenditures per scientist (Pardey, P.O., et al 1991. op. cit.), implying distinct improvement in research support to scientists. In 130 developing countries, on the other hand, there was negative growth in real expenditures per scientist, suggestive of horizontal rather than vertical expansion of the research system. Accordingly, there has been a deterioration in availability of operating funds per scientist. This has been the case for India as well (Randhawa, N.S. et al. 1993, op. cit.).

Over the Ninth and subsequent plans, these trends must be corrected and a target level of 7-8 percent of total agricultural outlay for agricultural research and education must be established. With concomitant growth in private sector spendings, this will help align total spendings on agricultural research with the needs of the agricultural sector. An aggressive R & D investment strategy is absolutely vital for agricultural growth in an ^internationally competitive environment.

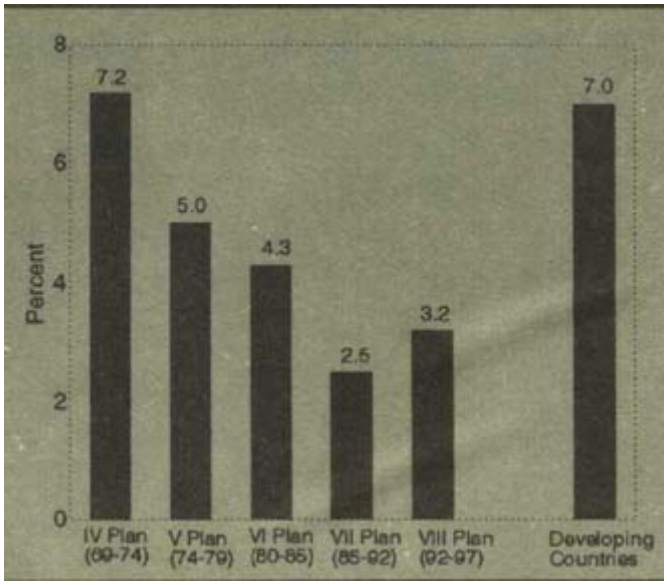

Fig. 2 Share of agricultural research and education in public spending on agriculture

How productive are research investments ?

There is massive evidence from all over the world, from developed as well as developing countries, indicating that agricultural research is one of the most rewarding investment options. Fig. 3 below shows the distribution of 150 empirical studies on agricultural research evaluation in terms of estimated internal rates of return.

The figure shows that, with the exception of studies in Africa, 85-99 percent of the studies show rates of return in excess of 20 percent; 46-63 percent of the studies estimate these to be in excess of 50 percent.

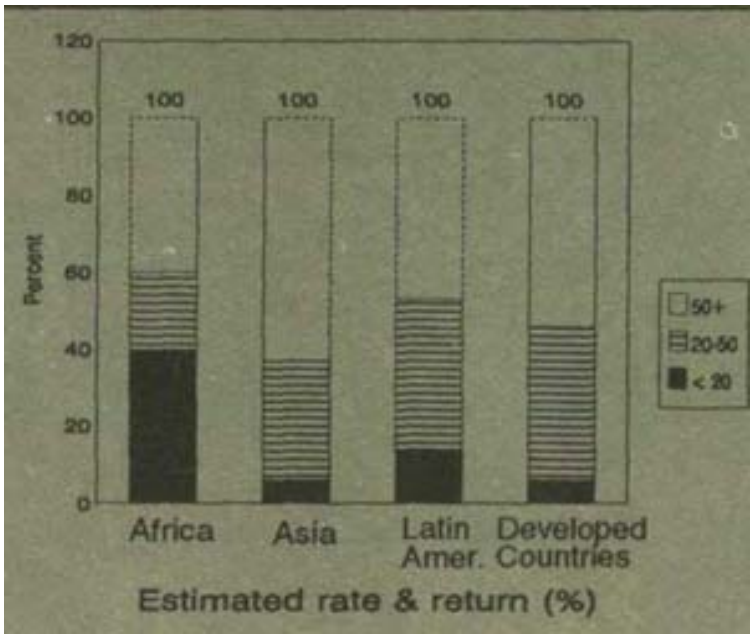

Fig. 3 Distribution of empirical studies on agricultural research

Source : Evenson, R.E. and M.W.

A number of evaluation studies have been conducted for India. Table 1 summarises the results of some important studies.

Table 1: Return to investments in agricultural research in India

Commodity	Period	Estimated internal rate of returns (%)	Source
All commodities	1953-71	40	(13)
	1956-65	60	(15)
	1966-76	68	(15)
	1977-87	75	(15)
	1961-87	87-96	(14)
Rice(India)	1971-88	60	(3b)
(East)	1971-88	58	(3b)
(North)	1971-88	53	(3b)
(South)	1971-88	33	(3b)
	1972-84	155	(3d)
	1956-88	80	(17)
Wheat	1972-84	51	(3d)
Sorghum	1972-84	117	(3d)
Pearl Millet	1972-84	107	(3d)
Maize	1972-84	94	(3d)
Livestock(Cattle)	1964-00	29	(16)

These estimates are generally based on the best available methodology and robust statistical analysis. Nevertheless, such evaluations are inherently complex and the database on research investments in the country is weak. Even if one were to discount the rates of returns estimates heavily, these still remain quite high in comparison with other investment opportunities. Indian experience is thus quite consistent with the consensus on high productivity of agricultural research.

Is all research so productive ?

This often vexes research administrators, because sometimes the question is put in an accounting context without making a distinction between the nature of research and other (productive) investments. Almost by definition, most research projects fail; the odd one that succeeds pays for everything else, and much more. There is, unfortunately, no way of completely eliminating the former; indeed failures often provide the building blocks for successful effort later on. Also, research lags are often quite large (exceeding 10-15 years), those looking for quick results do not fully appreciate this. Finally, substantial efforts are needed to maintain productivity levels. Such contributions in terms for losses saved are not easily measurable or visible.

The above is not an argument for unquestioned or open-ended claim on public resources. Accountability is crucial; monitoring and evaluation mechanisms and processes must be strengthened across the board. The national agricultural research system must shift to more rigorous prioritization procedures, project-based budgeting mode, and systematic evaluation. These are critical for ensuring efficient use of scarce public resources.

Strengthening national research system over the next decade implies :

- selective expansion of scientific manpower in frontier and neglected fields
- higher priority to human resource development, emphasising relevance and quality
- higher priority to raising operational funding per scientist, upgradation and maintenance of infrastructure and support systems.
- developing support mechanisms for improving backward and forward linkages.
- strengthening prioritization, monitoring evaluation and policy analysis capabilities.
- promoting greater private sector participation with adequate safeguards.

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1. Evenson, R.E. and D. Jha. 1973. "The Contribution of Agricultural Research System to Agricultural Production in India", Indian J. Agri. Econ. 28 (212-230).
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Suresh Pal,
Division of Agricultural Economics,
Indian Agricultural Research Institute,
New Delhi- 110012.

Dayanatha Jha,
National Centre for Agricultural
Economics and Policy Research,
Library Avenue, New Delhi -110 012.

NCAP has been established by the Indian Council of Agricultural Research ICAR) with a view to upgrading agricultural economics research through integration of economics input in planning, designing, and evalution of agricultural research programmes and strengthening the competence in agricultural policy analysis within the Council.

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