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Resource Allocation to Agricultural Research

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The untimely death of Dr J.D. Drilon, who was to attend the workshop as a representative of IFARD, is a great loss to all concerned with improving the welfare of the rural poor. This publication is dedicated to his memory.
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Resource Allocation to Agricultural Research in Pakistan

Malik Mushtaq Ahmad

Agriculture is the mainstay of Pakistan's economy. It contributes 29.1% to GNP, employs 52.9% of the total labour force, and provides livelihood to over 70% of the population. Of the total agricultural contribution to the GNP, crops contribute 67.9%, livestock 29.9%, fisheries 1.6%, and forestry 0.7%.

The total area of Pakistan is 79.61 million hectares, of which 20.12 million hectares are cultivated. The major crops grown are wheat, rice, cotton, sugarcane, maize and millets, and gram and pulses, which constitute 35.0%, 10.6%, 9.8%, 3.9%, 9.3%, and 8.7% of the cropped area, respectively. The livestock population consists of 14.85 million cattle, 10.61 million buffalo, 18.93 million sheep, 21.69 million goats, and a total of 3.44 million horses, donkeys, and camels. Annual fish production is 0.3 million tonnes, of which 13.6% is from inland waters and 86.4% is marine. Forests cover 3.5% of the area and produce 229,000 m³ of timber and 576,000 m³ of firewood.

Research System

To obtain sustained agricultural production, a well-structured and functional agricultural research system is necessary. At Independence in 1947, Pakistan inherited only one research institute on irrigation and the defunct Punjab Agricultural College and Research Institute, Faisalabad. These institutions were inadequate to support the research and development requirements of the large agriculture sector. However, Pakistan has developed a potentially viable research system.

The research system is composed of a number of diverse research establishments and organizations that are administratively controlled by different federal and provincial ministries. At the federal level, the Pakistan Agricultural Research Council (PARC) operates three institutes and six research units; the Pakistan Atomic Energy Commission (PAEC) maintains three institutes; the Water and Power Development Authority (WAPDA) has one directorate on soil and water quality monitoring; the Pakistan Central Cotton Committee (PCCC) operates three institutes on cotton. In addition to the PCCC, the Federal Agricultural Ministry has under its direct control, the Soil Survey of Pakistan and the Pakistan Forest Institute. The Irrigation Drainage and Flood Control Research Council is under the Ministry of Science and Technology. The Pakistan Tobacco Board is under the Ministry of Commerce. Other institutions, including the universities, are under the administrative control of the respective provincial governments.

PARC is a federal-level organization with a charter to promote, conduct, and coordinate agricultural research at the national level. It operates three research institutes: The Cereal Diseases Research Institute, which conducts research as well as provides research support to other institutions for the development of disease-resistant crop varieties, particularly wheat; and the recently established Arid Zone Research Institute, Quetta, and National Agricultural Research Centre, Islamabad (NARC). NARC is designed to provide facilities for basic research on agriculture and will have a well-maintained agricultural library, a computer-based data centre, a centre for plant introduction and genetic resources, and a centralized facility for instrumentation and repair of laboratory equipment. To strengthen the existing research system, NARC will conduct research in areas of national importance where such research is not currently being done, is seriously inadequate, or can best be done at a central place. PARC also maintains a Vertebrate Pest Control Centre, a Federal Pesticides Laboratory, the National Mycological Herbarium, and the National Insect Museum.

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1 Senior Documentation Officer, Pakistan Agricultural Research Council, P.O. Box 1031, Islamabad, Pakistan.
Currently, PARC is operating 17 national level cooperative/coordinated research programs at various provincial and federal institutes, as well as at NARC; coordinating 96 research projects at various research/education establishments; and operating 37 short-term research schemes covering various aspects of agriculture at different institutes.

Research by Subsectors

Research at provincial agricultural research institutions has been largely limited to verification trials and crossbreeding of major crops. Laboratory-oriented research and studies on socioeconomics have been neglected.

Crops

Major research for crops is conducted at four multidisciplinary provincial agricultural research institutes. These institutes comprise commodity sections, coupled with sections on supporting disciplines, including soil and plant chemistry, plant physiology, agronomy, disease and pest control, and food technology. Recently, because of expanding research needs, some of these commodity sections have been raised to the institute level.

In the multidisciplinary category, there are 12 research institutes. The fully operational institutes are the Ayub Agricultural Research Institute, Faisalabad; the Agricultural Research Institute, Sariab, Quetta; the Agricultural Research Institute, Tandojam; the Agricultural Research Institute, Tarnab, Peshawar; the Nuclear Institute for Agriculture and Biology, Faisalabad; and the Atomic Energy Agricultural Research Centre, Tandojam. The remaining six institutes are at different formative stages.

There are 14 monocommodity research institutes: one for wheat; four for cotton; two each for rice and sugar crops; and one each for oilseeds and maize and millets. The Cereal Crops Research Institute, basically the maize and millets research institute, was recently renamed to cover other cereals.

Four institutes cover plant protection: the Cereal Diseases Research Institute; the Commonwealth Institute of Biological Control; the Plant Protection Institute; and the Vertebrate Pest Control Centre. In addition, an insect museum and a mycological herbarium are maintained. A section and a station also exist for research on locust control. The CDRI, VPCC, and other sections are under PARC, whereas PPI is with the Punjab Agriculture Department.

Research on soil and fertilizer use is undertaken by the Rapid Soil Fertility Survey and Soil Testing Institute in Punjab. In other provinces these facilities exist on a smaller scale. The soil and plant chemistry sections at the multidisciplinary institutes also conduct research in this discipline.

Research efforts in agricultural machinery have been seriously lacking and it is only recently that the Agricultural Machinery Institute at Multan was established. The PARC has also established a full division on agriculture machinery at NARC.

Livestock

The development of the livestock sector has received less attention than the crop sector. There are five research institutes, one on livestock production and two each on veterinary sciences and poultry research. The Livestock Production Research Institute at Bahadurnagar has seven divisions: breeding; feeding and management; fodder crops and pastures; economics and marketing; development support communication; health control; and common services. These divisions conduct problem-oriented research.

The Veterinary Research Institute at Lahore has nine divisions: virology; bacteriology; immunology; parasitology; helminthology; biochemical; poultry vaccines; disease investigation; and epizootiology. The institute also operates a Foot and Mouth Disease Research Centre. The Veterinary Research Institute, Peshawar, established in 1949, has five divisions: microbiology; parasitology; animal production; biological production; and poultry husbandry.

There are two poultry research institutes: one established in 1970 at Karachi and the other established in 1976 at Rawalpindi. Research on pathology, nutrition, breeding and incubation, and economics and marketing is conducted at these institutes.

The provincial livestock development departments maintain about 12 livestock experiment stations in various provinces of the country. The Animal Husbandry Laboratory, Karachi, established in 1939, undertakes disease diagnostic studies and PARC has established a full-fledged livestock division at NARC, Islamabad, to study livestock breeding and the development of feed resources.

Fisheries

The exploitation and development of fish resources has remained low key. A small fisheries institute exists at Qadirabad, under the Directorate of Fisheries, Lahore. The Institute of Marine Biology, the centre of excellence, is located at Karachi University and is under the University Grants Commission.
Forestry

The Pakistan Forest Institute, Peshawar, is the only institute catering to research and education needs in forestry and allied subjects. The Faculty of Agriculture, University of Agriculture, Faisalabad, teaches forestry and range management.

Social Sciences

In addition to a number of university departments and financial institutions, there are four institutions maintaining research and development activities on economics, including agricultural economics and rural sociology. PARC has also recently established a full-fledged Division of Social Sciences at its headquarters to undertake and promote research on various aspects of agricultural economics and rural sociology.

Educational Institutions

There are three agricultural universities, one agricultural college, and one college of veterinary sciences. The Gomal University, D.I. Khan, has a faculty on agriculture. In addition, there are five training institutes. The University of Agriculture, Faisalabad, maintains six faculties: agriculture; agricultural economics and rural sociology; agricultural engineering and technology; animal husbandry; veterinary science; and science. There is one division of extension and three directorates, i.e., Directorate of Research, Directorate of Advanced Studies, and Directorate of Sports. The two colleges, the Barani Agricultural College, Rawalpindi, and the College of Veterinary Sciences, Lahore, are affiliated with Gomal University. The Sind Agriculture University, established in 1976, is operating with three faculties: agriculture; animal husbandry; and agricultural engineering. The faculty of agriculture, University of Peshawar, became the University of Agriculture, Peshawar, in 1981. The universities are under the respective provincial governments. The five training institutes produce field assistants and to some extent make available in-service training facilities to the extension staff.

Lack of Coordination

The institutional structure that has been described involves administrative control by different provincial and federal ministries. This often results in wasteful duplication and makes effective monitoring and coordination difficult. The commodity-oriented approach has resulted in the less efficient use of scarce research manpower and financial resources.

The government, which was concerned with the need to remedy this situation, decided to strengthen the existing system. An important initial step was to strengthen the Pakistan Agricultural Research Council by according it autonomous status and by creating a separate Agricultural Research Division at the federal level.

Resource Allocation System

Finances

Traditionally, funds from the finance department are channeled through the respective ministries to the various institutions. Broadly, funds are of two types, i.e., nondevelopmental (recurring) and developmental (nonrecurring). Developmental funds may provide for capital costs, including buildings and equipment.

The budget in the nondevelopment category is normally a fixed amount made available in bulk on an annual basis. The development budget is linked with short-term research projects and is usually limited to a period of 1–5 years. After achievement of the preliminary objectives, projects of a continuous nature are shifted to the nondevelopment category.

After approval by the institution leader, all projects are critically screened by a provincial research coordination board to assess their suitability and to try to eliminate duplication. Approved projects are then placed before the provincial planning and development department by the concerned ministry for final review and approval and budget allocation. The coordination boards, administrative secretaries, and planning and development departments have progressively increasing sanctioning authority. At the federal level, projects are submitted to the Central Development Working Party. Large projects are approved by the Economic Committee of the National Economic Council (ECNEC), headed by the Minister for Finance, Planning, and Provincial Coordination.

The whole process of project formulation, evaluation, and approval is not very objective and in most cases has resulted in imbalanced growth. Recently, PARC has designed CAREPLANS (Coordinated Agricultural Research Planning System) and CRISP (Current Research Information System of Pakistan) programs that involve modern objective-oriented procedures.

Manpower

Recently, PARC has established a national talent pool and plans to train an adequate number of scientists in the disciplines in which the country is particularly deficient. The services of these scientists will also be loaned to the various institutions on request. PARC is also building manpower at the
respective institutions by providing training at local as well as the foreign institutions. Manpower is recruited by advertisement and selection by the Public Service Commissions in the respective provinces.

**Total Investment in Agricultural Research**

Allocations to agricultural research have steadily increased, but the total investment remains low compared with spending in developed countries. During 1977–78, Rs. 187 million were expended on agricultural research, which represented 0.11% of total GNP and 0.37% of agricultural GDP. Assuming a rate of increase in expenditures on agricultural research of roughly 2.5% per year, the allocation in 1980–81 was estimated as Rs. 200 or 0.07% of GNP, 0.076% GDP, and 0.25% of agricultural GDP.\(^2\)

This drop in the allocation to research as a percentage of agricultural GDP is surprising and discouraging, but can be explained by recent increases in agricultural production that have not been accompanied by corresponding increases in research allocations.

**Allocation by Subsectors**

Of the total research allocation of Rs. 277.3 million given to educational institutions and research organizations in 1977–78, crops received Rs. 238.4 million (86%), livestock Rs. 29.2 million (11%), fisheries Rs. 6.3 million (2%), and forestry Rs. 3.4 million (1%).

**Allocation by Commodities**

The trade value of the three major crop commodities at government-fixed procurement rates in 1977–78 was Rs. 15 663 million for wheat, Rs. 6723 million for rice, and Rs. 8937 million for cotton.

The allocation in 1977–78 to the research institutes working on these commodities was Rs. 16.89 million and was distributed as follows: Wheat Research Institute, Faisalabad, Rs. 1.2 million; Rice Research Institute, Dokri, Rs. 4.2 million; Rice Research Institute, Kala Shah Kaku, Rs. 1.75 million; Cotton Research Institute, Multan, Rs. 1.75 million; Cotton Research Institute, Sakrand, Rs. 6.09 million; and Institute of Cotton Research and Technology, Karachi, Rs. 1.9 million. The Cotton Research Institute, Sakrand, was established after 1977–78 and is not considered here. These figures exclude allocations to commodity sections at some of the multidisciplinary research institutes, but these are only a small portion of the total allocations.

Assuming an increase in the budget of 7% from 1977–78 to 1980–81, the total allocation to these three major commodities would be about Rs. 18.1 million or only 0.06% of the trade value of these three commodities.

**Allocations to Educational Institutions**

During 1977–78, the two agricultural universities and the Faculty of Agriculture, Peshawar University, received Rs. 47 million, or about 17% of the total research and education allocation.

**Allocations within Research Institutes**

Table 1 presents a percentage breakdown of funds going to different areas within a selected number of agricultural research and education establishments. If salaries and wages are separated from other operating costs, a continual decline in operating costs is seen due to continual increases in scientific staff, their rising salaries, and occasional cuts in contingent allocations to hold down government expenditures.

If we assume that the total amount for contingencies is research money, the operational budget at the nine selected institutes ranged from 20.3% to 30.8%. This percentage includes rents, rates, taxes, and a number of other items that account very roughly for about 50% of the contingencies. Thus, the core allocation for actual research materials is reduced to 10.15–15.4%. The rapidly increasing cost of research materials further aggravates the situation and adversely affects overall research performance. A comprehensive program to correct this situation is required.

**Total Agricultural Graduates in Pakistan**

The University of Agriculture, Faisalabad; Sind Agriculture University, Tandojam (which also caters to Baluchistan Province); and the Faculty of Agriculture, Peshawar University, produce agricultural graduates. The output of agricultural graduates by these institutions up to 1976–77 was: University of Agriculture, Faisalabad, 7000; Sind Agriculture University, Tandojam, 1967(1600 for Sind, 367 for Baluchistan); and Agriculture College, Peshawar, 577.

The total number of graduates produced in relation to number of farms is very low. For Pakistan as a whole in 1976–77 there were 9554 graduates serving 4.86 million farms or 48.9 million acres. There is, on average, one graduate for every 514 farms or

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\(^2\) Data on agricultural resources and agricultural contribution to GNP from Survey of Pakistan 1979–80, Ministry of Finance, Government of Pakistan.
Table 1. Resource allocation by function: percentage of budget allocation to selected agricultural research and educational establishments by primary units of appropriation (1977-78).

<table>
<thead>
<tr>
<th>Establishment</th>
<th>Pay of officers</th>
<th>Pay of establishment</th>
<th>Allowance and honoraria</th>
<th>Contingencies</th>
<th>Total of first 3 columns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ayub Agricultural Research Institute, Faisalabad</td>
<td>25.50</td>
<td>29.50</td>
<td>14.20</td>
<td>30.80</td>
<td>69.20</td>
</tr>
<tr>
<td>Agricultural Research Institute, Tarnab, Peshawar</td>
<td>30.10</td>
<td>37.60</td>
<td>12.00</td>
<td>20.30</td>
<td>79.70</td>
</tr>
<tr>
<td>University of Agriculture, Faisalabad</td>
<td>65.55 (staff)</td>
<td>10.79</td>
<td>23.66</td>
<td>76.34</td>
<td></td>
</tr>
<tr>
<td>Faculty of Agriculture, University of Peshawar</td>
<td>95.40 (staff)</td>
<td>—</td>
<td>4.60</td>
<td>95.40</td>
<td></td>
</tr>
<tr>
<td>Cotton Research Institute, Multan</td>
<td>24.70</td>
<td>12.50</td>
<td>34.80</td>
<td>28.00</td>
<td>72.00</td>
</tr>
<tr>
<td>Cotton Research Institute, Sakrand</td>
<td>18.90</td>
<td>25.20</td>
<td>25.50</td>
<td>30.40</td>
<td>69.60</td>
</tr>
<tr>
<td>Vegetable Research Institute, Faisalabad</td>
<td>29.31</td>
<td>29.03</td>
<td>19.47</td>
<td>22.19</td>
<td>77.81</td>
</tr>
<tr>
<td>Wheat Research Institute, Faisalabad</td>
<td>26.29</td>
<td>26.45</td>
<td>18.66</td>
<td>28.60</td>
<td>71.40</td>
</tr>
<tr>
<td>Plant Protection Institute, Faisalabad</td>
<td>27.84</td>
<td>33.77</td>
<td>26.71</td>
<td>11.68</td>
<td>88.32</td>
</tr>
<tr>
<td>Sind Horticulture Institute, Mirpurkhas</td>
<td>16.17</td>
<td>54.95</td>
<td>7.48</td>
<td>21.40</td>
<td>78.60</td>
</tr>
<tr>
<td>Fisheries Research Institute, Quaidabad, Gujranwala</td>
<td>21.39</td>
<td>31.09</td>
<td>20.66</td>
<td>26.86</td>
<td>73.14</td>
</tr>
</tbody>
</table>

5175 acres. This is about 51 times lower for farms and 4.31 times lower in terms of acreage compared with the United States of America.

**Total Scientific Manpower**

The total research staff engaged by research and education institutions was 2834 in 1977-78. Of this total, 233 (8.2%) had a Ph.D., 1405 (49.6%) a M.Sc., and 1196 (42.2%) a B.Sc. The universities employed 120 researchers holding a Ph.D., 385 with a M.Sc., and 127 with a B.Sc.; the research institutes 113 at the Ph.D. level, 1020 holding a M.Sc., and 1069 with a B.Sc. The distribution of staff in the different subsectors is shown in Table 2.

Classification of Manpower by Commodity

In the absence of detailed information, the classification of manpower by commodity is based on the number of researchers working at different commodity institutes (Table 3).

PARC Program on Resource Allocation

To provide a basis for national coordinated agricultural research planning and effective management of research resources, the Pakistan Agricultural Research Council has instituted an automated system for storing and retrieving information on research projects in Pakistan.

The system known as the Current Research Information System of Pakistan (CRISP) uses a computer to store, for each research project, descriptive information such as title, principal investigator, performing organization, objectives, methodology, progress reports, and expenditures. In addition, it describes each project in terms of research problem area, field of science, commodity, and research activity. It will thus be possible to retrieve from the system summaries of research activities by commodity, field of science, activity, research problem area, location, subjects, etc.

Inputs into the system are made on CRISP I, II, and III forms covering different items including information on manpower and financial allocations as well as project objectives, performers, and location of research activity and in addition the methodology and the progress report. The output can take many forms including reports and summaries. The outputs that are expected immediately are: (1) a

---

Table 2. Distribution of research staff in the different agricultural sectors (1977-78).

<table>
<thead>
<tr>
<th>Sector</th>
<th>Ph.D.</th>
<th>M.Sc.</th>
<th>B.Sc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crops</td>
<td>184</td>
<td>1208</td>
<td>930</td>
</tr>
<tr>
<td>Animal husbandry*</td>
<td>40</td>
<td>138</td>
<td>210</td>
</tr>
<tr>
<td>Forestry*</td>
<td>6</td>
<td>40</td>
<td>36</td>
</tr>
<tr>
<td>Fisheries*</td>
<td>3</td>
<td>19</td>
<td>20</td>
</tr>
</tbody>
</table>

*Includes staff working in the universities.

---

1 Data on agricultural graduates and number of farms and farm areas from Dr M. Sami Khan Abid, Agricultural Graduates: Importance and Utilization, The Varsities, March-April 1978.
Table 3. Distribution of research staff working in major commodity institutes. *

<table>
<thead>
<tr>
<th></th>
<th>Ph.D.</th>
<th>M.Sc.</th>
<th>B.Sc.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cotton</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotton Research Institute, Multan</td>
<td>4</td>
<td>19</td>
<td>15</td>
<td>38</td>
</tr>
<tr>
<td>Cotton Research Institute, Sakrand</td>
<td>1</td>
<td>17</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>Institute of Cotton Research and Technology, Karachi</td>
<td>1</td>
<td>10</td>
<td>24</td>
<td>35</td>
</tr>
<tr>
<td><strong>Rice</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice Research Institute, Kala Shah Kaku</td>
<td>4</td>
<td>21</td>
<td>11</td>
<td>36</td>
</tr>
<tr>
<td>Rice Research Institute, Dokri</td>
<td>1</td>
<td>23</td>
<td>10</td>
<td>34</td>
</tr>
<tr>
<td><strong>Wheat</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat Research Institute, Faisalabad</td>
<td>2</td>
<td>31</td>
<td>3</td>
<td>36</td>
</tr>
</tbody>
</table>

*Excludes staff in commodity sections at multidisciplinary institutes.

A summary of progress on each major commodity, location, and research problem areas; and (3) a "directory of current research in agriculture," a summary of resources expended in all agricultural institutes in Pakistan.

The computer program for CRISP has been prepared and pilot output has been obtained using input from 150 projects. The implementation of CRISP on a national level is in progress.

**Uncertainties**

The data on manpower and budget allocations presented in this paper are based on information collected in 1977-78, under a collaborative effort by the Pakistan Agricultural Research Council and the National Science Council of Pakistan. These data have a few uncertainties. The budget information on the allocations by commodity and sector and the data on budget and staff at the multidisciplinary institutions and at certain organizations could not be separated in the absence of detailed information. Similarly, the allocations could not be separated for certain institutions undertaking both research and development activity. A more elaborate study is required to better understand the research system in Pakistan.