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Rapporteur's Report on Resource Use Efficiency in Agriculture

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I

THE CONTEXT

The impressive agricultural productivity growth witnessed following the green revolution with intensification of use of resources has led to: (i) considerable increase in cost of production (particularly paid out costs) leading to fall in net income of farmers and (ii) significant pressure on natural resource front, particularly soil degradation and over use of water. These two consequences have made new investments less attractive in agriculture. Perhaps, low investment in agriculture observed in recent years, may be on account of falling profitability and degrading natural resources. If the level of investment has to be enhanced, addressing these two issues assumes significance. Resource use efficiency (RUE) which addresses these issues is thus the key to make agriculture profitable, sustainable and investment attractive.

In the context of RUE, two sets of issues are identified for attention. One, (i) per unit returns to resources (technical efficiency) and (ii) optimal use of resources in the context of overall production process (allocative efficiency). Two, (i) resource use efficiency of the individual purchased inputs (seed, fertiliser, pesticide etc.) either in the marginal productivity framework or neo-classical framework and (ii) RUE of land and water with spread effects in terms of economic problems and environmental issues. Both the issues, from conceptual and methodological perspective, become specially complicated in irrigated areas on account of environmental compatibility and economic sustainability.

II

THEMES

In the above context, papers were invited to address the issues (mostly under irrigation) of (i) methodological innovations to estimate RUE particularly to capture environmental externalities, (ii) analysis of economic and environmental externalities and determinants thereof, (iii) mapping changes in irrigation use efficiency (IUE) in the aggregate production process across time and regions (iv) comparison of IUE in

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traditional irrigated areas, newly irrigated areas and rainfed agriculture under protective irrigation (v) efficiency of irrigated agriculture across different sources (canals, tanks etc.), (vi) IUE and its impact on changes in cropping pattern and more towards commercialisation, (vii) interplay of economic and environmental use efficiency of water under different cropping systems and agro-ecosystems and (viii) impact of irrigation subsidy on production environment and mining of water. Two important issues or aspects which are important under the theme but have been left out while inviting the papers include the role of institutions and inclusion of allied enterprises like livestock, fishery etc. along with crop husbandry. In view of their importance, papers have also been submitted under these two aspects also.

The response to this subject, as expected was good. In all, 59 papers have been submitted and 41 have been considered for discussion, 36 in summary form and 5 in full length. In general, in my opinion, the papers covered all the issues including the additional two indicated earlier. But the coverage was sketchy and skewed towards analysis of the obvious and routine (marginal productivity analysis of individual resources) but not on substantive issues of understanding and capturing externalities, methodological innovations, policy analysis etc.

III

BRIEF COMMENTS ON SOME OF THE ACCEPTED PAPERS

(a) As Vidya Sagar (1992) ably puts it, in the regime of high input use levels, farmer's managerial skills to substitute for input use becomes critical for enhancing the input use efficiency. In other words, improvement in use efficiency of resources is achieved by substituting information for input use. This requires development and dissemination of site and enterprise specific information. All most every paper, not withstanding the methodological limitations (Vidya Sagar, 1992), points out/input use inefficiency and attributes it to lack of needed information by the users of resources owing to failure of public extension system. Thus, such substitution could not take place and resource use inefficiency persists.

(b) Time series – cross section studies by Manjeet Kaur and M.K. Sekhon and R.M. Banda *et al.*, for Punjab agriculture further support the generally emerging view that progressive agriculture is inefficient. The specific results indicate falling land productivity, insignificant impact of seed and farm machinery on output, increasing profitability of dairy enterprise, and the contribution of technological change is still important but blunted on account of reduction in resource adjustment capacity by farmers in recent years. Some of the suggestions include precision farming, site-specific technology development, enterprise diversification, etc. The issue is how to make progressive agriculture inexpensive, profitable and competitive? In progressive agriculture areas, the role of institutions, policies and continuous innovations are critical.

(c) Evidence of how government policies can contribute to unsustainable and uneconomic resource use is provided by F.A. Shaheen and R.L. Shiyani. In fact, the study follows an earlier study by the authors on groundwater over-exploitation (Shaheen and Shiyani, 2003). The present study shows how higher subsidy at flat rate leads to over-exploitation of ground water, and how shift to prorata basis of energy tariff can help overcome the situation. The study illustrates how subsidised electricity tariff is contributing to mining of already depleting ground water in North Gujarat. The externality costs like frequency of failure of wells are taken for real pricing of ground water. Though the actual water use is only 73 per cent of the economic optimum, increasing water use level cannot be suggested by looking to the sustainability aspect; rather the farmers should economise water use by water saving technologies. The authors estimated that the highly subsidized power supply on flat tariff rate to farm sector reduces the marginal cost of extraction to near zero thereby encouraging the farmers to use the resource inefficiently. They suggest a shift to pro-rata tariff regime, supply management, provision of subsidy on water saving technologies, etc. The study raises issues of awareness campaign to farmers, proper estimate of the real value of resource use and importance of appropriate policies in resource use.

(d) One of the basic principles of resource use relates to optimal utilisation of the scarcest resource, which may be land, water, labour or any other resource. V. Ratna Reddy *et al.,* used this principle by focusing on water use efficiency in the water scarce environment of Andhra Pradesh. It is revealing to note that there is a misplaced emphasis on yield advantage of system of rice intensification (SRI) whereas it should have been on water saving and high labour intensity particularly in water-scarce, and low labour employment regions. On account of this, SRI practice is facing low adoption and high dis-adoption rates across the countries including India. The message is loud and clear that conventional mindset of fixed ideas should go, if we have to catch up with time and remain relevant. Again issues like awareness building and extension support on changing priorities across the system coupled with policy response (e.g., realistic water pricing) to such changes should receive priority attention.

(e) Agriculture in hills presents a unique feature with large risks. L.R. Kumar *et al.*, studied technical efficiency of rice farms using non-parametric approach. They state that modern varieties contribute more to overall efficiency on farm, and the farmer's age, education and farm size had positive and significant effect and the number of scattered fields had negative effect on the overall technical efficiency. The result suggests adoption of modern technologies, and extension agencies have to target younger and older and educated farmers having large number of scattered fields for higher adoption. They also suggest consolidation of holdings. But the paper has some loose ends. For example, (i) if the authors use the concept of technical efficiency which relates to whether a firm uses the best available technology in the production, why they at all measure the technical efficiency of local varieties is not clear and (ii) the authors

do not provide details as to how they have constructed the efficiency index while regressing factors relating to inefficiencies. They only mention that the efficiency indices determined from DEAP programme are regressed on explanatory variables.

(f) Saline irrigated environment presents yet another challenge in many states to maintain/enhance input use efficiency in agriculture. In a paper whose length could have been substantially restricted Subhasis Mandal *et al.,* examined resource use efficiency in saline irrigated environment in Uttar Pradesh, India. The data used for the analysis were collected from field experiments conducted on 30 farmers each during 2000-01 and 2003-04 relating to input-output relationship as well as soil and water quality parameters. The marginal value productivity of water was negative in all crops on account of salt concentration in root zone not being able to reduce through either enough rainfall or application of fresh water. They suggest supply of canal water during the most critical time of sowing to reduce the risks of crop failure. Combined with this, they suggest use of salt-tolerant varieties whose seeds of course are also not available. Therefore, efforts to grow and supply them should also be given attention. I feel, we may need many studies on longitudinal basis to study the salinity build up on the one hand and the impact of mitigation initiatives combining technologies, institutions and policies on the other. There are also more substantive issues connected with salinity and water logging. For example, Mishra (1987) points out about erosion of gene pool, underground water pollution or loss of soil borne micro-organisms. Can we consider them invaluable and therefore cannot be accommodated in the cost-benefit calculus as Mishra (1987) observed?

(g) Using a combination of individual and participatory research techniques, Dalbir Singh *et al.*, have shown how small developmental programmes like minor irrigation projects could contribute to sustainable rural livelihoods of the poorest of the land owning tribals in Rajasthan state. The main message of the paper is the strength with participatory management of all the development schemes. However, such useful tips remain only on paper and pronouncements.

(h) Another valuable paper by S.B. Nahatkar *et al.,* highlighting the benefits of crop insurance scheme (NAIS) for management of risk, relates to wheat crop in Madhya Pradesh during one of the severe drought years (2000-01). There was 69 per cent shortfall in wheat yield due to drought on sample beneficiary farms. The adoption rate was moderate showing that there is no tendency of farmers (who insure) to use less inputs in an attempt to maximise the expected claims. Even with drastic reduction in yield, insured farmers earned profit over their costs. The present study relates to one year only. Again, longitudinal studies covering many years may be needed to assess the benefits and sustainability of the scheme as a model for system wide application.

IV

ISSUES FOR DISCUSSION

1. Whether the intensity of resource use has increased over the years? If so, which specific inputs? Is the trend desirable? Can we guide the process? Whether such an increase can be measured keeping in view the change in resource composition, quality etc.?,

2. What has been the productivity trend? Whether the cost of production has increased? Whether the paid out costs have increased as compared to others, shrinking the net income of farmers? How to arrest the increase?,

3. Whether overuse of land and water resources inflicted significant pressure on natural resources? Whether we have been able to measure this and include it in the real cost of resource use? Have we made use of such information for planning resource use and production?

4. Is low investment in agriculture particularly after 1990s on account of falling profitability and degradation of natural resources?

5. Are there innovations in the new resources of inputs? If not, what is the way out? What kind of opportunities exist for substitution of information for input? What is the experience of private initiatives or initiatives at farmer's level? Are they effective and cheaper? What is the role of ICT in knowledge management?

6. Does conventional emphasis on yield still holds in policy/extension support against new dimensions like micronutrient use, quality of product, and saving in resources to reduce externalities? What is the role of improved agro-met and agro-market services for planning production and disposal? What is their status now?

7. Almost all the papers have attempted to estimate resource use efficiency (RUE) of the individual inputs including land and water from the point of view of marginal productivity, not in a typical neo-classical framework as stated in the outline. Further, no special treatment has been accorded to land and water which have significant spread effects in terms of economic problems, environmental issues as well as methodological angles particularly in irrigated areas. Similarly, institutional and policy analysis is missing. Mishra (1987) has pointed out the role of market, planning, policy technology and institutional underpinnings of ecological management.

8. Studies followed routine, convenient and casual approach of presenting the results as the data are available and the researcher's skill permits. If the data are to be used to fit into interesting situations/aspects like efficiency of irrigation in traditionally irrigated

areas vis-à-vis newly irrigated areas as well as a comparison with rainfed agriculture under protective irrigation as stated in the outline, resource use efficiency when every resource is priced according to opportunity cost, etc., it would been interesting and useful in policy making.

9. Time series cross-sectional analysis with reference to irrigation as a component of total production process is attempted but not in relation to dynamic changes in the multiple uses of water.

10. Some authors attempted to compare the different sources/structures (major or minor, surface water and groundwater, etc.) of irrigation but failed to capture the relative costs and benefits. There are serious data and methodological problems, which are not simple. In fact Dhawan (1999) suggests that some younger scholars should apply themselves to the measurement task in all earnestness to help in policy making.

11. Is the issue of change in the cropping pattern and the move towards commercial crops triggered by WUE? Papers explored this area but unsuccessfully in relation to connectivity of components.

12. Why researchers have not be able to design studies to address some of these issues? How to build the skill of our researchers?

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