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## Strengthening Agricultural Research in Africa: Some Neglected Issues

by Dayanatha Jha

Considerable efforts have been made since mid-seventies to upgrade national agricultural research capabilities in Africa. Over the last ten years, this sector has received substantial external assistance<sup>1</sup>. The current consensus is that such efforts have not been successful. Many reviews have appeared over the last 5 – 6 years which point out the many weaknesses of agricultural research systems and steps needed to improve them<sup>2</sup>. This brief article attempts to highlight some broad policy related issues which are crucial in this regard. Clear thinking at this level is necessary before effective planning can be done for strengthening national research systems. We raise six broad questions.

### 1. What importance is attached to agricultural research?

Experience in Asia and Africa during the pre-independence period clearly indicates that strong research programs developed under the colonial powers. The commercial crop bias persisted even after independence and till early seventies, most African countries continued to neglect food crop research. In almost all cases, greater priority was accorded to extension (*Boyce and Evenson 1975*).

Since then research resources have been substantially augmented. Table 1 shows this quite clearly, particularly with reference to scientific manpower. However, it is important to bear in mind that this has been made possible largely through external resources. Information from selected West African countries reported in Table 1 shows that such resources account for a very large proportion of current research spendings. In allocation of domestic financial resources African policy makers have not accorded priority to research. Salary obligations of a larger number of researchers account for most of the budgeted expenditures. Almost all reviews point out that governments find it difficult to meet the recurrent cost needs. There are other qualitative evidence which support the contention that, despite public pronouncements to the contrary and creation of ministries and departments for science and technology, agricultural research is not taken seriously. For example, in most cases governments have been reluctant to permit reorganization and restructuring of the research system, but have created a large number of autonomous parastatals in other spheres of agricultural activities. The tendency to depend on a number of donors for research resources has also created problems like lack of coordination, dispersal of resources, etc. We shall come back to this later.

Table 1: National Agricultural Research Resources of Africa

Category <sup>1</sup> / Country	Agric. GDP in 1980 (mill. U.S.\$)	Ag. Research expenditures in 1980 (mill. U.S.\$)	Number of Scientists (1980)	Growth (71-80) in		Research expenditure as % of agric. GDP	% of external funds
1	2	3	4	%	No. of Scientists %	7	8
<u>Rudimentary Systems</u>							
CHAD	285	1.60	42	36	61	0.56	6
GAMBIA	50	0.07	7	27	40	0.13	na
GABON	259	0.33	6	137	20	0.13	50
LIBERIA	374	0.39	20	28	43	0.10	75
MAURITANIA	127	0.28	8	10	14	0.22	na
SIERRA LEONE	335	0.70	35	24	17	0.21	32
BURKINA FASO	392	1.10	12	49	20	0.28	87
RWANDA	538	0.94	24	10	50	0.17	na
LESOTHO	77	0.46	14	53	100	0.60	na
SWAZILAND	na	1.31	23	88	92	na	na
<u>Small Systems</u>							
CAMEROON	1923	3.79	106	24	47	0.20	51
BURUNDI	434	3.61	41	255	71	0.83	na
ETHIOPIA	1881	3.40	155	-*	198	0.18	na
MADAGASCAR	1174	4.88	68	-24	-3	0.41	na
MALAWI	611	5.66	276	101	184	0.93	na
ZAMBIA	568	5.20	96	-30	18	0.91	na
BOTSWANA	na	4.98	61	542	85	na	na
<u>Medium-sized Systems</u>							
GHANA	10157	12.65	352	92	151	0.12	70
COTE D'IVOIRE	2390	12.77	116	-9	5	0.53	61
MALI	592	6.14	66	54	172	1.04	65
SENEGAL	768	9.73	172	48	32	1.27	68
TANZANIA	2349	7.21	212	-7	112	0.31	na
UGANDA	9720	7.45	175	-4	119	0.08	na
ZIMBABWE	436	10.56	201	106	17	2.42	na
<u>Large Systems</u>							
NIGERIA	18226	121.84	1034	224	261	0.67	*
KENYA	2037	22.71	400	192	90	1.11	na

Source: Data on research expenditures and scientists from Judd, M. Ann et al 1983 and on external funding from World Bank 1987.

<sup>1</sup> Rudimentary systems - less than 2 million US\$ (1980) research expenditures, Small Systems - 2 to 5 million, Medium-sized Systems - 6 to 20 million, Large Systems - more than 20 million

\* Less than 1 percent

In Table 1 we show that despite high growth in research resources over the recent past, there is substantial underinvestment. Only four countries spend more than one percent of their agricultural GDP on research, 14 spend less than 0.5 percent. This wide variation provides one indication of differences among countries with respect to support for research. Perhaps more significant is the fact that the share allocated to research is not related to the size of the agricultural sector — in some sense a proxy for capacity to invest. Table 1 shows that countries within the same agricultural GDP size class devote widely differing shares to agricultural research. There is thus a strong basis for arguing that national policy makers do not look upon agricultural research and its potential in the same way as, for example, donors and academicians do. This must change. Enthusiasm and willingness on the part of senior research administrators and the international community must be backed by commitment at the highest policy making level, not only in the ministry of agriculture but also in finance and economic affairs, planning, and other related departments.

## 2. What are national research systems trying to accomplish?

We have shown that research resources have grown substantially over the last 10 to 15 years. It is important to ask where have the incremental resources gone? In the first instance, there has been a broadening of research base in terms of number of commodities. In response to past neglect of food crops research, most national systems have initiated or strengthened this area. Analyzing commodity-wise breakdown of scientific publications from Africa, *Bennell and Thrope* (1987) found that in 1973, nearly 78 percent of all commodity oriented publications pertained to nine commodities (maize, rice, fruits and nuts, oil crops, pastures, cotton, cocoa, coffee and tea); their share came down to 67 percent in 1978 and 55 percent in 1982. Legumes and root crops, which claimed about 5 percent of the total in 1973, went up to about 12 percent in 1978, and 28 percent in 1982. At the same time, there was considerable spatial expansion. New research stations, substations, and experimental sites were established in large numbers. Strengthening research capabilities in relatively low potential regions became an important goal. Both these forces have contributed to inefficient dispersion of research resources. Donor assisted projects have further aggravated this proliferation. This expansion has, in most cases, outpaced the management capacity of existing organizations (*Ruttan* 1986). This brings the question of priorities to the fore. In the absence of any institutional mechanism or capacity to analyze and articulate priority areas, any and every research project finds justification, more so if additional resources come with the project.

In viewing priorities, it is useful to consider several dimensions. First, specific goals for the agricultural sector must be articulated in terms of commodities as well as regions. In broad terms, most African countries focus on two major goals: food self-sufficiency and augmentation of foreign exchange through agricultural exports and/or import substitution. Additionally, there is growing concern for 'marginal' lands whose capacity to produce is being outstripped by population growth. The problem is that, thus stated, these do not provide any guidance for research priorities — all research can potentially contribute to one or the other goal. The first task should be to enunciate

these goals more specifically and carefully analyze alternative strategies available to achieve them. As mentioned earlier, research can contribute to any goal but it may not be the most effective. Research administrators seeking opportunities for expansion and political leaders often find it convenient to exaggerate the importance of research to their clients.

Second, one must distinguish the relevant time horizon for research. For some priority crop or region, there may be enough research knowledge already available in the country or outside. With modest investment in adaptive and on-farm research, an impact can be expected in a relatively short period of time. In other cases, on-station research may need to be initiated because there is no stock of relevant knowledge. Here, research can have a long-term impact only and resource needs would be higher. The Indian experience with sorghum and millets research — two crops of considerable importance to Africa — is relevant in this context. Intensive research on these crops was initiated in the early sixties; it is only now that productivity improvements are becoming discernable in aggregate data for some regions. In the quest for short term impact (preferably during the short life span of a project) the balance between on-farm and on-station research is often distorted. High expectation is followed by frustration and research loses goodwill and credibility.

Third, the broad ecological contours which determine production systems in different regions, need to be carefully woven in the scheme of priorities. For example, intensification of agriculture over most of Africa has ushered concern for degradation of natural resources. Similarly, human and animal diseases issues have implications for production systems. Excessive commodity orientation often results in a neglect of these issues. Fourth, in addition to ecological endowments research priorities must explicitly be based on relative factor scarcities. It has been suggested that such consideration can improve potential pay-offs to research. This perspective and awareness provides a much sounder articulation of 'farmer' needs' than is being searched for under the rubric of farming system research in most African countries.

To what extent can these factors be tied together in a neat model of research resource allocation is still a frontier area of research. However, even systematic articulation of these dimensions based on relatively straightforward analysis will, in my view, greatly improve the process of research resource allocation. The inventory of research needs thrown up by this process would, in all cases, be too large in relation to available resources, and choices will have to be made. The essential point is that such analysis will make the trade-offs explicit. The need for such analysis has been well recognised (ISNAR, 1981), but lack of strong social science resources in most African research systems tends to perpetuate this weakness.

### **3. How are research resources organized and managed?**

The above discussion focussed on level of resources and priorities. How these resources are organized and managed is equally crucial. Almost all reviews of national research systems in Africa<sup>3</sup> indicate that all agricultural and livestock research should be integrated within one organization: that this organization must have a reasonable level of

administrative and financial autonomy since civil service rules which often apply to research institutions are not conducive to efficient research; and that better career and reward structures must be designed to attract and retain qualified staff. None of these suggestions are readily accepted. On the other hand, suggestions regarding improving research infrastructure (buildings, laboratories, vehicles, computers, equipment, etc) are easily accepted, as are suggestions to modify research approaches (from disciplinary to multi-disciplinary approach, and from largely on-station to greater effort on field testing under farmer conditions) and training researchers. The latter end up as the main components of plans to strengthen national research systems. Neither local research leadership nor donor pressure has made any significant impact on the basic structural constraints identified in the first part of this paragraph. Yet the fact remains that unless these are overcome, strengthening other components would not have the desired effects (USAID, 1982). It should be noted that African governments have not hesitated in creating autonomous, well-funded parastatals. Indeed, even within the agricultural research sector, several countries maintain such institutions for research on important export crops. It is time that serious efforts are made to bring about a change in this situation.

#### 4. What is the role of external assistance?

Donor involvement in agricultural research in Africa over the last 15 years has been heavy, and largely ineffective (World Bank 1981, USAID 1982, FAO 1984). Most evaluations agree that such projects have been too demanding on national managerial and manpower resources. All these contribute to rapid erosion of gains made during the life of the project. The last few years have witnessed significant changes in donor attitudes and steps are being taken to overcome these problems. I would like to point out three specific issues which are largely internal and are likely to restrict the effectiveness of donor assistance. *First*, assistance for research has to be sustained over a long period of time. Very few donor agencies have the mandate to plan and commit resources for the required length of time. Even research under the CGIAR system operates under a constrained situation in this regard. Educating aid administrators and policy makers in donor countries is an extremely important first step. The process has just been initiated (USAID 1985, World Bank 1987). *Second*, physical infrastructure (including soft infrastructure such as information systems) and training are two crucial areas where external assistance is needed. Experience has shown that these are best addressed at the system level rather than at individual project level. These needs usually are beyond the capacity of individual donors, and cooperation and coordination between different donors becomes essential. This is no easy task. *Third*, specific donor countries may have specific expertise in an area of research or commodity, or may have training institutions in specific fields relevant for a given national research system. This is the simplest and most rational basis for technical assistance and training. But as donor involvement increases or as more and more donors join, this perspective is completely ignored. Few donor countries have strong capacity for research and training in tropical agriculture, yet almost all donors tie technical assistance and training to their respective countries. This often implies lower quality at higher costs.

The difficulties involved in removing these constraints should not be undermined. Legislative guidelines, internal pressure groups, geo-political considerations, etc determine the broad framework of aid policy. Building institutions and human capital calls for a different set of rules.

The role of the International Agricultural Research Centers (IARC's) deserves special mention. The Consultative Group on International Agricultural Research (CGIAR) allocates, in the aggregate, nearly 25 percent of its commodity specific research resources to Africa, and the share is likely to increase (CGIAR 1987). In the food crops research sector, the IARC investments represent a sizeable proportion of total national research efforts, more so in terms of quality and skill levels. Apart from the basic task of developing improved technologies for the mandate crops, considerable importance is attached to strengthening national capacity for research through collaborative work with national institutions. We focus here on the latter role, since this is evolving and subject to considerable debate.

The demand for greater involvement of the IARCs in national programs is driven by three forces. First, within the Centers and as part of a well-accepted research methodology, there is demand for testing materials and ideas over a wide range of environments. This is not possible on-site. The approach followed initially, particularly with reference to varietal testing, was to design international testing programs in which Center materials (alongwith nationally developed cultivars) were tested at a large number of locations in a number of countries. With wheat and rice, this approach proved quite useful (rather than its output) closer to the target environment is being emphasized. Some centers<sup>4</sup> have established their own regional stations, others have used sister Centers in Africa for this purpose. Placing center researchers in national research systems has been another mechanism used for this purpose.

Secondly, multilateral and bilateral donors have sponsored several *regional* research initiatives in Africa<sup>5</sup>. These depend largely on the IARCs, which find such institutions extremely helpful in enabling larger center presence in the region and furthering their objectives. Finally, donor assisted research projects in specific countries sometimes solicit direct center participation in national research programs. The result of all these forces is relatively larger deployment of Center resources outside the host country. It has been shown, for example, that out of 313 IARC researchers working in Africa, 44 percent were located away from the main center. In Asia and Latin America, the figure was about 15 percent (Plucknett, et al. 1986).

Two issues are important in this context. *First*, as has been argued above, strengthening national research systems requires a system-level perspective. By focussing on mandate crops only, individual IARCs become vulnerable to the same criticisms which were applied to individual donors. Since bilateral/multilateral assistance is crucial for both national research systems as well as the IARCs, it is important that these issues are analyzed and a consistent position is developed. *Secondly*, there is the more basic issue of whether deployment of an increasing quantity of additional resources away from the main center is efficient or is leading them towards the same path of regional dispersion for which we found fault with the national systems. The answer obviously lies in the way these resources are used. If they are used for tasks which do not really require their high-powered (and costly) skills as researchers or do not explicitly contribute to the research goals of the Centers, such deployment is inefficient.

## 5. What approach is relevant for small countries?

Small countries face special problems. It has been shown (table 1) that in several countries smallness of research system is due to underinvestment. Here we are concerned with those cases where size poses a real constraint (*Gamble and Trigo, 1984*). The crucial question is how do such countries harness their meager research resources? Diversity of crops and ecology further compound the problem – in terms of research needs, it puts them in the same category as large countries. There seems to be a consensus that the research approach in such cases should be based on extensive borrowing from larger systems, IARCs or other external sources, and designing national systems largely on the basis of adaptive research (*ISNAR, 1984*). There are two issues which need some further thought. What implication does this approach have for research organization, management and funding? It probably means that more agronomists than breeders would be needed; one would need to shift from major research station to a larger number of experimental sites; the nature of research support and infrastructure would be different. The idea is perhaps best conveyed by looking at the differences in organization and structure between a producing firm and a marketing firm. So far, attention in this area has been focussed on networking and linkages, the above aspects have not been carefully considered.

The second issue relates to export crops research in small countries. Regional research institutions for these crops which were created during colonial times have all declined and become national institutions. As neighbors compete for enlarging their shares in the world market, there is no incentive for sharing research results. Countries where such institutions are located try to internalize the gains from their research. This forces others to initiate research on their own. Small countries are again put at a disadvantage. Experience of small countries in the developed world indicates that highly specialized nature of agriculture and high involvement of commercial producers and agri-business, have enabled the small European countries to maintain viable research systems (*de Zeeuw 1984*). These conditions are not likely to obtain for quite some time in Africa. In situations where export crop production is under the estate sector or managed by large multi-national firms, the position is better.

## 6. Where do we go on farming systems research?

As a new and relatively unproven idea, farming systems research has claimed a substantial part of donor funds for research in Africa since the mid-seventies. It has been the subject of a large number of national and international workshops and conferences where the concept, approaches, terminology and organizational aspects have been discussed extensively. We wish to make a few points regarding the logical basis of much of the current work in this area.

Existence of demand, apparent or latent, is a pre-condition for success of any applied research. This implies awareness of the conditions under which users operate, their constraints and motivations. In agricultural research this means understanding of 'farming systems' on the part of researchers. Research organized within this context is defined in current terminology as 'research with farming system perspective'. Lack of

this perspective among scientists and the resulting irrelevance of their work is rightly identified as an important factor explaining why a lot of innovations are not accepted by farmers.

It is also argued that if innovations developed by researchers were subjected to verification on farmers' fields, this inconsistency would be immediately apparent. It would show that the superiority observed under experimental farm conditions often disappears when the 'improved' practice is tested under farmer conditions. Lack of adequate on-farm testing results in perpetuation of irrelevant research at experiment stations on the one hand, and irrelevant extension messages on the other.

Both the above premises are undoubtedly correct. Problems arise in the way these constraints are addressed. Most farming system research projects try to combine these two factors, usually as independent appendage to on-going research activities. The two are operationalized under a survey (diagnostic and in-depth), and an on-farm testing, verification, and adaptation components. This approach has conferred almost a discipline-level status to farming systems research with its own vocabulary, methodology, and most important, cadre of farming system scientists. The performance of these teams has not been subjected to any rigorous evaluation, but almost everywhere the impression is that while they have amply demonstrated the inappropriateness of recommended innovations under farmers' conditions (the second premise), they have not contributed significantly to rationalization of on-station research (the first premise).

It is contended here that the goals of farming systems research cannot be accomplished unless *all* researchers share the farming system perspective. It cannot be accomplished by putting together a few agronomists and economists in a team and sending them outside the fences of the research station, while those inside continue as usual. It cannot even be accomplished by mid-career training of all researchers because most of them have been trained earlier in a tradition which encourages specialization in a rigid disciplinary framework.

The most efficient way of achieving this would be to develop a strong curriculum on farming systems and include this as a core requirement for all agricultural degree programs. This would ensure that agricultural specialists coming out of their training programs are conscious of the relevance of their discipline in context of the larger system. This much needed reform has not received any attention, particularly in educational institutions in the developing world.

Similarly, on-farm testing, verification and adaptation can easily be incorporated in research programs on experiment stations as a necessary final step of the research process. In fact, several African research systems had such programs in the past. These were discontinued due to non-availability of resources. Strengthening this activity should be a priority.

## Conclusions

In this brief paper, we have tried to focus on those issues related to agricultural research which have not received enough attention. As donor agencies and national governments begin the task of strengthening national research systems in earnest, these issues should be carefully examined. These are enumerated below.

1. Commitment to agricultural research must be created at the highest policy making level. Without this the necessary structural changes and resources will not be forthcoming.
2. A careful analysis of research priorities based on agricultural sector goals on the one hand and a realistic assessment of the contributions research can make towards these on the other, must precede other steps to strengthen research. Almost invariably this is not done.
3. External assistance for agricultural research must be based on (a) a system wide perspective, (b) focussing on training and infrastructure, and (c) in technical assistance, on balanced consideration of recipient country needs and donor country expertise.
4. For small countries, the priority issue is changes in organization and management structures, and operating rules which facilitate maximization of their capacity to borrow relevant research from outside.
5. Finally, the most efficient way of orienting research towards a system perspective would be to ensure that researchers are trained, during their early degree program, to think in system rather than discipline terms. This will require strengthening agricultural colleges and universities. Also, support for on-farm testing and verification should be viewed as extension of on-station research work, rather than an independent activity. This approach will also generate pressures on scientists to be more responsive to local needs.

## Summary

In spite of considerable efforts to upgrade national agricultural research capabilities in Africa many national research systems are still weak. Research resources have been substantially augmented, largely by external assistance. In allocating domestic financial resources African policy makers have not accorded priority to research. Moreover, many national programs are not sufficiently focussed, rational systems of priority setting are often lacking and research resources are dispersed inefficiently. Donor involvement has been heavy but largely ineffective because projects have been too narrowly focussed, too short too uncoordinated, and too demanding on national managerial manpower resources. Many African countries are suffering from the small country syndrome. The concept of Farming Systems Research has been widely misinterpreted making it almost a discipline instead of giving a farming systems perspective to all important agricultural research activities. Thus original hopes pinned to this approach have been belied.

In order to strengthen national agricultural systems in Africa, several steps are required. Most important among them are: commitment to agricultural research at the highest policy-making level, the setting of clear priorities, a better conceptualization of external assistance (based on a system-wide perspective, with a stronger focus on training and infrastructure, and more effectively reflecting recipient country needs and donor

country expertise), efforts to enable small countries to borrow relevant research from outside to the maximum extent, and finally the training of researchers during their early degree programs, to think in system rather than discipline terms.

## Zusammenfassung

Trotz erheblicher Anstrengungen, die Leistungsfähigkeit der nationalen Agrarforschung in Afrika zu verbessern, sind viele nationale Forschungssysteme nach wie vor schwach. Die Forschungsmittel wurden erheblich gesteigert, vor allem durch Hilfe von außen. In der Zuweisung nationaler Mittel haben die politischen Entscheidungsträger Afrikas der Forschung keine Priorität eingeräumt. Darüber hinaus sind viele nationale Programme nicht scharf genug auf die Ziele ausgerichtet, es fehlt weitgehend an einer rationalen Prioritätensetzung und die Forschungsmittel werden ineffizient verstreut. Der Beitrag von Entwicklungshilfegebern war erheblich, aber weitgehend ineffektiv, da Projekte zu eng, zu kurz und zu unkoordiniert angelegt wurden und die Kapazität des nationalen Forschungsmanagements überforderten. Viele afrikanische Staaten leiden unter den typischen Problemen eines kleinen Landes. Das Konzept des „Farming Systems Research“ wurde weitgehend fehlinterpretiert, indem daraus fast eine Disziplin wurde, anstatt alle wichtigen Aktivitäten der Agrarforschung auf den Betriebssystemansatz auszurichten. Auf diese Weise wurden anfängliche Hoffnungen, die mit diesem Ansatz verbunden waren, enttäuscht.

Um die nationalen Agrarforschungssysteme in Afrika zu stärken, sind verschiedene Schritte notwendig. Die wichtigsten unter ihnen sind: Verpflichtungen zu Gunsten der Agrarforschung auf der höchsten politischen Entscheidungsebene, klare Prioritätensetzung, bessere Ausrichtung der Auslandshilfe (mit Blick auf das Gesamtsystem, stärkerer Konzentration auf Ausbildung und Infrastruktur sowie besserer Anpassung an den Bedarf der Empfängerländer und die Erfahrungen der Geberländer), Maßnahmen, um es kleinen Ländern zu ermöglichen, soweit als möglich, relevante Forschungsergebnisse von außen zu übernehmen, und schließlich eine Ausbildung von Forschern bereits während ihres Studiums, die sie befähigt, im Systemzusammenhang statt in den Kategorien einer Disziplin zu denken.

## Notes

<sup>1</sup> According to one calculation (AID 1985) external assistance for agricultural research in Africa grew more than three-fold between 1976 and 1980 to reach nearly 192 million US dollars.

<sup>2</sup> The International Service for National Agricultural Research (ISNAR) has conducted reviews of several national systems in Africa. The World Bank and USAID have conducted large multi-country studies. The topic has been the subject of a number of seminars, conferences, and special initiatives.

<sup>3</sup> See, for example, reviews of several national systems by ISNAR; World Bank (1987).

<sup>4</sup> For example, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), located in Hyderabad, India.

<sup>5</sup> For example, Semi-Arid Food grain Research and Development Project (SAFGRAD), Comité Inter-estate de Lutte Contre la Secheresse au Sahel (CILSS), Southern African Center for Cooperation in Agricultural Research (SACCAR), and several others.

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